



7.0 SECTION G - APPENDICES



APPENDIX A.1

**EIA Instructions:
Instructions for Preparation of an Environmental
Impact Document in the Economic Waters for Installation,
Operation and Maintenance of Submarine Systems, and
Laying of Pipelines in the Leviathan Field Development
Project (Leases I/14 and I/15)**



State of Israel
Ministry of National Infrastructures, Energy and Water Resources
Natural Resources Administration

Ministry of Environmental Protection
Marine and Coastal Division

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**Instructions for Preparation of an Environmental Impact Document in the
Economic Waters for the Installation, Operation and Maintenance of Submarine
Systems and Laying of Pipelines in the Leviathan Field Development Project
(Leases I/14 and I/15)**

Introduction

These Instructions are given for the purpose of preparation of an environmental impact document in the Economic Waters (hereinafter: the "Document") which shall accompany the application for the development plan for the Leviathan Field, for the performance of the laying of pipelines and the construction of submarine natural gas production facilities and gas production operations in Israel's Economic Waters (hereinafter: the "Application").

The Instructions were drafted by the Ministry of National Infrastructures, Energy and Water Resources and the Ministry of Environmental Protection, based on the Framework Instructions for Offshore Exploration Drilling, the Deeds of Lease I/14 and I/15, the environmental impact documents for the construction of similar infrastructures in the North Sea and the Gulf of Mexico, and the guidelines attached to NOP 37/H.

The guidelines relate to laying submarine production infrastructures, laying a transmission / supply pipeline, chemical / service transmission pipeline including communication and power cables, command and control systems, commissioning tests, running in and maintenance, and production until the end of the project's life, in accordance with the development plan submitted for the approval of the Petroleum Commissioner. The guidelines for drawing up the environmental impact survey for the production drillings, production tests and their completion were given separately on October 6, 2014 and in this connection an Environmental Impact Document shall be drawn up and submitted separately. The guidelines for preparing the Environmental Impact Document for development of the Leviathan Field for laying the submarine production infrastructures, laying the transmission / supply pipeline, chemical / service transmission pipeline including communication and power cables, command and control system, production and treatment facilities, storage and offloading (FPSO) unit, commissioning tests, running in and production until cessation of production were



given to Noble on December 1, 2014. The Leviathan Field development plan has been amended such that the fixed treatment and production platform shall be located within the territorial waters at a site approved in the framework of NOP 37/H. These guidelines replace the guidelines for drawing up an environmental impact survey of December 1, 2014.

The Document shall include an Introduction the purpose of which shall be to present an overall picture of the Project, and all of the components thereof. The Introduction shall contain a general description of the Project and the principal components thereof, including production drillings, submarine production infrastructures, transmission / supply pipelines, chemical / service transmission pipelines, command and control systems, treatment and production platform, transmission / supply pipeline, communications / power cables up to connection to the coast and a plan describing the location thereof in the region.

The environmental response to infrastructures in the territorial waters of Israel, including the transmission / supply pipeline, the treatment and production platform, and up to connection to the coast shall be provided in the plan as defined in NOP 37/H.

Information requested with respect to Israel's territorial waters regarding the pipeline alignment up to the platform is intended to provide an overall picture, and is necessary in order to understand the considerations that will determine the pipeline alignment from the field up to the production platform connecting point. It is hereby clarified that while preparing the EIS as per the NOP 37/H, further information or other materials may be required.

The Document shall be prepared in accordance with the details below:

General Requirements

- A. The Environmental Impact Document will be drafted at the responsibility of the Leaseholders, and will include the name of the person responsible for its performance and the names of the professional service providers that participated in its preparation and performance.
- B. The Environmental Impact Document will be prepared and performed by a company with experience and expertise in evaluation of environmental impact and marine research. The Company preparing the Document shall have proven experience in examining the environmental impact of at least 2 projects similar to offshore natural gas development.
- C. The Company that will be selected to prepare and implement the Document shall include experts with proven experience in marine environment research of Israel in the following areas: marine ecology, marine biology, a marine biologist specializing in deep sea systems, marine chemistry, hydrodynamics, sedimentology, geology, geological risks, atmospheric chemistry and marine



geophysics. In the event that the Company is a foreign company, it shall be assisted by Israeli experts with proven experience in the fields of content set out above, (the experience of each of the experts shall be set out in accordance with Table 1 at the end of this Document). The team shall be presented at the time of submission of the Application for the approval of the Commissioner and the Ministry of Environmental Protection.

- D. For the purpose of preparing the Environmental Document, it shall be possible to rely on the most up-to-date information in existence while preparing the Document, including that which is collected in the context of the background survey for development of the Leviathan Field, information from surveys conducted by Noble Energy for exploration and production in the adjacent areas, projects or plans near to the coast, and other relevant information that complies with scientific criteria collected over the past decade.
- E. The author of the Document and the professional consultants shall fill in and sign the appropriate affidavits (Form 1, 2) in the form appearing in Section 14(c) of the Planning and Building (Environmental Impact Studies) Regulations, 5763-2003.
- F. The Environmental Impact Document will be submitted in Hebrew and in English and will include an extended summary at its start, which shall contain the principal findings, conclusions and recommendations for implementation of the Application. Likewise, a full bibliography and the sources of the data used by the authors of the document, separately for each of the environmental aspects, shall also be attached. Submission of the Environmental Impact Document in English shall only be possible after receipt of prior, written consent. In the event that the Environmental Document is submitted in English, an extended summary will be attached to it containing the main findings, conclusions and recommendations for implementation of the Application in Hebrew as well.
- G. The Environmental Impact Document shall be submitted, in accordance with the details set out in the Introduction, in digital form as well (PDF and DOC files). Digital vector maps and the sketches in the document shall also be submitted in DWG (AutoCad) format, and in SHP (ArcGis) format. Ground and aerial photographs (including orthophotos) used for the document shall be submitted in JPEG, TIFF and GeoTIFF or ECW or MrSID formats, in accordance with the kind of result or other format approved in advance and in writing by the Commissioner, acting on behalf of the Ministry of National Infrastructures, Energy and Water Resources. The data shall also be required to be submitted in Excel format, as set out in the Instructions.
- H. Maps and aerial photographs that are submitted on digital media shall be at the highest possible resolution employed in the process of preparation thereof. On the other hand, maps and aerial photographs that are to be prepared for the purpose of preparation of the Document and that are to be attached to the hardcopy of the Document shall be adjusted, in terms of scale, to the guidelines set out in the



relevant section of the Document. The maps shall set out the date of preparation and the name of the entity that prepared and approved them, including the signature of the persons who performed the mapping.

- I. The Document shall contain full reference to every section of the guidelines, in accordance with the order of the guidelines. It should be noted that the process of examining a Document that is submitted incompletely might be delayed until completion of the missing items, and in certain cases, the Document may be returned to the parties who submit it without being examined.
- J. If a particular section is submitted in a format that is different from the requested format, prior written approval for such must be obtained from the Commissioner, and the change as compared with the guidelines must be set out and explained. **For the sake of the efficiency of the process, the Developer is requested to submit reasoned requests for amendment as soon as possible, and not to wait until the formal stage of submission of the Document.** Leaseholders and authors of the Document shall be responsible for including topics, findings or other impacts that are discovered during the course of preparation of the Application and the Document, that are not mentioned in these Instructions.
- K. These Instructions shall constitute a part of the Document, and shall be attached to it as an Appendix.
- L. In order not to cause harm to commercial secrets, confidential information in the Document must be marked in order to enable publication of the Environmental Document without the disclosure of such information. It is clarified that the fact that materials constitutes a commercial secret shall be in accordance with the provisions of the Freedom of Information Law.
- M. The Document must be submitted to the Petroleum Commissioner, in one copy and to the Ministry of Environmental Protection, in two copies, as an edited, continuous and complete paper document, and in digital form as well.
- N. The Document shall be approved by the Petroleum Commissioner and the Ministry of Environmental Protection, who shall be assisted by the relevant entities,
- O. These Instructions shall be valid for three years after the date of their publication, and after this period shall be updated as needed.

1. Chapter A –Description of the Current Maritime Environment to which the Application Relates

1.1. General

- 1.1.1. The existing environmental system is the starting point for forecasting



environmental impacts in the future. The environmental areas set out in this Chapter shall be used later on for examining and describing the possible environmental impacts expected to develop due to development of the Leviathan Field and production of the gas therefrom.

- 1.1.2. The current condition of the marine and coastal environment shall be described in detail, including the scientific knowledge in terms of biological, ecological, chemical, sedimentological, atmospheric, geological, hydrodynamic aspects and aspects related to cultural and heritage sites.
- 1.1.3. The environmental condition of the entire marine area expected to be affected or likely to be affected as a result of the actions must be described in the Application. The area of impact shall be assessed, *inter alia*, in accordance with the current regimen at sea in the various areas. For the purpose of preparing the Document, it shall be necessary to rely on the most up-to-date, relevant and focused information that exists in the professional literature, including environmental material, and on NOP 37/H (Chapters A-B) and the Leviathan Offshore Field Development Background Monitoring Survey –Scope of Work / Sampling and Analysis Plan, April 2014, Israel), and the documents attached thereto. The Plan was prepared in reliance upon Appendix B1(Guidelines for Monitoring the Marine Environment due to Oil and Natural Gas Exploration Activity in Israel, Draft for Public Comment –December 2013), and was approved together with comments and conditions for performance on April 9, 2014 (Leviathan Field - FPSO) and on May 18, 2014 (Transmission Pipeline).
- 1.1.4. The current situation will be presented according to the following regions: The region of the field and submarine production infrastructures, the region of the pipeline alignment from the field to the western border of the continental shelf, the region of the pipeline alignment from the border of the continental shelf to a seabed depth of 100m, the region of the pipeline alignment from a seabed depth of 100m to the connection to the production platform. **If the survey of the alignment shows significant changes in the characteristics of the territory at a higher resolution, the description must be set out in accordance with subdivisions as the case may be.**
- 1.1.5. Additional actions currently being taken in the areas covered by the Application such as shipping, trawler fishing and pelagic fishing, sea sport, various uses in the coastal crossing zone, etc., must also be noted, along with the nature of the interface between such actions and the actions under the Application.

1.2. Boundaries of Application and Area of Influence

- 1.2.1. The detailed area of the Application (blue line) shall include the marine zone that is up to 2 km from all components of the Project, apart from the supply / transmission pipeline. The area of application of the supply/ transmission pipeline will be divided into two sections. section 1: Form the Leviatha field to 1 Km west



of the the continental slope bottom, the application area is 0.3 km from each side of the pipelines ; section 2: 1 Km west of the continental slope bottom to the production platform, the area of application is 1 km on each side of the pipelines. The maritime area will include the water column, seabed and sub-seabed, and the maritime infrastructure and facilities situated at this site.

- 1.2.2. The area of impact of the Application shall include the entire marine zone that might be environmentally affected as a result of ongoing operations or a fault in any of the drilling sites, submarine production systems, transmission / supply / service pipelines (umbilicals), and other necessary facilities, including ecological impacts, acoustic impacts, air quality impact and hazardous materials. **It is clarified that the area of impact varies depending on each of these matters and therefore, the author of the Document must consult with the Ministry of Environmental Protection in order to obtain a specific delineation of the various impact boundaries, prior to preparing the Document.**

1.3. Maps and Orthophoto

- 1.3.1. All maps and orthophotos that are to be prepared for the purpose of the Environmental Document shall be on the New Israeli Grid, and in accordance with the regulations of the Israel Mapping Center.
- 1.3.2. In addition to the above, the location of all components of the Application must be marked on a geographic grid (Lat, Lon and UTM grid) and must be described in detail in words.
- 1.3.3. The distance between the drilling sites, the treatment and production platform, points of reference on the coast (Rosh Hacarmel, Hadera) and the perpendicular distance from the coast must also be noted.
- 1.3.4. A general depth map must be presented at a scale of 1:100,000 of the deep sea off the coast of Israel, with the location of all components of the Application, including the drilling sites, submarine production systems, including transmission / supply pipelines, existing and proposed maritime boundaries and areas, including marine reserves and Defense Regulation lines (the "Defense Regulations of 2005"), existing gas transmission / supply pipelines and shipping routes being noted on it.
- 1.3.5. A series of regional depth maps must be presented at a scale of 1:20,000, at a distance of 2 km from each of the various sites and facilities, as described in the Introduction, apart from the supply / transmission / service pipeline at a distance of up to 0.3 km from the center of the planned alignment for laying the end pipes on either side of the planned alignment within the economic waters up to 1 km west of the bottom of the continental shelf, and 1 km from the center of the planned alignment for laying the end pipes on either side of the planned alignment, and at a distance of 1 km to the west of the bottom of the continental shelf up to connection to the production platform. On the maps, areas of exposed rock on the seabed, the type of soil (for example: clay, silt, sand), fractures, and landslides should be



marked, as well as surface and underwater infrastructures and facilities at each site (these areas should be detailed as required in Section 1.3.7). The differences between the depth contours on the maps shall be 5 meters, and the mapping data shall be the most up-to-date available. If there is information at a distance of more than 2 km, it should also be presented. In sections where the pipeline is to be laid over a considerable distance on a homogenous seabed, mapping of 1:50,000 should be used. For the sake of orientation, a "legend map" should be attached detailing the transition between areas drawn to different scales.

- 1.3.6. If there is maritime agricultural activity within a field of less than 30 km from the transmission / supply / service pipeline, the location of such activity and the location of it and any other adjacent facilities or components must be noted on a map at a scale of 1:50,000.
- 1.3.7. Detailed depth maps of the Application area (blue line) are to be set out at a scale of 1:5,000 around each of the sites, and mark on them the exposed rocky areas, the seabed, the type of ground (for instance: clay, silt, sand), sensitive ecological systems (seaweed carpets, cold springs) and above water and underwater infrastructures and facilities existing in any area. The differences between the depth contours on the maps shall be 1 meter and the mapping data shall be updated to the last decade. The sedimentological characteristics of the seabed shall be based on a granulometric and mineralogical survey which faithfully represents the sediment in the area of the Application on the basis of the background survey, as set out in Section 1.1.3.
- 1.3.8. Maritime transportation and infrastructure systems, electricity infrastructure and facilities, communications and energy lines, corridors, pipelines and terminals for various infrastructures (gas, petrol, hazardous materials, desalination, etc.) in the area of the Application must be set out on a maritime map at a scale of 1:100,000.

1.4. Geological, Seismic and Sedimentological Characteristics

- 1.4.1. A general geological / geomorphological / bathymetric map must be set out at a scale of 1:250,000 of the seabed off the coast of Israel, with the location marked of the production drilling sites, submarine production systems, including the transmission / supply / service pipelines (umbilicals). On this map, mark geological fractures, with an emphasis on fractures that are active or that are suspected of being active. Fractures described as being "suspected of being active" by the Israel Geological Institute or similar entities shall be deemed to be active unless it is proven that they are not active using the usual methods (conduct of research and geophysical cross-sections, and paleoseismological analysis). Likewise, mark locations of historical earthquakes of a magnitude of more than 2.5, areas liable to landslides and other geological and morphological phenomena which are notable.
- 1.4.2. A series of regional geological / geomorphological / bathymetric maps at a scale of



1:20,000, of the seabed around all of the planned facilities must be prepared with geological fractures being marked upon them, with an emphasis on active (young) fractures or fractures suspected of being active, including the Or Akiva Fracture and the average rate of their movement. Furthermore, the location of historical earthquakes of a magnitude of more than 2.5 must be marked, along with areas slated for landslides, instability in the region of the continental shelf as a result of tectonic faults, and other geological phenomena, landslides and activity including the Dor disturbance, exposed rocky infrastructure on the surface of the seabed, and the age thereof, and other geological and morphological phenomena that need to be noted including transportation of sediment, previous sediment slides and activity, shallow gas springs, channels and depressions in the seabed. The distance from the submarine production infrastructure and the anchors thereof, apart from the transmission pipeline, 2 km. The distance at which the data from the transmission pipeline is to be presented, 300 m from the central alignment for laying the pipeline in the economic waters. In segments in which the pipeline will be laid on a homogeneous seabed over a large distance, transition to mapping at a scale of 1:50,000. For the purpose of orientation, attach a “legend map” setting out the transition between the sections that are drawn at different scales.

- 1.4.3. There should be a brief verbal description of the general location of the production drilling sites, submarine production systems including transmission / supply / service pipelines up to the connection to the production platform, with regard to: bathymetry, geomorphology, geology, rock surface (lithology), seismology (historic and contemporary earthquakes over 2.5 magnitude), areas subject to landslides, and other geological and morphological phenomena worthy of mention.

1.5. Geological Risks

- 1.5.1. Provide a brief verbal description of the following geological risk factors: faults (active, suspected of being active, and regular), ground accelerations, possible amplifications, bathymetric inclines, stability of escarpments, underwater channels, liquefaction, tsunami, gas flow.
- 1.5.2. For each of the risk factors described in Section 1.5.1, note the conditions in which they could occur (over time, during earthquakes, and so forth... such as in the case of liquefaction and stability of escarpments). In addition, the degree of severity of each of the risk factors should be described (for example, the map of faults should show faults that are active, suspected of being active, and regular). It is possible to make use of the IS 413 risk maps, and the risk maps drawn up by the Geological Institute for the onshore environments, with the necessary adjustments.
- 1.5.3. Present the pipeline alignment against the background of a summary risk map on a regional scale (1:20,000) describing all the risks in the given area. In sections where the pipeline is laid for a considerable distance on a homogenous seabed, mapping of 1:50,000 should be used.



- 1.5.4. Describe the rocky infrastructure along the pipeline alignment and at the main sites in detail. Present detailed information that could clarify the geotechnical properties of the soil (for example: speed of shear waves, depth to infrastructure rock, properties affecting non-linear behavior, and so on).

1.6. Nature and Ecology

- 1.6.1. Set out the various habitats that exist in the body of water, and in the various seabed environments including hard surface areas, sponge gardens, deep coral reefs, seaweed carpets. A detailed description must be provided of fauna and flora societies in each of these habitats, including coverage percentages, and taxonomic information regarding the identity of species in the region. A map of the various habitats in the area of the Application must be included.
- 1.6.2. The species within the area of the Application and within the area of its impact (as described in Section 1.2.2) must be described including micro and macro algae, seaweeds, seabed dwelling fauna, sedentary or territorial. In addition, describe the coastal natural monuments, as the case may be, situated within the area of the Application and within the area of its impact. The information regarding natural phenomena will be in reliance upon a detailed biological survey (as set out in the approved Background Monitoring Plan –Section 1.1.3), which will be conducted within the area of the Application and impact, and on information, if such exists in this area, from prior surveys. The information included shall be set out in tables, maps, graphs, pictures, video, and shall be accompanied by a detailed verbal description of the findings and with lists of inventory, including scientific names based on taxonomic classification. Note the presence of rare, unique or delicate organisms.
- 1.6.3. The condition of marine mammals, sea turtles, permanent sea birds, migrating birds (based on seasonal and hourly distribution, migration paths, reproduction seasons), and species of pelagic fish located in the region of the planned infrastructure, must be presented in accordance with information from the most up-to-date professional literature and from field surveys and population sizes must be estimated.
- 1.6.4. Pursuant to the above sections, a detailed analysis must be conducted of the information including on the basis of the following issues:
 - 1.6.4.1. Identification of the creatures to a species level or to the most detailed taxonomical level possible.
 - 1.6.4.2. Density of individuals,
 - 1.6.4.3. Richness of species (in the various taxonomic groups),
 - 1.6.4.4. Variety, the appropriate index must be chosen from the acceptable variety indexes such as: Shannon-Wiener, Simpson (2004), Magurran, and give reasons for the choice.



