

The WELCOME Integrated Management Strategy for large scale historical soil and groundwater contaminations: Introduction and example Rotterdam Harbour Region

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TNO | Knowledge for business



Huub Rijnaarts and Jeroen ter Meer

Contents

- Introduction WELCOME project
- Groundwater Directive
- Integrated Management Strategy (IMS)
- Application of IMS to Rotterdam megasite
- Conclusion

WELCOME project

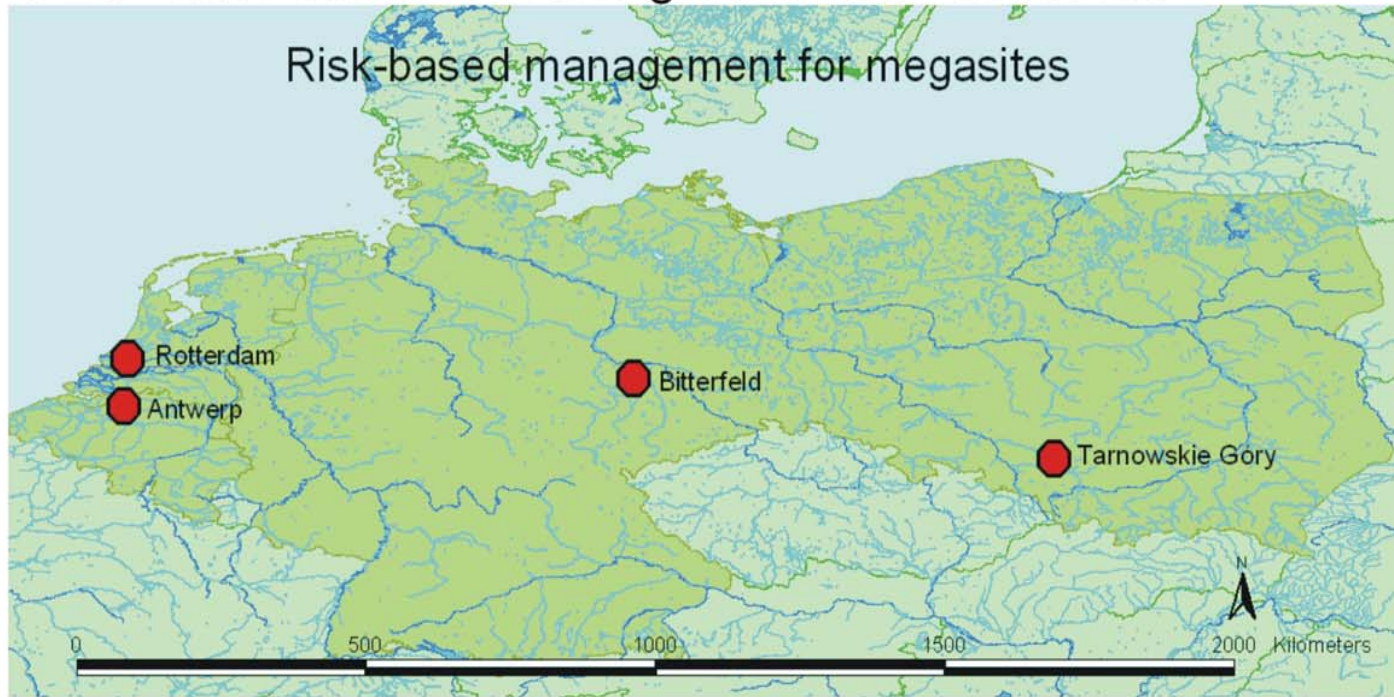
- The WELCOME-project was funded by the European Union (FP5, EESD, EVK1-CT-2001-00103) and executed from January 2002 until December 2004
- 13 partners from 4 different EU member states and of different background; case study related end-users, research-institutes, universities, and consultants,
- interaction with an international group of end-users (see website: <http://www.EUwelcome.nl/>)
- Aiming at results with high research quality as well as with practical utility

WELCOME project

- Addressing groundwater, surface water and soil contamination on large (former) industrial sites:
 - Bitterfeld
 - Rotterdam and Antwerp harbour
 - Tarnowskie Gory
- Goal:
 - to make an Integrated Management Strategy (IMS) for Prevention and Reduction of risks at Contaminated Industrial Megsites for
 - Protection of groundwater and surface water resources in line with EU water framework and groundwater directives

WELCOME megasite cases

Protection of surface and groundwater resources according to the EU water framework and groundwater directives



Position
in river
basin:

Estuary

Middle

Spring area

EU Groundwater directive

- Establishes specific measures as set out in article 17 of the WFD in order to prevent and control groundwater pollution. Measures include:
 - Criteria for the assessment of good groundwater chemical status
 - Criteria for the identification and reversal of significant and sustained upward trends and the definition of starting points for trend reversal
 - Requirements to prevent or limit indirect discharges of pollutants into groundwater
- Annex IV, indent 1.4 (version submitted to the EU parliament)
 - Specific trend assessment shall be carried out for relevant pollutants in bodies of groundwater that are affected by point sources of pollution, including historical point sources, in order to verify that plumes from contaminated sites do not expand over a defined area and deteriorate the chemical status of the groundwater body.
- The IMS aims to take these EU requirements into account during building megasite management plans.

Integrated Management Strategy (IMS)

- Aimed at guiding the user through the whole process of establishing a megasite management plan; from the initial screening to the final definition of the remediation scenarios and long-term site management plan
- The IMS includes:
 - basic strategies of the IMS
 - a manual for technical experts and environmental managers
 - examples of the implementation of the IMS at the Welcome megasite cases
 - an overview of the technical support tools

Integrated Management Strategy

Adres <http://www.euwelcome.nl/kims/manual/index.php?index=2&sec=1>

Welcome Strategies | Manual | Examples | Tools | Questions Glossary | About

Integrated Management Strategy for Prevention and Reduction of Pollution of Waterbodies at Contaminated Industrial Megasites

IMS

Introduction

- > **Starting IMS**
 - Problem definition
 - Organizing stakeholders
 - Boundary conditions
 - Inventory of information
 - Building a conceptual model
 - Decision on IMS
- Risk Assessment**
 - Megasite characterization
 - Clustering
 - Modelling
 - Determining risks
 - Finalize clustering
- Risk Management Scenarios**
 - Basic scenarios
 - Potential and preferred scenario
 - Final scenario
- Implementation**
 - Management plan
 - Monitoring program
 - Review process

