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CHAPTER 4 THE IMPLEMENTATION OF THE WFD IN DENMARK

The sub-basin: Odense Fjord Basin

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4.1 Introduction

Characteristics of the Odense Fjord (sub) River Basin

The Odense Fjord river basin, situated on the island of Funen is our case basin in Denmark. The Odense basin encompasses an area of about 1,046 km² (this is roughly one-third of Funen). The catchment drains into the Odense Fjord, and the River Odense runs through it. Watercourses stretch to a length of about 1,100 km, and there are approximately 2,600 lakes and ponds that are larger than 100 m². The River Odense is the largest river on Funen, which is about 60 km long. The catchment of this river is approximately 625 km² (Environment Centre Odense 2007b). In this basin, very small watercourses occupy a large proportion of the basin watercourse network.

The population of the catchment is about 246,000 (density: 234/km²). In Odense, the population is 182,000, which makes it the third largest city in Denmark (Environment Centre Odense 2007b). In the sparsely built-up areas, 10% of the population is not connected to the sewerage system. The main land use in the area is agriculture. About 68% of the basin is used for agricultural activities. About half of the registered farms are livestock farms. The livestock density (livestock units – LU) is about 0.9 LU/ha farmland on average within the basin. Livestock production in the basin has increased in recent years and the trend is expected to continue, especially for pig production (*Fyns Amt* 2003; Environment Centre Odense 2007b). Of the crops produced in the basin, only 10% are for grass fodder, the main crop is cereal grains.

The land use in the rest of the basin is distributed as follows:

Land use in %	Odense River Basin	Denmark
Built-up areas	16	12
Farmland	68	70
Woodland	10	11
Natural/semi-natural countryside	4	5
Wetlands	2	2

Table 2: Land use (given in percentages) for the Odense river basin and Denmark. Source (Environment Centre Odense 2007)

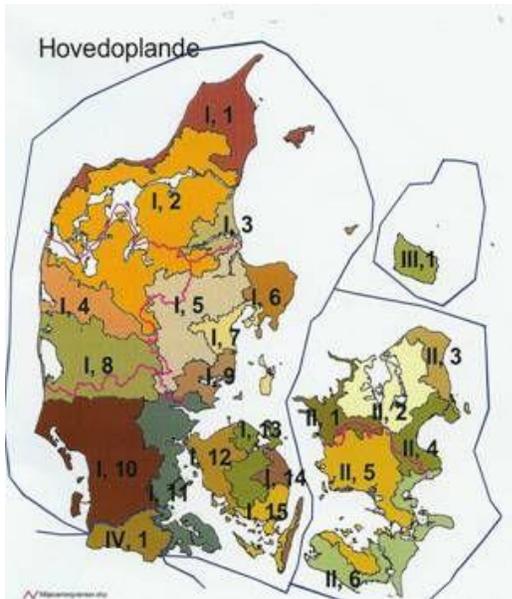
According to the Environment Centre Odense, drainage, watercourse regulation, regular watercourse maintenance and the reclamation of former wetlands (meadows and mires

in the river valley and elsewhere, shallow lakes and fjords), have been carried out over the years to meet the agricultural requirements for arable land (Environment Centre Odense 2008). These activities have increased physical pressure on the water bodies, however, especially on watercourses and wet habitats, and have increased the nutrient loading of lakes and coastal waters as well due to reduced natural turnover of the nutrients that leach from the fields.

Approximately 55% of the agricultural land in the basin is drained. Most of the lowland areas within the river valleys are cultivated. A large proportion of the watercourses in the pilot river basin are regulated, primarily to meet the need for arable land. Thus, at least 25% of the watercourses are culverted. Of the remaining open watercourses, 60% are estimated to be regulated (straightened, deepened, etc.). Reclamation and drainage of former wetlands has resulted in the disappearance of more than 70% of the large meadows and mires over the past 100 years. Thirteen of the larger lakes have disappeared due to land reclamation. Regarding the coastal areas, Odense River Basin is among the areas on Funen where the most extensive land reclamation has been carried out, with low-lying coastal areas and some marine areas having been diked in and reclaimed. The shoreline of Odense Fjord has thereby been reduced from approximately 150 km in length to the present approximately 67 km, and 22 islands have disappeared from the fjord.

River Basin Management and its coordination

The Odense sub-basin belongs to the River Basin District (RBD) Jutland and Funen, which covers in total fifteen of the sub-basins (see Map 1: the large circle on the left indicates RBD Jutland and Funen). The five Environment Centres spread over the RBD Jutland and Funen prepare the sub-basin management plans for each of the fifteen identified sub-basins. An Environment Centre would be responsible for about three to four sub-basin plans. The River Basin Management Plan (RBMP) Jutland and Funen will therefore be a compilation of fifteen sub-river basin plans, including the Odense river basin plan. Municipalities are then responsible for drawing up the Municipal Action Plans, making a detailed programme of measures, and they are also responsible for the implementation of measures to ensure that the goals set in the sub-basin plans are achieved. Consequently, some municipalities will be dealing with more than one sub-basin plan.



Map 1: Denmark's four water districts (shown with Roman numerals) and the 23 sub-catchments for which there will be 23 separate water management plans to be made. The light lines in the map indicate the administrative borders of each of the seven Environment Centres belonging to The Ministry of Environment.

The Environment Centre Odense is responsible for drawing up the sub-basin management plan for the Odense basin. The Environment Centre Odense is also responsible for three other sub-basins, since it is responsible for the entire island of Funen. The island of Funen is divided into four sub-basins (the island in the middle in Map 1). There are ten municipalities on the island. Since the Odense basin is spread over seven municipalities, seven Municipal Action Plans are relevant to the management of the Odense basin. Consequently, municipal borders do not coincide with the basin borders. From the perspective of a municipality, the municipality of Odense has to draw up its Municipal Action Plan while implementing three river basin management plans on Funen (Environment Centre Odense 2007a). Below is a figure showing different layers of organisations and management units, and the position of the Odense River Basin.

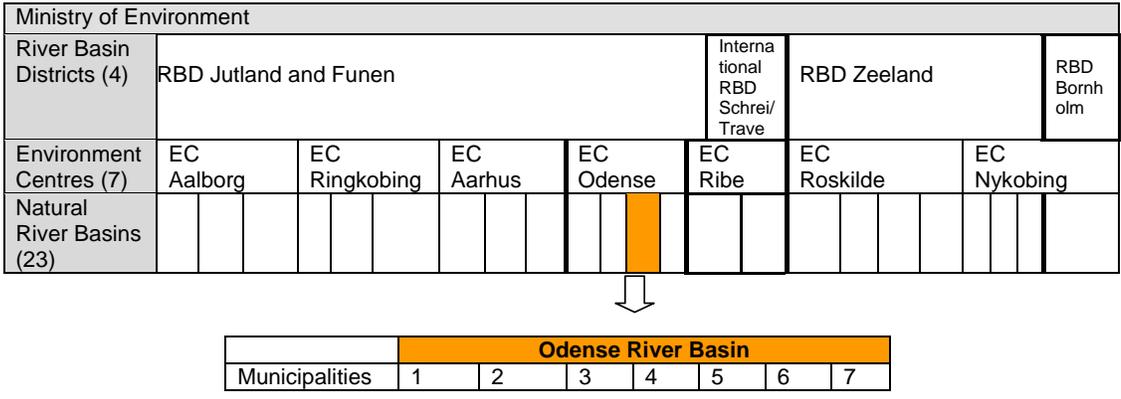


Figure 9: Organisation involved in WFD implementation in Denmark and the position of the Odense river basin. Note: The borders between Environment Centres and borders between natural river basins do not always coincide, which is not indicated in this figure. Lines in bold indicate clear divisions of management scales.

4.2 Goal-Setting Process

Designation of Water Bodies

Legal Establishment

From the MML, it is not clear who exactly designates water bodies as natural, heavily modified or artificial. Article 15 MML does lay down the criteria for a water body to be designated as artificial or heavily modified. Those are the same as the ones mentioned in Article 4 (3) WFD.