- 1.6.4.5. Fixed and mobile species.
- 1.6.4.6. "Target species": key species, species of commercial value, most common species (breeding season, egg-laying season, area in which drilling operations will be tolerable, heavy metals and organic contaminants in target species).
- 1.6.4.7. Classification of species based on origin: Mediterranean-Atlantic, species with broad geographical distribution, invasive species,

1.7. Sea Water and Sediment Quality

- 1.7.1. Set out the characteristics of the sea water and sediment quality within the area of impact, around each of the planned infrastructure facilities. The information regarding the quality of the seawater and sediment shall be based on a seawater and sediment quality survey (Section 1.1.3) to be conducted in the area of impact of the Application and on additional relevant information if any in this area, from the monitoring plan and previous surveys. The information included shall be set out in maps, graphs and shall be accompanied by a detailed verbal description of the findings.
- 1.7.2. Set out the quantity of floating material in the water column, in a variety of marine climatic conditions (winds, waves, currents). The presentation of this data shall be based on sediment samples in accordance with the details in Section 1.1.3 and on additional relevant information if such exists in this area. The level of turbidity of the water shall be measured at the surface, in the center of the water column and near to the seabed at each of the sites. Likewise, set out the climatic conditions at the time of taking the samples.
- 1.7.3. Set out the levels of chlorophyll in the water column within the area of the Application. Likewise, an assessment of the dispersion of chlorophyll must be conducted over the entire area of impact, using remote sensing methods.
- 1.7.4. Describe, in detail, the chemical characteristics of the water column (dissolved oxygen, pH, salinity, temperature, nutrients), within the area of the Application, submarine production infrastructure and along the transmission / supply pipeline.
- 1.7.5. Describe, in detail, the chemical characteristics of the sediment within the above area of the Application. The description shall focus on toxic substances, on chemical derivatives of heavy metals, TOC, PAH, SBF and their derivatives (including the results of decomposition), oxygen concentration in sediments. The sediment sampling system (the number of stations and their location) will be approved prior to performance as is set out in Section 1.1.3.
- 1.7.6. Likewise, describe the characteristics as set out in Section 1.7.5 of the fauna on the hard bed (if any) and of the fauna on the soft bed and of the fauna within the bed (in filtering animal tissue such as clams, snails, worms, polychaetes and crabs and fishes). The extent of the sampling shall be approved in advance prior to



performance, as set out in Section 1.1.3.

1.8. Culture and Heritage Sites

The information regarding antiquities and cultural heritage sites shall be based on a detailed archeological survey or as a result of processing of a visual survey, a geo-hazard survey, a remote sensing survey (side sonar scanner, multi-beam, ROV movies, etc.), which shall be conducted within the area of the Application and on information that exists regarding the area from prior surveys. The sites known to the Antiquities Authority (both declared and as yet undeclared sites) and other sites containing information about archeological findings or sunken ships from must be included. The total data shall be presented on maps at a scale of 1:20,000, up to a depth of 100 m, and 1:50,000 at a depth of between 100 and 1000 m, and 1:100,000 at a depth of more than 1,000 m, following consultation with the Marine Archeology Unit at the Antiquities Authority, and shall include the archeological sites, pictures, video and be accompanied by detailed verbal descriptions of the findings within the area of the Application and its immediate environs. The approval of the Marine Archeology Unit at the Antiquities Authority shall be attached to the Document as an appendix.

1.9. Meteorology and Air Quality

- 1.9.1. Describe the existing meteorological conditions in the area of the Application and its environs.
- 1.9.2. Special meteorological conditions that might cause conditions of dispersal that will give rise to high air pollution concentrations in the environment must be noted.
- 1.9.3. The air quality data in the region of the Application shall be presented, if any, from either measurements or calculations.

1.10. Noise

- 1.10.1. Set out the magnitude of the sub-marine noise at a number of representative points near to each of the components of the Application.

1.11. Marine Transportation System and Infrastructure

On the basis of Section 1.3.8, describe, in words, the marine transportation and infrastructure system in the region of the Application (the Leviathan field, the submarine production systems, including the transmission / supply / service pipelines (umbilicals). Set out the current operations of the system: Traffic volumes, entry and exit directions of vessels in accordance with the various classes of vessel, fuel containers, fishing boats, maritime farming service boats,



yachts, tugboats and operations vessels, etc.

2. Chapter B –Location and Technology Alternatives and Reasons for Preferring the Proposed Alternative

2.1. General

This Chapter must contain all of the reasons for choosing the proposed sites in the Application for the submarine production infrastructure, for the alignment for laying the transmission / supply / service pipeline (umbilicals), and other planned infrastructures or such that does not appear in the Application. In addition, please refer to geological and seismic, environmental, planning, engineering and economic aspects, such as proximity to existing and planned infrastructures, exploitation of additional natural resources, impact on natural monuments, air quality, noise, etc. Data from drilling operations and development plans effected in the past near to the area of the Application, if any, must also be addressed,

2.2. Location alternatives: Give details of and explain the various reasons that led to the determination of the proposed site of the various infrastructures as set out in Section 2.1. Set out the location alternatives examined, the preferred alternative and the reasons that gave rise to its selection it.

For each location alternative, the following criteria at least will be examined: Structural analysis issues, the size of the field and the location of the target stratum; risk areas on the seabed and in the shallow zone beneath the seabed. Other geological dangers on the seabed such as land disturbances and slides, methane wells, channels, the flow of sediments in channels, high pressure liquid pockets in the seabed; marine reserves; areas defined as special areas such as ridges, channels, canyons or deep reefs of corals, sponges, clams or other sedentary organisms; habitats of animals in danger of extinction; shipping lanes; infrastructure, communications and energy lines; current regime; fish reproduction zones and times; fishing lanes and mariculture zones; the possibility of using additional fields in the transmission infrastructure,

2.3. Technological alternatives: Set out and explain the various technological alternatives examined and the various considerations that gave rise to the decision to use the technology set out in the Application, including:

- 2.3.1. Submarine infrastructure including well heads (such as security systems and well monitoring faucets), jumpers, submarine transmission manifold, service line connection facilities.



- 2.3.2. Transmission / supply, command and control pipelines, from the field up to the boundaries of the territorial waters. Alternatives for the transmission / supply pipeline alignment.
- 2.3.3. The possibility and feasibility of an additional entry point adjacent to the selected alternative should be presented as of 10 km from the borders of the territorial waters and westward. The additional strip shall be identical in width to that presented in its dimensions.
- 2.3.4. In summary of this Chapter, the alternatives shall be set out in a comparison table, with each topic under examination being ranked, according to weight, together with the professional reasons for selecting it. An example of a criteria table is attached in [Appendix B2](#) on the website of the Ministry of National Infrastructures, Energy and Water Resources.

3. Chapter C –Description of Actions Stemming from Performance of the Application

3.1. General

This Chapter shall set out the Application in accordance with the stages of work and construction, including the submarine production infrastructure, the transmission / supply / service pipeline, and other planned infrastructure. Set out the distance between the production drillings, the submarine production infrastructure, from them to the treatment and production platform, from it to the coast and then to the connection point to the coast. The Application must be presented on simulation photographs, on a bathymetric map, noting the distances between the various facilities and infrastructure on the Application, as well as points of reference on the coast. The various sea- and aircraft, their characteristics and the activities that they will perform must also be set out. The description in the Application must relate to all of the work that is done, to the installation and set-up of the infrastructure set out above, the acceptance tests (commissioning), running in, abandonment, dismantling and rehabilitation. The various stages must be set out on a Gantt work plan including milestones and timetables. All of the items of the Application must be set out as examined in Chapter D, and must include subjects, findings or other influences discovered during the course of preparation of the Document,

3.2. Description of the Application

3.2.1. General

Describe all of the facilities in the Application in accordance with the stages of



work and construction, including the infrastructure used by and adjacent to such facilities must be described, as well as the actions involved in setting them up and the auxiliary impacts. The forecast need for future facilities, including compressors, power sources, maintenance and service vessels must also be described,

- 3.2.1.1. Describe the sea- and aircraft involved in the construction stage, including the laying of submarine infrastructure, the laying of transmission pipelines, and the production stage including ongoing maintenance, and periodic treatments,
 - 3.2.1.2. Describe the planned submarine production infrastructure including control infrastructure.
 - 3.2.1.3. Describe the transmission / service, command and control pipeline from the field to the treatment and production platform and up to the production platform.
 - 3.2.1.4. Describe additional planned infrastructures,
- 3.2.2. Development of the field – submarine production infrastructure; transmission / supply pipeline, chemical transmission pipeline; command and control systems (umbilicals).
- 3.2.2.1. Installation of submarine production infrastructure
 - 3.2.2.1.1. Describe the method of installation of the submarine production infrastructure that connects to the various production drillings including jumpers, submarine transmission manifold, collection pipes from the drillings to the submarine manifold and any other submarine infrastructure used for connecting the production drillings to the supply / transmission pipeline, including systems for command, control, transmission of chemicals and emergency shut-down systems.
 - 3.2.2.1.2. Describe the actions required for laying the infrastructure set out in Section 3.2.2.1.1 on the sea bed. Describe the laying of pipeline infrastructure with respect to the seabed, whether and where the infrastructure will be exposed or buried, at what depth it will be buried in the seabed, and in what way it will be anchored to the seabed.
 - 3.2.2.2. Supply / transmission pipelines
 - 3.2.2.2.1. Describe the actions required in order to lay the pipelines for supply / transmission, command and control, transmission of chemicals and the method of laying them from the field to the treatment and production platform up to the border of the territorial waters of Israel. In this context, the various segments and the lengths of them must be set out, and details must be given as to whether excavation actions are required, or other actions due to landslides, marine channels or the crossing of existing infrastructure lines,



including the Tamar field transmission pipeline. Describe the laying of pipeline infrastructure with respect to the seabed, whether and where the pipeline will be exposed or buried, at what depth it will be buried in the seabed, and in what way it will be anchored to the seabed, and whether it will also be laid, in part, in a pipeline cluster.

- 3.2.2.2.2. Set out the cleaning actions required prior to commencement of production and the ongoing maintenance of transmission / supply pipeline, noting the date, duration of cleaning and method of performance thereof. Note the list of chemicals including the type of hydraulic liquid that will be used for operation, present the information sheets, the quantity of liquids / chemicals and the disposal destination.
- 3.2.2.3. Describe the method of construction and installation of other planned infrastructure and their expected impact on the environment.
- 3.2.2.4. Describe the means and methods for discovering leaks.

3.3. Noise Hazards

Set out details of the mechanical equipment and the noise levels from the dominant sources characteristic of each form of technology. Set out details of the duration of the work, the hours of work each day, the number of sea vessels that will operate at the same time, throughout the hours of the day, and the aircraft involved in the work. Set out details of the frequency and magnitude of the noise that will be generated during the course of work at various distances from the source of the noise.

3.4. Hazardous Materials

Describe and set out all of the hazardous materials planned to be used, including anti-freeze, ongoing maintenance, treatment of faults, during the run-in and production stages. The following details must be noted for each material:

The chemical composition, the commercial name, the CAS (Chemical Abstract System) number; the UN number; the Material Safety Data Sheet (MSDS), the quantity, the purpose of use and method of use, their location (together with a chart), storage and collection, method of treatment and disposal. The data must be set out in a table of chemicals.

3.5. Geological and Seismic Risk Assessment

The risk to the submarine production infrastructure, the transmission / supply pipelines, the chemical transmission / service pipelines, the command and



control systems, as a result of exposure throughout the entire period of their operation to geological phenomena and tsunamis, as described in Sections 1.4, 1.4.1, 1.5, 1.5.4 must be assessed. Furthermore, a specific site survey must be performed for the development of seismic parameters which shall be performed in accordance with the provisions of ASCE-7-05, Chapter 21 (Appendix E to Amendment 5 of Standard 413), in compliance with the following requirements:

- 3.5.1. A seismotectonic analysis in order to determine the level of the seismic load on the bedrock as a result of model earthquake. Model quakes (repeat times or repeat intervals) are given in the codes relevant for the construction of marine platforms and pipelines.
- 3.5.2. Amplification coefficients, the response spectrum and the level of sensitivity to liquefaction will be calculated on the basis of geotechnical characteristics which will be measured during the course of investigation of the ground.
- 3.5.3. Subsoil exploration for the purpose of defining those areas of the Application which are subject to potential liquefaction.

3.6. Abandonment of the Field and Dismantling of the Infrastructure

- 3.6.1. Describe the details of the actions required at the time of termination of production, and the order of performance thereof, including permanent abandonment or temporary abandonment, dismantling of infrastructure.
- 3.6.2. Submarine production infrastructure, the transmission / supply pipelines –the principles of the dismantling plan of the submarine production infrastructure and other relevant infrastructures and the date of submission of the detailed plan must be presented.

4. Chapter D – Evaluation of the Environmental Impacts Expected to Develop Due to Performance of the Application and Measures to be Taken to Prevent / Minimize Such

In this Chapter, the various topics expected to have an environmental impact shall be set out graphically and verbally, including impact on moving or stationary species within the areas of the Application and its close and remote environs, in accordance with the provisions of Section 1.2.2. This description of the environmental impacts and the sources thereof shall be qualitative and quantitative, and shall refer to all of the actions and impacts set out in Chapter C. Set out the variety of actions expected to take place in the Leviathan Field and in the auxiliary infrastructure thereto during the construction process, the acceptance tests (commissioning), run-in, production (in ongoing operation and during faults), and upon completion of production, abandonment of drillings and dismantling of



infrastructures. With respect to each subject, an explanation shall be given as to whether it is necessary to prevent or reduce the negative environmental impacts and what means must be employed in order to prevent or reduce such, if any,

In the event that during the course of preparation of the Application, influences or other findings are found that are not mentioned in this document, these must be addressed and means must be proposed for reducing the impact in the Document,

A safety and environmental management system (SEMS) must be set out, detailing the means and methods for reduction and prevention of the hazards for those actions that give rise to environmental impacts that are considered to be undesirable or unacceptable (unacceptable impacts must be prevented permanently or reduced to acceptable levels), and a complete response will be given for the fact that development and production of the field will not cause unnecessary environmental harm.

4.1. Assessment of Potential Impact on Marine Environment

4.1.1. Submarine production infrastructure and transmission / supply pipeline.

- 4.1.1.1. Assess the impact of the pipeline on the fauna on the seabed, Set out the impacts in accordance with the characteristics of the seabed in the various segments, Set out the principles of operation and the work processes in cases in which there is a need to divert the pipeline from sensitive areas.
- 4.1.1.2. Calculations shall be presented regarding the stability of the pipeline in various segments, and with respect to extreme storm conditions. The storm values that are tested shall be coordinated in advance and in writing.
- 4.1.1.3. Measures and alternatives shall be presented for the prevention of damage to the transmission / supply pipeline, the chemical transmission pipeline, the command and control systems, due to all risk factors (such as: earthquake, landslides or other geological event, the weighing of anchors in the area of shipping lanes, trawler fishing, crossing existing infrastructures, etc.), such as an external concrete casing, concrete mattresses, rock dumping, etc. (note: **rock dumping** shall require a permit for the disposal of waste into the sea, in accordance with the law),

4.2. Environmental Impacts of a Sea Pollution Event by Oil Based on Extreme Scenarios

4.2.1. The change in the current field and in the movement of the oil stain from the place



of the leak, including the transmission / supply pipeline and the submarine production infrastructure, must be set out in detail and in stages from the production bores along the coast of the Eastern Mediterranean Sea, from the Gaza Strip in the south to the coast of southern Lebanon in the north, and west to the coast of southern Cyprus. This description should rely, *inter alia*, on the results of activation of a three-dimensional hydrodynamic model, which has been fed with wind data and the other necessary hydrodynamic characteristics. The hydrodynamic model must set out, precisely, the field of currents in accordance with the layout of the local seabed.

- 4.2.2. Presuming that the oil slick, based on the findings of the hydrodynamic model, is likely to penetrate the shallow portion of the continental shelf off the coast of Israel, describe via the appropriate hydrodynamic model for simulating the hydrodynamic processes in the coastal environment the current regime in the area affected mainly by local winds and waves, and analyze the impact of such currents on dispersal of the oil slick on the coastal environment.
- 4.2.3. In running the model and in all of the calculations derived therefrom, please take into account the worst-case scenario of 30 continuous days of discharge into the marine environment, at a maximum daily capacity in accordance with the facility data. The type of oil in the model must be the most resilient oil expected in the reservoir.
- 4.2.4. Please run each of the four most common sea conditions on Israeli beaches for a period of 30 days:
 - 4.2.4.1. Extreme winter wave storm: 9.12.2010 - 08.01.2011
 - 4.2.4.2. Winter wave storm: 26.01.2008 - 14.02.2008
 - 4.2.4.3. Summer swell: 17.07.2008 - 16.08.2008
 - 4.2.4.4. Strong North-Easterly wind (Spring and Autumn): 25.09.2007 - 25.10.2007
- 4.2.5. Please explain in clear detail all of the data and estimates for the maximum daily quantity of oil set out in the document, and the general quantity during the course of the current scenario, without 30 day control, including formulas and calculations. Please clarify the objective difficulties in evaluating the expected quantities and the possible areas of imprecision. Please address the relevance of the modeling method performed and expand, in the explanation, on the relationship between the results of the model and the actual anticipated assessment based on international knowledge and experience from past oil pollution incidents. Explain the nature of the oil spill over the water, including the thickness and expected spread of it, and the environmental significance of the thickness and spread of the spill.
- 4.2.6. Please analyze, on the basis of the findings of the model, the results of the spread of the oil stain from the drilling bore and give a detailed explanation of the



environmental significance of the results of the model. Please refer to the marine environment in general and to the coastal area and the various sites therein in particular. Give details and explain the environmental and other implications that might arise from an oil spill incident at sea under the various scenarios, vis-à-vis the various environments, including a description of sensitive areas that might be affected by a pollution incident (based on a map of sensitivity of beaches to sea pollution by oil. The map is accessible on the Internet and a copy may be obtained from the Marine and Coastal Division as a GIS layer). Address the various significances, including:

- 4.2.6.1. The impact on the ecosystem in general, and on the various species in particular.
 - 4.2.6.2. The impact of the various uses including an assessment of the measures required to remedy the damage and to restore the previous condition, an assessment of the length of time during which uses might be harmed and a general assessment of the costs of restoring the previous condition, all in accordance with open reports of international experiences.
 - 4.2.6.3. Please address the following environments: The open sea environment, including a distinction between deep water and the critical transition zone, the seabed, beaches used for swimming and leisure, rocky beaches and/or sandy beaches that are rich in biota, marinas, moorings, marine anchorages and ports, power station cooling water suction plant and coal terminal, reverse osmosis plants and fish farm cages.
- 4.2.7. Set out an oil spill spread model (name of model, name of manufacturer and representative calibration data), and output data, for the prior approval of the Ministry of Environmental Protection (Marine and Coastal Division), prior to running the model. For the purpose of approval of the calibration stage, please set out a document describing, in detail, the boundary conditions and the starting conditions of the model, and the various variables and non-variables chosen for the purpose of running the model. The following are the details, variables and conditions that are required for the approval:
- 4.2.7.1. General
 - 4.2.7.1.1. Name of the model.
 - 4.2.7.1.2. Brief description of the model.
 - 4.2.7.1.3. Reasons for adapting the proposed Eastern Mediterranean Sea (oil) spill simulation model.
 - 4.2.7.1.4. Examples from around the world for use in the proposed spill simulation model.
 - 4.2.7.2. Meteorological-physical conditions and variables
 - 4.2.7.2.1. Conditions of edge of model (boundaries and surface)



- 4.2.7.2.2. Conditions of commencement of model.
- 4.2.7.2.3. Resolution of model, both horizontal and vertical.
- 4.2.7.2.4. Characteristics of starting data for model: winds, currents, sea level, temperature, salinity, etc.
- 4.2.7.2.5. Bathymetry.
- 4.2.7.3. Chemical variables
 - 4.2.7.3.1. Type of oil.
 - 4.2.7.3.2. Quantity of oil emitted per unit of time.
- 4.2.7.4. Calibration and verification of model
- 4.2.7.5. Methodological description and explanation of the proposed method of calibration.
 - 4.2.7.5.1. Presentation of the variables required for calibration for the purpose of achieving the requisite model performances.
 - 4.2.7.5.2. Presentation of calibration findings (in figures, tables, and a verbal explanation).
 - 4.2.7.5.3. Methodological description and explanation of the proposed method of verification.
 - 4.2.7.5.4. Presentation of verification findings (in figures, tables, and a verbal explanation).
- 4.2.7.6. Scenarios for examination
 - 4.2.7.6.1. Analysis of the usual and extreme hydrodynamic characteristics in the area and environs of the drilling bore.