Manual

IMS > Manual > Starting IMS

Starting IMS

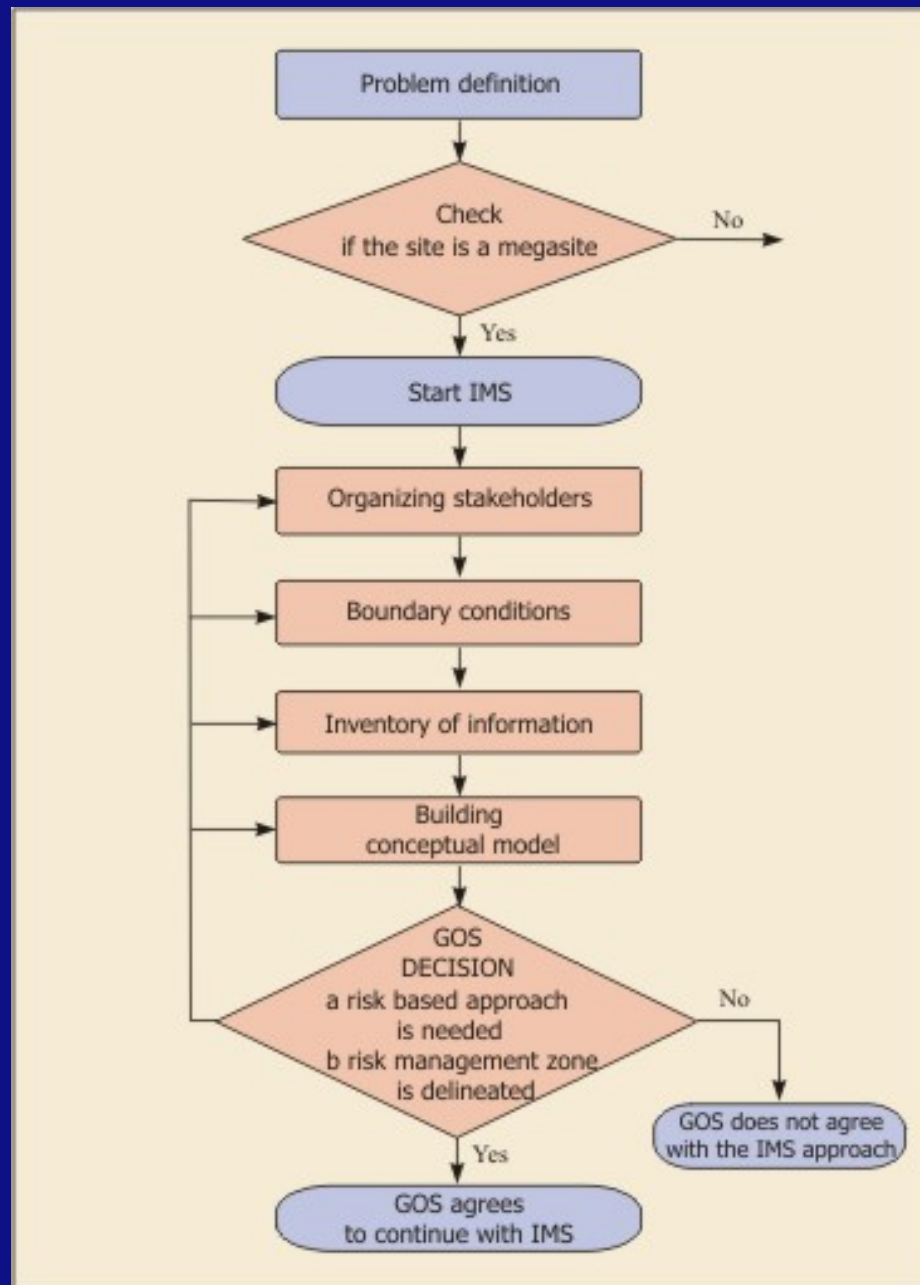
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graph TD
    A[Problem definition] --> B{Check if the site is a megasite}
    B -- No --> Exit1[ ]
    B -- Yes --> C([Start IMS])
    C --> D[Organizing stakeholders]
    D --> E[Boundary conditions]
    E --> F[Inventory of information]
    F --> G[Building conceptual model]
    G --> H{GOS DECISION  
a risk based approach is needed  
b risk management zone is delineated}
    H -- Yes --> I([GOS agrees to continue with IMS])
    H -- No --> J([GOS does not agree with the IMS approach])
    