Designation in Practice

According to the European Commission’s first stage WFD implementation report, Denmark provisionally designated a remarkably low number (less than 10%) of its water bodies as HMWBs and AWBs (this was done earlier in the Article 5 report) in comparison to other Member States (EC 2007). There seemed to be a rather straightforward interpretation of the WFD, where water bodies that were currently modified, but could potentially be brought to natural conditions, should strive to meet good ecological status instead of good ecological potential (Interviews). There was also an observation that the Environment Centre Odense did not concern itself too much about whether the water body was preliminarily identified as HM or Natural, as it was recognised that a similar effort/cost would be associated with the implementation

regardless of the designation (Interview). The HMWBs are not exempt from WFD obligations.

For the Odense pilot management plan, very few water bodies were designated as HMWBs – in fact only the coastal waters (seventeen water bodies in total). Although the Article 5 Report identified some lakes as heavily modified water bodies, in the pilot management plan, none of the lakes were designated as such (Environment Centre Odense 2007a). It is important to point out that the pilot management plan did not identify (and hence designate as HMWBs) all of the many former lakes within the basin which had disappeared over past decades due to the land reclamation/drainage that was implemented to meet agricultural requirements for arable land. A total of 84 km of watercourses were designated as artificial. In the pilot plan these water bodies were assigned to meet the GEP (Environment Centre Odense 2007b).

However, more water bodies could still be designated as HMWBs, because the political assessment of the draft sub-basin plans are currently being conducted at the ministerial level.

Setting Formal Standards

General Environmental Goal of Good Status

The general environmental goal of the WFD (good status) is defined in Section 12 of the MML, with the deadline being 22 December 2015. According to the MML, good status means the same as defined in Article 2 (18) and (20) of the WFD. If more stringent quality requirements or shorter deadlines are set under other legislation, these apply (§ 20 MML).

On 13 November 2007, the European Commission submitted an opening letter to the Danish government due to its wrongful implementation of the WFD. The Commission claimed – amongst other things – that the Danish implementation did not fully comply with the requirements for targets for environmental objectives in Article 4 of the WFD. The Danish government partly accepted the criticism but the legal changes promised in the response to the Commission have, to date, not been adopted (Questionnaire).

Specific Environmental Goals

The general goal of good status will be further elaborated in a statutory order. As the European intercalibration process is still underway, this statutory order has not yet been issued (Interview).

Neither the adopted water plans nor the PoMs are binding for polluters or private citizens (Questionnaire). The RBMPs or sub-plans and the PoMs are legally binding for the relevant authorities (most often the municipalities) in their administration, including the control of diffuse and point sources of pollutants. Hence, discharge permits issued to

citizens or companies by the municipality must comply with the plans and the PoMs (Interview).

Type of Obligations

When the WFD was drafted and approved by the Member States, Denmark interpreted the obligation of good status as an obligation of best effort (Interview). The wording of Section 12 MML is as follows: 'By 22 December 2015, at the latest, all surface water and groundwater shall meet the objective of good status, with the exceptions listed in Sections 15-20'. Although Danish law does not make a distinction between the two different wordings of the WFD ('aim to achieve' or 'aim of achieving' on the one hand and 'shall achieve' on the other), this does not mean that the wording of the MML implies obligations of result, according to some interviewees. It is usually the case that this wording means that it is legally binding (Interview).

The values which will be defined by the water plans are considered as intervention values. According to the preparatory work of the MML, the limit values defined in the plans are binding (Questionnaire).

Extra

For previous EU water directives, Section 14 of the Environmental Protection Act requires that the Minister of the Environment should implement binding quality standards for water adopted in the previous directives. In practice, however, this has never been considered binding but only a target which might be reached in the future (Questionnaire).¹⁷

4.3 The Planning Process

National level, the political process

In the beginning, Denmark took a very open approach to the implementation of the WFD. The Ministry of Environment and the Ministry of Agriculture set up an 'Actors' Group' in 2004, consisting of representatives from NGOs, municipalities, counties and the agricultural sector. The group was supposed to advise the government on how to implement the WFD and to set goals (Interview). The group met frequently (about fourteen times in a year) until July 2005 (Interview). The discussions held during the meetings were rather technical/scientific, and not too much emphasis was put on what was politically possible (Interview). This was particularly valued by some of the members. An interviewee recalls the relatively strong emphasis on environmental objectives at this stage (Interview).

¹⁷ Since 1996, binding environmental quality standards have been established for dangerous substances by a statutory order. For other directives, guiding standards according to the directives have been established for relevant parameters (Interview).

The picture changed quite abruptly, however. The demand for goals and ambitions put forward by the majority of the Actors' Group (not only environmental NGOs but also water suppliers, ex-county representatives and even some agricultural representatives) was very high (Interview). The government soon noticed the high costs involved for implementation of the WFD, and removed stakeholders' involvement from the process. In the summer of 2005, the government presented a document to the Actors' Group; in 2006 this document became Denmark's preliminary goals for the intercalibration work. This interim Danish definition of good ecological status was based mainly on the existing objectives from the County Regional Plans (see quick scan, page 2). At the same time, the members of the Actors' Group were told that this was not to be discussed further in the group (Interview). The Actors' Group was never summoned after that point. Some interviewees believed that behind this scene was a troika consisting of the Office of the Prime Minister, the Ministry of Finance and the Ministry of Economic and Business Affairs, which informally seemed to have decided that the issue was not suitable to be discussed with stakeholders (Interview). After that point, the Ministry of Finance began to take a lead in WFD-related discussions.

A committee (the Godtfredsen Committee, named after the chairman of the committee from the Ministry of Finance) was established to estimate the cost of WFD implementation and to calculate in a straightforward manner the most economically efficient measures for implementing the WFD in Denmark. This required focusing on measures to reduce diffuse P and N pollution from the agricultural sector (see the Programme of Measures section). At this point, economic concern became the main focus of the discussion concerning the WFD in Denmark.

This Committee involved a range of ministries: the Ministry of Finance, Ministry of Economic and Business Affairs, Ministry of Taxation, Ministry of Food, Agriculture and Fisheries, Ministry of the Environment and, at the very last meeting, the Ministry of Climate and Energy. Discussions within the Committee, however, were said to be dominated by the Ministry of Finance, the Ministry of Food, Agriculture and Fisheries and the Ministry of the Environment (Interview). In the summer of 2007, the Godtfredsen Committee produced a report on its economic analysis of the WFD implementation in Denmark.

The Committee also produced three scenarios as its second phase investigation, which were never published (Interview). These scenarios were based on the definition of good status. There were three scenarios: the expected outcome of the intercalibration process (scenario 2), a higher ambition (scenario 1), and a lower ambition (scenario 3) (Interview). The ambition of scenario 1 was considered higher than that expected by the WFD itself. The government preferred the second scenario, and the discussion is still ongoing. However, some adjustment might be made if the results of the intercalibration work turn out to be more ambitious than scenario 2, which was pursued by the government (Interview). Although the intercalibration work was a parallel process to

the work of the Godtfredsen Committee, it turned out that the definition used for this scenario was close to the intercalibration results that were officially published in October 2008. However, some modification might be foreseeable: for rivers, the intercalibration results were close to scenario 2, while for lakes and coastal-waters, the intercalibration results were in between scenario 1 and 2 (Interview). The scenarios serve as the basis of the government's discussion about the use of exemptions.

The results of the intercalibration results adopted by the European Commission following the parliamentary procedure of 30 October 2008 will soon be put into law, which will replace the interim goals based on the Country Regional Plans. There are discussions as to what extent these new goals derived from the intercalibration results differ from the interim goals, and how they affect the planning and ambition setting so far. Some believe that not much change is expected, meaning that the environmental objectives based on the Danish County Regional Plans are similar to the work of the intercalibration process. Where changes are expected (for lakes and coastal waters) the intercalibration work might push for higher objectives in Denmark. For deep lakes specifically, more stringent objectives will be applied in the further planning process (Interview).