4.3. Noise

The expected noise impact on fauna throughout all of the production stages must be assessed; the impact of the noise from installation of the transmission / supply pipeline during run-in and production must be assessed as well. Details must be given of the local species that might be harmed by such noises (with an emphasis on pelagic animals such as fish, whether wild or caged, marine mammals, turtles), and measures for reducing damage.

4.4. Nature and Ecology

- 4.4.1. Assess the level of sensitivity of the animals and the possible impacts of the laying of the submarine production infrastructure, the laying of transmission / supply



pipelines, chemical transmission pipelines, command and control systems, on habitats as described on the habitat map in Section 1.6.

- 4.4.2. Describe and assess the possible impact of production on habitats as described on the habitat map in Section 1.6, including physical impacts and the cumulative impacts of production drillings, submarine production infrastructure, transmission / supply pipelines, chemical transmission pipelines, command and control systems. Address, *inter alia*, the question of fouling and the establishment of invasive species and the generation of a situation of a fish aggregating device.

4.5. Culture and Heritage Sites

Examine the impact of implementation of the Application on declared sites and on sites that may be discovered and exposed during the performance of the Application, as described in Section 1.8.

4.6. Hazardous Materials

- 4.6.1. Set out the measures for reducing risks from hazardous materials in accordance with the details in Section 3.4 above.
- 4.6.2. Describe and set the measures for treatment in the event that hazardous materials are discovered during the course of the drilling, including H2S.
- 4.6.3. Set out the method of treatment in emergencies (hazardous material event) and the means for minimizing risks.

4.7. Measures for Reduction of Geological and Seismic Risks

- 4.7.1. Set out the measures and mechanisms, both automatic and manual, which will respond to an early warning of earthquakes or tsunamis.
- 4.7.2. Set out the measure for prevention of damages due to liquefaction, landslides and other phenomena as set out in Sections 1.4, 1.4.1, and 1.5 and in accordance with the risk analysis and assessment performed in Section 3.5 above, including the identification of discontinuity, dynamic change of geotechnical stability of the seabed.
- 4.7.3. Prepare emergency procedures or a chapter of existing emergency procedures for the handling of earthquakes. These procedures must address all exceptional situations, including: failure of communications and contact, inability to reach emergency forces, partial emergency team, etc.



4.8. Fishing and Marine Farming

- 4.8.1. In accordance with the findings set out in Section 1.6, set out the impact of the submarine production infrastructure, transmission / supply pipelines, chemical transmission pipelines, command and control systems on fishing operations and the methods of reducing such impacts in the event of harm to fishing operations.
- 4.8.2. Suggest methods of preventing overfishing in the region of fish-attracting marine facilities, and set out the safety and fishing prohibition distances required from the pipeline.

4.9. Safety and Protection

Estimate the safety range required around the submarine transmission / supply infrastructures and pipelines to protect against harm to existing infrastructure and seacraft during the course of development of the field, installation of the production infrastructure, and production.

4.10. Monitoring and Control Program

- 4.10.1. Describe the various means of monitoring and control for air, water, the seabed, flows, production by-products, transmission / supply / service pipelines (umbilicals) and all sources that are discharged into the sea, which will ensure that the development of the field, construction of infrastructures and production are performed in accordance with the plan, that faults or defects are located and that actions are taken to remedy such. Note, *inter alia*, what tests are planned to be done continuously, which are done visually and which are done in laboratories on the infrastructure, which are done at external laboratories, and at what frequency.
- 4.10.2. Describe the method of taking samples in order to obtain representative samples, for continuous / visual / laboratory sampling.
- 4.10.3. Describe the calibration and maintenance actions on monitoring and control instruments.
- 4.10.4. Present a marine environment background monitoring plan in accordance with the Background Monitoring Plan approved as set out in Section 1.1.3.

4.11. Abandonment and Dismantling of the Infrastructure

Examine the impact of shutdown of the production and performance of the actions set out in Section 3.6 on the environment and the means required to prevent such impacts, including the removal of materials, equipment and waste.



5. Chapter E – Proposed Instructions for a Plan for Preservation and Prevention of Harm to the Application Environment

General:

- 5.1. This Chapter shall set out all of the proposals for setting the Application guidelines, at the level set out as being required for detailing the possible impacts set out in the chapters of this Document, and the measures that are to be taken if necessary in order to prevent or reduce such impacts.

- 5.2. The guidelines shall refer to the actions that must be taken or not taken in the entire area of the Application, during the course of and throughout the various stages of development and production of the field, during the construction or installation of the infrastructure, production, abandonment and dismantling. The guidelines shall relate to all of the aspects set out in Sections 5.3 and 5.5 regarding the construction stages, acceptance tests, run-ins and operation of the submarine production infrastructure, the supply / transmission pipeline, the chemical transmission / service pipeline, command and control systems, up to the border of the territorial waters of Israel and shall be submitted in accordance with the provisions of the Introduction to these Instructions and in accordance with the provisions below.

- 5.3. The guidelines shall relate to the installation and operation of systems to track and monitor the effects that flow or that may flow from this Application within the Economic Waters,

- 5.4. Supplementary information, data, geotechnical parameters, etc. that are required in order to complete the risk assessment.

- 5.5. The Instructions shall relate to actions that must be taken in the entire area of the Application, upon the making of a decision to effect acceptance tests, run-ins and production, until cessation of such production, closure of the production drilling, abandonment and dismantling of the infrastructure within the area of the Application, and shall include, inter alia, the following matters:
 - 5.5.1. Instructions for the various stages of performance of the Application.
 - 5.5.2. Instructions for the handling of hazardous materials.
 - 5.5.3. Instructions for the reduction and prevention of harm to land and to seawater and



- the coastline, and including harm to the marine ecology, heritage and cultural sites, fishing and marine farming.
- 5.5.4. Instructions for preservation of fauna and flora in the area of the Application including instructions for the prevention of harm to habitats, to pelagic species whose presence around the production platforms might be increased, such as sharks, marine mammals and birds.
 - 5.5.5. Instructions for the collection of data for the purpose of monitoring and follow-up of seawater quality, the form of the seabed, the depth of coverage of the sandy layer above the pipeline, the state of the transmission / supply pipeline, the quality and quantity of the sediment, the current regimen, the flora and fauna and mariculture in the environment of the production facilities and the pipeline auxiliary thereto, and actions that will be taken if the data points to deviations or faults that might cause harm to the environment. The Instructions shall be proposed separately for the construction stage and for the operations stage of the facilities.
 - 5.5.6. Instructions for measures for preventing or reducing noise.
 - 5.5.7. Instructions for the definition of safety and protection zones and the management of safety against harm to existing infrastructure and sea vessels.
 - 5.5.8. Instructions for preparation of emergency procedures in the event of faults or accidents, including submission of a factory emergency plan for the treatment of oil pollution events at sea, gas explosion, fire, dangerous geological event (earthquake, landslide, and other relevant events), hazardous materials events, detection of H₂S.
 - 5.5.9. Instructions for the reduction of geological and seismic risks and reference to up-to-date relevant standards.
 - 5.5.10. Instructions for protection of the transmission / supply pipeline and the maintenance thereof after being laid, including procedures for periodical tests, so as to ensure the prevention of corrosion, the location of exposure of pipes that were buried, the location and prevention of leaks, the location of downcutting of the seabed in the vicinity of the pipelines, the lifting of pipelines due to liquefaction and exposure, and treatment of pipelines that have become exposed, or of downcutting of the seabed.
 - 5.5.11. Instructions for actions to be taken when shutting down and rehabilitating a production bore, termination of production in the entire field and dismantling of the infrastructure, and the date of submission of a detailed abandonment and rehabilitation plan.
 - 5.5.12. Instructions for periodical reporting of faults or exceptional incidents to the Petroleum Commissioner, and of environmental issues to the Ministry of Environmental Protection.
 - 5.5.13. Instructions relating to changes in the development plan and examination of the impact of such on the environment and details of the updates required as a result of



such changes.

- 5.5.14. Instructions for implementation of an Safety and Environmental Management System (SEMS), including updating the system for subcontractors.
- 5.5.15. Instructions for the setting up of a team to accompany the Application, and the composition thereof.

For the purpose of proof of compliance by the members of the proposed team with the conditions of education and experience required under the General Requirements of Section C, please attach, as an Appendix to the Document, the CV of each of the experts and the information required in accordance with the details in Table 1 below:

Table 1: Details of Experts, Experience and Professional Knowledge

Position of Expert	Name of Expert / Company	Education	Field of Experience	Years of Practical Experience	References Attached

* Fill in the table by typing in on a computer and not by hand.



APPENDIX A.2

Leviathan Production EIA Team Summary and Experience (Curriculum Vitae)



Details of Experts, Experience, and Professional Knowledge of EIA Preparation Team As required per Instructions (in Appendix A.1 of this Report)

POSITION OF EXPERT	NAME OF EXPERT / COMPANY	EDUCATION	FIELD OF EXPERIENCE	YEARS OF PRACTICAL EXPERIENCE	REFERENCES ATTACHED
EIA Project Manager (All Chapters)	Safina Jivraj	<ul style="list-style-type: none"> • MSc Environmental Engineering (Imperial College University of London) • BEng (Hons) Chemical Engineering (University College University of London) 	Environmental Skills Group Manager [Environmental Engineering / O&G Pollution Prevention and Control/ EIA Management-International Projects]	20	CV
QA / QC (All Chapters)	Giselle Naylor	<ul style="list-style-type: none"> • BSc (Hons) Chemistry 	Senior Consultant Environmental [Environmental Engineering/ EIA Management-International Projects]	33	CV
Co-author (All Chapters)	Mathieu Neale	<ul style="list-style-type: none"> • MSc Environmental Impact Assessment and Auditing, Norwich • BA Hons Environmental Geoscience, London 	Consultant Environmental [Environmental Engineering/ EIA Management-International Projects]	16	CV
Co-author (Chapters B-C)	Simon Beckett	<ul style="list-style-type: none"> • MEng Chemical Engineering (University of Bath) 	Environmental / Process Engineer	3	CV



POSITION OF EXPERT	NAME OF EXPERT / COMPANY	EDUCATION	FIELD OF EXPERIENCE	YEARS OF PRACTICAL EXPERIENCE	REFERENCES ATTACHED
Co-author (Chapters D&E)	Kayleigh Hughes	<ul style="list-style-type: none"> • MSc Marine Environmental Protection • BSc Zoology with Marine Zoology 	Marine Scientist/ EIA Specialist	8	CV
Co-author Chapter D& E	Ross Cormack	<ul style="list-style-type: none"> • MA (Hons) Environmental Geography (Aberdeen University) • MSc Ecological Design (Robert Gordons University Aberdeen) 	Consultant Environmental Engineer/ EIA Specialist	12	CV
Co-author, Chapter D	Perry Hanson	<ul style="list-style-type: none"> • MSc Chemical Process Engineering (Hons) (University College London) • BSc Chemical Engineering (University of Idaho) 	Environmental Modelling Specialist/ Environmental Engineer	6	CV
Oil spills leak rate (PHAST Modelling Input)	Samuel Richardson	<ul style="list-style-type: none"> • MEng Engineering, Durham University • CEng, Institute Mechanical Engineers • Certified Functional Safety Expert, Exida 	Technical Safety Specialist	11	CV



POSITION OF EXPERT	NAME OF EXPERT / COMPANY	EDUCATION	FIELD OF EXPERIENCE	YEARS OF PRACTICAL EXPERIENCE	REFERENCES ATTACHED
Co-author, Chapter A	Larry Reitsema, Ph.D. / CSA	<ul style="list-style-type: none"> • Ph.D., Marine Biology/Toxicology, Texas A&M University, 1981 • M.S., Fisheries, Texas A&M University, 1975 	Marine Biology / Toxicology, Environmental Impact Assessment, Risk Assessment, Oil and Gas HSE Management	39	CV
Co-author, Chapter A	Kathleen Gifford / CSA	<ul style="list-style-type: none"> • M.S., Chemical Oceanography, Florida Institute of Technology, 2009 • B.S. Marine Sciences, Richard Stockton College of New Jersey, 2007 	Chemical Oceanography, Marine Science, Water Quality Assessment, Quality Management	5	CV
Co-author, Chapter A	John Tiggelaar / CSA	<ul style="list-style-type: none"> • M.S., Biology, Old Dominion University, 2012 • B.A., Biology, Wittenberg University, 2008 	Marine Ecology, Marine Environmental Monitoring, Environmental Impact Assessment	4	CV
Co-author, Chapter A	Elad Mills / CSA	<ul style="list-style-type: none"> • M.S., Environmental Studies, Tel Aviv University, 2012 • B.S., Marine Sciences & Biotechnology, Ruppin Academic Center, 2009 	Marine Environmental Science, Field Engineering, Marine Environmental Monitoring	3	CV



POSITION OF EXPERT	NAME OF EXPERT / COMPANY	EDUCATION	FIELD OF EXPERIENCE	YEARS OF PRACTICAL EXPERIENCE	REFERENCES ATTACHED
Science / Technical Reviewer, Chapter A	Brian Balcom / CSA	<ul style="list-style-type: none"> • M.S., Biology (Marine Biology emphasis), University of Southern California, 1980 • B.S., Biological Sciences, University of Southern California, 1975 	Marine Benthic Ecology, Environmental Impact Assessment, Environmental Engineering	40	CV
Technical Reviewer	Deborah Fawcett / CSA	<ul style="list-style-type: none"> • M.S., Marine Science, University of South Alabama, 2003 • B.A., Biology, Wittenberg University, 2000 	Marine Benthic Ecology, Marine Habitat Restoration, Environmental Impact Assessment	11	CV
Marine Archaeological Assessment of Sonar Contacts	Shelley Wachsmann, Ph.D. / Texas A&M University	<ul style="list-style-type: none"> • Ph.D., Near Eastern Archaeology, Institute of Archaeology, Hebrew University, Jerusalem, 1990 • M.A., Near Eastern Archaeology, Institute of Archaeology, Hebrew University, Jerusalem, 1984 • B.A. Near Eastern and Classical Archaeology, Institute of Archaeology, 	Professor of Biblical Archaeology	38	CV



POSITION OF EXPERT	NAME OF EXPERT / COMPANY	EDUCATION	FIELD OF EXPERIENCE	YEARS OF PRACTICAL EXPERIENCE	REFERENCES ATTACHED
		Hebrew University, Jerusalem, 1974			
Science / Technical Reviewer	Yossi Azov, Ph.D. / CSA	<ul style="list-style-type: none"> • Ph.D., Environmental & Water Resources Engineering, Technion – Israel Institute of Technology, 1979 • Master of Human Environmental Sciences, Hebrew University of Jerusalem, Israel, 1975 • Bachelor in Biology, Hebrew University of 	Marine Pollution, Environmental Engineering, Land Use, Environmental Impact Assessment, Water Quality, Environmental Monitoring	34	CV



POSITION OF EXPERT	NAME OF EXPERT / COMPANY	EDUCATION	FIELD OF EXPERIENCE	YEARS OF PRACTICAL EXPERIENCE	REFERENCES ATTACHED
		Jerusalem, Israel, 1973			
GIS, Maps, and Figures	Brent Gore / CSA	<ul style="list-style-type: none"> • M.A. Geography, East Carolina University, 2013 • B.A., Geography, University of North Carolina, 2009 	Geospatial Analysis, Database Management, Cartography, Remote Sensing	3	CV
Technical Editor	Kim Dunleavy / CSA	<ul style="list-style-type: none"> • A.A.S Electrical Engineering Technology, State University of New York at Farmingdale 	Technical Editing	25	CV



CV – SAFINA JIVRAJ



Safina Jivraj

Genesis Environmental Skills Group Manager London

PROFILE

Number of years' experience: 20

Genesis Grade: E0

Education and Qualifications: M.Sc. in Environmental Engineering, B.Eng. (Hons.) in Chemical Engineering, IEMA Approved Lead Environmental Auditor Certification, Sintef Accredited for DREAM and PARTRACK. Approved ENVID Chairman for Centrica

Professional Affiliations: Institute of Chemical Engineers IChemE and IEMA

Languages: English

Safina Jivraj has over 20 years' experience in the oil and gas industry. Safina is the London Environmental Skills Group Manager and is responsible for leading and managing the Environmental team in London. Her responsibilities include the overall administration and technical direction of the group; placement of staff; improvement of department working procedures; the development of the environmental business within Genesis, producing and reviewing man-hour proposals and expenditure on projects; and providing a technical quality assurance role on environmental delivery for each study and/ or project which runs out of the London office.

Safina has extensive technical experience in providing environmental consultancy, having worked on a diverse range of projects both in the UK and overseas with sector experience in onshore/ offshore O&G; Refineries; LNG, GTL, unconventional O&G and Master planning. Safina is proficient in providing environmental engineering support on consultancy studies, projects and assets through their lifecycle, adding value to our clients. Her expertise includes:

- Regulatory reviews
- Permits and consent plans
- Project environmental scope development,
- Technical environmental design,
- Environmental option screening,
- ESIA subcontractor's management,
- Environmental audits reviews and environmental evaluation.
- Environment, health & safety (EHS) management system
- Environmental & Social Impact Assessment (ESIA) and BAT Assessments
- GHG Studies and Energy Efficiency studies
- Scoping offshore environmental baseline survey
- Government agency stakeholder engagement & environmental approval process
- Environmental mitigation plan management
- Social and environmental risk compliance for project financing (IFC, OPIC, Equator Principles)
- Environmental Due Diligence studies for lenders
- Emergency response & oil spill response management (ICS/NIMS)
- Noise modelling, Air dispersion Modelling and PW discharge modelling

Working knowledge of environmental requirements in countries include Abu Dhabi, Algeria, Australia, Bahrain, Benin, Brazil, Cyprus, Egypt, Falkland Islands, Former Soviet Union, Ghana, Germany, Greenland, India, Israel, Kazakhstan, Nigeria, Norway, Qatar, Russia, Saudi Arabia, Serbia, Thailand, Trinidad and Tobago, Togo, Uganda, UK, USA and Vietnam.

Safina is extremely motivated and has recently gained an IEMA Approved Lead Environmental Auditor qualification, is certified in using DREAM (PW modelling) and PATRACK (cutting modelling) and has been trained



to use OSCAR (for oil spills modelling). Safina also is able to conduct in-air noise modelling using PREDICTOR and has working practice in Microsoft packages including Projects and technical packages ISC/AERMOD/SCREENS Air Dispersion Modelling, Cormix, Hysis, AutoCad.

Safina co-published an article in the TCE on “Operator response to changing OSPAR regulations” Aug 2012. This article was in response to gaining interest in our produced water modelling capabilities which is used as a decision making tool in design. The model supports changes in current thinking regarding operational discharges to the marine environment, adopting a whole effluent based analysis (rather than an indicator pollutant approach) in assessing Environmental risk of PW discharge.