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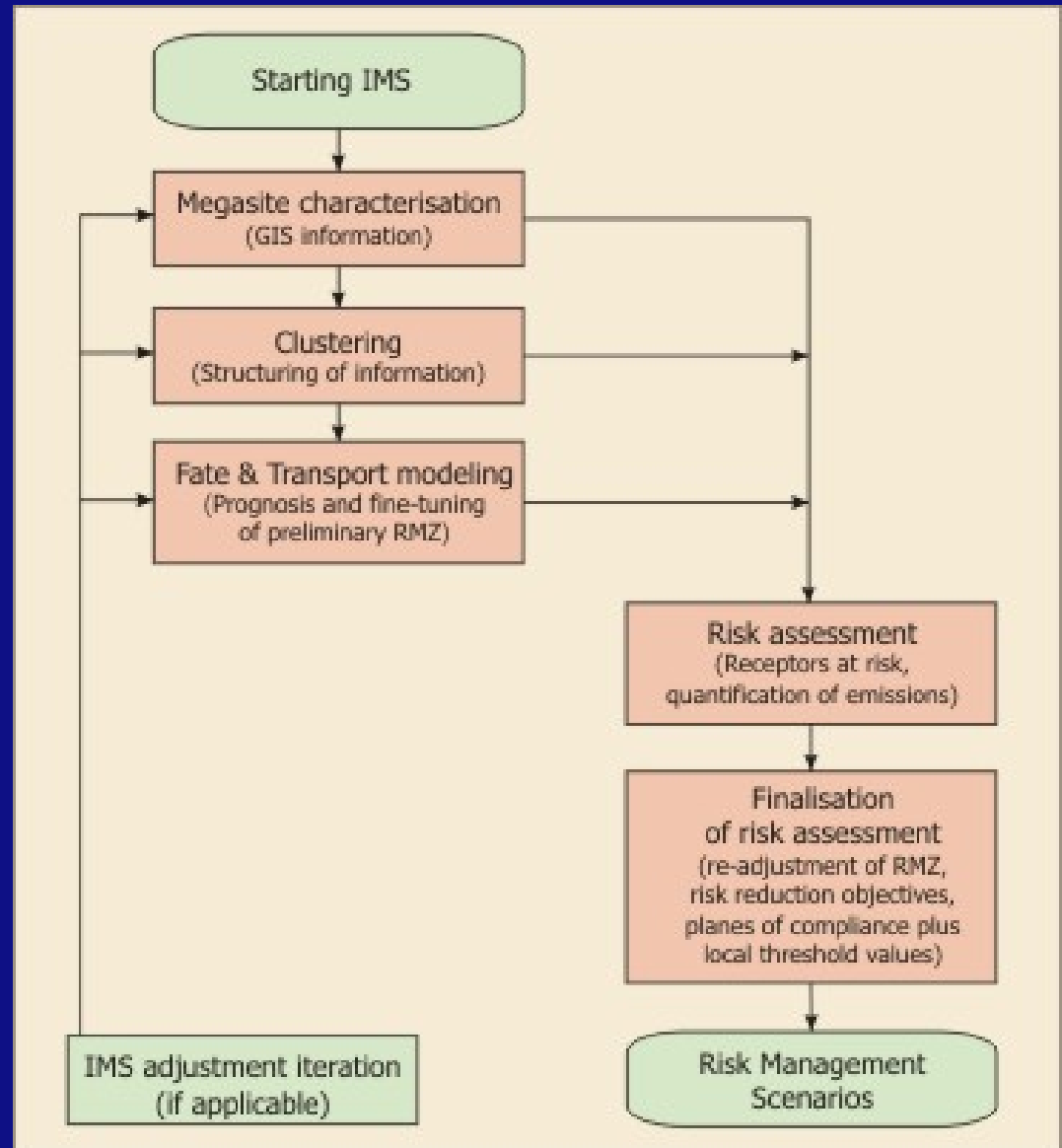
Definitions

- BC - Boundary conditions
- CM - Conceptual model
- GIS - Geographical Information System
- IMS - Integrated Management Strategy
- Megasite
- Plane of compliance
- RMZ - Risk Management Zone
- Stakeholders

