ANNEX 2

Contractor's Tender

OPEN CALL FOR TENDERS
MARE/2008/03

Preparatory Actions for European Marine Observation and Data Network

ANNEX 2
TENDER FORMS

ANNEX 2 TO THE CALL FOR TENDERS MARE/2008/03
"PREPARATORY ACTIONS FOR EUROPEAN MARINE OBSERVATION AND DATA NETWORK"

LOT NO: 1 – HYDROGRAPHIC DATA

TECHNICAL TENDER FORM

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The technical offer must contain the following elements:

1. **Understanding of objectives.**

The European Commission, represented for the purposes of this call for tenders by the Directorate-General for Maritime Affairs and Fisheries (DG MARE), wishes to conclude service contracts for creating pilot components of the European Marine Observation and Data Network. The overall objective is to create pilots to migrate fragmented and inaccessible marine data into interoperable, continuous and publicly available data streams for complete maritime basins.

The results will help to define processes, best technology and approximate costs of a final operational European Marine Observation and Data Network. It will also provide the first components for a final system which will in themselves be useful to the marine science community.

The call for tenders comprises 4 lots. This bid concerns the lot 1: hydrographic data.

The specific objectives of the project are to:

- collate existing data from public and private organisations relating to the state of maritime basins; processing them into interoperable formats which includes agreed standards, common baselines or reference conditions;
- assessing their accuracy and precision and assembling them into common datasets;
- develop, test, operate and maintain a **portal** allowing public access and viewing of these data and a link to WISE-marine
- monitor and report on the effectiveness of the system in meeting the needs of users in terms of ease of use, quality of information and fitness for purpose of the products delivered;
- analyse what further steps need to be taken to improve the accuracy, precision, coverage and ease of use of the data, including a scheme for sustainable quality assurance and control of the data delivered to the system, both in this preparatory action and in the future larger system.
- analyse the necessary requirements to maintain the components built up in each lot as a sustainable infrastructure

- keep the portal operational afterwards and be prepared to transfer to the Commission.

The hydrographic Call asks to produce the following geographical information system layers:

1. water depth in gridded form over whole of maritime basin on a grid of at least quarter a minute of longitude and latitude.
2. water depth in vector form with isobaths at a scale of at least one to one million.
3. depth profiles along tracklines
4. multibeam surveys along tracklines
5. coastlines
6. underwater features – wrecks, seabed obstructions etc

It is accepted that the accuracy and precision of the gridded data will vary over the basin in question. No new data should be collected specifically for this project. The aim is to provide access to data from existing monitoring programmes. All data delivered to EMODNET should be INSPIRE compliant.

The hydrographic data should concern the following geographical regions:

- the Greater North Sea, including the Kattegat and stretches of water such as Fair Isle, Cromarty, Forth, Forties,Dover, Wight, and Portland.
- the English Channel and Celtic Seas.
- Western Mediterranean, the Ionian Sea and the Central Mediterranean Sea.

The portal must be developed with the main purpose to allow the download of data for further analysis by users and to make it available for combination with data from other portals including the other portals developed in this preparatory action. The portal will also allow the maritime community and potential users to understand how the data was collected as well as the overall aims of the EMODNET project. Thus the portal should allow:

a. On-line instructions.
b. Viewing a catalogue of the data available. The catalogue shall be structured in line with best practices relevant to the field of science covered by the data.
c. Querying of data. The description of the data shall as much as possible employ the INSPIRE metadata implementing rule while downloading should be based on the INSPIRE download service implementing rule or should it not be available, on the OGC Web Feature and Coverages Services Specifications.
d. On-line capability to view the position and magnitude of data as well as geographical information system layers delivered in accordance with the INSPIRE View Service Implementation Rule. This should include an online viewer allowing layer-selection, attribute queries, panning and zooming.
e. Downloading of GIS layers, monitoring and contiguous data.
f. Understanding of the precision of the data and how it has been processed.
g. Users to receive feedback on queries sent by e-mail.
h. Links to other relevant web-sites (on measurements, standards, similar projects etc).

2. **Added value.**

This EMODNET Hydrographic data joint tender has been prepared and submitted by members of the **SeaDataNet** consortium together with other organisations from marine science, the hydrographic survey community, and industry. The partners combine expertises and experiences of collecting, processing, and managing of bathymetric data together with

expertises in distributed data infrastructure development and operation and providing OGC services (WMS, WFS, and WFS) for viewing and distribution.

SeaDataNet is a leading infrastructure in Europe for marine & ocean data management. It is actively operating and further developing a Pan-European infrastructure for managing, indexing and providing access to ocean and marine data sets and data products, acquired via research cruises and other observational activities, in situ and remote sensing. The basis of SeaDataNet is interconnecting 40 National Oceanographic Data Centres and Marine Data Centers from 35 countries around European seas into a distributed network of data resources with common standards for metadata, vocabularies, data transport formats, quality control methods and flags, and access. Thereby most of the NODC's operate and/or are developing national networks to other institutes in their countries to ensure national coverage and long-term stewardship of available data sets.

The majority of data managed by SeaDataNet partners concerns physical oceanography, marine chemistry, hydrography, and a substantial volume of marine biology and geology and geophysics. These are partly owned by the partner institutes themselves and for a major part also owned by other organizations from their countries.

SeaDataNet is implemented as an EU Research Infrastructures I3 project, which was awarded in the FP6 programme, began in early 2006 and has a duration of 5 years. Version 1 of its infrastructure upgrade was launched in April 2008 and is now rolled out to all 40 data centres. It comprises the network of 40 interconnected data centres (NODCs) and a central SeaDataNet portal. V1 provides users a unified and transparent overview of the metadata and controlled access to the large collections of data sets, that are managed at these data centres.

The SeaDataNet V1 infrastructure comprises the following middleware services:

- Discovery services = Metadata directories and User interfaces
- Vocabulary services = Common vocabularies and Governance
- Security services = Authentication, Authorization & Accounting
- Delivery services = Requesting and Downloading of data sets
- Viewing services = Mapping of metadata
- Monitoring services = Statistics on system usage and performance and Registration of data requests and transactions
- Maintenance services = Entry and updating of metadata by data centres

In the coming years the SeaDataNet infrastructure will be extended into Version 2 with a further development of:

- Viewing services = Quick views and Visualisation of data and data products
- Product services = Generic and standard products

As a basis for the V1 services, common standards have been defined for metadata and data formats, common vocabularies, quality flags, and quality control methods, based on international standards, such as ISO 19115, OGC, NetCDF (CF), ODV, best practices from IOC and ICES, and following INSPIRE developments.