Safina is a credible environmental engineering professional and has delivered successfully in all engineering phases with technical competence.

CAREER HIGHLIGHTS

2009 - Present | Genesis
2008 - 2009 | SJB ASSOCIATES LTD
2006 - 2008 | Genesis
2002 - 2006 | NEXANT LTD
1996 - 2002 | BECHTEL LTD

GENESIS (SELECTED) EXPERIENCE

Career Experience with Genesis | Jun 2006 – Present

Noble Energy: Leviathan Development EIA (on-going) |

Safina project management and co-ordinated the development of the Leviathan gas field development EIA. The Leviathan field is located in Israel's exclusive economic zone of the Eastern Mediterranean with its production platform located within territorial waters (within the TAMA designated zone). Leviathan is being developed to supply gas to both the Israeli domestic gas market and regional gas importers. This EIA was prepared to meet Ministry of National Infrastructures, Energy and Water Resources (MNIEWR) and the Ministry of Environmental Protection (MoEP) requirements, in line with their instructions for Preparation of an Environmental Impact Document in the Economic Waters for the Installation, Operation and Maintenance of Submarine Systems and Laying of Pipelines in the Leviathan Field Development Project (Leases I/14 and I/15)", dated April 14th 2016. EIA Study due date: 15th July 2016.

Duqm Refinery: IFC Compliance and Lender Support (ongoing) |

Safina project management and co-ordinated the development of the IFC Compliance and Lender support scope on behalf of Duqm refinery. Duqm refinery is a joint venture between the state-owned Oman Oil Company and the International Petroleum Investment Company (IPIC). The new Refinery is located adjacent to an industrial development at Duqm, approximately 600km south of Muscat on the Arabian Sea coast of Oman within the SEZAD. The Refinery is dependent on a number of associated facilities including the provision of crude oil via a pipeline from the Ras Markaz Oil Terminal; natural gas is supplied via a pipeline (by others) to feed the Hydrogen Production unit and supplement the refinery fuel gas system; electrical power and desalinated water will be imported across the Refinery fence from Centralised Utility Company (CUC); Refinery's Wastewater will be discharged to common outfall facilities and products exported via pipelines to the Port of Duqm where they will be stored and then loaded onto ships by Duqm Petroleum Terminal Company (DPTC). The solid products of petroleum coke and sulphur will be transported by trucks to DPTC. An Environmental Impact Assessment (EIA) has been separately prepared for the Project by HMR Consultants to meet the Omani regulatory requirements, and in support of the Project seeking external financing, HMR have additionally prepared a separate report to determine the Project EIAs compliance with the Equator Principles III (prepared and submitted during FEED stage design in 2015) which Safina was required to review and offer she expert advice. Subsequent to this, a Genesis team, under the supervision of Safina was engaged to undertake a detailed evaluation of project FEED stage documentation gaps against the IFC Performance Standards as well as those requirements of 5 export credit agencies and corporate governance provided by the OECD. The results of this report highlighted a number of priority actions (ahead of EPC award in Q1 2017). Assistance in delivering against the identified gaps (ie: development of a corporate ESMS Manual and corporate procedures, stakeholder identification and tactical plan for stockholder engagement, a resettlement technical note, environmental and social performance competency



matrices, job descriptions and training and development plan. All of which strengthen Duqms corporate Env and SP capacity to guide contractors and reduced lending risk.

Centrica: Morecambe Hub Lifecycle Project – DP6 & DP8 FEED (ongoing) |

Chaired ENVID workshop with a multi-disciplinary group of project personnel including Client engineering, operations, decommissioning and environmental representatives. Prepared ENVID report.

Delonex Energy: Environmental and Social Due Diligence Study (ongoing) |

Delonex Energy is exploring the acquisition opportunity of the Shell Gabon assets and has engaged Genesis to assist in the due diligence process by performing a technical review. As part of this assignment, Safina supplied an Environmental and Social Due Diligence (ESDD) review as independent technical experts and providers of independent Environmental and Social Advisory service. The study has been divided into four key areas, namely to:

- Review of Vendor data room data of understand environmental performance of the vendor operating facilities. This included a review of the ERM prepared “HSSE & SP Vendor Due Diligence Report” to offer our expert opinion of their ability to perform such a study and evaluation of the environmental and social issues the report identifies;
- Evaluate whether the Shell Gabon assets’ performance is generally aligned to national environmental and social legislation as well as internationally accepted guidance of the IFC and GIIP;
- Advice on the environmental and social performance areas of concerns associated with investing in this acquisition;
- Provide some early guidance and recommendation on environmental and social investment needed to achieve alignment and manage legacy / potential environmental and social liabilities.

Noble Energy Mediterranean (NEM) Inc: EU Regulatory Guidance (ongoing) - |

Safina provided advise on EU air quality requirements in relation to existing platforms Mari A and Tamar B by informing them of not only UKCS practice but also other EU member states. Previous support provided an EU air Regulatory roadmap which concentrated on arguing why onshore regulations cannot be applied offshore. The focus of this study was to offer guidance on which BREF should be applied (ie: Large combustion plant BREF rather than the mineral oil refining BREF). Support extended to providing examples of how other EU member states (ie: Germany and the Netherlands) have applied such requirements to their offshore sector.

Genesis scope included:

- Providing an overview of the EEMS reporting system and the reporting requirements of which Directives and Regulations this is designed to meet.
- Where it was possible, Genesis also provide examples of an emission permit under section 1.2 "Refining of mineral oil and gas", of annex 1 of the IED directive. (Rather than under section 1.1. "Combustion of fuels in installations with a total rated thermal input of 50 MW or more").
- Provide a brief summary of the BREFs pertinent to combustion installations below 50MWth (i.e. not captured by the Industrial Emissions Directive and the associated Large Combustion Plant BREF) and confirm the current regulatory and reporting requirements.

Noble Energy Mediterranean (NEM) Inc: Regulatory Environmental Roadmap- |

Safina supported Nobel in preparing a report which explained how air emissions from offshore installations are managed by the regulators in the UK. Israel’s MOEP follows the IPPC and the IED directive. The Genesis air report provided an understanding of how the UK managed air emissions from an offshore installation and enforces permits so they are not exceeded (and in the event of exceedances, how DECC is notified, outlining the procedure)/ the regulatory and Permits Roadmap included: - An environmental related regulatory requirements related to if emission at offshore facilities - How air emissions are managed and enforced by the regulatory bodies at offshore facilities - Air permit for offshore platforms – on which regulatory regime/laws the requirement to have a permit is based on - What are the basic requirements that the permit enforce Deliverables included UKCS Regulatory and Permits Roadmap (Air Quality).

Petronas: Environmental Services for UIO Facilities (Package 14) for RAPID, Malaysia- |

Safina as the team manager, acted as lead for technical and timely delivery of the Environmental scope for PETRONAS who are developing a grass root integrated Refinery and Petrochemicals Complex by developing the Refinery and Petrochemical Integrated Development (RAPID) Project to meet both domestic and Asia’s energy and chemicals demand. The scope of this study is to develop a GHG inventory and Leak Detection and Repair (LDAR) plan to cover the following facilities included in the UIO Package 14 for the RAPID Project: Utilities, pipeline interconnections and metering, Offsites, MCB and Support Buildings and HV Power Transmission



- GHG Report was prepared to consider GHG Emissions (CO₂, CH₄, N₂O and SF₆) during normal and emergency operation for direct and indirect emissions within Package 14.
- LDAR Report included: Program Framework, LDAR System Identification and Mapping, LDAR Program Procedure. All supporting calculations and materials were provided to the client and Package 14 systems P&IDs updated with unique leak component level identification tagging on over 200 P&IDs.

Oryx: Demir Dagh (Kurdistan) Permanent Production Facilities FEED - |

Safina as the team Manager, acted as lead for technical and timely delivery of the Environmental scope. Safina was responsible for the Project ENVID review, conducted to identify environmental aspects associated with the Project in Kurdistan. The ENVID workshop arranged by her team, for multidisciplinary, systematic capture of likely environmental impacts based on design layouts, PFDs and Project baseline data to ensure all likely activities during construction, operation and decommissioning for the onshore facility were considered.

New Age (African Global Energy) Ltd: Etinde Project - |

New Age (African Global Energy) holds a minority interest in the MHLP-5, 6 and 7 Blocks offshore Cameroon. The Operator is Bowleven, through its local subsidiary, Euroil. Following exploration success, a development plan (in Cameroon called the Exploitation Authorisation Application, EAA) is soon to be submitted for the first discovered field, Etinde, located in Block MHLP-7. New Age has consequently prepared an initial draft of its own Etinde Full Field Development Plan based on offshore processing of gas and condensate, delivering gas to the Government of Cameroon-supported fertiliser and Cameroon LNG (CLNG) Projects.

Safina lead the Environmental Services scope as the Project Sponsor and was ultimately responsible for the development of the Environmental Philosophy, Environmental Roadmap, Environmental Screening Exercise, Environmental Overview, Environmental BOWTIE Analysis, Stakeholder Identification Plan and Stakeholder Management Plan.

Noble Energy Mediterranean (NEM) Inc.: Permits and Consents Roadmap to support Aphrodite Development, Cyprus- |

Participating in a team of in-country consultants, we were commissioned by NEM to provide a comprehensive list of oil and gas developments permit requirements for Cyprus covering all engineering phases including design, mechanical completion, commissioning, start-up, domestic export, commercial permits, decommissioning. Where these codes are currently not in place in Cyprus, Genesis conducted a gap analysis to advise NEM of what EU codes Cyprus were signatory to, providing guidance on the likely provisions. Genesis also participated in a workshop in Cyprus to regulators presenting the engineering aspects of offshore LNG developments to gain additional insight to permit roadblocks and opportunities.

Noble Energy Inc.: Leviathan Development Project ESHIA for nearshore and terrestrial elements - |

Safina is the Leviathan Development ESHIA Project Sponsor, responsible for the overall timely delivery of the Environmental Social and Health Impact Assessment Study report, being prepared during the FEED stage of design. As part of the licensing arrangements with the government, the national rules obliges Noble to include near-shore (PRMP) and terrestrial elements of the project as a means of reviewing the development as a whole. There has been a strong local content component to this study, and Safina has been actively involved in client liaison, in-country consultants, baseline survey team to designate plans for ESIA delivery. Safina is involved in documentation reviews and overseeing the activities of the Genesis ESHIA team are delivered. The Genesis ESHIA Team is composed of a multi-disciplinary group of environmental consultants, engineers and modelling specialists.

BG Tanzania: Upstream Concept Selection Project for Block 1 & 4 - |

Lead Engineer providing management and technical input to the Concept and Select stage Environmental delivery, including:

- Environmental Philosophy
- Water ENVID
- Concept Environmental Screening
- Waste ENVID
- Waste Management Strategy
- Emissions Inventory for 4 key concepts
- Noise Studies
- BAT Study
- GPP site selection studies



•GIS, Social and local content planning

On selection of upstream concept phase 2 scope intended to focus of validation of a single Block 1 and 4 concept through modelling and pollution prevention and controls.

SASOL: PSA Development and LPG Project - |

Overview provided to the SPI ESIA which was prepared and submitted to the Regulator (MICOA) within a 7 month schedule to meet Client FID requirements. Reviewed detailed Scope of Work for, and provided oversight of my team who were responsible for managing the Subcontractor preparing the Environmental Impact Assessment (EIA) for the SASOL PSA Development and LPG Project in Mozambique. The work was successfully completed to schedule despite a very compressed timescale. Also took part in the Public Consultation meetings held in Mozambique.

Premier Oil: Sea Lion Development Project ESIA - |

Successfully bid and awarded the Environmental and Socio-Economic Impact Assessment (ESIA) Services Contract for the proposed Sea Lion Development Project, the first offshore oil and gas development in the Falklands Islands (FI). Sea Lion lies in a water depth of 450m and is 220 kilometres north of FI. The reservoir area is made up of a series of overlapping 'fans'. Oil has been discovered in both the Sea Lion Main Complex and satellites (Casper and Casper South) with a recoverable total oil reserves estimated at 300-350 million barrels. Beverley to the south is a gas discovery. The basic concept is to produce the reservoir fluids via one subsea drill centre tied back to a TLP with artificial lift provided by gas lift to aid oil flow. The TLP is connected to an FSU for oil storage and export. The anticipated peak throughput is around 120,000 barrels/day.

This significant award was competitively bid with Genesis beating an incumbent FI Environmental Consultancy. Having supported the Sea Lion Development on a number of environmental studies, (Rockhopper during Select and then Premier Oil through the Pre-FEED Concept stage), has demonstrated our deeper understanding of the Falklands, its regulatory requirements, its environmental and social sensitivities; and this backed by the experience held within the proposed ESIA team has certainly contributed to our success.

Sasol Petroleum International (SPI): SPI Environmental Support - |

Study Sponsor for delivering a detailed Scope of Work for an Environmental Impact Assessment (EIA) on behalf of SASOL PSA Development and LPG Project in Mozambique to select and engage a subcontractor to deliver against scope to time and budget. The work was successfully completed to schedule despite a very compressed timescale.

Sasol Petroleum International (SPI) : Provider of Decommissioning & Abandonment (D&A) Consultancy Services as Independent Experts (on-going) - |

Incumbent Independent Expert since 2012 to date. Genesis has been commissioned by SPI to provide a IEs participation in the Asset Retirement Obligations Assessment Team (AROAT) and review material presented by the respective SPI Asset Manager's.

As the D&A Work Scope Manager, Safina led a specialist Genesis team of experts (in decommissioning, safety engineering, environmental and regulatory), which was supported by a leading well abandonment consultancy in the provision of:

- Review of current Decommissioning Cost Estimate (DCE) prepared by assets following Asset Retirement Obligations Assessment Meeting (AROAM) held in SPI Offices in London during May 2012
- Prepare DCE Scope of Work (SoW) for assets in Mozambique, Gabon and Canada to re-estimate SPI Asset Retirement Obligations (ARO) for each asset. These were guided by the SPI process for disclosing ARO, which provides an auditable framework for the estimation, review, approval and reporting of ARO and in so doing ensure consistency when there is a requirement to update these costs.
- Genesis scope included validation of Contractor prepared DCEs on completion of the activities and invitation to participate in AROAM this coming May 2013.

Noble Energy Inc.: Leviathan Development Project ESHIA (FPSO Development Option) - |

The Leviathan Development in the Eastern Mediterranean will provide production capacity of 0.750 BCFD for Israeli domestic supply. The project will transport processed gas from Sub-sea Systems, including sub-sea production flowlines via a deepwater FPSO through a Domestic (DOM) export pipeline to onshore Israel. The ESHIA addresses all in-country environmental and social aspects during the Installation, HUC and production



phases until decommissioning and considers impacts associated with routine, non-routine and accidental events for all Leviathan activities outside of the 12 nautical mile zone.

Safina is the Leviathan Development ESHIA Project Sponsor, responsible for the overall timely delivery of the Environmental Social and Health Impact Assessment Study report, being prepared during the FEED stage of design, to ensure it meets the Clients satisfaction and complies with the requirements of the IFC. Safina has been actively involved in client liaison, and engaging in-country client participation to understand potential areas of concern using teachings from NEM other operating facilities in Israel. Safina is involved in documentation reviews and overseeing the activities of the Genesis ESHIA team are delivered. The Genesis ESHIA Team is composed of a multi-disciplinary group of environmental consultants, engineers and modelling specialists.

Abu Dhabi Company for Onshore Oil Operations (ADCO): (ADCO) - Conceptual Study for Al'Dabbiyya, Rumaitha/Shanayel Field Development (s) - |

Supervision, Management and Technical input to the Concept stage Environmental delivery, including:

- Preparation of Emissions Inventory
- Coordination of Environmental Issues Identification (ENVID) Workshop
- Preparation of Best Available Techniques (BAT) Demonstration Report
- Execution of initial EIA Scoping and input into preliminary HSEIA Report

Khalda Petroleum Company, : Qasr Compression Project FEED - |

Prepared a noise study for the Qasr compression project, which added several items of equipment such as gas turbine mobile power unit generators (MPUs), gas turbine driven gas compressors, air compressors and pumps to the existing Qasr facility, located in the Western Desert of Egypt. This noise study modelled expected sound propagation from the noisiest equipment types associated with the Qasr compression project and considered:

- Brief summary of noise propagation and key influences;
- Identifies main noise sources, their relative noise outputs and characteristics;
- Preliminary calculations for distances at which noise will be attenuated to levels that meet the statutory requirements;
- Recommend hearing protection zones.

Rockhopper: Sea Lion Development Project - |

The Sea Lion discovery is the first commercially viable hydrocarbon resource in the North Falkland Basin. The first successful well test on the field was performed in September 2010 by Rockhopper. The Sea Lion reservoir is located approximately 200 km north of the Falkland Islands, is in approximately 450m water depth and is the first oil discovery and contingent oil resource in the North Falkland Basin. Safina took on the role of lead environmental engineer for this development during a two phase Concept Screening Study (Concept screening and Concept engineering). Safina attended and advised the options screening workshop from an environmental perspective, moving forward from 13 options to three, including:

- Option 1. A leased FPSO with (hot) HSPs and ESPs with wet and dry trees.
 - Option 2: Leased FPSO, with gas Lift, all wet trees; and
 - Option 3: A large TLP with a combination of dry (ESPs) and wet tree producers (with HSPs) and a leased FSO.
- Deliverables prepared for the study included the project environmental philosophy addressing legislation, guidance and industry environmental best practices that the project must adhere to for drilling activities, operations, the onshore supply base and the shuttle tanker (when within 500 m of the offshore facility). Coordinated ENVID (to determine Environmental aspects) and prepared ENVID report with recommendations and actions to be carried forward into next phase. Also prepared, Best Available Techniques (BAT) assessment, environmental screening assessment, ESIA scoping report and ESIA scope of work (for tender by 3rd Party). Additional studies co-ordinated VOC recovery and Produced water disposal study using CORMIX.

Groument Reganne: REGGANE NORD DEVELOPMENT PROJECT SURFACE FACILITIES - |

Supervision, Management and Off project support to develop the surface facilities for an onshore project in Algeria. Deliverables include the following:

- HSE Plan
- Environmental BoD
- Emissions, effluents and discharges table,
- CO2 block diagram,
- Regulatory, Environmental and Permitting Management Plan,
- Construction Environmental Management Plan (EMP),
- Construction Waste Management Plan (WMP); and



- Environmental engineering support to the following aspects:
 - Facility design including wastewater treatment and disposal,
 - Venting, draining, sewers and pits philosophy and design criteria,
 - Plant layouts; and
 - Input to the environmental scope of work during EPC phase.

Noble Energy Inc.: Leviathan Development Project, Eastern Mediterranean - |

Supervision, Management and Technical input to the Leviathan FPSO Concept stage Environmental delivery, including:

- Preparation of Gap Analysis against US CFR and Israeli Environmental Regulatory requirements
- Preparation of Environmental Basis of Design for Offshore Deepwater FPSO and nearshore Pressure Reduction & Metering Platform
- Development of Environmental Permitting & Consents Plan for Oil & Gas Construction & Operations in Israel
- Development of preliminary BAT Study for Deepwater FPSO, including NOx atmospheric emissions dispersion modelling
- Preparation of Emissions Inventory for normal FPSO operations
- Development of Technical Scopes of Work to support ESHIA and EBS ITT's

Abu Dhabi Company for Onshore Oil Operations (ADCO): Conceptual Study for Al'Dabbiyya, Rumaitha/Shanayel Field Development (s) - |

Supervision, Management and Technical input to the Concept stage Environmental delivery, including:

- Preparation of Emissions Inventory
- Coordination of Environmental Issues Identification (ENVID) Workshop
- Preparation of Best Available Techniques (BAT) Demonstration Report
- Execution of initial EIA Scoping and input into preliminary HSEIA Report

BG Trinidad and Tobago: East Coast Development Study - |

Lead Environmental Consultant is the Assess phase study considering area development concepts for various undeveloped gas fields integrated with brownfield development of the existing Dolphin Alpha facility. Options selection delivery included support to Assess Stage ENVID, Emissions Inventory and BAT studies.

