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Hollandse Kust (zuid) Wind Farm Zone

Unexploded Ordnance (UXO) - Desk Study

Commissioned by the Netherlands Enterprise Agency

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Contents of this presentation for the webinar

1. Introduction to REASeuro
2. Main objectives Desk Study
3. Historical research
4. UXO risk assessment
5. Regulation and standards
6. Conclusions

1. Introduction to REASeuro

- Fully specialized on all explosives topics
- IED and UXO
- Dutch B.V. and German GmbH
- Onshore UXO clearance operations
- Offshore UXO clearance operations
- EOD management by delivering:
  - Advice
  - Services
  - Training, Education & Certification

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2. Main objectives Desk Study

- Assessment of the presence of UXO based on historical data
- Outline of types of UXO to be expected

3. Historical research

- Conducted according the WSCS-OCE guidelines
- Information drawn from:
  - information derived from RVO
  - literature
  - archives
  - Dutch Coastguard & the Royal Netherlands Navy
  - open source information
- Both WWI and WWII are relevant

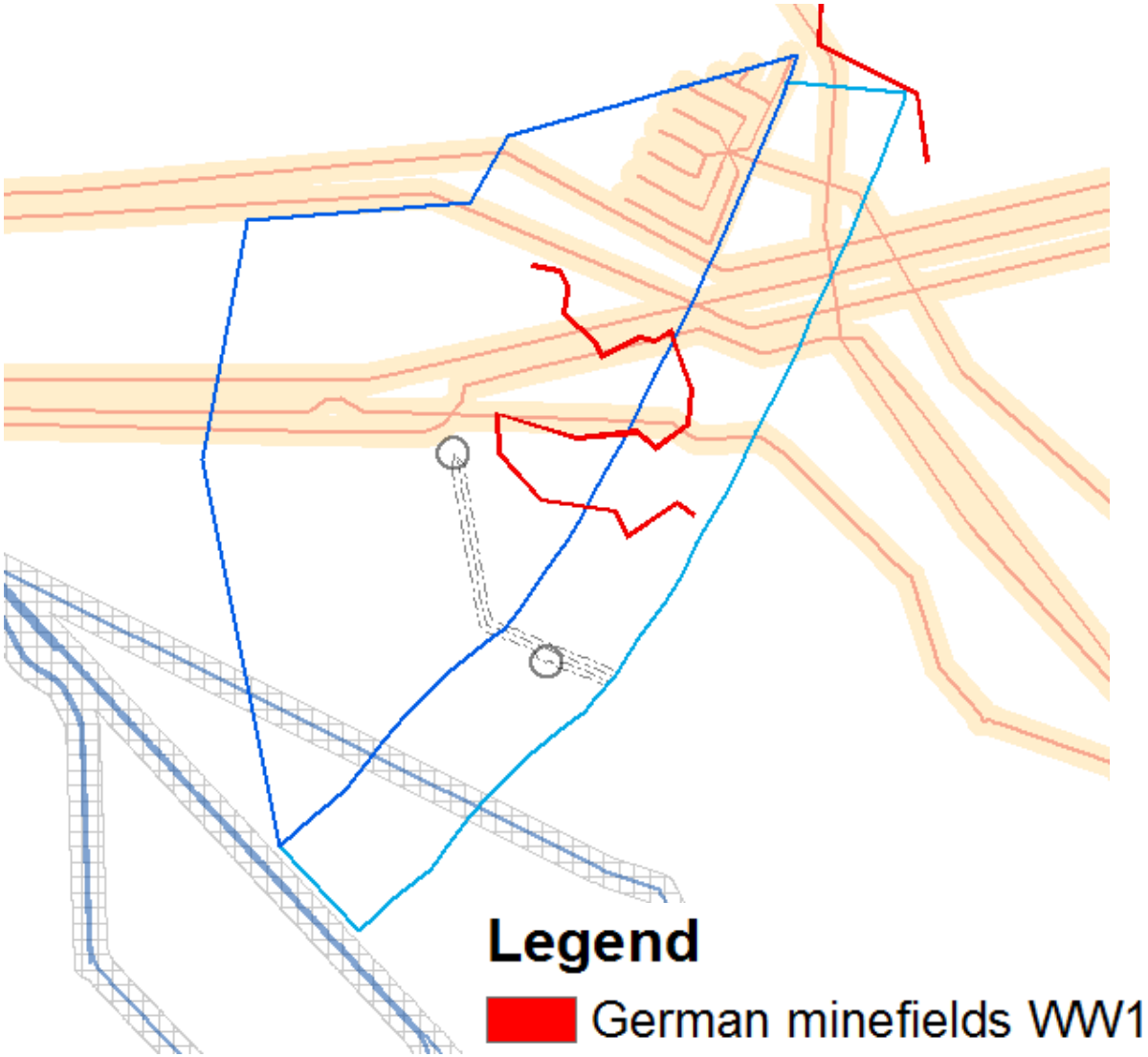
3. Historical research

Maritime warfare on the North Sea

Naval warfare	Aerial warfare	Post war activities
Laying of mine fields	Attacks on convoys	AXO dumping
Torpedo attacks on ships	Torpedo attacks	
Engagements between naval ships	Mine laying	
Sinking of (ammunition) ships	Bomb jettison	
Attacks on submarines	Airplane crashes	

