

Role of stakeholders' perspectives in complex water issues

A case study: Project Mainport Rotterdam,
Appropriate Assessment Wadden Sea

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Preface

This report describes the case study research on the Appropriate Assessment Wadden Sea, that is conducted by Ir Saskia Hommes as part of her PhD-project, as complete as possible. In the period from April to November 2005, the researcher participated in the project Appropriate Assessment Wadden Sea, which is part of Project Mainport Rotterdam, by attending and observing project meetings. And from October 2005 to July 2006, the researcher conducted interviews with participants of the project.

We would like to thank RIKZ and in particular Rien van Zetten and John de Ronde for giving us the opportunity to observe the project “from the inside” and guiding the researcher. Furthermore, we are grateful to all the participants for their cooperation and remarks and especially the participants with whom we did an in-depth interview.

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List of abbreviations

BHD:	Birds and Habitats Directive (Dutch: <i>Vogel- en Habitatrichtlijn</i>)
CPD+:	Core Planning Decision plus (Dutch: <i>Planologische Kernbeslissing plus</i>)
DD:	Domain Decomposition
DG RWS:	Directorate-General of Public Works and Water Management
DGTL:	Directorate-General for Civil Aviation and Transport
EC:	European Commission
EIA:	Environmental Impact Assessment
ERA:	Existing Rotterdam Area
EU:	European Union
EZ:	Ministry of Economic Affairs
GAB:	Reference Design II
GAN:	Reference Design I
HWE:	Heinis Water & Ecology
LNV:	Ministry of Agriculture, Nature and Food Quality
MV2:	Extension of Maasvlakte/Second Maasvlakte (Dutch: <i>Maasvlakte 2</i>)
NIOO:	Netherlands Institute of Ecology
NIOZ:	Royal Netherlands Institute for Sea Research
PMR:	Project Mainport Rotterdam
PoR:	Port of Rotterdam (Dutch: <i>Havenbedrijf Rotterdam</i>)
RIKZ:	National Institute for Coastal and Marine Management (Dutch: <i>Rijksinstituut voor Kust en Zee</i>)
RIVO:	Netherlands Institute for Fisheries Research
SPA:	Special Protection Area
SPM:	SusPended Matter
VROM:	Ministry of Housing, Spatial Planning and the Environment
V&W:	Ministry of Transport, Public Works and Water Management
WFD:	Water Framework Directive
ZUNO:	Southern North Sea model

1 Introduction

1.1 Research scope

Rotterdam Mainport in the Netherlands is one of the largest ports in the world. In Project Mainport Rotterdam (PMR), the Dutch government aims to strengthen this position by a 1000 hectares seaward extension of the port. This extension may affect the Wadden Sea area, a unique nature area protected by the European Bird and Habitat Directives. Therefore, a so-called Appropriate Assessment procedure had to be carried out, to show the impact of the project on the integrity of the area. Decision-makers involved in these kinds of plans have to deal with ecological effects, physical effects, economic costs and benefits and technical feasibility. Furthermore, they operate within a complex web of interactions between national and international policy and regulations, and social and political processes.

This PhD-project aims at assisting decision-makers in constructing assessments of the impact of future human interventions in large-scale water systems, i.e. rivers, estuaries, coastal zones and seas. In the period from March 2005 – July 2006, we have investigated the project Appropriate Assessment Wadden Sea, which is part of Project Mainport Rotterdam, to learn lessons from practice and combine these with theory. Our analysis in this report focuses on the *process* as well as the *contents* of the Appropriate Assessment Wadden Sea. For the process we focus on: how the problem was structured; and how the assessment framework was developed and used. The contents part focuses on the use of technical and natural scientific knowledge (i.e. hydraulic models, ecological models, expert judgement) in the effect assessment. Although, process and contents are strongly interwoven in reality (see e.g.: Edelenbos et al., 2000), for analytical reasons we separate them.

1.2 Research method & instruments

In this report, we describe the case study observations and reflect on the research questions, which are formulated in the next section. We analyzed this case study using:

- project documents;
- news reports;
- interviews with participants; and
- observations from attended project meetings.

In the period from April to November 2005, the researcher participated in the project Appropriate Assessment Wadden Sea by attending project meetings (see list Appendix A). The researcher had the role of observer in these project meetings. The observations and minutes from these meetings were used to get better insight into the project.

From October 2005 to July 2006, the researcher conducted interviews with nine participants (see list Appendix B) of the project Appropriate Assessment Wadden Sea. These interviews were done to understand the process of the project and the perspectives¹ of the participants involved in the project. The list of interview questions evolved with each interview and eventually we clustered the questions around themes, which are also used in this report.

¹ We use the following definition of *perspective*: "A coherent and consistent description of the perceptual screen through which (groups of) people interpret or make sense of the world and its social dimensions, and which guides them in acting. A perspective thus comprises both a worldview (i.e. how people interpret the world) and a management style (i.e. how they act upon it) (Van Asselt (2000), "Perspectives on Uncertainty and Risk - The PRIMA Approach to Decision Support")

The research method that is used in this case study is called *ethnography*. Hammersley and Atkinson (1995) describe the methodology of ethnography as "...the ethnographer participating, overtly or covertly, in people's daily lives for an extended period of time, watching what happens, listening to what is said, asking questions – in fact, collecting whatever data are available to throw light on the issues that are the focus of the research [...] An important aspect of social science and thus of ethnography is *reflexivity*: the fact that we are part of the social world we study...(Hammersley and Atkinson, 1995)" This is an important aspect to keep in mind in the analysis of our case study.

1.3 Research questions

The research questions for the case study of the Appropriate Assessment Wadden Sea are divided into questions on: context (question 1); process to contents (question 2 and 3); and contents to process (question 4). The questions are as follows:

1. *How does policy context influence the Appropriate Assessment Wadden Sea project? (context)*
2. *How is the problem structured in the Appropriate Assessment Wadden Sea project? (process → contents)*
3. *How is the Assessment framework developed in the Appropriate Assessment Wadden Sea project? (process → contents)*
4. *What is the role of technical and natural scientific knowledge in the Appropriate Assessment Wadden Sea? (contents → process)*

1.4 Reading guide

We use the so-called *planning triangle* to structure this report. This triangle, which is used in spatial planning, consists of the following aspects: contents; process; and context. The *content* forms the object of the problem situation. The *process* focuses on stakeholders², means, time planning and organisation. The *context* sets the boundary conditions in which the content and procedural (process) objectives can be realised (Spit and Zoete, 2002).

In the next chapters, we first describe the context of our case study analysis: the Project Mainport Rotterdam (Chapter 2) and the Appropriate Assessment Wadden Sea (Chapter 3, research question 1). Then the process of the Appropriate Assessment Wadden Sea project is analyzed. In Chapter 4, the focus is on the process of problem structuring (research question 2) and in Chapter 5 the development of the assessment framework is investigated (research question 3). The contents part that is analyzed in this report is the role of technical and natural scientific knowledge (Chapter 6, research question 4). At last, conclusions are drawn in Chapter 7. Note that in the text boxes reflection, on the Appropriate Assessment Wadden Sea project, is given by the researcher.

² We use the following definition of **stakeholder**: "Any person, group or organisation with an interest or "stake" in an issue, either because they will be affected or because they have some influence on its outcome (HarmoniCOP (2005), "Learning together to manage together - improving participation in water management".) Thus, all participants in the Appropriate Assessment Wadden Sea projects are stakeholders.

2 Context: Project Mainport Rotterdam

2.1 Project history

Rotterdam Mainport is located in the Southwest of the Netherlands and is one of the largest ports in the world. The Dutch government wishes to strengthen this position and on the other hand they wish to increase the quality of the living environment of the Rotterdam region. This wish resulted in the project decision 'Space shortage at the Mainport of Rotterdam' on 14 July 1997³ in which the cabinet acknowledges "...that finding space for expansion activities at Rotterdam would be useful and necessary and that, in the context of spatial development, opportunities should be utilised to improve the quality of the living environment in and around the port."³ The Project Mainport Rotterdam (PMR) was established to conduct further research and to set up project activities for realising this double objective. PMR is a collaborative project comprising the following government authorities: Ministry of Transport, Public Works and Water Management (V&W); Ministry of Finance; Ministry of Economic Affairs (EZ); Ministry of Housing, Spatial Planning and the Environment (VROM); Ministry of Agriculture, Nature and Food Quality (LNV); Rotterdam urban region; Municipality of Rotterdam; and Province of South Holland.⁴

Project Mainport Rotterdam consists of three subprojects (Figure 2.1):

1. Existing Rotterdam Area: 14 projects aimed at more intensive utilisation of space and existing port and industrial area and improvement of the quality of the living environment;
2. Wildlife and recreational area: a 750-hectare area near Rotterdam, designed to improve the quality of the living environment, will be developed;
3. Land reclamation (Maasvlakte 2): construction of a new, 1.000 hectares of port and industrial area in the North Sea linked to the existing Maasvlakte (Ministerie van V&W, 2001). The subproject Maasvlakte 2 is the focus of our case study and is further described in section 2.3;



Figure 2.1: Subprojects of Project Mainport Rotterdam (Ministerie van V&W, 2001)

³ Lower House, 1996-1997, parliamentary session 24 691, no. 3

⁴ Website PMR (2005), "www.mainport-pmr.nl"

2.2 Core Planning Decision

The decision process concerning the Project Mainport Rotterdam took place via a Core Planning Decision-plus (CDP+). The CDP+ procedure for PMR started in 1998 and will end with a government's position on the project. The aspects that are included in the CPD+ are the following: the location and scope of the land reclamation; the area within which sand extraction may take place; possible locations for compensating natural resources lost through land reclamation; the location(s) and layout of a 750-hectare wildlife and recreational area.

For several of the activities from the Core Planning Decision-plus, an Environmental Impact Assessment (EIA) procedure is followed. The EIA describes the various projects' effects on wildlife, recreation and the natural environment. It provides the environmental data needed for weighing of interests in the decision process of the PMR projects. The environmental effects of PMR are assessed in comparison to the reference situation; the situation in 2020 without realization of PMR. Furthermore, the EIA also indicates ways of mitigating or compensating for any negative effects. At last, the EIA forms part of the decision process and is subject to public participation and advice (Ministerie van V&W, 2001).

2.3 Maasvlakte 2

The EIA describes the environmental effect of two realistic examples of potential land reclamation, the so-called reference designs I and II (Figure 2.2). Reference designs I and II are both situated in the northern part of the search area (see Figure 2.1). Together with the existing Maasvlakte, they form a single large port and industrial area. A southerly variant also exists for reference design II, to give an impression of the effects of a southerly location.

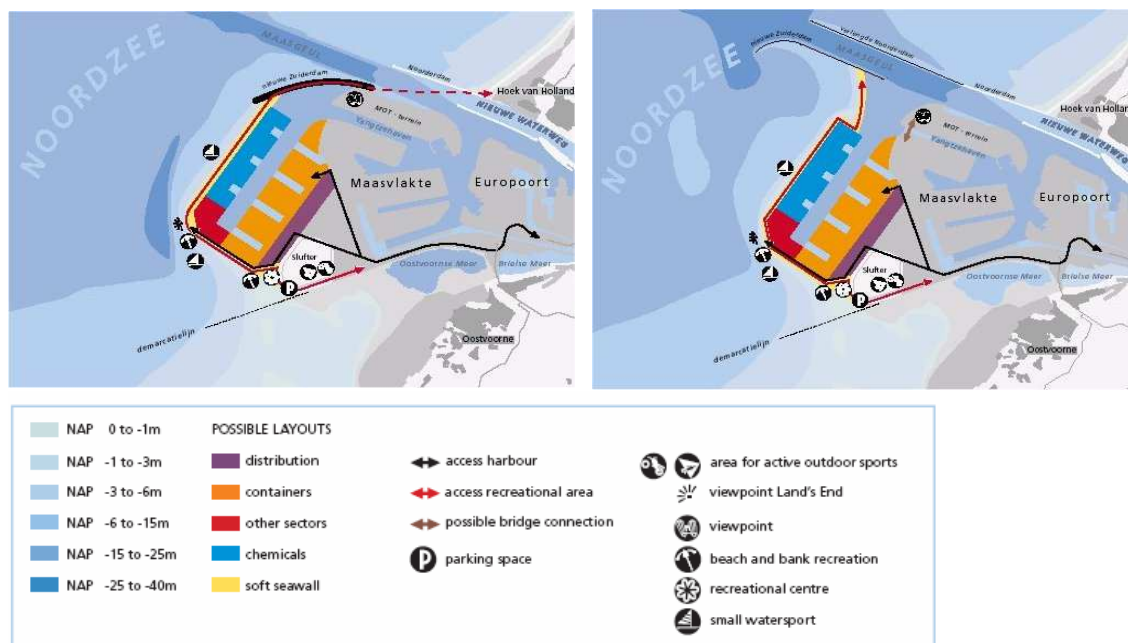


Figure 2.2: Reference designs (Ministerie van V&W, 2001)
left: Reference design I; right: Reference design II

The reference designs have been modified on the basis of additional studies into what is referred to as the Cutting-through variant (Dutch: *Doorsteek variant*). This variant is characterized by a port entrance through the existing Yangtze-harbour, similar to the Reference Design I. The difference with this design is that the Cutting-through variant protrudes less far into the sea and it has a smaller gross area. Furthermore, the shape of the coastline has been designed in such a way that the current pattern in the sea is influenced as little as possible (see Figure 2.3). The Cutting-through variant has been further developed by the Port of Rotterdam in the framework of the Construction EIA, in which the Cutting-through variant will be compared to the Reference Designs (De Jong et al., 2005; De Snoor, 2004).