Shell : Propane Compressor Refurbishment, Bacton Gas Terminal UK - |

Provision of environmental support to Project team in impacts associated with the refurbishment of existing Propane Compressors required dew pointing, in the delivery of up to 1200 MMSCFD. Delivered a BAT demonstration study on various refurbishment options under consideration, a GHG and Energy Efficiency Report with supporting calculations and conducted a review on noise modelling and abatement methods proposed by Shell sub-contractors (Bureau Veritas) to ensure the recommendations would meet expectations on environment agency, communities and protect sensitive receptors such as barbastelles bat

Tullow: Greenland – Technical Challenges Study - |

Responsible for advising the Client of potential environmental issues and concerns associated with developing oil and gas facilities in the arctic conditions that exist in Baffin Bay, Greenland. Report considered environmental conditions, regulations, sensitivities, stakeholders and issues associated with oil spills contingency planning.

Shell EP Projects: Pearls Development Project, Kazakhstan - |

Provision of environmental support and advisory services to the Shell project team in their pursuit to develop a set of four prospects (Khazar, Auezov, Tulpar and Naryn) located in ~ 9m of water depth in the northern Caspian Sea, Kazakhstan.

Conducted a review of all environmental reports and baseline survey and prepared a Gap Analysis Report to determine where additional work may be necessary to satisfy IFC compliance Environmental Impact Assessments. Following on, Gap Closure Baseline Survey Scope of Work for additional offshore and onshore data collected was developed.

GUPCO: Hilal Re-Development Project, Egypt - |

Reviewed any existing data for the Concession and carried out a preliminary environmental impact study for the Hilal development project.

This was done by convening preliminary ENVIDs, by means of a multidiscipline workshop held in London, for all the development options. It aimed to identify the key environmental impacts which would need to be addressed



in DEFINE and provided recommendations made for the design to eliminate, reduce or mitigate their consequences.

The Study incorporated an emissions and effluents quantification study which was carried out based on both preliminary designs.

BG Trinidad and Tobago : Assess Stage Development Engineering Studies -ECMA - |

Perform a series of ENVID workshops on the generic building blocks and ranked each option against a pre-defined severity criteria. These were collated for each development concept and used within an environmental options evaluation study.

BP Egypt : West Harbour Expansion (WHX) FEED Project - |

Environmental Support provided to Project in the preparation of project environmental philosophy, development of a waste management philosophy and provided guidance in updating existing WHX waste management plan.

Nexen Petroleum UK Limited : Golden Eagle Area Development Project, UK - |

Provision of environmental engineering support to the Golden Eagle Project during conceptual design in the areas of: conduction ENVID workshops and preparation of reports with include preliminary Aspect Registers for each option under consideration; Acid Gas disposal study, VOC recovery study, Emissions Inventory, BAT demonstration studies and a permits and consents plan.

RWE UK Limited: Breagh Offshore ES, UK - |

Provided a project management role in support of delivering the offshore Environmental Statement for the facility, located in the Southern North Sea.

Centrica: Baird Gas Storage Project – FEED Development Study, UK - |

Provided environmental support and process design guidance for gas storage project which will use the Baird reservoir during periods of low use, for gas return during periods of high use, i.e. winter.

Support provided to the project through development of onshore and offshore environmental philosophies, BAT demonstration studies and noise impact studies. Role extends to supporting the ES and EIA sub-contractor with environmental and emissions data.

Premier Oil Vietnam Offshore B.V. (POVO) : Design Competition - |

Assisted the Client to evaluate the final submission for FPSO and EPIC Design Competition. Four design houses submitted for FPSO FEED & EPC Contract and two for EPIC respectively. Responsibilities included development of bid discriminators and evaluation of Environmental deliverables to determine optimum solution.

BP : West Nile Delta Project- Pre-FEED Support Studies, Egypt - |

A 900MMScfD offshore gas development, with Onshore processing. Responsible for evaluating Produced Water Disposal means to arrive to the best practicable option. Evaluation applied technical, environmental and cost based screening during pre-FEED (Appraise) stage of project.

Karachaganak Project Development Ltd : Karachaganak Gas Project Pre-FEED, Kazakhstan- |

Environmental Consultant responsible for evaluating 6 alternative development options during Pre-FEED selection activities. Responsibilities included development of waste inventories for each option and preparing Air dispersion model in AERMOD to demonstrate best location for new facility (within the existing Sanitary Protection Zone or outside at an alternative location-20km away from field). Russian normative emission factors and equipment passport data (where available) where used to build air dispersion model, otherwise, emissions were calculated using EPA Ap42 emissions factors.

BP: West Nile Delta Project-Pre-FEED Support Studies, Egypt - |

Environmental Consultant responsible for selection and management of Project ESIA Consultant, contracted to prepare Environmental Scoping Study for 900MMSCFD gas development Project. Responsibilities included: Preparation of tender documentation, technical Scope of Work and evaluated bids during tender review. Supported and managed selected ESIA Consultants with provision of specialist environmental and engineering advisement and inputted to Public disclosure process.

Nexen : Golden Eagle - Conceptual Development Study - |

Environmental options evaluation study for the development of the Golden Eagle prospect, located in Block 20/1N. Additional responsibilities included development of Environmental Philosophy, Emissions inventory and



CO2 Life Cycle Analysis (LCA) of identified development options to assess each options' CO2 foot print. The CO2 LCA study was used as an input in overall options screening process.

TullowOil: Mputa Project, Uganda - |

Environmental Specialist responsible for developing the environmental definition for project- an oil and gas onshore facility being developed in a ecologically sensitive game reserve, near lake Albert. Assisted Client is preparing all Project Feed Tender Document including Design Specification, Scope of Work and Design Basis document for environmental contribution to the project.

Talisman Energy Ltd: PPC Permit Application for Fulmar Platform, UK - |

Lead Environmental consultant involved in the preparation of the Fulmar Platform PPC Permit. Activities involved quantifying all emissions to air from the facility, preparing all necessary material for dispersion modelling to demonstrate air quality standards are not breached and validated use of Best Available Technique in operation of combustion equipment.

Talisman Energy Ltd: PPC Permit Application for Bleo Holm FPSO, UK - |

Prepared the Bleo Holm FPSO PPC permit application. Lead Environmental consultant undertaking emissions quantification to air from the facility. Further, prepared all necessary material for dispersion modelling to demonstrate air quality standards are not breached and demonstrated Best Available Technique (BAT) was practiced for combustion equipment.

BP: West Nile Delta Project- Pre-FEED Support Studies, Egypt - |

Environmental Consultant responsible for facilitating the development of both a Environmental Scoping Study and the Project Environmental and Social Impact Assessment Study (conducted by 3rd Party) to gain approvals for onshore and offshore facilities of BP's WND Project.

Responsibilities included: Preparation of Scoping ESIA and Project ESIA Technical Scope of Work and assistance in selecting contractor by preparing Bid Appraisal Methodology, Tender Evaluation Review. Supported and managed selected ESIA Contractor with provision of specialist environmental and engineering reports (as required) and inputted to Public disclosure process.

ESIA Study was required to meet both national and BP's requirement for New Projects.

BG Norge Ltd: Bream Options Identification and Review Study, Norway - |

Prepared a Project environmental basis of design for development, located in Norway Block 17/12(PL 407) in the Egersund Basin in the Central North Sea. Study included a review of Norwegian regulations for new projects and recommended waste disposal routes applying best practice.

Shell: SNS Long Term Opportunity Study Option, Norway - |

CO2 emissions study to determine the least emissions solution from Case I (the supply of power from gas fire turbines located within the project boundaries) or Case II (an electrification case, where power was supplied from the grid).

Karachaganak Project Development Ltd: Karachaganak Phase III Pre-FEED, Kazakhstan - |

Environmental Consultant responsible for evaluation of alternative development options during Pre-FEED selection activities. Responsible Specialist, for developing emissions inventory for eight (8) key development options, using Russian normative emission factors and equipment passport data (where available).

Prepared and developed the Project Pre-FEED Environmental and Social Impact Assessment (ESIA) to IFC/WB standards conducted for the selected Phase III concept, and included facilities, drilling, infield pipelines and export routes for refined products.

Consultant responsible for delivering presentation to Client providing summary of Pre-FEED ESIA impacts and mitigations, contributed to FEED Contractor ENVID and supplied detailed handover to facilitate easy transition to FEED

PRIOR EXPERIENCE

SJB ASSOCIATES LTD | Jun 2008 - Dec 2009

Karachaganak Petroleum Operator (KPO), Kazakhstan

Provided Environmental & Socioeconomic advisory support across all projects within the KPO Project Development Directorate (PDD) including Phase III, Gas Upgrade Project, 3D Seismic Campaign & Aksai Consolidation. Responsibilities including project HSE document review (from international best practice stand point); conducting Project Environmental & HSE MS Audits, preparing PDD Environmental & Social



Philosophies/Standards; developing terms of reference for project ESIA's, scoping public consultation, resettlement plans to satisfy IFC Standards and managing sub-contractors for timely delivery of baselines and studies. Support also provided to manage ISO 14001 work programmes to gain ISO certification. Participate in Value Assurance Process. Became custodian of the Sustainable Development (SD) agenda within KPO which seeks to improve local content; social and environmental performance; training and nationalization targets. Successfully delivered the company's SD charter, SD strategy and Kazakhstan's first Sustainability Report to GRI standards in 3 languages.

NEXANT LTD | Aug 2002 - Jun 2006

Senior Environmental Consultant

Reliance RPL Refinery Expansion, India - Led and conducted environmental due diligence advising Project & a consortium of fourteen Lending Banks on further work requirements to fulfil expectations of the Equator Principles. Client Citibank.

Limán Project, Serbia - Performed Environmental Due Diligence on behalf of the Privatisation Committee lead by Meryl Lynch for the Privatisation of all Serbian National Oil and Gas assets including production, processing, distribution and retail.

Kilroot LNG Project, N. Ireland - Led technical and environmental feasibility study for converting an existing oil receiving terminal to an LNG receiving terminal proposed as a means of security of energy supply to the Kilroot power plant. Review of possible environmental and socio-economic impacts related to terminal and jetty conversion.

SELB Project, Thailand- Led an environmental screening & risk assessment study for PTT national oil company, to investigate crude oil transportation options (pipeline verses shipping). Evaluation involving identification of suitable pipeline route & terminals citing to minimise impact to social and environment as well as determine potential health and safety risks associated with the development.

Urban Clean Fuel Project, India- developed 5 separate Initial Environmental Assessment and Socio-Economic Assessment to ADB bank standards for introducing CNG to 5 cities in India. Study was conducted to ensure WHO air quality standards could be achieved in these targeted cities by 2010 by fuel substitution. Client-Asian Development Bank.

West Africa Gas Pipeline- Technical/ environmental adviser to the governments & Environmental agencies of the Benin, Ghana, Nigeria and Togo on methodology of offshore gas pipeline developments. Assisted in review of project EIA, EMP, Risk assessments, including HazIds & HazOps. Client- USAID.

Gas Supply Strategy, Cyprus- As Technical evaluation of gas product transportation options to bring gas to Cyprus. Performed a preliminary environmental assessment (fatal flaw analysis) and strategic review of Cyprus's accession into the EU & its consequence to the Project with respect to environmental legislation. Ministry of Energy-Cyprus.

Ras Laffan Master Plan, Qatar- Master plan for the development of Ras Laffan Industrial City until 2025. Specific project responsibilities included industrial site planning and developed a strategic environmental assessment of impacts, developing air dispersion study, waste inventory and traffic model for the purpose of making recommendations on strategic implementation of environmental management plan for city expansion.

Petrochemical Master Plan Study, Turkmenistan- Pre-feasibility study for development of a gas-based polyethylene project. Responsible for definition and technical evaluation of gas separation facility to separate ethane & infrastructure requirement.

Egyptian Petrochemical Industrial Site Master Plan, Egypt- Master plan to define & optimise gas feedstock, product & utility infrastructure. Conducted environmental evaluation on applicable legislation, project CO₂ reduction & provided recommendation on strategic implementation of EMS.

BECHTEL LTD | Sep 1996 - Aug 2002

Lead Environmental Engineer



BAPCO-LSDP Project, Bahrain- Lead Environmental Eng. for 2 refinery-upgrade options for mid-distillate production to meet changing market requirements. Responsibilities included the development of FEED & environmental permitting documentation.

Kirishi Refinery Upgrade Project, Russia- Assisted in the preparation of a preliminary process design and environmental assessment for a proposal cost estimation.

Reliance Refining Complex Jamnagar, India- Responsible for developing the Environmental Philosophy for the entire engineering scope of the project. Responsibility extended to the detailed design development of both the Refinery's and Marine tank farms effluent collection and treatment plant.

Reliance QYI Project Jamnagar, India- Process Engineer responsible for undertaking processing simulation studies and delivering a Process package for the revamp of three wastewater stripper trains.

WDDM Scarab/Saffron Development Project, Egypt- Lead Environmental Specialist in developing FEED & EPC contract package deliverables, providing environmental solutions for an offshore - onshore gas production, treatment and gas export facility.

Simian/Sapphire Development Project, Egypt -Process Engineer undertaking conceptual/ FEED studies. Assisted in a process feasibility study to replace MEG with methanol for hydrate inhibition. Developed a offshore flow line/ pipeline simulation (using PipeSim) to determine back-pressure in system. Conducted plant wide PSV calculations.

ADNOC OGD Project 1219, Phase II -Review of the Conceptual EIA for a New Lean Gas Export Pipelines from Habshan Gas Plant to Ruwai and Maqat and advised on requirements for subsequent phases to project development.

ADNOC – Atheer Sulphur Pipeline Proposal, Engineer responsible in defining the environmental FEED scope of work and execution plans including FEED deliverables & man-hour schedule for construction of a 10" diameter buried Sulphur Pipeline, with Skin Effect Current Tracing, transporting liquid sulphur from Habshan to granulation plant in Ruwais.

BOROUGE - CO2 Emissions from boiler stack-Air dispersion Study, Abu Dhabi- Conducted an Air dispersion study to alleviate/mitigate against possible danger to construction and commissioning personnel, from CO2 emissions through early utilities operation. Work done to validate Loss Prevention's findings.

Ourhoud Ex-Qoubba Project Proposal, Algeria -Technical input as Lead Env. Engineer to an EPC proposal relating to environmental and HSE matters. Prepared execution plans, schedules and cost estimates for engineering.

Shell Global Solutions Int. B.V - SMDS 2 Project Proposal -Developed the Corporate Environmental Strategy Statement on Gas to Liquids projects.

Karachaganak Development Project, Kazakhstan-Assisted in process Design and P&IDs the KPC Gas Sales Process LP and MP Sweet Gas Dehydration and Dew Point Control.

Karachaganak Development Project, Kazakhstan-Managed packages to obtain permits to construct a Gas Development Field based in Kazakhstan.

BGE&P Gas Terminal-Easington, UK- Process BATNEEC & BEPO review covering all processes and activities undertaken at the Easington Terminal covered within the authorisation to BGE&P (the operator) issued by the Environmental Agency under EPA 1990 part 1.



CV – GISELLE NAYLOR



Giselle Naylor

Senior Consultant Environmental Engineer

London

PROFILE

Giselle Naylor has over 31 years' experience in oil and gas

Genesis Grade: E0

Education and Qualifications: B.Sc (Hons) Chemistry, Diploma in Safety Management

Professional Affiliations: Chartered Chemical Engineer (CEng), Fellow of the Institution of Chemical Engineers (FIChemE), Chartered Member of IOSH (CMIOSH)

Languages: English (Fluent), French (Basic)

KEY SKILLS

- Development and implementation of ES&H management systems in compliance with OHSAS 18001 and ISO 14001 to deliver corporate 'zero accidents' policy for complex oil, gas and petrochemicals projects including: preparation of ES&H plans and procedures; preparation of work related risk assessments; emergency planning; ES&H performance reporting and development of key performance indicators (proactive & reactive); preparation and delivery of ES&H training and education programmes; organise and participate in ES&H management system assessments and audits.

- Managed Environmental Impact Assessment sub-contractors for oil & gas projects in Africa and Middle East.

- Very good understanding of principal technologies for oil, gas and petrochemicals processing and the key areas of ES&H risk for design, construction and operation.

- Practical 'hands-on' understanding of complex engineering and construction projects.

- Chaired safety reviews such as HAZID, ENVID and participated in HAZOP, SIL and Safety Critical Elements reviews.

Very good understanding of Contracts: practical experience of preparation of contract scopes of work, contractor selection and tender evaluation and contractor supervision and incentives programmes.

Excellent understanding and knowledge of ES&H law and regulatory framework in UK, EU, parts of Eastern Europe, Former Soviet States, Africa, and Middle East.

Demonstrates ES&H leadership by acting as advocate for ES&H matters including representing ES&H in meetings and discussions with the Executive Management Team; and presenting ES&H management programme and safety performance record to potential Clients.

Proven management/leadership ability; managed site ES&H team for a project in the Middle East and managed the ES&H functional department graduate 2006 programme and directed the work of two graduates. As former Chief Environmental Engineer managed the Environmental Department team of eight engineers and scientists. Excellent written and verbal communication skills; develops corporate training programmes to deliver corporate ES&H strategy where required (recent examples are Project ES&H Manager's guide and project ES&H self-assessment); delivers project ES&H orientation programmes, advises on behavioural based safety programme;



prepares and delivers ad hoc safety talks to other functional departments; member of organising committee for annual corporate ES&H conference.

Successfully worked with Clients from diverse cultures, government regulatory authorities and financial institutions.

Considerable global professional on-site experience; has worked and visited many geographical regions including, Europe, Turkey, Kazakhstan, the Middle East and South East Asia

CAREER HIGHLIGHTS

2011 - Present | Genesis
2008 - 2010 | Petrofac Engineering Services
1993 - 2008 | Bechtel Ltd
1992 - 1993 | Stone & Webster
1985 - 1992 | BP Research

KEY SKILLS

- ISO 14001
- OHSAS 18001
- HSE Plans and procedures
- Environmental Impact Assessment
- Construction HSE
- Contracts (Technical Scope, Tendering, Evaluation)
- HSE Law and Regulation
- Oil & Gas processes
- Communication skills

OTHER EXPERIENCE

Career Experience with Genesis | Apr 2011 – Present

Tullow Ghana Limited: Jubilee Full Field Development - Offshore, Subsea Ghana | ENVID Chair
Tullow Ghana Limited is the Owner / Operator of the Jubilee Development, Offshore in Ghana.

The Jubilee Development is located 130 km WSW of Takoradi, in a maximum water depth of 900 - 1,700m. Oil will be produced at approx. 150 bopd from 25 wells, at an FPSO and exported via pipeline(s).

Genesis was tasked with the provision of subsea engineering and flow assurance services associated with the Pre-FEED, FEED phases of the project.

Specifically, the scope included:

- Subsea Field Development
- Subsea FEED

Involving the following Disciplines:

- Costing
- Health / Safety
- Process/Flow Assurance
- Pipelines
- Subsea Controls
- System Engineering

Special Features included:

- Brownfield
- Deepwater
- Diverless Systems



- Dynamic Simulation/Transient Analysis
 - Offshore
 - Oil
- Chaired project ENVID workshop.