Conversely, a number of people are worried that some of the objectives in Denmark will be lowered by the intercalibration results (meaning that the national interim goals were more ambitious), while others have an impression that this is not the case. Another concern expressed is that the WFD objectives will be achieved without special efforts for rivers and lakes (Interview). This concern is based on the opinion that some of the objectives of the County Regional Plans were so low that these objectives have already been reached, and that it means no efforts are required. Others argue that if some WFD objectives have already been reached, then this is due to the efforts taken in Denmark regarding diffuse and point source pollution during more than two decades of water planning and management.

Sub-Basin Management Plan at the Environment Centre Odense

In parallel with the political goal-setting process at the central government level, river basin management plans are being prepared by the Environment Centres. Ecological goals are set at the sub-basin level by the responsible Environment Centre. The Environment Centre Odense is therefore responsible for setting the environmental objectives for the sub-basin Odense. However, it should be noted that prior to the administrative reform conducted in Denmark in 2007, counties were responsible for the tasks that today are carried out by the Environment Centres. This means that the pilot project to prepare the Odense River Management Plan has mainly been carried out by Fyn County. Today, employees at the Environment Centre Odense who are responsible for WFD implementation are mainly those who were previously responsible for the same tasks in Fyn County.

Until the results of the intercalibration process are adopted in a statutory form by the Danish government, the goals that the Environment Centres are using will be based on the interim goals proposed by the government in 2006, which were in turn based on the old goals previously set by the counties in their Regional Plans (see quick scan, page 2). Once the intercalibration results are officially put into law in Denmark, the goals that are set at the Environment Centre level might need some modification. It is unclear whether the intercalibration results will decrease or increase the ambition level as discussed earlier.

Drafting of the Odense sub basin management plan has been a technical process, focusing not on cost, but on the WFD requirements (Interview). Some are of the opinion that the pilot has proven that WFD implementation could be successfully and satisfactorily implemented without outrageous cost (Interview). Currently, the drafting process is in the political phase, where resources and political considerations are discussed at the ministerial level. According to the interviewees, this will most probably mean that the technically ambitious goals will be weakened, more water bodies will be designated as heavily modified, and more exemptions will be invoked (Interview).

Some interviewees claimed that the national government was not particularly fond of the Odense pilot project at the beginning, since the plan contained too many politically unpopular measures that focused on the agricultural sector (Interview). However, at that point, the responsibility for conducting the pilot basin project was vested in the hands of Odense County, and the central government could not do much about it even if it had wanted to. At the present time, the central government also recognises the importance of addressing the need for the agricultural sector to meet WFD objectives as was also expressed by the Godtfredsen Committee's report, which focused on the most cost-effective measures for addressing the diffuse pollution caused by nutrients from the agricultural sector (see Section 2.4. Programme of Measures and Appendix 4). This does not mean that the central government has come to a conclusion on what will be done. The experience from the Odense River Basin is said to have provided important input to the work in the Godtfredsen Committee (Interview).

There seem to be some reasons behind this rather ambitious management plan in Odense. First of all, this was carried out as a WFD Common Implementation Strategy pilot project, meant to test whether or not the WFD was technically implementable, without considering the political feasibility. Moreover, the Fyn County Council, which was previously responsible for the Odense pilot project, was said to have been more politically 'green' in comparison to the national government (Interview).

4.4 Programme of Measures

In Denmark, municipalities are responsible for the actual implementation of the programme of measures. Each municipality is required to prepare a Municipal Action

Plan to ensure the goals set by the Environment Centres in its sub-basin management plan are met. Before the municipalities draw up their action plans, the Environment Centres prepare a catalogue of the most cost-effective measures for guiding the municipalities in their implementation process.

For the Odense pilot basin management project, the Environment Centre Odense first listed all the existing measures (basic measures) that had already been adopted but not yet fully implemented (see Appendix 2). Such measures were in line with the already existing directives such as the Nitrate Directive and the Wastewater Directive, but also with national programmes including the Regional Plans, the municipal wastewater disposal plans and the Action Plan for the Aquatic Environment III (Environment Centre Odense 2007b). The expected status of water bodies, taking these basic-measures into consideration, was 'baseline 2015'. Baseline 2015 was the foundation for determining the supplementary measures that were needed to ensure achievement of the environmental objectives of the WFD.

Some assumptions that were made for baseline 2015:

- a) Agricultural measures pursuant to APAEIII were equally distributed throughout Denmark.
- b) Presently ongoing set-aside of a total of 608 ha (8,000 to 15,000 in total in DK) for wetland pursuant to APAEIII is assumed to be fully implemented.
- c) Any changes in livestock production on livestock holdings would not increase losses of nutrients etc., to the environment.

The majority of water bodies in Odense are at risk of not meeting a good status by 2015 without supplementary measures (See Appendix 1, for the result of risk analysis). The supplementary measures were selected on the basis of a cost-effectiveness analysis. These measures were aimed at reducing point-source pressures, physical pressures and diffuse nutrient loading from agriculture (See Appendix 3 for supplementary measures for the Odense pilot).

According to the pilot report, ensuring the full achievement of the environmental objectives (with a limited use of exemptions) in the Odense basin would cost about DKK 94 million (equivalent to 13 million euros) per year. The main activities were directed at reducing diffuse pollution from the agricultural sector. Of the costs, 46% were associated with these measures. The most important measures here included environmental optimisation of crop production by means of increased area of catch crops, and a reduced N fertilisation norm as well as the setting aside of arable lands, especially for re-establishing wetlands. In fact, 19% (12,480 ha) of the farmland was to be set aside in total, not only for wetlands but also for permanent grasslands as well as buffer zones where extensive farming was to be partially allowed. Setting aside farmlands also was expected to improve the physical conditions.

Of the costs, 43% were associated with measures to reduce point-source pressure. However, it was generally understood in Denmark that the cost-effectiveness of measures for reducing nitrogen would be much higher when addressing the diffuse pollution from the agricultural sector as compared to the point sources from other sectors. The cost effectiveness of the setting aside of arable land for wetlands was expected to be 42DKK/kg N, and for improved wastewater treatment for sparsely built-up areas it was 1,037DKK/kg N.

Whether the cost of supplemental measures for meeting WFD environmental objectives was disproportionately expensive for the society (political assessment) was not included in the pilot project. However, the Odense management plan stressed that the amount required was not significant. Compared to the total expense for water use in the Odense basin at that time, which amounted to DKK 612 million, and taking into consideration the total income and production value of DKK 116,600 million, the costs for the WFD correspond to an increase in the total expense for water from 0.5% to 0.6% of total income and production value. However, the political assessment of the cost was to be made by the central government. At the same time, the project did not consider how the programme of measures was to be financed, in other words; who was to cover the costs. Another important aspect was that this pilot management plan did not look into the extent to which the available legislation ensured implementation (Environment Centre Odense 2007a).

In parallel to the work of the Environment Centres on the programme of measures, the Godtfredsen Committee also listed the most cost-effective measures that Denmark could make use of in implementing the WFD. The resulting report which came out in 2007 consisted mainly of measures related to the agricultural sector, where a combined reduction of N and P was aimed for (Schou, Kronvang et al. 2007) (see Appendix 4). The next year, committee selected seven of the most cost-effective measures out of the 22 measures (see Appendix 4). The committee, led by the Ministry of Finance, was not overly sensitive about the political issues surrounding cost, but simply looked for the cheapest option for Denmark (Interview). The report also stated that the uncertainties were related to 1) the demand for the products produced; 2) politics and 3) the practical application of the measures. The political appraisal of the Godtfredsen measures is most likely taking place as the present report is being written. Such political assessment could result in the use of more extensions of deadlines than had been planned so far in the Odense pilot project (Interview).