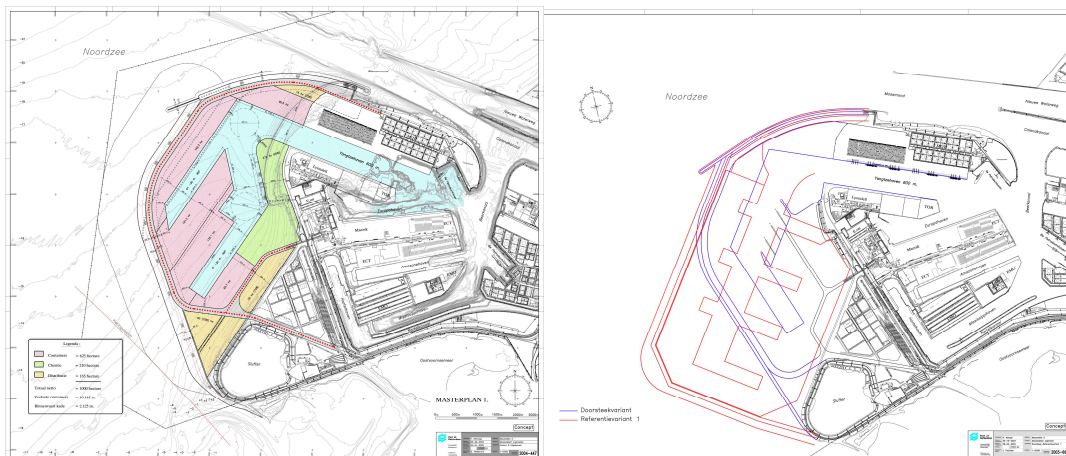


Figure 2.3: Cutting-through variant (left) and Reference design I (right, red)

3 Context: Appropriate Assessment Wadden Sea

3.1 Judgement Council of State

In January 2005, the Council of State⁵ (Dutch: *Raad van State*) judged that a number of objections against specific policy decisions⁶ of the Core Planning Decision plus (CPD+) PMR were valid. The Council of State declared all specific policy decisions invalid, because they are interconnected (Raad van State, 2005). Due to the Council's decision, the implementation of PMR has become less certain. Therefore, the PMR partners have decided to rectify the specific policy decisions in the CPD+. One of the reasons why the Council of State invalidated the specific policy decisions is that they claimed that "...it can not be excluded that the land reclamation has consequences on the fish larvae and mud transport northwards along the coast and that this [...] can have significant consequences for the Special Conservation Area Wadden Sea in the frame of its conservation objectives. This means that the defender should have made an *Appropriate Assessment* in aid of the consequences of the land reclamation on the protected values of the Wadden Sea..."⁷ Furthermore, the Council of State concluded that "...it was not made plausible that further research could not contribute to more clearness on the amount and the consequences of the decreased mud and fish larvae transport for the protected values of the Wadden Sea..."⁷

In short, the Council of State concluded that the land reclamation (MV2) may affect the Wadden Sea area, a unique nature area protected by the European Bird and Habitat Directives. Therefore, a so-called Appropriate Assessment procedure had to be carried out, to show the impact of the project on the integrity of the area. This procedure was not carried out before. Furthermore, the Council of State stated that the investigations that were done for the CPD+ do not indicate that further research, on changes in mud and fish larvae transport, could not give more insight into the impact of MV2 on the protected values of Wadden Sea. Therefore, part of the revision of the CPD+ is to perform an Appropriate Assessment procedure and the related investigations.

Researcher's reflection

In February 2002, the Dutch Council of Ministers filed a request for advice, in the framework of Article 6.3 and 6.4 of the Habitats Directive concerning the Project Mainport Rotterdam*, to the European Commission. In this report, they wrote that "...The nature and magnitude of the effect of changes in North-Sea silt transport, due to construction of the reclaimed land, involving a possible change in the Wadden Sea is not known. Nor is it known whether the effect would be positive, neutral or negative (and perhaps significant). Various studies (e.g. "Silt Distribution Research", WL|Delft Hydraulics, 2001) have failed to provide guiding solutions. Expert judgement indicates that further, supplementary studies would do little to reduce the uncertainty. Given current knowledge, no new data is expected in the next five to ten years. If monitoring programs should reveal significant negative effects, mitigating and compensatory measures would then be taken...(Project Mainport Rotterdam, 2001)"

* Including Appropriate Assessments for the protected areas Voordelta, Voorne dunes, Kwade Hoek and Kop van Goeree.

⁵ The Department of Administrative Law of the Council of State forms the highest general administrative judge of the Netherlands. This department administers justice in matters of dispute between citizens and government.

⁶ Specific policy decisions are part of a CPD+ and are binding for lower authorities.

⁷ Raad van State (2005), "Uitspraak zaaknummer 200307350/1"

Researcher's reflection (continued)

In April 2003, the European Commission gave an answer to this request. With regard to the effects of MV2 on the Wadden Sea, the European Commission states that "...the possible consequences of the land reclamation [...] on the Wadden Sea are thoroughly investigated, using state-of-the-art knowledge; however the error rate of the calculations is substantial. From the view of the precautionary principle, the Commission claims that risk of negative consequence by the land reclamation [...] on the Wadden Sea should be handled by careful monitoring as part of the realization of the project, with the possibility of taking correcting measures when significant negative consequences for the conservation status of the Wadden Sea occur or are most likely to occur...(Europese Commissie, 2003)"

Although the European Commission advised the Dutch government in 2003 to handle the effects of MV2 on the Wadden Sea by *careful monitoring*, the Council of State judged in 2005 that an *Appropriate Assessment procedure* for the Wadden Sea should have been carried out. We observe that the legislation, i.e. Birds and Habitats Directive, is interpreted differently by the Council of State than by the European Commission.

3.2 Appropriate Assessment procedure

3.2.1 Birds and Habitats Directive

The aim of the European Birds and Habitats Directive is to ensure the sustainable protection of habitats, plants and animal species and their natural living environments on European scale. In particular, the Directives impose the assignment of Special Areas of Conservation, the Natura2000 sites (e.g. Wadden Sea) and the formulation of conservation objectives for these sites. To assess whether a project is in compliance with the European Birds and Habitats Directive, a procedure needs to be followed. This procedure has been laid down in Article 6 (3) and (4) of the Habitat Directive and can be translated into four stages (see Appendix C and European Commission, 2001).

Stage I: Screening

Screening is the first stage (Figure 3.1) of the procedure. In this stage, the initiator must determine whether the plan/project is likely to have a significant effect on a Natura 2000 site. Article 6 (3) states that "...Any plan or project not directly connected with or necessary to the management of the site but *likely to have a significant effect* thereon [...] shall be subject to appropriate assessment [...] This phrase includes a cause-and-effect relationship. On the one hand, it is necessary to explore what sorts of effects are covered ('*significant effects*'), and then to explore what sorts of causes are likely to create such effects ('*likely to have*').... (European Commission, 2000)" Thus, if significant effects are to be expected the initiator of the plan/project has to execute an Appropriate Assessment.

Researcher's reflection

The European Commission (2000) describes that "...The notion of what is significant needs to be interpreted objectively [...] And the procedure is triggered not by a *certainty* but by a *likelihood* of significant effect..." However, no clear criteria are given by the European Commission for these two important parameters: significance and likelihood. It is therefore not clear why it is necessary to include the Wadden Sea in the CPD+ PMR and why it is not necessary to include another Natura 2000 site (for instance along the coast of Germany or Denmark) and who should determine this. In this case, the Council of State judged that the Appropriate Assessment Wadden Sea should be executed; however they have no ecological expertise on for instance the geographical reach of the impact of MV2. One could argue that this should be determined using expert judgement.

Stage One: Screening

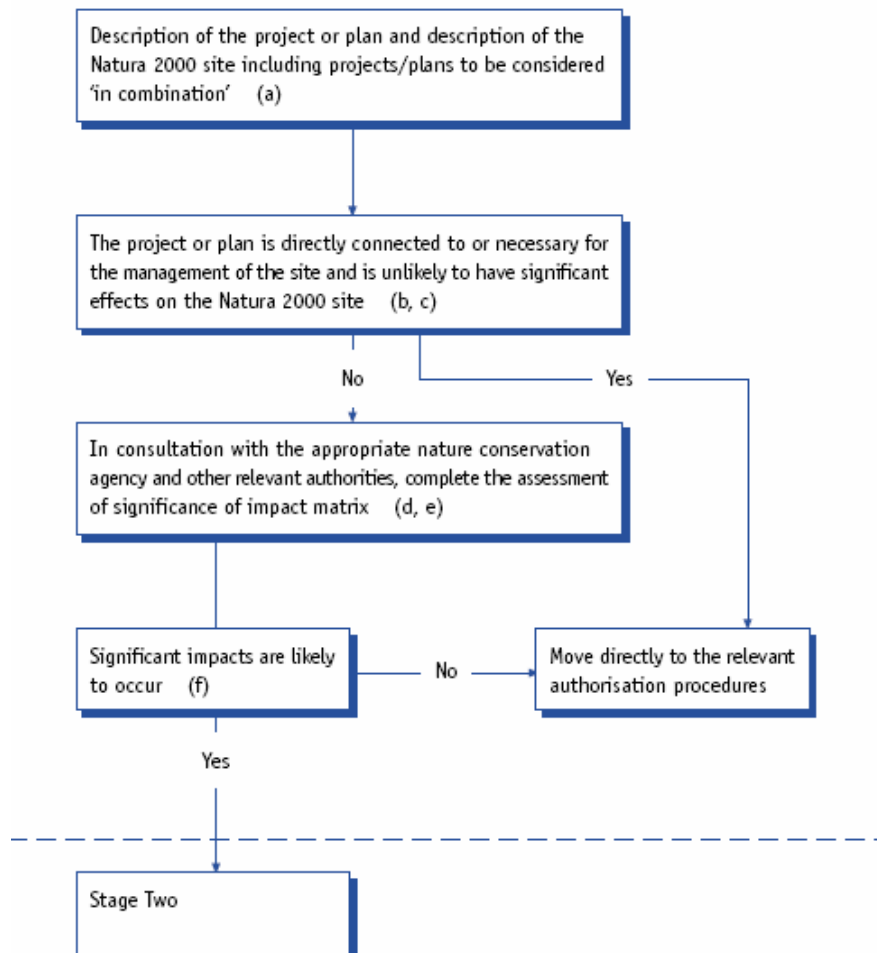


Figure 3.1: Flow chart for screening stage of the Habitats Directive Article 6(3) and 6(4) (European Commission, 2001)

Stage II: Appropriate Assessment

The Appropriate Assessment is the second stage in the procedure (Figure 3.2). “In this stage, the impact of the project [...] on the integrity of the Natura 2000 site is considered with respect to the conservation objectives of the site and its structure and function...(European Commission, 2000)”

Stage Two: Appropriate assessment

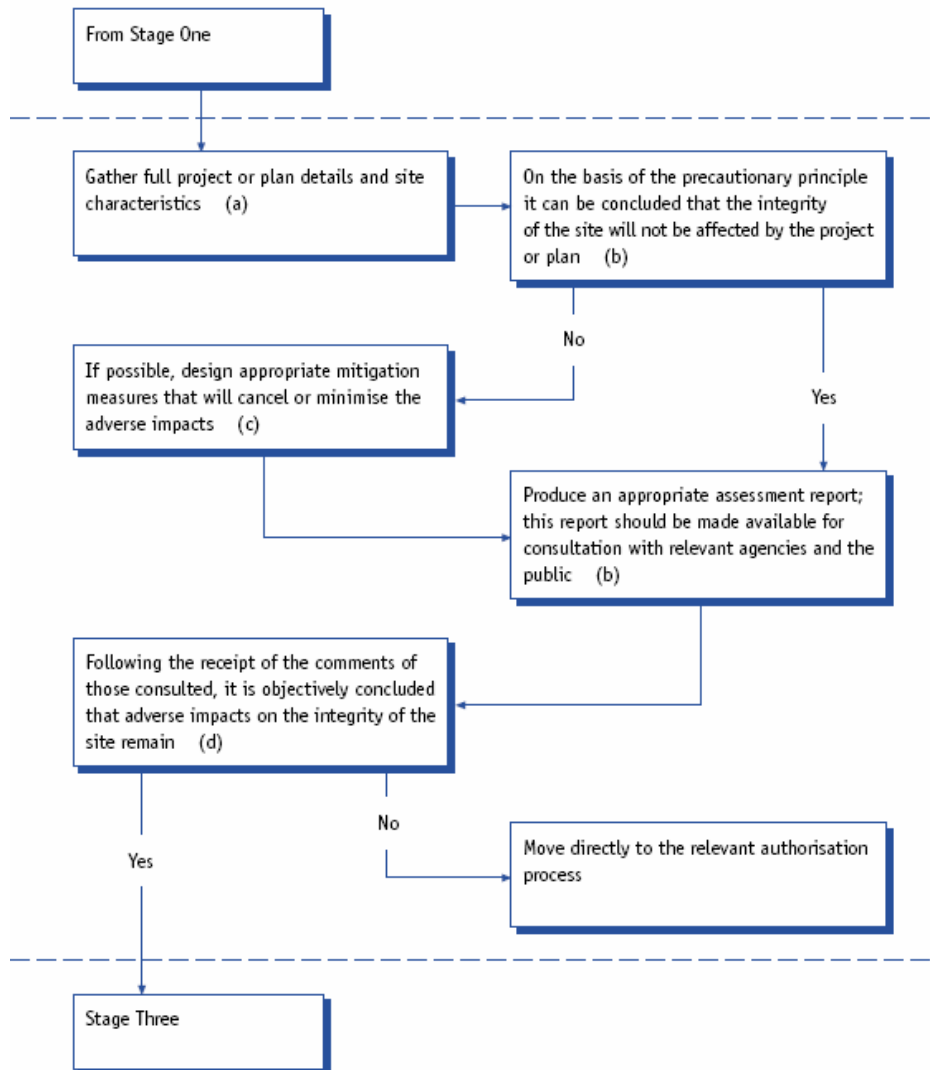


Figure 3.2: Flow chart of the appropriate assessment stage of the Habitats Directive Article 6(3) and 6(4) (European Commission, 2001)

Researcher's reflection

In their judgement the Council of State claims that an Appropriate Assessment procedure should be executed to determine the effects of MV2 on the Wadden Sea. However, this procedure forms the second stage of the Habitat Directive Article 6.3 and 6.4. In the first stage (screening), it must be determined if MV2 is likely to have significant effects on a Natura 2000 site, in this case the Wadden Sea. This stage is however not made explicit in the CPD+ PMR and the outcome of this stage is somehow taken for granted by the Council of State.

3.2.2 Methodological guidance on Appropriate Assessment procedure

According to the methodological guidance of the European Commission (2001), an Appropriate Assessment (Stage II, Figure 3.2) consists of the following steps:

1. Information required: identify conservation objectives of the site and those aspects of the project that will affect those objectives.
2. Impact prediction: should be done within a structured and systematic framework and completed as objectively as possible.
3. Conservation objectives: assess whether there will be adverse effects on the integrity of the site as defined by the conservation objectives and status of the site. If at this stage information is lacking, then adverse effects should be assumed (precautionary principle). Where it cannot be demonstrated that there will be no adverse effects, it is necessary to take mitigation measures.
4. Mitigation measures: need to be assessed against the adverse effects the project is likely to cause.

Researcher's reflection

RWS/RIKZ used what they call an assessment framework^a for the Habitats Directive, article 6 (part 3 and 4) that was “developed” by Moes CMS BV^b. This assessment framework is similar to the flow chart from the European Commission (Appendix C), of which the Appropriate Assessment is one stage. It is not clear why they used this “different” assessment framework and did not use the methodological guidance by the European Commission (European Commission, 2000; 2001, see also Section 3.2.2). One of the project members of RIKZ remarks to have used the EU methodological guidance to think about the assessment framework RIKZ used for the Appropriate Assessment document^c (see Section 5.3.1).

^a The term assessment framework is used by RWS/RIKZ to describe the flow chart for the Habitats Directive (Appendix C). Note that this definition is different from the definition we use in Chapter 5.