The Common Data Index (CDI) is the central discovery service in SeaDataNet enabling users to have a detailed insight of the availability and geographical extent of marine data, archived at the connected data centres. It gives the metadata of individual data sets and measurements with key fields (what, where, when, how, who etc.). It also provides the linking pin from the

discovery services towards the delivery services, because it is directly related to the data sets, to which the users can request access. Users can freely search and browse the CDI discovery services and identify relevant data sets.

Considerable work has been undertaken, at first in Sea-Search and later in its successor SeaDataNet, to define the CDI metadata format (xml) and XML schema (xsd) as an extended marine profile of the ISO 19115 standard for geographical data sets, and to develop Common Vocabularies, entry tools and services for validation and retrieval of the CDI XML records.

Also a SeaDataNet architecture has been designed to provide a coherent system of the various V1 services and a later extension with V2 services. For the implementation, a range of technical components have been defined and developed. These make use of recent web technologies, and also comprise Java components, to provide multi-platform support and syntactic interoperability. To facilitate sharing of resources and interoperability, SeaDataNet has adopted the technology of SOAP Web services for various communication tasks.

The SeaDataNet architecture has been designed as a multi-disciplinary system from the beginning. It is able to support a wide variety of data types and to serve several sector communities. SeaDataNet is willing to share its technologies and expertise, to spread and expand its approach, and to build bridges to other well established infrastructures in the marine domain.

Therefore SeaDataNet has developed a strategy of seeking active cooperation on a national scale with other data holding organisations via its NODC networks and on an international scale with other European and international data management initiatives and networks. This is done with the objective to achieve a wider coverage of data sources and an overall interoperability between data infrastructures in the marine and ocean domains. It should be noted, that these objectives coincide perfectly with the aims of EMODNET with respect to Pan-European marine data management and data access.

While SeaDataNet has an overall data scope to provide a one-stop-shop for all kinds of marine and ocean data, other European data management initiatives and networks are mostly discipline oriented. Establishing cooperation and interoperability requires a dedicated approach, tuned to the individual disciplines and their parties:

Geological & geophysical domain

As part of its strategy, SeaDataNet is closely cooperating with EuroGeoSurveys and its members, the national geological surveys in Europe, to improve the overview and accessibility of marine geological & geophysical data sets. This has recently resulted in a joint proposal, Geo-Seas, - involving 24 geological surveys -, submitted to the FP7 Research Infrastructures programme, to upgrade and to integrate the existing EU-SEASED and SEISCAN metadata services by adopting the SeaDataNet interoperability principles, architecture and components wherever possible. Geo-Seas will use the SeaDataNet standards and procedures, adapting these for specific requirements of the geological and geophysical domain. This will ensure a common basis for interoperability.

If the proposal is awarded, Geo-Seas will expand the SeaDataNet infrastructure by connecting the data centres of national geological surveys and selected geological research institutes, and their marine geological and geophysical data holdings. It will expand the SeaDataNet metadata catalogue of available data, the Common Data Index (CDI), based upon ISO 19115.

It will provide users standard access to federated, marine geological and geophysical datasets via the SeaDataNet mechanisms. Thus it will enrich the total data coverage and offer of the SeaDataNet infrastructure, that will be actively maintained and operated by an enlarged group of data centres over Europe.

Biological domain

It is recognized by SeaDataNet that in the field of biology already a number of strong networks and infrastructures are operating in Europe. These comprise MarBEF, ICES, WCD-MARE/PANGAEA, and EurOBIS (European implementation of OBIS, a global initiative under Census of Marine Life (CoML), concerting with GBIF), that involve many institutes in Europe and operate large thematic databases in the field of biology.

Therefore as strategy for the biological domain, SeaDataNet decided to establish cooperation with these groups and as recent opportunity to encourage a joint approach to EMODNET for establishing a unified European marine biological portal. As part of the implementation, the NODCs of SeaDataNet will actively contribute to the population of the EurOBIS data infrastructure with data sets, while EurOBIS will adopt metadata standards from SeaDataNet and will populate the SeaDataNet CDI directory with CDI entries, describing the data sets as included in EurOBIS. EurOBIS as thematic database system, bringing together data sets from multiple organisations, will thus be connected to the SeaDataNet infrastructure. This will ensure, that users of SeaDataNet will be able to find the data sets, contained in EurOBIS, and get access to these data sets via the SeaDataNet V1 shopping and access mechanism, in line with the one-stop-shop philosophy.

Internationally:

Internationally SeaDataNet has cooperation and exchange with e.g. DMAC (data management infrastructure), and MMI (metadata & vocabularies) in the USA, has recently agreed a cooperation with UNIDATA for formulating together a new NetCDF Core Data Model, and is involved in JCOMM (IODE – WMO). The underlying objective is to achieve common standards and interoperability.

Hydrographical domain:

Hydrography is another discipline, for which SeaDataNet wants to achieve a cooperation and a good presence of available data sets in the SeaDataNet offer. A number of NODCs in SeaDataNet already manage hydrographic data sets, such as multibeam surveys from scientific cruises. These are catalogued via the CDI metadata and users can get access to these via the SeaDataNet V1 shopping and access mechanism. In addition, there are the following parties in the provision of hydrographic data:

- Hydrographic Offices, that are responsible for surveying the navigation routes, fairways and harbour approach channels and producing from these the nautical charts on paper and as Electronic Nautical Charts (ENC), that are used for navigation. The HO's are members of the International Hydrographic Organisation (IHO) and have their own data policy, which has restrictions. Partly this is due to the fact, that many HO's are part of the navy and that high resolution data sets are treated as confidential for security purposes; partly it is also due to the fact, that HO's have more or less a monopoly on the production of nautical charts and create income from this. These charts have a legal status. Every captain must use certified nautical charts and the production and publication of these is an activity which must follow stringent international procedures. The latter results in a condition that HO's are careful in delivering and distributing bathymetric survey data sets.

- Authorities, responsible for management and maintenance of harbours, coastal defences, shipping channels and waterways. These authorities operate or contract regular bathymetric monitoring surveys to assure that an agreed nautical depth is maintained or to secure the state of the coastal defences. Part of these data is already included in SeaDataNet, because its data centres belong to the same institutes, that perform the surveys.
- Research institutes, that collect multibeam surveys as part of their scientific cruises. Part of these data is already included in SeaDataNet, because its data centres belong to the same research institutes.
- Industry, especially the energy industry, that contracts multibeam surveys for pipeline and cable routes (in case of windfarms) and the telecommunication industry for phone and internet cable routes.