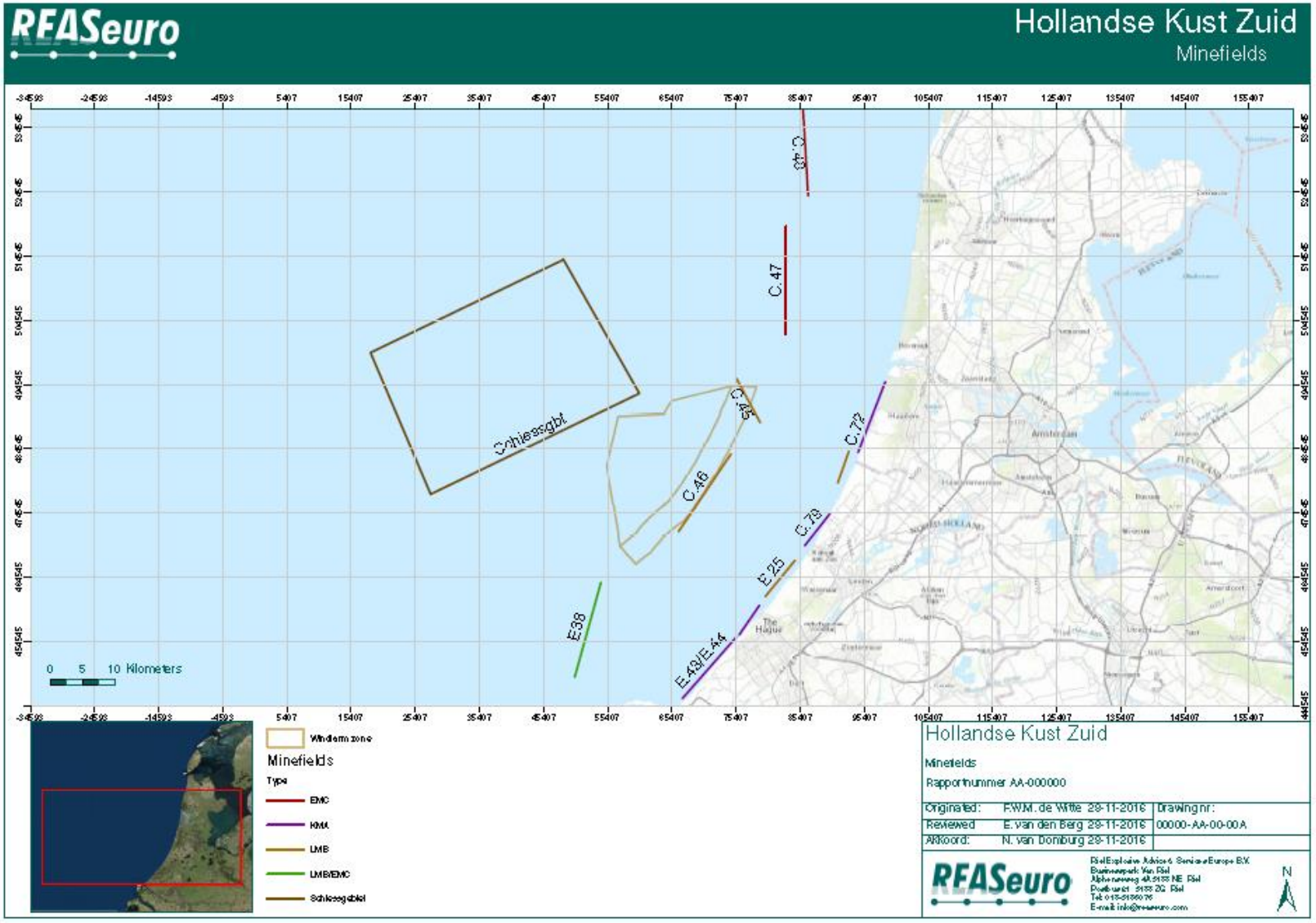
3. Historical research

Naval mine fields WW I



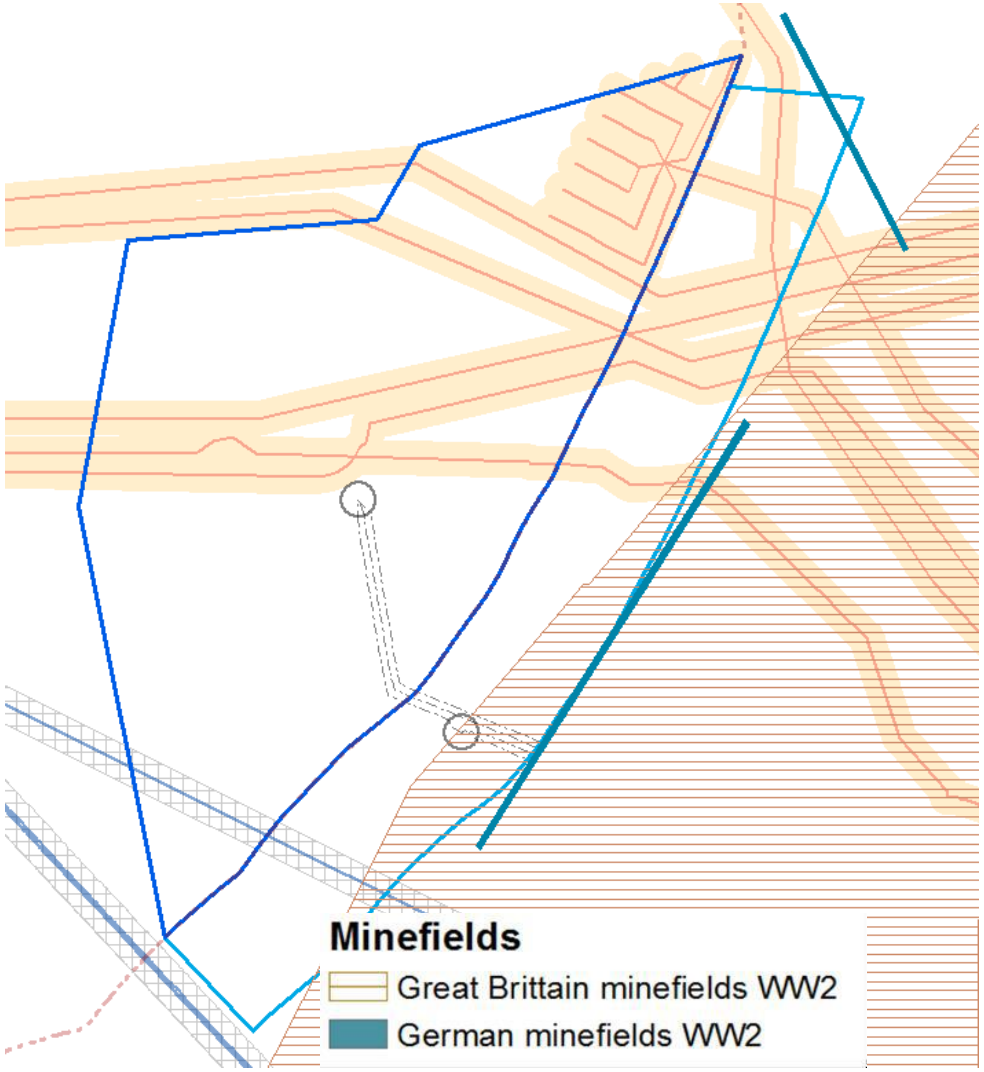
3. Historical research

Naval mine fields WWII



3. Historical research

Naval mine fields WW II



3. Historical research

Aerial attacks

- Ships and convoys were attacked on a regular basis