^b A one-man business in the field of law, technology and spatial planning; Website Moes CMS BV: www.Moes-CMS.NL

^c Interview project member RIKZ: 8 November 2005

3.3 Organization structure

The organisation structure for the Appropriate Assessment Wadden Sea is given in Figure 3.3. In this figure it is shown that one of the public organizations, more specifically the Dutch Fishermen Union objected to the CPD+ PMR on land reclamation, at the Council of State. Then the Council of State invalidated this specific policy decision (see Section 3.1) and obliged to the authorities in the Project Mainport Rotterdam (PMR) to revise the CPD+. The Ministry of Transport, Public Works and Water Management, which is part of PMR, commissioned the Directorate-General for Civil Aviation and Transport (DGTL) to revise the CPD+ on the part of the land reclamation. DGTL in their turn commissioned the task of performing the Appropriate Assessment procedure to the National Institute for Coastal and Marine Management (RIKZ), one of the specialist services of the Directorate-General of Public Works and Water Management (DG RWS).

RIKZ and the Port of Rotterdam (PoR) worked together on the Appropriate Assessment Wadden Sea, because they were both ‘problem owner’. PoR is responsible for the Construction Environmental Impact Assessment (EIA) and the government is responsible for the CPD+. Both are necessary to ensure the construction of MV2. PoR and RIKZ commissioned Consortium 3|MV2, which already existed and had contracts for the Construction EIA, for the investigations in the context of the Appropriate

Assessment.⁸ Finally, RIKZ asked a panel of international experts to perform an audit of the scientific underpinning of the Appropriate Assessment and the consistent use of scientific results in the Appropriate Assessment, at the end of the project (in October 2005). In the next chapter, the relevant organizations (stakeholders) will be described.

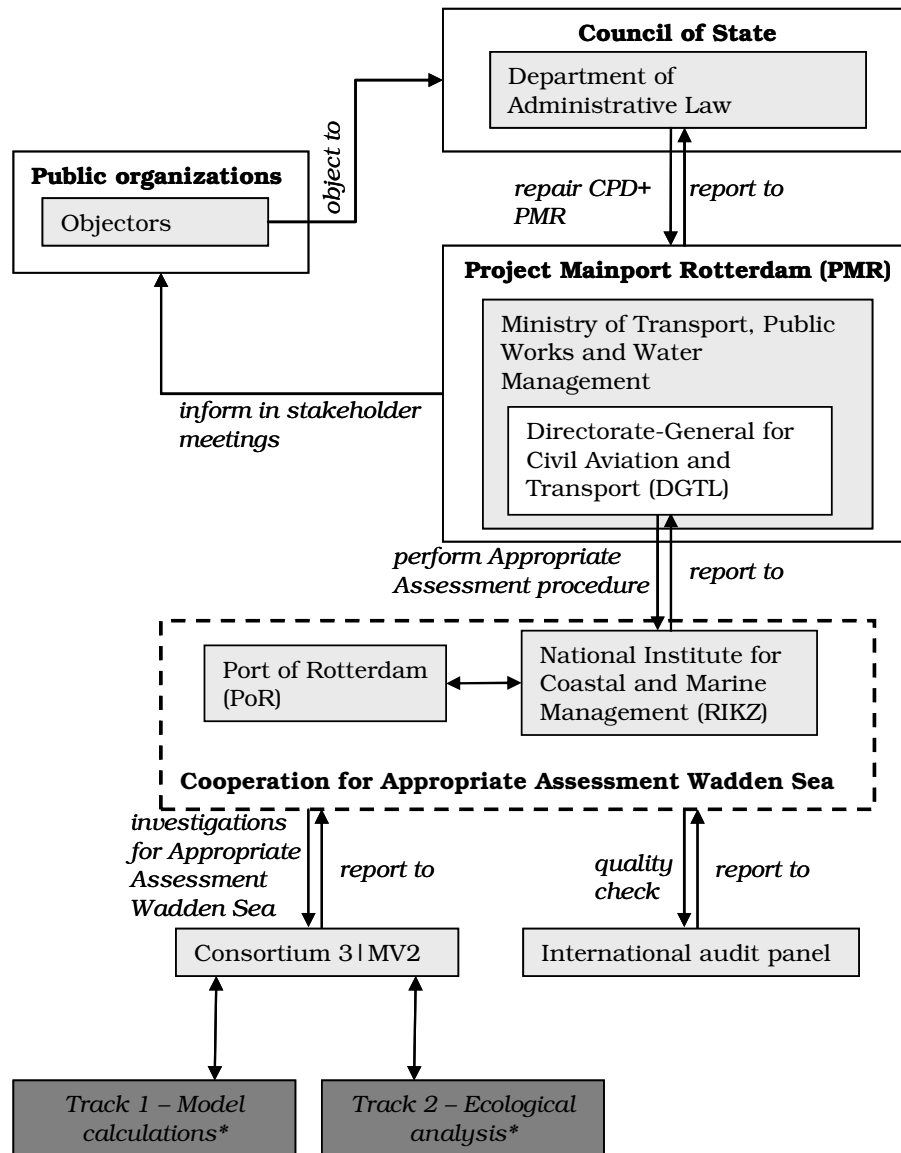


Figure 3.3: Organization structure, Appropriate Assessment Wadden Sea
* described in Chapter 4

As we now introduced the Project Mainport Rotterdam, the Appropriate Assessment Wadden Sea and the organizations involved in the project, the remainder of the report focuses on the analysis of the case study. This analysis focuses on the *process* as well as the *contents* of the assessment and reflects on the research questions formulated in Section 1.2. In the next chapter, we describe how the problem was structured by the different stakeholders in the process.

⁸ Interviews project leader RIKZ, 22 November 2005 and 13 March 2006

4 Process → Contents: Problem structuring

4.1 Introduction

The simplest description of a *problem* is a gap between a normative criterion and a perception of a current or expected situation. In every problem two very dissimilar elements are joined together: criteria or normative elements (standards, values, principles, ideals, goals); and empirical or factual elements (situations, conditions). Therefore, problems are never objective, non-human facts (Van de Graaf and Hoppe, 1996) and can be interpreted differently by every stakeholder. That is why it is important to know how the different stakeholders, in the project Appropriate Assessment Wadden Sea, interpreted the problem at hand.

In this chapter, we analyze this process of problem structuring in the project Appropriate Assessment Wadden Sea. We define the term *problem structuring* as: defining the problem, deciding how to approach the problem and which steps are needed to solve the problem. The analysis is done using the following operational questions:

- How (who, when, what) was the problem defined?
- How (who, when, what) was the problem approach developed?
- How do the information exchange and communication influence the process of problem structuring?
- How do perspectives of the different stakeholders influence the process of problem structuring?

In Section 4.2, we analyze the first research question on the problem definition. Then in Section 4.3, the focus is on the problem approach (second research question). The third and fourth research questions, on influence of information exchange, communication and stakeholders' perspectives, are interwoven into these two sections.

4.2 Problem definition

In this section, we will describe *who* defined the problem, *when* the different stakeholders did this and *what* problem definition they used. In Section 4.2.1 to 4.2.3, this analysis is done using project documents and information from e.g. stakeholders' websites to determine the stakeholders' interests (formal position) and their position in the project. In Section 4.2.4 to 4.2.6, additional observations from project meetings and interviews were used to analyze the stakeholders' problem definitions.

4.2.1 Objectors – Dutch Fishermen Union

In the period from 30 September to 11 November 2003, a total number of 18 objections were filed against specific policy decisions in the CPD+ PMR, by different stakeholders at the Council of State (see Figure 3.3). One of the objectors was the Dutch Fishermen Union, they objected to the specific policy decision for the land reclamation. They claim that "...the specific policy decision for land reclamation, as far as the consequences for fish larvae and mud transport to the Wadden Sea are concerned, is contrary to the [...] Habitats Directive (article 6, part 3) and the precautionary principle [...], because the ecological effects were not or not sufficiently investigated..."⁹

⁹ Raad van State (2005), "Uitspraak zaaknummer 200307350/1"

Researcher's reflection

The problem definition of the Dutch Fishermen Union is not made explicit in the judgment of the Council of State. However, their stake is in sea and coastal fishing^a, thus their problem definition must be in that direction. The fishermen are afraid to lose profit, due to decrease in the amount of fish as an effect of decreased mud- and fish larvae transport to the Wadden Sea. The Dutch Fishermen Union was involved in the project Appropriate Assessment Wadden Sea in stakeholder meetings, held by PMR to inform public organizations interested in the Wadden Sea (see Figure 3.3). However, they were not present at these meetings.^b This gives the impression that they are not so much concerned about the Wadden Sea, but had other reasons to object to the CPD+, for example the loss of fishing area where MV2 is constructed. Thus, the problem definition by the Dutch Fishermen Union describes a spatial problem: *'Loss of fishing area!'* They are afraid to lose fishing area where the MV2 is constructed and are not so much concerned about the Wadden Sea.

^a Website Dutch Fishermen Union: <http://www.vissersbond.nl/>

^b Minutes stakeholder meetings: 15 July 2005, 26 September 2005 and 25 November 2005

4.2.2 Council of State – Department of Administrative Law

The Department of Administrative Law of the Council of State forms the highest general administrative judge of the Netherlands. This department administers justice in matters of dispute between citizens and government: in this case the Dutch Fishermen Union and PMR. The Council of State is a law institution and has their stake in justice.

Researcher's reflection

The problem definition of the Council of State can be described as follows: the specific policy decision for land reclamation in the CPD+ PMR does no justice to the Habitat Directive, article 6, part 3 (see also Section 3.1), which states that an Appropriate Assessment procedure should have been followed for the effects of MV2 on the Wadden Sea. Therefore, the Council of State declared this specific policy decision invalid and obliged the authorities in the Project Mainport Rotterdam (PMR) to revise the CPD+ on this part (and other parts, but this is outside the scope of our analysis), by performing an Appropriate Assessment procedure.

Thus, the problem is interpreted by the Council of State as a legal/procedural problem: *'Procedure not followed!'* In the CPD+ PMR no Appropriate Assessment procedure for the Wadden Sea is done, as required by the Habitats Directive.

4.2.3 PMR and DGTL

PMR is responsible for the CPD+, which is carried out to ensure the spatial developments in the Rotterdam area and specifically (for our analysis) the land reclamation (MV2). PMR is DGTL commissioned to revise the CPD+ PMR at this part. Their problem definition is described in the assignment letter to RIKZ¹⁰. The assignment is to:

- make the assessment based on complete and current knowledge;
- use Conservation Targets for the area to assess the effects;
- make the effects as quantitative as possible; and
- make participation, appeal and objection possible.

RIKZ is responsible for the first three points and DGTL/PMR takes the last point as their responsibility. This is done by involving public organizations in stakeholder meetings (Figure 3.3) and making the revised CPD+ open for appeals and objections (RWS/RIKZ, 2005).

Researcher's reflection

The problem definition of PMR is that, by the invalidation of the CPD+ PMR on the part of land reclamation, the construction of MV2 is no longer ensured by legal means. Thus, this describes a legal/procedural problem definition: '*Construction MV2 not ensured!*'

4.2.4 RIKZ

RIKZ forms one of the specialist divisions of DG RWS and is supplier of knowledge on subjects concerning the sustained use of estuaries, coasts and seas. DGTL commissioned RIKZ to carry out the Appropriate Assessment procedure. Essentially, the Council of State invalidated the specific policy decision on land reclamation, because the Appropriate Assessment procedure was not carried out. Thus, the Council of State only judges the process/procedure that was (not) followed and not the contents. However, a few of the project members of RIKZ have the feeling that in this case also the contents was judged, because it was explicitly named that the consequences for the Wadden Sea of effects on mud and fish larvae transport were not sufficiently investigated.¹¹ Therefore, the project leader of RIKZ insisted on discussing about the argumentation for the judgment with the Council of State. However, DGTL did not think this was necessary, because they have enough juridical expertise to explain the judgement.¹²

Researcher's reflection

The feeling that dominates among all project members of RIKZ was that '*...we must pull out all the stops...*' or '*....we must work on the edge of what is possible...*'. Thus, the problem is interpreted as a *scientific problem*, namely the effects of MV2 on the Wadden Sea are not sufficiently investigated.

¹⁰ RWS/RIKZ (2005), "Passende beoordeling PMR Waddenzee - PROJECTPLAN"

¹¹ Personal communication with project leader RIKZ, 7 March 2005; Interview track 1 leader Consortium, 31 July 2006

¹² Interview project leader RIKZ, 13 March 2006

4.2.5 Port of Rotterdam

The Port of Rotterdam (PoR) became a government-owned corporation in 2004. The Port Authority develops, manages and operates the port of Rotterdam. It also promotes the interests of the port community and helps strengthen the port's competitive position. The construction of MV2 is aimed at strengthening this position. However, this construction has become less certain after the judgement of the Council of State.

Moreover, the PoR is also responsible for the Construction EIA. In this EIA, which was started in October 2004, the effects of MV2 on the Wadden Sea must also be investigated. Thus the results of the model investigations in the Appropriate Assessment Wadden Sea will also be used in the concession application for the land reclamation and the necessary sand extractions.

Researcher's reflection

The problem definition of the Port of Rotterdam is that, by the invalidation of the CPD+ PMR on the part of land reclamation, the construction of MV2 is no longer ensured by legal means. Thus, this can be described as a legal/procedural problem: *'Construction MV2 not ensured!'*

The problem definition of PoR also focuses on the description of the environmental effects for the EIA. Thus, the problem is also interpreted as a scientific problem: *'Scientific knowledge on effects not sufficient!'*

4.2.6 Consortium 3|MV2

PoR and RIKZ commissioned Consortium 3|MV2 for the investigations in the context of the Appropriate Assessment Wadden Sea. The Consortium already existed and had contracts with PoR for the Construction EIA. It consists of the following organizations: Royal Haskoning (leader); HWE; and WL|Delft Hydraulics. Furthermore, for the ecological analysis (see Section 4.3) experts from Alterra, RIVO, NIOO-CEME and NIOZ were involved. The problem definitions by each of these organizations, which we observed during the project, are described below.

Royal Haskoning (Consortium 3|MV2 leader)

Royal Haskoning is an independent, worldwide consultancy. Rooted in a technical background, their consulting services focus on the broad field of the interaction between people and their environment.¹³ Royal Haskoning is the leader of Consortium 3|MV2. Their problem definition is described in the plan of approach (De Jong et al., 2005): "...The impact of the sand extraction and land reclamation activities and realisation of Maasvlakte 2 on SPM (suspended matter), nutrients and fish larvae may have ecological impacts on particular habitats and species such as birds. Explaining and (as far as possible) quantifying these effects is therefore of importance to predict the ecological impacts in the surrounding coastal system and to judge whether these impacts are significant."