Concluding, there are 4 types of parties, that perform bathymetric surveys, thereby partly overlapping and mostly complementing their geographical coverages. Data are collected at different frequencies and even date back to previous centuries.

Considering this situation and sensitivities, the following SeaDataNet strategy was formulated, which is proposed as approach for the EMODNET Hydrographic pilot:

- Develop a high-end Hydrographic portal, outfitted with a powerful spatial database, that is complemented with WMS, WFS and WCS services (OGC) to serve users and to provide layers for e.g. the other EMODNET portals, the prototype European Atlas of the Seas, and the broad-scale European Marine Habitats map;
- Involve research institutes, monitoring authorities, and HO's, in providing hydrographic data sets for producing Digital Terrain Models (DTM) with specific resolution for each geographical region, that are loaded and integrated afterwards into the portals' spatial database
- Include in the portal a metadata discovery service, by adopting the SeaDataNet CDI metadata standard, that inter alia gives clear information about the background data used for the DTM, the access restrictions and distributors; this also ensures the connection of the Hydrographic portal with the SeaDataNet portal.

This system and organizational approach will have the following benefits for EMODNET and SeaDataNet:

- It facilitates an expansion of the geographical coverage of the EMODNET hydrographic portal to other seas, because this involves confronting data holders in other sea areas with the principles and product services of the pilot, which are convincing;
- It facilitates an expansion of the base of background data sets used for the DTM productions with data sets from other data holders, such as more HO's, research institutes, and port & coastal authorities, and industry (energy and telecommunication industries), because the EMODNET model respects possible data access restrictions and distribution conditions as set by data providers to end-users, while the data sets are used internally by a select group of experts for producing and finetuning the DTMs for the regions;
- In comparison to a Hydrographic portal, fully based and undertaken by HO's, the chosen EMODNET model of a cross partnership is more open and attractive to other data sources, such as scientific institutes and industries, - also because of the SeaDataNet outreach -, to contribute their data sets, which will enrich the basis and accuracy of the DTM production;

- The one-stop-shop of SeaDataNet will be expanded with metadata references to hydrographic data sets, of which part can be downloaded directly from NODCs via the SeaDataNet shopping mechanism and of which another part can be requested from their owners, whereby the SeaDataNet shopping mechanism will be of service for routing the requests.

3. Coverage of data and access restrictions

The hydrographic data should cover the following 3 geographical regions:

- the Greater North Sea, including the Kattegat and stretches of water such as Fair Isle, Cromarty, Forth, Forties,Dover, Wight, and Portland.
- the English Channel and Celtic Seas.
- Western Mediterranean, the Ionian Sea and the Central Mediterranean Sea.

As indicated in chapter 2, the EMODNET Hydrographic pilot will be based upon data from:

- Hydrographic Offices, that are responsible for surveying the navigation routes, fairways and harbour approach channels and producing from these the nautical charts on paper and as Electronic Nautical Charts (ENC), that are used for navigation. The data of HO's have been collected over a long period of time, with even data going back to centuries old lead line data. Some parts of the seas have even never been surveyed, while others are surveyed at a large interval. The highest frequency of surveys focuses on the navigation routes, also taking into account the differences in dynamic behaviour of the seabed between areas. Two hydrographic offices have agreed to be a partner in the EMODNET hydrographic pilot: GSI from Ireland and SHOM from France.
  In addition the HO's from Norway, Denmark, Germany, Netherlands and Belgium have agreed to supply:
  - Bathymetric survey data from which a grid coverage of at least a quarter of a minute of longitude and latitude can be generated for their area of responsibility in Europe;
  - Samples of multibeam surveys
  - Selected objects from relevant Electronic Nautical Charts which include objects that together form the coastline and underwater features like wrecks, obstructions and pipelines.

  These data sets are delivered under the conditions, that the data stay the property of the HO's, that the data are only used for the EMODNET project, and that it must be explicitly advertised at the EMODNET portal, that the data products are not to be used for navigation. These data supplies are confirmed by official letters, which are included in the annex with Data Inventory.
  The active participation of the two HO's allows to make use of their specific expertises and experiences with processing and quality controlling of bathymetric data sets. It also will 'smooth' the supply of data sets and possible involvement of the HO's that have signed the data supply agreement letters. Moreover it will stimulate possible other HO's to supply additional data sets, if required during the actual production of the DTM's.

  The Data Inventory annex gives an overview of available hydrographic data sets from the HO's in the EMODNET regions. This is an extract from an official report from IHO member states and will be used during production for selecting the data sets, that will be requested from the HO's. A provision has been made in the budget for funding the supply licence costs.

This Data Inventory annex is complemented by overviews of data of SHOM and GSI and of research institutes, that are project partners.

- Research institutes, that have collected multibeam surveys as part of their scientific cruises, and that are full partner in the project. These are:
  - IFREMER (France)
  - IEO (Spain)
  - NERC-NOCS (United Kingdom)

  The Data Inventory annex gives an overview of available hydrographic data sets from each of these partners.

From the Data Inventory it can be concluded that the data from the cruises combined with data sets from the HO's make it possible to cover most of the requested EMODNET pilot regions. Gaps can be filled into a lesser resolution using data from international databases, such as the NGDC, USA database GEODAS and GEBCO.

Verifying the requested data layers, the situation is as follows:

1. water depth in gridded form over whole of maritime basin on a grid of at least quarter a minute of longitude and latitude: Digital Terrain Models (DTMs) will be produced from the available bathymetric data sets from all partners for each of the 3 regions, including indications of accuracy per cell; for the DTM grid a cell width of 500 meter will be feasible;
2. water depth in vector form with isobaths at a scale of at least one to one million: Contours will be created from the DTMs.
3. depth profiles along tracklines: Will be created from the DTMs for pre-defined transects and possibly via the portal for user defined transects
4. multibeam surveys along tracklines: the tracks of the multibeam surveys will be included as layer via the CDI metadata, while the access to the actual data sets will go through the SeaDataNet CDI shopping mechanism
5. coastlines: will be derived from the data supplies by HO's; from the ENCs a coastline of 1: 150.000 can be provided, which is an improvement in comparison to the World Vector Shoreline (WVS) with a scale of 1:250.000; for specific regions a higher resolution of 1:75.000 might be achieved;
6. underwater features – wrecks, seabed obstructions etc ; these will be derived from the data supplies by HO's and will comprise those underwater features, that are included in the nautical charts and ENC's.