Abu Dhabi Company for Onshore Oil Operations: Hail & Ghasha Integrated Development Concept Study - Offshore, Onshore, Subsea Abu Dhabi | Environmental Engineer

The Hail and Ghasha fields are situated offshore Abu Dhabi (AD) in water depths of 0 to 15 metres. Sour gas levels are in the range of 18 to 35% of H₂S and 5 to 10% CO₂ depending on the reservoir. Oxy require the evaluation of various concepts for the optimal development of the fields to include a technical review of each of the options along with the preparation of high level cost estimates. Nine reservoir scenarios are to be evaluated and a short list of three will be selected for concept definition (pre-FEED). The expectation is that the short list for Concept Definition will comprise one option for each of Hail only, Ghasha only and Hail and Ghasha integrated. Prepared scope of work for environmental consultant to prepare an EBS and EIA ToR to Abu Dhabi EAD standards and reviewed subcontractor deliverables. Prepared emissions inventory; aspects register; prepared terms of reference, chaired and wrote reports for Phase 1 & 2 project ENVID workshops; prepared narrative to accompany project Phase 1 HSEIA on environmental topics. Reviewed and commented upon Civils subcontractor bids for artificial islands civil construction. Reviewed BAT report, and environmental gap analysis.

Reliance Industries Limited: Stage 2 of Conceptual Engineering for KG-D6-MJ Development - Offshore, Subsea India | ENVID Chair

Chaired ENVID workshop with a multi-disciplinary group of project personnel including Client representatives. Prepared ENVID report.

SASOL: PSA Development and LPG Project - |

Prepared detailed Scope of Work for, and managed, the Subcontractor preparing the Environmental Impact Assessment (EIA) for the SASOL PSA Development and LPG Project in Mozambique. The work was successfully completed to schedule despite a very compressed timescale. Also took part in the Public Consultation meetings held in Mozambique.

Noble Energy: Leviathan Development - |

Chaired ENVID comprising Genesis and Noble Energy attendees at Noble Energy offices in Houston USA for this offshore gas development in the Eastern Mediterranean. Also Technical Authority for the ESHIA for the same development prepared by Genesis.

Reliance Industries Ltd: KG-D6 Concept Validation and FEED - |

Chaired ENVID comprising Genesis and Reliance attendees and participated in HAZID for off-shore gas development in the Bay of Bengal. Prepared Hydrotest Water Disposal Philosophy.

Galp Energia: Jupiter Field Development - |

Prepared Environmental Philosophy for the development of an off-shore gas condensate field in accordance with Brazilian environmental regulations.

Statoil: LUVA SPAR FPSO Concept Study - |

Participation in ENVID as Environmental Engineer and preparation of a brief Environmental Assessment Report for the construction, operation and decommissioning of the Spar hull.

Suncor Energy Norge AS : Beta Project - |

Prepared an Environmental Options Screening Report for the various concept schemes for this off-shore development.

Rockhopper Exploration plc : Sea Lion Development - |

Chaired ENVID review comprising GOGC and Rockhopper (Client) attendees for a new off-shore development in the South Atlantic. The work also included preparation of the ENVID review report.

Valiant: Causeway Project - |



Reviewed draft Environmental Impact Assessment (by others) for additional pipelines to support the Causeway off-shore development.

GDF: Cygnus Project - |

Chaired ENVID review comprising GOGC and GDF Suez (Client) attendees for a new off-shore oil development in UK southern North Sea. The work also included preparation of the ENVID review report.

BGT&T: EMCA Project - |

Chaired ENVID meeting comprising GOGC and BG Exploration and Production attendees for an off-shore oil & gas development in India. The ENVID review was held in the Client offices in Mumbai..

Valiant – Causeway Project

Reviewed draft Environmental Impact Assessment (by others) for additional pipelines to support the Causeway off-shore development.

Premier Oil: Dua Project - |

Chaired ENVID meeting comprising GOGC and Premier Oil attendees for a new off-shore oil development in Vietnam. The work also included preparation of the ENVID review report.

Prior Experience

PETROFAC ENGINEERING SERVICES | Jan 2008 - Dec 2010

2008-2010. Operations HSSE Manager for the Woking office reporting to the Integrity and Assurance Manager. Responsible for the HSSE management system and compliance to BS OHSAS 18001. Responsible for developing and implementing an Environmental Management System (ISO 14001:2004) with certification achieved in May 2010. Developed and delivered Safety Leadership programme for senior management.

2008. Project HSSE Manager for a large expansion of an oil and gas development in Kazakhstan with overall responsibility for project ES&H performance reporting to the Project Director.

BECHTEL LTD | Jan 1993 - Jan 2008

2006-2008. Projects ES&H Manager reporting to Global ES&H Manager (Oil, Gas and Chemicals). Responsibility for corporate ES&H programmes roll-out, construction site training and Safety Leadership programmes, and recruitment for site posts.

2003-2006. Project ES&H Manager for petrochemicals EPC developments in Middle East with overall responsibility for project ES&H performance reporting to the Project Director. Work included implementation of ES&H management system on project, ES&H education and training, oversight of engineering design and construction ES&H risks and their minimisation to ALARP and reporting ES&H performance to the business unit ES&H Manager.

1998-2003. Chief Environmental Engineer with functional management responsibilities for the Environmental Group (maximum 8 staff); job function ran concurrently with the project roles as described below.

2002-2004. Lead Environmental Engineer for large gas/condensate FEED project in Middle East covering multiple sites. Work included conceptual engineering designs, subcontract management of the consultant preparing the Health, Safety and Environmental Impact Assessment for the project. The work also involved site visits and liaison with Client Head Office ES&H staff.

2001-2002. Environmental consultant to off-shore gas developments in Egypt and Tunisia.

1997-2002. Permits Manager and Lead Environmental Engineer for large gas and gas condensate field in Kazakhstan covering several separate processing areas and pipelines. The permitting work included managing a team of 6 UK engineers and 15 Kazakh Design Institute engineers (at peak) obtaining permits to construct and Kazakh certificates of conformity for materials and equipment. The work involved frequent visits to Kazakhstan to establish permitting protocols with the Kazakh Government Officials.



1995-2002. Environmental consultant to a motorway project in Poland. The work involved managing a Polish Environmental consultant to produce an EIA to ERBD (European Bank of Reconstruction and Development) standards. The work required holding public meetings in Poland and frequent liaison with EBRD.

2000–2002. Prepared effluent plant treatment design for revamped Greek Oil Refinery to meet future 'Seville Protocol' discharge standards.

1997. Researched and developed waste management plan for large grass roots refinery in India.

1996-1997. Assisted Client in negotiations with Environment Agency (formerly HMIP) regarding discharges from on-shore gas processing facility on UK East coast.

1996. Assigned to Technip in Paris as Environmental Engineer for LNG project in Yemen.

1993-1996. Lead Environmental Engineer for polyester and PTA/Aromatics development in Saudi Arabia.

STONE & WEBSTER | Jan 1992 - Jan 1993

Environmental Engineer responsible for conceptual engineering design for upgrade to effluent treatment plant design for small batch chemical manufacturer.

BP RESEARCH | Jan 1985 - Jan 1992

Environmental Engineer responsible for conducting programmes of environmental engineering research. The work involved pilot scale work at site and providing technical support for effluent treatment plant at oil and chemical sites.

Team member executing waste minimisation studies at Singapore Refinery (Far East) and Grangemouth Refinery (Scotland)



CV – MATHIEU NEALE



Mathieu Neale

Genesis Consultant Environmental Engineer London

PROFILE

Number of years' experience: 16

Genesis Grade: A1

Education and Qualifications: Master of Science (MSc) 1996 - Environmental Impact Assessment and Auditing University of East Anglia, Norwich, UK; Bachelor of Science (Hons) 1995 - Environmental Geoscience (Upper 2nd Class) University College, London, UK

Professional Affiliations:

Languages:

KEY SKILLS

Mathieu Neale has over 16 years' experience and is a practical and dedicated environmental specialist, with experience of technical advisory, consultancy and training roles within the Oil & Gas industry. An IEMA qualified Environmental Auditor with BOSIET offshore safety certification. Experience includes:

- Oversight of environmental engineering, preparation of Best Available Technique (BAT) assessments, emissions inventories, atmospheric emissions dispersion modelling and ENVID studies;
- Implementation of EMS in accordance with ISO 14001 (2004) during Exploration & Construction phases on major oil and gas projects;
- Coordination & preparation of ESIA's, Oil Spill Contingency Plan's, contractor environmental audits and HSSE compliance management systems;
- Execution of environmental & occupational health monitoring surveys

CAREER HIGHLIGHTS

Present | Genesis

2009 - 2011 | Mathieu Neale Consulting Ltd., London, UK

2007 - 2009 | Eni S.p.A. Exploration & Production Division, Milan, Italy / Luanda, Angola

2006 - 2007 | BP Azerbaijan Strategic Performance Unit, Baku

2005 - 2006 | Briggs Marine Environmental Services, Baku, Azerbaijan

2000 - 2005 | Caspian Environmental Laboratory, Baku, Azerbaijan

OTHER EXPERIENCE

Career Experience with Genesis | – Present

SASOL: PSA Development Project Export Jetty - |

Prepared detailed Scope of Work for, and managed, the Subcontractor preparing the Environmental Impact Assessment (EIA) for the SASOL PSA Development Product Export Jetty. The work is ongoing and scheduled in a very compressed timescale by the end of the year. Also took part in the Public Consultation meetings held in Mozambique.

Gujarat State Petroleum Company: Deen Dayal Concept Select Study - |

Concept environmental screening of offshore platform options



Comparative HAZID/ ENVID of Concept option

Noble Energy Inc.: Cyprus Block 12 Permitting & Consents Support - |

Review of EU environmental permit requirements for application to offshore floating production facilities and export pipeline in Cyprus

Rosneft Oil Company: ADEPT Test Arctic Shelf License Blocks, Russian Federation - |

Preparation of Environmental Basis of Design for 3 offshore blocks in the Russian Arctic
High Level screening of environmental aspects

SASOL: Inhassoro Field Development EIA, Mozambique - |

PMC for preparation of EIA's and EIA Addendum for onshore gas and liquids full field development

Noble Energy Inc.: Leviathan Development Project, Eastern Mediterranean - |

Preparation of Gap Analysis against US CFR and Israeli Environmental Regulatory requirements
Preparation of Environmental Basis of Design for Offshore Deepwater FPSO and nearshore Pressure Reduction & Metering Platform
Development of Environmental Permitting & Consents Plan for Oil & Gas Construction & Operations in Israel
Development of preliminary BAT Study for Deepwater FPSO, including NOx atmospheric emissions dispersion modelling
Preparation of Emissions Inventory for normal FPSO operations
Development of Technical Scopes of Work to support ESIA and EBS ITT's
Preparation of Environmental & Social Impact Assessment for offshore FPSO, subsea production system and export pipeline development proposals
Coordination of ENVID for offshore, nearshore and onshore facilities

Abu Dhabi Company for Onshore Oil Operations (ADCO): Conceptual Study for Rumaitha/Shanayel Phase III Field Development - |

Preparation of Emissions Inventory
Coordination of Environmental Issues Identification (ENVID) Workshop
Preparation of Best Available Techniques (BAT) Demonstration Report
Execution of initial EIA Scoping and input into preliminary HSEIA Report

PRIOR EXPERIENCE

MATHIEU NEALE CONSULTING LTD., LONDON, UK | Sep 2009 - Dec 2011

Responsibilities included:

- Lead Environmental Engineer for KJO Dorra Field Development (Arabian Gulf)
- PMC for Environmental Impact Assessment across Kuwait & Saudi Arabia
- Development of Environmental Baseline/EIA Scopes of Work
- Technical Bid Evaluation & development of bid assessment criteria

Lead Environmental Engineer for FLEX LNG FEED Study (Papua New Guinea)

- Development of Environmental Budget for Topsides and Hullside emissions and discharges
- Evaluation of disposal options for acid gas stream, incorporating AERMOD/SCREEN 3 dispersion modelling

Lead Environmental Engineer for BP Sullom Voe Terminal H2S Management Project

- Development of BAT evaluation for acid gas disposal facilities at Shetland Island gas processing facility in accordance with EU IPPC/UK Environment Agency Guidance
- Preparation of Regulatory Compliance Plans and draft EIA Scoping Reports

Lead Environmental Engineer for Statoil Bressay Concept Study (UK)

- Coordination of Best Available Technique Assessment for offshore PDQ
- Preparation of emissions inventories & discharge summaries
- Coordination of Concept Study ENVID workshop

Environmental Engineer for Eni Norge Goliat FPSO development project (Norway)

- Verification & update of BAT Study & Environmental emissions inventory
- Development of Project Waste Management Plan/ Energy Optimization Study



Environmental Engineer for BG Jordbaer FPSO development project (Norway)

- Coordinating multi-disciplinary engineering teams during ENVID Workshops
- Alignment of base case design with regulatory expectations and best practice
- Initial Production chemicals selection assessment & package sizing

ENI S.P.A. EXPLORATION & PRODUCTION DIVISION, MILAN, ITALY / LUANDA, ANGOLA | Sep 2007 - Sep 2009

Responsibilities:

- Oversight of HSE design philosophy during Concept Selection phase of FPSO development project (Deepwater Angola);
- Development of ISO 14001 EMS for Exploration drilling phase facilities and offshore activities (Deepwater Angola);
- Verification of environmental design against EIA requirements, identification of environmental aspects and HSE auditing of contractors during Execution phase of offshore gas development project (Adriatic Sea);

BP AZERBAIJAN STRATEGIC PERFORMANCE UNIT, BAKU | May 2006 - Sep 2007

Responsibilities;

- Implementation of HSSE Compliance Management System across BP Strategic Performance Unit (SPU) in Azerbaijan, Georgia & Turkey
- Conducting regulatory reviews to determine national, international legislation and IFI/WBG Lender guideline applicability to BP operations
- Developing and overseeing ESIA and regulatory permit compliance requirements

BRIGGS MARINE ENVIRONMENTAL SERVICES, BAKU, AZERBAIJAN | May 2005 - May 2006

Selected Projects;

Auditor, AIOC Major Projects, Contractor Control Plan Audit, 2005

- Coordinated audits of fabrication yards/ beachpull & terminal expansion sites
- Assessed sub-contractors against Project waste management/ spill response/ pollution prevention & marine construction compliance requirements

Project Manager, AIOC Major Projects, Environmental Assurance Plan & EMS Development, 2005/06

- Reviewed & prepared aspects registers/ policy objectives & targets/ annual KPI's
- Developed operational controls for principle Project Waste Management sub-contractor
- Conducted compliance audits of Project Waste Management facilities

Project Manager, BP AzSPU, Azerbaijan Coastal Protection Plan update, 2005/06

- Managed a country wide assessment of coastline threat from offshore oil spills
- Assessed response times/ access/ logistical constraints & equipment requirements

CASPIAN ENVIRONMENTAL LABORATORY, BAKU, AZERBAIJAN | Jul 2000 - Apr 2005

Daily duties;

- Coordinating terrestrial and offshore surveys in line with BP HSE expectations
- Execution of monitoring programmes to assess ambient and work place air quality/ potable and waste water quality
- Managing analytical programmes and project scheduling within the Caspian Environmental Laboratory for clients based in Azerbaijan, Georgia and Kazakhstan.

Selected Projects:

Survey Leader & Project Manager, BP AzSPU, Integrated Environmental Monitoring Programme, 2003-05

- Coordinated & executed nearshore (pipeline vicinity) benthic & pelagic fauna surveys & seafloor habitat assessments
- Coordinated a hydrographic survey in the vicinity of the Sangachal oil reception terminal

Project Manager ACG / BTC (Az)/ SDGE Projects , Sewage Treatment Unit Assessments, 2004



- Coordinated a wastewater engineering assessment of STP treatment technology and performance evaluation including sludge treatment & disposal

Project Manager, ACG/ BTC Azerbaijan Project, Occupational Health and Environmental Air Quality Monitoring, 2004

- Delivered occupational exposure assessments (OES) in line with UK HSE EH/40 requirements for Welding/Paint Fumes/Incinerator residues
- Designed an ambient air quality monitoring programme on behalf of Sangachal Terminal in accordance with EU/WBG guidelines

Project Manager, ACG Phase 1 Early Template Well EIA (2001) & Az SPU, Thermal Desorption Unit EIA (2003)

- Delivered successful EIA's for key BP environmental permit applications
- Conducted scoping & aspects screening with MENR & BP Research & Monitoring Group
- Lead Public Consultation exercises with NGO's & national scientific community



CV – SIMON BECKETT



Simon Beckett

Genesis Process/ Environmental Engineer London

PROFILE

Number of years' experience: 3

Genesis Grade: A4

Education and Qualifications: MEng Chemical Engineering

Professional Affiliations: IChemE

Languages: English

Simon Beckett has over 3 years' experience in the Oil and Gas industry with Genesis.

He has worked within the Genesis Environmental, Process, Flow Assurance and Subsea departments and has gained experience on a wide range of projects. Project experience includes large Greenfield frontier projects (e.g. South Atlantic and East of Africa) and brownfield studies in both Europe and the Middle East.

In addition to consultancy Simon has on-site experience in a non-oil and gas role for Bayer Agrochemicals.

CAREER HIGHLIGHTS

2014 - Present | Genesis

2012 - 2013 | Genesis

2011 - 2011 | Bayer Crop Science

KEY SKILLS

- Environmental Engineering: Incl. MEMW DREAM/OSCAR and PREDICTOR
- Flow Assurance Engineering: Incl. PIPESIM and OLGA
- Process Engineering: Incl. ASPEN HYSYS and FLARESIM

OTHER EXPERIENCE

Career Experience with Genesis | Jun 2014 – Present

Technip E&C Limited: Environmental Support Services - Oman - Onshore | Environmental Engineer

Duqm Refinery are developing a 230,000 bpsd greenfield petroleum refining complex close to the Port of Duqm in Oman. The project is to be financed through a series of loans from commercial banks and export credit agencies. In order to make the project eligible for such financing it was required to demonstrate compliance with the Equator Principles, and as a result, the IFC Performance Standards for Social and Environmental performance of projects.

Genesis Oil and Gas were contacted by Duqm Refinery to assist in a) demonstrating EP and IFC compliance, and b) identify gaps in the existing project documentation which results in EP/IFC non-compliance.

Simon was responsible for developing an Equator Principles Supplementary Report on the Associated Facilities related to the refinery project. The objective of this document was to:

- Identify Associated facilities based on the definition given in IFC Performance Standard 3
- Detail relevant national and international legislation regarding ambient air and water quality guidelines that should be applied to the project.
- Estimate environmental impacts (air, aqueous, noise and social) from Associated Facilities
- Estimate the cumulative impact of emissions from Duqm Refinery and its Associated Facilities
- Perform preliminary modelling to quantify the cumulative impact of air and noise emissions from Duqm Refinery and its Associated Facilities.



Abu Dhabi Company for Onshore Oil Operations: Hail & Ghasha Integrated Development Concept Study - Abu Dhabi - Offshore | Environmental Engineer

The Hail and Ghasha fields are situated offshore Abu Dhabi in water depths of 0 to 15 metres. Sour gas levels are in the range of 18 to 35% of H₂S and 5 to 10% CO₂ depending on the reservoir. Oxy require the evaluation of various concepts for the optimal development of the fields to include a technical review of each of the options along with the preparation of high level cost estimates.

Genesis were contracted to perform Concept Identification/Selection and Definition to enable the project to progress into Pre-FEED.

Simon was responsible for assessing the environmental impact of a subsea Methyl Diethanolamine leak from the offshore amine pipelines, with a particular focus on potential impacts to nearby Marine Protected Areas. Work was completed through the application of MEMWs DREAM software which is an environmental modelling tool developed specifically for the purpose of assessing the impact on the marine environment of chemical discharges from oil and gas exploration/production installations.