WL|Delft Hydraulics (Consortium 3|MV2)

WL|Delft Hydraulics is a GTI, an officially-recognised technological institute (Dutch: Groot Technologisch Instituut). It is a not-for-profit foundation under Dutch law.¹⁴ Experts of WL|Delft Hydraulics were asked by RIKZ to predict the effects of MV2 on mud, nutrients and fish larvae transport to the Wadden Sea using the "state-of-the-

¹³ Website Royal Haskoning: <http://www.royalhaskoning.nl/>

¹⁴ Website WL|Delft Hydraulics: <http://www.wldelft.nl/>

art”.¹⁵ According to the track 1 leader of Royal Haskoning, the project members of WL|Delft Hydraulics that “...if they wanted to improve the effect predictions, detailed model calculations (i.e. high resolution grid) must be done.”¹⁶ This coincides with the perspective of the project leader of WL|Delft Hydraulics, who “...considers it their role to “work on the edge of what is possible and to be innovative.”¹⁷

Researcher's reflection

The problem definition by Royal Haskoning is that the effects of MV2 must be quantified to predict the ecological impacts. And the problem definition of WL|Delft Hydraulics is that their modelling instruments are not sufficiently developed to predict the effect of MV2 on mud, nutrients and fish larvae. Thus, the problem is interpreted by both Royal Haskoning and WL|Delft Hydraulics as a scientific problem: ‘*Scientific knowledge on effects not sufficient!*’

HWE (Consortium 3 | MV2)

Heinis Water & Ecology is the consultancy of Dr. Floor Heinis. HWE was the leader of the ecological analysis (see Section 4.3). According to HWE, the problem definition was that the effects of MV2 on the protected species and habitats in the Wadden Sea are not described in the CPD+, as is required by the Habitat Directive.¹⁸

Expert pool (Alterra, NIOZ, RIVO and NIOO-CEME)

In the ecological analysis (see Section 4.3), experts from the following organizations were involved: Alterra¹⁹; NIOZ²⁰; RIVO²¹ and NIOO-CEME²². All three are research institutions on the field of marine ecology. Ecological experts from these institutes were consulted in the Appropriate Assessment Wadden Sea project in three expert workshops as well as on individual basis. In the first expert workshop (May 2005), the experts are sceptic about the project approach. They comment that first model results on mud, nutrients and fish larvae (from track 1, see Section 4.3) are needed to determine the effects of MV2 on the species and habitats in the Wadden Sea. Furthermore, the experts feel pressured, because they think they are asked to “...determine the effects on species and habitats, and how bad [significant] these effects are.”²³ At last, one of the experts remarks²⁴ that a system analysis of the Wadden Sea, e.g. what role mud plays in the system, could help to structure the discussion. “If such a frame of reference is present [and everyone commits to this], the effects of changes in mud and nutrients transport can be determined.”²⁵ Thus, a joint frame of reference, on which the effects will be assessed, is missing.

¹⁵ Interview project leader RIKZ, 13 March 2006

¹⁶ Interview track 1 leader (Consortium), 31 July 2006

¹⁷ Interview project leader WL|Delft Hydraulics, 14 February 2006

¹⁸ Interview track 2 leader (Consortium), 21 June 2006

¹⁹ Research institute of the Wageningen University and Research Centre concern, website Alterra: <http://www.terra.wur.nl/>

²⁰ The Royal Netherlands Institute for Sea Research is an independent research institute associated with the Netherlands Organisation for Scientific Research (NWO). Website NIOZ: <http://www.nioz.nl/>

²¹ The Netherlands Institute for Fisheries Research, RIVO became part of the Institute for Marine Resources & Ecosystem Studies (IMARES) mid 2006. Website IMARES: <http://www.wageningenimares.wur.nl>

²² The Netherlands Institute of Ecology, Centre of Estuarine and Marine Ecology, website NIOO-CEME: <http://www.nioo.knaw.nl/CEME/>

²³ Minutes track 2 workshop, 19 May 2005

²⁴ By e-mail after the workshop on 19 May 2005 and at the workshop on 20 September 2005

²⁵ Minutes track 2 workshop, 20 September 2005

Researcher's reflection

The problem definition by HWE (Consortium) is that Appropriate Assessment procedure, as required by the Birds and Habitats Directive, is neglected in the CPD+. The ecological experts have the problem definition that ecological effects (on protected species and habitats) of MV2 on the Wadden Sea are not determined. Thus, both HWE (Consortium) and the expert pool (ecological analysis) interpreted the problem as a legal/procedural problem: *'Procedure not followed!'*

4.3 Problem approach

4.3.1 Parallel tracks

The problem approach was developed by RWS/RIKZ and Consortium 3|MV2. In the period from January 2005 to May 2005 they simultaneously wrote two Plans of approach for their clients: DGTL/PMR and RWS/RIKZ. The Plan of approach by RWS/RIKZ describes that the scientific investigations for the Appropriate Assessment Wadden Sea will take place in two parallel tracks: 1) model calculations, bottom-up approach; 2) ecological analysis, top-down approach (RWS/RIKZ, 2005). The approaches within track 1 and 2 are described in the Plan of approach by the Consortium 3|MV2 (see Section 4.3.2 and 4.3.3). The tracks form parallel tracks. RWS/RIKZ chose to run these tracks simultaneously, because the Dutch Parliament set a time limit of 7 months to the Appropriate Assessment.²⁶ The communication track (track 3) is the responsibility of PMR/DGTL and is outside the scope of our case study.

Furthermore, RIKZ requested an international audit panel to check the scientific underpinning and the consistent use of scientific results in the Appropriate Assessment Wadden Sea. At last, in August 2005 RIKZ decided to include two historical data analyses, to investigate whether large-scale activities (e.g. Delta works, Maasvlakte 1) carried out along the coast of The Netherlands can be recognized in historical data. In the first analysis by Prof. Dr. Dronkers of RIKZ, the expected impact of the proposed Maasvlakte extension on the sediment dynamics of the Wadden Sea has been estimated by comparison to other past interventions along the Holland coast (Dronkers, 2005). The second analysis by Prof. Dr. Laane of RIKZ, aims to identify the origins of past changes in the eutrophication status of the Wadden Sea (Laane, 2005). In Appendix D, the detailed organization structure for the project Appropriate Assessment Wadden Sea can be found.

4.3.2 Model calculations (track 1)

In the model calculations (track 1), the effect of MV2 on the Wadden Sea are predicted using several computational models. This track was immediately started in February 2005. Project members remark that track 1 on mud and fish larvae were initiated because this was explicitly named in the judgment of the Council of State.²⁷ The Council of State concludes that "...it was not made plausible that further research could not contribute to more clearness on the amount and the consequences of the decreased mud and fish larvae transport for the protected values of the Wadden Sea..."²⁸ Furthermore, this research (approach) was also planned as part of the Construction EIA.²⁹ Later on RIKZ added nutrient transport and primary productivity calculations to this track.³⁰

²⁶ Kamerstuk 2004-2005, 24691, nr. 59, Tweede Kamer 22-04-2005

²⁷ Interview track 1 leader Consortium, 31 July 2006; Interview track 2 leader Consortium 21 June 2006

²⁸ Raad van State, Uitspraak zaaknummer 200307350/1, 2005

²⁹ Interview project member RIKZ, 3 October 2005

³⁰ Interview project member WL|Delft Hydraulics, 14 February 2006

In track 1, the effects of MV2 on the Wadden Sea are predicted starting from the intervention (MV2) and calculating the effects on the water motion, transport of mud (SPM=suspended matter), nutrients, primary productivity and fish larvae (see Figure 4.1): a so-called *bottom-up approach*.

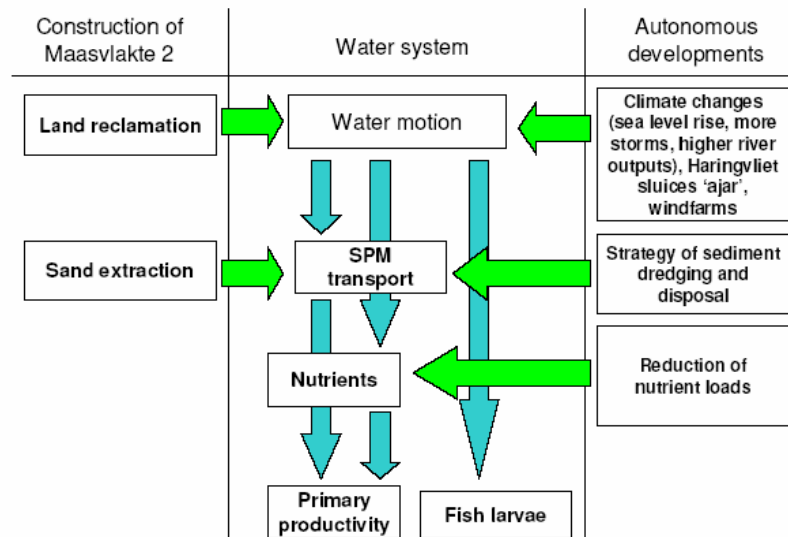


Figure 4.1: Relationship between the MV2 intervention (and autonomous developments) and the natural water system (Heinis et al., 2005)

In the plan of approach by the Consortium (De Jong et al., 2005), this bottom-up approach is split into five phases:

- Phase 1: Inventory of former studies for Maasvlakte 2
- Phase 2: Design and feasibility of the modelling instruments
- Phase 3: Definition of forcing, parameters and scenario's for model calculations
- Phase 4: Calibration of the instruments
- Phase 5: Determination of the impact on mud, nutrients, primary production and fish larvae in the North Sea and the western Wadden Sea

In this approach, a number of models are used, the relationships between these models are shown in Figure 4.2.

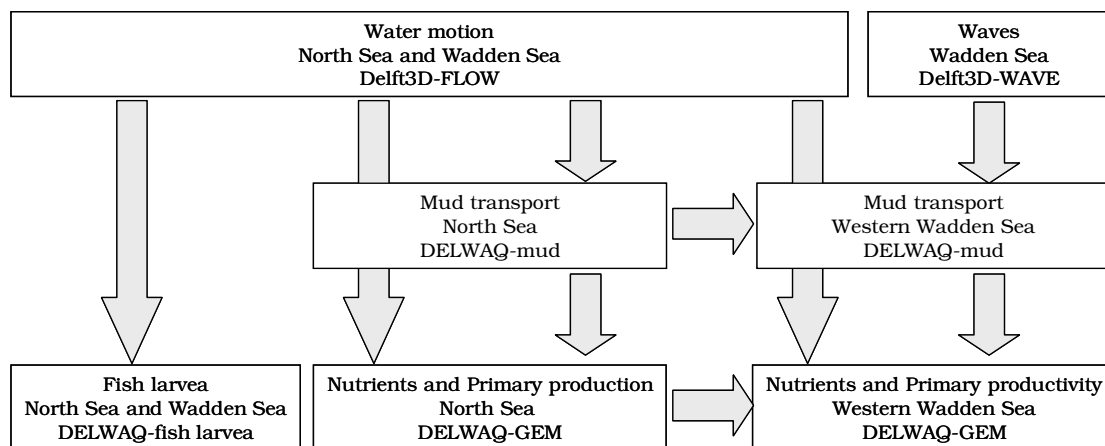


Figure 4.2: Models and relationships (Van Ledden, 2005)

In the modelling calculations, two different schematization models of the southern North Sea and the Wadden Sea are used:

- ZUNO-coarse: This Southern North Sea model ('ZUIDelijke NOordzee model') already existed and has been used on several occasions in earlier studies (MV2 and Flyland among others). The ZUNO-coarse model was only used for a part of the fish larvae research.
- ZUNO-DD: The three-dimensional water motion in the North Sea and Wadden Sea is computed by extending the existing ZUNO-model with Domain Decomposition, the so-called ZUNO-DD model. Domain decomposition is necessary, according to WL|Delft Hydraulics³¹, "...to include MV2 in a proper way and to obtain accurate results...(De Jong et al., 2005)". The ZUNO-DD model was used as input for silt, nutrients and primary productivity and for fish larvae calculations.

However, one of the difficulties with this high resolution model, ZUNO-DD was the tight time "schedule" for the project. Thus, it was decided to work with the high resolution, but only perform 14-day calculations and a few annual calculations to calibrate the model.³¹ These calculations were set up as follows (Van Ledden, 2005):

- Annual calculations: For the annual calculations use was made of the current forces for the river discharge, the wind speed and direction and atmospheric pressure. A one year computation with ZUNO-DD was done for the period November 1988 – November 1989, whereas nine years computations have been done using ZUNO-coarse. In combination with available measurements these latter calculations give an idea of the natural variability of the system.
- 14-day calculations: Use was made in these calculations of average river discharges and a representative wind climate. This calculation was set up in such a way that the 'long-term average' situation was simulated.

4.3.3 Ecological analysis (track 2)

The ecological analysis (track 2) was initiated by a participant of the Construction EIA, who became the track 2 leader. She noticed that PoR and RIKZ started "calculating at random" and did not realize that assessments had to be made on the level of species and habitats.³² In track 2, the effects on species and habitats were estimated by expert judgment, as there was not enough time available to execute a complete ecosystem research based on literature. According to the track 2 leader (Consortium) this also directly creates scientific anchoring.³²

Researcher's reflection

The ecological analysis (track 2) was only initiated after a participant of the Construction EIA, noticed that PoR and RIKZ did not realize that assessments had to be made on the level of species and habitats, although the Appropriate Assessment procedure is part of the Birds and Habitats Directive, which is logically aimed at the protection of bird species and habitats. However, in the beginning of the project only RIKZ, PoR and WL|Delft Hydraulics (part of Consortium) were involved for the investigations, because the existing organisation structure and contracts of the Construction EIA were used. As these stakeholders are mainly focused on modelling calculations, in the frame of the Construction EIA, this explains that at first there was no ecological analysis included.

³¹ Interview track 1 leader (Consortium), 31 July 2006

³² Interview track 2 leader (Consortium), 21 June 2006

Through a *top-down approach*, starting from protected species and habitats, a reflection was made to non-biological parameters that might be influenced by the construction of MV2. Based on assumptions of changes in these parameters (nutrients, mud and fish larvae), species and habitats on which no effects are expected are stripped off. In the plan of approach by the Consortium, this top-down approach is described in the following steps:

- Step 1: identifying the parameters for the appropriate assessment
- Step 2: demarcating the parameters that will possibly be affected
- Step 3: describing present state of these parameters and identifying intervention-impact chains
- Step 4: determining boundary values for basic factors to be affected by Maasvlakte 2
- Step 5: describing the impact on the relevant habitats and species as quantitatively as possible
- Step 6: assessing the relevance of the impacts on regional (Wadden Sea), national and European scale

Note, that these steps are similar to the steps from the methodological guidance of the European Commission (European Commission, 2001; and see Section 3.2.2).

In the first expert workshop, this approach was presented to the experts and they were sceptic about it. They comment that the results from the model calculations on mud, nutrients and fish larvae (track 1) are needed to determine the effects of MV2 on the species and habitats in the Wadden Sea. This is however not possible, due to time pressure.³³ In the second workshop, the experts were less sceptic and cooperated in a constructive way.

At the end of the first expert workshop it was decided, after request from some of the ecological experts, to use an ecosystem model (EcoWasp) for the Wadden Sea developed by Alterra.³³ According to the track 2 leader this had a positive effect on the willingness of some of the experts to cooperate.³⁴ This box model describes the dynamic behaviour of several ecological parameters (primary productivity, filter feeders and chlorophyll-a) as a function of various forcings (e.g. wind) along the boundaries (North Sea, IJsselmeer) and in the area itself. The model and the parameters used, as well as the system characteristics were set up in an earlier study (Heinis et al., 2005).