- Bombs, rockets and torpedoes were used
- Exact locations are often not known
- Several airplane crashes were reported
- Air dropped bombs >50% of all UXO encounters

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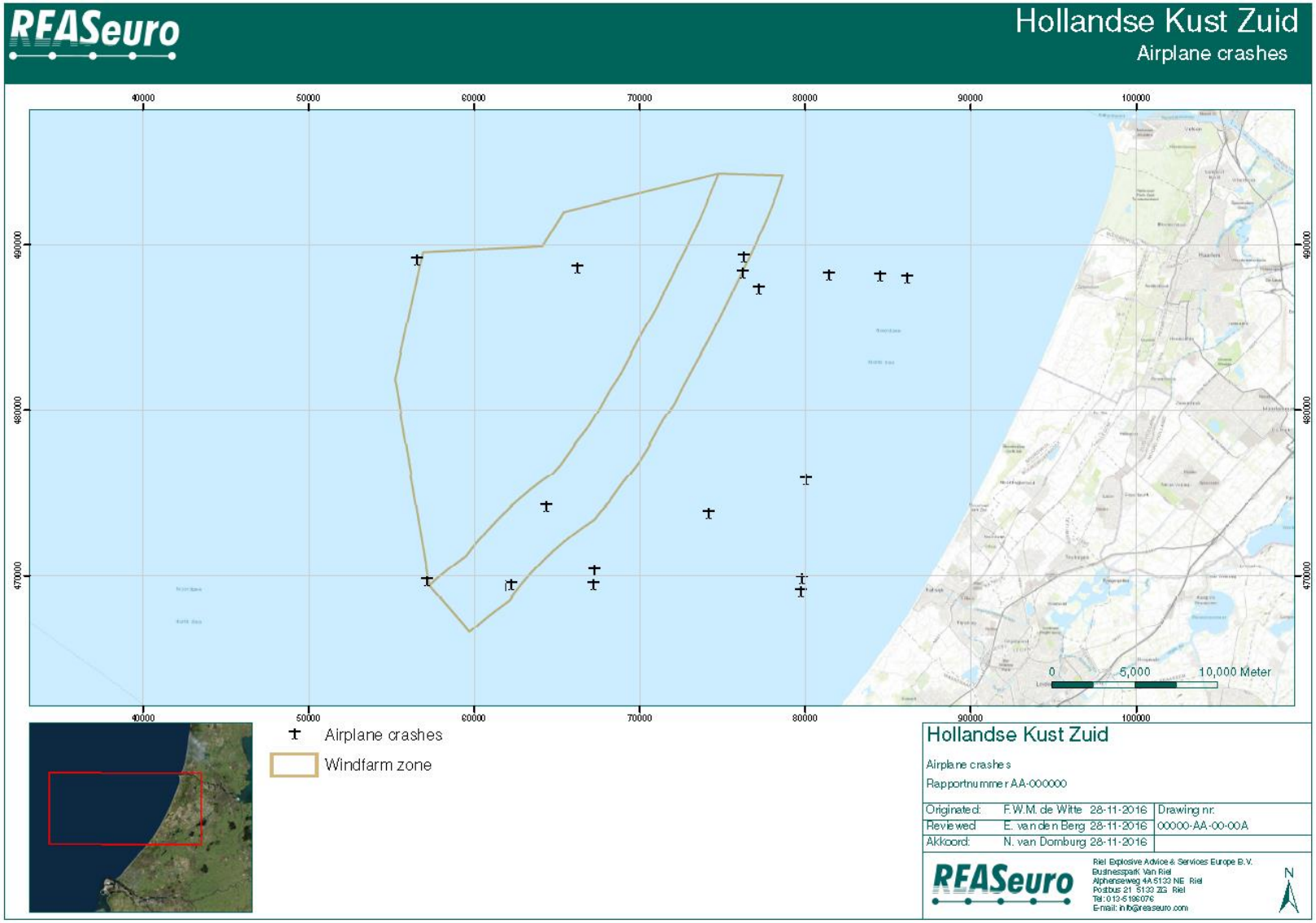
3. Historical research

Airplane crashes



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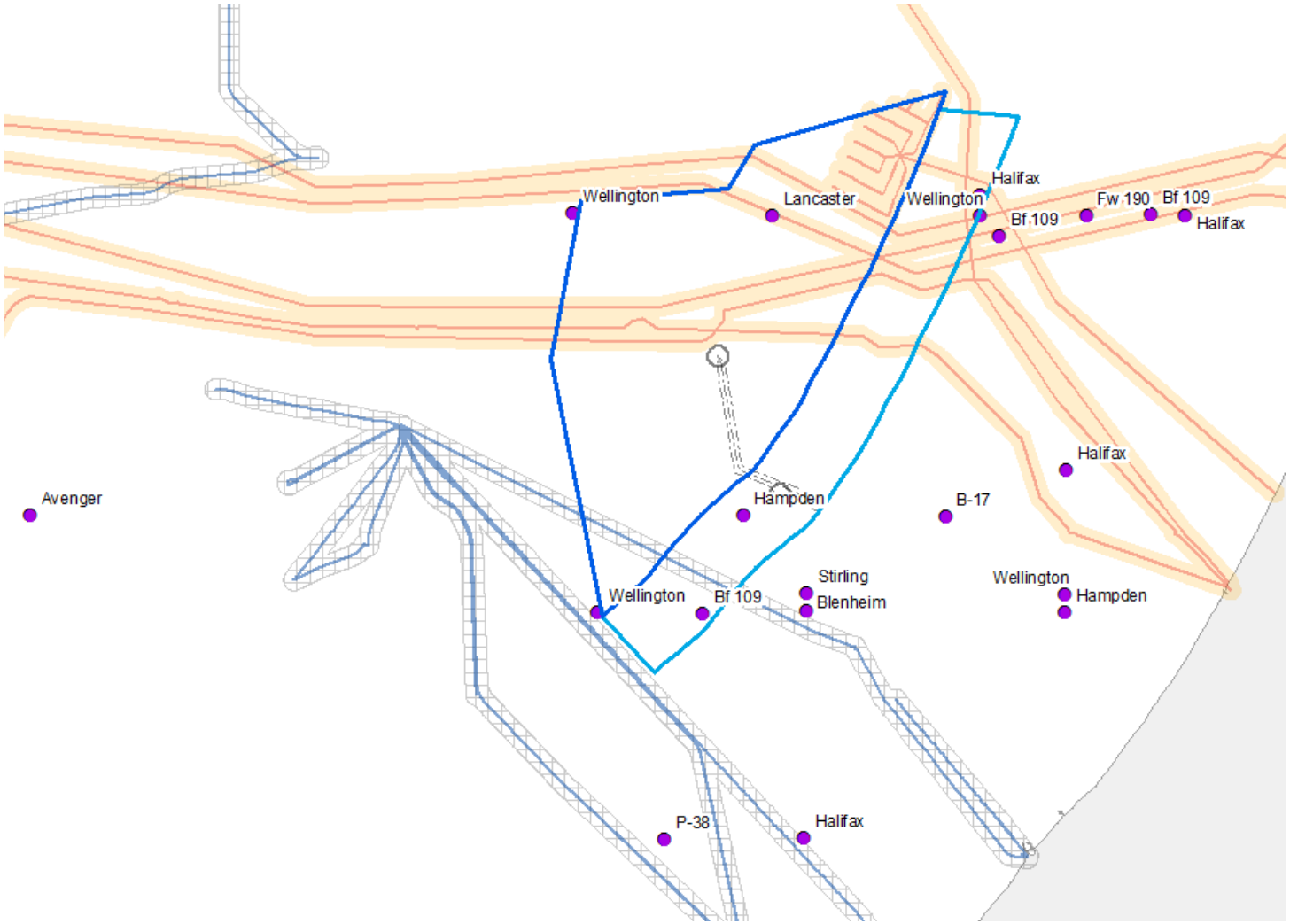
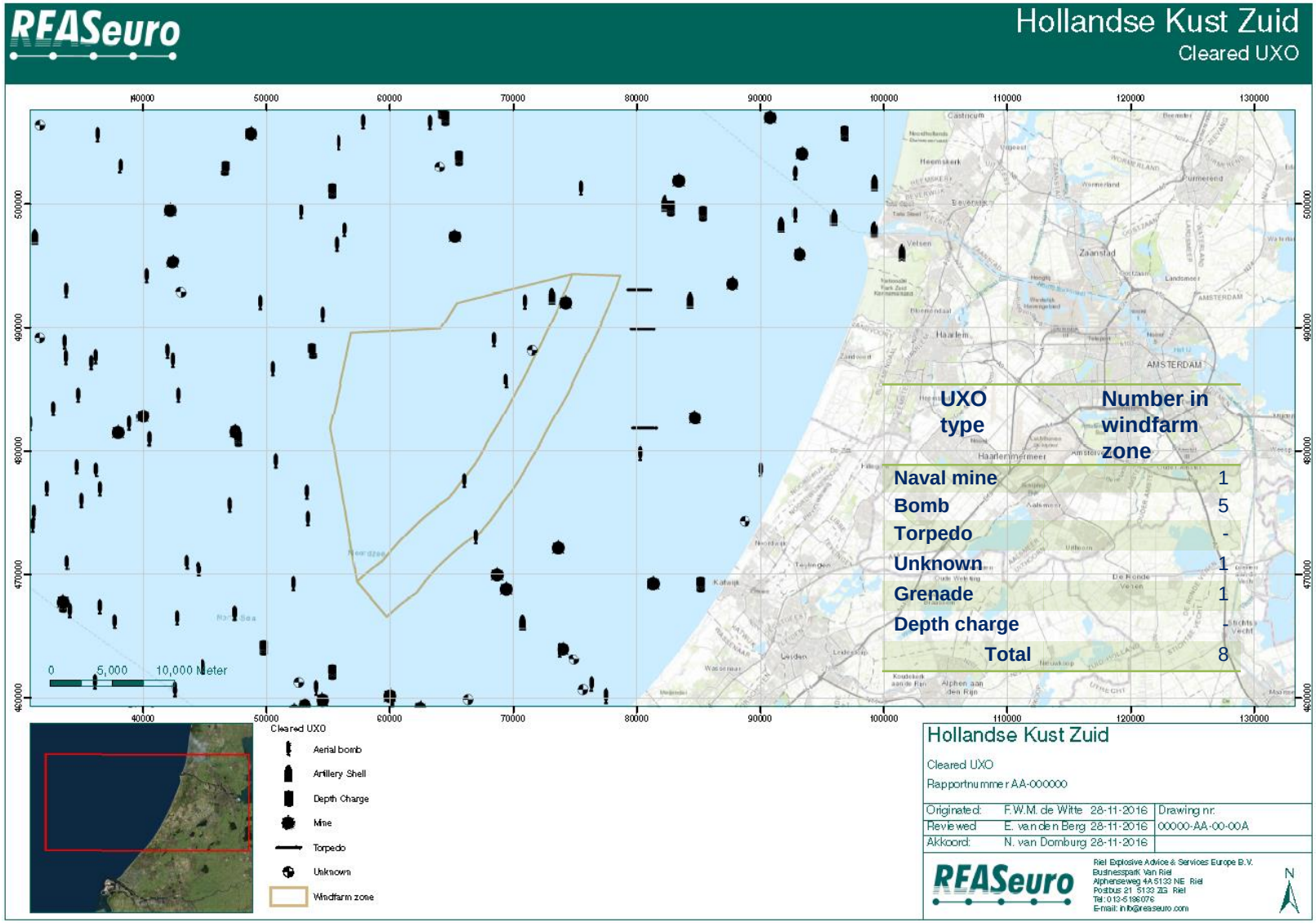
3. Historical research

