

A novel interdisciplinary approach to building system-based environmental impact assessments for marine and aquatic environments

Jody Edmunds^{1,3}, Jeff Wilson^{1,3}, Shawn Hinz^{1,3}, Jennifer Coston-Guarini², Carl Van Colen³, Jean-Marc Guarini¹

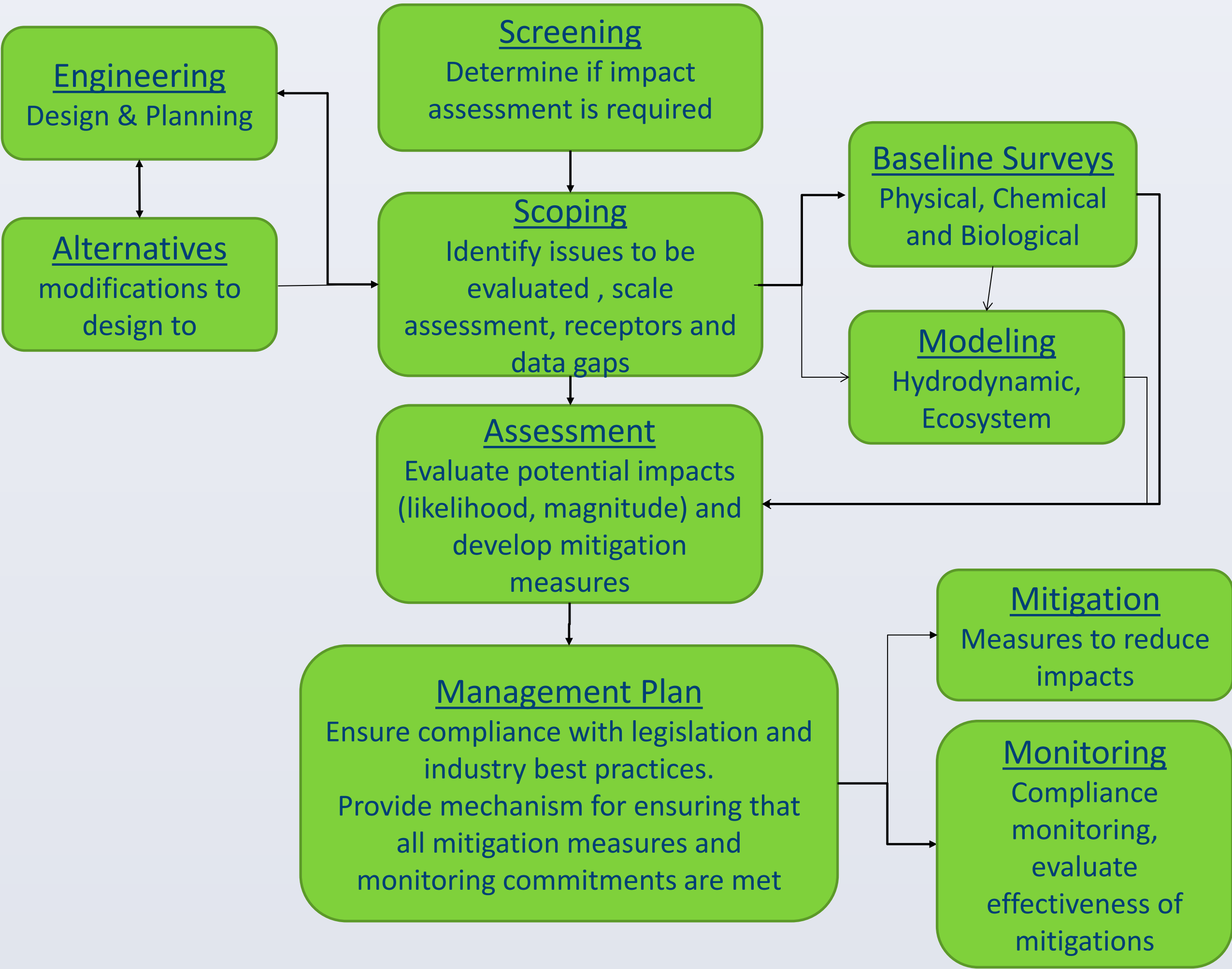
1-UPMC-UMR 8222 LECOB (France), 2-UBO-UMR 6539 LEMAR (France), & 3-University of Ghent (Belgium)
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INTRODUCTION