With the EcoWasp model, several scenarios, for changes in mud and nutrients based on model results from the Flyland study (Airport on an island in the North Sea), will be run to calculate the effect on ecological parameters (e.g. primary productivity).³⁴ These parameters will be used as input for the second expert workshop. WL Delft | Hydraulics uses another model (DELWAQ-GEM) to calculate the ecological parameters, but the results from this model will not yet be available at the second expert workshop.³³

³³ Minutes track 2 workshop, 19 May 2005

³⁴ Interview track 2 leader (Consortium), 21 June 2006

5 Process → Contents: Assessment framework

5.1 Introduction

An assessment framework consists of strategic objectives, operational objectives and assessment criteria. In such an assessment framework, an overview of the effects of a project on the objectives can be given, enabling decision-makers to compare them systematically and formulate an assessment (see for example: De Boer et al., 1999; Van Koningsveld, 2003). In this chapter, we analyze the development of the assessment framework for the Appropriate Assessment Wadden Sea. This is done using the following operational questions:

- How (when, who, what) are the strategic objectives formulated?
- How (when, who, what) are the operational objectives formulated?
- How (when, who, what) are the assessment criteria formulated?
- How do the information exchange and communication influence the development of the assessment framework?
- How do perspectives of the different stakeholders influence the development of the assessment framework?

In Section 5.2, we analyze the first research question on the strategic objectives. Then in Section 5.3, the focus is on the operational objectives and assessment criteria (second and third research question). The last two research questions, on influence of information exchange, communication and stakeholders' perspectives, are interwoven into these two sections.

5.2 Strategic objectives

Step 3 of the Appropriate Assessment procedure (see Section 3.2.2) is to assess whether there will be adverse effects on the integrity of the relevant Natura 2000 area as defined by the so-called *conservation objectives* and on the status of the site. In carrying out the assessment one should apply the *precautionary principle*, which requires that the conservation objectives should become predominant where there is uncertainty in the effects (European Commission, 2001). The conservation objectives are what we call *strategic objectives*, because they are formulated on a high abstraction level.

For the Wadden Sea area, no conservation objectives were formulated at the time the Appropriate Assessment was performed. Therefore, RIKZ asked the ministry of Agriculture, Nature and Food Quality (LNV), who is working on the conservation objectives for the Wadden Sea, to formulate provisional conservation objectives. These provisional conservation objectives were accepted during a ministerial consultation on 22 April 2005.³⁵

The provisional conservation objectives that LNV formulated for the Wadden Sea are as follows:

*"The policy and management [...] are focused on the sustainable protection and development of the Wadden Sea as a nature area, in which human influence is minimized, and on maintaining or restoring a favourable state of preservation for the structures, species, plants and animals that are designated for protection under the Bird and Habitat Directives for the Wadden Sea. To achieve this, the policy and management are focused on carrying out as naturally as possible the sustainable protection and development of [...] hydrological processes, water quality, soil and air, and also of the (soil) flora and fauna, including the foraging, breeding and resting areas of birds."*³⁶

³⁵ Interview project leader RIKZ, 22 November 2005

³⁶ Harte, et al. (2005), "The Wadden Sea Area in Perspective"

Researcher's reflection

Project members of RIKZ remark that administrative accepted conservation objectives like these are not juridical solid.^a Furthermore, we observe a difference in interpretation of the legislation (i.e. Birds and Habitats Directive) between the project leader of RIKZ and the track 2 leader of the Consortium (HWE). According to HWE (track 2 leader), the fact that there are no conservation objectives available means that the Birds and Habitats Directive becomes directly operative. The assessment should therefore be made on the list of species and habitat types (Dutch: *aanwijzingsbesluiten*) assigned for the Birds and Habitats Directive.^b This is also the approach described in the Plan of Approach by RIKZ (RWS/RIKZ, 2005). The track 2 leader remarks that "...RIKZ chose the approach of protecting dynamic processes, to avoid having to set objectives for species and habitats. This interpretation of the Birds and Habitats Directive by RIKZ does not correspond to the EU-manuals (European Commission, 2001)."^c And according to HWE "...the Nature Protection Law^d (Dutch: *Natuurbeschermingswet*) focuses on the protection of species and habitats, thus not on the protection of dynamic processes (only implicitly)."^c However, the project leader of RIKZ claims this is a too static approach for a dynamic system like the Wadden Sea.^e They both used their own preferred approach. We conclude that it is not clear what the implications of the juridical framework, i.e. the Birds and Habitats Directive and the Nature Protection Law, are for the Appropriate Assessment Wadden Sea.

^a Interviews project members RIKZ: 3 October 2005, 8 November 2005 and 22 November 2005

^b Minutes track 2 workshop, 19 May 2005; Interview track 2 leader (Consortium), 21 June 2006

^c Interview track 2 leader (Consortium), 21 June 2006

^d This law was not yet active during the project Appropriate Assessment Wadden Sea, it was implemented in October 2005.

^e Interview project leader RIKZ, 22 November 2005

5.3 Operational objectives and Assessment criteria

The assessment framework for the Appropriate Assessment Wadden Sea document, which consists of operational objectives and assessment criteria, is described in Section 5.3.1. In section 5.3.2 and Section 5.3.3, the operational objectives and assessment criteria used in respectively the model calculations (track 1) and the ecological analysis (track 2) will be investigated.

5.3.1 Appropriate Assessment Wadden Sea document

The Assessment Framework for the Appropriate Assessment Wadden Sea document is formulated by RWS/RIKZ, and discussed with LNV, PoR, DGTL and Consortium 3|MV2.³⁷ It was first made explicit in July 2005, when three project members of RIKZ started writing the Appropriate Assessment document (see Appendix D).³⁸ The operational objectives were derived from the strategic objectives; the provisional conservation objectives (see Section 5.2). The operational objectives were defined as follows (Harte et al., 2005; Project Mainport Rotterdam, 2006):

- Objective 1: Boundary conditions for dynamic processes that guarantee the existence of the natural relationship between species and habitats are not limited;
- Objective 2: Continued existence of protected species and habitats is guaranteed.

³⁷ Interview project member RIKZ: 8 November 2005

³⁸ Interviews project members RIKZ: 3 October 2005 and 8 November 2005

The assessment criteria, which were formulated by RWS/RIKZ, for these objectives are as follows (Harte et al., 2005; Project Mainport Rotterdam, 2006):

- Criterion 1: Degree of disturbance of processes responsible for the natural development of species and habitats;
- Criterion 2: The conservation status of protected species and habitats.

Researcher's reflection

Initially, the Assessment Framework consisted of three operational objectives. The third objective was defined as follows: "Connect to development goals of other EU guidelines, (like Water Framework Directive) integrated and shared administrative visions of the area, and administrative agreements on area development."^a However, in November 2005, this third operational objective was dropped. The project leader of RIKZ stated that "...This objective was no longer needed in the argumentation, because the effects on nutrients and mud transport were less than expected..."^b Thus, the formulation of the operational objectives in Assessment Framework of the Appropriate Assessment Wadden Sea document is influenced by the achieved modelling results from track 1.

Project members from RIKZ concluded that the Assessment Framework should have been made explicit earlier in the project; although in practice they are often reformulated during a project.^c However, during the project the members already had a "...feeling of what the assessment would look like in the end..."^d; thus they have an implicit Assessment Framework. The project leader of RIKZ also agrees that the Assessment Framework could have been made explicit earlier in the project. However, he concludes that in the beginning of the project it was important "...to get things going, for instance the model calculations"^b. Another project member of RIKZ states that when the Assessment Framework was made explicit earlier in the process, this could have affected the approach for the model calculations. "Now it could have been the case that the results of the model calculations were not suitable to assess the criteria. This was a risk."^e However, we remark that this was not a real risk, because the objectives and assessment criteria were formulated in an abstract way.

^a Appropriate Assessment document "Het Waddenzeegebied in perspectief", versie 23 september 2005

^b Interview project leader RIKZ, 22 November 2005

^c Interviews project members RIKZ: 3 October 2005 and 22 November 2005

^d Interviews project members RIKZ: 3 October 2005 and 8 November 2005

^e Interview project member RIKZ, 22 November 2005

5.3.2 *Model calculations (track 1)*

The operational objectives for the model calculations (track 1) are formulated by WL|Delft Hydraulics in discussion with RIKZ and PoR at the beginning of the project (March 2005). These objectives are described as to quantify (De Jong et al., 2005):

- Objective 1: Changes in SPM concentrations and (gross/net) fluxes
- Objective 2: Changes in transport of nutrients and primary production
- Objective 3: Changes in larvae transport of herring, plaice and sole

The first and the third objective (mud and fish larvae transport) were included because this was explicitly named in the judgment of the Council of State.³⁹ Furthermore, these are also objectives that were already formulated for the Construction EIA (De Jong et al., 2005). Later on RIKZ added the second objective; nutrient transport and primary productivity.⁴⁰

Researcher's reflection

The parameters that are calculated in track 1 are used by RIKZ to assess criterion 1 *Degree of disturbance of processes responsible for the natural development of species and habitats* from the Assessment Framework in the Appropriate Assessment Wadden Sea document. Therefore, there are no separate assessment criteria formulated in track 1.

5.3.3 Ecological analysis (track 2)

The Assessment Framework for the ecological analysis is derived from the list of species and habitat types ('aanwijzingsbesluiten') assigned for the Birds and Habitats Directive, because according to the track 2 leader the fact that there are no conservation objectives available means that the Birds and Habitats Directive becomes directly operative.⁴¹ In the final report of the ecological analysis (Heinis et al., 2005), the aim of the research is formulated by the Consortium 3|MV2 in the following research questions:

1. "How do the primary abiotic factors, which are influenced by the land reclamation, relate to the natural values of the Wadden Sea and North Sea coastal zone that have to be protected under the terms of the Birds and Habitats Directives?"
2. Which of these values that have to be protected may be negatively affected by the land reclamation?

And finally:

3. To what extent can it be expected that the land reclamation will have a (significant) negative impact on the favourable state of conservation of the Wadden Sea and North Sea Coastal Zone Natura 2000 areas? (Heinis et al., 2005)"

The operational objectives are to answer these research questions. Thus, the operational objectives are, to determine:

- Objective 1: relationships between the protected natural values and primary abiotic factors; so-called intervention-impact chains
- Objective 2: effects by MV2 on the protected natural values through changes in the intervention-impact chains
- Objective 3: impact of MV2 on the favourable state of conservation

The first and the second objective are discussed in respectively the first and the second expert workshop.⁴² The third objective is a sum of the first and the second objective.

³⁹ Interview track 1 leader Consortium, 31 July 2006; Interview track 2 leader Consortium 21 June 2006

⁴⁰ Interview project member WL1 Delft Hydraulics, 14 February 2006

⁴¹ Minutes track 2 workshop, 19 May 2005; Interview track 2 leader (Consortium), 21 June 2006

⁴² Minutes track 2 workshop, 19 May 2005

The assessment criteria, which were formulated by HWE and a project member of RIKZ after the second expert workshop (end of June 2005), for these objectives are as follows (Heinis et al., 2005):

- Criterion 1: *extent of impact*, determined by the assessment of intervention-impact chains by expert judgment (see Section 6.2.1);
- Criterion 2a: *conservation status of the species*, a reference value based on the Wadden Sea Area Birds Directive Assessment Framework (LNV DRZ-Noord 2005, in: Heinis et al., 2005);
- Criterion 2b: *proportion of the population that is affected*, is determined by the proportion of the biogeographical population that stays in the part of the Wadden Sea of North Sea coastal zone impacted by the MV2 project;
- Criterion 3: *significance of the impact* is a sum of the three criteria named above (see Section 6.4.1).

Researcher's reflection

The operational objectives and assessment criteria for the Appropriate Assessment Wadden Sea document and the ecological analysis are formulated by respectively RIKZ and HWE, in approximately the same phase of the project (respectively July and June 2005). Thus, the Assessment Framework in the Appropriate Assessment Wadden Sea document formed no explicit, direct guidance for the operational objectives and assessment criteria in track 1 and 2.

Furthermore, the Assessment Framework for the Appropriate Assessment Wadden Sea document consists of two objectives: if the requirements for the dynamic processes are limited (objective 1 is exceeded), then the continued existence of protected species and habitats must be guaranteed (objective 2). And vice versa, if objective 1 is not 'exceeded', it is not necessary to look at the protected species and habitats, according to the Assessment Framework by RWS/RIKZ. Note, that these objectives 1 and 2 are not independent. The project leader of RIKZ states that objective 1 forms a 'threshold' for objective 2.* The Assessment Framework for the ecological analysis aims to assess the impact of MV2 on the favorable state of conservation of the Wadden Sea and uses three independent criteria to assess this state.

* Interview project leader RIKZ, 22 November 2005

6 Contents → Process: Role of technical and natural scientific knowledge

6.1 Introduction

Wesselink (2006) uses the term *expertise*, to describe the combination of *knowledge, experience and competences* to use this knowledge. Thus, use of knowledge differs per stakeholder. She also describes three different types of expertise in water management:

1. content expertise; about problem definitions and possible solutions,
2. administrative expertise; about relevant social groups, relations between these groups and decision-making processes and
3. expertise about social processes; interaction between social groups.

In this study, we focus on content expertise; more specifically we only focus on the use of *technical and natural scientific knowledge*. In this chapter, we describe and analyze the role of technical and natural scientific knowledge in the Appropriate Assessment Wadden Sea. This is done using the following operational questions:

- Which resources of technical and natural scientific knowledge are used? And why?
- How (who, when, what) is dealt with uncertainties in this technical and natural scientific knowledge?
- How is the final assessment of the effects formulated?
- How (when, who, what) is the assessment framework used?
- How is the technical and natural scientific knowledge communicated?
- How is (the use of) technical and natural scientific knowledge affected by stakeholders' perspectives?

In Section 6.2, we analyze the first research question on resources of technical and natural scientific knowledge that are used in the Appropriate Assessment Wadden Sea. Then in Section 6.3, the focus is on how is dealt with uncertainties in this knowledge (second research question). Furthermore, how the effect assessment is formulated and the assessment frameworks are used is described in Section 6.4. The last two research questions, on the communication of technical and natural scientific knowledge and the influence of stakeholders' perspectives on this knowledge, are interwoven into the other sections.

6.2 Resources of technical and natural scientific knowledge

6.2.1 Ecological analysis (track 2)

In the ecological analysis (track 2), the main sources of technical and natural scientific knowledge are: expert judgement from ecological experts in workshops; and an ecosystem model (EcoWasp).

Expert judgement

In the ecological analysis, several experts from different institutes (see Section 4.2.6, page 19) are consulted in three workshops as well as on individual basis. The track 2 leader remarks that expert judgment was used as there was not enough time available to execute a complete ecosystem research based on literature.⁴³

The participants of the workshop received information on the project, before the first expert workshop on 19 May 2005. At the first workshop, three introductory presentations were held to give background information for the discussions in

⁴³ Interview track 2 leader (Consortium), 21 June 2006

subgroups. The potential relevant parameters and intervention-impact chains were discussed in subgroups, around three themes (wadden birds; habitats and salt marshes; and fish, birds and sea mammals) with 'matching' experts. The main conclusions from these discussions were that the effects on habitats are expressed in surface areas and quality of the habitats. Furthermore, the effects on species are expressed via the food chain.⁴⁴

The second expert workshop was a two-day workshop (22 & 23 June 2005) and was held on the island of Texel, where the participants stayed in a hotel. The input for this workshop was: a preliminary report of the ecological analysis; an explanation on some preliminary results of track 1; and results from the EcoWasp model (see below). The main conclusions from this workshop were that no effects can be expected on: surface area of habitats; fish; plant eating birds; dune birds; birds of prey; and sea mammals. However, on the quality of habitats (i.e. diversity of the habitat, concentration of filter feeders on the habitat, etc.), on fish eating birds and on wadden birds effects are possible, according to the experts. Therefore, these aspects are further investigated and assessed by HWE and RIKZ (see Section 6.4.1). Finally, four species are named on which significant effects are possible. And which therefore have to be assessed in the Appropriate Assessment.⁴⁵

EcoWasp model

Ten scenarios for changes in mud and nutrient transport were calculated with the EcoWasp model. The scenario of 15% less mud and 10% less nutrients (the so-called *basic scenario*), was derived from the Flyland study and formed the reference for the other nine scenarios. The EcoWasp model gives results for the effect of changes in mud and nutrients transport on the following ecological parameters: biomass of filter feeders; primary productivity; and concentration of nutrients. These parameters are used as input for the discussion in the second expert workshop (22 & 23 June 2005).

The results from the EcoWasp model on the basic scenario (-15% mud and -10% nutrients) show that "...a decrease of the silt and nutrients results in a decrease of the maximum filter feeder biomass, this is in line with earlier research and field data. This change is (almost) entirely caused by the changes in the nutrients; the filter feeders are not very sensitive to changes in the silt content. The model also shows that the pelagic primary production is much less sensitive to changes in the silt and nutrients supply than filter feeders. The influences of silt and nutrients are opposite to each other in the primary production. For benthic primary production, the reduction in nutrients is slightly more important, resulting in a decrease while, for pelagic production, it is the reduction in silt supply that is the deciding factor and leads to an increase. Finally, the algal content in the water column increases and the algal content at the sediment surface decreases with a decreasing supply of nutrients. Just as for filter feeders, these values are not significantly influenced by variations in the silt content and are almost entirely governed by the changes in the supply of nutrients.(Heinis et al., 2005)"

⁴⁴ Minutes track 2 workshops: 19 May 2005, 20 September 2005

⁴⁵ Interview track 2 leader (Consortium), 21 June 2006

Researcher's reflection

The results of the EcoWasp were subject of discussion and were disputed by some of the experts in the second workshop (June 2005). According to the project leader of RIKZ this is due to on the one hand distrust between institutes. And on the other hand, it is due to the fact that EcoWasp calculates the maximum filter feeder biomass, which is not realistic value because there are always limiting factors (e.g. extra mortality, predation or fishing) present in the system.^a Thus, this output parameter is difficult to interpret. Furthermore, Heinis (2005) conclude that "...for the remaining variables (primary production, and concentration of nutrients) that play a role in the translation to higher trophic types, the predicted results are surrounded by many uncertainties. Further attention will therefore be paid to these in the model study for 'track 1'."

HWE (track 2 leader) experienced the interaction with scientists in the expert pool of the ecological analysis as positive. According to the track 2 leader this might even influence future research. Furthermore, the choice to grant the wish of Alterra to use the EcoWasp model had a positive effect on the willingness of the experts to cooperate.^b However, the role of the ecological experts was experienced as difficult by some of the RIKZ project members. They claim that their knowledge is subjective, because every expert has his/her own working field and background.^c Every stakeholder has his/her own perspective. At last, a RIKZ project member commented that it was positive that a lot of experts were involved in the process, because although they might not commit to the results, they were at least involved.* This implies that in this way support from the scientific community is created.

^a Interview project leader RIKZ, 13 March 2006

^b Interview track 2 leader (Consortium), 21 June 2006

^c Interview project member RIKZ, 3 October 2005

6.2.2 *Historical analyses*

RIKZ conducted two historical analyses, on mud transport and nutrients transports.

Mud transport

Dronkers (2005) expects that the long-term impact of the Maasvlakte extension on the annual mean suspended matter concentrations in the Wadden Sea will be much smaller than the fluctuation of a factor 2 or more, which has occurred in the period 1970-1990. According to a comparison with past analogous interventions, the impact of the Maasvlakte extension on suspended sediment concentrations in the Wadden Sea will be more probably in the order of 10 %, or even less.

Nutrient transports

Laane (2005) concludes that the inter-annual variability in nutrient loading via the Dutch coastal zone of the western Wadden Sea is mainly affected by the variability in the concentration and water discharge of the river Rhine and by the Atlantic Ocean. Furthermore, he states that there are no indications that former extensions in the Dutch coastal zone between 1950-2000 had a major impact on the nutrient load of the Dutch coastal zone and on the western Wadden Sea.

6.2.3 Model calculations (track 1)

In track 1, the main sources of technical and natural scientific knowledge are several computational models for hydrodynamics, mud transport, nutrients and fish larvae transport.

Hydrodynamics

The Delft3D-FLOW model by WL|Delft Hydraulics is used to predict the effects of MV2 on the hydrodynamics on the grid of ZUNO-DD, relative to the situation without MV2. The parameters that were calculated are the following: tidal propagation; salinity patterns; residual discharges; and residual velocities. The parameters are compared with field measurements to calibrate the model. It is however not possible to validate the model results, whereas the intervention has not yet taken place.

DELWAQ-mud model

The DELWAQ-mud model is used to predict the effects of MV2 on mud transport, also relative to the current situation. The predictions are that "...the Doorsteekvariant causes a decrease in the mud concentration of the Western Wadden Sea of approximately 8% (bandwidth 5% - 15%) and in the North Sea coastal zone of approximately 10% (bandwidth 5% - 15%). The effect of Reference Design II (GAB) is a decrease of approximately 17% (bandwidth 10 - 25%) in the Western Wadden Sea and approximately 13% (bandwidth 5 - 15%) in the North Sea coastal zone. (Van Ledden, 2005)"

DELWAQ-GEM model

The DELWAQ-GEM model is used to predict the effects of MV2 on nutrients and primary productivity, relative to the current situation. The predictions are that "...the effect of the Doorsteekvariant on nutrients in the North Sea coastal zone and the Western Wadden Sea is a decrease of approximately 2% (bandwidth 1 - 3%). For Reference Design II (GAB), this decrease is approximately 3% (bandwidth 1 - 5%). Organic carbon is considered to be one of the most important parameters for determining the subsequent effects on higher trophic levels in the ecosystem. The Doorsteekvariant shows an increase of organic carbon in the North Sea coastal zone of approximately +2% (bandwidth 1 - 4%) and in the Western Wadden Sea of approximately +1% (bandwidth 0.5 - 2%). For Reference Design II (GAB), these increases are approximately +4% (bandwidth 2 - 6%) in the North Sea coastal zone and +4% (bandwidth 2 - 6%) in the Western Wadden Sea. The effects on primary production are of the same order of magnitude (Van Ledden, 2005)".

DELWAQ-fish larvae model

The DELWAQ-fish larvae model is used to predict the effects of MV2 on fish larvae transport, relative to the situation without MV2. The predictions are that "...the impact of the Doorsteekvariant on the amount of fish larvae reaching the North Sea coastal zone and Wadden Sea and the timing of arrival in these areas is negligible. No model computations have been carried out for Reference Design II (GAB). However, it seems reasonable to conclude that the effects on the transport of fish larvae due to Reference Design II will also be negligible due to its limited effect upon the large-scale hydrodynamics (Van Ledden, 2005)".

Researcher's reflection

Much effort (time and computational capacity) has been put into increasing the model resolution. Afterwards, the track 1 leader of the Consortium however wonders if this was essential for the effect analysis. The predicted effects are not very different from the results with the Flyland model, which had a lower resolution.^a The project leader of WL|Delft Hydraulics however remarks that this way it is possible to proof that a higher resolution does not give different results. And the comments that the geometry of MV2 is not modelled detailed enough, in the Flyland model, can be taken away.^b One could argue that the effort that has been put into the improvements is affected by the perspectives of the stakeholders that have a stake in these model calculations. On the one hand, WL|Delft Hydraulics, who have a stake in improvement of their model instruments for the market. On the other hand, Port of Rotterdam who needs these model calculations for the concessions for the Construction EIA. Thus, we conclude that afterwards the problem definition of WL|Delft Hydraulics does no longer focus on the prediction of the effects of MV2 on the Wadden Sea, but on the development of the computational models, for the market and the Construction EIA.

^a Interview track 1 leader (Consortium), 31 July 2006

^b Interview project leader WL|Delft Hydraulics, 14 February 2006

6.2.4 Communication between track 1 and 2

The communication between track 1 and 2 took place via the track leaders of the Consortium. The track 1 leader aggregated the results for example in the form of a summary; this was used as input for the track 2 workshops. The other way around, the track 1 leader joined the track 2 workshops and communicated relevant points to track 1.^{46,48} However, it was not always possible to make adjustments in the model calculations (track 1) along the way. A project member of WL|Delft Hydraulics remarked that the combination of short time period and a heavy methodology "...a tanker that went in a certain direction..." left little space for changes.⁴⁷ For example, when it was remarked at the track 2 workshop that from an ecological point of view 1989 was not an appropriate year to use for validation, it was not possible to adjust this because the year calculations were already done. This year was chosen in track 1 because it was also used in Flyland, so the model was already calibrated and validated with this dataset. And in this year a lot of measurements were taken. In short, it saved a lot of time to run this year.⁴⁸

Researcher's reflection

The split into the two parallel tracks and the interaction between them was rewarded positive by all project members of RIKZ. However, a project member of WL|Delft Hydraulics commented that the Appropriate Assessment Wadden Sea was not carried out as one project, because the two tracks were treated very separately from the beginning. For him, the approach in parallel tracks felt like "throwing the results over the hedge".* Thus, there was a lack of interaction.

* Interview project member WL|Delft Hydraulics, 14 February 2006

⁴⁶ Interview track 2 leader (Consortium), 21 June 2006

⁴⁷ Interview project member WL|Delft Hydraulics, 14 February 2006

⁴⁸ Interview track 1 leader (Consortium), 31 July 2006

Researcher's reflection (continued)

According to the track 1 leader (Consortium), profit could have been gained when in an early stage of the project a “playing model” (simple version of the track 1 model) would have been available to give some quick insights to the results. This could then be used in the ecological analysis^a, in the way the EcoWasp model was now used.

At the end of June 2005, it was decided by DGTL to base the Appropriate Assessment only on the results of the ecological analysis, later this decision was turned down. The project leader of RIKZ insisted on “...not quitting the ‘modelling train’ (track 1), to avoid frustrations, the so-called Flyland trauma.”^b This is what we would like to call a solution from the Dutch *Poldermodel*. Furthermore, the project leader of RIKZ remarks that PoR also needs the model results for the Construction EIA and it provides knowledge for the monitoring program.^b Thus, it was of importance for PoR to continue the model calculations.

^a Interview track 1 leader (Consortium), 31 July 2006

^b Interview project leader RIKZ, 22 November 2005

6.3 Dealing with uncertainties

6.3.1 Model calculations (track 1)

Uncertainty analysis

On beforehand, three major sources of uncertainties are distinguished in track 1 (model calculations):

1. forcing (hydrodynamics);
2. model resolution;
3. seasonal water-seabed exchange.

It was discussed with experts, in qualitative terms, how important and how feasible it was to encounter for these aspects in the given time frame. The conclusion was that water-seabed exchange would be neglected in the model calculations, for time saving reasons. Point 1 and 2 were both important; in these points investments are made. For the modelling of fish larvae transport a similar approach is used.⁴⁹

Uncertainties in model results

The uncertainties in the model results are quantified by on the one hand, sensitivity analysis and on the other hand, by expert judgment.⁵⁰ The uncertainties are estimated around 50%. The track 1 leader however comments that this number is a wild guess, because we can not check the model results.⁴⁹

6.3.2 Ecological analysis (track 2)

In every step of the intervention-impact chain uncertainties are present. More specifically, there is no general scientific consensus and/or significant uncertainties exist on the following subjects:

1. “The effect of silt concentrations in the water on silt concentrations in the sea bed;
2. Effect of silt concentrations in the water on transparency;
3. Effects of nutrient concentrations on shellfish biomass.(Heinis et al., 2005)”

⁴⁹ Interview track 1 leader (Consortium), 31 July 2006

⁵⁰ Interview project member RIKZ, 22 November 2005

“Ad 1. There is currently no general consensus about how a change in silt supply will affect the composition of the seabed. The extreme scenarios are:

- A change in the concentration in the water has a proportional effect on the concentration in the sea bed; a drop of 15% in the water will therefore result in an overall decrease of the concentration in the sea bed of 15%;
- The composition of the seabed in the Wadden Sea is not sensitive to the silt supply (silt enters in excess) and is determined solely by the local hydrodynamic conditions.

The impacts were determined on the basis of the first scenario because it represents the worst-case situation.(Heinis et al., 2005)”

“Ad 2. There is uncertainty about whether changes in the transparency might possibly cause changes in the ease at which prey is caught by fish eaters (terns, divers and grebes). The impacts were assessed based on the assumption that these bird species sustain no substantial negative effects as a result of these changes.(Heinis et al., 2005)”

“Ad 3. The simulations produced by the EcoWasp model show a more than proportional relationship between changes in the nutrient concentrations and the maximum shellfish biomass. There was a great deal of discussion about these results in the workshops on 22/23 June and 20 September 2005. Although most of those present agreed that the relationship is more likely to be directly proportional than more than directly proportional, the impacts appraisal was based on the assumption that the relationship is more than directly proportional (worst case).(Heinis et al., 2005)”

According to the track 2 leader a top-down approach is useful, because this way one can show that whatever will happen, for some species and habitats, some effects can be excluded.⁵¹

Researcher's reflection

The track 1 leader remarks that one could argue not to use models at all, because we do not know how uncertain the model results are. However, he says, these models are available so one should use them. An alternative could be to use expert judgment.^a Also, a project member of RIKZ comments that the Appropriate Assessment could have been done without model predictions. However, the models are available so one should use them.^b

Both in the model calculations and in the ecological analysis (translation of the effects on mud, nutrients and fish larvae to species and habitats) large uncertainties exist. However, the choice is made in the Appropriate Assessment Wadden Sea to invest the most in model calculations (four times the amount of money that is invested in the ecological analysis^c), without comparing the uncertainties in both approaches on beforehand. Thus, although large uncertainties exist in both the model calculations and the ecological analysis, there is no explicit argumentation why the investment in model calculations should be four times as big as that for the ecological analysis.

^a Interview track 1 leader (Consortium), 31 July 2006

^b Interview project member RIKZ, 22 November 2005

^c (RWS/RIKZ, 2005)

⁵¹ Interview track 2 leader (Consortium), 21 June 2006

6.3.3 International audit

The audit panel judged on: the soundness of the methods used in the underlying scientific studies, and the use of best available knowledge, that;

- "The Assessment was carried out very well, using the best possible methods, data and expertise, there are no major deficiencies;
- Conclusions reached are based on a valid and peer reviewed interpretation of the data available and the model outcomes;
- However, it is emphasized that the model outcomes for the sedimentological and subsequent biological and chemical processes depend on the performance of the physical model of hydrodynamics;
- Further consideration of the constraints and limitations of the model output are likely to strengthen the conclusions rather than to undermine them.(Hoogewoning, 2005)"

And on the integrity of the Appropriate Assessment relative to the science input, the audit panel judged that:

- "The Appropriate Assessment has followed the recognized and required protocol given in the EU Habitats Directive and is thorough despite the as yet incomplete implementation of the EU Habitats Directive by the Netherlands;
- The bottom-up processes are well-covered by the assessment but there is the need to develop a conceptual model to indicate the links between the changes perceived/predicted especially the links to the higher level consumers (fish, birds, mammals);
- The inherent spatial and temporal variability (year to year and decadal, which could include effects of the North Atlantic Oscillation - NAO) is often much larger than the calculated effects, and exceeds the differences between the scenarios adopted (based on the physical models);
- In all topics the changes predicted as the result of the development scenarios are all less than the observed natural variations. There is no reason to expect that the likely changes would be greater than those created by previous developments such as Maasvlakte 1, or closure of the Haringvliet, neither of which were noticeable in the historical data;
- Changes predicted as a result of MV2 are also small compared to the likely changes brought about by the implementation of other EU directives and related management strategies, for example in relation to the Nitrates and the Urban Waste-water Treatment Directives;
- The predicted reduction of nutrients due to transport changes could be offset by the removal of the cockle fishery, but the balance between these effects cannot be evaluated without further information on the carrying capacity and trophic dynamics of the Wadden Sea;
- The planning and future monitoring has to be dictated by the conservation objectives adopted for the Wadden Sea; it is of concern that those objectives are not yet suitably rigorous and thus it will be impossible to determine when they have been met (Hoogewoning, 2005)."

Researcher's reflection

All project members are very content with the judgement of the international audit panel.* They are very proud of the work they did and feel the need to show this to the public, for instance in the "Zoutkrant" (Van Zetten and Hoogeboom, 2006) and at the MV2 Conference (in September 2006).

* Minutes (final) project meeting RIKZ, 3 November 2005

6.4 Effect assessment

6.4.1 Ecological analysis (track 2)

In the ecological analysis, the effects on species and habitats are assessed using the assessment framework described in Section 5.3.3. The *significance of the impact* is determined on the basis of a combination of the following three criteria: *conservation status of the species; the proportion of the biogeographical population that is affected; and the extent to which the impact occurs.*

The assessment is considered to be '*possible significant*' if (Heinis et al., 2005):

- the conservation status of the species is unfavourable or very unfavourable and
- more than 1% of the total biogeographical population stays in the area affected and
- the extent of the impact is big or average.

And the assessment is considered to be '*probably not significant*' if (Heinis et al., 2005):

- the conservation status is moderately unfavourable or favourable or
- the numbers in the area affected compared with the total biogeographical population are relatively modest (<1%) or
- the extent of the impact is limited.

The assessment shows that "...under the 'basic scenario' four species are subject to possibly significant negative impacts from the reduction in nutrient contents associated with the presence of Maasvlakte 2 (the silt concentration has no effect). This concerns three shellfish eaters and one fish eater.(Heinis et al., 2005)"

First, this assessment was formulated by the Consortium and RIKZ (after the second expert workshop on 22&23 June 2005), and then the results were checked with the experts in the third expert workshop on 20 September 2005.

6.4.2 Appropriate Assessment document

In the Appropriate Assessment document, the assessment is done by RIKZ using the assessment framework described in Section 5.3.1. The criteria are assessed in a qualitative way; describing whether the effects by MV2 on the Wadden Sea are significant or not. For the assessment of the significance of the effects, RIKZ used the definition by the Court of Justice of the European Commission. They define that effects are significant if it cannot be excluded that a plan or project will jeopardize the conservation objectives of the area.⁵²

The results from the model calculations on mud, nutrients and fish larvae (track 1) and the historical analysis are used to assess the first criterion: *degree of disturbance of processes responsible for the natural development of species and habitats.* It is concluded that "...the land reclamation (MV2) will have a very limited impact on the dynamic processes, which are responsible for the existence of the natural relationship between species and habitats. (Project Mainport Rotterdam, 2006)"

The results from the ecological analysis (track 2) and from the model calculations on mud, nutrients and fish larvae (track 1) are used to assess the second criterion: *the conservation status of protected species and habitats.* It is concluded that "...the land reclamation could have an effect on four bird species (as concluded in the ecological analysis); however this effect is not significant. Therefore, the conservation status of protected species and habitats will not be influenced negatively by the land reclamation. (Project Mainport Rotterdam, 2006)"

⁵² Hof van Justitie EG, 7 september 2004, C-127/02, rechtsoverweging 46 e.v.

Furthermore, three comments are put forward: 1) “a decrease of nutrients corresponds with the policy objectives of the Water Framework Directive”; 2) “Due to the stopping of the shellfishery in the Wadden Sea the conservation status of shellfish eating birds will probably improve”; and 3) “The natural variability in mud and nutrients is very high, much larger than the changes caused by MV2” (Project Mainport Rotterdam, 2006)

Researcher's reflection

There is no agreement on this argumentation. The project leader of RIKZ states that the model results from EcoWasp form a worst-case and that the model results from track 1 are used to “tune” the conclusions of the ecological analysis.^a However, the track 2 leader claims that much of the transparency of the ecological analysis is lost in the Appropriate Assessment Wadden Sea document. She claims that when the effects calculated in track 1 proved to be less than assumed in the basic scenario, the whole track 2 reasoning should have been done again; this is not done. Now, it is claimed in the Appropriate Assessment document that “...the effects are less [than in the basic scenario], thus the effects are not significant”.^c Furthermore, the track 2 leader states that the results from the ecological analysis were not correctly translated into the Appropriate Assessment document. Furthermore, too many other things [historical analysis; policy developments] were used as arguments to formulate the assessment. These arguments were not well [scientifically] underpinned and were not audited. This way the research results from track 1 and 2 are undermined. And it is a shame for the goodwill that was obtained from the scientists [participants in expert workshops, track 2], now they have the feeling that “...the government does what she wants and does not really listen to them”.^b

^a Interview project leader RIKZ, 13 March 2006

^b Interview track 2 leader (Consortium), 21 June 2006

Researcher's reflection

The ecological experts resist against the final conclusions, that no significant negative effects can be expected from MV2 on the Wadden Sea, presented at the expert workshop on 20 September 2005. They think for instance that a decrease of 1% of the population can be significant for some species. The project team of RIKZ explains that the final conclusions are not only based on the ecological analysis, but also depends on policy. Experts request that it will be clearly stated in the final document where their [scientific] knowledge ends.^a We observe that the definition of the term significance is not unambiguous and not made explicit in the expert workshop on 20 September 2005 as it is done in the Appropriate Assessment document (see Section 6.4.2). Finally, the ecological experts claimed that they feel pressured, because they think they are asked to determine the effects on species and habitats and how bad [significant] these effects are.^b From this, we conclude that the separation in responsibilities is not clear for every stakeholder in the project.

In the project, the Consortium had the task of determining the effects of the MV2 on the Wadden Sea and RIKZ carried out the assessment of the effect. RIKZ asked for comments on the Appropriate Assessment document, but in principle RIKZ based this document on the track 1 and 2 documents.^c The separation in responsibilities for on the one hand the effect analysis, by the experts (in track 1 and 2), and on the other hand effect assessment by policy-makers (RIKZ) and jurists was remarked positively by RIKZ participants.^d However, the track 2 leader of the Consortium resisted against this approach from the beginning of the project. She claims that "...the scientists should have the feeling that they would have formulated the assessment in the same way; they must agree on the conclusions and this was not the case."^e Also, the track 1 leader remarks that "...as the government (RIKZ) has a stake in the construction of MV2 [different caps], one could argue that the assessment should have been done by an independent party; in this case the Consortium."^f

^a Minutes track 2 workshop, 20 September 2005

^b Minutes track 2 workshop, 19 May 2005

^c Interview project leader RIKZ, 13 March 2006

^d Interview project member RIKZ, 22 November 2005

^e Interview track 2 leader (Consortium), 21 June 2006

^f Interview track 1 leader(Consortium), 31 July 2006

7 Conclusions

7.1 Context: Appropriate Assessment Wadden Sea

In this section, the following research question is answered:

How does policy context influence the Appropriate Assessment Wadden Sea project?

In January 2005, the Council of State concluded that the land reclamation (MV2) may affect the Wadden Sea area, a unique nature area protected by the European Bird and Habitat Directives. Therefore, a so-called Appropriate Assessment procedure had to be carried out, to show the impact of the project on the integrity of the area. This procedure was not carried out before. Furthermore, the Council of State stated that the investigations that were done for the CPD+ do not indicate that further research, on changes in mud and fish larvae transport, could not give more insight into the impact of MV2 on the protected values of Wadden Sea. Therefore, part of the revision of the CPD+ is to perform an Appropriate Assessment procedure and the related investigations.

Although the European Commission advised the Dutch government in 2003 to handle the effects of MV2 on the Wadden Sea by *careful monitoring*, the Council of State judged in 2005 that an *Appropriate Assessment procedure* for the Wadden Sea should have been carried out. We conclude that the legislation, i.e. Birds and Habitats Directive, is interpreted differently by the Council of State than by the European Commission. Moreover, it is not clear why it is necessary to include the Wadden Sea in the CPD+ PMR and why it is not necessary to include another Natura 2000 site (for instance along the coast of Germany or Denmark) and who should determine this. In this case, the Council of State judged that the Appropriate Assessment Wadden Sea should be executed; however they have no ecological expertise on for instance the geographical reach of the impact of MV2. We argue that this should be determined using expert judgement.

Furthermore, in their judgement the Council of State claims that an Appropriate Assessment procedure should be executed to determine the effects of MV2 on the Wadden Sea. However, this procedure forms the second stage of the Habitat Directive Article 6.3 and 6.4. In the first stage (screening), it must be determined if MV2 is likely to have significant effects on a Natura 2000 site, in this case the Wadden Sea. This stage is however not made explicit in the CPD+ PMR and the outcome of this stage is somehow taken for granted by the Council of State.

7.2 Process → Contents: Problem structuring

In this section, the following research question is answered:

How is the problem structured in the Appropriate Assessment Wadden Sea project?

It can be concluded that the problem definition of the project Appropriate Assessment Wadden Sea differs per stakeholder. We distinguish three “types/levels” of problem definitions: spatial problem; legal/procedural problem; and scientific problem. First, the problem definition by the Dutch Fishermen Union describes a spatial problem: ‘*Loss of fishing area!*’ They are afraid to lose fishing area where the MV2 is constructed and are not so much concerned about the Wadden Sea. Second, the problem definition by: Council of State, PMR, DGTL, Port of Rotterdam, HWE (Consortium) and the expert pool (ecological analysis), can be described as a legal/procedural problem: ‘*Procedure not followed! Construction MV2 not ensured!*’ In the CPD+ PMR no Appropriate Assessment

procedure for the Wadden Sea is done, as required by the Habitats Directive. And as the CPD+ PMR is invalidated the construction of MV2 is not ensured by legal means. At last, RIKZ, Royal Haskoning (Consortium) and WL|Delft Hydraulics (Consortium) define the problem as a scientific problem: '*Scientific knowledge on effects not sufficient!*' According to them the problem is that the scientific knowledge on the effects, on mud, nutrients and fish larvae by the construction of MV2 on the Wadden Sea, is not sufficient. We claim that these differences in problem definitions lead to different stakeholders' perspectives on the approach and the solution to the problem.

RIKZ and the Port of Rotterdam (PoR) worked together on the Appropriate Assessment Wadden Sea, because they were both 'problem owner'. PoR is responsible for the Construction Environmental Impact Assessment (EIA) and the government is responsible for the CPD+. Both are necessary to ensure the construction of MV2. PoR and RIKZ commissioned Consortium 3|MV2, which already existed and had contracts for the Construction EIA, for the investigations in the context of the Appropriate Assessment. The problem approach was developed by RWS/RIKZ and Consortium 3|MV2. The scientific investigations for the Appropriate Assessment Wadden Sea took place in two parallel tracks: 1) model calculations, bottom-up approach; 2) ecological analysis, top-down approach. Furthermore, RIKZ requested an international audit panel to check the scientific underpinning and the consistent use of scientific results in the Appropriate Assessment Wadden Sea. At last, in August 2005 RIKZ decided to include two historical data analyses, to investigate whether large-scale activities (e.g. Delta works, Maasvlakte 1) carried out along the coast of The Netherlands can be recognized in historical data.

In the model calculations (track 1), the effect of MV2 on the Wadden Sea are predicted from a bottom-up approach, starting from effects on hydrodynamics to mud, nutrients, primary productivity and fish larvae transport, using several computational models. This track was immediately started in February 2005, because of the Council of State stated that the investigations that were done for the CPD+ do not indicate that further research, on changes in mud and fish larvae transport, could not give more insight into the impact of MV2 on the protected values of Wadden Sea. Furthermore, this research (approach) was also planned as part of the Construction EIA. The other parallel track, the ecological analysis (track 2) was however only initiated after a participant of the Construction EIA, noticed that PoR and RIKZ started "calculating at random". They did not realize that assessments had to be made on the level of species and habitats, although the Appropriate Assessment procedure is part of the Birds and Habitats Directive, which is logically aimed at the protection of bird species and habitats. However, in the beginning of the project only RIKZ, PoR and WL|Delft Hydraulics (part of Consortium) were involved for the investigations, because the existing organisation structure and contracts of the Construction EIA were used. As these stakeholders are mainly focused on modelling calculations, in the frame of the Construction EIA, this explains that at first there was no ecological analysis included. We conclude that the perspectives of RIKZ, PoR and WL|Delft Hydraulics had a great influence on the problem approach for the Appropriate Assessment Wadden Sea.

7.3 Process → Contents: Assessment framework

In this section, the following research question is answered:

*How is the Assessment framework developed in the
Appropriate Assessment Wadden Sea project?*

We observe difference in the interpretation of the legislation (i.e. Birds and Habitats Directive) between the project leader of RIKZ and the track 2 leader of the Consortium (HWE). The latter states that the strategic objective should be the list of species and habitats protected by the Birds and Habitats Directive. However, the project leader of RIKZ claims this is a too static approach for a dynamic system like the Wadden Sea. And they use qualitative, provisional conservation objectives for the Wadden Sea, which were formulated by the Ministry of LNV and accepted at a ministerial consultation. We conclude that it is not clear what the implications of the juridical framework, i.e. the Birds and Habitats Directive and the Nature Protection Law, are for the Appropriate Assessment Wadden Sea.

The differences in perspectives of the stakeholders HWE and RIKZ leads to the development of two assessment frameworks, one is used for the ecological analysis and one is used in the Appropriate Assessment document. These two assessment frameworks were formulated in approximately the same phase of the project (respectively July and June 2005). Although, there is some overlap in the two assessment frameworks, the framework in the Appropriate Assessment Wadden Sea document formed no explicit, direct guidance for the operational objectives and assessment criteria in the ecological analysis. Moreover, the formulation of the operational objectives in the assessment framework of the Appropriate Assessment Wadden Sea document is influenced by the achieved modelling results (from track 1). Project members from RIKZ concluded that the Assessment Framework should have been made explicit earlier in the project; although in practice they are often reformulated during a project and everyone has an implicit Assessment Framework. We conclude that the development of the Assessment Framework was an *iterative process*.

7.4 Contents → Process: Role of technical and natural scientific knowledge

In this section, the following research question is answered:

*What is the role of technical and natural scientific knowledge in the
Appropriate Assessment Wadden Sea?*

Resources of technical knowledge

In the ecological analysis (track 2), the main sources of technical knowledge are: expert judgement from ecological experts in workshops; and an ecosystem model (EcoWasp). The results of the EcoWasp model were subject of discussion and were disputed by some of the experts. According to the project leader of RIKZ this is partly due to distrust between institutes. Thus, at this point the (use of) technical knowledge (i.e. EcoWasp model) is greatly affected by the stakeholders' perspectives (i.e. ecological experts wish to work with their own model and only trust their own model). In track 1, the main sources of technical knowledge are several computational models for hydrodynamics, mud transport, nutrients and fish larvae transport. Much effort (time and computational capacity) has been put into the improvement these models. However, the predicted effects are not very different from the results with the Flyland model. One could argue that the effort that has been put into the improvements is affected by the perspectives of the stakeholders that have a stake in these model calculations. On the

one hand, WL|Delft Hydraulics, who have a stake in improvement of their model instruments for the market. On the other hand, Port of Rotterdam who needs these model calculations for the concessions for the Construction EIA. Thus, we conclude that afterwards the problem definition of WL|Delft Hydraulics does no longer focus on the prediction of the effects of MV2 on the Wadden Sea, but on the development of the computational models, for the market and the Construction EIA.

Dealing with uncertainties

In track 1, an uncertainty analysis is done on beforehand to determine the main sources of uncertainties and to discuss how important and feasible (given the timeframe) it was to encounter for them. Furthermore, the uncertainties in the model results are quantified by expert judgement. It can be concluded that this is however a wild guess, because the results cannot be checked. And one could even argue not to use models at all, because we do not know how uncertain they are. Also, we conclude that although large uncertainties exist in both the model calculations and the ecological analysis, there is no explicit argumentation why the investment in model calculations is four times as big as that for the ecological analysis.

Effect assessment

First, the effects of MV2, described using the EcoWasp model, on the protected values of the Wadden Sea were assessed in the ecological analysis. This assessment showed that for four species possible significant negative effects are expected. These four species are reviewed in the Appropriate Assessment Wadden Sea document. Here, first the effects on the dynamic processes (mud, nutrients and fish larvae) are assessed. RIKZ concludes that these processes are not significantly affected. Therefore, the four species are also not significantly affected.

There is no agreement on this argumentation. The project leader of RIKZ states that the model results from EcoWasp form a worst-case and that the model results from track 1 are used to “tune” the conclusions of the ecological analysis. However, the track 2 leaders claims that much of the transparency of the ecological analysis is lost in the Appropriate Assessment Wadden Sea document. Also, the ecological experts resist against the final conclusions. This dissatisfaction is probably caused by the fact that two assessment frameworks were developed and used to formulate the assessment. First, HWE used one for the ecological analysis and then RIKZ used one for the final assessment. We conclude that the perspective of the ecological experts (including HWE) is that the final assessment should be a scientific one, whereas RIKZ’s perspective is that the assessment is a mixture of policy and science.

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Appendix A: List of attended project meetings

In the period from April to November 2005, the researcher participated in the project Appropriate Assessment Wadden Sea by attending project meetings (see table below). The researcher had the role of observer in these project meetings.

Date	Location	Participants	Subject
04-04-2005	Den Haag*	RIKZ project members	Progress project
14-04-2005	Utrecht	RIKZ project members	Progress project
29-04-2005	Utrecht	RIKZ project members	Progress project
29-04-2005	Utrecht	RIKZ, PoR & Consortium	CPD Wadden Sea & Conservation objectives BHD
19-05-2005	Den Helder	RIKZ, PoR, Consortium & Expert pool	Expert workshop 1
13-06-2005	Den Haag*	RIKZ project members	Progress project
20-06-2005	Delft	RIKZ, PoR & Consortium	Progress track 1
22-06-2005	Texel	RIKZ, PoR, Consortium & Expert pool	Expert workshop 2
23-06-2005	Texel	RIKZ, PoR, Consortium & Expert pool	Expert workshop 2
28-06-2005	Den Haag*	RIKZ project members	Progress project
01-09-2005	Utrecht	RIKZ project members	Progress project
20-09-2005	Den Helder	RIKZ, PoR, Consortium & Expert pool	Expert workshop 3
13-10-2005	Utrecht	RIKZ project members	Progress project
03-11-2005	Utrecht	RIKZ project members	Final project meeting
28-09-2006	Rotterdam	Open to public	Conference "MV2 and the Wadden Sea in perspective"

*Contact with project members at RIKZ-Haren through videoconferencing

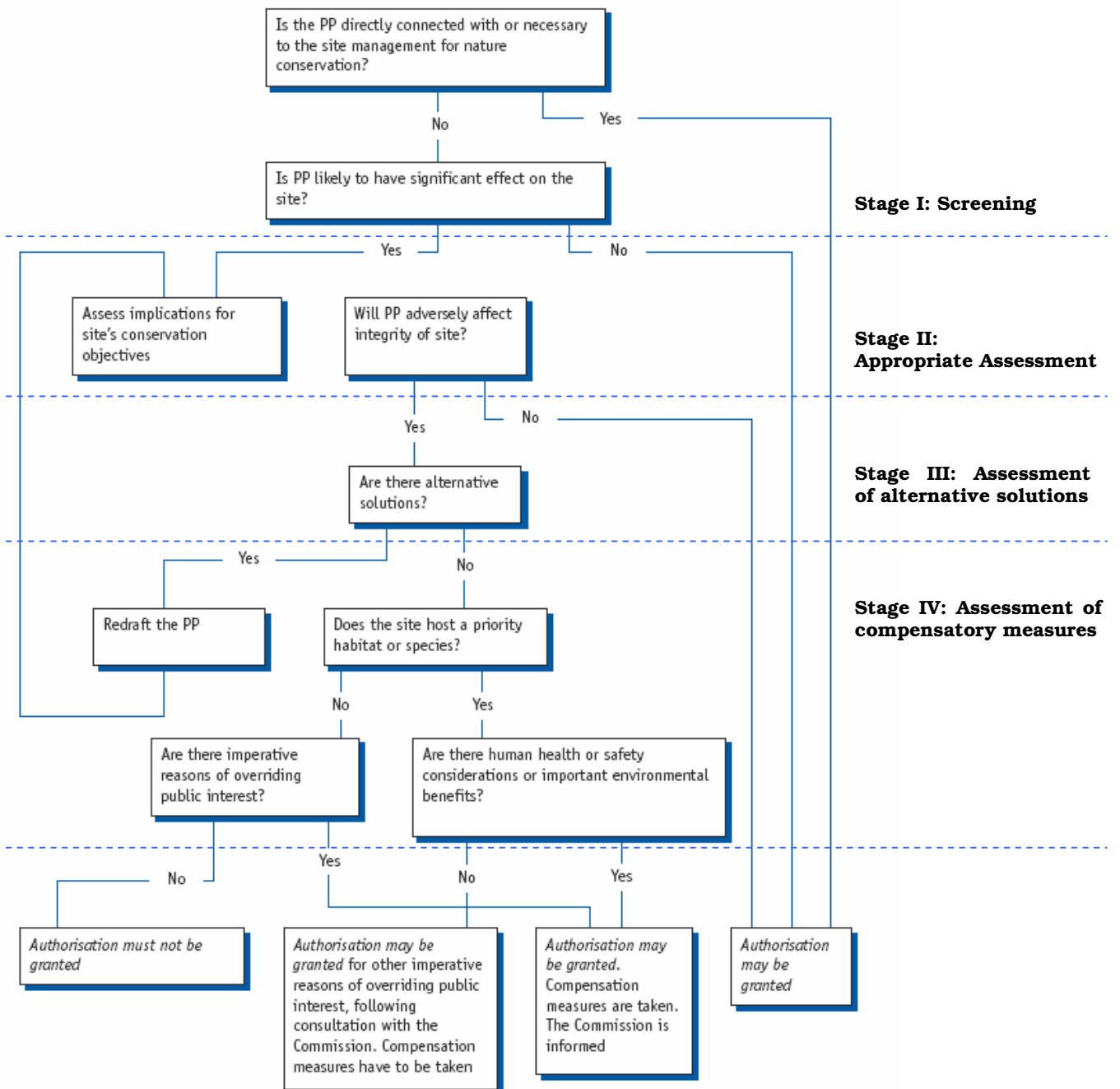
Appendix B: List of interviews with participants

From October 2005 to July 2006, the researcher conducted interviews with nine participants of the project Appropriate Assessment Wadden Sea (see table below). These interviews were done to understand: the process of the project and the perspectives of the participants involved in the project.

	Respondent	Role	Institute	Date	Time
Client	Rien van Zetten	Project leader	RIKZ	22-11-2005 13-03-2006	90 min. 90 min.
	Mariska Harte	Project member	RIKZ	03-10-2005	60 min.
	Bianca Peters	Project member	RIKZ	08-11-2005	90 min.
	Job Dronkers	Project member, historical analysis & international audit	RIKZ	22-11-2005	90 min.
	John de Ronde	Leader track 1	RIKZ	09-11-2005 13-03-2006	75 min. 30 min.
Consortium 3MV2	Mathijs van Ledden	Leader track 1	Royal Haskoning	14-02-2006 31-07-2006	30 min. 60 min.
	Floor Heinis	Leader track 2	HWE	21-06-2006	75 min.
	Johan Boon	Project leader track 1 at WL Delft Hydraulics	WL Delft Hydraulics	14-02-2006	50 min.
	Hans Los	Project member track 1	WL Delft Hydraulics	14-02-2006	50 min.

Appendix C: Flow chart for Article 6(3) and 6(4) of the Habitats Directive

CONSIDERATION OF PLANS AND PROJECTS AFFECTING NATURA 2000 SITES

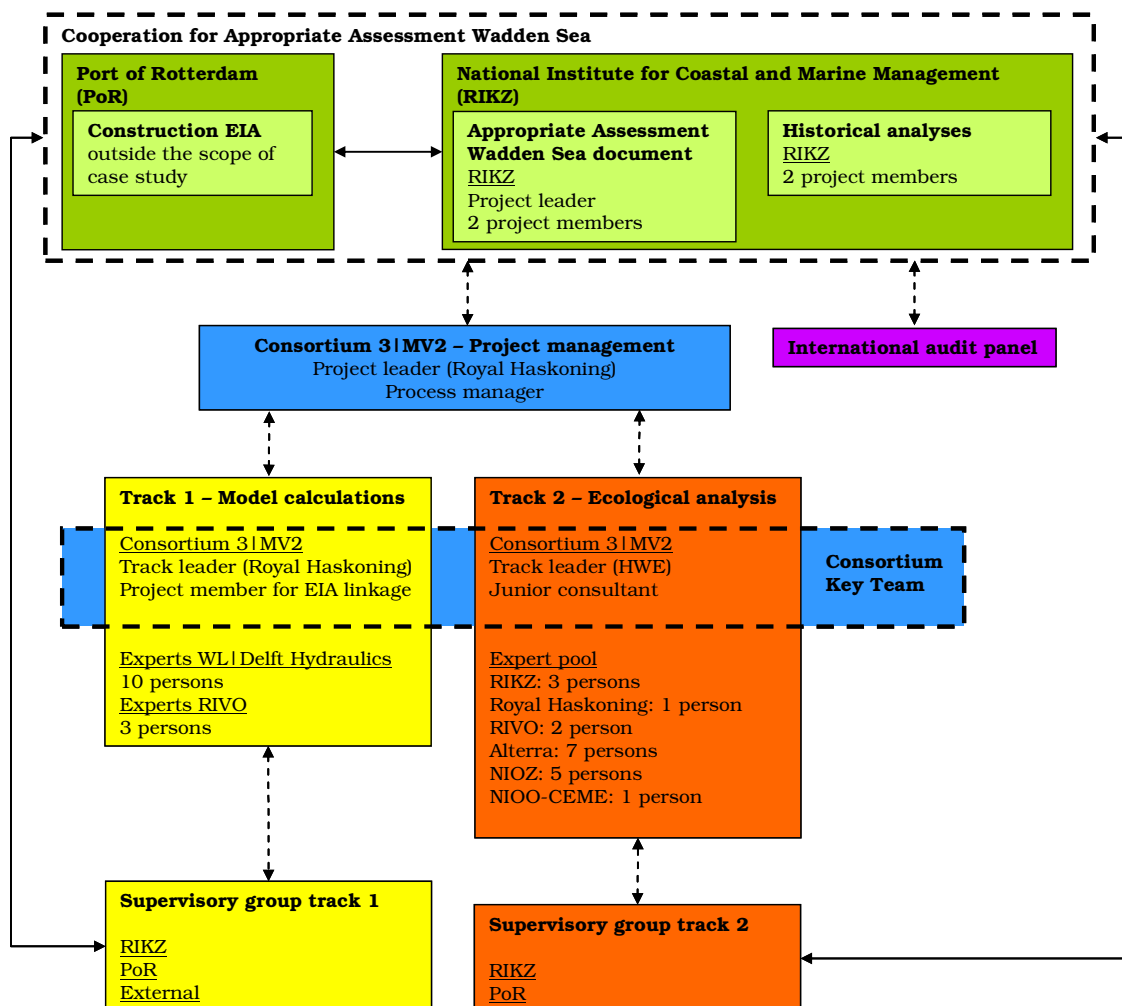


(European Commission, 2000)

PP = Plans and Projects

Appendix D: Detailed project organization

In the figure below, the detailed project organization for the Appropriate Assessment Wadden Sea is shown. The Port of Rotterdam and RIKZ worked together for the Appropriate Assessment Wadden Sea. They commissioned Consortium 3|MV2 with the investigations along two parallel tracks: model calculations (track 1) and ecological analysis (track 2). Also, two supervisory committees, one for each track, are formed to enable internal quality assurance.⁵³ Furthermore, RIKZ asked a panel of international experts to perform an audit of the scientific underpinning of the Appropriate Assessment and the consistent use of scientific results in the Appropriate Assessment. Finally, RIKZ wrote the Appropriate Assessment document and conducted two historical data analyses. And the PoR is responsible for the Construction EIA, which is outside the scope of our case study.



⁵³ Interview project leader RIKZ, 22 November 2005