BP Exploration Operating Company Limited: Snadd Concept Development - Norway - Offshore | Lead Environmental Engineer

BP are planning to develop the offshore Snadd gas/condensate field by way of a subsea tie-back to the existing Skarv FPSO. The existing facility lies approximately 210 km from the Norwegian coast in a water depth of approximately 400 m.

Genesis were contracted by BP to assist them in achieving concept selection. The scope of work included option identification and definition with subsequent work performed to determine the extent of brownfield modifications required to the topsides facilities to facilitate the tie-in of the Snadd field.

Simon was the Lead Environmental Engineer responsible for assisting the project team achieve concept selection by: a) Identifying environmental show stoppers for the concepts under consideration, and b) Aiding in the differentiation of similar concepts on an environmental basis.

Specific tasks included:

- a. Developing a base case emissions inventory for air and aqueous discharges from the Skarv facility during normal operations following Snadd development.
- b. Estimating air/aqueous emissions arising as a result of process upsets.
- c. Assessing alternative concepts by difference to the base case.
- d. MEMW DREAM modelling to assess the Environmental Impact Factor of continuous produced water discharge from the Skarv facility following Snadd development.
- e. MEMW DREAM modelling to assess the Environmental Impact Factor of intermittent discharges of contaminated water during production start-up and upset events.
- f. Attending the client Environmental and Social Screening Workshop as the project Environmental Engineer.

Japan Oil Development Company: Concept Screening Study for the Mid Term Development Plan of the Umm Al Dalkh Field - Abu Dhabi - Offshore | Field Development Engineer

JODCO were looking to enhance the mid/late life production performance of the Umm Al Dalkh oil field offshore Abu Dhabi with a view to extending plateau production beyond that achievable with the existing production systems.

Genesis were contracted by JODCO to perform concept identification/screening for the brownfield works required on the Umm Al Dalkh field to achieve the stated objectives. The study considered a range of concepts featuring a combination of brownfield modifications to existing platforms and new 'greenfield' platforms to facilitate additional production wells and separation equipment.

Simon was responsible for developing CAPEX estimates for both greenfield and brownfield cost blocks through the application of ADEPT, this required the development of more than 20 ADEPT models. Cost blocks included



pipelines, platforms (topsides + substructures) and subsea power cables. Further responsibilities included developing the finalised cost matrix which built up completed options from the cost blocks developed. This was the primary tool for option comparison.

Further to the initial scope of work, additional work was completed with the objective of developing OPEX and UTC estimates for the refined options catalogue. This was based on benchmarking and adjusting the ADEPT OPEX calculation against client data, and then running the revised model for the proposed options.

Noble Energy Mediterranean Ltd.: Environmental Support in preparation of EMMP Management Procedures - Israel - Offshore | Environmental Engineer

Noble Energy were looking to develop the Leviathan gas field in the deepwater of the Eastern Mediterranean to supply gas to both the domestic Israeli market and regional consumers in the Eastern Mediterranean region. Development was envisaged as a deepwater FPSO with gas export via subsea pipelines.

Genesis were contracted by Noble to revise the existing project EIA to bring it in-line with that required for approval by the Israeli petroleum ministry.

Simon was responsible for developing air and noise emissions inventories for both the deepwater FPSO and the near-shore Pressure Reduction and Metering Platform (PRMP). Subsequent responsibilities included developing the nearshore EIA addendum for the PRMP and associated export pipelines and shore crossings. This assessment considered the impacts arising from the installation, commissioning and operations phases of the Leviathan Development Project.

BG Tanzania: Tanzanian Upstream SELECT Stage Study - Tanzania - Offshore | Flow Assurance Engineer

BG Tanzania are planning to develop their gas fields in the deepwater offshore environment of Tanzania. Total recoverable gas resources for the initial phase of the development are ~ 15 Tcf with monetisation via an onshore LNG Plant for which a site has already been identified and design activities are ongoing. Genesis were contracted by BG to perform SELECT stage studies for the Upstream elements of the development. Key aspects included in the scope included:

- a. Floating production concepts.
- b. Onshore vs. offshore compression.
- c. Subsea architecture.
- d. Hydrate mitigation strategy development.
- e. Integrated production modelling.
- f. Onshore upstream gas plant site selection.
- g. Interface with LNG plant.

Simon operated as a Flow Assurance Engineer on this project and was responsible for:

- a. Infield and trunkline sizing through application of PipeSim.
- b. Development of pipeline/trunkline operating envelopes.
- c. Preliminary assessment of ramp-up surge volumes.
- d. Enhanced line sizing based on the use of Olga 7.3 with HD module.
- e. Transient analysis (performed during the Definition phase) to assess the operability of long subsea tiebacks.
- f. Transient analysis (performed during the Definition phase) to assess the flow assurance benefits of an electrically heated (DEH of ETHPiP) subsea production system with offshore processing.

Further responsibilities included developing the upstream development economics for the concept screening phase. This involved bringing together inputs from the Genesis cost estimating and IAM groups within the BG economic model, and adjusting the model to allow for varying fuel use and first gas dates.

During this project Simon gained experience in Process Design Reviews, Option Screening/Selection Workshops and a wide range of Project Risk Reviews.

Premier Oil UK Limited: Sea Lion Pre-FEED Concept Select Studies - Falkland Islands (Malvinas) - Offshore | Process Engineer

Following their 2012 farm-in, Premier Oil UK were looking to complete concept engineering on the Sea Lion development in Block 14/10 in the North Falkland Basin. The Sea Lion field is located approximately 200 km north of the Islands in approximately 450 m water depth, particular development challenges associated with Sea Lion include:



- a. Production chemistry issues relating to high wax content, high wax appearance temperature, and pour points, which lead to a propensity to form high strength gels when allowed to cool.
- b. Reservoir pressure maintenance is required, with hot water injection desirable to increase oil mobility.
- c. The frontier nature of the North Falkland Basin means there is currently little existing infrastructure in place to support oil and gas development in the region.

Genesis were contracted by Premier to perform Concept Identification/Selection and Definition to enable the development to progress.

Simon operated as a Process Engineer on this study, responsible for:

- a. Developing and maintaining complex topsides process simulations using Aspen HYSYS.
- b. Developing a sensitivity study into the potential economic benefit of NGL recovery through development of a Hysys simulation, and subsequent preliminary estimation of equipment size, weight and cost.
- c. Developing Heat and Mass balances for the topsides facilities.
- d. Completing a Crude Desalting Study.
- e. Completing a preliminary flare sizing study through the use of FlareSIM.

Additional responsibilities beyond the Process Engineer role included working with the Flow Assurance team to develop subsea flowline sizes for a variety of subsea configurations under steady-state operational conditions.

Premier Oil UK Limited: Balmoral Area Redevelopment - United Kingdom - Subsea | Subsea Engineer

The Balmoral area is situated in around 470 m water and comprises of the Balmoral field and its satellites. It is currently produced through the Balmoral FPV. The Balmoral FPV is reaching the end of its economic life and as such Premier wished to evaluate low cost development options to replace the FPV and continue production from the area and future prospects. The study primarily focussed on reviewing options for subsea tie-in to nearby producing infrastructures, as well as considering other third party facilities which could be tied into the Balmoral system to reduce the OPEX attributable to the Balmoral fields.

Simon operated as a Subsea Engineer on this study, responsible for assisting the discipline lead and flow assurance team in assessing options for enhanced late life performance from the Balmoral Area. Specific responsibilities included:

- a. Reviewing client data and developing hybrid production profiles for an extended Balmoral area facility (e.g. including 3rd party facilities).
- b. Developing steadystate line sizes for a range of subsea architectures and production profiles through the extended use of PipeSIM.
- c. Developing a range of subsea configuration options, and subsequently producing MTO cost estimates for each by utilising the Subsea Cost Estimating model.

This project had a significant focus on the application of subsea processing technology (specifically subsea separation and pumping) to enable prolonged production from declining assets.

Alpha Petroleum Resources Ltd: Cheviot Development Support - United Kingdom - Offshore | Process Engineer

ATP Oil & Gas (UK) Ltd. (now Alpha Petroleum) is the operator of the Cheviot field which lies on the UKCS east of the Shetland Isles. ATP were looking to develop the Cheviot field through either an FPSO or a novel semisubmersible with condensate storage.

Genesis were contracted by ATP to provide services to the Field Development Planning phase of the project, with a specific focus on evaluating the technical feasibility of producing the Cheviot field over the Schiehallion (ex.) FPSO. The scope primarily included assessing the suitability of existing equipment for redeployment to the Cheviot field, and the brownfield modifications required to enable such use.

Simon operated as a Process Engineer responsible for reviewing the existing equipment list and specifications of the Schiehallion FPSO and comparing it against the proposed processing scheme for the Cheviot development. This work was primarily based on a detailed review of PFDs and Equipment datasheets.

National Petroleum Construction Company: Qusahwira Vapour Recovery System Dynamic Study - United Arab Emirates - Onshore | Process Engineer

ADCO were undertaking projects for further development of their marginal fields to expand sustainable crude oil production from 1.1 to 1.8 MMBOPD. One of these marginal oil fields was Qusahwira, located 80km Southeast



of the existing Asab oil field and 200km southeast of Abu Dhabi city. Consistent with the no-flaring policy, the Qusahwira development included a vapour recovery system that collects low pressure gases used to purge and blanket tanks and drain drums. Genesis were contracted to perform a dynamic simulation study of the vapour recovery system to validate that the design and control system provides an adequate response to operational and emergency scenarios.

Simon operated as a Process Engineer responsible for modifying and running a series of dynamic Aspen Hysys models of the Qusahwira vapour recovery system to ascertain controller performance over a range of process upset scenarios. Additional responsibilities included reviewing as built P&IDs and plant isometrics to identify deficiencies in the piping design, specifically looking for low points in the flare system where liquid could gather and prevent effective pressure release.

PRIOR EXPERIENCE

GENESIS | Jul 2012 - Jul 2013

Year In Industry Placement

BAYER CROP SCIENCE | Jul 2011 - Aug 2011

Junior Technical Specialist

Completed an internship between years 2 and 3 of University working as an assistant to the Senior Technical Specialist at Bayer Crop Science's Norwich production site (now named Briar Chemicals). This site produces a range of fine chemicals for use in the agriculture industry; unit operations include batch reaction, batch distillation and filtration

- Based in the technical department – gained experience in laboratory work and operations and maintenance.
- Actively partook in re-commissioning of the Bromophenol Acetate (BPA) plant following a complete control system overhaul - worked with stakeholders across the business and became familiar with the associated processing equipment and control scheme.
- Completed a laboratory investigation into the formation of unwanted Hydrogen Bromide in storage tanks – this drew on a strong underlying knowledge of organic chemistry.
- Wrote and circulated operations and maintenance reports on events on the assigned plants - this involved going plant side, discussing events with operators, and observing maintenance inspections.

FURTHER INFORMATION

Awards/Honours/Publications

- University of Bath First Class Masters in Chemical Engineering with Honors
- "Toward Better Understanding of the Catalytic Action of Acidic Zeolites: Investigation in Methan and Ethan Activation and Transformation" - ACS Catalysis (2012)

Certifications

- OLGA Flow Assurance
- AGR: Introduction to Drilling
- GPA Europe Young Professionals
- GENESIS: Reservoir Engineering



CV – KAYLEIGH HUGHES



Kayleigh Hughes

Marine Scientist & Senior Environmental Specialist

Kuala Lumpur

PROFILE

Number of years' experience: 8

Genesis Grade: A3

Education and Qualifications: MSc Marine Environmental Protection, 2008; BSc Marine Zoology with Marine Zoology, University of Wales Bangor, 2006; TBOSIET

Professional Affiliations:

Languages: English

Kayleigh Dawn Hughes has over 8 years' experience Kayleigh specialises in upstream oil and gas and has worked on projects during feasibility, concept select, FEED, detailed design and decommissioning phases of development. Kayleigh's primary responsibility include the provision of environmental support to a range of process engineering projects as well as stand-alone environmental studies such as Best Available Technique Evaluation Studies and Emissions Inventories.

Kayleigh's experience includes UK and international ESIA environmental screening, scoping, stakeholder engagement, ENVID, EMP, offshore marine surveys (including rigs to reef) and critical habitat assessment. Kayleigh is a highly skilled and proficient user of the ESRI ArcGIS package and a user of the MapInfo GIS package and held the position of GIS Team Lead at her previous company.

Kayleigh also currently holds the position of marine scientist for a marine mammal research NGO called MareCet, carrying out offshore marine surveys involving marine mammal observation using the Tag- Recapture method, seawater and sediment sample collection and scuba diving. Kayleigh is also responsible for the mapping and spatial and statistical analysis of species distribution data using ArcGIS.

Kayleigh is a diligent and passionate individual and a strong team player as she understands the importance of collective input. Kayleigh is self-motivated and a self-starter and takes great pride in being highly organised and motivated. Kayleigh adapts very quickly to new projects and new project environments and has excellent communication skills both written and interpersonal.

CAREER HIGHLIGHTS

2014 - Present | Genesis

2013 - Present | MareCet Marine Mammal Research Organisation

2013 - 2014 | Environmental Resources Management

2010 - 2013 | Genesis

2008 - 2012 | Xodus Group

Career Experience with MareCet Marine Mammal Research Organisation | Feb 2013 – Present

Kayleigh currently works as a marine scientist for a marine mammal research organisation called MareCet. Kayleigh is currently involved in the following projects:

Langkawi Dolphin Research Project



Kayleigh is responsible for the spatial and statistical analysis and mapping of long-term temporal ecological data sets using ArcGIS. The purpose of the study is to establish the first comprehensive dolphin abundance and distribution data in Peninsula Malaysia. Findings are shared with local authorities to help improve marine mammal conservation and management efforts in the area.

Dugong Research and Conservation Project

Kayleigh was involved in conducting marine surveys to assess and understand the Dugong population and their habitat to provide a scientific basis for the design of a Marine Protected Area for the endangered dugong. Survey activities included marine mammal observation and manual sediment and sea grass sample collection.

Kayleigh is also responsible for the spatial and statistical analysis of the temporal data collected using ArcGIS which will be used to inform the Marine Spatial Plan being prepared in order to advise on the optimal design for the Marine Protected Area.

Matang Dolphin Research Project

Kayleigh was involved in conducting marine surveys to establish baseline information on the ecology of coastal cetaceans in the area, investigating their abundances, movements and behaviour. Survey activities include marine mammal observation, photo ID using the Tag- Recapture method and collecting measurements of the physical properties of the water column.

Other duties at MareCet include assisting with Dugong autopsy in the event of a stranding, grant/ funding proposal management, coordination of permanent educational exhibition and conducting fund raising and awareness campaigns. Kayleigh is also providing input to the production of informative reference material regarding environmental impacts arising from the oil and gas industry to marine mammals. Kayleigh is also Project Coordinator of a PhD study being conducted by Nottingham University on the 'Seismic Activities and Legislation in Malaysia' which is being supported by MareCet.

Genesis Selected Experience | Dec 2010 – Present

Groupement Reggane: FEED for Reggane Nord Project Surface Facilities - Algeria - Onshore | Lead Environmental Engineer

Groupement Reggane (GRN), comprising Sonatrach, Repsol Exploración Argelia S.A., RWE Dea AG and Edison International are developing the Reggane Nord Project located in the Reggane Basin, approximately 1,500 km southwest of Algiers (refer to Figure 1 below). The Surface Facilities include a gas gathering system connecting widely dispersed wells to a Central Processing Facility where the gas will be processed to sales specification. The gas will then be compressed, metered and exported via a pipeline to a tie-in on the main gas transport system in the region.

Kayleigh took on the role of project manager and was responsible for the production of an Environmental Basis of Design, Construction Environmental Management Plan, Construction Waste Management Plan, Permitting Plan, Health, Safety and Environment Plan, Emissions Study and CO2 Block Diagram.

THHeavy Engineering Berhad: Safety Studies for Layang FPSO - Malaysia - Offshore | Lead Environmental Engineer

Environmental and Safety Studies for Layang FPSO

Kayleigh was the Lead Environmental Engineer and was responsible for production of a Detailed ENVID, Environmental Design Review, Produced Water Technical Note, Emissions Study and Environmental ALARP Study. Kayleigh was also responsible for the production of the Design and Operational Safety Case for this development

Technip Consultant (M) Sdn Bhd: Mubadala M5 Field Concept Selection - Malaysia - Offshore | Lead Environmental Engineer

Concept study for the development of WHP and CPP offshore Malaysia

Kayleigh was the Lead Environmental Engineer and is responsible for production of an Emissions Study and providing ongoing support to the Project.

Idemitsu Oil & Gas Co. Ltd: Field Development Concept Study for Blocks 05-1b and 05-1c - Viet Nam - Offshore | Lead Environmental Engineer

Concept study for offshore CPP and WHP development offshore Vietnam



Kayleigh was the Lead Environmental Engineer and is responsible for production of an Emissions Study and providing ongoing support to the Project.

Rockhopper Exploration PLC: Sea Lion Development Concept Phase - Falkland Islands (Malvinas) - Offshore | Lead Environmental Engineer

The Sea Lion field is located 200 km north of the Islands in approximately 450 m water depth. This was a two-phase Concept Screening Study to evaluate the viability of the 13 options during the options evaluation workshops. The 3 options carried forward to Phase II were: 1 - A leased FPSO with (hot) HSPs and ESPs with wet and dry trees; 2 - Leased FPSO, with gas Lift, all wet trees; and 3 - A large TLP with a combination of dry (ESPs) and wet tree producers (with HSPs) and a leased FSO.

Kayleigh took on the role of Lead Environmental Engineer during this project Kayleigh prepared the Environmental Philosophy in accordance with Falkland Island legislation, UK and IFC/ WB. Kayleigh coordinated the ENVID process and acted as lead environmental engineer during the workshop. Kayleigh conducted a semi- quantitative environmental screening assessment of potential impacts of the development using key environmental indicators. Such environmental impact differentiators were then considered alongside the risked economics. Kayleigh conducted a Best Available Techniques (BAT) assessment which included) an assessment of the FPSO vs. TLP with FSO; artificial lift; topsides analysis; thermal discharges; and noise and vibration. Kayleigh also produced the ESIA scoping report and ESIA scope of work.

Genesis Internal : Onshore | Genesis Environmental Auditor

Kayleigh was responsible for the continued development and implementation of the Genesis Environmental Management System (EMS) in order to maintain the Genesis ISO 14001 certificate. Components of this include being responsible for the management, monitoring and reporting of energy use and waste management within the Genesis London offices, conducting internal audits of office environmental practices and establishing environmental Key Performance Indicators (KPIs).

Technip Brazil: Environmental Support to Genesis Brasil - Brazil - Offshore | GIS Consultant Gas Evacuation Route Study Brazil

Kayleigh provided extensive GIS support to a gas evacuation route study for a proposed field development, 250 km offshore from the southern coast of Rio de Janeiro. Kayleigh produced a series of interactive maps which identified potential constraints enabling an evaluation to be conducted of the most practicable routing option. Kayleigh adopted a phased approach and produced a series of interactive maps illustrating the various routing options, influencing factors and environmental constraints in order to identify the optimal pipeline route.

Technip USA LTD: Provision of ESIA Services to Noble Energy (Leviathan Asset) - Israel - Offshore | Environmental Engineer

Production of ESIA for FPSO development Israel

Kayleigh was responsible for the production of the Nature and Ecology and the Marine Ecology Environmental Impacts section of the ESIA.

Setanta Energy Roussette S.A.: Roussette (Offshore Gabon) Concept Selection Study - Gabon - Offshore | Environmental Engineer

Kayleigh completed a legislative review and developed the legislation and policy framework to inform Shell's produced water handling and management.

BG Trinidad & Tobago: Assess Stage Development Engineering Studies -ECMA - Trinidad and Tobago - Offshore | Lead Environmental Engineer

BG T&T are developing the Starfish field which is intended to be either a subsea production system or a wellhead platform.