Note: that it must be explicitly advertised at the EMODNET portal, that the data products are not to be used for navigation.

Data access:
The metadata in the EMODNET pilot will be public domain and freely available for all users. The DTM data products (GIS layers) will be freely available as OGC services. However for data access (= downloading in particular the background data as detailed in the data inventory and as used for the products) the data copyrights of owners must be respected. But the possible problem of unclear data access restrictions and distribution is solved by the SeaDataNet V1 infrastructure, by including in its metadata a value for data access restriction for every data set it manages, as well as a clear indication of the distributor. The data access restriction value is derived from a SeaDataNet Common Vocabulary (L081), that ensures

standardisation. It varies from 'unrestricted' to 'restricted' with a number of values in between. This label gives users clear and well defined information about the possible data access restrictions. The distributor is indicated by a value from EDMO, the SeaDataNet European Directory of Marine Organisations.

4. **Methodology + time/work schedule.**

The EMODNET Hydrographic data pilot is undertaken by a European consortium of 7 partners from 5 coastal countries. These comprise members of the **SeaDataNet** consortium (partners 1 and 2) together with other organisations from marine science (partners 4 and 5), the hydrographic survey community (partners 6 and 7), and industry (partner 3). The partners combine expertises and experiences of collecting, processing, and managing of bathymetric data together with expertises in distributed data infrastructure development and operation and providing OGC services (WMS, WFS, and WFS) for viewing and distribution.

Participant Number *	**Participant organisation name**	**Country**
1 (project coordinator)	Mariene Informatie Service 'MARIS' BV (MARIS)	Netherlands
2	Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER)	France
3	ATLIS	Netherlands
4	NERC - National Oceanography Centre, Southampton (NERC-NOCS)	United Kingdom
5	Institute of Oceanography (IEO)	Spain
6	Geological Survey of Ireland (GSI)	Ireland
7	Service Hydrographique et Océanographique de la Marine (SHOM)	France

Details about the qualifications of the partners and their key persons can be found in the Annex.

In addition, 5 Hydrographic Offices (HO's) have agreed to supply data:

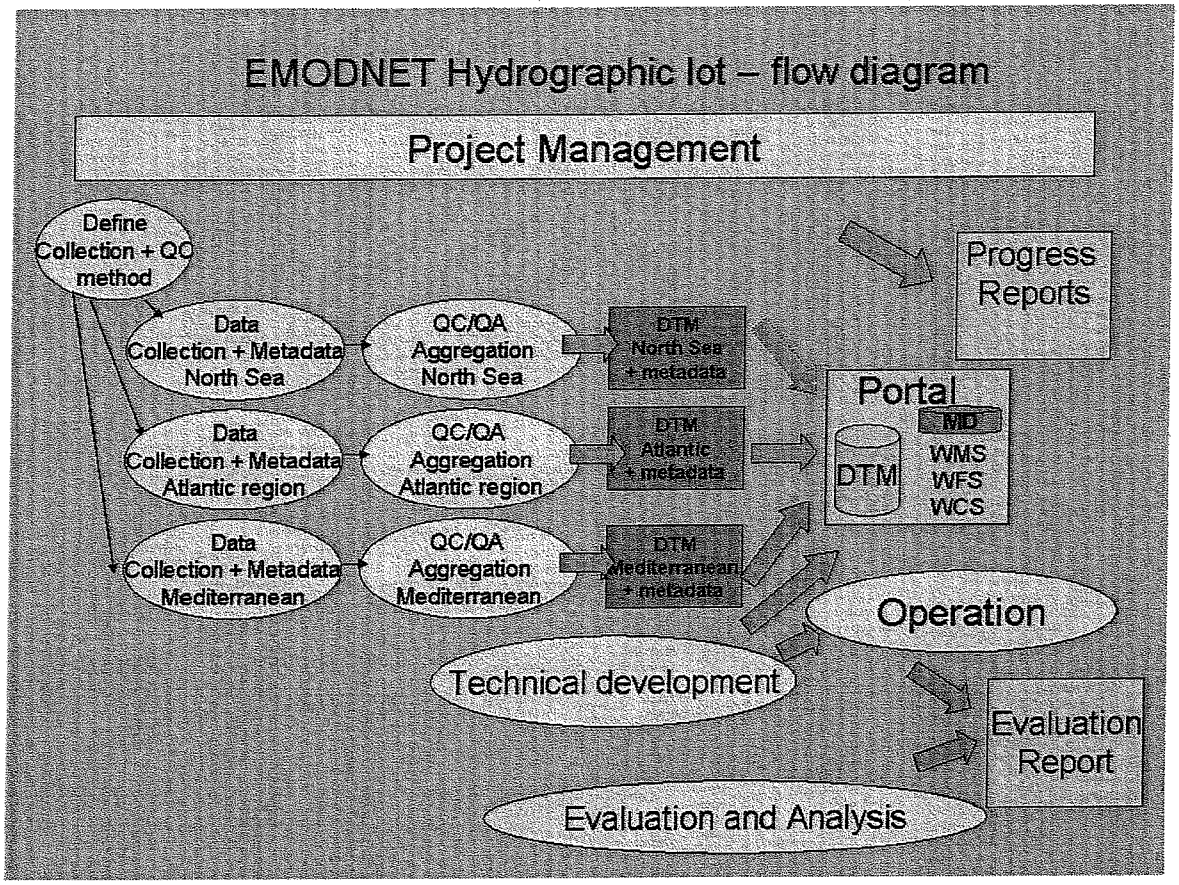
- Norwegian Mapping Authority – Norway
- Danish Maritime Safety Administration – Denmark
- Hydrographer of the Netherlands Royal Navy – Netherlands
- Bundesamt fur Seeschifffahrt und Hydrographie – Germany
- Agency for Maritime and Coastal Services - Belgium

Workplan:
To achieve the objectives of the EMODNET Hydrographic pilot the work plan is divided in the following Work Packages (WP):

WP1	**Project management**
WP2	**Data collection and metadata compilation**

WP3	**QC/QA and producing Digital Terrain Models**
WP4	**Technical development and operation of portal**
WP5	**Analysis and evaluation**

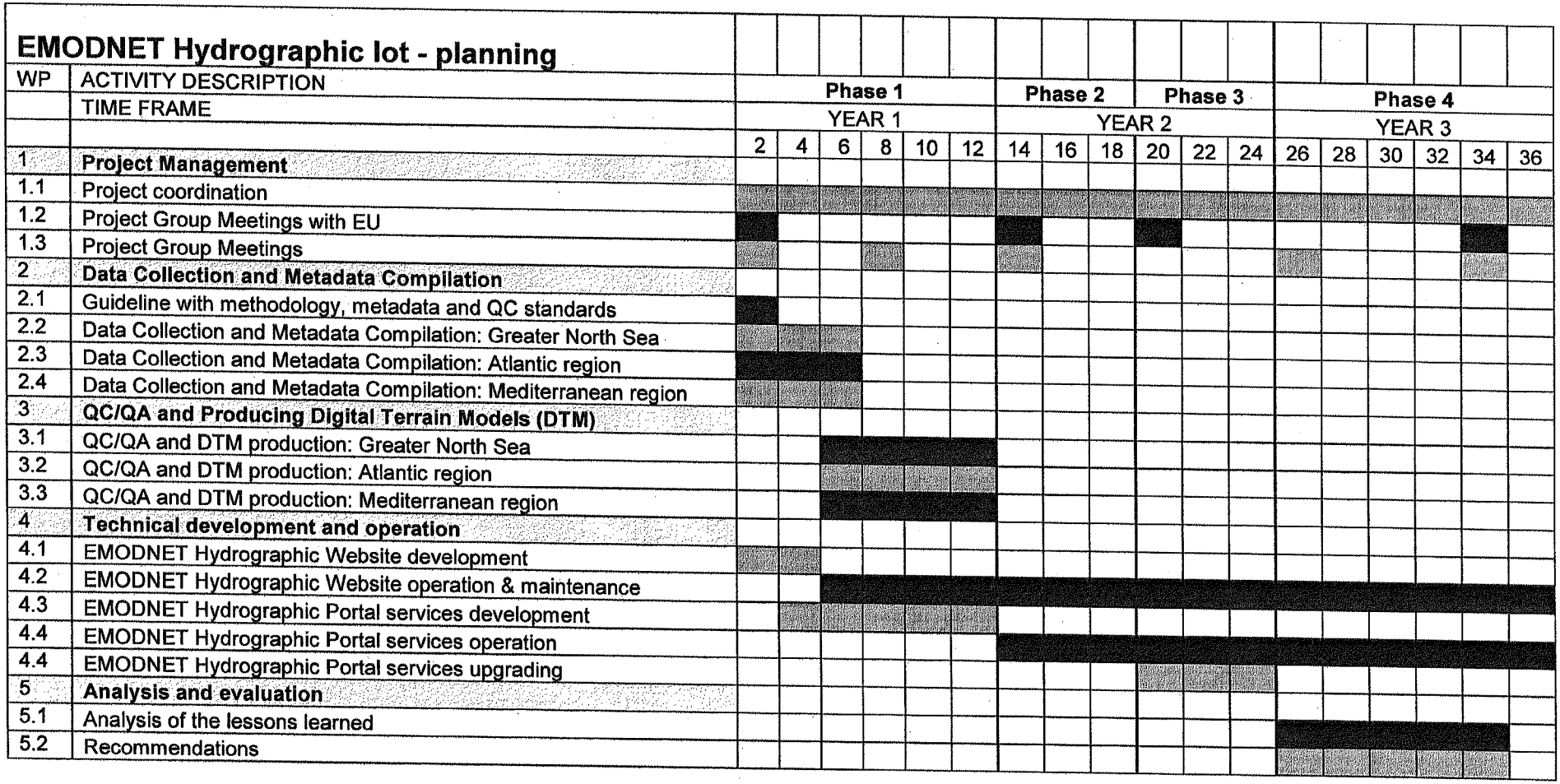
The work flow is illustrated in the following diagram:



The project is executed in 4 Phases:

- Phase 1 - Months 1-12 - Development and build
- Phase 2 - Months 13-18 - Test and monitor
- Phase 3 - Months 19-24 - Upgrade
- Phase 4 - Months 25-36 - Maintenance and operation

The planning of activities is given in the following planning diagram:



The Work packages are detailed as follows:

Work package number	WP1								
Work package title	**Project Management**								
Participant number	1	2	3	4	5	6	7	8	9
Participant short name	MARIS	IFREMER	ATLIS	NERC-NOCS	IEO	GSI	SHOM		
Involved	X								

Objectives

- To manage and to coordinate all project activities, ensuring timely delivery and high quality of results and products

Description of work:

The overall project management activities include:

- preparation and organization of Project Group meetings
- preparation of minutes and action lists of the meetings
- coordination of agreed actions and deliverables
- monitoring progress and possible revised planning of activities
- financial administration
- preparation of 2-monthly concise progress reports to be posted on the project web-site indicating meetings held, difficulties encountered, inventories of data made available, through phases 1 to 3
- preparation and submissions of management reports and progress reports for each phase, including invoices, to the EC.

The project organisation consists of the following elements:

- Project coordinator
- Project Group, consisting of all partners (MARIS, IFREMER, ATLIS, NERC-NOCS, IEO, GSI and SHOM

The Project Management activities will be performed by the Project Coordinator, supported by the Project Group members. Project management is a continuous activity during the full project period of 36 months.

The Project Group will meet with the Commission in Brussels for:

1. A kick-off meeting at the beginning of the project with representatives of all lots,
2. A meeting at the end of the first phase to present the first interim report, review progress, present the operational portal and exchange experience between different lots of the project,
3. A meeting after the end of the second phase to present the second interim report,
4. A meeting two months before the end of the fourth phase to coincide with the release of the final prototype product and draft final report.

Task lead by MARIS

Deliverables :

- bimonthly progress reports to be posted on the project web-site indicating meetings held, difficulties encountered, inventories of data made available. These start at month 2 and continue through phases 1 to 3
- a first interim report after phase 2

- a second interim report after phase 3
- a draft final report to be presented 2 months before the end of phase 4
- a final report at the end of phase 4 indicating:
    - what was done in the project
    - challenges faced
    - analysis of performance and lessons learned
    - analysis of sustainability
    - maintenance report at the end of phase 4
    - 15-page executive summary that can be read by a non-specialist

Work package number	WP2								
Work package title	**Data collection and metadata compilation**								
Participant number	1	2	3	4	5	6	7	8	9
Participant short name	MARIS	IFREMER	ATLIS	NERC-NOCS	IEO	GSI	SHOM		
Involved	X	X	X	X	X	X	X		

Objectives

- To gather identified hydrographic data sets
- To compile metadata for all hydrographic data sets in CDI format

Description of work:

Right after the start the partners will discuss and formulate an effective method for gathering and processing the data sets from the partners and Hydrographic Offices, agreed as data suppliers. A guideline document will be prepared, including the standards and available tools, that will be applied for QC / QA and preparing all metadata for the gathered bathymetric data sets.

Gathering:

The actual gathering will take place per region. Using the Data Inventory annex for each region a master list of data sources will be compiled. Own data sources of partners will be assessed and it will be determined which additional data sets should be requested from the Hydrographic Offices. The delivery of data sets by the HO's will be negotiated and agreed. All source material from partners and HO's will be brought together per region, giving also accurate estimates of source data volumes, and work required to assimilate the data. Where needed, analogue sources to fill in gaps will be identified and digitized. The coverage and source data quality will be assessed by region and quality control methods, and quality standards achievable for each region will be determined.

The data gathering, processing and metadata compilation will be coordinated per region as follows:

- The Atlantic Ocean (Channel, Celtic Seas, Western Approaches - task coordinated by NERC-NOCS with contributions from GSI, SHOM and IFREMER
- The North Sea and Kattegat - task coordinated by ATLIS with contributions from NERC-NOCS, IFREMER, SHOM, and data supplies from HO's of Belgium, Netherlands, Germany, Denmark and Norway
- The Western and Central Mediterranean sea and Ionnian Sea – task coordinated by IFREMER with contributions from SHOM and IEO, if needed, supplemented by data supply by HO's in the region

Note: Only processed and gridded multibeam data will be considered. In the event of data-gaps, digitizing of published maps and analogue data will be used.

Metadata compilation:

For the metadata the V1 standards of SeaDataNet will be adopted and where needed, extended for:

- Metadata format: the Common Data Index (CDI) metadata profile, based on ISO 19115
- Common vocabularies, governed by an international board and provided as Web services, for describing parameters, platforms, instruments, etc

The Common Data Index (CDI) is the central discovery service in SeaDataNet enabling users to have a detailed insight of the availability and geographical extent of marine data, archived at the connected data centres. It gives the description of individual data sets and measurements with key fields (what,

where, when, how, who etc.). It also provides the linking pin from the discovery services towards the delivery services, because it is directly related to the data sets, to which the users can request access. Users can freely search and browse the CDI discovery services and identify relevant data sets. The CDI User Interface includes a shopping basket and transaction processing mechanism, by which users can request access to selected data sets.

Considerable work has been undertaken, first in Sea-Search and later in its successor SeaDataNet, to define the CDI metadata format (xml) and XML schema (xsd) as an extended profile of the ISO 19115 standard for geographical data sets. The latest version makes use of standard mark-up terms, wherever possible, which are managed in the Common Vocabularies, while for Organisation information, standard references are included to the EDMO – European Directory of Marine Organisations. Furthermore tools and services have been developed for generating CDI XML records from the data management systems of data centres, a CDI XML validation Web service, parsing the CDI XML records against an extended CDI schema including vocabularies support, and tools for importing CDI records into a central CDI Directory.

The SeaDataNet Vocabulary Web services have been set-up to provide 'controlled vocabularies', which are used to mark up the CDI metadata and to label data. These common vocabularies provide access to lists of standardised terms that cover a broad spectrum of disciplines of relevance to the oceanographic and wider community. Using standardised sets of terms solves the problem of ambiguities associated with data markup and also enables records to be interpreted by computers.

Content governance of these vocabularies is very important to stay up-to-date and synchronised with ongoing developments. Therefore a combined SeaDataNet and MarineXML Vocabulary Content Governance Group (SeaVoX) has been set up, moderated by NERC (BODC), and with active membership from experts from SeaDataNet, MMI, MOTIIVE, JCOMMOPS and further international groups. SeaVox operates by mailing list server.

The common vocabularies comprise various lists, such as related to variables, but also other relevant topics, such as sea area names, platform classes, instrument types, and so on. Already the vocabularies comprise various terms from the hydrographic domain, but these have to be validated and where needed, extended for the EMODNET Hydrographic pilot. In practice this will be done by proposing additions or modifications to the international SeaVox governance group, that will respond quickly by accepting or denying proposed items. If accepted, these terms will be added to the operational vocabularies via the SeaDataNet moderator NERC (BODC).

The CDI population and maintenance will include sub-activities:

- Analysis of the formats and local availability of metadata at partners
- Mapping and local editing activities
- Compiling and validating a first test batch of metadata
- Compilation and/or updating of the metadata by the data centres and validation
- Importing into the central CDI directory

These activities will take place in Phase 1 of the project and will provide the data sets, that together form the pilot collection.

Taskleader Greater North Sea area: ATLIS
Taskleader Atlantic Ocean region: NERC-NOCS
Taskleader Mediterranean region: IFREMER

Deliverables :

- Guideline with method and tools for gathering and QC, including algorithms for accuracy, of the data sets from the partners and Hydrographic Offices, agreed as data suppliers, and standards and tools for metadata and vocabularies
- Data sets from partners and HO's available in digital form and described in CDI records

Work package number	WP3								
Work package title	**Quality Control / Quality Assurance and Producing Digital Terrain Models**								
Participant number	1	2	3	4	5	6	7	8	9
Participant short name	MARIS	IFREMER	ATLIS	NERC-NOCS	IEO	GSI	SHOM		
Involved		X	X	X	X	X	X		

Objectives

- To validate and to harmonise the quality of all hydrographic data sets
- To generate a Digital Terrain Model (DTMs) per region of the waterdepth with a width per grid cell of 1000 m
- To generate accuracy and reliability indicators

Description of work:

The partners will use their in-house software packages for the Quality Control of all the collected data sets. These will be configured according to the agreed methodology and accuracy indicators. For the latter algorithms will be agreed for max, min, and variance of data per cell and for confidence limits calculation. A separate Quality Control grid might be defined with reference to input data. The cells will be set to values that indicate the source, density and accuracy of the input data used to obtain the equivalent bathymetry grid cell value.

The QC and DTM production activities will again take place per geographic region with the same partners as taskleaders and involved partners as in WP2:

- The Atlantic Ocean (Channel, Celtic Seas, Western Approaches - task coordinated by NERC-NOCS with contributions from GSI, SHOM and IFREMER
- The North Sea and Kattegat - task coordinated by ATLIS with contributions from NERC-NOCS, IFREMER, and SHOM,
- The Western and Central Mediterranean sea and Ionnian Sea – task coordinated by IFREMER with contributions from SHOM and IEO.

The actual work per region will be illustrated by describing the process for the North Sea region:

North Sea processing as example:

ATLIS will use it's SENS Bathymetry product. This is designed to analyse, validate, store and manage huge volumes of bathymetric data using Oracle Spatial technology. Originally designed by experts from the Canadian Hydrographic Service, Oracle Spatial aids users in managing geographic and location-data in a native data type, supporting a wide range of applications.

A typical bathymetric workflow starts with importing available source data. SENS Bathymetry uses flexible plug-ins for importing survey data. Currently supported formats are: Delimited xyz grid files, Delimited xyz irregular point files, ESRI ASCII Grid file, Trimble Terramodel point data file, Trimble Terramodel polygon data file, QTM/QPD, Binary WSV file, BAG, S-57 (bathy ENC), NetCDF, NGA DTED, USGS DEM, ETOPO etc and ESRI Shape. All dataset are converted to a common data format used for further processing. Quality control takes place using internationally recognised tools such as Fledermaus (by IVS3D) or QLOUD (by QPS). These tools integrate smoothly into the provided solution. Although it is expected that data suppliers will deliver cleaned and validated data sets, using advanced data cleaning and validation software enables the consortium to produce a high quality output dataset for use as background data in EMODNET. Part of the import

process is ensuring that all available data sources are defined relative to a common vertical datum. Although it is preferable to use the ellipsoid reference for this purpose it is unlikely that a good ellipsoid reference is available for the complete EMODNET area. The Project Group will therefore decide on the best approach based on available source data.

Data storage is uses gridding techniques that ensure considerable data reductions whilst accuracy and resolution of the seabed is maintained. SENS Bathymetry uses a flexible and configurable metadata engine. The metadata schema for EMODNET will be based on the SeaDataNet Common Data Index (CDI).

For the North Sea region, SENS Bathymetry will act as both an archive system for the original source data and as a tool for creating and managing a seamless bathymetric surface or Digital Terrain Model (DTM). The width per grid cell will be set to 500 m as requested. Together with the DTM generation, max, min, and variance of data per cell and the confidence limits will also be calculated and indicated. If the accuracies are very good, then it might be considered to make the grid size smaller. r

Note: Multiple surfaces or DTMs can be defined to suit various user communities' needs without the need of duplicating the data. Surfaces are generated based on priority rules that define which dataset takes precedence over which. E.g. recent multi beam data would replace older single beam if more sources are available in the same area. The priority rules are fully configurable and therefore most of the work is completed automatically. Individual results can be adapted if deemed necessary. This functionality will be very useful in future operations, when new background data are acquired and added, for updating the resulting DTM.

The other 2 regional teams will also produce a seamless bathymetric surface or Digital Terrain Model (DTM) and accuracy indicators for their geographic regions, using their own tools, but in a mutually tuned way. The DTM results of their activities will then be transferred to ATLIS for import into the SENS Bathymetry, thereby creating an integrated DTM for all 3 EMODNET regions. The integrated DTM will provide the basis for the EMODNET portal services as will be described in WP4.

Taskleader Greater North Sea area: ATLIS
Taskleader Atlantic Ocean region: NERC-NOCS
Taskleader Mediterranean region: IFREMER

Deliverables :

- All hydrographic data sets processed and quality controlled in the 3 regional background databases
- A Digital Terrain Model (DTM) per region, giving x,y coordinates and waterdepth, with a width per grid cell of 500 m
- Calculated max, min, and variance of data per cell and the confidence limits

Work package number	WP4								
Work package title	**Technical development and operation of the portal**								
Participant number	1	2	3	4	5	6	7	8	9
Participant short name	MARIS	IFREMER	ATLIS	NERC-NOCS	IEO	GSI	SHOM		
Involved	X		X						

Objectives

- To develop and launch the EMODNET website and portal services
- To keep the website and portal services operational, including monitoring

Description of work:

A dedicated website will be developed for the EMODNET Hydrographic portal by MARIS. The website gives background and progress information about the project and is maintained via an online Content Management System. It will also give information on the QC/QA procedures, formats and involved partners.

As part of WP3 for each region a Digital Terrain Model (DTM) has been produced, that have been integrated into the Oracle Spatial database, managed by ATLIS. The Hydrographic portal services will be developed by ATLIS and based on it's SENS Distribution solution, that will be configured on top of the integrated DTM database.

SENS Distribution is a scalable web-based solution for the distribution of bathymetric products (e.g. seafloor DTMs, contours and spotsoundings). It runs in a service oriented architecture and consists of a web portal for the definition and ordering of products, OGC map services and product services for serving maps and pre-defined products and one or more SENS product servers for the generation of user-defined products.

The web portal shows an ENC map with the bathymetry. Both the ENC and the bathymetry are served by a WMS (Web Map Service). The coastline and underwater features will be added as additional WMS layers. After selecting the area-of-interest the user can start the ordering process. The solution provides a great flexibility in products to be ordered. The user can either order pre-defined products or define its own user-defined product.

The pre-defined products are delivered to the end-user within an OpenGeospatial framework. The bathymetry coverages are delivered through a WCS (Web Coverage Service) while the contours and spotsoundings are delivered through a WFS (Web Feature Service).

User-defined products are generated upon the user's request by the SENS product server. Products are prepared for downloading and if required, users are notified by e-mail when the requested product is available. The products are generated on the basis of the detailed continuous seafloor DTM for the 3 regions that is stored in Oracle Spatial and can be delivered in a number of different raster and vector formats.

The web portal runs in a standard browser (IE or Firefox). It is based on Ajax technology to give the web application the responsiveness and interactivity from desktop applications. Ajax combines JavaScript, DHTML, and the XMLHttp behaviour in the browser to provide truly dynamic content on a web page without page refreshes.

For the map functionality and communication with OGC services OpenLayers and Google Web Toolkit (GWT) are used. OpenLayers is a powerful, standards compliant geographic mapping client that runs in a web browser allowing to easily add dynamic maps and information from many other sources to a web site. It is based on Ajax technology and does not require the installation of any plugin. It supports the Open Geospatial consortium (OGC) standards and is capable of rendering maps from Web Map Services (WMS).

The OGC services are implemented with IONIC's RedSpiderWeb. RedSpiderWeb offers a complete set of Java components for deploying WMS, WFS and WCS in a service orientated architecture. IONIC's technologies are 100% based on XML, Java, HTML, and are synchronized with the Open Geospatial Consortium (OGC), ISO, OMG and W3C. The RedSpiderWeb support a variety of different outputs such as GIF, JPG, KML, SVG, GeoTIFF, PNG, GML and shape. Input formats (data connectors) supported by RedSpiderWeb are a.o. Oracle 10R2 (for vector data) and Geotiff (for raster data).

The ordering and product generation process is implemented as a chain of services. This guarantees an open en flexible solution that can be extended and integrated with already existing services (e.g. for authorisation, payment and e-mailing).

Note: SENS Distribution is based on the implementation of the WAB*Info system for the Dutch Waterway Authorities and is further developed for the Norwegian Hydrographic Service (NHS). NHS will use SENS Distribution for disseminating government bathymetric data to expert users outside NHS. The implementation is fully integrated in Digital Norway, the Norwegian Spatial Data Infrastructure and is fully INSPIRE compliant.

The use of open standards enables integration with WISE-Marine. Available OGS services provided by SENS Distribution can be accessed through the WISE-Marine system. The maps will alos be available as WMS services:

- for the prototype European Atlas of the Seas
- to support the broad-scale European Marine Habitats map

The Common Data Index (CDI) services will be integrated into the portal, including its services for requesting background data sets from their distributors.

Phases:
The EMODNET website is launched within 2 months after the project start and also will include an extranet for project documentation. The EMODNET portal services are launched, once the background data sets have been collected and processed and the DTM's have been prepared. This is planned in Month 12, to conclude the Phase 1 of the project.

Thereafter the website and services are kept operational and monitoring data are collected via general web statistics (e.g. via the Open Source software for web statistics AW Stats) and via actual user transactions. This gives useful information about users, and their requests (what and when). That information gives input to WP5 Analysis and Evaluation.

Input is expected from the meeting with the other portals (biological, geological and hydrographic), and WISE-MARINE, which seek for interlinking and tuning functionalities. These upgrades will be undertaken in Phase 3, if feasible and not beyond budget, and added to the portal.

Then, in Phase 4, the website and core services will run operationally for another 12 months, thereby collecting more user feedback. It is expected that the user feedback from WP5 in this phase will generate requests for additional useful and extra functionalities or upgrades of existing features of the portal. These requests will be collected for the analysis report. Selected upgrades will be undertaken in Phase 4, if feasible, not beyond budget and really giving added-value.

Taskleader: ATLIS

Deliverables :

- Dedicated website with project information, maintained by CMS
- OGC compliant Hydrographic portal services for selection, viewing and downloading of hydrographic layers via WMS, WCS and WFS
- CDI service for discovery and requesting of background hydrographic data sets
- Upgraded services
- Monitoring data about visits and usage

Work package number	WP5								
Work package title	**Analysis and evaluation**								
Participant number	1	2	3	4	5	6	7	8	9
Participant short name	MARIS	IFREMER	ATLIS	NERC-NOCS	IEO	GSI	SHOM		
Involved	X	X	X	X	X	X	X		

Objectives

- To report on the effectiveness of the system in meeting the needs of users
- To analyse what further steps need to be taken for improvement, expansion and sustainability

Description of work:

The portal will run in pre-operational mode in Phase 2 and in full operational mode for at least 6 months in Phase 4. During this time statistics will be collected (number of hits, amount and type of data used, purpose for which it is intended). During phase 4 users will be questioned about their experiences and their assessment of ease-of-use and fitness for purpose of the data. A report on intensity of use as well as possible improvements relating to the ease of use of the portal will be submitted as part of the final report. All communications of users by e-mail to the portal will be logged and annexed to the report. Ease of use improvements will be implemented by the end of the contract, if feasible, not beyond budget and really giving added-value.

An analysis of the lessons learned during this project will be prepared, including analysis of:

- The main barriers to the provision of data by data holders – scientific (uncertainties in measuring or obtaining indicator for required parameters), institutional (willingness of bodies to share data), legal (rules limiting access to data), commercial (cost of data), information technology (formats, standards, information systems) and financial (effort required to prepare data). The Project Group will suggest a plan outlining how to overcome those barriers.
- The challenges to rendering data interoperable including different measurement techniques, different baselines, different standards, different nomenclature etc. The Project Group will indicate what steps that might be taken by data holders or the portal operator to improve interoperability.
- The challenges to producing contiguous data over a maritime basin from fragmented, inhomogeneous data and how to overcome these challenges.
- The priorities and effort required for improving the accuracy, precision and coverage of the data collated including a description of how an appropriate data quality assurance and control system can be established.
- The performance of the chosen portal technology in terms of speed of response, user-friendliness.

Finally a set of recommendations will be prepared as part of the final project report describing what would be necessary for the overall EMODNET to remain as a sustained infrastructure. This will cover at least recommendations on:

- availability of standard procedures facilitating data flow,
- maintenance,
- the model for governance by actors in the system,
- the institutional setting,
- required resources including cost.

Taskleaders: MARIS and IFREMER

Deliverables :

- report on the effectiveness of the system in meeting the needs of users
- report on analysis of the lessons learned
- set of recommendations for sustainability of the infrastructure

6/10/05

MARIS

Stamp, date and signature of tenderer

ANNEX 2 TO THE CALL FOR TENDERS MARE/2008/03
"PREPARATORY ACTIONS FOR EUROPEAN MARINE OBSERVATION AND DATA NETWORK"

LOT NO: 1 TITLE: HYDROGRAPHIC DATA

FINANCIAL TENDER FORM

Company name: Mariene Informatie Service 'MARIS' BV	Telephone: +31 70 3004710
Address: Koningin Julianalaan 345A, 2273JJ Voorburg, The Netherlands	e-mail: dick@maris.nl

Tenderers will quote a lump sum for the project.

The price must be a fixed amount, non revisable and including all costs.

Prices must be expressed in euros, not including VAT, and amounts must be quoted to two decimal places.

A. Development Costs Costs incurred for phases 1-3 of project (see section 2.4 of specifications)	€ 800.000,--.
B. Maintenance Costs Costs incurred for phase 4 of project (see section 2.4 of specifications)	€ 175.000,--
TOTAL COST (A+B)	€ 975.000,--

6/10/08

MARIS

Stamp, date and signature of tenderer