FEBRUAR 2022
LANDBRUG & FØDEVARER

UNDERSØGELSE AF ASPEKTER OMKRING VANDPLANER I DANMARKS NABOLANDE

ENDELIG RAPPORT

COWI

ADDRESS COWI A/S
Parallelvej 2
2800 Kongens Lyngby
Denmark

TEL +45 56 40 00 00
FAX +45 56 40 99 99
WWW cowi.com

FEBRUARY 2022
LANDBRUG & FØDEVARER

COUNTRY REPORT FOR SWEDEN

FINAL REPORT

PROJECT NO.

A231827

VERSION	DATE OF ISSUE	DESCRIPTION	PREPARED	CHECKED	APPROVED
Final report	Feb. 10, 2022	Report	EVBR, MTIO	LSSA	JDCR

CONTENTS

1 Country report for Sweden

1.1 Delimitation

This country report addresses the implementation of the Water Framework Directive (WFD) in Sweden. With the purpose of making the findings relevant for comparisons with the Danish implementation, the focus of this report is on the geographical area of the river basin district of Southern Baltic Sea. Even though the Southern Baltic Sea is at focus, data for Sweden in total are presented to some extent and with regards to many of the addressed issued, the findings apply to Sweden's implementation in general.

Sweden is separated into five river basin districts (RBD) based on the major sea basins and catchment areas. For each RBD, there is one water district authority (competent authority) preparing and administrating the management in accordance with the Water Framework Directive (WFD). The competent authorities are now leading the preparation for taking Sweden into the third management cycle in accordance with the directive. The Swedish Agency for Marine and Water Management (SwAM) is the national agency responsible for coordinating the work performed by the competent authorities, to develop guidelines, relevant national legislation and for reporting to the European Commission.

In November of 2020, the competent authorities presented management programs and Program Of Measures (POM) as well as environmental quality standards for WP3. This was followed by a period of public consultation in which a large number of stakeholders participated. The consultation period ended on the 30th of April and the comments are now under consideration. According to the original time plan for implementation, a governmental decision to accept the suggested management plans, POMs and environmental quality standards is expected in December of 2021. Reporting of final versions to the Commission should be done in March 2022.

There was however serious critique presented during the consultation period suggesting that the prepared POMs of WP3 have weaknesses large enough to

risk the fulfillment of formal requirements of the WFD. The criticism was put forward by SwAM together with 15 municipalities. It is now suggested that the Swedish Government review whether this is true. Such a trial will most likely delay the implementation, to what extent is dependent on the result of the trial and the extension of eventual requested revisions of the POMs[1]. A decision on whether the Government will try the POMs is expected in early fall of 2021.

The main critique of the proposed POMs for WP3 relates to evaluation, or the lack of evaluation and understanding of the measures performed during WP2 (2015-2021). No efforts have been made to quantify the results from measures performed during WP2, hence it is not clear whether these measures have led to improvements in environmental quality.

This report is written in August of 2021 when the RBMP of WP2 is still under implementation. It is understood that many of the regulative measures presented in the POMs of WP2 have not been successfully implemented during the period and will instead be transferred to the coming POMs of WP3.

Table 1: Status on Water Plan 2, Sweden Southern Baltic Sea

Country	Status on WP2	Link to WP2	Comment
Sweden - Southern Baltic Sea	*Under implementation*	*RBMP Southern Baltic Sea - Part 1* *RBMP Southern Baltic Sea - Part 2* *RBMP Southern Baltic Sea - Part 3* *RBMP Southern Baltic Sea - Part 4* *RBMP Southern Baltic Sea - Part 5* *2nd RBMP website*	

Table 2: Status on Water Plan 3, Sweden – Southern Baltic Sea

Country	Status on WP3	Link to WP3	Comment
Sweden - Southern Baltic Sea	*Draft. Revised during Nov 2020 – April 2021.*	*3rd RBMP Southern Baltic Sea, draft* *3rd RBMP website*	*Suggested management plans, Program Of Measures and environmental quality objectives for five River Basin Districts*

[1] The Program Of Measures of WP2 presented in 2015 was subject to a Governmental trial leading to revisions of the draft versions and a delay for implementing final versions of approximately one year.

The country report for Sweden is delimited to focus on the Southern Baltic Sea RBP.

Table 3: Delimitation of the analysis, Sweden

Country	River basin management plans
Sweden	Southern Baltic Sea

1.2 Country context and analysis

The five RBD´s in Sweden cover a significant geographical area and large variations are found between the north and the south with regards to land use and conditions for the water environment. Large differences are also found between the coastal environments in the east, where for example the Baltic Sea faces serious challenges with regards to e.g. eutrophication, whereas the marine environment of the west coast is not as heavily affected.

The Southern Baltic Sea RBD, that is the main focus of this report, includes the regions of Skåne, Blekinge, Kalmar, Gotland, Östergötland and the largest parts of Kronoberg and Jönköping, the area is shown in Figure 1.

Figure 1: The area analysed in this report include RBD of Southern Baltic Sea. Figure collected from the management plan of the area prepared by Vattenmyndigheterna.

As for Sweden in general, the land use in Southern Baltic Sea RBD is dominated by forestry as can be seen in Figure 2 below showing the distribution of land use in the RBD and for Sweden in total. Land use for agricultural activities, both cropland and grassland, constitutes a larger share of the land use in the

Southern Baltic Sea RBD compared to Sweden in general due to relatively productive land in the southern parts of the country.