Airplane crashes



3. Historical research

UXO encounters since April 2005



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3. Historical research

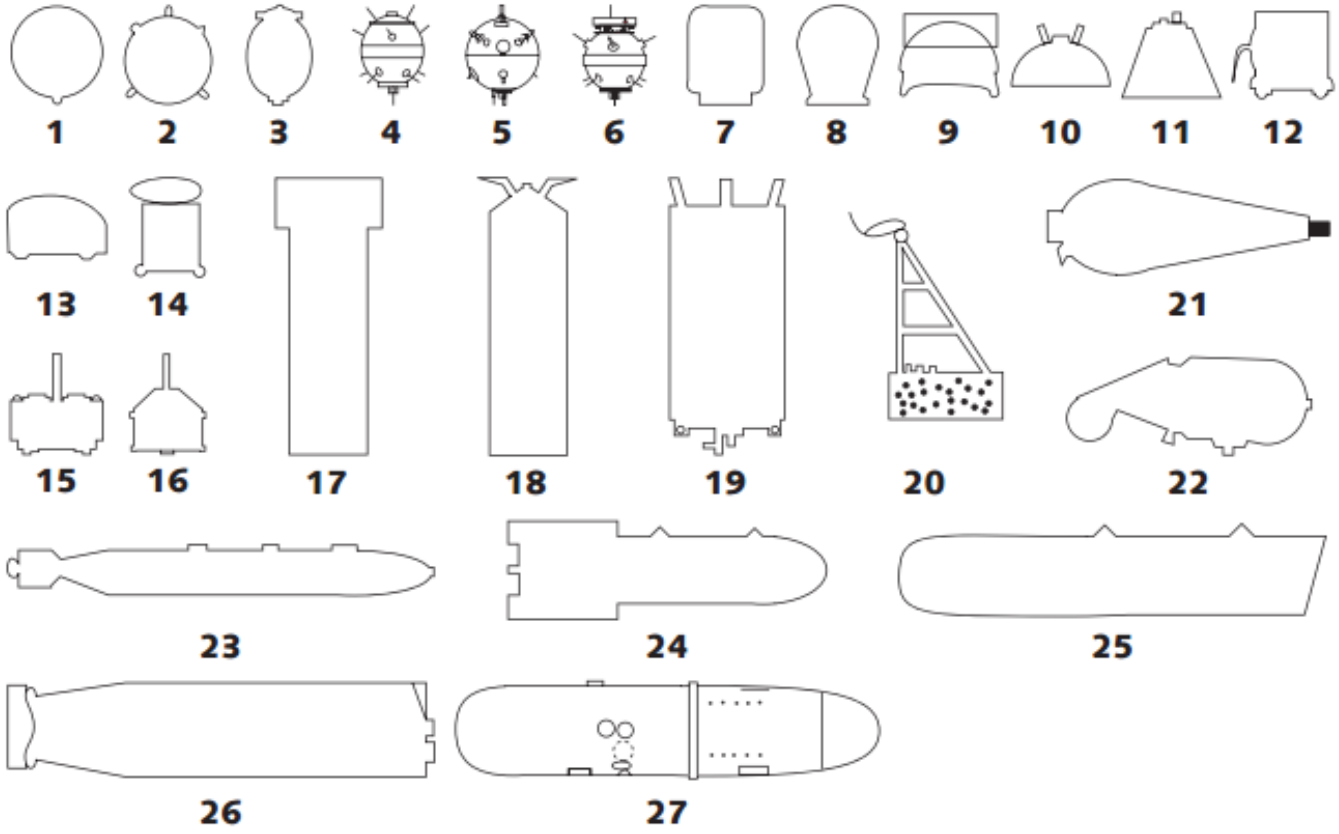
Conclusions

The Hollandse Kust (Zuid) wind farm zone is to be considered a UXO risk area because:

- Several mine fields were present in the area
- Ships and convoy were attacked with bombs, torpedoes, rockets and cannons
- The Allied airplanes were attacked by German fighters and Flugabwehrkanone
- Since April 2005 eight UXO were encountered within wind farm zone
- Due to trawling UXO may have been moved unintentionally

The following UXO are likely to be encountered:

- Naval mines

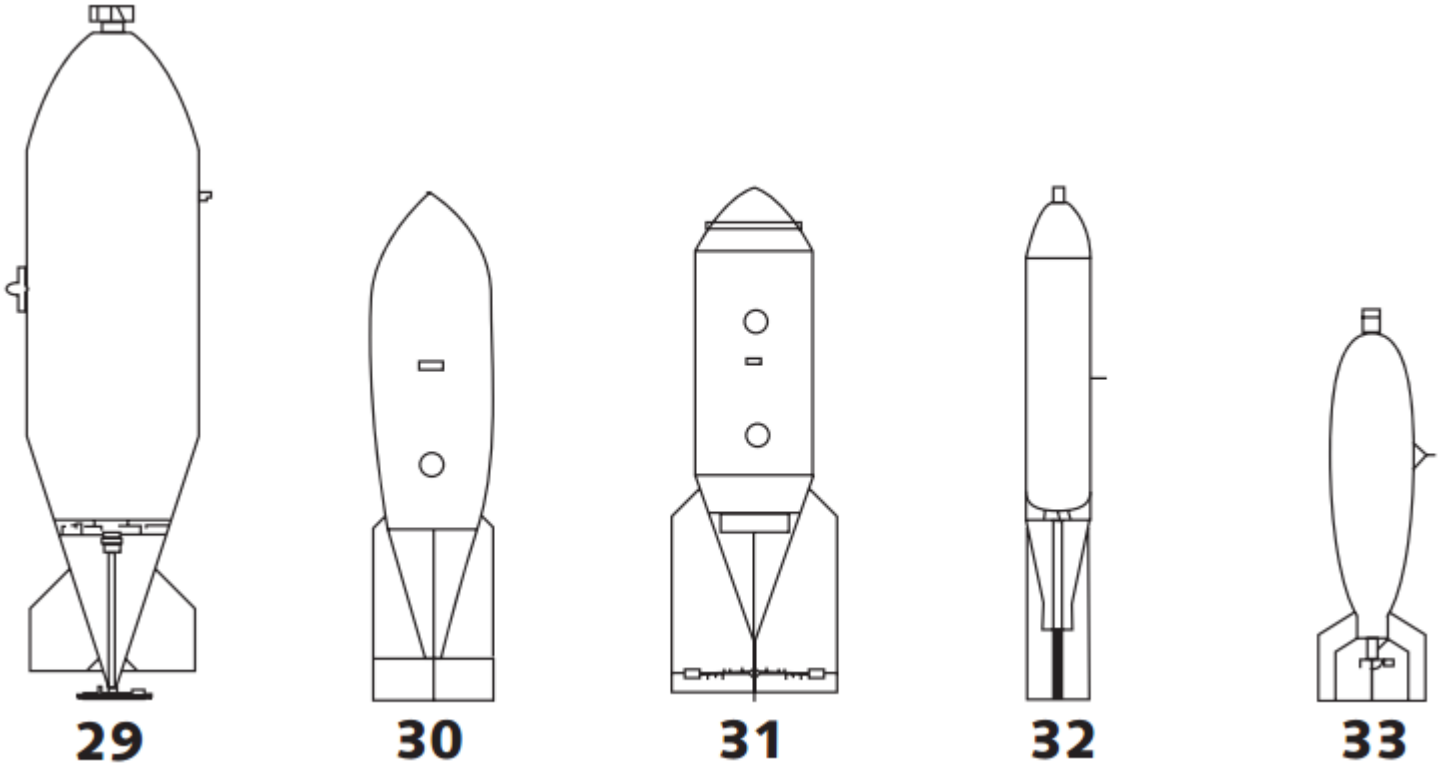


3. Historical research

Conclusions

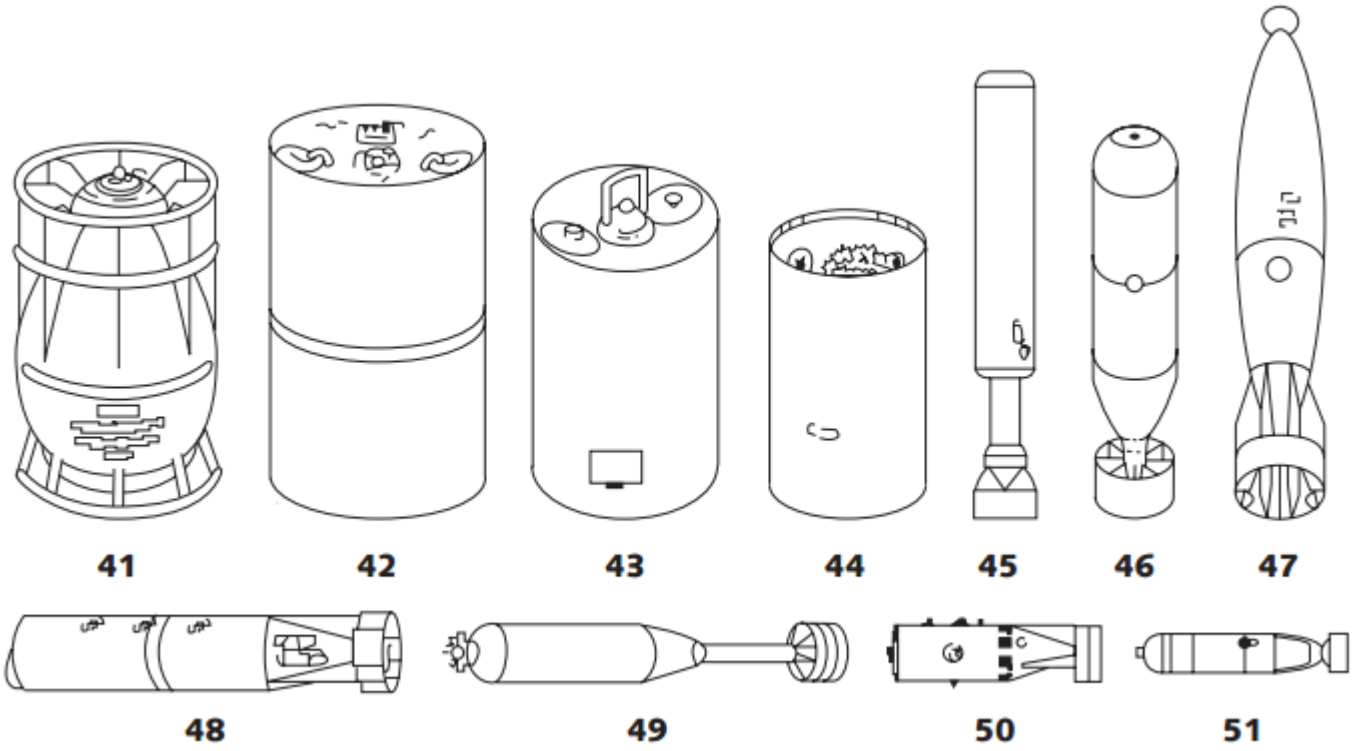
The following UXO are likely to be encountered:

- Air dropped bombs



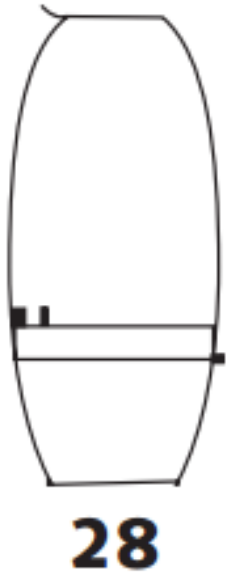
The following UXO are likely to be encountered:

- Depth charges



The following UXO are likely to be encountered:

- Mine destruction charges



The following UXO are likely to be encountered:

- Torpedoes

37

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The following UXO are likely to be encountered:

- Artillery shells

34

4. UXO risk assessment

Rationale

- All encountered targets and positively identified UXO must be considered armed and dangerous
- Most UXO have a large NEQ
- Intrusive activities will be needed for wind farm development
- This may cause a fuze to function, leading to a detonation
- Personnel may be harmed and equipment may be severely damaged
- A detonation forms an intolerable risk
- UXO risk mitigation measures are needed

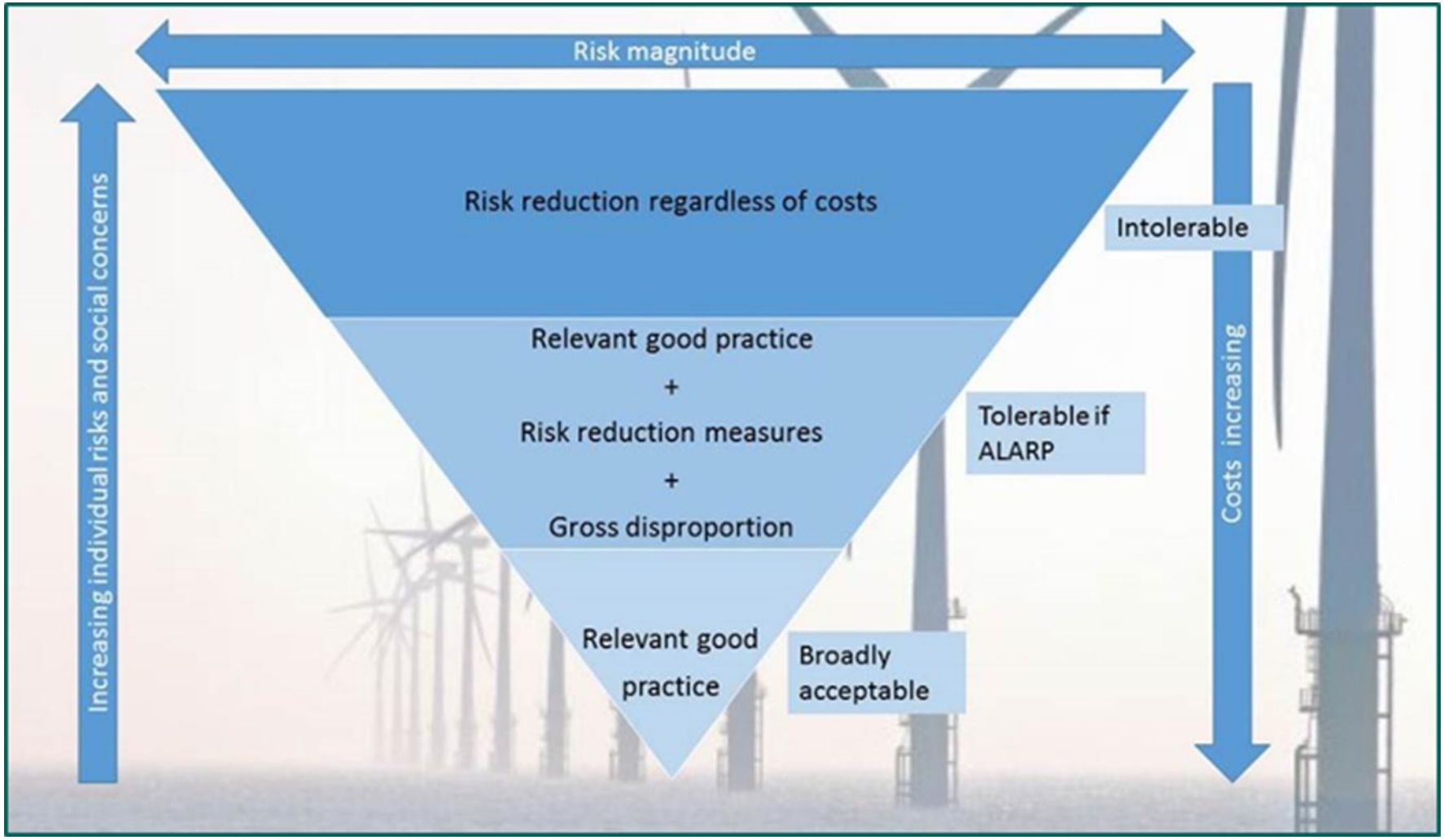
4. UXO risk assessment

Effects of under water detonations

Effect	Likelihood	Reason
Direct damage	Unlikely	Direct contact between vessels and UXO is not to be expected
Bubble jet effect	Possible	Dependent on the distance of vessels to the detonation point
Shock	Likely	Dependent on the distance of vessels to the detonation point
Shredding	Feasible	Divers can be affected up to 2,700 m to the detonation point
Fragmentation	Unlikely	Unlikely that lethal fragments are ejected above the surface of the water

4. UXO risk assessment

UXO ALARP certification



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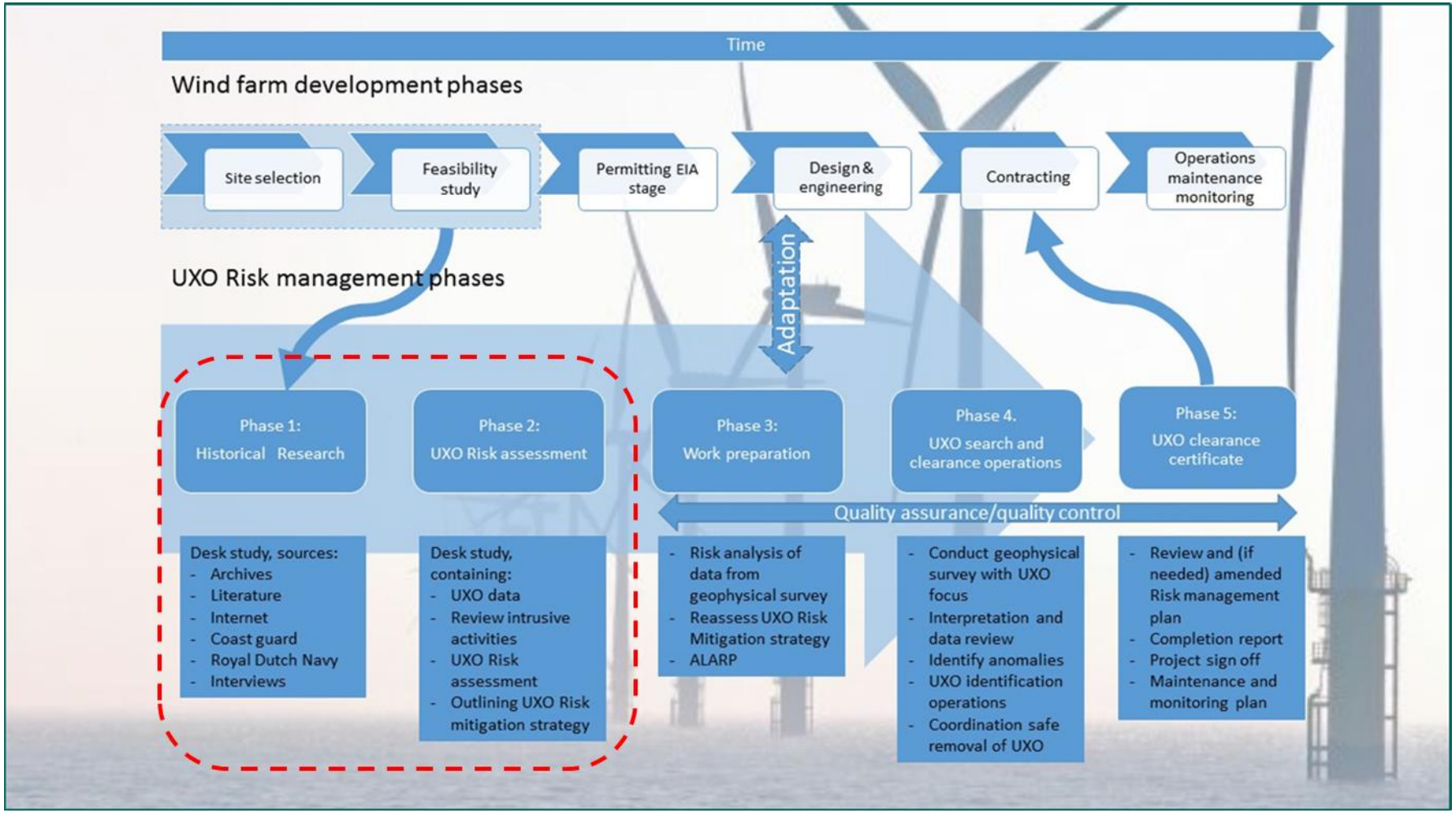
4. UXO risk assessment

UXO mitigation strategy



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4. UXO risk assessment

UXO mitigation strategy

1. General awareness on UXO within all participants
2. ALARP assessment based on the DTS, environmental site data and further UXO related information in order to determine the threshold criteria
3. Determination UXO survey method
4. Determination UXO survey areas (WTG locations and cable routes)
5. Execution of the UXO survey
6. Evaluation of UXO survey data (deliverable: Main Target List, first objective: avoidance or re-routing)
7. Identification of targets with ROV or divers and qualified personnel
8. Removal of non-UXO objects and as-left survey
9. Disposal of UXO by the Netherlands EOD authority and as-left survey
10. Preparation and issuing of documentation and UXO sign-off certificates

5. Regulation and standards

UXO mitigation strategy

- Dutch law is applicable:
  - Dutch Working Conditions Act (ARBO)
  - WSCS-OCE
- Close cooperation with EOD authorities is needed (planning and execution of disposal operations)

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