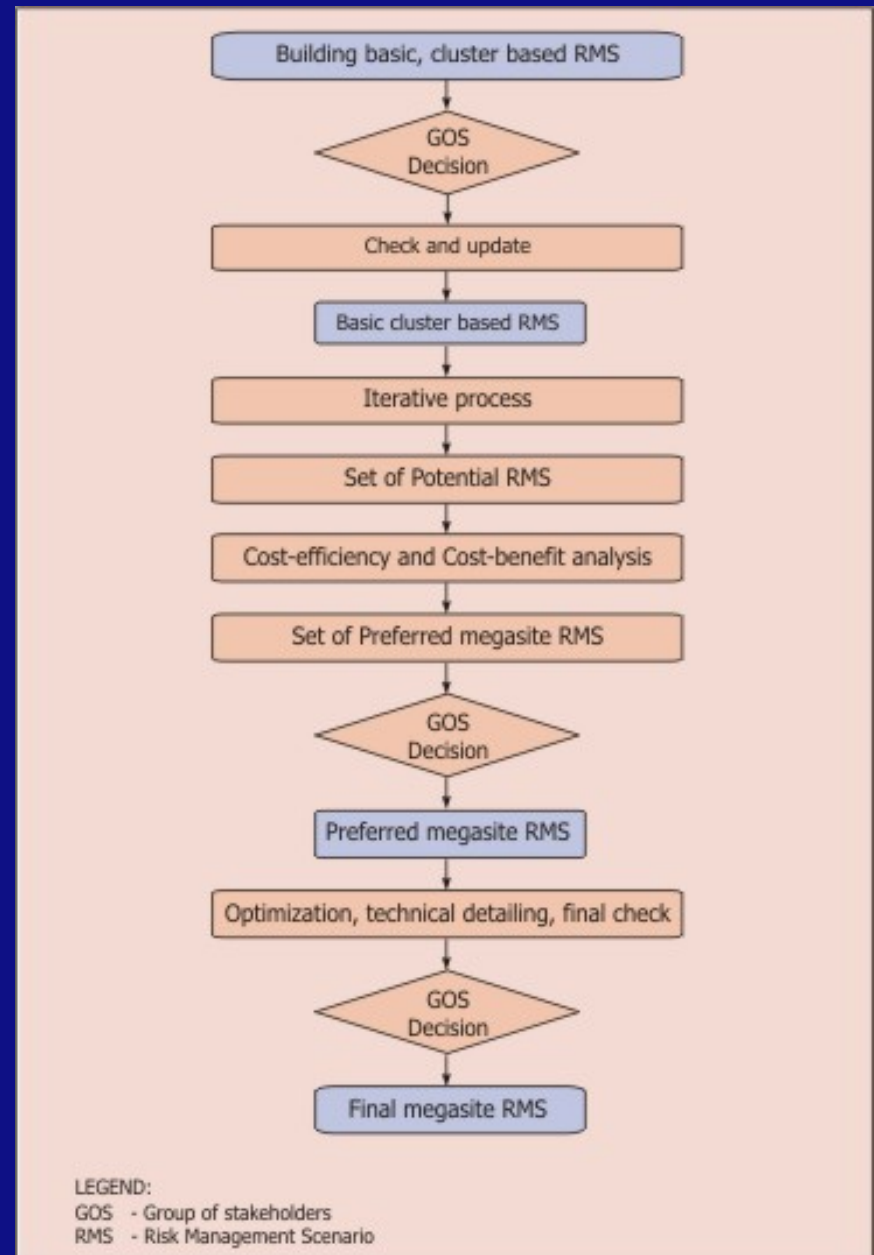
Starting the IMS



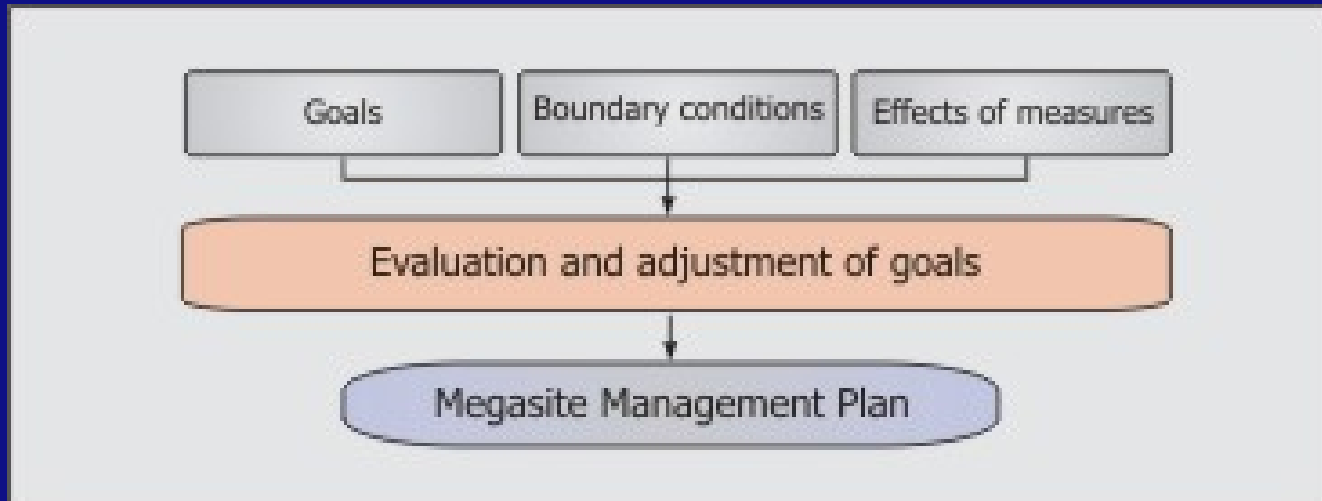
Risk assessment



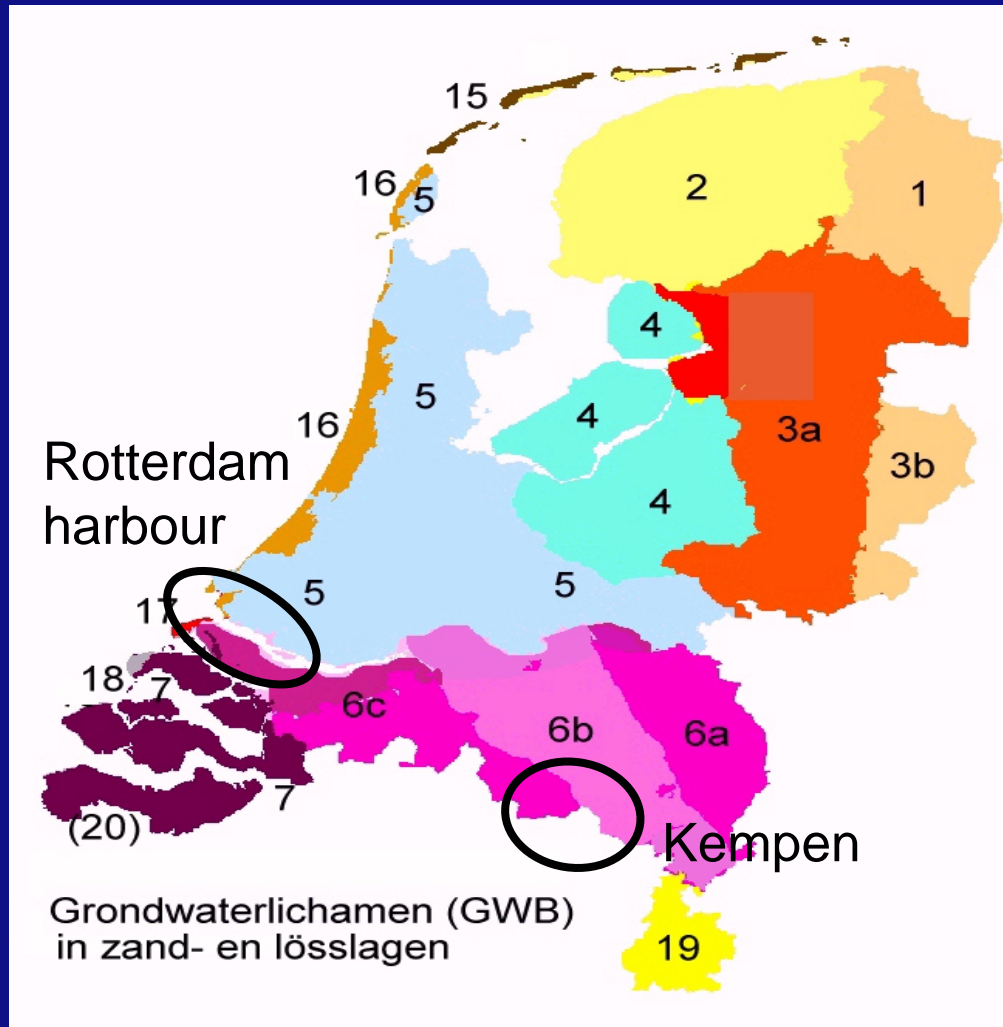
Management scenarios



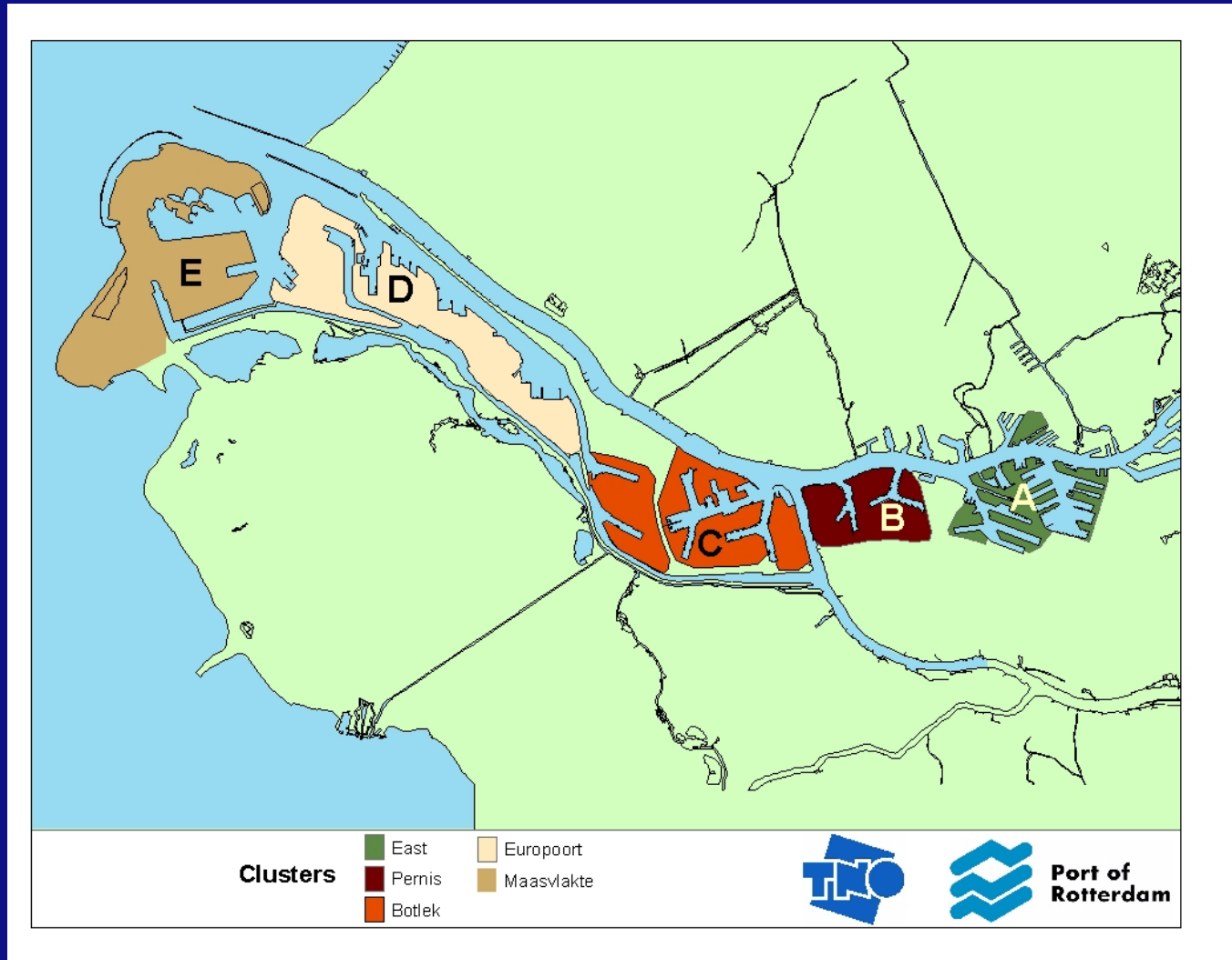
Implementation



Two megasites in the Netherlands and their relation to Regional Groundwater Bodies



Application the IMS to the Rotterdam harbour region

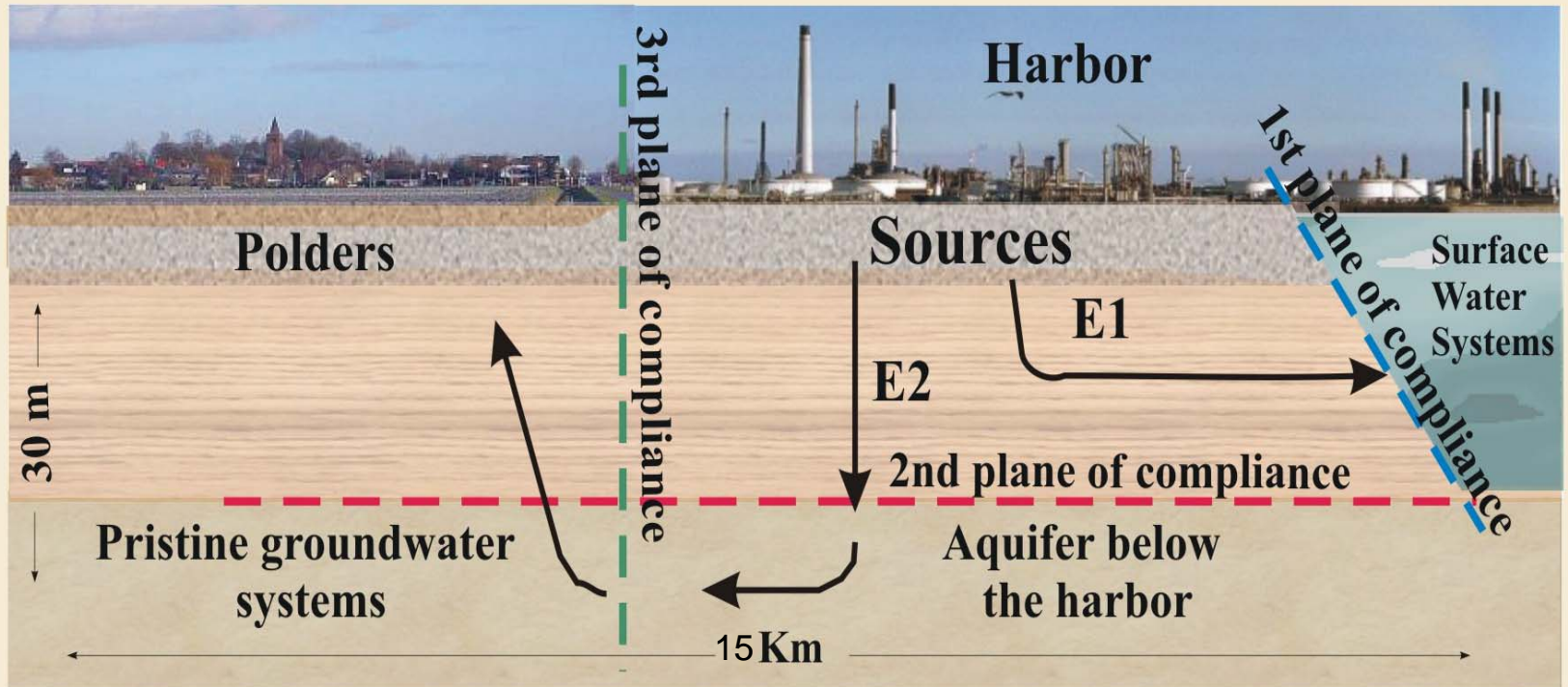


Starting the IMS 1: Organising stakeholders

- Stakeholders involved in steering group:
 - Port of Rotterdam (PoR)
 - Environmental Agency for Rotterdam region (DCMR)
 - Department of Environment (VROM)
 - Industry (united in the interest group Deltalinqs).

Starting the IMS 2: Conceptual model

Rotterdam megasite - planes of compliance - cross section

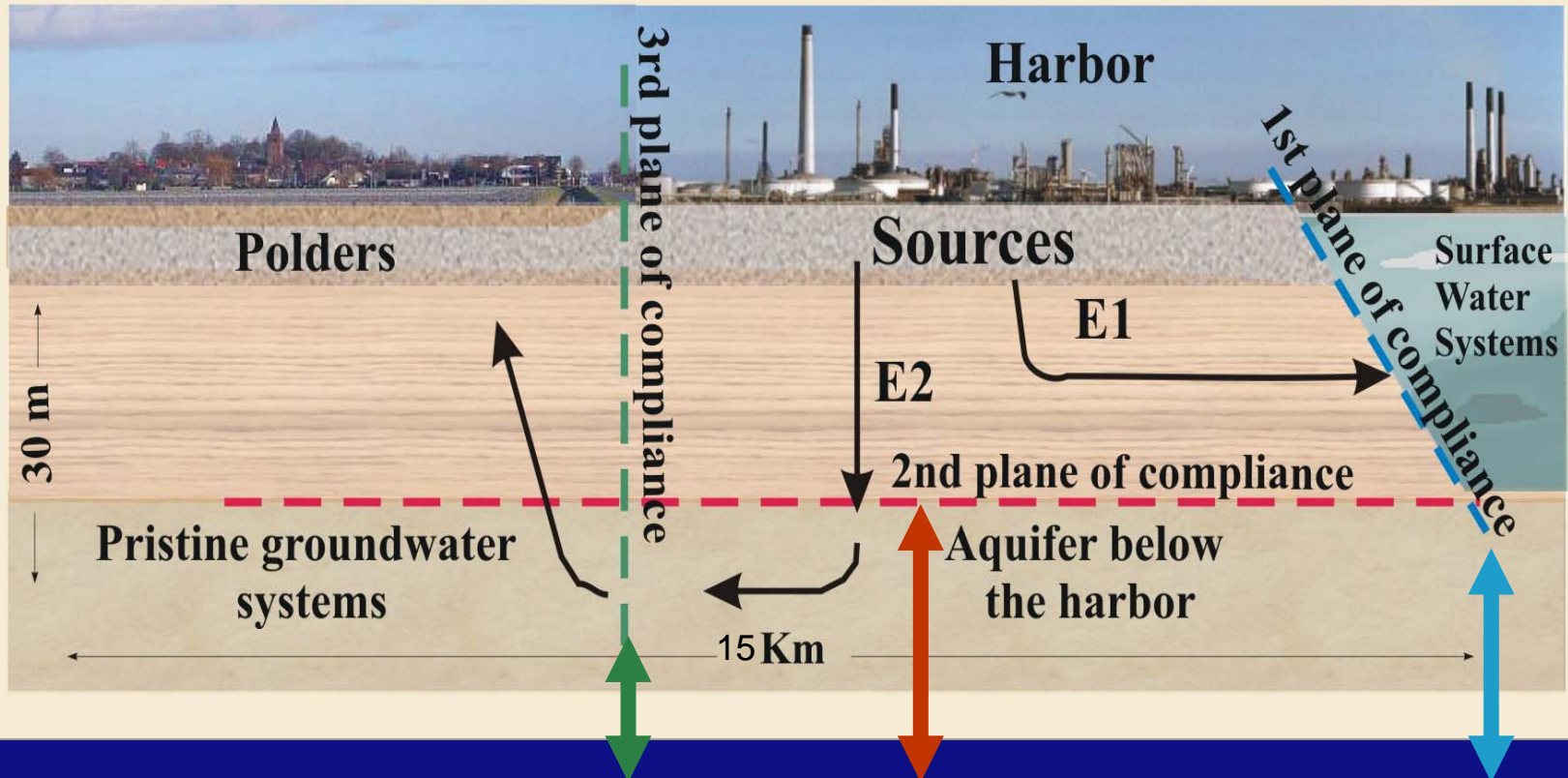


Risk assessment 1: megasite characterization

- Contaminant distribution
 - Availability of representative field data (from databases and industry)
 - Priority contaminants
 - Related to industrial activities
- Geohydrology
 - Regional scale
 - Complex soil stratification
 - Influence of heterogeneities (sand piles, groundwater extractions)
- Natural attenuation
 - Very important for long travelling times
 - Redox conditions
 - Biodegradation rates from representative field studies
- Prediction of fate and transport with model
 - Current and future impact at receptors
 - uncertainty quantified in Monte-Carlo analysis

Result regional risk assessment Rotterdam Harbour

Rotterdam megasite - planes of compliance - cross section



Possible Significant Effects on GWQ; time frame, 2020-2060. Contribution NA??

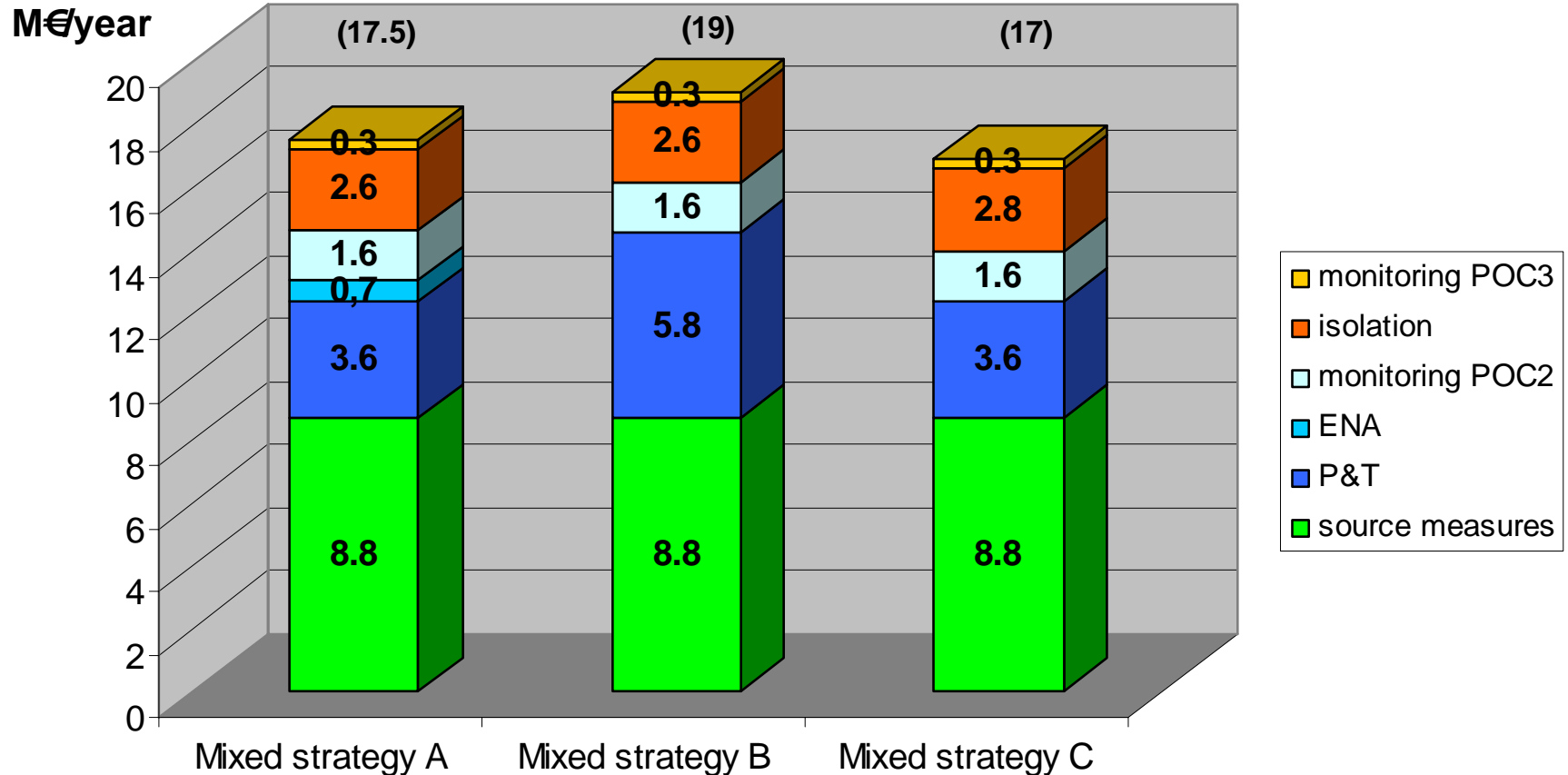
Significant Effects on GWQ; time frame, 2005-2040

No significant Effects on SWQ

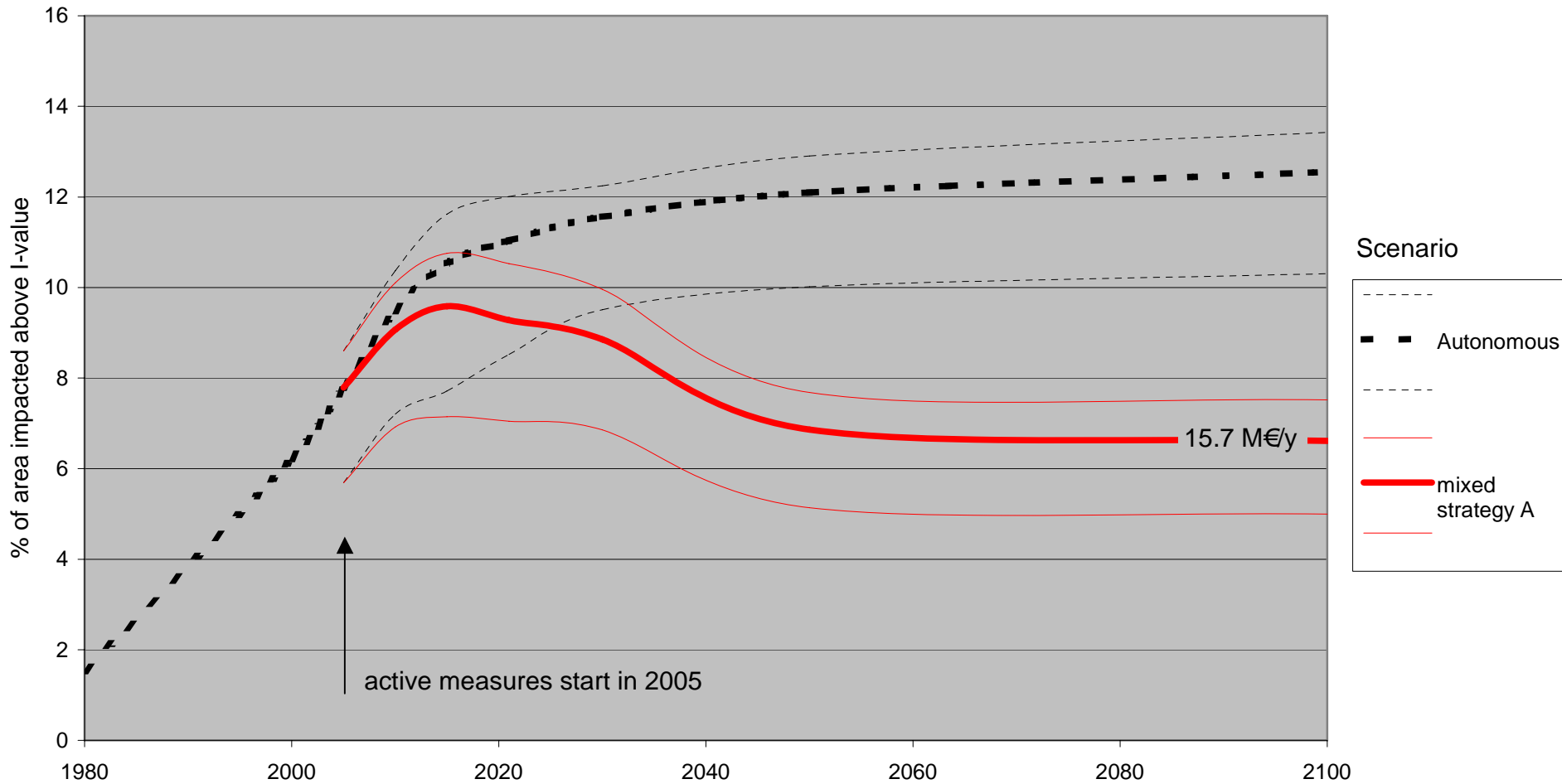
Costs:

Mixed strategies: 15 to 20 M€/year

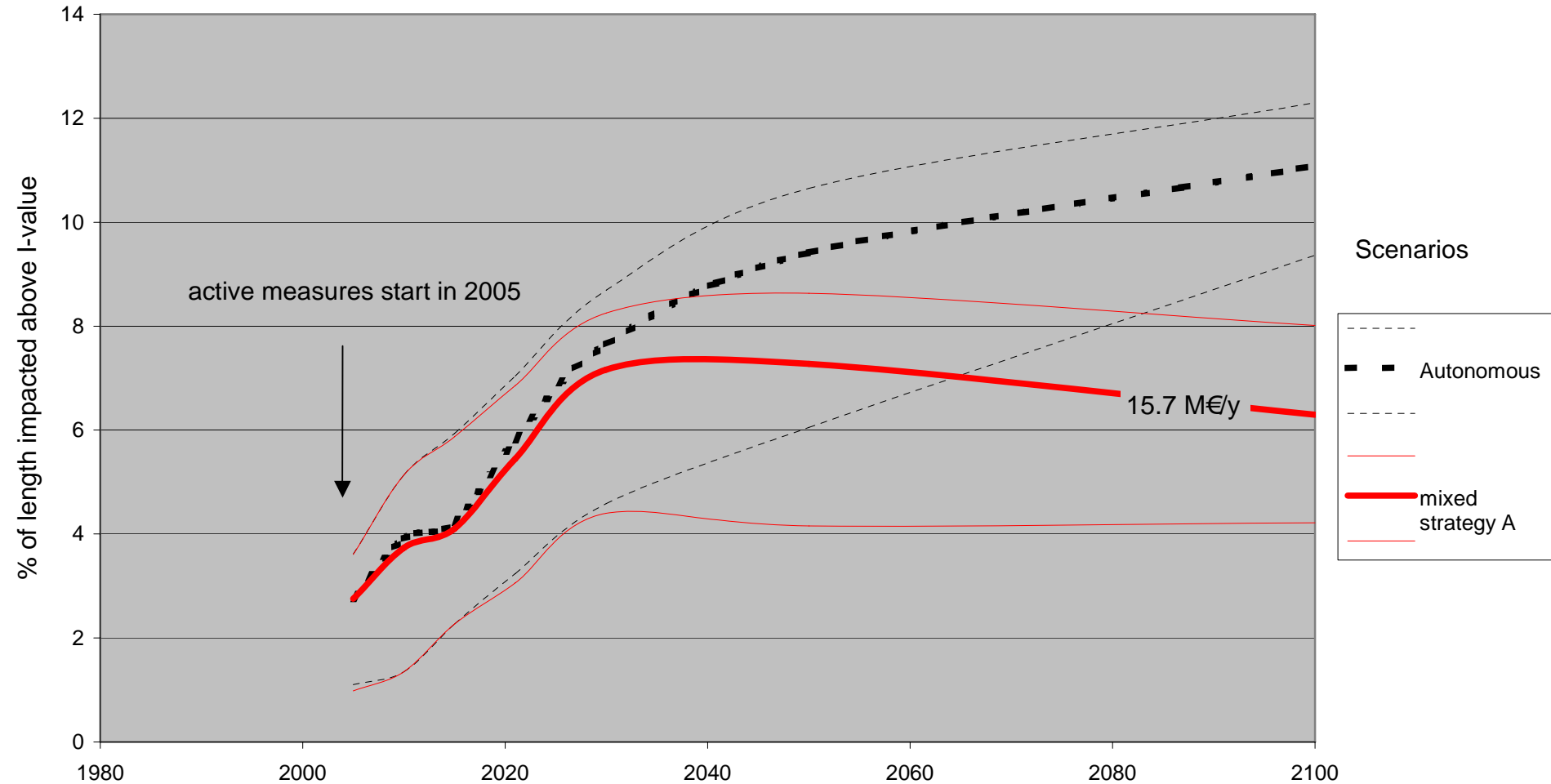
Compare: current expenditure 10 M€/year; full clean-up, 100 M€/year.



Effect of mixed strategy A (impact on 2nd plane of compliance)



Effect of mixed strategy A (impact on 3rd plane of compliance)



Conclusion

- The WELCOME IMS
 - Is **generic** (attaching to national and EU **regulations**) and **flexible** (allowing for tailor-made region specific and iterative approaches)
 - Includes **stakeholder** participation and is based on **natural science principles** (establishing trends and appropriate measures using risk assessment procedures, fate and transport models, and taking into account natural attenuation and immobilisation processes)
 - Includes **cost-indications**
 - based on tools and practical engineering know-how,
 - to address the **proportionality principle** as mentioned in EU and national directives
 - May serve as a basis for further technical detailing of the groundwater directive with regard to management of large scale historical contaminations

Acknowledgments

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- All Welcome partners contributed to the IMS and the tools included, as well as the team of end-users (see website: <http://www.EUwelcome.nl/>)
- The members of the Welcome team that has built the final version of the IMS were:
 - Martin Keil (LAF) , Antje Ritter, Judith Sievers, and Jochen Grossmann of GICON, Andreas Bielke of QUADRIGA, Lida Schelwald of POR, Bert Satijn and Stefan Ouboter of NOK, Greg Malina of TUC, Janush Krupanek of IETU, Arno Kaschl from UFZ, and Jeroen Ter Meer, Natalia Hoogeveen, Hans van Duijne, and Huub Rijnaarts from TNO.
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- The Rotterdam Case Study was carried out by
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