Environmental Impact Assessments (EIAs) are designed to both evaluate environmental consequences and suggest means to mitigate possible impacts that may occur from development projects (infrastructure creation, urban expansion, offshore development, mining, etc.). The formal EIA process is critical to ensuring decision makers consider the environment prior to proceeding with a project. EIAs are used in almost every country in the world today; yet despite the important role they have in decision-making, there is little or no standardization in the practice. The process is essentially a qualitative exercise which does not take fully into account the complexity of ecosystems nor the true cumulative impacts.

We suggest a new approach to EIA is necessary today to incorporate advances in ecosystem based modelling, hydrodynamic modelling and survey technologies made over the last two decades.

EIA Conceptual Diagram



CRITICISMS OF TRADITIONAL, CATEGORY-BASED EIA APPROACH

- Qualitative criteria cannot be comparatively evaluated
- Receptor choices often not based on best available research
- Baseline surveys often do not represent true geographical extent of potential impacts
- Survey sample sizes limit ability to measure impacts causing false positive results
- Hydrodynamic models are often not site specific and are not coupled to ecosystem modeling
- New advancements in remote sensing and survey technology not often utilized for baseline and monitoring studies

OBJECTIVES

The goal of this new approach to the EIA process is to be able to understand impact in terms of the interactions and functions attributable to ecosystem processes. This would replace the current focus on a receptor based approach which does not integrate the full picture of physical and biological processes nor does it allow effective evaluation of alternatives. The expected outcome of our work is a new methodology for full lifecycle assessment of environmental impacts.



PROJECT EXAMPLE:

Dredge in Caspian Sea

- Receptors included seals, benthos and sturgeon
- Minimal baseline data collected
- Hydrodynamic modeling only focused on engineering design not impact assessment
- Criteria were qualitative
- Assessment conclusions not risk based
- Monitoring minimized

APPROACH

To achieve a new EIA approach, we are examining three different aspects:

- Developing a screening or scoping framework for system based environmental impact assessment (JEdmunds);
- Using a system based hydrodynamic modeling approach to predict environmental responses in coastal systems (JWilson); and
- Using remote sensing and ground-truthing to optimize nearshore environmental survey methodologies (SHinz)

