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Geoscience Research
GSI
Suirbhéireacht Gheolaíochta Éireann
Geological Survey of Ireland

Geological Survey of Ireland Research Programme
- Short Call 2015, Final Report -

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Organisation name	Geocoast Research Centre Ltd		
Organisation type:	☐HEI	☐Public Sector (other)	☒Private Sector
Department/section			

Project Title	Development of a coastal infrastructure GIS (open source) for Ireland
Contract No.	2015-sc-011

INFOMAR

Tellus
Understanding Underground

Marine Institute
Foras na Mara

2. Project information:

Title of project	
Did you make any formal amendment to the project work plan/budget?	yes☐ no v If yes, please specify:

Project Report (*max 1500 words, excluding figures and headings*):

(i) Objectives and scientific/engineering targets beyond the state of the art

The objective of this project was to develop a coastal infrastructure webGIS for Ireland using open source technology. The project addressed one of the priority themes of the GSI Geoscience Research Programme (Short Calls) 2015 entitled "Development of a coastal infrastructure GIS (open source) for Ireland". This was implemented using the open source MapServer technology (Windows and Unix supported). MapServer - is an Open Source platform for publishing spatial data and interactive mapping applications to the web (http://www.mapserver.org).

The developed webGIS interface (Figure 1) is cross-browser compatible, is implemented using JavaScript and AJAX frameworks, notably OpenLayers, Ext JS and GeoExt. MapServer is capable of rendering maps from vector and raster data sources such as Shapefile, GeoTIFF, WMS (Web Map Service), etc. It also has the capability to project spatial data on-the-fly with 1000s of projections.

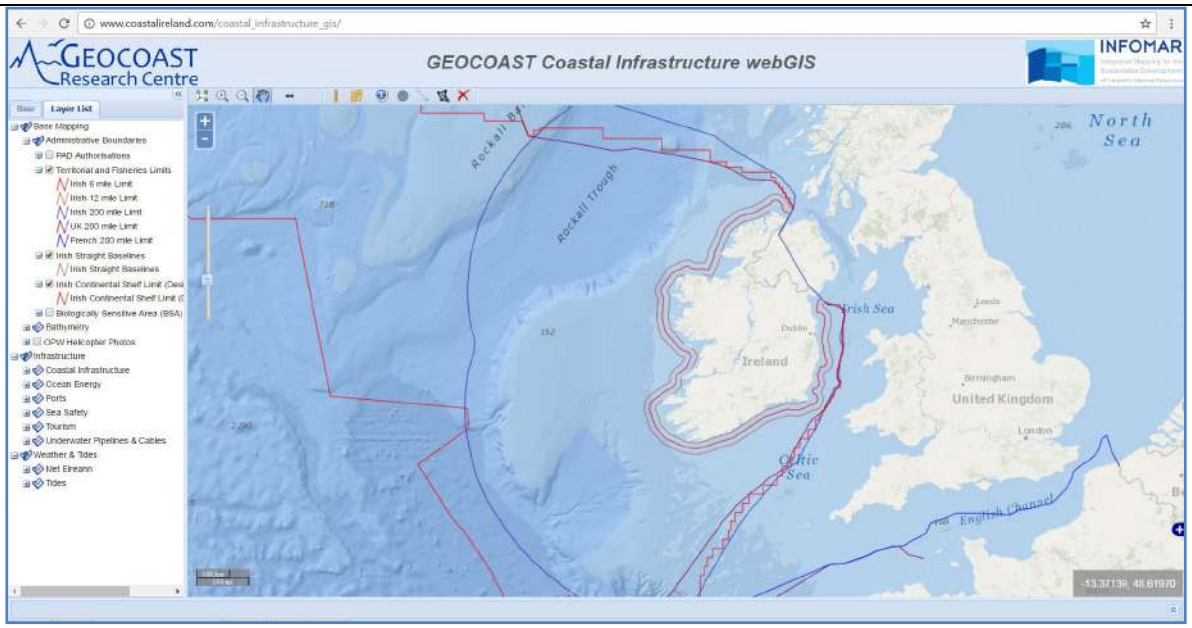

Figure 1: Appearance of the developed *GEOCOAST Coastal Infrastructure webGIS*.

The project has collated, standardised and integrated within the developed online webGIS framework substantial amount of spatial data related to Ireland's coastal and near-shore infrastructure, including the following layers:

- Coastal Infrastructure
- Ocean Energy
  - Arklow Wind Farms
  - Codling Wind Park (Proposed)
- Ports
  - Commercial Ports
  - Fishing Ports
  - Local Ferry Ports
- Sea Safety
  - Community Rescue Boats
  - Coast Guard Stations
  - Marine Data Buoys
  - Beacons
  - Buoys and Major Floating Aids
  - Lighthouses
  - RNLI Lifeboat Stations
- Tourism
  - ISA Sailing Clubs
  - Marinas and Pontoons
  - Visitor Moorings
- Underwater Pipelines and Cables
  - Underwater Pipelines
  - Underwater Cables
- Weather and Tides
  - Met Eireann Latest Weather
  - Met Eireann Prevailant Weather
  - Irish Weather Buoys
  - Easy Tide Predictions
  - Tide Gauge Network

(ii) Implementation (including reference to timelines, milestones, management)

The project was undertaken in a number of stages as outlined in the project proposal mainly adhering to the proposed work plan. The project was implemented through desktop research and development of the online webGIS interface and assembly of the relevant GIS datasets. Spatial data was quality checked and gaps filled based on interpretation of available aerial photographs and field visits.

The *GEOCOAST Coastal Infrastructure webGIS* is built on MapServer. MapServer is open source software which enables the dynamic display of spatial maps over the Internet. The MapServer mapfile is used to configure data access and styling. MapServer supports many vector and raster data formats and services, which are configured in the mapfile. The *GEOCOAST Coastal Infrastructure webGIS* uses the Shapefile (for points, lines and polygons) and GeoTIFF data formats, and also Web Map Service (WMS) layers from other remote WMS servers.

MapServer dynamically renders maps based on the user's current view extent and layer selection in the webGIS. The map layers are rendered on-the-fly as PNG images using the Web Map Service (WMS) standard, which are then displayed in the web-GIS user interface. In addition, base layers maps are included to provide context. Base layers used include ESRI ArcGIS Online Basemaps, Google Maps, and Open Street Map (Figure 2). The webGIS user interface is implemented using HTML, CSS and JavaScript technologies. It uses OpenLayers, Ext JS, and GeoExt JavaScript libraries.

The webGIS user interface supports functionality such as map panning and zooming (incl. zooming to previous/next extent), layer selection, layer overlay, legends, and layer feature querying (Figure 1). It also allows reading coordinates of the mouse pointer, drawing notes in map view and perform measurements on the line or of the area (Figure 3).

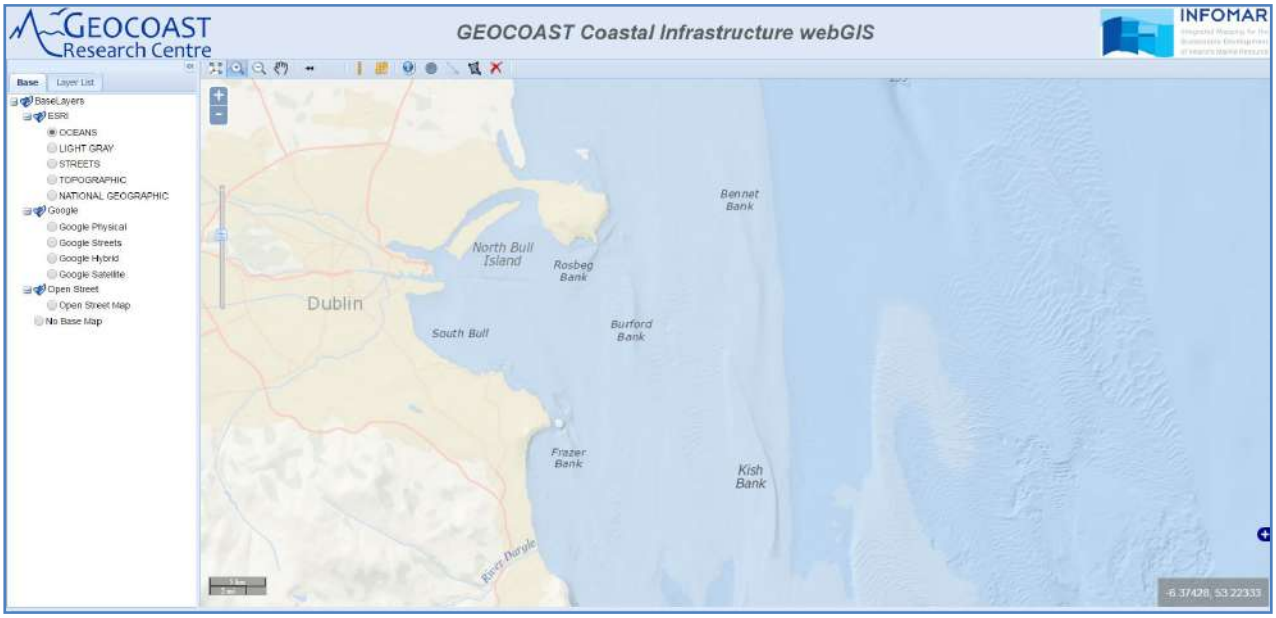

Figure 2: The webGIS integrates a number of Base Layers (incl. Google, ESRI, Open Street Map).

Figure 3: Front end overview of the developed webGIS interface.

The webGIS interface presents a flexible frame structure allowing to minimise or change the dimensions of the frames (layer list / legend; data view; information window) (Figure 4).

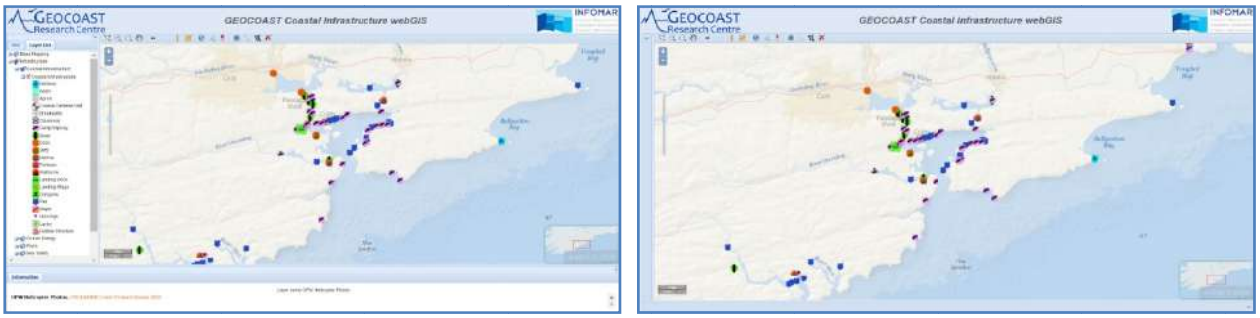

Figure 4: Illustration of the flexible frame structure - note that left "Layer/Legend" and lower "Information" frames can be collapsed or resized.

Among other layers - the developed webGIS integrates OPW Helicopter Photos, therefore, providing visual insight at each infrastructure object if viewed in combination with the Coastal Infrastructure Layers (Figure 5).

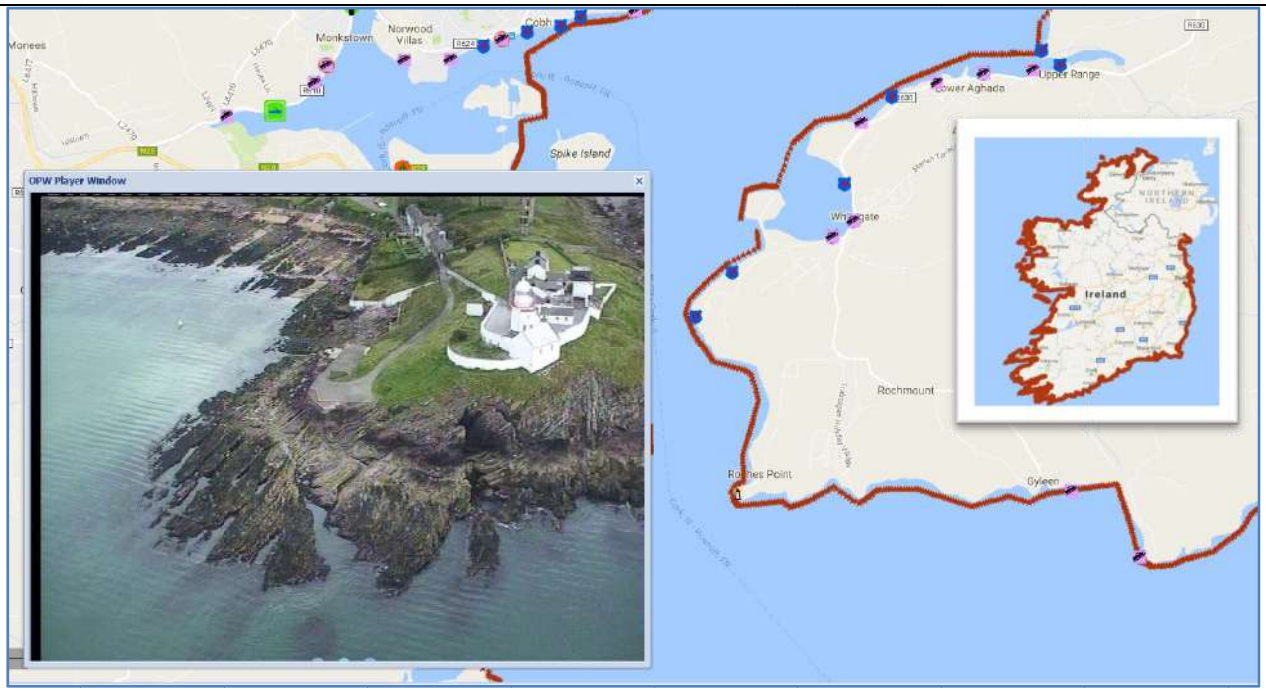

Figure 5: webGIS integrates OPW Helicopter Photos.

As mentioned above, the webGIS integrates tools allowing to perform measurement of objects in the map viewer (Figure 6).

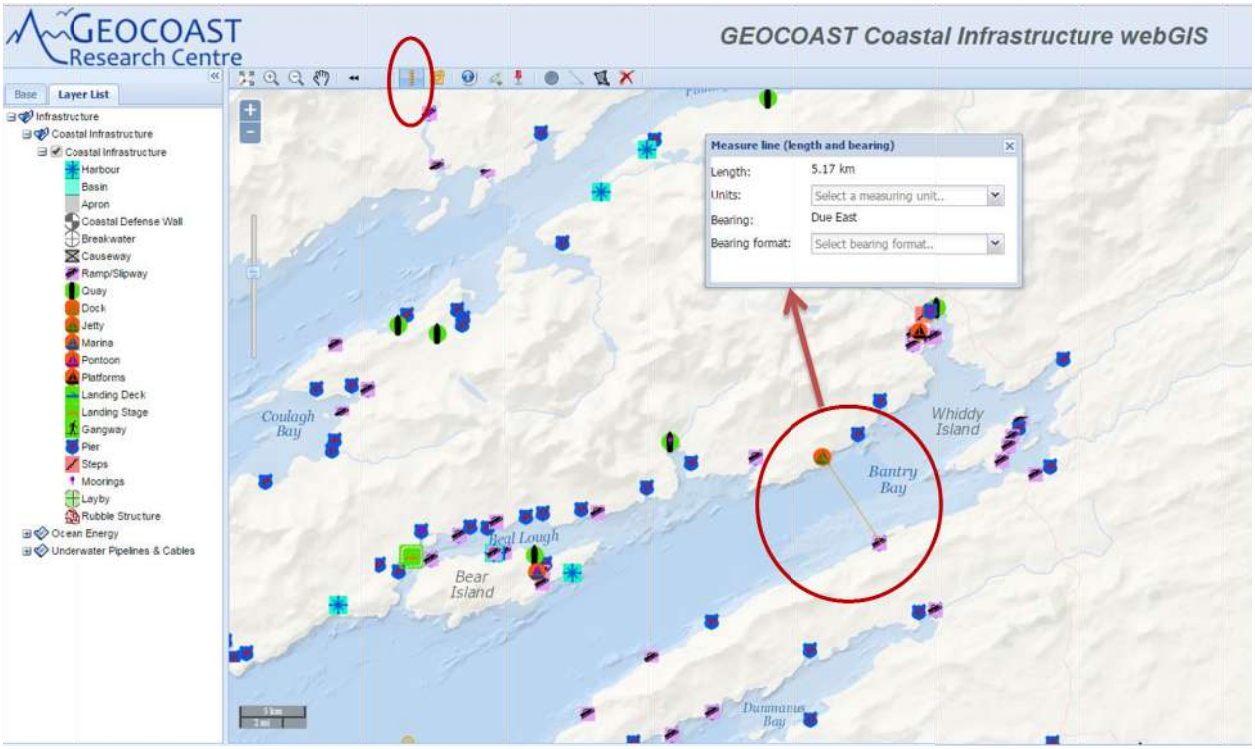

Figure 6a: Tools allow to performs measurements on the line.

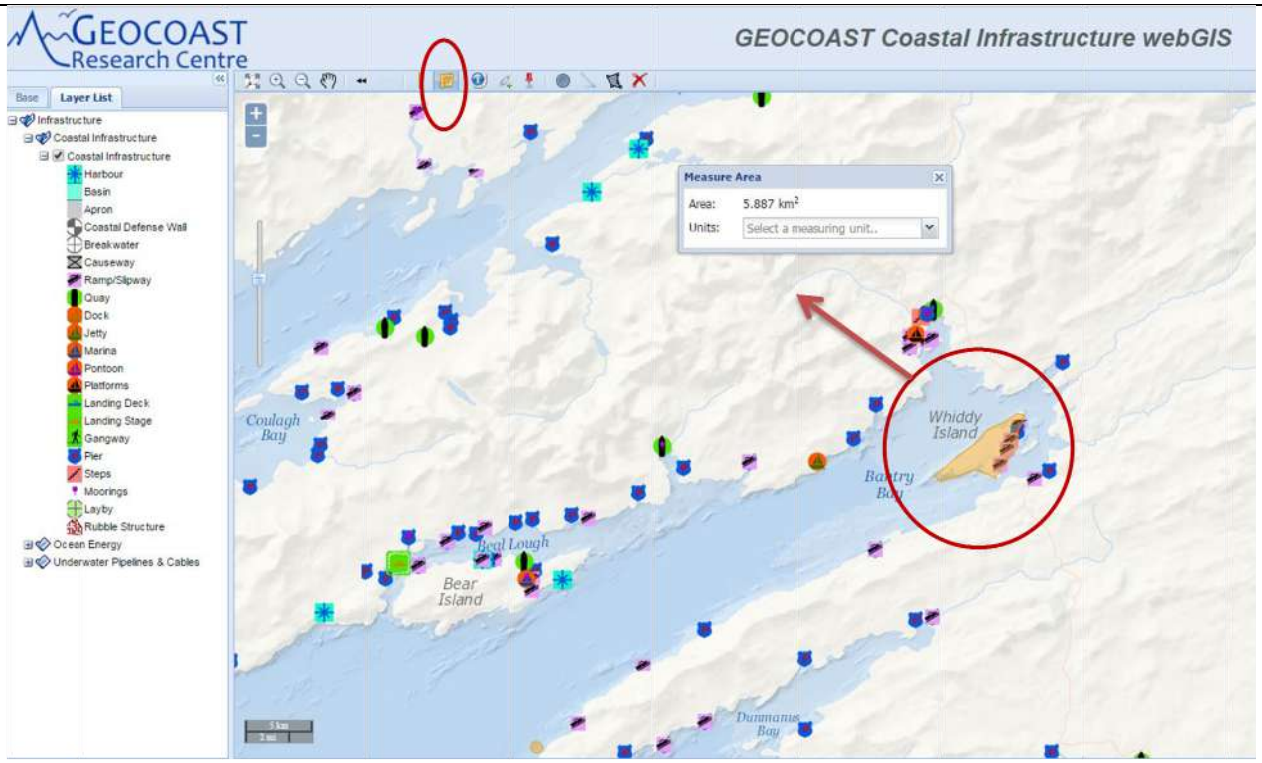

Figure 6b: Tools allow to performs measurements of the area.

The developed system is cross browser and cross platform compatible and has been successfully tested to work on PC computers, Apple computers, iPhones and iPads (Figure 7a) as well as on Android phones and tablets (Figure 7b).

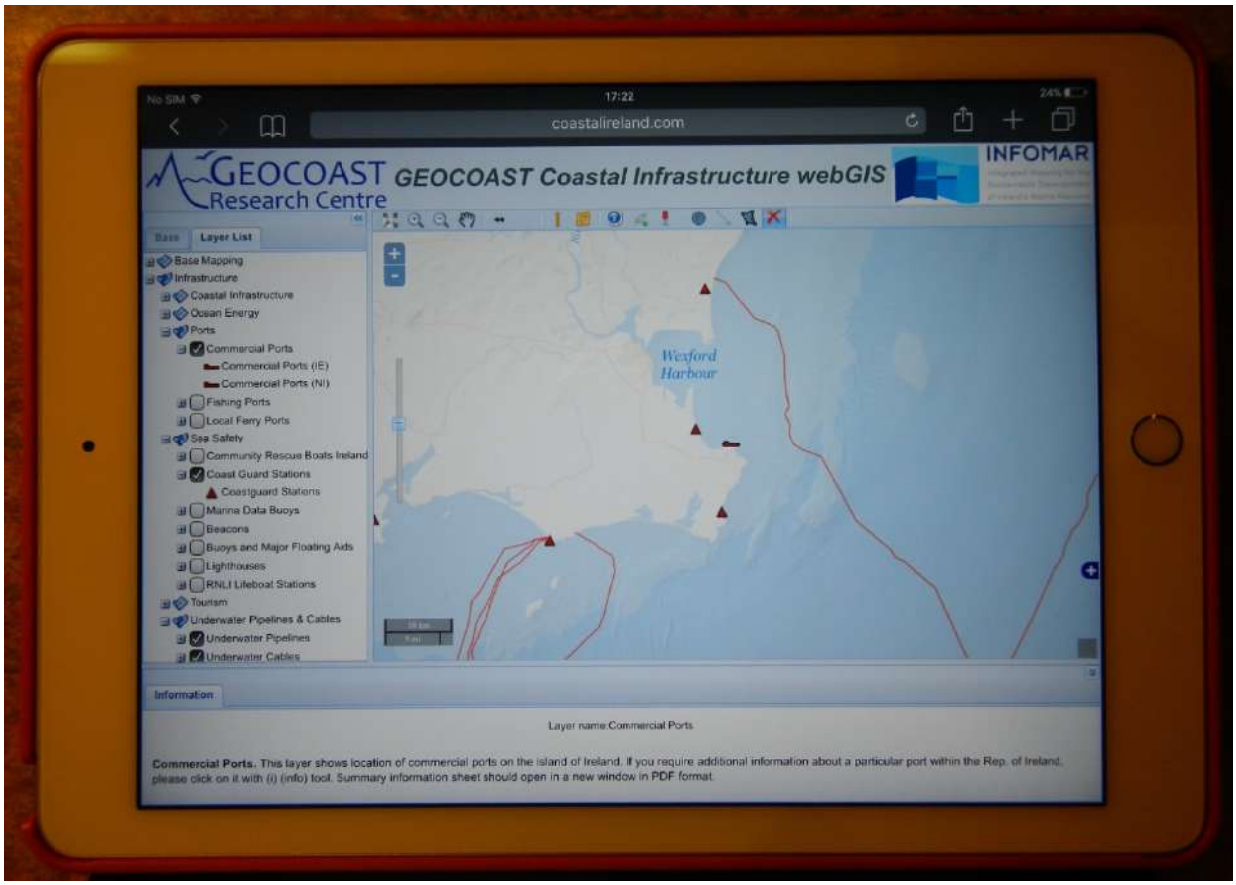

Figure 7a: The GEOCOAST Coastal Infrastructure webGIS displaying on iPad Air 2.

Figure 7b: The GEOCOAST Coastal Infrastructure webGIS displaying on Android phone (Samsung Galaxy J1).

Following the submission of the project results the Geological Survey of Ireland had made a number of constructive comments and suggestion in relation to data content, map appearance and metadata. All of these comments have been addressed and technical issues fixed. If required, the developed webGIS along with associated data can be installed on the server of the Geological Survey at any convenient time. Alternatively, we are happy to continue hosting the developed webGIS on our server and provide technical support, make sure the GIS layers are up to date and the site is functioning as it should.

(iii) Outputs (please use bullet points)

- Coastal infrastructure webGIS for Ireland developed using open source technology. The final product can be viewed at the following address: http://www.coastalireland.com/coastal_infrastructure_gis/

Impact/value of the project (M*ax 500 words*):

The use of the free open source technology used in creating the *GEOCOAST Coastal Infrastructure webGIS* allows to save on costs comparatively to using solutions provided by ESRI. The produced webGIS may be useful for planning and undertaking coastal and offshore fieldwork (e.g. for INFOMAR). It may also be relevant in evaluating onshore and foreshore licence applications (e.g. seaweed harvesting, wind farms, aquaculture, etc...). The webGIS may also be used as educational tool and, therefore, benefit students in their research projects and fieldwork planning.

Appendix 1 – Publications & Presentations:

Kozachenko, M. (2016) Development of a coastal infrastructure webGIS for Ireland using open source technology. INFOMAR Seminar – 19th October 2016, Oranmore, Marine Institute.