The municipalities will have a chance to react to the draft management plans before the official phase of public consultation¹⁸. The problem is, even if the municipalities make complaints about some of the issues in the draft plans, the decisions reacting to the

¹⁸ The finalisation of the draft RBMPs will be delayed until early 2009. A final decision as to the municipal and public consultation procedure is therefore pending.

complaints by the government (Ministry and Environment Centres) will most probably be made only after the municipalities have prepared their Municipal Action Plans in 2010. The Environment Centre's list of programme of measures might grant some freedom for the municipalities to choose which measures to apply within their territory. However, the Environment Centre will decide the pollution reduction target, and if the potential for reduction is the same or smaller than the target, then the municipality will have little or no freedom in choosing the measures. It is still under discussion as to how strictly the sub-basin plans should be prepared by the Environment Centres and to what extent the plans should allow for flexibility for the municipalities in reaching the goals set by the Environment Centres. A statutory order on Municipal Action Plans will be issued after the summer of 2009, and this order will establish the powers of the municipalities in enforcing the measures. However, it is not yet fully clear if municipal powers in the existing legislation are sufficient, or if additional powers are needed (Interview).

4.5 Resources

As mentioned earlier, it is still not clear who will cover the expected costs of fulfilling WFD objectives. Everyone, including municipalities and the agricultural sector, is anxious about who will be responsible for the costs of WFD implementation (Interview). In any case, it is clear from both the Godtfredsen Committee and the Odense pilot plan that the planned budget for water management will increase in order to meet the WFD obligations. It seems that the political decisions concerning the implementation funding, as well as where to find the resources, will apparently come at the last minute. The basin plans will then be ready (at least in draft form). This means that targets and measures may also be renegotiated until the last minute, especially if the costs turn out to be higher than anticipated or if distribution of costs turns out to be highly problematic.

There is some indication of where the resources might be generated from. Through the modulation process under the new Common Agricultural Policy – involving a reduction in direct payment – a large part of the budget allocated for rural development will be earmarked for environment and nature issues; this could provide part of the financing for the WFD measures related to farming. This funding for the agricultural sector is expected to help to achieve WFD objectives quite significantly (Interview). Farmers' associations support this. Meanwhile the central government is expected to raise resources from taxpayers (Interviews). One of the interviewees recalls that when the Godtfredsen Committee's report was presented, that it estimated the costs for compensating the farming sector at about 2 billion euros.

4.6 *No Deterioration Principle*

Legal Establishment

Although the principle of no deterioration is not formally implemented as a principle (Questionnaire), it is reflected in the MML: 'deterioration of the status of all surface water bodies and all groundwater bodies shall be prevented (§11 MML).' According to this article, the principle applies per water body and per status class.

In Practice

There is some disagreement amongst the interviewees concerning the date from when the principle becomes applicable. Some say it applies from the date the action plans come into force (i.e. 2009), others say it has applied from 22 December 2003, when the MML entered into force, still others link the date to the PoMs (i.e. 2012), because the principle is connected to these programmes in the first sentence of Article 4 (1) WFD. Interviewees also recognise that activities may endanger the attainment of the objective before it enters into force, resulting in the principle having effect even before it formally enters into force.

The principle is also incorporated in the RBMPs, in the same wording as in the MML. The drafts currently contain guidelines on how to deal with applications for permits in relation to the no deterioration principle.

Some complaints were made by NGOs regarding water management by the municipalities to the Environmental Board of Appeal, referring to the no deterioration principle of the WFD (Interviews). Complaints were made on specific issues, such as the extension on pig farms and discharge from the farms influencing surface water status (17 January 2008, Nordfyn Kommunes – municipality of Northern Funen, Bogense). What is meant by deterioration and the starting date is expected to become clearer if there is a court decision about a specific case (Interview).

The Odense pilot management plan includes guidelines (Section 6.5, p. 73) with regard to issuing permits for discharges of wastewater and for other activities that affect the state of the water in the Odense basin. It is clearly stated that any deterioration in the status of water bodies is to be prevented. It also continues to state that no increase in direct or indirect pollution of surface waters is permissible unless this restriction leads to increased pollution of other water bodies. This means that it can be acceptable to allow increased pressure/pollution of a water body if this is the only way to prevent/hinder increased and serious pollution of another water body.

4.7 Use of Exemptions

Legal Establishment

Section 16 of the MML provides for derogation from the highest standard in case reaching it is technically infeasible or disproportionately costly. Moreover, Section 17 of the MML grants derogations from the highest quality caused by changed physical conditions. The wording of the exemptions is a copy of the WFD (Interview).

Exemptions in Practice

It is expected that the ministerial level might make certain decisions regarding where to use the exemptions when it comes to agricultural diffuse pollutions, while for other issues, Environment Centres will decide where to use the exemptions (Interview). The Agency for Spatial and Environmental Planning has presented a guidance memorandum on how to use the exemption clause of the Directive for the Environment Centres. All of the possibilities for the exemptions will be used, but especially the extension of deadlines (Art.4.4).

The Agency clearly sees that it will not be possible to meet good status by 2015 for some of the water bodies, especially due to the diffuse pollution from agriculture. It will be cheaper to spread the costs associated with the measures for reducing diffuse nutrient pollution from the agricultural sector over several planning cycles. If it is necessary to claim some land for this purpose, the price will rise quickly. Prolonging the time frame to the third cycle will thus reduce the costs involved (Interview).

The scenarios prepared by the Godtfredsen Committee are serving as the basis for the government discussion about the use of exemptions. However, it is not known to what extent the use of exemptions should be expected if scenario 2 (which is favoured by the central government) is pursued. No decision by the central government has been made about the extent of the use of exemptions so far.

Odense River Basin

In the Odense pilot basin management plan, the aim is clear: to achieve a good status for most of the water bodies before the end of 2015. What is interesting to mention here is the expected use of the extension clause for water bodies that currently have heavily modified characteristics, but are not designated as HMWBs, as the ultimate objective is to achieve good ecological status (GES) and not good ecological potential (GEP). The hydromorphological modifications made to water bodies will not necessarily be brought back to the natural state in the first planning cycle in some cases (see Text Box).

Text Box: Use of extension in Odense Pilot River Basin Project

Rivers: In the Basin, there is about 240 km of culverted watercourse, which amounts to 25% of the watercourses (Environment Centre Odense 2007b). These watercourses have not been designated as HMWBs. However, most of these watercourses will be granted the extension provision: 'due to environmental, technical and socio-economic considerations, it is not considered possible to plan and carry out measures to ensure good ecological status in these water bodies by 2015, and therefore for these water bodies, decisions on environmental objectives and associated measures for achieving them will thus be postponed until the next planning period' (Environment Centre Odense report). The efforts will still be made, especially for those watercourses given high quality objectives, to reach a good status.

Lakes: Although no lakes in the Odense basin have been designated as HMWBs, some of the lakes which were previously provisionally designated as HMWBs are dried out. Some of these lakes have since been completely re-established. However, the pilot plan points out that it has not been decided if the rest of these dried-out lakes are to be re-established during the first planning period or in the next planning period, in the latter case making use of the extension provision (Environment Centre Odense Pilot Project Report).

Coastal Waters: As mentioned earlier, in total, 17 coastal water bodies have been designated as HMWBs. According to the pilot plan, GEP will be applicable to only five of these water bodies. For the remaining twelve water bodies (which are diked-in or drained areas), decisions on environmental objectives and associated measures for achieving them are to be postponed until the next planning period, due to the same reasons as the culverted watercourses (Environment Centre Odense Pilot Project report).

In addition, some historical accumulation of substances in the basin (nutrients and phosphorus) found in sediments in lakes and the fjord will be too expensive to remove, and therefore the extension clause is to be used for these cases. In general the pilot project uses an extension of deadline instead of setting less stringent objectives. Some changes to the use of the extension clause for the Odense Basin could be made in the actual management plan.

4.8 Integration

Integration in general

In general, all state and local authorities are bound by the RBMPs and the Municipal Action Plans when decisions are made based on all other legislation and they must ensure the implementation of the PoM (§ 3 (2) MML). Formally, the authorities must ensure compliance with the plan, but whether this will work in practice is rather doubtful.

Internal Integration

According to a statutory order from 2006 on water supplies, the authorities (the municipalities) shall take into account, among other things, the size of the groundwater (or surface water) body and the protection of the environment and nature when a permit for water abstraction is issued (Interview).

It is still rather unclear whether authorities will also take the objectives of the WFD into account when they issue permits for the discharge of waste into the water or for the abstraction of water for industrial, agricultural or drinking water purposes. To date, no proposal for a plan has been published, so the contents of the proposed plans is unknown (Questionnaire). Since the statutory order of 2006, the quality standards have been considered to be binding regarding the issuing of new permits for the discharge of pollutants. It should however be noted that this has no effect on the discharge of pollutants which are not subject to new permits. Moreover, this scheme seems to be only partly applied by the local councils (Questionnaire).

Nature and Water

Legal Establishment

The entering into force of the MML in 2003 harmonised the implementation of the WFD and the Birds and Habitat Directives. The MML integrates the adoption of water management plans and the adoption of management plans for the preservation and improvement of Natura 2000 sites.

Integration in Practice

At the time of transposition, these directives were under the responsibility of two different agencies: the Environmental Protection Agency, which dealt with the WFD and the Forest and Nature Agency, which took care of the Birds and Habitat Directives. Today, the three directives are under the responsibility of one agency, the Agency of Spatial and Environmental Planning. This was the result of the national administrative reform in 2007, which merged the Water Division (only) from the Environmental Protection Agency with some (but not all) divisions from the Forest and Nature Agency and the seven Environment Centres. Still, the management of the directives is separated at the national level, taken care of by different divisions within the Agency. The WFD (except for coastal waters) is taken care of by the Water Protection Division, whereas coastal waters and the Birds and Habitats Directives are taken care of by the Nature Division of the Agency for Spatial and Environmental Planning.

True integration between nature and water management occurs in Denmark at the municipal level. In practice, this means that each municipality must develop a Municipal Action Plan consisting of measures it plans to implement in accordance with the Environment Centre's river basin management plan(s) as well as the management plan(s) for Natura 2000¹⁹. These two plans are prepared in parallel, and Environment Centres need to make sure that the plans are not in conflict. While some measures have positive effects concomitantly for the management of water and nature, the Ministry of

¹⁹ In Denmark 246 Natura 2000 plans are being prepared: one plan for each Natura 2000 area. Nine of these areas are situated within the River Basin Odense Fjord.

Environment has published a report indicating what should be handled under the WFD implementation process and what should be the measures for Natura 2000 sites. It is commonly understood that the WFD is providing the basis for the surface water quality on which the Natura 2000 objectives can be achieved (Interview). Through integrative implementation of these directives, conflicts between the directives appear to come to the surface earlier and solutions can be searched for sooner.

Text Box: Natura 2000 and the WFD in Odense

An example of a conflict between the WFD and Natura is the WFD -measure: 're-creation of wetlands and the re-establishment of natural hydrology in the river valley.' This cost-effective WFD measure retains nutrients by re-creating the greater natural turnover of leached nutrients, and at the same time, reducing the physical pressures on rivers by allowing them to meander. This measure, however, means that Natura 2000 habitats adapted to the artificial hydrology (caused by drainage and regulation of river valley) experience local flooding and threaten the survival of some Natura 2000 species. In practice the conflict could be avoided because the re-creation of wetlands often leads to the possibility of re-creating new, similar Natura 2000 habitats to compensate for the flooded habitat (Interview).

There are seven Natura 2000 sites located in the Odense Basin, covering approximately 8,000 ha. In addition, three wetland habitat types are protected under the Nature Protection Act (Environment Centre Odense 2007b). The Fyn County Regional Plan for 2005-2013 has also designated areas of special scientific interest and specified quality objectives, and since the administrative reform, the plan has been accorded legal status through a National Planning Directive (Environment Centre Odense 2007b). The Odense pilot plan takes the Birds and Habitats Directives well into consideration. The plan stresses that the WFD permits for more stringent environmental objectives than a 'good status'. The plan explicitly addresses in which cases a higher objective should be set (see Text Box below).

Text Box: Case for more stringent objectives in Odense

For example, if the water body already has a better than good status, if it has previously been assigned the highest quality objective in the Regional Plan, or if it has been designated as a Special Area of Conservation pursuant to the Habitats Directive, the goal is 'high ecological status'. If a lake has been assigned as an 'area of scientific interest' (which includes all Natura 2000 sites) in the old Fyn County Regional Plan, then the high ecological status is also used as its objective. Therefore, by attempting to reach the high ecological status for these areas under the WFD obligations, the requirements for the Natura 2000 sites are met. It is believed that high ecological status will concomitantly ensure favourable conservation status. Out of the twelve main lakes, six have been given high ecological status as their environmental objective. For the coastal area, the northwest, outer part of the fjord has been designated as a reference area of scientific interest in the Regional Plan, and therefore this body also

Agriculture and Water

As has already been illustrated, the main discussion and concern in Denmark focuses on how to reduce the diffuse nitrates pollution from the agricultural sector. The Godtfredsen Committee's report shows 22 measures to be applied for this purpose. Moreover, the Odense pilot plan shows that the majority of the implementation cost is allocated to measures in the agricultural sector. It is widely recognised that diffuse pollution is the biggest challenge for Denmark when implementing the WFD. In comparison, this problem dwarfs all others (Interview). In relation to this, it is also generally understood that the cost-effectiveness of measures is higher when addressing diffuse pollution from the agricultural sector as compared to other measures that address sewerage treatment, for example.

The agricultural sector has been involved in the WFD implementation process from the beginning. In fact, in cooperation with the Ministry of the Environment and the Ministry of Food, Agriculture and Fisheries, the two ministries organised the 'Actors' Group' (a stakeholder group) in 2004 at the national level.

The main concern for the agricultural sector is the new **Environmental Permit Law on Livestock Expansion**²⁰ which was enacted in January 2007. In principle, this new regulation makes it easier to issue permits to livestock farms for expansion. There has been a warning from the European Commission, questioning whether this new law is in compliance with the Directive on Environmental Impact Assessment (Interview). Environmental NGOs question why such a law has come out when the entire nation should be involved in implementing not only the WFD, but also the Nitrates Directive and the Habitats Directive.

However, there have been cases in which municipalities have interpreted the law in a much stricter manner, and were hesitant to issue permits. They are aware that they will soon have to implement the Municipal Action Plans to meet the objectives set by the Environment Centres in their RBMPs as well as the plans for the Natura 2000 sites. Issuing permits today might mean buying those permits back in the near future in order to be able to meet the objectives. This could be very expensive for the municipalities. In some cases, farms have been granted permits if the new modification or expansion would not increase pollution at all. How can municipalities do this? The law has its own standards to be used for permits, but also states that every case needs to be evaluated, and that for special cases more stringent rules may be applied. Municipalities often refer to the case of the Wadden Sea²¹ when refusing permits. It seems that Natura 2000 is

²⁰ *Lov om miljøgodkendelse m.v. af husdyrbrug.*

²¹ Judgment of the court of 7 September 2004 in Case C-127/02. Directive 92/43/EEC – Dutch case. 'The competent authority [...] are to authorise such an activity only if they have made certain that it will not adversely affect the integrity of that site.'

putting more pressure on municipalities to not issue permits easily than the WFD. The situation depends on the municipality and its politics.

In the first year, 2,300 applications were submitted and only 147 permits were issued (Interview). Another reason for this 'deadlock' or 'standstill', as perceived by the agricultural sector, was the lack of capacity in municipalities to suddenly having to process such an amount of applications.

Action Plan for the Aquatic Environment (APAE I, II, III)

Since the 1980s, these plans have contributed to reducing agricultural pressure on terrestrial natural habitats and the aquatic environment (see quick scan). The APAE III for the period 2005-2015 is closely related to the WFD as well as the Habitats Directive (APAE III 2004). This ten-year agreement period is set to harmonise with the WFD and Natura 2000 management planning cycle. The diffuse nitrogen runoff from agriculture into watercourses in the Odense basin has already decreased by 20% to 30% due to the APAE (Environment Centre Odense 2007b). Similarly, for the period up to 2015, the third APAE is expected to further reduce nitrogen loading of the aquatic environment by approximately 15%, and phosphorus surplus applied to fields by around 50% (Environment Centre Odense 2007b). The third phase of the APAE focuses on the agricultural sector.

Under this programme, some measures are based on voluntary action (combined with subsidies) such as the setting aside of farmlands. The objective was to set aside 30,000 ha of farmlands nation-wide as buffer-zones alongside rivers and lakes before 2009. What has been achieved so far is about 400 ha (Interview) (see quick scan). A further 20,000 ha is to be set aside by 2015 under the APAE III. A total of DKK 375 million was to be allocated between 2004-2009 for such initiatives. Other actions are more general and obligatory, including a tax on the mineral phosphorous in feed and, a tightening of regulations regarding late crops and requirements for utilisation of nitrogen in livestock manure, etc.

In Odense, the expected results derived from the APAE are fully incorporated into the 2015 baseline calculation. Since this programme is known for not achieving the voluntary objectives, there is speculation that the baseline for Odense might turn out to be too optimistic. The APAE III is being evaluated in 2008 and will be evaluated again in 2011. With the evaluation, it is possible to assess the effects of the efforts in relation to the objectives of the RBMPs as well as the Natura 2000 plans (APAE III 2004).

AGWAPLAN

In 2005, the Danish Agriculture Advisory Group initiated the AGWAPLAN (<http://www.agwaplan.dk/agwaplan.htm>), a 2 million euros EU-funded LIFE project. Twenty-three farmers in Aarhus and the Environment Centre Aarhus were involved in the initiative. This pilot project was to demonstrate how the environmental objectives of

the WFD for N and P in surface and groundwater could be reached in farming areas via the voluntary implementation of good agricultural practices (GAP) by farmers. The AGWAPLAN was initiated by the Danish Agriculture Advisory Group because they had seen that the Odense pilot project was very much a top-down process, and they wanted to take an approach that was from the perspective of farmers. It sought to investigate what could be done by farmers to meet the challenges of the WFD, and concentrated efforts on vulnerable zones, avoiding the use of general regulations and improving cost effectiveness.

There is a general acceptance by all parties that there should be measures to reduce diffuse pollution from the agricultural sector. Some have the opinion that to address the sector, farmers will have to be compensated, and that paying farmers will be the only way to achieve success with the WFD, since making farmers pay for their pollution would be out of the political discussion (Interviews).

Spatial Planning and Water

Legal Establishment

Because the MML (which is the foundation of the RBMP) is legally superior, the regional development plans and the municipal spatial plans have to follow the requirements in the RBMPs. New permits must respect the RBMPs (Interview).

Integration in practice

Spatial planning is also under the responsibility of the municipalities. As mentioned earlier, spatial planning must respect the RBMPs (or the sub-basin plans respectively) and the Natura 2000 management plans. However, in practice it is difficult to speculate to what extent this will be the case. Municipalities usually place the top priority on issues such as unemployment and urban development, and they are not used to taking this degree of responsibility for water and nature.

The three largest Environment Centres take care of the national interest in municipal planning, such as city development, industry, landscape, nature and recreation. These Environment Centres issue permits for spatial planning, taking over the tasks for the smaller centres which also issue permits for industries. To avoid confusion, all seven Environment Centres are dealing with RBMPs and Natura 2000 management plans.

Sewage Treatment and Water

Legal Establishment

According to the Environmental Protection Act, the municipal wastewater plan shall be consistent with the RBMP. This provision will enter into force when the final RBMPs will be published by 22 December 2009 (Environmental Protection Act, Section 32, Paragraph 7.2 and accompanying notes 5 and 25).

The municipal wastewater plan lays down rules for the overall treatment and discharge within the municipality, including plans for the establishment and maintenance of sewer systems, deadlines etc. The authorities shall act in accordance with the waste water plan in their administration, i.e. when granting discharge permits to citizens or companies or municipal wastewater treatment plants etc. (Interview).

Integration in Practice

Sewage treatment is also under the responsibility of the municipalities. It is, however, not considered to be a big problem. The Danish municipal wastewater treatment plants are quite advanced, and therefore removing even more nutrients from the sewage plants is very expensive. About 10% of the population in Odense lives in sparsely built-up areas outside the sewerage system. The Odense pilot management plan includes measures for those areas, even though the cost is relatively high.

4.9 Conclusion

The overall definition of the goals is set at the central level by the Ministry of the Environment. Specific objectives for individual water bodies are set by the Environment Centres. As soon as the intercalibration work is formally published, a statutory order will make sure that the overall definition of the goals is legally binding. Until then, Denmark uses objectives that were derived by the Counties somewhat earlier for the Counties' Regional Plans. Environment Centres also define their environmental objectives based on those objectives.

Although Environment Centres play a major role in setting the environmental objectives and designing the programme of measures, the municipalities are responsible for the implementation of the measures to meet the WFD objectives through their Municipal Action Plans and to ensure the goals set in the sub-basin plans are achieved. Since the administrative reform, municipalities receive considerably more responsibilities in the WFD implementation process. However, their role and capacity is still under discussion. On the one hand, it is still unclear to what extent the Environment Centres' sub-basin plans allow for local discretion by the municipalities in reaching the goals set by the Environment Centres. On the other hand, it is also not clear whether municipalities' powers in existing legislation are sufficient or if additional powers are needed (Interview) to successfully implement necessary measures.

The focus is on impact by diffuse pollution from agriculture. The measures that are considered most cost-effective in Denmark predominantly focus on reducing diffuse pollution from the agricultural sector. The municipalities are likely to enforce those measures through the Municipal Action Plans. It is not yet clear if the municipalities receive more legal power in order to execute some of the measures. In any case, the agricultural sector is concerned about the possible introduction of general obligatory

rules without compensations and is eager to be involved in the process. It even initiated its own pilot project in the form of the AGWAPLAN. Another possible reason for a rather active attitude by the sector in the WFD implementation process could be that the sector speculates that it will receive generous subsidies from the government. They do understand that something has to be done sooner or later, and if the sector is to be affected, it is better to be compensated.

Apart from the focus on diffuse pollution from agriculture in implementing the WFD, the integration of nature and water management in Denmark has been clearly established under the framework of *Miljømålsloven*. The national government as well as the Environment Centre Odense realises the synergetic outcome in implementing those related directives (WFD, Habitat and Birds) simultaneously.

Ambitions at the Environment Centre Odense's pilot project are rather high. This is most probably due to the fact that the draft management plan for the Odense basin has been drawn up as an EU pilot project to see if the WFD was technically implementable at all. At the same time, it was also pointed out that the Fyn Region, being responsible at the beginning for this project, had a rather green government. The Environment Centres also do not receive an indication for a concrete budget with which the WFD has to be implemented. Answers to the questions of 'how much' and 'by whom' will only become clear at the last moment. Meanwhile, the Environment Centre Odense has demonstrated that the cost involved in the implementation of the supplementary measures is not outrageously high. How this will be perceived by the politic is still unknown.

One point to mention is that in the Odense pilot project the use of extension has been popular for water bodies that have characteristics of hydromorphological changes which are destined to meet the good ecological status in the future, but not at the moment. Instead of designating water bodies with high hydromorphological changes as HMWB and set GEP instead of GES, the preliminary Environment Centre Odense designates such water bodies as natural with the intention to bring the status back to good status. The extension clause is then used to postpone not only the achievement of the good status but the actions to attain such status altogether.

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Questionnaire Denmark: A response to written questions by Peter Pagh, professor of Environmental Law at the University of Copenhagen.

Interviewees

Jens Thygesen, Danish Society for Angling, 8 September 2008, Vejle

Hans Roust Thyssen, Danish Agricultural Advisory Service, 9 September 2008, Århus

Harley Bundgaard Madsen, Environment Centre Odense, 10 September 2008, Odense

Stig Eggert Pedersen, Environment Centre Odense, 10 September 2008, Odense

Thorben E. Jørgensen, Odense Municipality, 10 September 2008, Odense

Henning Mørk Jørgensen, Danish Society for Nature Conservation, 11 September 2008, Copenhagen

Henning Karup, Agency for Spatial and Environmental Planning, Ministry of Environment, 11 September 2008, Copenhagen

Steen Pedersen, Agency for Spatial and Environmental Planning, Ministry of Environment, 11 September 2008, Copenhagen

Appendix 1: Risk Analysis WFD Implementation in Odense Pilot River Basin Project

Water body type	Water bodies at risk (% of number)	Reason for lack of compliance with objectives Pressures that should be reduced/prevented
Watercourses	>90%	Physical pressures (regulation and culverting of watercourses, watercourse maintenance and drainage of river valleys for agricultural purposes, obstructions to the free passage of fauna Wastewater discharges (stormwater outfalls, sparsely built-up areas)
Lakes	88%	Nutrient loading, especially from agriculture Nutrient release from nutrients accumulated in lake sediment
Coastal waters	100%	Nutrient loading, especially from agriculture Wastewater discharges, especially from sparsely built-up areas and stormwater outfalls Hazardous substances from households, industry and shipping, etc. Physical pressures, for example from dredging of shipping fairways, raw materials extraction, fishery and marine dumping of harbour sediments
Groundwater	92%	Nitrate loading from agriculture Hazardous substances that leach from former industrial sites, etc. or in connection with pesticide use Pressure from overexploitation of the water resource (reduced water flow in watercourses and through lakes, drying-out of wetlands and intrusion of salt water, etc.)
Wetlands	(% of area)	Reduced area, fragmentation of terrestrial ecosystems and drying-out (lowering of the groundwater table) of wetlands due to draining, land reclamation and water abstraction
Coastal meadows	30–70%	Nutrient loading, especially from agriculture, in particular atmospheric deposition of ammonia nitrogen Pesticide loading Overgrowth of habitats due to the lack of natural grazers
Freshwater meadows	>50%	
Mires	>75%	

(Source: Environment Centre Odense 2007a)

Appendix 2: Baseline 2015 in Odense Pilot River Basin Project

Table 6.3 Baseline 2015 – Assumptions						
Adopted but not yet (2004) fully implemented measures pursuant to the Regional Plan, municipal wastewater disposal plans, Action Plan on the Aquatic Environment III, trend in livestock production, etc.						
Initiated measures and assumptions	Dose	Effects				Economics Economic cost (DKK 1,000/yr)
		Nitrogen Change in waterborne discharge to water bodies (tonnes/yr)	Phosphorus Change in waterborne discharge to water bodies (tonnes/yr)	Physical Pressure - Reduction	Natural habitats Re- establish- ment and improve- ment of quality	
Diffuse nutrient and pesticide loading – agriculture (Total cultivated land in the river basin: 68,421 ha)						
<i>Action Plan on the Aquatic Environment III</i>						
Catch crops: Increased area	3,216 ha	47	0			1,000
5% higher utilization of the N content of manure	68,421 ha	29	0			2,100
EU agricultural reform (CAP) + improved utilization of the N content of fodder	68,421 ha	51				0
Structural development (reduction in area relative to 2003)	2,824 ha	40				0
Agri-environmental measures – buffer zones and wetlands	90 ha	8		+		600
Set-aside of land for afforestation (upland ¹)	596 ha	6			+	2,000
Set-aside of land for wetlands (APAE II-III)	603 ha	131	0.6	+	+	2,500
<i>Gothenburg Protocol – reduced airborne nitrogen emissions</i>						
Reduced N emission from agriculture, power stations, traffic, etc.	Whole DK	?	0		+	-3 kg N/ha deposition on water surfaces and -1.3 kg N/ha on terrestrial natural habitats
<i>Livestock production – prognosis 2005–2015</i>						
20% increase in production (prognosis by Danish Agriculture). It is assumed that requirements will be imposed to ensure that the increase in production does not lead to increased emissions/discharges or attenuate the effect of the measures adopted to reduce the pressure from existing production.		0	0			No increase in ammonia emissions
Reduction of pressure from point sources						
Sparingly built-up areas – improved wastewater treatment	4,291 properties	8	2			Reduced discharge of oxygen-consuming substances and ammonia
Wastewater treatment plants – improved wastewater treatment through optimization of operation	13 WWTPs	2	0			32,000
Stormwater outfalls – overflow lagoons at outfalls from combined sewerage systems	131 localities	5	2			Reduced discharge of oxygen-consuming substances and ammonia
Stormwater outfalls – overflow lagoons at outfalls from separate sewerage systems in lake catchments	4 localities	<1	<1			Reduced discharge of oil residues, precipitates, etc.
Disused waste depository – Stige Ø: Remedial measures to protect Odense Fjord	1 locality	73	?			Reduced discharge of hazardous substances
Enterprises – Fynsværket CHP Plant: Reduction of pressure from cooling water discharge by re-routing the River Odense, etc.	1 locality					Reduced temperature pressure from cooling water
Contaminated sites – remediation	107 localities					Hazardous substances – reduced loss to the environment
COMBINED EFFECT AND COST		330	5			126,500

¹Upland farmland is defined as farmland lying more than one metre above the normal high water level in the adjacent watercourses into which the runoff takes place.

(Source: Environment Centre Odense 2007b)

Appendix 3: Supplementary Measures in Odense Pilot River Basin Project

Table 6.4						
WFD Programme of Measures						
Cost-effective dosing of measures to meet the environmental objectives for water bodies and terrestrial natural habitats in Odense River Basin						
Measure		Effects				Economics Economic cost (DKK 1,000) /yr
		Nitrogen Change in waterborne discharge to water bodies (tonnes/yr)	Phosphorus Change in waterborne discharge to water bodies (tonnes/yr)	Reduced physical pressure	Natural habitats Re-establishment and improvement of quality	
Diffuse nutrient and pesticide loading – agriculture						
<i>Environmental optimization of crop production – upland</i>						
1. Catch crops: Increased area	11,482 ha	115	0			3,358
2. Additional 5% higher utilization of the N content of manure	41,548 ha	17	0			632
3. P fertilization regulation: Balance between applied and removed phosphorus at field level	30,745 ha	0	No loss increase			?
4. P fertilization regulation: Reduced P fertilization of soil with a high P index (26% of all farmland)	10,802 ha	0	Reduction not quantified			?
<i>Environmental optimization of crop production – lowland/river valleys</i>						
5. Catch crops: Increased area	4,656 ha	121	0			1,362
6. Additional 5% higher utilization of the N content of manure	13,116 ha	14	0			199
7. Reduced N fertilization norm (-10%)	12,953 ha	32	0			909
8. P fertilization regulation: Balance between applied and removed phosphorus at field level	9,706 ha	0	No loss increase			?
9. P fertilization regulation: Reduced P fertilization of soil with a high P index (26% of all farmland)	3,410 ha	0	Reduction not quantified			?
<i>Set-aside of farmland – upland</i>						
10. Land for afforestation (broadleaf)	1,532 ha	16	0.153		+	5,255
11. Permanent grassland	304 ha	3	0.030		+	981
12. Restrictions on cultivation of land potentially subject to erosion	258 ha	3	0.026	+	+	832
<i>Set-aside of farmland – lowland/river valleys</i>						
13. Land for re-establishment of wetlands	3,185 ha	319	3.185	+	++	13,509
14. Permanent grassland on farmland	541 ha	14	0.054	+	++	1,744
15. 5-m buffer zones alongside watercourses in lake catchments	17 ha	0.9	0.017	+	+	72
16. 10-m buffer zone around ponds in lake catchments	10 ha	0.5	0.010	+	+	43
<i>Groundwater protection measures</i>						
17. Set-aside: Permanent grassland kept unfertilized	4,598 ha	44.1	0.092		++	14,832
18. Pesticide-free cultivation of farmland around water supply wells (300-m zone) (no pesticide leaching)	2,056 ha	-	-		+	?
Reduction of physical pressure on watercourses						
19. Removal of obstructions to fish migration	220 localities	-	-	++		2,415
20. Cessation of watercourse maintenance combined with extensification of cultivation in river valleys through the establishment of on average 15, 50 and 150 m wide buffer zones alongside small, medium and large watercourses (incl. re-establishment of wetlands corresponding to measure 13)	2,035 ha 524 km	204	2,035	++	++	6,772 -6,287
21. Remeandering of watercourses, laying out of spawning gravel, stones, etc.	227 km	-	-	++		7,438
Reduction of pressure from point sources						
22. Sparsely built-up areas – improved wastewater treatment	1,516 properties	7.8	2.945			11,324
23. Wastewater treatment plants – improved wastewater treatment (UV and ozone treatment) • Disinfection and removal of hazardous substances	7 WWTPs	0	0	-	-	28,581
Special measures – terrestrial natural habitats						
24. New terrestrial natural habitats (coastal meadows, mires/freshwater meadows and dry grassland) • Carried out integrated with measures 11–18	Coastal meadows: 450 ha Mires/meadows: 2400 ha Dry grasslands: 600 ha	+	+	+	++	See Table 6.7
25. Reduced ammonia emission from livestock holdings >35 LU ¹ • 50% reduction – 840 tonne reduction in NH ₃ emission	450 properties (2003)	25			++	
26. Nature management – Grazing down, haymaking etc. on present terrestrial natural habitats	2,450 ha				++	
27. Nature management – Clearance	360 ha				++	
28. Improved hydrological conditions (decommissioning of ditches/drains)	300 km	+	+	+	++	
COMBINED EFFECT (Nutrients) AND COST WFD		926	8.5			94,000

¹ Upland farmland is defined as farmland lying more than one metre above the normal high water level in the adjacent watercourses into which the runoff takes place.
² LU: Livestock Unit: 1 LU = the quantity of livestock producing 100 kg nitrogen per year in manure measured ex store, e.g. 1 Jersey dairy cow, 35 slaughter pigs, etc.

Appendix 4: Godtfredsen Committee List of Measures

The definitive list of the seven most cost-effective measures for reducing diffuse N and P pollution related to the agricultural sector recommended by the Godtfredsen Committee for implementing the WFD in Denmark are: numbers 1, 2, 7 and 14 in particular, and in addition numbers 19, 9, 13 (and partially number 3). However, no decision has been made in terms of the application of these measures.

Table 0 Effects and costs per year measured at the source

	Primary effect	N-emission	P-emission	Financial economic cost	Welfare economic cost	Welfare economic cost per unit of primary effect	Derived environmental effects			
							Climate gasses	Ammonia	Pesticides	Biodiversity and landscape
Changed farming methods										
1. Conversion of extensive cattle production to organic production methods	N	6-41 kg/ha	-	0	0	0	+	+	+	+
2. Ammonia fertilisers in stead of NO ₃	N	6-8 kg/ha	-	0	0	0	+	-		
3. Catch crops – current practice	N	12-55 kg/ha	-	330-660 DKK/ha	386-772 DKK/ha	7-64 DKK/kg N	+			(-)
4. Optimised use of catch crops	N	20-95 kg/ha	-	315-700 DKK/ha	368-820 DKK/ha	4-41 DKK/kg N	+			(-)
5. a. Demand for "injection of manure" from harvest to April 1. b. No till or plowing from harvest to April 1	P	a. -6-0 kg N/ha b. 10-25 kg N/ha	a. 0,01-0,125 kg/ha b. 0,025-0,250 kg/ha	a. 50-150 DKK/ha b. 250-750 DKK/ha	a. 60-175 DKK/ha b. 300-880 DKK/ha	a. 480-17.500 DKK/ kg P b. 1.200-35.200 DKK/ kg P	a. - b.	b. + b. +	b. +	b. +
6. Reduced N-application by 80%	N	3,4-5,0 kg/ha	-	87-151 DKK /ha	101-176 DKK /ha	20-52 DKK/kg N	+	+		
7. Harvest of hay in stead of permanent cattle grassing	N	26-109 kg/ha (pure mowing)	-	0	0	0	+	-		
		13-54 kg/ha (2 x mowing)		0	0	0				
8. Reduced N-application to pastures	N	18-77 kg N/ha (clover grass)	-	295-1.375 DKK/ha	345-1.610 DKK/ha	4-76 DKK/kg N	+	+		
		20-85 kg N/ha (pure grass)								
9. Catch crops in two years after plowing of permanent pastures	N	55 – 110 kg/ha		415 DKK/ha	485 DKK/ha	2-4 DKK/kg N	+			
10. Early sowing of winter crops	N	5-7 kg/ha	-	0	0	0	+			
11. Only winter crops and under sowing of catch crops on fields with high risk of soil erosion	P	12-55 kg/ha	0,06-0,250 kg/ha	250-750 DKK/ha	300-880 DKK/ha	1.200-14.600 DKK/kg P				
12. Reduced P-application	P	-	0,003-0,10 kg P/ha	25-50 DKK/ha	30-60 DKK/ha	300-20.000 DKK/kg P				
13. Fertilisers in stead of manure	N	24-28 kg N/ha	0,01-0,1 kg P/ha	200-250 DKK/ha	235-290 DKK/ha	8-12 DKK/kg N		-		-

Table 0... continued	Primary effect	N-emission	P-emission	Financial economic cost	Welfare economic cost	Welfare economic cost per unit of primary effect	Climate gasses	Ammonia	Pesticides	Biodiversity and landscape
Change in land use										
14. Permanent energy crops on land in rotation	N/P	30-55 kg/ha	0,003-0,100 kg/ha	0	0	0	+	+	+	+/-
15. Permanent grassland on with high risk of soil erosion	P	26-66 kg/ha	0,06-0,250 kg/ha	1.200-2.600 DKK/ha	3.600-6.800 DKK/ha	14.400-113.000 DKK/kg P	+	+	+	+
16. Buffer zones with permanent grassland adjacent to lakes and streams	P	26-66 kg/ha	1-3 kg/ha	1.900-2.600 DKK/ha	3.600-6.800 DKK/ha	120-6.800 DKK/kg P	+	+	+	+
17. Permanent grassland on high lying fields	N	26-66 kg/ha	0,06-0,250 kg/ha	1.200-2600 DKK/ha	3.600-6.800 DKK/ha	54-262 DKK/kg N	+	+	+	+
18. Afforestation of agricultural land	N	30-70 kg/ha	?	2.140-3.880 DKK/ha	2.560-6.040 DKK/ha	36-129 DKK/kg N	+	+	+	+/-
19. Permanent pastures or grassland in river valleys	N/P	100-150 kg/ha	10-30 kg/ha*	500-1.100 DKK/ha	900-1.700 DKK/ha	6-17 DKK/kg N; 60-340 DKK/kg P**	(+)	+	+	+
Technical measures										
20. Incineration of livestock manure	P	0,7-6,5 kg N/ha	Case dependent	Case dependent	Case dependent	Case dependent	+	(-)		+/-
21. Stop dredging of streams	Changes physical conditions	10-45 kg N/ha	10-30 kg/ha*	500-1.100 DKK/ha	900-1.700 DKK/ha	Excl. saved costs dredging		(+)	(+)	+
22. Restoration of streams	Changes physical conditions	10-45 kg N/ha	10-30 kg/ha*	?	?			(+)	(+)	+

NB. Derived environmental effects are indicated with an "+" (positive effect) and "-" (negative effect).

*The effect on P relates to the number of hectares occasionally flooded.

**The per unit abatement costs for P are calculated assuming that 50 percent of the extensivated area are occasionally flooded.

Source: (Schou, Kronvang et al. 2007)