SYSTEM BASED MODELING - A NEW APPROACH

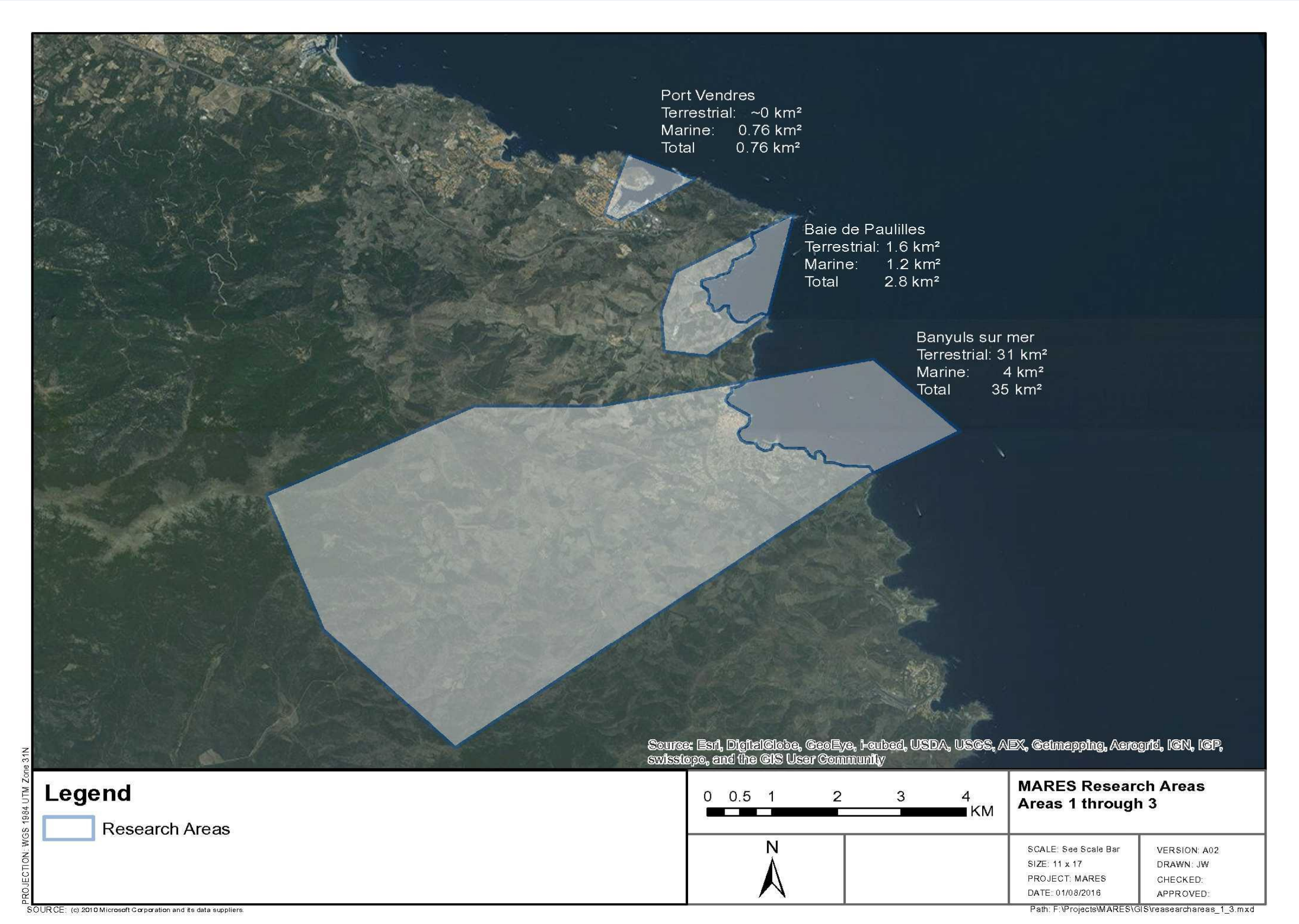
- Use of network modeling to assess baseline and monitoring data objectives during screening & scoping phases
- Definition of System-Based Quantitative Impact framework based on modeling
- Optimized data collection through model sensitivity analysis and technologically advanced spatial survey techniques
- Selection of criteria based on probability & decision theory

METHODOLOGY & STUDY SITES

The system based impact assessment methodology will be compared to current qualitative methodologies and tested at three project sites located on the western Mediterranean coast near Banyuls-sur-Mer (France). At each site, development projects have been previously proposed (including expansion of a recreational marina, a nuclear power plant, and a deep-water port expansion project with extensive dredging). Three impact assessments will be conducted using hypothetical projects and project locations with each approach (traditional, category-based and ecosystem-based).

The study locations are:

- Banyuls-sur-mer a 50-year old recreational marine port and beach area
- Port-Vendres is a 200-year old, deep water commercial port
- Baie de Paulliles is a natural bay with very little existing infrastructure



CURRENT PROGRESS

- Produced regional hydrodynamic model
- Collected Bathymetric Lidar data and Water Quality measurements at all three study sites
- Conducting literature review of EIA for state-of-the-art
- Planning to collect multi-beam and AUV surveys in 2016
- Planning to install ADCP's in 2016
- Developing ecosystem model framework



Bathymetric LIDAR data collected from Baie de Paulliles

COLLABORATORS AND CONTACTS

These three doctoral projects grew out of a collaboration between two environmental consulting companies and an independent group in ecological research beginning in 2014. The aim of this group (the GLG consortium) is to propose a quantitative option for impact assessment based on theory and modelling. The three member groups are: LimOce Consulting (www.limoce.com); Gravity Consulting (www.gravitycon.com); The Entangled Bank Lab (www.entangled-bank-lab.org).