Kayleigh worked on the project during Concep Select, assisting in the the definition of the surface and subsea facilities of the Starfish development strategies. Kayleigh coordinated the ENVID workshop and produced a comprehensive ENVID report. Kayleigh also conducted a BAT assessment the objective being to identify an optimum solution with respect to factors such as technical suitability, cost, safety and process as well as the environment. Aspects investigated included subsea vs. wellhead platform, pipeline routing, hydrate inhibitor selection and corrosion protection technology.



BP:North West Hutton and Don Decommissioning License - - Offshore | Environmental Engineer

Kayleigh was involved in the production of the first marine license in the UK for the decommissioning activities for the subsea facilities of the NWH and Don fields in the North Sea.

Korea National Oil Corporation - Vietnam: Service of "Optional and Feasibility Study for Pigging of 6" and 18" Pipeline" - Viet Nam - Offshore | Lead Environmental Engineer

Pigging Study, Offshore Vietnam, of the condensate export pipeline and spur gas pipeline

Kayleigh was the environmental engineer in support of the combined HAZID/ ENVID to assess the potential environmental impacts associated with the pigging modes under evaluation.

Nautical Petroleum: Kraken Field Development Project Management & Engineering Services - United Kingdom - Offshore | Environmental Engineer

The Kraken development is a heavy oil field located 400 km north east of Aberdeen in 116 m water depth.

Kayleigh prepared a Permits and Consents Roadmap and assisted in conducting a FPSO fuel source BAT study during the select phase. The heat and power demand is high, various combinations of heat and power generation equipment were considered (turbines, engines, steam boilers, fired heaters and waste heat recovery units) together with the available and potentially available fuel sources (associated gas, imported gas, crude oil). An emissions assessment and comparison of the equipment and fuel options was presented plus an assessment of impacts on receptors.

Sonatrach-Activite Amont: FEED for Inlet Separation and Boosting - Algeria - Onshore | Environmental Engineer

Extension of Field Life for the Onshore Field 'Alrar'.

Kayleigh provided environmental engineering support during FEED. Kayleigh coordinated the ENVID workshop and prepared a comprehensive ENVID report and produced the Project HSE Plan.

GDF SUEZ E&P UK Ltd: Concept Study for Cygnus Eastern Area Development Project - United Kingdom - Offshore | Environmental Engineer

Cygnus Offshore Gas Field Development Concept Definition.

Kayleigh coordinated the ENVID workshop and produced a comprehensive ENVID report. Additionally, Kayleigh conducted a regulatory compliance evaluation to determine how the statutory requirements have been incorporated in to the Cygnus Development Project design at the concept definition stage of the project development.

Premier Oil Vietnam South B.V.: Dua Subsea FEED study - Viet Nam - Offshore | Lead Environmental Engineer

Dua Field FPSO Development. The Dua Filed lies some 400 km offshore Vietnam in 104 m water depth, the development will include a tie-back to an existing FPSO.

Kayleigh was the lead environmental engineer during the ENVID and the Hazard Identification (HAZID) workshops and was responsible for preparation of the ENVID report and the environmental section of the HSE Plan.

BG Egypt Sa: Rosetta 3rd party Gas Tie-in Concept Select - Egypt - Onshore | Environmental Engineer

BTEX Emissions Dispersion Study for the Rosetta Onshore Processing Facility

Kayleigh conducted a BTEX emission dispersion study for an onshore processing facility at Idku; the study assessed the potential occupational health impacts on near-by communities as well as potential environmental atmospheric impacts. The modelling work was undertaken using AERMOD V7 and applied Egyptian Environmental Affairs Agency (EEAA) and BG Standards.

Technip Malaysia: Maharaja Lela South GHG Emission Study - Malaysia - Offshore, Onshore | Environmental Engineer

Offshore and Onshore GHG Emissions Study

Kayleigh assisted in conducting a study of the Greenhouse Gas (GHG) emissions that were attributed to the drilling and operation of a new offshore platform and associated onshore processing plant; the methodology used



was Totals' 'methodology for the assessment of GHG emissions' and is validated by industry bodies such as OGP and API.

Groupement Reggane: FEED for Reggane Nord Project Surface Facilities - Algeria - Onshore | Environmental Engineer

Groupement Reganne is developing an onshore natural gas field in southwest Algeria
Kayleigh was responsible for developing the Environmental Basis of Design and is responsible for maintaining the waste inventory and providing ongoing environmental engineering support to the project team.

PRIOR EXPERIENCE

ENVIRONMENTAL RESOURCES MANAGEMENT | Feb 2013 - Jun 2014

Kayleigh's primary responsibilities included providing environmental engineering support, coordinating offshore marine environmental surveys and producing EIAs for both onshore and offshore developments.

Kayleigh also took on the role of GIS Team Lead at ERM and provided extensive GIS support to a number of Projects.

Lead Environmental Engineer

Detailed Design Environmental Engineering Support to Offshore Gina Krog Development, Norway, Norway - Offshore

Detailed Design Environmental Engineering Support to Offshore Gina Krog Development, Norway
Kayleigh was responsible for providing environmental support to the offshore Gina Krog gas and condensate platform. Kayleigh performed an Environmental Design Review and BAT Evaluation Study during detailed design to ensure that the development was in line with BAT and provided recommendations for optimisation and improvement. Kayleigh also produced an Environmental Assessment and Budget Study and a Waste Handling Philosophy.

Lead Marine Environmental Consultant

Rigs to Reef Survey, - Offshore

Coordinate rigs to reef survey to examine whether previous decommissioning option to convert to a reef was successful

Kayleigh took on the role of rigs to reef expert in ERM and was Project Manager of a rigs to reef survey being performed on a jacket structure that was decommissioned in this nature. The objective was to identify whether the rigs to reef programme was successful to support future decommissioning BPEO assessments.

GIS Consultant

Critical Habitat Assessment and IA, - Offshore, Onshore

Conduct a Critical Habitat Assessment and IA

Kayleigh provided extensive GIS support to the critical habitat assessment and IA. Kayleigh assisted in the survey planning process by identifying areas for sampling by looking at the region, proposed project activities and other environmental constraints comparatively. Kayleigh produced a number of habitat maps using the survey data and provided advisement on potential areas of critical habitat.

Project Manager and GIS Consultant

Offshore Marine Sediment and Seawater Survey, - Offshore

Offshore Marine Sediment and Seawater Survey

Kayleigh provided extensive GIS support to the offshore marine sediment and seawater survey and river baseline surveys. Kayleigh assisted in the survey planning process by identifying areas for sampling by looking at the region, proposed project activities and other environmental constraints comparatively. Kayleigh compiled survey datasets into a manageable interactive library using GIS.

Marine Environmental Consultant

Offshore Deepwater IA, - Offshore

Offshore deepwater IA production

Kayleigh was responsible for preparing the marine environmental impact assessment component of the IA. Kayleigh also provided extensive GIS support to the marine environmental baseline survey. Kayleigh assisted in the survey planning process by identifying areas for sampling by looking at the region, proposed project activities



and other environmental constraints comparatively. Kayleigh compiled survey datasets into a manageable interactive library using GIS.

Project Manager and GIS Consultant

GIS and Data Standards for Environmental Baseline Survey Work, - Onshore, Offshore

GIS and Data Standards for Environmental Baseline Survey Work

Kayleigh was responsible for sorting all temporal data collected by the client for all coral, seawater and sediment sampling surveys conducted. Kayleigh produced an interactive GIS library, in GDB format, of all data according to location and survey period. Additionally, Kayleigh produced a Data Standards document to be employed internally to advise survey teams on how the data is to be collected and presented in order to create an efficient, standardised environmental baseline survey library.

Lead Marine Environmental Consultant

BPEO Offshore Decommissioning Study, - Offshore

BPEO Offshore Decommissioning Study

Kayleigh conducted a BPEO study for the decommissioning of offshore platform and pipeline assets in order to determine the Best Practicable Environmental Option.

XODUS GROUP | Dec 2008 - Dec 2012

Kayleigh started with Xodus as a Graduate Environmental Consultant. Kayleigh's primary responsibilities included the production of EIAs for offshore oil and gas developments, wave and tidal renewable energy projects and fish farms. Kayleigh was involved in all aspects of EIA production. Kayleigh was also responsible for the production of Petroleum Operations Notices for developments in the North Sea for various phases of operation.

Laggan - Tormore FPSO Development, - Offshore Marine Environmental Consultant

The Laggan–Tormore development, 125 km north- west of Shetland, comprises a gas processing plant, on and offshore flowlines and a high pressure export gas line.

Kayleigh took responsibility for managing the stakeholder consultation process and assisted in the production of the Final ESIA for both the onshore and offshore components. Kayleigh prepared the waste and decommissioning sections for inclusion in the Environmental Management Plan (EMP) and the drainage and wastewater appraisal.

Logbaba Gas and Condensate Field, Cameroon, - Onshore GIS Consultant

Evacuation route mapping

Kayleigh took on the role of environmental advisor for an oil and gas field development, onshore Cameroon during Concept Select. Kayleigh attended numerous scoping workshops and prepared an Environmental Considerations Technical Note informed by the IFC performance standards.

Kayleigh provided substantial GIS support, preparing over 100 maps displaying the intended phased pipeline routing for the development along with relevant topographical features and influencing factors. These maps were presented to the Government of Cameroon as an aid towards receiving Field Development Plan (FDP) approval.



CV – ROSS CORMACK



Ross Commack

Principal Environmental Specialist Houston

PROFILE

Number of years' experience: 11

Genesis Grade:

Education and Qualifications: MS, Ecological Design, Robert Gordon's University, Aberdeen, Scotland, 2001
MA, (Hons) Environmental Geography, University of Aberdeen, Scotland, 1998

Professional Affiliations:

Languages: English, Spanish

More than eleven years of experience in environment and safety loss prevention engineering with strong project management and analytical skills. Experienced in EIA, Permits, Modelling, BAT Assessment, ENVID, Design Safety Assessments and Safety Case Updates.

Career Highlights

2016 - PRESENT | GENESIS

SELECTED GENESIS EXPERIENCE

Career Experience with Genesis | Jan 2016 – Present

PTTGCA Petrochemical Complex as Environmental Consultant

ENVID Facilitator - ENVID Terms of Reference, Register and Report, Environmental Management Plan

ExxonMobil, Scarborough Subsea Development

Management of environmental scope - Regulatory Compliance Plan, Environment Plan, Hydrotest Discharge Modelling, Decommissioning Option Selection, ENVID, Environmental support.

Yuhuang Inc., Methanol Plant

Development of Environmental Design Criteria for the proposed methanol plant located in Louisiana. Management of a small team to complete stormwater pollution prevention plan (SWPPP), spill prevention countermeasure plan (SPCP), hazardous materials storage facility plan, used oil storage and handling procedure and general environmental support.

Summit Power Texas Clean Energy Project (TCEP)

Development of Environmental Design Criteria for the proposed TCEP coal gasification plant located in West Texas. Management of a small team of consultants to complete several deliverables including an environmental baseline, waste management plan, waste catalyst management and radioactive materials studies.

PRIOR EXPERIENCE

Xodus Group (Ltd. and Inc.), Key Assignments, 2009 to 2014 | Environmental Consultant

Worley Parsons (Chevron) Rosebank FPSO Development - Houston, 2012 to 2014

Project management and technical environmental engineering activities in FEED and Detail Design for the Chevron Rosebank FPSO, located in deep-water, NE Atlantic, West of Shetland.



- Development of Air, Water and Waste Strategies
- BAT Assessment for power generation, flaring, venting and cargo offloading
- BAT Assessment for produced water and produced sand
- Energy efficiency workshop
- Development of atmospheric emissions inventory, discharges to sea and waste inventories
- Participation in HAZOP workshops and environmental modelling review cycles
- Engineering support

Shell UK Ltd. Wells delivery operational support, 2012

Management of environmental permits (PON15B drilling, PON15F abandonment and well intervention operations, Oil Pollution Emergency Plan, Oil Pollution Prevention Control and Consent To Locate applications) and general operational support.

Shell UK Ltd. Denver SWEEP development ES, 2012

Project management activities, atmospheric emission quantification and discharge to sea analyses and compilation of the final Environmental Statement.

Total E&P UK Ltd. Dunbar phase IV drilling preparations, 2012

Project management activities, preparation of ENVID methodology, attendance at workshop and production of the final ENVID report.

Shell UK Ltd. Pierce oil in water and radioactivity assessment, 2012

Analysis of oil in water discharge and levels of radioactivity in produced water as a result of new wells tied-back to the Pierce - Haewene Brim FPSO.

Brighton Marine Redevelopment, Trinity E&P Ltd., Trinidad and Tobago, 2012

Completion of Certificate of Environmental Clearance (CEC) for the decommissioning of platforms and pipelines, as well as drilling, platform construction and pipe laying activities in south-west Trinidad.

Renewable energy trade mission, Santiago, Chile, 2012

The objectives of the trade mission were to identify real opportunities in marine energy in the short-term. Activities included networking and business development.

- Identification of opportunities with developers looking to work in Chile
- Identification of potential investors in marine energy in Chile (potential clients)
- Opportunities with Chilean companies looking to invest in marine renewables

SBM Atlantia, Fram FPSO FEED, Six month Secondment, Houston, 2011 to 2012

Project management activities for the Fram FPSO environmental engineering work-scope in concept select and FEED: Activities included progress reporting, data gathering and working closely with project engineers and management to achieve deliverables.

Best Available Technique (BAT) Reviews and Assessments for:

- Produced water handling and re-injection optimization
- Flaring, venting, VOC emissions and offshore loading
- Power generation
- Environmental sampling
- Greenhouse gas energy management plan

Development and review of design philosophies for topside facilities, including:

- Drainage systems
- Flaring and venting
- Produced water handling
- Materials and chemical selection



- Sand and scale management
- Abandonment plan

TAQA Bratani Ltd. Otter Production Increase Environmental Statement, 2011

Project management activities including development of the initial proposal and costs, client liaison, environmental analysis, facilitation of ENVID workshop and compilation of the ENVID report and the final ES, including PON16 submission.

TAQA Bratani Ltd. Tern Alpha EOR ENVID, 2011

Preparation of the initial proposal, facilitation of the ENVID workshop and production of the final ENVID report, including budgeting and client liaison.

Woodside Energy Limited. Browse LNG upstream development NW Australia, 2011

Compilation of stakeholder handbook chapters for the Browse LNG upstream development in offshore north-western Australia, client liaison and progress reporting.

Chevron North Sea Ltd. DREAM chemical discharge modelling (Cambo well), 2011

Use of DREAM software to model chemical discharge impacts from the Cambo well and preparation of the final chemical discharge modelling report.

Centrica oil spill modelling (Briggs) Eastern Irish Sea, 2011

Use of OSCAR software to model oil spill scenarios from a one well drill development in the Eastern Irish Sea and preparation of an oil spill modelling report.

DEO Petroleum UK Ltd. Perth Field Development ES, 2011

Responsible for preparing the data request and interpretation of technical documentation, including concept select and FEED documentation for the compilation of the ES project description. Responsible for atmospheric emission analysis and drilling discharge impacts.

Centrica plc. Kittiwake and Hummingbird Oil Pollution Emergency Plan posters, 2011

Based on current legislation, responsible for the development of oil spill posters incorporating information regarding types of spill, response strategies, spill notification procedures and offshore team responsibilities as well as identification of the environmental sensitivities for these areas of the North Sea.

Centrica plc. Management system support toward ISO 14001, 2011

Development of a legislation update service procedure and a questionnaire designed to determine degree of impact on the business

Mobil North Sea LLC SAGE Oil Spill Justification, 2011

Responsible for the compilation of the SAGE oil spill justification document which compliments the SAGE Oil Pollution Emergency Plan.

Total E&P UK Ltd – Franklin and Hild Sustainability 2011

Responsible for the compilation of these sustainability chapters based on the Company's objectives regarding sustainable development.

Total E&P UK Ltd- Elgin production increase and West of Franklin Phase 2 ES addendum 2011

Responsible for managing the project description element of the ES, including client liaison, literature review, cost, time and resource allocation, as well as compiling and drafting the report.

Total E&P UK Ltd- Laggan-Tormore Visual Impact Assessment 2011

Project management of the visual impact assessment element of the Laggan-Tormore Development in the near shore area of Shetland. Responsible for costs, time and allocation of resources, sub-contractor management and client liaison.

Total E&P - Various PONs 2010 to 2011

Responsible for PON15D project description, impact assessment and FEPA applications for various rock-dump operations in the North Sea as well as the impact assessment element of the West of Shetland PON15C including



atmospheric emissions analysis, seabed impacts, chemical use and discharge, noise and interaction with other sea users. Project management (cost, time and resource allocation) of the East of Shetland PON15C export gas pipeline, including drafting the project description and environmental impact chapters.

Shell UK Limited - Fram Development, 2010

Responsible for drilling discharge analysis, atmospheric emission quantification and waste management for the Fram Development ES, as well as project management duties, client liaison, literature review and development description work.

DCENR - IOSEA4 Strategic Environmental Assessment of the Celtic and Irish Seas, 2010

Responsible for compilation of the draft plan & alternatives and atmospheric emission quantification chapters of the SEA.

Confidential: Environmental Due Diligence, 2010

Environmental due diligence for two offshore installations

BP Exploration Operating Company, Clair Ridge Development, 2010

Responsible for the production of the development description and discharges to sea EIA chapters of the ES, document review and analysis, aspects of project management and the PON 16 application.

Premier Oil UK Ltd, ELARP, 2010

Project management for an environmentally as low as reasonably practicable workshop for Premier North Sea installation. Responsibilities included proposal writing, cost, time and resourcing, workshop attendance and compilation of a final report with recommendations.

BP Exploration Operating Company, Quad, 204 2010

Responsible for atmospheric emission quantification for Quad204 and development and compilation of the atmospheric emissions chapter.

BP Exploration Operating Company, Sullom Voe Terminal Odour Assessment, 2010

Responsible for the preparation (including the initial proposal) and completion of an on-site assessment, budgetary control, compilation and issue of the final report to ensure BP meet pollution prevention control (PPC) requirements.

TAQA Bratani, Tern North (Falcon) completion and development EIA/ES, 2010

Responsible for the production of the project description via document review and liaison with project engineers. Conducted atmospheric emissions quantification, discharges to sea analysis and interaction with other sea users and drafted the EIA chapters of the ES.

TOTAL E&P UK Limited - Total Islay ES addendum, 2010

Project manager for the TOTAL Islay development ES addendum. Responsible for managing a small team of Xodus consultants, coordination of resources, client liaison, drafting sections of the ES and final document compilation.

Shell UK Limited - Corrib North Environment Area Assessment, 2010

Project manager for the Shell Corrib North Environmental Area Assessment. Responsible for managing a small team of Xodus consultants and coordination of resources to complete the EAA, which included client liaison and EAA compilation.

BP Exploration Operating Company, Devenick Basis of Design & EIA/ES, 2009 to 2010

Project manager responsible for budget control, client liaison, EIA, (including all analyses) and drafting the final ES. Preparation of environmental input into the Devenick Basis of Design.

ConocoPhillips, Jasmine Development Project Scoping Report / EIA/ES, 2009

•Preparation of a scoping report and environmental input into the EIA process and ES compilation.

Shell UK Limited, Shell Wells PONs 2009

Project manager for the Shell Wells (PON15B) contract which primarily included resourcing, client contract meetings and quality assurance.



Mobil North Sea LLC, Tay Cormorant EIA/ES, 2009

Project Management for the Tay Cormorant subsea tie-back to the Beryl Alpha platform, including project kick-off, ENVID workshop, client liaison, EIA and production of the final ES.

Mobil North Sea LLC, