Development and Review of a TraC Hydromorphology Decision Support Tool for (a) screening proposed new or altered activities / structures for compliance with WFD water body status and (b) classifying TraC waters under the WFD

TraC-MImAS

SNIFFER

June 2012

Final Report

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1 INTRODUCTION

Royal Haskoning has been commissioned by the Scottish and Northern Ireland Forum For Environmental Research (SNIFFER) to develop the existing TraC-MImAS (Transitional and Coastal Waters Morphological Impact Assessment System) tool and to set the outputs within a broader deterioration and regulatory framework. This short report sets out the steps taken by Royal Haskoning in the development of the TraC-MImAS tool.

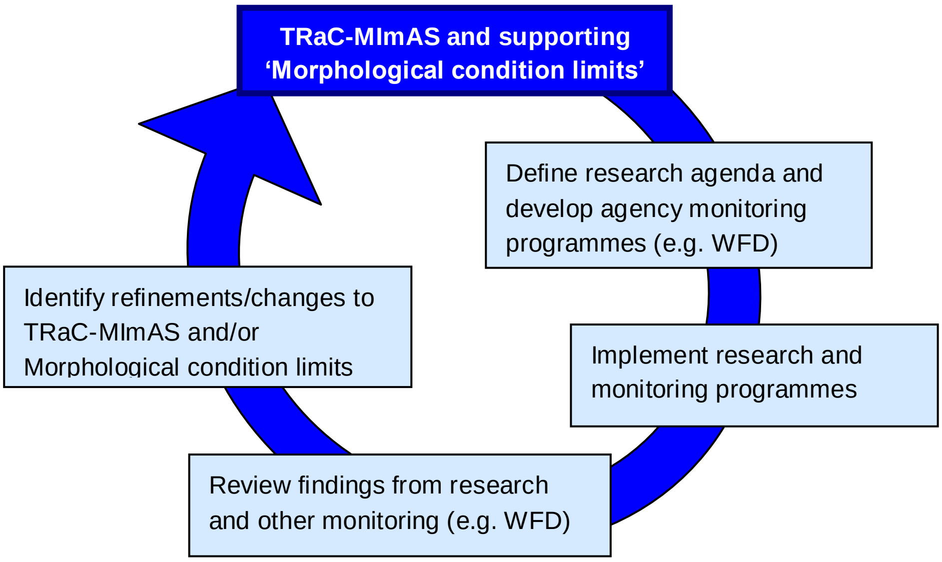
1.1 Background to the Project

The TraC-MImAS tool is a simple risk based regulatory decision-support tool in Excel. Specifically, the tool is intended to help regulators identify those proposals that could threaten the aim of achieving 'good ecological status or result in a deterioration in ecological status resulting from changes in hydromorphology. It was developed as part of a wider UKTAG programme in 2007. For further details on the functionality of the tool the reader is referred to the UKTAG website (www.wfduk.org/).

The underpinning principles behind the TraC-MImAS tool is to ensure that there is appropriate 'space' for habitats to continue to thrive, and to ensure that there is no potential for deterioration. The use of the TraC-MImAS tool will be used to protect these key WFD and other habitats by application of the tool as a regulatory aid. By emphasising these elements of the tool to flag those important habitats, the user of the tool is forced to consider the impact of the historic and new pressures on the water body.

The tool is not intended to be applied in isolation, and would be used to complement existing regulatory procedures as part of a pre-screening exercise. Similarly, the tool is not intended to replace expert judgment or existing impact assessments, or to provide a detailed assessment of hydromorphological or ecological processes. The tool will complement these areas and provide risk-based guidance to provide a regulatory decision matrix of the cumulative impacts acting upon water bodies.

As many elements of TraC-MImAS tool are underpinned by professional judgment, it operates within an 'adaptive management' framework. TraC-MImAS will be reviewed as new evidence on the relationships between ecology and hydromorphology become available. Where necessary, the tool will be updated. The ultimate aim will be to test / validate the assumptions underpinning the tools and, where necessary, replace professional judgment with empirically tested data.



The tool uses the concept of 'system capacity' which assumes that as system capacity is consumed by human activities it follows that there is an increased risk that morphological and ecological conditions will degrade. The boundaries of the system's capacity are defined as 'High', 'Good', 'Moderate', 'Poor' and 'Bad' by the Morphological Condition Limits (MCLs). However, these thresholds do not imply there is a sudden drop in status from one status category to the next, but rather that at some point between the boundaries there is a risk of further degradation and deterioration in ecological status.

An independent technical review of the tool as originally developed was undertaken by Anton Edwards (Metoc). The review covered a breadth of tasks, the main ones being an assessment of the principles underpinning TraC-MImAS and a review of the technical details of the tool. Other topics covered included reviewing its role in regulation, methods to support future trialling and R&D, and recommendations/considerations for future updates or versions of the tool. The conclusion of the review processes stated 'The tool is, with minor technical reservations, fit for its purpose'.

Notwithstanding, a number of areas were highlighted for future improvement of the tool which were captured in the SNIFFER Invitation to Tender. SNIFFER has commissioned Royal Haskoning to develop the existing TraC-MImAS tool, set the outputs within a broader deterioration and regulatory framework and to provide a sufficient picture of likely outcomes to important habitats e.g. saltmarsh and seagrass.

1.2 Aim and Objectives

The aim of the project is split into two constituent parts, namely:

1. Improving the tool; and
2. Developing the wider process.

The work presented herein seeks to build on the previous TraC-MImAS tool development work and to improve and simplify the existing TraC-MImAS tool and to enable a more transparent and understandable process of assessment. The project will give further consideration to the response of hydromorphological processes to marine structures to develop new and existing pressure categories to improve the tool assessments.

It has been identified by the participating agencies of this project that a more comprehensive approach to screening for ecological deterioration is required to include habitats. The project will place the assessment of ecological deterioration inside a broader process that will allow a more comprehensive consideration of threats to these habitats.

In line with SNIFFER's requests, the following principal changes have been made to the existing tool:-

- The pressure categories (originally without high and low change in impact categories) have been developed by expanding them to include low and high change in impact categories to take a better account of varying spatial and temporal factors i.e. magnitude and frequency of activity.

- The impact ratings have been categorised into 5 categories of sensitivity to enable impact rating comparisons to be made with ease. Originally, the sensitivity was based on 3 categories (0 – no impact, 0.5 - moderate impact and 1.0 – high impact).

- The tool has been adapted in the manner by which it assesses impounding structures and causeways, and other structures that have the potential to make a significant protuberance into the flow regime whilst having a small footprint; e.g. long breakwaters that extend across an estuary to narrow its width by 20% but occupy a small direct footprint area on the estuary bed. A simple rule has been developed any impoundment present either within or adjacent to a water body will indicate that that water body cannot be at a high status. Within the tool, any impoundment pressure will cause exceedence of the Morphological Condition Limits and therefore trigger expert assessment. Therefore, any impoundment, historic or new, should automatically trigger expert assessment.

- Impact ratings have been developed for important WFD habitats in each type by incorporating these under the 'Morphological features and substrate' attribute in the ecogeomorphic attributes module using a similar approach to those already developed within the existing tool.

- Pressure categories have been incorporated for pipelines and high voltage cabling and tidal devices. Blasting and large scale shellfish farming have not been included. This is discussed in **Section 2.2**.

- The sensitivity of the tool has been explored by running the tool with less sensitive impact ratings and more sensitive impact ratings for some pressure categories. In developing the existing version of the tool a significant amount of effort went into making minor adjustments to the values in the tool as part of an iterative process to ensure that the impact ratings were logical and sensible.

1.3 Overview of the Structure and Content of this Report

This report comprises four sections of which this introduction is **Section 1**. The methodology and approach to the development and improvement of the existing tool is set out in **Section 2**. The methodological approach for the development of the wider assessment process and deterioration framework is presented in **Section 3**. A summary of key points and concluding remarks are presented in **Section 4**.

2 DEVELOPING AND IMPROVING THE EXISTING TOOL

The following sections sets out those steps undertaken by Royal Haskoning in the development and improvement of the existing TraC-MImAS tool.

2.1 Simplification of the TraC-MImAS tool

To simplify the TraC-MImAS tool following its technical developments, Royal Haskoning has removed all worksheets from the updated tool. Only the front-end of the tool is available for user interface. This final simplified tool comprises one worksheet showing both the data input and output results.

A second version of the tool, comprising all modified worksheets, is supplied to facilitate direct comparisons to be made between the previous version of the tool and the amended version.

In simplifying the tool, attention has been paid to ensure consistency between terminology in and between the user front end and the accompanying technical report. One key example relates to the correct use of terminology; within the subtidal zone there are subheadings on the nature and extent of coastal features. This has been changed to subtidal geomorphological features.

2.2 Develop additional pressure categories

During the initial phase of tool development 11 generic pressures were incorporated into the tool. Some of these pressures were subdivided into high and low change in impact pressure categories to account for varying spatial and temporal impacts and to facilitate the differentiation between one-off and repeat activities. Other pressure categories were limited to a single category.

Subject to discussions with SNIFFER it was felt that blasting could be removed as this can be viewed as a type of excavation/dredging process already covered in the tool. Large scale shellfish farming (or any type of fishing activities) could also be removed from further consideration as it was felt that it could be covered by the ‘Other disturbances to seabed’ category in the tool.

The development work gives further consideration to the response of hydromorphological processes to marine structures to develop new and existing pressure categories to improve the tool assessments. Royal Haskoning have developed high and low pressure categories (**Section 2.2.1**) for all pressures in the new tool and developed additional pressure categories, including:

1. Tidal devices

2. High Voltage (HV) cables and Pipelines

2.2.1 High and low pressure categories

Each pressure has been divided into high and low pressure categories. The purpose of this is predominantly to differentiate between historic pressures and new pressures. Historic pressures are categorised as low change in impact, due to their existing exposure to the water body (and its likely adjustment to them over time). This includes existing structures and maintenance dredging. New pressures (those to be constructed) are categorised as high change in impact. These include, for example, a capital dredge or the construction of a new structure.

It is important to state that maintenance or refurbishment of structures is not considered as an impact where the works involve no alteration to the existing footprint. Therefore, there is no need to consider this type of activity within the tool's assessment.

This historic versus new pressure categorisation applies to the following pressures:

- Land claim;
- Dredging;
- Barrages;
- Flow & sediment manipulation;
- Shoreline reinforcement – hard engineering;
- Shoreline reinforcement – soft engineering;
- Flood defence embankments;
- Piled structures; and
- Tidal devices.

For a small number of pressures, there are necessary differences to the above approach to high / low categorisation, as described in the following (please also refer to **Table 4** 'Definitions of generic categories of morphological alterations used in TraC-MImAS' in the accompanying Technical Report which expands on the high and low change in impact categories for all the pressures):

Tidal channel realignment
'Historic tidal channel realignment' refers to previous pressures on a water body; 'Recent tidal channel realignment' refers to a new pressure. To differentiate between high and low a guideline percentage of 5% of the subtidal / intertidal zone is proposed – exceedence of 5% would indicate a high change in impact.

HV cable and pipelines
Where the cable or pipeline is buried at or below the sea-bed level it is categorised as low change in impact. Where the cable or pipeline is above the sea-bed level and therefore presents an obstruction or, in some cases, requires protection it is categorised as high change in impact. The previous version of the TraC-MImAS tool considered HV cables and pipelines as a linear pressure. The updated version will consider HV cables and pipelines as an area defined pressure.

Tidal Devices

Tidal devices are any device which exploits the natural ebb and flow of coastal / marine tidal waters. This predominantly covers tidal energy-generating devices. A high change in impact pressure would be a commercial scale installation of multiple devices arranged in arrays in any area of the seabed. Low change in impact pressure would be installation of a single device or small number of devices (less than 4) within seabed areas already licensed as demonstrator sites. The footprint rules regarding this pressure is to take the 'development' area of the overall footprint of the devices, irrespective of the number of devices present.

Use of dredged material

Sea disposal of dredged material will be undertaken at a licensed site and therefore all disposals will be consented. This activity is therefore a maintenance activity and deemed low change in impact. Where use of dredged material is not at a licensed site, such as recharge of a shoreline, is categorised as a new pressure and therefore high change in impact (despite it potentially having a beneficial use).

Impoundments

Impoundments follow the same model as the grouped pressures in that a historic impoundment is classed as low change in impact, and a new impoundment is classed as high change in impact. Technical discussion has dictated that any impoundment, historic or new, should automatically trigger expert assessment as the difficulty arises that a number of structures (e.g. weirs, marinas, barrages etc.) could cause an impoundment and each of these different types has varying morphological responses. Due to the bespoke nature of impoundments, it is more appropriate to conduct an expert assessment on the water body. This removes the differentiation between low and high change in impact – as a rule, any impoundment present either within or adjacent to a water body will indicate that that water body cannot be at a high status, therefore within the tool any impoundment pressure will cause exceedence of the MCLs and therefore trigger expert assessment. Full explanation of the impoundment footprint rules are included within **Section 2.2.2** 'Footprint rules' within the Technical Report.

Other seabed uses

Other seabed uses are classed as any other pressures that could directly affect the bed morphology or substrate character of the water body. This may include, for example shellfisheries and fisheries farming.

2.3 Impact ratings

In developing new impact ratings for important habitats Royal Haskoning have built on the previous work within the existing tool. The equation used to calculate the impact rating can be summarised as:

Impact Rating	=	Relevance	X	Ecological Sensitivity	X	Morphological Sensitivity	X	Likelihood of Impact	X	Zone of Impact
		Output from typology module		Output from sensitivity module		Output from sensitivity module		Output from pressure module		Output from pressure module

The impact assessment module in the existing tool comprised three classes of likelihood of impact ranked from 1.0, 0.5 and 0, which are defined as high, moderate and low respectively (see **Table 2.1**).

Table 2.1 Existing summary of classes for likelihood of impact.

Impact class	Definition
High	In most cases, this activity will result in an impact on a hydro-geomorphic indicator
Moderate	In some cases, this activity will result in an impact on a hydro-geomorphic indicator
Low	In most cases, this activity will not result in an impact on a hydro-geomorphic indicator

The TraC-MImAS approach requires an assessment of the likelihood that any specified pressure will impact upon the established list of eco-geomorphic indicators. As part of the development of the tool the three original impact classes have been expanded to five classes to better capture the variation in activities and pressures (1.0, 0.75, 0.5, 0.25 and 0). By expanding the classes a greater range of activities can be more adequately assessed. The proposed five classes of likelihood of impact are defined in **Table 2.2**.

Table 2.2 Updated summary of classes for likelihood of impact.

Impact class	Definition
High	In all cases, this activity will result in an impact on a hydro-geomorphic indicator
Moderate to High	In most cases, this activity will result in an impact on a hydro-geomorphic indicator
Moderate	In some cases, this activity will result in an impact on a hydro-geomorphic indicator
Moderate to Low	In most cases, this activity will not result in an impact on a hydro-geomorphic indicator
Low	In all cases, this activity will not result in an impact on a hydro-geomorphic indicator

Within the TraC-MImAS worksheets habitat types have been incorporated under the ‘Morphological features and substrate’ attribute in the eco-geomorphic attributes module using a similar approach to those already developed within the tool.

2.3.1 Summary of modules and scoring system within TraC-MImAS

As set out previously (see Technical Documents), the TraC-MImAS tool is based on five modules. Collectively the modules provide an assessment of impacts to morphological conditions. All impacts are measured in terms of impacts to ‘system capacity’. Each module is designed to be semi-independent of the others, thereby allowing individual modules to be updated over time as more information becomes available.

The scoring system combines the information contained in each module to calculate a numerical ‘impact rating’. Each zone (hydrodynamic, intertidal and subtidal) has separate impact ratings (to be characterised by review of the various module scores). **Tables 2.4** to **2.6** present the newly developed impact ratings for the respective zones for all activities, including high and low change in impact activities where applicable.

Table 2.3 highlights the change between the impact rating of those pressures that were retained from the previous TraC-MImAS tool has been made with the impact ratings from the updated tool. This applies to ‘Land claim’ (high and low change in impact) and ‘Dredging’ (high and low change in impact).

Table 2.3 Summary of changes in impact ratings from previous TraC-MImAS tool (previous impact ratings in italics, updated in bold)

PRESSURES	**Transitional**		**Transitional or coastal**				**Coastal**					
							Sheltered		**Mod-exposed**		**Shelt-exposed coast**	
Location of activity	**Meso-tidal**		**Lagoon**		**Sea loch**		**Sedimentary**		**Sedimentary**		**Bedrock**	
Hydrodynamic Zone												
Land claim – high impact	*0.50*	**0.38**	*0.50*	**0.38**	*0.50*	**0.38**	*0.25*	**0.19**	*0.25*	**0.19**	*0.25*	**0.19**
Land claim – low impact	*0.13*	**0.09**	*0.13*	**0.09**	*0.13*	**0.09**	*0.06*	**0.06**	*0.06*	**0.06**	*0.06*	**0.06**
Dredging – high impact	*0.06*	**0.13**	*0.00*	**0.13**	*0.00*	**0.13**	*0.06*	**0.09**	*0.00*	**0.09**	*0.00*	**0.09**
Dredging – low impact	*0.06*	**0.03**	*0.00*	**0.03**	*0.00*	**0.03**	*0.06*	**0.03**	*0.00*	**0.03**	*0.00*	**0.03**
Intertidal Zone												
Land claim – high impact	*1.33*	**1.25**	*0.83*	**0.79**	*0.83*	**0.79**	*1.00*	**0.92**	*1.67*	**1.58**	*0.33*	**0.33**
Land claim – low impact	*0.50*	**0.33**	*0.29*	**0.21**	*0.29*	**0.21**	*0.33*	**0.25**	*0.58*	**0.42**	*0.08*	**0.08**
Dredging – high impact	*0.67*	**0.54**	*0.67*	**0.46**	*0.67*	**0.46**	*0.67*	**0.46**	*0.67*	**0.46**	*0.33*	**0.25**
Dredging – low impact	*0.25*	**0.08**	*0.25*	**0.08**	*0.25*	**0.08**	*0.25*	**0.08**	*0.25*	**0.08**	*0.13*	**0.04**
Subtidal Zone												
Land claim – high impact	*1.33*	**1.19**	*0.67*	**0.63**	*0.83*	**0.88**	*1.00*	**0.94**	*1.33*	**1.00**	*0.33*	**0.56**
Land claim – low impact	*0.50*	**0.25**	*0.25*	**0.29**	*0.29*	**0.29**	*0.33*	**0.33**	*0.42*	**0.42**	*0.08*	**0.08**
Dredging – high impact	*0.50*	**0.69**	*0.67*	**0.63**	*0.50*	**0.69**	*0.83*	**0.81**	*0.17*	**0.50**	*0.33*	**0.56**
Dredging – low impact	*0.19*	**0.22**	*0.25*	**0.17**	*0.19*	**0.20**	*0.31*	**0.25**	*0.06*	**0.16**	*0.13*	**0.19**

Table 2.4 Summary of impact ratings for morphological alterations- Hydrodynamic zone

HYDRODYNAMICS	**Transitional**	**Transitional or coastal**		**Coastal**		
				Sheltered	**Mod-exposed**	**Shelt-exposed coast**
Morphological Alteration	**Meso-tidal**	**Lagoon**	**Sea loch**	**Sedimentary**	**Sedimentary**	**Bedrock**
Land Claim - High Impact	0.38	0.38	0.38	0.19	0.19	0.19
Land Claim - Low Impact	0.09	0.09	0.09	0.06	0.06	0.06
Historic Tidal channel realignment (high)	0.13	0.09	0.09	0.06	0.06	0.06
Historic Tidal channel realignment (low)	0.06	0.03	0.03	0.03	0.03	0.03
Recent Tidal channel realignment (high)	0.28	0.19	0.19	0.14	0.14	0.14
Recent Tidal channel realignment (low)	0.06	0.03	0.03	0.03	0.03	0.03
Dredging - High Impact	0.13	0.13	0.13	0.09	0.09	0.09
Dredging - Low Impact	0.03	0.03	0.03	0.03	0.03	0.03
HV cable and pipelines (high)	0.03	0.00	0.00	0.03	0.00	0.00
HV cable and pipelines (low)	0.00	0.00	0.00	0.00	0.00	0.00
Sea disposal of dredgings (high)	0.03	0.00	0.00	0.03	0.00	0.00
Sea disposal of dredgings (low)	0.00	0.00	0.00	0.00	0.00	0.00
Impoundments (high)	0.50	0.50	0.50	0.25	0.25	0.25
Impoundments (low)	0.09	0.05	0.05	0.05	0.05	0.05
Barrages (high)	0.50	0.50	0.50	0.25	0.25	0.25
Barrages (low)	0.19	0.19	0.19	0.09	0.09	0.09
Flow & sediment manipulation- submerged (high)	0.14	0.14	0.14	0.14	0.14	0.14
Flow & sediment manipulation- submerged (low)	0.03	0.03	0.03	0.03	0.03	0.03
Shoreline reinforcement - hard engineering (high)	0.19	0.19	0.19	0.09	0.09	0.09
Shoreline reinforcement - hard engineering (low)	0.06	0.06	0.06	0.03	0.03	0.03
Shoreline reinforcement - soft engineering (high)	0.03	0.03	0.03	0.03	0.03	0.03
Shoreline reinforcement - soft engineering (low)	0.00	0.00	0.00	0.00	0.00	0.00
Flood defence embankment (high)	0.19	0.19	0.19	0.05	0.05	0.05
Flood defence embankment (low)	0.06	0.13	0.06	0.00	0.00	0.00

HYDRODYNAMICS	Transitional	Transitional or coastal		Coastal		
				Sheltered	Mod-exposed	Shelt-exposed coast
Piled Structures (high)	0.19	0.19	0.19	0.14	0.14	0.14
Piled Structures (low)	0.03	0.03	0.03	0.03	0.03	0.03
Tidal devices (high)	0.03	0.03	0.03	0.03	0.03	0.03
Tidal devices (low)	0.00	0.00	0.00	0.00	0.00	0.00
Other sea bed uses	0.03	0.03	0.03	0.03	0.03	0.03

Table 2.5 Summary of impact ratings for morphological alterations- intertidal zone

INTERTIDAL ZONE	Transitional	Transitional or coastal		Coastal		
				Sheltered	Mod-exposed	Shelt-exposed coast
Morphological Alteration	**Meso-tidal**	**Lagoon**	**Sea loch**	**Sedimentary**	**Sedimentary**	**Bedrock**
Land claim – high impact	1.25	0.79	0.79	0.92	1.58	0.33
Land claim – low impact	0.33	0.21	0.21	0.25	0.42	0.08
Historic tidal channel realignment – high impact	0.38	0.23	0.25	0.25	0.46	0.08
Historic tidal channel realignment – low impact	0.22	0.13	0.16	0.16	0.28	0.06
Recent tidal channel realignment – high impact	0.88	0.56	0.56	0.63	1.13	0.25
Recent tidal channel realignment – low impact	0.44	0.28	0.28	0.31	0.56	0.13
Dredging – high impact	0.54	0.46	0.46	0.46	0.46	0.25
Dredging – low impact	0.08	0.08	0.08	0.08	0.08	0.04
HV cable and pipelines – high impact)	0.08	0.08	0.08	0.08	0.08	0.04
HV cable and pipelines – low impact	0.02	0.02	0.02	0.02	0.02	0.00
Use of dredged material – high impact	0.41	0.28	0.28	0.28	0.28	0.13
Use of dredged material – low impact	0.19	0.13	0.13	0.13	0.13	0.06
Impoundments – high impact	1.33	0.83	0.83	1.00	1.67	0.33
Impoundments – low impact	0.22	0.13	0.16	0.16	0.28	0.06
Barrages – high impact	1.33	0.83	0.83	1.00	1.67	0.33
Barrages – low impact	0.50	0.31	0.31	0.38	0.63	0.13
Flow and sediment manipulation, submerged – high impact	0.63	0.38	0.41	0.44	0.75	0.13
Flow and sediment manipulation, submerged – low impact	0.17	0.10	0.13	0.13	0.21	0.04
Shoreline reinforcement, hard engineering – high impact	0.75	0.47	0.47	0.56	0.94	0.19
Shoreline reinforcement, hard engineering – low impact	0.17	0.10	0.10	0.13	0.21	0.04
Shoreline reinforcement, soft engineering – high impact	0.69	0.44	0.44	0.50	0.88	0.19
Shoreline reinforcement, soft engineering – low impact	0.17	0.10	0.10	0.13	0.21	0.04
Flood defence embankment – high impact	0.63	0.41	0.44	0.44	0.81	0.19
Flood defence embankment – low impact	0.15	0.27	0.10	0.10	0.19	0.04

INTERTIDAL ZONE	Transitional	Transitional or coastal		Coastal		
				Sheltered	Mod-exposed	Shelt-exposed coast
Piled structures – high impact	0.75	0.47	0.47	0.56	0.94	0.19
Piled structures – low impact	0.29	0.19	0.19	0.21	0.38	0.08
Tidal devices – high impact	0.00	0.00	0.00	0.00	0.00	0.00
Tidal devices – low impact	0.00	0.00	0.00	0.00	0.00	0.00
Other seabed uses	0.00	0.00	0.00	0.00	0.00	0.00

Table 2.6 Summary of impact ratings for morphological alterations- subtidal zone

SUBTIDAL ZONE	**Transitional**	**Transitional or coastal**		**Coastal**		
				Sheltered	**Mod-exposed**	**Shelt-exposed coast**
Morphological Alteration	**Meso-tidal**	**Lagoon**	**Sea loch**	**Sedimentary**	**Sedimentary**	**Bedrock**
Land claim – high impact	1.19	0.63	0.88	0.94	1.00	0.56
Land claim – low impact	0.25	0.29	0.29	0.33	0.42	0.08
Historic tidal channel realignment – high impact	0.38	0.20	0.28	0.31	0.38	0.19
Historic tidal channel realignment – low impact	0.13	0.06	0.09	0.09	0.09	0.06
Recent tidal channel realignment – high impact	0.89	0.47	0.70	0.75	0.89	0.52
Recent tidal channel realignment – low impact	0.13	0.00	0.13	0.13	0.13	0.13
Dredging – high impact	0.69	0.63	0.69	0.81	0.50	0.56
Dredging – low impact	0.22	0.17	0.20	0.25	0.16	0.19
HV cable and pipelines – high impact)	0.28	0.16	0.25	0.34	0.19	0.22
HV cable and pipelines – low impact	0.19	0.08	0.14	0.22	0.13	0.13
Use of dredged material – high impact	0.47	0.28	0.42	0.47	0.28	0.28
Use of dredged material – low impact	0.23	0.12	0.21	0.23	0.14	0.14
Impoundments – high impact	1.50	0.88	1.13	1.25	1.50	0.75
Impoundments – low impact	0.13	0.06	0.09	0.09	0.09	0.06
Barrages – high impact	1.50	0.88	1.13	1.25	1.50	0.75
Barrages – low impact	0.38	0.22	0.28	0.31	0.38	0.19
Flow and sediment manipulation, submerged – high impact	0.56	0.33	0.47	0.52	0.61	0.38
Flow and sediment manipulation, submerged – low impact	0.20	0.13	0.17	0.20	0.23	0.16
Shoreline reinforcement, hard engineering – high impact	0.38	0.26	0.30	0.33	0.38	0.23
Shoreline reinforcement, hard engineering – low impact	0.06	0.06	0.06	0.06	0.06	0.06
Shoreline reinforcement, soft engineering – high impact	0.34	0.19	0.19	0.31	0.22	0.16
Shoreline reinforcement, soft engineering – low impact	0.13	0.06	0.06	0.13	0.06	0.00
Flood defence embankment – high impact	0.06	0.06	0.06	0.06	0.06	0.00
Flood defence embankment – low impact	0.00	0.00	0.00	0.00	0.00	0.00

SUBTIDAL ZONE	Transitional	Transitional or coastal		Coastal		
				Sheltered	Mod-exposed	Shelt-exposed coast
Piled structures – high impact	0.56	0.30	0.40	0.52	0.52	0.28
Piled structures – low impact	0.19	0.08	0.11	0.19	0.16	0.09
Tidal devices – high impact	0.31	0.06	0.27	0.28	0.31	0.22
Tidal devices – low impact	0.13	0.03	0.13	0.13	0.13	0.13
Other seabed uses	0.16	0.06	0.13	0.13	0.16	0.09

2.4 Develop impact ratings for important WFD habitats

In the assessment of ecological deterioration from new developments, the existing tool does not provide a sufficient picture of likely outcomes to important habitats e.g. saltmarsh and seagrass. It is possible that relatively small developments could cause major impacts to these habitats in the locality of the development potentially altering the status of the water body for these biological quality elements where they are close to a status boundary.

Habitat types are not defined within the WFD Directive *per se*. Habitat types were therefore derived from the UK Biodiversity Action Plan (BAP), and have been incorporated within the improved TraC-MImAS tool. As stated below, the integration of habitat types will not be fully functional within this version of the tool. This is an area for further development. At this stage, flagging of broad habitat types will push the user toward expert assessment of a specific habitat depending on the pressure and its impact on the subtidal or intertidal zone. The broad habitat types are listed in **Table 2.7**. Habitat types are classified by their respective zone of occurrence, either intertidal or subtidal.

Table 2.7 Habitats and zone of occurrence

Habitat	Zone of Occurrence
Coastal sand dunes	Intertidal
Saltmarsh	Intertidal
Mudflat	Intertidal
Seagrass beds	Intertidal / Subtidal
Sabellaria spp.)	Subtidal
Modiolus spp.	Subtidal
Maerl	Subtidal

The updated TraC-MImAS tool provides a high-level assessment of the potential impact upon the intertidal and subtidal habitats as listed in **Table 2.7**. The updated TraC-MImAS tool assesses impacts upon these habitats based on five modules. Collectively the modules provide an assessment of impacts to the ecological and morphological conditions of the respective habitat. All impacts are measured in terms of impacts to 'system capacity'. Each module is designed to be semi-independent of the others, thereby allowing individual modules to be updated over time as more information becomes available.

To ensure habitat assessment was broadly compatible with the existing TraC-MImAS modules and assessment framework information was gathered from the Marine Life Information Network (MarLIN) website (http://www.marlin.ac.uk/habitats.php) for the parameters of:

1. Relevance
2. Ecological sensitivity
3. Resilience
4. Resistance
5. Morphological sensitivity (Resilience x resistance)

The assessment of habitats is underpinned by sensitivity information provided by MarLIN. There are number of key areas, which are discussed in the proceeding short sections, where the definitions in and between the TraC-MImAS and the Marlin website differ materially. These terms relate to

1. Resilience
2. Resistance
3. Morphological sensitivity:

'MarLIN' when discussing 'sensitivity' of a species/habitat states that sensitivity may be defined as:

Intolerance + Recoverability = Sensitivity

Where:

'**Intolerance**' = is the susceptibility of a habitat, community or species (i.e. the components of a biotope) to damage, or death, from an external factor. Intolerance must be assessed relative to change in a specific factor (e.g. smothering, physical disturbance, changes in emergence, tidal flow etc).

Royal Haskoning have interpreted MarLIN's usage of the term 'intolerance' to be broadly compatible with the TraC-MImAS term of 'resistance'.

'**Recoverability**' as the ability of a habitat, community, or species (i.e. the components of a biotope) to return to a state close to that which existed before the activity or the event which resulted in any change.

Royal Haskoning have interpreted MarLIN's usage of the term 'recoverability' to be broadly compatible with the TraC-MImAS term of "resilience'.

'**Sensitivity**' is dependent on the intolerance of a species or habitat to damage from an external factor and the time taken for its subsequent recovery. For example, a very sensitive species or habitat is one that is very adversely affected by an external factor arising from human activities or natural events (killed/destroyed, 'high' intolerance) and is expected to recover over a very long period of time, i.e. >10 or up to 25 years ('low'; recoverability). Intolerance and hence sensitivity must be assessed relative to change in a specific factor.

Royal Haskoning have interpreted MarLIN's usage of the term 'sensitivity' to equate to the TraC-MImAS terminology of 'morphological sensitivity', in relation to habitat.

The TraC-MImAS tool has incorporated these impact ratings for WFD habitats to determine at a high level where a pressure has the potential to impact on a WFD habitat. Where the tool identifies any potential impact, it is flagged in the tool and suggests expert assessment is required to categorise the actual impact and what mitigation is required. Reference is made to the online Mitigation Measures Manual.

Environment Agency (2011) Mitigation Measures Manual:
(http://evidence.environment-agency.gov.uk/FCERM/en/SC060065.aspx)

2.4.1 Role of morphological condition limits

Morphological Condition Limits (MCLs) are intended to provide risk-based guidance to inform regulatory decisions. Morphological Condition Limits (MCLs) represent thresholds of alteration in morphological conditions beyond which it is understood that morphological and/or ecological conditions could be altered in ways that could result in deterioration in status. In a risk assessment context these values should not be regarded as absolute rather that a change in status is likely to occur at some unknown point above these thresholds. They would be used to complement existing regulatory methods and form part of a wider decision-making-process for managing TraC waters. Specifically, MCLs are intended to help regulators determine whether the Ecological Objectives of the WFD are threatened. MCLs are therefore critical in their role in identifying the existing regulatory methods and form of the wider decision-making-process.

Morphological condition limits are defined for three TraC zones- hydrodynamic, intertidal and subtidal zone. Distinguishing between these zones provides regulators with a simple method of identifying which aspect of a TraC water body is likely to be impacted. This information is particularly useful when setting the outputs of TraC-MImAS tool within a broader regulatory framework and defining the scope of a more detailed assessment (see **Section 3.0**).

The assessment of capacity used in relation to MCLs are presented in the front-end (user interface) of the TraC-MImAS tool. Previously this part of the user interface highlighted the three zones, the percentage (%) capacity used and the status of the proposed activity in relation to the assessment criteria. **Table 2.8** presents existing classes for the MCLs in relation to the hydrodynamic, intertidal and subtidal zones.

Table 2.8 Morphological Conditions Limits (MCLs) for zones

Zone	High/Good	Good/Moderate	Moderate/Poor	Poor/Bad
Hydrodynamics	5%	15%	30%	45%
Intertidal	5%	15%	30%	45%
Subtidal	5%	15%	30%	45%

Of importance to the development of the TraC-MImAS tool is the concept of system capacity and its applicability to habitats. System capacity has previously been defined as '*a measure of the ability of the water environment to absorb morphological alterations. The likelihood (or risk) that morphological and ecological conditions are degraded will increase as system capacity is consumed. This concept does not infer that degradation of the environment is acceptable; rather it assumes that there is a degree to which minor changes can be tolerated by the system*'.

The term system capacity, with regards to applicability to habitats, is utilised in the absence of a more unambiguous concept at this stage and may be subject to future modification and change.

Notwithstanding the above, within the new improved TraC-MImAS tool, habitats are incorporated within the user interface. This required the establishment of MCLs for each habitat type. MCLs similar to those for hydrodynamic, intertidal and subtidal zones have been applied as a first step (see **Table 2.9**). However, it is recommended that expert judgement is applied to the outputs of the TraC-MImAS tool, with regards to the MCLs for habitats, to ensure that local knowledge is incorporated within the decision making process. For further details on the consideration of habitats in relation to a pressure and the level of required assessment, the reader is referred to the broad regulatory framework (see **Section 3.0** and **Appendix 1**).

Table 2.9 Morphological Conditions Limits (MCLs) for zones and habitats

Zone/Habitat	High/Good	Good/Moderate	Moderate/Poor	Poor/Bad
Hydrodynamics	5%	15%	30%	45%
Intertidal	5%	15%	30%	45%
Coastal sand dunes	TBC	TBC	TBC	TBC
Saltmarsh	5%	15%	30%	45%
Mudflat	TBC	TBC	TBC	TBC
Subtidal	5%	15%	30%	45%
Reef	TBC	TBC	TBC	TBC
Modiolus spp.	TBC	TBC	TBC	TBC
Seagrass	5%	15%	30%	45%
Maerl	TBC	TBC	TBC	TBC

MCLs for habitats of 5%, 15%, 30% and 45% are being used.

2.5 Trialling

The aims of the trialling and validation exercise are to:

- Test the sensitivity of the improved tool.
- Compare outputs from the enhanced TraC-MImAS tool developed here with the outputs from the original TraC-MImAS tool .
- Identify improvements to the tool and areas where further work, research or trialling would be beneficial.

TraC water bodies identified for assessment were provided by SNIFFER (see **Appendix 2**). These TraC waters were selected on the basis of professional judgement (those TraC waters which experts can confidently make judgement upon) and where supporting data to facilitate assessment was available. The updated TraC-MImAS tool was then run on these water bodies and the results compared with the previous trialling runs.

The outputs of the trialling work have been used to identify areas (scoring, pressures and TraC types) where the tool is either overly sensitive or under representing potential impacts so that refinements can be made to improve its ability to predict risks to morphological conditions.

2.5.1 Approach

The trialling has focused on water bodies in Scotland, Northern Ireland, Republic of Ireland, England and Wales. The updated tool was run on an initial list of 20 water bodies. In addition, a further 5 water bodies that had been trialled during development of the original tool were also selected for cross-comparison of outputs between existing and updated versions of the tool. In total, the updated tool was trialled on 25 water bodies that covered the full range of TraC-MImAS water body types.

Water bodies were identified which covered a range of types, conditions and status classes which experts had knowledge of and could confidently make a judgement on, and that had been included in the previous trialling run (excluding one water body – Carrick Roads CS – that was not included in the previous trialling run. The water body had been classified by expert judgement).

Selected water bodies were trialled for impacts at high and low levels and the results included for both. The outputs from TraC-MImAS were compared with the expert judgement decisions and the previous trialling run. No trialling was undertaken for the new pressure categories identified in the previous phase of the project as adequate data for trialling was not available at the time.

The results from the trialling exercise are presented in **Table 2.10**. A colour coded comparison is provided to facilitate judgement on the ability of the improved tool to accurately capture status of WFD water bodies. Results are presented from the original assessment (Predicted Status (Original), TraC-MImAS Status (Original)) with the new status assessments (TraC-MImAS High change in impact) and TraC-MImAS Low change in impact).

Future trialling will also provide an opportunity to run the tool on water bodies that were not trialled previously, subject to data availability, which have morphologically complex histories and capture the new high and low impact activities.

2.5.2 Trialling results

Of the 25 water bodies trialled (eleven in Scotland, five in the Republic of Ireland, four in Northern Ireland, four in England and one in Wales), seven water body assessments result in the same status outputs from the original and improved tool. This indicates that the new TraC-MImAS tool is concluding assessments which are broadly comparable with those of the original tool.

Only two water body assessments results in materially different status between the original and new tool. One of these water body assessments, Oitir Mhor & Traigh Leathann, results in an increase in status from good (original) to high (improved). The other water body assessment, Swansea, results in a decrease in status from high (original) to poor (high impact) or moderate (low impact).

Table 2.10 Comparison of original trialling results with updated outputs

Country	WB ID	WB Name	TraC-MImAS Water Body Type	Predicted status (Original)	TraC-MImAS Status (Original)	TraC-MImAS High change in impact	TraC-MImAS Low change in impact
Scot	WB200131	Peterhead (Ugie Estuary to Buchan Ness)	Coastal, exposed bedrock	Moderate	Moderate	Moderate	Moderate
Scot	WB200105	Don Estuary to Souter Head	Coastal, Mod Exp - Exposed Sedimentary	Good	Good	Poor	Moderate
Scot	WB200480	Oitir Mhor & Traigh Leathann	Coastal, sheltered sedimentary	Good	Good	High	High
Scot	WB200041	Kinghorn to Leith Docks	Coastal, sheltered sedimentary	Moderate	Good	Moderate	Good
Scot	WB200079	Montrose Basin	Transitional	Good	Good	Moderate	Good
Scot	WB200435	Lower Forth	Transitional	Good	Good	Good	Good
Scot	WB200436	Middle Forth	Transitional	Poor	Moderate	Moderate	Moderate
Scot	WB200437	Upper Forth	Transitional	Poor	Poor	Poor	Poor
Scot	WB200510	Inner Clyde	Transitional	Bad	Bad	Bad	Bad
Scot	WB200026	Largs Channel	Coastal, sheltered sedimentary	Moderate	Good	Good	Good
Scot	WB200418	Loch Bee	Lagoon	High	High	High	High
ROI	IE_SW_060_0000	Cork Harbour	Sheltered Sed	Good	Good	Moderate	Good
ROI	IE_SW_230_0200	Castlemaine	Transitional	Good	Good	Moderate	Good
ROI	IE_SW_230_0100	Cromane	Transitional	Good	High	Good	High
ROI	IE_SW_170_0100	Inner Bantry Bay	Transitional	Good	High	High	High
ROI	IE_SW_230_0000	Outer Dingle Bay	Coastal, Mod Exp - Exposed Sedimentary	High	High	High	High

Country	WB ID	WB Name	TraC-MImAS Water Body Type	Predicted status (Original)	TraC-MImAS Status (Original)	TraC-MImAS High change in impact	TraC-MImAS Low change in impact
NI	UKGBNIIE6NB030	Carlingford Lough	Coastal, sheltered sedimentary	**Good**	**Good**	**Moderate**	**Good**
NI	UKGBNI6NE030	North Channel	Coastal, Moderately to Exposed Sedimentary	**Good**	**Moderate**	**Moderate**	**Moderate**
NI	UKGBNI6NE130	Strangford Lough South	Coastal, sheltered sedimentary	**Good**	**Good**	**Good**	**Good**
NI	UKGBNI5NE10001 01	Lagan Estuary	Transitional	**Moderate**	**Bad**	**Bad**	**Bad**
Eng	GB531206908100	Mersey	Transitional	**Poor**	**Moderate**	**Moderate**	**Moderate**
Eng	GB520503613600	Stour and Orwell	Transitional	**Moderate**	**Moderate**	**Bad**	**Poor**
Eng	GB641008180000	Outer Loughor	Transitional	**Good**	**Good**	**Poor**	**Moderate**
Wales	GB641008260000	Swansea	Coastal, Moderately to Exposed Sedimentary	**High**	**High**	**Poor**	**Moderate**
Eng	GB650806250000	Carrick Roads CS	Transitional	**Good**	**Not Available**	**Good**	**Good**

The results indicate that the updated TraC-MImAS tool agreed with professional judgement in 40% of cases for the High change in impact pressures, and 48% of cases for the Low change in impact pressures (**Table 2.11**, **Figure 2.1** and **Figure 2.2**). There was 75% agreement for water bodies at the extremes of the classification scale (high and bad) at both High change in impact and Low change in impact pressures.

For comparison to the original TraC-MImAS tool, there was agreement with 54% of cases for the High change in impact pressures, and 79% of cases for the Low change in impact pressures. It should be noted that the original tool was not run on water body Carrick Roads CS and as such this was excluded from this percentage (dropping the tool trials to 24 for comparison with the previous tool). There was 71% agreement for water bodies at the extremes of the classification scale for High change in impact pressures, and 86% agreement for Low change in impact pressures.

Where there was disagreement, the tool was within one status class in 84% of cases between professional judgement and High change in impact, and 96% of cases for the Low change in impact pressures. And between the original tool and the High change in impact trial there was one status class difference in 83% of cases, and 91% of cases for the Low change in impact pressures.

Cases where there was significant difference between the professional judgement / original trial run and the high or low change in impact updated tool were:

- Don Estuary to Souter Head (WB200105);
- Stour and Orwell (GB520503613600);
- Outer Loughor (GB641008180000); and
- Swansea (GB641008260000).

Don Estuary to Souter Head (WB200105)
Case Study 3 from the TraC-MImAS Technical Report – version (a4) (SEPA, date unknown) categorises the current status of the water body as ‘Less than good’ (i.e. Poor). This does not match with the status condition provided in the trialling spreadsheet. SNIFFER have stated that Case Study 3 is a stage 1 regulatory trialling example carried out at the local scale i.e. within a 0.25km assessment area. As such the good status result from the previous trialling results is not a comparison of like with like. However, Rrunning the water body through the updated TraC-MImas tool produces a ‘good’ status for the low change in impact scenario and a ‘moderate’ status for the high change in impact scenario. SNIFFER have confirmed that these results are acceptable considering the existing shoreline defences are approximately 4km in length and the shoreline length for this water body is 8km.

Stour and Orwell (GB520503613600)
The Stour and Orwell water body is failing the MCLs due to the pressure on the subtidal zone. Investigation into the difference between the previous trialling results and the updated MImAS result determined that the trialling spreadsheet provided categorised the Stour and Orwell water body incorrectly. The spreadsheet stated that the water body was ‘Transitional’ when the ‘Report on the Initial Findings of England and Wales’ (Cefas,

date unknown) categorises the water body as 'Coastal, sheltered sedimentary'. When the updated tool was run within this category the tool produced a Poor result for the High change in impact scoring and a Moderate result for the Low change in impact scoring. The Low change in impact scoring matches the professional judgement and previous trialling result, and there is only one status class difference under the High change in impact scoring.

Outer Loughor (GB641008180000) and Swansea (GB641008260000)
No additional data was available regarding the Outer Loughor and Swansea water bodies. Re-trials of these water bodies were run and confirmed that the capacity percentages were correct. It is assumed that the professional judgement status and original trial runs did not have a complete data set with respect to existing pressures, or categorisation of the type of water body was incorrect. It should be noted that the pressures that are tipping the water body status in to a moderate / poor condition are 35.4km of flood defence embankment for Outer Loughor and Shoreline reinforcement of 12.23km for Swansea. These numbers are significantly high for water bodies in a good or high condition status.

Statistical analysis of the results is difficult due to the nature of the datasets, however, a Spearman Rank correlation on the data indicated an R2 value of 0.88 ($p<0.05$) described the correlation between original trial and the LOW outputs from the updated tool.

Table 2.11 Overview of & agreement between TraC-MImAS updated tool and professional judgement and previous trial

Level of Agreement	Number	Percentage (%)	R^2
Professional Judgement			
Updated MImAS (high) agrees with professional judgement	10	54	0.45
Updated MImAS (low) agrees with professional judgement	12	79	0.67
Previous MImAS Trial			
Updated MImAS (high) agrees with previous trial	13	71	0.63
Updated MImAS (low) agrees with previous trial	19	86	0.88

Figure 2.1 Comparison of the HIGH TraC-MImAS output with the professional judgement / previous trial run for the 25 water bodies tested during trialling (where 1 = BAD, and 6 = HIGH)

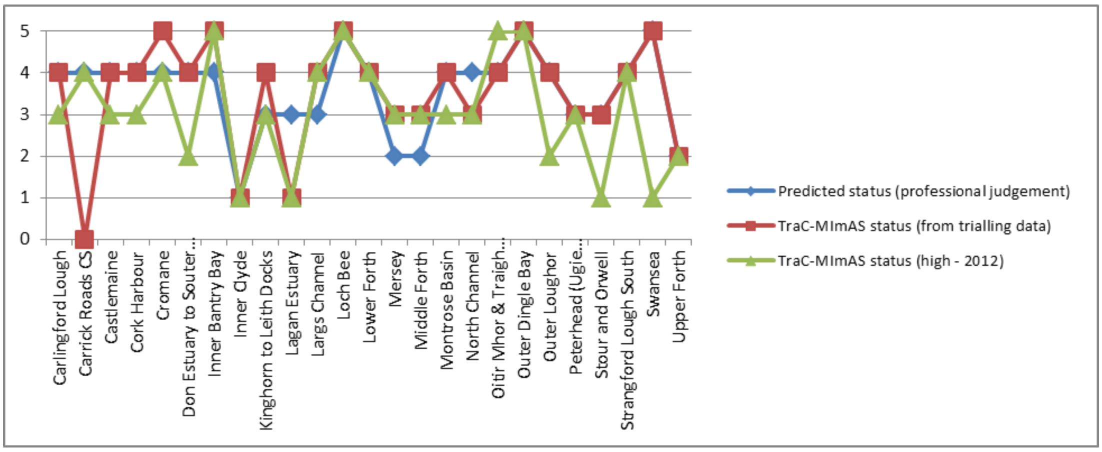
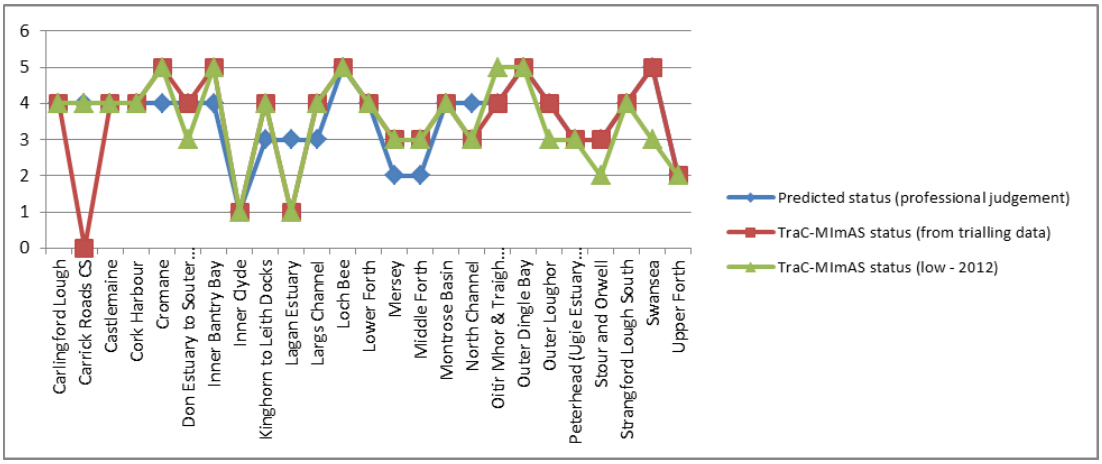


Figure 2.2 Comparison of the LOW TraC-MImAS output with the professional judgement / previous trial run for the 25 water bodies tested during trialling (where 1 = BAD, and 6 = HIGH)



3 DEVELOPING THE WIDER PROCESS

3.1 Setting tool within a broad regulatory framework

The key output from the TraC-MImAS tool relates to Morphological Condition Limits (MCLs) and the capacity used for each of the respective zones (hydrodynamic, intertidal and subtidal). These outputs are intended to provide risk-based guidance to inform regulatory decisions. MCLs can be used to complement existing regulatory methods and form part of a wider decision-making-process for managing TraC waters. Specifically, MCLs may help regulators determine whether the Ecological Objectives of the WFD are threatened and whether unacceptable impacts upon intertidal and subtidal habitats are anticipated. The outputs from the improved TraC-MImAS tool will therefore be required to feed into the wider regulatory and assessment framework to inform where more detailed assessment is required, and where a regulatory exemption test may be required.

It is recognised that this tool is not the sole consideration to inform competent assessors as to whether there will be deterioration in ecological status resulting from new development. In the assessment of ecological deterioration from new developments, the existing TraC-MImAS tool does not provide a sufficient picture of likely outcomes to important habitats e.g. saltmarsh and seagrass. It is possible that relatively small developments could cause major impacts to these habitats.

The application of the TraC-MImAS tool should therefore not be completed in isolation, but form an integral part of a wider regulatory framework. Key to the development of the TraC-MImAS tool is the consideration of how the tool outputs sit within a broader regulatory framework, and in doing so guide end-users (regulators) in the consideration of habitats when assessing potential hydro-morphological deterioration from new activities (proposals).

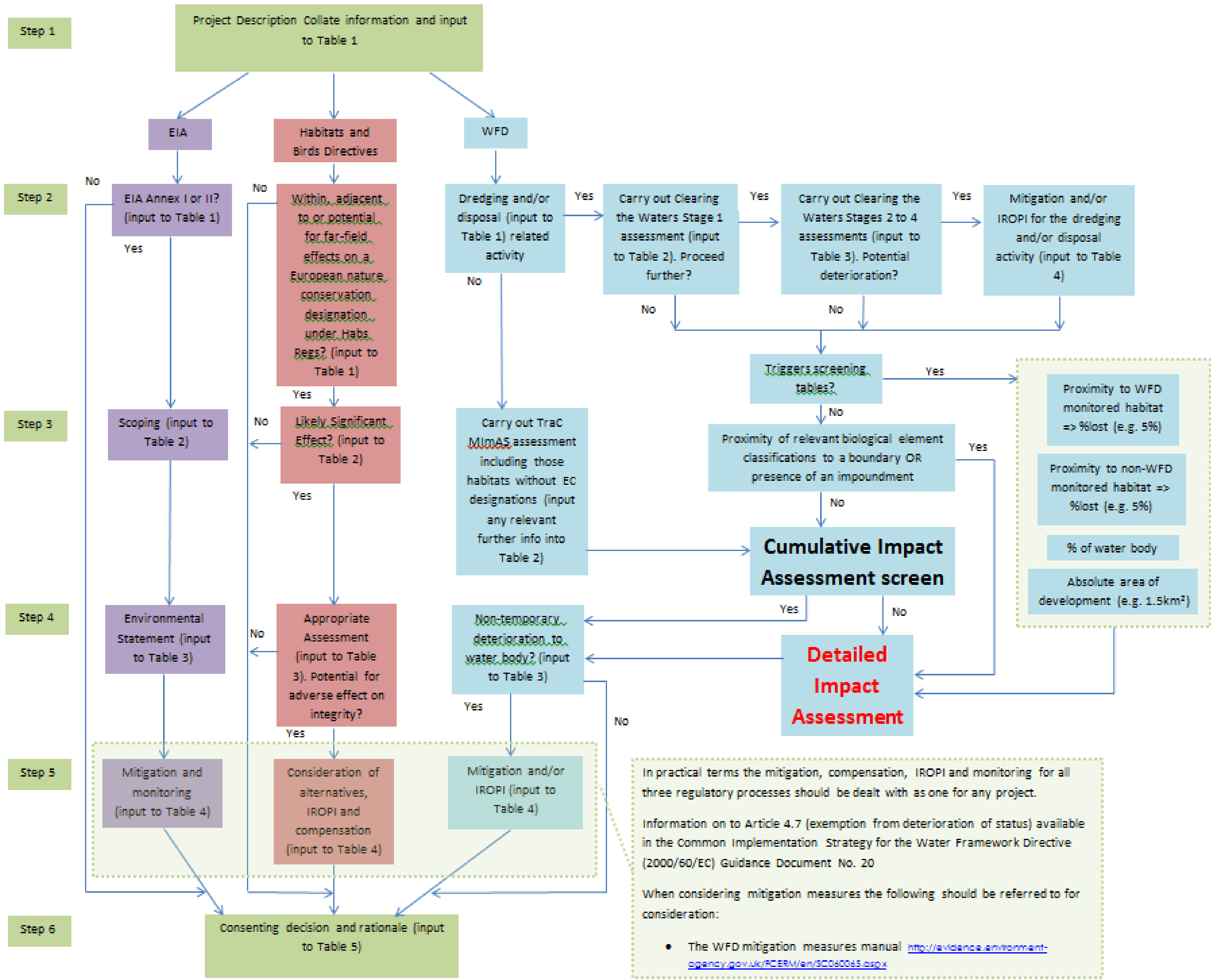
In developing a broad regulatory framework, for consideration by decision makers, to ensure that all habitats are considered, the existing framework of Environmental Impact Assessment (EIA), Habitats Regulations Assessment (HRA) and WFD provide the key starting point for any developer and competent authority assessing hydromorphological deterioration (including habitats).

To aid the end user in the determination of further data requirements and to set the TraC-MImAS tool outputs within a wider regulatory framework, Royal Haskoning have developed a conceptual flowchart (decision matrix) to guide users (regulators and competent authorities) in the consideration of habitats when assessing potential hydromorphological deterioration from new proposals (see **Figure 3.1**).

The broad regulatory framework comprises three key components:

1. Regulatory Framework Flowchart (decision matrix) (**Appendix 1.A**)
2. Regulatory Framework Rationale (**Appendix 1.B**)
3. Regulatory Framework Tables (**Appendix 1.C**)

Figure 3.1 Regulatory Framework – Flowchart



3.1.1 Regulatory Framework Flowchart

The approach adopted by Royal Haskoning draws upon the 'Clearing the waters' dredging guidance, in that the user is prompted, via key 'trigger' questions, in guiding the assessment process. The regulatory framework flowchart is presented in **Figure 3.1** and comprises 6 key steps:

1. Collate project information (including the development of the footprint data)
2. Determine key directives for assessment and scoping
3. Carry out TraC-MImAS assessment
4. Determine further assessment requirements
5. Determine requirement for monitoring/mitigation/IROPI
6. Consenting decision

3.1.2 Regulatory Framework Rationale

This section sets out the rationale for the Regulatory Framework Rationale. This section should be read in conjunction with **Appendix 1.A, 1.B** and **1.C**. All the required information are input to tables in **Appendix 1.C** to which the reader is referred.

Step 1

At this first step all relevant data for the project should be collated and recorded. Where relevant this information should be input into **Table 1; Project information**. This would for example include the nature, size, duration (both construction and operation) and location of the activity.

Step 2

The relevant directives (EIA, HRA and WFD) need to be assessed for relevance at this stage of the regulatory framework in order to establish whether one, two or all three directives are relevant to a specific project. Where relevant this information should be input into **Table 2; Scoping the issues**.

Step 3

Dependent upon the relevant Directives the user shall determine whether one or all of the Directives are applicable to the application and complete a TraC-MImAS assessment (Point 3):

1. Scope of the EIA, if required
2. Anticipated 'Likely Significant Effect' and requirement for HRA/AA.
3. TraC-MImAS Assessment to inform WFD

Where relevant this information should be input into **Table 3; Assessment**

Step 4

During Step 4 all three processes continue as follows:

1. For EIA the process enters the Environmental Statement stage. The applicant will submit the ES to the regulator for assessment. The results of this

assessment to be recorded in Table 2 and referenced in Table 5. The process then continues to Step 5.

2. For Habitats and Birds Directives an Appropriate Assessment will now be carried out based on the information provided to the regulator by the applicant. If no Significant Effect is likely then the results can be input into Table 3 and referenced in Table 5. If a Significant Effect is likely then the process continues onto Step 5.

3. For WFD assessment the output of the TraC-MImAS tool should be recorded in Table 3. If no non-temporary deterioration to a water body is predicted then the process is complete and the outcome also recorded in Table 5 as part of the consenting decision. Where the TraC-MImAS tool outcome conflicts with any outcome from the Clearing the Waters outcome with respect to dredging at this stage it is suggested that the default would be the worst case scenario. If a non-temporary deterioration in a water body is anticipated then the process continues to Step 5.

Where relevant the outputs of the TraC-MImAS tool should be input into **Table 4; TraC-MImAS outputs**

Step 5

This step defines:

1. For EIA any mitigation and/or monitoring suggested and agreed should be recorded in Table 4 and referenced in Table 5.
2. For the Habitats and Birds Directive any mitigation and/or compensation suggested and agreed to be recorded in Table 4 and referenced in Table 5
3. For WFD assessment and mitigation and/or IROPI should be recorded in Table 4 and referenced in Table 5.

For further information on WFD Assessment, prevention of deterioration (and exemption tests under Article 4.7) and measures to deliver good ecological status / potential please refer to the European guidance (http://ec.europa.eu/environment/water/water-framework/index_en.html, accessed 25/05/2012) or the Common Implementation Strategy for the Water Framework Directive (2000/60/EC) Guidance Document No. 20 published by the European Commission.

Where relevant this information should be input into **Table 4; Mitigation, monitoring, compensation and IROPI**. When considering mitigation measures the following should be referred to for consideration:

- The Water Framework Directive mitigation measures manual (http://evidence.environment-agency.gov.uk/FCERM/en/SC060065.aspx)
- Estuary Edges: Ecological Design Guidance (www.environment-agency.gov.uk/cy/busnes/sectorau/100745.aspx).

Step 6

This step brings together all the data gathering and assessments carried out in Steps 1 to 5. Table 5 provides a transparent audit trail of the way the decisions have been made and where in the process. The final consenting decision will be based on all three outcomes from the EIA, Habitats and Birds Directives and the WFD. For consent to be granted all three outcomes must be satisfactory.

Where relevant this information should be input into **Table 5; Consenting decision and rationale**.

4 SUMMARY AND CONCLUSIONS

The TraC-MImAS tool has been simplified via the presentation of only a user interface, with all working worksheets hidden from view (in addition to supply of the tool with all worksheets included). Additional pressure categories have been developed in line with discussion with the wider working group, and high and low change in impact categories created for all activities.

The number of impact ratings has been expanded from three to five for all pressures to take a better account of varying spatial and temporal factors i.e. magnitude and frequency of activity.

A high-level 'flagging' system has been incorporated into the updated tool. Though MCLs have been set for each habitat type, the tool indicates that expert assessment is required if any potential exceedence of a MCL is predicted. This simple approach is adopted due to the uncertainty surrounding the interaction between pressures and habitats responses – this is an area for further development.

Impact ratings for important habitats have been developed for seven habitat types (three intertidal and four subtidal), though further work is required on the development of Morphological Condition Limits (MCLs). The inclusion of habitats within the TraC-MImAS tool, while straight forward in principle, represents a number of problems in terms of developing a capacity used approach in line with the existing tool functionality. Royal Haskoning have adopted the principle that any pressure within a water body (hydrodynamic, subtidal or intertidal zone) has the potential to impact on the habitats. In the absence of spatial data regarding location and extent of habitats in relation to the proposed activity it is currently unclear how the quantification of pressures and their potential impact on habitats shall be concluded. Further work is required to finalise the approach to assessment for these habitats, particularly MCLs for habitats.

The trialling results indicate that the development and improvement of the original tool results in assessment outputs which are not materially different from the original tool.

The development and setting of the TraC-MImAS tool outputs within a broad regulatory framework ensures a holistic approach to the assessment of activities. However, further refinement on the approach as set out in **Appendix 1** may be required further to review by the working group.