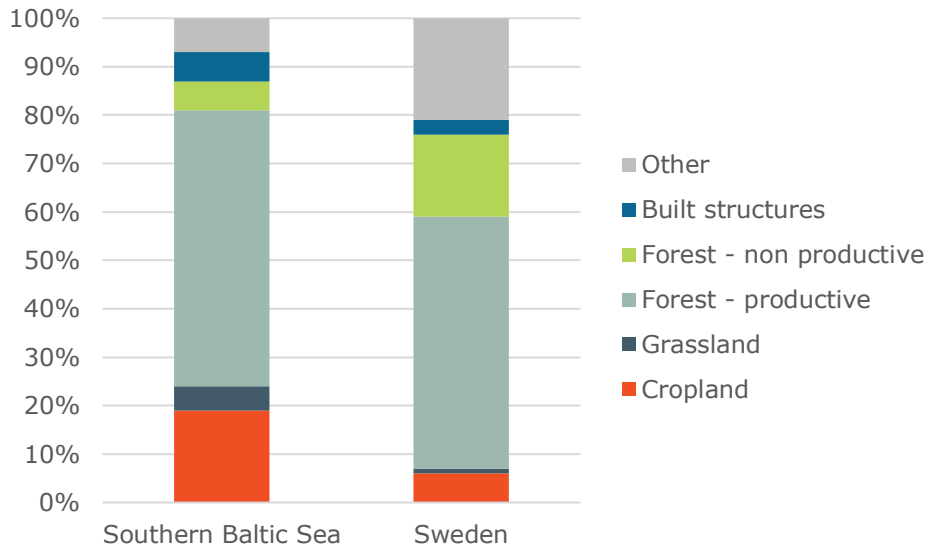

Figure 2: Land cover of the RBD Southern Baltic Sea and Sweden in total. The category Other include mineral mining, golf courses and more. Source: Draft 3rd RBMPs, Chapter 2.1.

The Southern Baltic Sea RBD consists of 1 862 surface water bodies in total (heavily modified and artificial water bodies excluded), consisting of 506 lakes, 1 178 rivers and 178 coastal water bodies. The environmental conditions of the fresh and marine waters in the district are generally not satisfactory, current status classification shows that only 20% of the water bodies are assessed to achieve good ecological status in accordance with the WFD. Eutrophication, environmental toxins, and physical modifications are the main reasons why good ecological status is seldom achieved. Looking at the different types of waterbodies, only one of the 178 coastal water bodies in Southern Baltic Sea has good ecological status. Among the lakes in the water district, the situation is somewhat better, 43% achieve good ecological status whereas the equivalent for rivers is only 13%.

Pressure factors affecting the water bodies in the Southern Baltic Sea are presented in chapter 5.1. Looking specifically at nutrient supply in the coastal water bodies in the Southern Baltic Sea RBPM, there are several significant pressures contributing to the nutrient levels and situation with regards to eutrophication. Figure 3 illustrates the distribution of nutrient supply including both phosphorus and nitrate from different sources. Coastal water is understood to be heavily affected by nutrients from surrounding waters, both from national sources and from neighboring countries. From nutrient supply associated with land use and other sources from land, the largest contribution is from agricultural activities (23%), whereas small sewages, forestry, urban land use and treatment plants also plays a significant part, adding up to 33% of the nutrient supply in total.

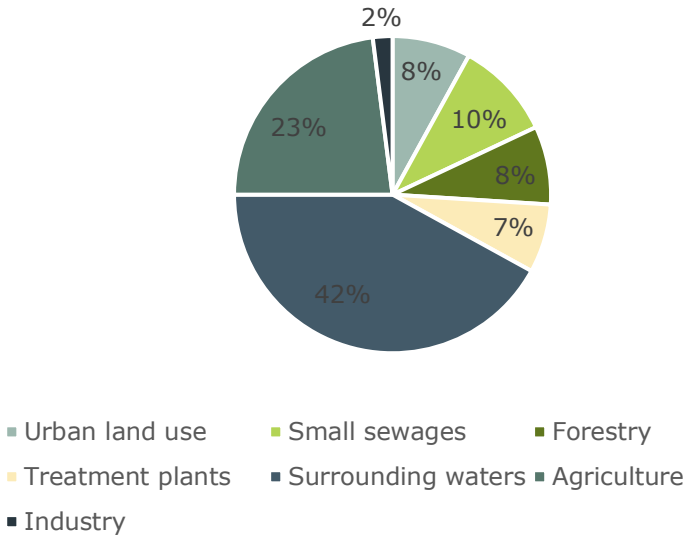

Figure 3: Sources of pressures regarding nutrients in coastal water bodies in the district of Southern Baltic Sea. Assessment of significant pressures from nutrients in coastal water bodies are based on both phosphorus and nitrate.

In Figure 4 below, the distribution of sources of nutrients to lakes and rivers in the Southern Baltic Sea RBD are presented. The use of fertilizers in the agricultural sector is describes as one of the main drivers, and leakage of nutrients from small sewages is equivalently large. Other significant sources of nutrients are urban land use followed by treatment plants, whereas historic emissions and nutrients from industrial processes only contributes to small extent.

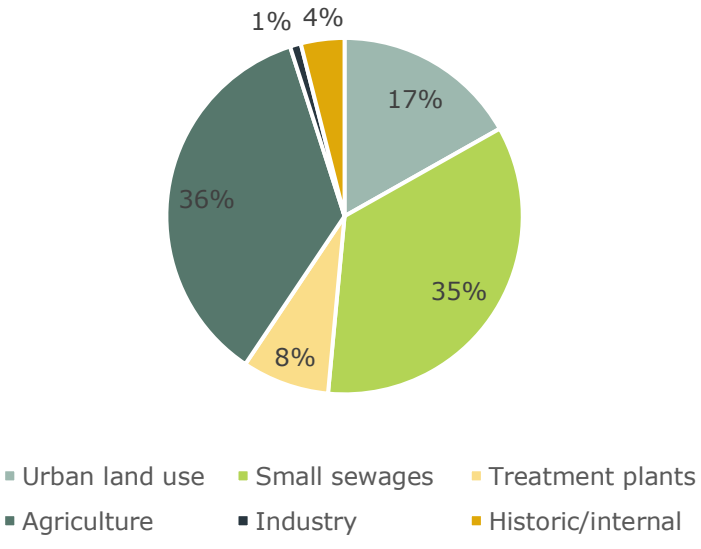

Figure 4: Sources of pressures regarding nutrients (phosphorus and nitrate) on lakes and rivers in the district of Southern Baltic Sea. Assessment of significant pressures from nutrients in rivers and lakes mainly focus on phosphorus whereas assessment of nitrate is assessed where relevant.

The competent authorities in each river basin district are now leading the preparation for taking Sweden into the third cycle of the water management in accordance with the directive.

2 Changes since last COWI comparative assessment

2.1 Have there been significant changes in aspects and approaches described in ”Nabotjek af EU-landes fremgangsmåder ved planlægning for marine vandområdet i henhold til Vandrammedirektivet”, by COWI for Miljøstyrelsen (The Danish Environmental Agency) in 2018?

The implementation process and the management in accordance with the WFD of WP3 is understood to be very much equivalent to the ongoing water management cycle of WP2, no significant changes in the overall management are made.

Delimitation of water bodies, methods of assessment and data changes to some extent between every water management cycle. It is stated in the draft RBMP that a larger focus is spent on water bodies with identified significant pressures in WP3, whereas previous management plans and PoMs have had a broader scope. In the 3rd RBMP's, the geographical scope of water bodies has been modified resulting in a larger number of water bodies compared to WP2 for lakes and rivers. The number of water bodies in WP3 and the change from WP2 is listed in Table 4. The number of coastal water bodies in the Southern Baltic Sea RBD has not changed since WP2.

Table 4: Number of surface water bodies (natural) by type in Southern Baltic Sea RBMP and Sweden, with changes from the 2nd RBMP in parentheses

Type of water	Southern Baltic Sea RBD	Sweden, all five RBD´s
Rivers	1 189 (+166)	15 381 (+709)
Lakes	506 (+12)	7 270 (+117)
Coastal waters	178 (+0)	654 (+1)
Total waterbodies	1 873 (+178)	23 305 (+827)

Source: Draft, 3rd RBMPs.

The ecological conditions with regards to eutrophication in the coastal water bodies in WP3 are similar to the assessments made in WP2. Comparing risk assessments over the two cycles, no improvements of the status with regards to eutrophication in the coastal water bodies can be shown.

With regards to the usage of exemptions for water bodies to reach good ecological status (GES) after 2027, the number of exemptions has increased significantly from WP2 to WP3. In WP2, only 9 of 1 706 natural surface water bodies, all coastal, in the Southern Baltic Sea RBD were addressed with exemptions to not reach GES in 2027 (all 9 water bodies were addressed with less stringent environmental objectives in accordance with article 4.5 in the WFD). In WP3, the equivalent number of surface water bodies are 505 out of 1 831, where the number of coastal water bodies with exemptions make up 177 (for an overview of exemptions for coastal water bodies see Table 10 below.

Table 10: Exemptions for coastal water bodies in the Southern Baltic Sea RBMP). From the 505 water bodies having exemptions to reach GES after 2027, 21 are addressed with less stringent environmental objectives in accordance with article 4.5. The remaining 484 water bodies have time exemptions motivated by the need for natural recovery. Other reasons behind the more extensive use of exemptions are not explicitly given in the RBMP of WP3, however, possible reasons could be insufficient implementation of measures during WP2, more limited time for implementation of measures in WP3 among other reasons.

No significant changes are found between WP2 and WP3 with regards to methods used to assess reference values for eutrophication in the coastal waters. Minor changes and improvements on data accuracy in models used to estimate nutrient loads from runoff have been made, however applied methodological approaches in general are understood to be the same in WP3.

3 Reference for quality parameters in WFD

3.1 How is the reference condition for the quality parameters used in the country established? i.e. are historical measurements, modelling, or expert assessments used and which point in time/year is used as reference for quality parameters in the WFD, in the case of historical measurements or modelling back to a historical point in time?

Status with regards to eutrophication is assessed based on both biological and physico-chemical quality elements. Biological quality elements including e.g. phytoplankton, macrophytes and phytobenthos, fish fauna and diatoms, whereas physico-chemical quality elements include oxygen balance, nutrient levels, and transparency. Each quality element is built up by one or several indicators. In practice, not all quality elements are assessed for each water body, instead the most relevant biological and physico-chemical quality element is used to determine eutrophication levels. For priority reasons, we focus on describing methods for reference values for the quality elements that are most commonly used in the assessment of eutrophication in the Southern Baltic Sea RBD.

Assessment of diatoms is the biological quality element most often used for rivers. Diatoms is assessed using a robust index, IPS. Reference value for IPS is fixed at the level of 19,6 for all water bodies, the literature does however not explain further on what basis the reference value is decided. The biological quality element most often used for lakes is phytoplankton which is built up by three indicators: phytoplankton biomass, chlorophyll-a and plankton trophic index. Reference values for all three indicators are based on reference lakes.

With regards to physico-chemical quality elements, lakes and rivers are most often assessed based on the nutrient quality element, for which phosphorus (tot-P) is used as indicator for most assessments. Reference values for tot-P is calculated for each water body separately due to local variabilities in natural levels of nutrients. Reference values for tot-P is normally calculated based on measured current values of tot-P from the specific water body that are inserted in a mathematical formula calculating the assumed pristine levels of tot-P[2]. The same method is used to calculate reference values in rivers where the geographical area of the sub-basin consists of less than 10% agricultural land. For rivers with more than 10% agricultural land, additional reference is used

[2] Details on relevant mathematical models for lakes and rivers respectively is found in the guideline for assessment of ecological status: Bedömningsgrunder för ytvattenförekomster (havochvatten.se)

that is based on modelled values from unfertilized lay/meadow (*DK: kløvergræs*) using Pollution Load Compilation (PLC6) calculations[3].

For coastal water bodies, phytoplankton is normally used to assess the biological quality element. Two parameters are measured and weighted together; phytoplankton biomass and chlorophyll-a. Due to lack of unaffected waters in the coastal zones, it is not possible to use reference waters to detect reference values for coastal water bodies. Instead reference values for phytoplankton biomass and chlorophyll-a are based on calculated values, in some cases with support from measured recent values from the actual water body. The calculated reference values are fixed, and the fixed level differs for different water types. Reference values are then corrected for salinity to adjust for the natural background nutrient gradient in coastal waters.[4]

As for lakes and rivers, the physico-chemical quality element normally used for coastal water bodies is nutrients for which several parameters are measured; winter concentrations for tot-P, total nitrogen (tot-N), dissolved inorganic nitrogen (DIN) and dissolved inorganic phosphorusus (DIP) together with summer concentrations of tot-P and tot-N. The quality element is then established by summing and weighing mean values of the parameters measured over three years. Reference levels of nutrients in the coastal waters is determined based on both estimated natural nutrient runoff from land (i.e. runoff without human pressures or interference) and from estimated pristine nutrient levels in the coastal water. Background load with regards to tot-P and tot-N runoff is determined based on a hydrological model in which anthropogenic load is removed, the model used is S-HYPE which in turn uses nutrient load estimations from PLC6 calculations. Reference values for tot-P and tot-N from runoff is then used to define reference values for DIN and DIP by regression analysis based on relations between tot-P and DIP as well as tot-N and DIN. Reference values for nutrients in coastal waters are defined as fixed values for each coastal water type (25 different types), however background nutrient load in water bodies within the same water type can vary.

The relevant quality elements used to assess eutrophication, and methods for deriving reference values are described above, Table 5 concludes these findings. None of the relevant indicators is understood to have reference values based on historic values, instead mathematical relationships, reference waters, calculations and, in rare cases, expert assessments are used to determine the reference conditions.

[3] The PLC6 model is presented here: SMED-Rapport-185-2016_AvrinningPLC6.pdf

[4] The calculation of reference values for phytoplankton biomass and chlorophyll-a is done with a formula making use of reference values for TN (TotalNitrogen) in coastal waters. This reference values are in turn calculated through the relationship between DIN – TN. The reference values for DIN have been adopted from previous research performed within HELCOM and OSPAR. The methods are however not fully accepted yet due to weak significance in the relationship between the different fractions in some water types. Investigations are ongoing to eliminate the methodological weaknesses.

Table 5: Quality parameters used and their reference condition method

Quality parameter	Establishment method for reference condition	Point in time/year as reference (if historical or modelling)	Comment
Phosphorusus (tot-P) lakes and rivers	Mathematical formula and measured current values	N/A	Used to assess nutrients - a physico-chemical quality element to assess eutrophication
Nitrate, lakes and rivers	Expert assessment	N/A	Same as above
Phosphorusus (tot-P), nitrate (tot-N), non-organic nitrogen compounds, non-organic phosphorusus compounds, coast	Calculations	N/A	Used to assess nutrients - a physico-chemical quality element to assess eutrophication
IPS (index), rivers	Fixed reference value of 19,6	N/A	Used to assess diatoms – a biological quality element to assess eutrophication
Chlorophyll-a, lakes	Reference lakes	Recent	Used to assess phytoplankton – a biological quality element to assess eutrophication
Phytoplankton biomass, lakes	Reference lakes	Recent	Same as above
Plankton Trophic Index, PTI, lakes	Reference lakes	Recent	Same as above
Phytoplankton biomass, coast	Calculations	N/A	Used to assess phytoplankton – a biological quality element to assess eutrophication
Chlorophyll-a, coast	Calculations*	N/A	Same as above

*See: Naturvårdsverket (2007) *Bedömingsgrunder för kustvatten og vatten i övergångszon*.

4 Status

4.1 How large part of the country's/region's water areas are in high, good, moderate, and poor condition, respectively?

The ecological condition of the surface water bodies in the water district is presented in Table 6. Only 20% of the surface water bodies are assessed with either Good or High ecological status, leaving 80% of the water bodies not achieving Good status. Only one of the 178 coastal water bodies in Southern Baltic Sea has good ecological status. Among the lakes in the water district, the situation is somewhat better, 43% achieve Good ecological status whereas the equivalent for rivers is only 13%.

Comparing with the status in the beginning of the second cycle (2016-2021), the share of waterbodies with Good or High status has decreased and the share of waterbodies not reaching Good status has increased in the beginning of the third period. This indicates that the overall environmental quality has worsened, however, methodological and administrative changes between the periods makes comparisons difficult.

Table 6: Ecological conditions, Sweden. Number of surface water bodies in Southern Baltic Sea RBD

	Sweden, Southern Baltic Sea			
	Lakes	**Rivers/streams**	**Coastal water bodies**	**Total**
High	0 (0%)	1 (0%)	0 (0%)	1 (0%)
Good	215 (43%)	151 (13%)	1 (1%)	367 (20%)
Moderate	237 (47%)	908 (77%)	160 (90%)	1 305 (70%)
Poor/bad	54 (11%)	118 (10%)	17 (9%)	189 (10%)

4.2 What is the current status for implementing Water Plan 2 in the country?

When writing this report, in August of 2021, it is at the end of the period for

Water Plan 2. Management and action plans for WP3 have been prepared, the drafts have been in public consultation but no decision on implementation has yet been taken. As mentioned in the introduction, there are major critiques presented which will likely lead to delays in implementing the plans.

With regards to status on implementing measures from WP2, it is understood that many of the administrative measures/actions, a total of 55 measures, presented in the Program of Measures of WP2 have not been completed but are transferred to the action plan of WP3. Some of these measures are planned to continue over a longer period of time, whereas others have not been fully carried out within WP2. The reason for this being that they are extensive and applies to a large geographical scale, and therefore takes longer time to fulfil.

With regards to coastal waters, it was estimated in WP2 that 169 coastal water bodies out of 178 (i.e. 95%) would reach Good ecological status in 2027. The equivalent number stated in WP3 is 38 (21%) out of 178 coastal water bodies. This leaves 140 (79%) of the coastal waters with exemptions to reach GES after 2027 implying that the usage of exemptions in WP3 has increased significantly. Descriptions of the usage of exemptions are found in chapter 5.2.

An interpretation of the larger usage of exemptions to reach GES after 2027 is that implementation of WP2 and measures according to the PoM of WP2 have not been sufficiently executed.

As previously mentioned, when going into WP3, it is not clear what the effects and results are with regards to reduction of nutrients, from measures of the PoM of WP2. The question of efficiency and effectiveness of measures is not addressed in the proposed management plans of WP3, implying that it is not clear if measures have led to improvements in water quality and changes in ecological status. This is one of the main critiques of the suggested POMs for WP3 that was lifted in the public consultation process that was recently closed.

5 Water Plan 3 contents

5.1 Are efforts planned on other pressure factors than nutrients in Water Plan 3?

For the Southern Baltic Sea RBMP in general, eutrophication is one of the major environmental issues affecting the surface water negatively, it is reported that 21% of the surface water bodies in the district are at risk of not reaching GES due to eutrophication, see Table 7 below for more details. However, there are other environmental issues with more severe impacts when it comes to affecting a larger number of water bodies. Physical moderation is affecting 49% of the surface water bodies from morphological alternations whereas 24% of rivers are affected by flow alterations. The agricultural sector stands for the largest impact with regards to flow alterations of rivers as well as lakes mainly due to historical land use transformation. Hydro power and infrastructure such as road and rail network are other sources to alterations of rivers and lakes whereas shipping is a main driver for physical modifications in the costal water bodies.

Table 7. Number of waterbodies at risk of not achieving GES due to different environmental problems. Water bodies where the risk is considered to be uncertain are omitted.

Environmental problem	Rivers/Streams	Lakes	Coastal waters
Eutrophication	172 (9%)	78 (4%)	141 (8%)
Flow alterations	410 (24%)	24 (1%)	10 (0,5%)
Morphological alterations and continuity	827 (44%)	75 (4%)	8 (< 0,5%)
Certain other substances	47 (2,5%)	12 (0,5%)	8 (< 0,5%)
Priority substances	1873 (100%)	1873 (100%)	1873 (100%)
Priority substances excluding mercury and PDBE	24 (1%)	18 (1%)	19 (1%)
Acidification	146 (8%)	93 (5%)	-

Source: Draft, 3rd RBMP.

Acidification is another central issue for the water environment, it is estimated that 13% of the lakes and rivers in the Southern Baltic Sea RBMP are at risk of not achieving GES due to pollution of sulfur and nitrate resulting in acidification. Atmospheric deposition of sulfur oxides has been the main pressure historically and despite large emissions reductions since the 1990'ies, the recovery of

environmental quality has been slow in some cases. Atmospheric deposition of nitrate has not reduced as much, sources of polluting nitrate are mainly from combustion plants and from road traffic.

Regarding pollutants, there are 277 water bodies, corresponding to 15% of the surface waterbodies in the Southern Baltic Sea RBMP that are estimated to have a significant impact from specific pollutants. The largest source of specific pollutants to the water environment is from polluted areas, followed by diffuse discharge from agriculture and from point source of sewage treatment plants.

With regards to eutrophication, there are measures planned in WP3 targeted at all the main pressures, i.e. agricultural activities, treatment plants, urban land use (such as wastewater treatment) and small sewages. The distribution of measures between these sources is however not quantified in available sources of information.

Measures to reduce pollutants are targeted at agriculture, small sewages, contaminated sites, treatment plants, industry, wastewater and marinas. Acidification is mainly addressed through measures targeted at the forestry sector and efforts to reduce acidification in lakes by liming programs.

Table 8: Pressure factors identified in water plans, Sweden Southern Baltic Sea

		Sweden, Southern Baltic Sea	**Actions planned**
Point sources	Industry	Significant	Yes (pollutants)
	Treatment plants	Significant	Yes (eutrophication, pollutants)
	Aquaculture	Identified but not significant	Information not available at pressure factor level
Diffuse sources	Scattered settlements	Significant	Information not available at pressure factor level
	Agriculture	Significant	Yes (eutrophication, pollutants)
	Rain-related outlets	Identified but not significant	Information not available at pressure factor level
	Airborne deposits	Significant	Information not available at pressure factor level
	Other diffuse sources	Significant	Information not available at pressure factor level
Physical impacts	Water extraction	Significant	Yes (groundwater)
	Physical modification	Significant	Yes (morphological alterations)
Other	Invasive species	Identified but not significant	Information not available at pressure factor level
	Fisheries	Identified but not significant	Information not available at pressure factor level
	Acidification	Significant	Information not available at pressure factor level
	Other	Significant	Information not available at pressure factor level

In Table 9 below, environmental problems are listed which are affecting the coastal water bodies of the Southern Baltic Sea RBD to the extent that reaching Good ecological status at the end of WP3 is at risk (including uncertain risk). Impact from eutrophication and environmental toxins (priority substances) are found to be significant environmental problems for all coastal water bodies of the RBD. Physical moderation in terms of morphological alterations and flow alterations have a significant impact on 12 % and 13 % of the coastal water bodies respectively.

Table 9: Environmental problems affecting coastal water bodies to the extent that water bodies is at risk to not reach Good ecological status, the Southern Baltic Sea RBD. One coastal water body can be affected by several environmental problems.

	Number (and %) of coastal water bodies
Eutrophication	178 (100%)
Morphological alternations	22 (12%)
Flow alterations	23 (13%)
Toxins, specific pollutants	8 (4%)
Toxins, priority substances	178 (100%)

Source: Draft, 3rd RBMP

5.2 Have exemptions from the WFD been used in Water Plan 3 – which and to which extent?

The current status assessment shows that 1 361 or 80% of the surface water bodies in the district does not reach a level of Good ecological status. For 21 of these water bodies less stringent environmental objectives are applied, implying that there is an exemption to achieve GES. These are water bodies that are heavily affected by human activity such as ports, municipal water supply and contaminated sites.

However, for the main part of the water bodies that are currently not achieving Good ecological status, the deadline is postponed, either to 2027 or to the period beyond 2027. The exemptions to 2027 are motivated by the argument that it is not technically possible to remedy earlier (article 4.4. in the WFD). The environmental quality objectives for ecological status implies that 970 or 52% of the surface water bodies in the district have exemption to 2027, whereas 484 or 26% have a deadline to reach GES beyond 2027. Time exemptions extending beyond 2027 is generally not accepted by the European Commission. This has however been regarded as necessary by the Swedish competent authorities due to the general lack of available measures to reduce the leakage of nutrient sufficiently to achieve the objectives stipulated by GES. The same procedure

regarding exemptions has been applied for physical alterations in rivers. In this case the Swedish authorities are working systematically to reconsider permits for hydropower in Swedish rivers which has convinced the EC that the problem is addressed in a systematic and continuous manner. This has resulted in a more understanding EC-attitude regarding the prolonged time exemptions. Due to the lack of available measures, it is harder to demonstrate that the work is systematic and continuous in a similar manner when it comes to mitigating nutrient emissions. Sweden has therefore received criticism from the EC when it comes to times exemptions exceeding 2027 regarding nutrients and GES. With regards to measures addressed to the agricultural sector, it is stated in the draft RBMP that measures that are given low priority in the PoMs can even be expected to delay the deadline to achieve GES to 2039.

The number of water bodies with extension of deadline to 2027 or beyond has increased from 1 208 to 1 464 or by 21% from WP2 to WP3. The same pattern was seen between Water Plan 1 (WP1) in 2009 and WP2 in 2015 where the number of water bodies with extended deadline to 2027 increased significantly in WP2.

Focusing on the coastal water bodies of the Southern Baltic Sea RBPM, only one of 178 coastal water bodies in total is assessed to reach GES according to current status classifications. With planned measures during WP3, GES is assessed to be reached for 37 or 21% of the coastal water bodies in 2027. However, the majority of the coastal water bodies, 79% is not expected to reach GES at the end of WP3 and will hence be imposed with exemptions. Water bodies that do not reach GES today but are expected to reach GES at the end of WP3 (in 2027) are addressed with exemptions motivated by article 4.4. in the WFD, i.e., based on technical, or economic arguments or natural recovery. The same article 4.4. is used to motivate exemptions for water bodies expected to reach GES after 2027, however only natural recovery can be applied as argument for exemptions. The water bodies that are assessed to not reach GES (moderate or poor ecological status in 2027 or after) are instead addressed with exemptions motivated by article 4.5 implying less stringent environmental objectives. The number of costal water bodies in Southern Baltic Sea RBD with exemptions according to article 4.4 and 4.5 are listed in Table 10 below.

Table 10: Exemptions for coastal water bodies in the Southern Baltic Sea RBMP

	Number and % of coastal water bodies	**Motivation for exemption**
High ecological status today	0 (0%)	No exemption
Good ecological status today	1 (1%)	No exemption
Good ecological status 2027	37 (21%)	Art. 4.4
Good ecological status after 2027	134 (75%)	Art 4.4
Moderate ecological status 2027	1 (1%)	Art. 4.5
Moderate ecological status after 2027	4 (2%)	Art. 4.5
Poor ecological status after 2027	1 (1%)	Art. 4.5
Total number of coastal water bodies	**178**	

Source: Draft, 3rd RBMP.

It is stated in the draft RBMP that it is not allowed to motivate exemption beyond 2027 on the basis of economic or technical arguments[5]. Exemption beyond 2027 can only by justified when the water body needs longer time to recover naturally. From what is presented above, it is however clear that additional measures will be needed after 2027 in order to reach GES, which implies that exemptions motivated only by natural recovery cannot be used for many water bodies. How the European Commission will treat this is not clear at this date. It was confirmed during interview with country experts, that Sweden is planning to present a politically decided and established time plan for implementation of measures for the time period after 2027, and is hoping for the European Commission to accept this strategy as a substitute for not being able to present exemptions on the basis of technical or economic arguments.

[5] This is the implication of the Swedish interpretation of article 4.4 (p. C) in the WFD.

5.3 What are the targets for nitrogen and phosphorus in Water Plan 3? How large reductions (in tons and %) are necessary, and are there concrete targets such as concentration in river waters by estuary?

Leakage of nutrients and resulting eutrophication is a significant problem in the Southern Baltic Sea RBD. All coastal water bodies, and a third of the lakes and rivers in the district are heavily affected by nutrients. In total, 21% of the surface water bodies in the district are at risk of not reaching Good ecological status because of eutrophication.

To reach the quality requirements (GES), the overall leakage of nutrients in the river basin district must be reduced by 210 tons of phosphorus, from which 100 tons are targeted at rivers and lakes, and 2 700 tons of nitrogen[6]. There are however no readily available information in VISS, or in the RBD management plan, on the overall anthropogenic discharge of nutrients into the Baltic Sea from the RBD. Consequently, it's not possible to assess the share of the anthropogenic nutrient leakage that is represented by the reductions to achieve GES described above. This information deficit has also been identified by SwAM who states that the problem with information availability on RBD-level in i.e., VISS extends to other pressure types as well, e.g., specific pollutants.

We know however that suggested measures on nutrients in WP3 will not be sufficient to reduce eutrophication so that GES is achieved at the end of WP3 for many of the water bodies in the RBD (more on this below). No specific target on nutrient reduction is presented for WP3, however there is an expected level of reduction from presented actions that should be implemented according to the Program Of Measures of WP3.

Looking at nutrients from agriculture on a national level for Sweden[7], the estimated reduction needed to achieve GES in all rivers, lakes and coastal water bodies is 405 tons of phosphorus and 1 960 tons of nitrogen. However, presented measures targeted at agriculture during the management period of 2021-2027 is expected to result in reduction of 275 tons of phosphorus and 920 tons of nitrogen which corresponds to 68% and 46% of the reductions level needed to reach GES for phosphorus and nitrogen Insufficient implementation of measures is mainly due to economic limitations.

Reduction targets for nutrients are decided for each water body separately based on local conditions for the specific water as well as pressures and geophysical conditions of the catchment area. There is no use of general nutrient reduction targets for recipients of a catchment area, such as targets for estuaries.

[6] The target reduction of nutrients as a percentage of the overall leakage of nutrients is not presented in the draft RBMP. Request of the data was made in complementary interviews, however it was confirmed that such data is not available.

[7] Equivalent statistics is not available for the Southern Baltic Sea RBD specifically.

Table 11: Targets for nitrogen and phosphorus in Water Plan 3 and reductions necessary. Reduction targets in terms of percentage is not available.

Nutrient	Target	Reductions necessary to reach good ecological status
Nitrogen	Not reported	2 700 ton
Phosphorus	Not reported	210 ton

From available reports and complementary interviews with country experts, it has not been possible to understand whether any changes have been made in WP3 compared to WP2 with regards to availability of data on nutrient load and nutrient targets.

5.4 Do the countries have efforts in Water Plan 3 that are expected to lead to achieving good ecological condition and is there an implementation plan for the efforts?

From the vast usage of exemptions and the large number of water bodies that are expected not to reach Good ecological status at the end of WP3, it is understood that measures presented in WP3 are not expected to be effective in full. For Southern Baltic Sea RBMP, 52% of the surface water bodies have exemption to 2027 indicating that planned measures are assessed to be successful in reaching GES in the end on WP3 for a large share of the water bodies. However, presented measures for WP3 are not assessed to be successful in full since 26% of the surface water bodies in the district have exemption to reach GES beyond 2027.

The Program Of Measures (POM) includes only measures targeted at public authorities including municipalities, county administrative boards and central agencies with relevant responsibility areas. Measures presented in the POM are mandatory for targeted authorities to comply with and the authorities are responsible for carrying out the measures in accordance with the program. Examples of measures in the POMs are preparation of relevant guidelines, giving priority to relevant physical measures or to increase compliance with existing legislations by increased supervision and control.

Physical measures, such as establishing wetlands, barrier zones or growing catch crops are not addressed in the POMs. These are instead presented in the digital platform and database Water Information System Sweden, WISS[8] where also classification of waterbodies, environmental monitoring, environmental quality standards and more are presented. The physical measures presented in

[8] Välkommen till VISS (lansstyrelsen.se)

WISS are not mandatory for landowners and operators to carry through, they are instead implemented on a voluntary basis. However, the overall purpose of the regulatory (and mandatory) measures presented in the POMs is to support and ensure that these physical measures are implemented.

The Swedish context with regards to implementation of measures in accordance with the WFD is very much affected by the structure with regards to the roles and mandate of the agencies responsible for managing and executing the Swedish implementation of the WFD. The competent authorities (one for each of the five river basin districts) are responsible for developing and presenting POMs which are then approved (or not approved) by the government. However, due to existing national environmental legislation, it is not possible for the competent authorities to present physical mandatory measures such as e.g. wetland establishment in the POMs, instead regulatory measures addressed to other authorities is presented in the POMs (as described above). Even though these regulatory measures are mandatory for the addressed authorities to execute, it is not stipulated exactly which physical or regulatory measures that should be applied. This is to be decided within each of the governmental organizations listed in the PoM. Actual measures, e.g. physical or regulatory measures, are to be integrated into the general administrative activities performed by each of the appointed agencies. This administrative design presents a problem when it comes to estimating the effects from the proposed PoM, i.e. whether it is sufficient to achieve the environmental objectives, and is likely to have a negative impact on the implementation process of physical measures during WP3.

Measures targeted at agriculture to reduce nutrients include mainly changing of land use such as establishing barrier zones or wetlands, and to grow catch crops or to use liming to reduce leakage of nutrients. As described above, presented actions are not expected to be executed in full during WP3. The most cost-effective efforts are suggested to be performed before the end of 2027, thereafter efforts will focus on measures with lower efficiency. Cost-effective actions for nutrient reductions are calculated for separate geographical areas based on local reduction potential and cost for implementing different types of actions.

6 Regulation of fertilizer storage and application

6.1 Which rules apply regarding fertilizer use? Specifically: Are there norms/quotas for nitrogen and phosphorus application? Which ones?

The agricultural sector is one of the largest contributors with regards to nutrients and eutrophication contributing with 35% of the nutrient pressures for lakes and rivers in the Southern Baltic Sea RBD. Actions addressed to farmers in order to reduce leakage of nutrients are many, including administrative actions targeted at municipalities and central agencies. There are also more direct restrictions when it comes to applying fertilizers on the fields as well as handling and storing fertilizers.

With regards to the distribution of phosphorus, there is a norm of 22 kg of phosphorus per hectare (as a mean per year over five years). This considers phosphorus from the use of all types of fertilizers and applies to general arable land. Farmers having up to 10 livestock units (*sv: djurenhet*) are exempted and can apply fertilizers resulting in a larger concentration when applying manure from their own livestock onto their own land. No quota or norm applies to distribution of nitrogen.

Table 12: Nutrient norms Sweden

Nutrient	Quota / Norm	Comment
Nitrogen	N/A	No general norm for nitrogen
Phosphorus	22 kg/ha/year	Mean over 5 years

Source: Interviews

6.2 Are there requirements to equipment for storing and applying livestock manure? Which ones?

Requirements regarding equipment are addressed only to spreading of liquid fertilizers applied to growing crops. The following methods are allowed:

- spread spectrum technique (*sv: bandspridningsteknik*) or similar technique resulting in the manure being placed directly on the farmland under the plant cover

- liquid manure injector (*sv: myllningsaggregat*) or other similar technology resulting in the manure being placed directly on the farmland
- technology resulting in the manure being partly diluted with at least 50% of water before spreading
- irrigation with at least 10 millimetres after spreading

Furthermore, if having livestock, you are required to have adequate capacity to store livestock manure and to store it in a way that leakage to surrounding environment is avoided. Adequate storage capacity is dependent on the number and type of livestock being held and if the livestock are within zones identified as vulnerable to nitrate or not. The requirements of storage capacity are specified in Table 13 below.

Table 13: Requirements to storage capacity

	Vulnerable zones according to Article 3 (2), Nitrate Directive 91/676/EEC		**Non-vulnerable zones**	
	Capacity to store manure if having cattle, horses, sheep, goats	*Capacity to store manure if having other livestock*	*Capacity to store manure if having cattle, horses, sheep, goats*	*Capacity to store manure if having other livestock*
Livestock >100	8 months	10 months	8 months	10 months
10 < livestock < 100	8 months	10 months	6 months	10 months
2 < Livestock < 10	6 months	6 months	No specific requirements	No specific requirements
Livestock ≤ 2	No specific requirements	No specific requirements	No specific requirements	No specific requirements

Source: Lagra gödsel - Jordbruksverket.se

6.3 Are there requirements in terms of point in time for storing and applying livestock manure? Which ones?

Areas in the southern regions of Sweden (Blekinge, Skåne and Halland) are designated as vulnerable zones for nitrate in accordance with the Nitrate Directive 91/676/EEC Article 3 (2). The use of fertilizers in vulnerable zones are restricted as follows:

- In August, September and October, it is only allowed to apply fertilizers on growing crops or to prepare for autumn sowing of oilseeds. If the clay content in the soil exceeds 15 % it is allowed to use fertilizers on other crops sown in autumn. The crops must be intended for wintering and must not be crops planted with the main purpose to extract nutrients.

- In October, it is allowed to spread solid fertilizers on growing crops and on bare soil. Poultry manure can only be spread onto growing crops.

- Through 1st of November to 28th of February, the usage of fertilizers is forbidden.

- In areas identified as vulnerable to nitrate, it is not allowed to spread fertilizers on land that is saturated or flooded, or that is frozen or covered by snow. Neither is it allowed to use fertilizers on land closer than 2 meters from a field bordering a lake or river or on land with inclination larger than 10% towards a stream or lake.

For areas not identified as vulnerable to nitrate the following restrictions apply:

- 1 December – 28 February: livestock manure and other organic fertilizers must be applied at least 10 cm deep which must be done within 12 hours from the time of spreading.

- Chemical fertilizers applied all year around must be deepened in the soil within 4 hours after spreading.

7 Pressure factors from other regions

7.1 How are pressure factors dealt with, e.g. nutrient supply and non-natural substances, from other countries/regions?

For lakes and rivers, nutrients from other countries are not identified as a significant pressure affecting the environmental quality with regards to eutrophication. For coastal water bodies on the other hand, the conditions on eutrophication can to a larger extent be affected by nutrient supply from the countries surrounding the Baltic Sea. From the management plan of WP2, it is found that more than 40% of pressure with regards to nutrients on the coastal water bodies are from surrounding waters, however, the contribution from neighboring countries is unclear. Even though nutrient supply from surrounding waters including neighboring countries is understood to have a significant contribution to nutrients concentrations in the coastal water bodies, mapping and quantification of nutrient supply from specific neighboring countries is not understood to be made within the regular work with the RBMPs and PoMs. Nutrient supply from neighboring countries is not addressed in the draft RBMPs or PoMs. From performed interviews within this project, it is understood that nutrient supply from other countries is not analyzed in detail, instead pressures in terms of nutrient supply from neighboring countries are addressed indirectly through assessment of nutrient load to coastal waters from surrounding waters. Measures presented in the draft PoMs for WP3 includes regulative measures addressed to national authorities, however, international cooperation within the Baltic Sea region is lifted and strongly advocated when it comes to atmospheric deposition with effects on acidification and environmental toxins.

8 Other information

8.1 Distribution in characterization: natural, strongly modified, and artificial streams.

Table 14: Distribution in characterization. Number of surface water bodies in Southern Baltic Sea RBD.

Type	Distribution
Natural	1 862 (99,4%)
Strongly modified	4 (0,2%)
Artificial streams	7 (0,4%)

9 Summarized findings

Table 15: Summary table, Sweden

	Subject / Question	Sweden, southern Baltic Sea
2	***Changes since last COWI neighbor assessment***	
2.1	*Have there been significant changes in aspects and approaches described in 05050000-Redegorelse1-korr.PDF (mst.dk)*?	No significant methodical or structural changes. No improvements of ecological status proven. More extensive use of exemptions
3	***Reference for quality parameters in WFD***	
3.1	*Methodology for establishing reference condition for quality parameters?*	Mathematical calculations with measured values and in some cases expert assessment dependent on availability of data
3.2	*Point in time*	N/A
4	***Status (Southern Baltic Sea)***	
4.1	*Water areas in high, good, moderate, and poor condition*	0% high, 20% good, 70% moderate, 8% poor
4.2	*Status for implementing Water Plan 2 and Water plan 3*	*RBMPs under preparation. Draft versions under public consultation during Nov 2020 – April 2021.*
5	***Water Plan 3 contents***	
5.1	*Efforts planned on other pressure factors than nutrients in WP3 and is there an implementation plan for efforts in WP3?*	Yes Implementation after cost-effectiveness of measures
5.2	*Exemptions from the WFD used in WP3? And is there a "Plan B", e.g. preparations for a potential 4th plan period or for seeking exemptions to larger degrees?*	Yes Extensive use of exemptions to reach GES beyond 2027, i.e. WP4
5.3	*WP3 target, nitrogen (ton, %)*	No percentage target on nitrogen reduction is presented
5.3	*WP3 target, phosphorus (ton, %)*	No percentage target on phosphorus is presented
5.3	*Reductions necessary to reach targets, nitrogen? (ton, %)*	2700 ton
5.3	*Reductions necessary to reach targets, phosphorus? (ton, %)*	210 ton
5.3	*Concrete targets, e.g., concentration in estuaries, nitrogen?*	No
5.3	*Concrete targets, e.g., concentration in estuaries, phosphorus?*	No
5.4	*Efforts in WP3 expected to lead to good ecological condition?*	Measures planned 2021-2027 are assessed to lead to GES for 52% of the waterbodies. 26% of all water bodies in the district have exemption beyond 2027

6	***Regulation of fertilizer storage and application***	
6.1	*Norms/quotas for nitrogen application?* *Which ones?*	No general norm for nitrogen application
6.1	*Norms/quotas for phosphorus application?* *Which ones?*	Yes 22 kg/ha/year, as a mean value over 5 years
6.2	*Requirements to equipment for storing and applying livestock manure?* *Which ones?*	Yes Requirements apply to liquid fertilizers including technology for increased precision during application and irrigation after spreading
6.3	*Requirements in terms of point in time for storing and applying livestock manure?* *Which ones?*	Yes In nitrate sensitive zones no application of fertilizers is allowed from November to February. More restrictions for application of fertilizers are presented in section 5.3. In non-vulnerable zones, fertilizer application is allowed all year however treatment requirements varies over time.
7	***Pressure factors from other regions***	
7.1	*How are pressure factors dealt with, e.g. nutrient supply and non-natural substances, from other countries/regions?*	No measures or other specific treatment of pressures from other regions or countries
8	**Additional information**	
	Distribution in characterization: natural, strongly modified, and artificial streams.	Natural: 1 862 / 99.4% Strongly modified: 4 / 0.2% Artificial streams: 7 (0.4%)

Table 16: List of interviewees

Country	Name	Organisation
Sweden	Martin Erlandsson Lampa	Competent authority
Sweden	Anneli Harlén	Swedish Agency for Marine and Water Management
Sweden	Jonas Svensson	Swedish Agency for Marine and Water Management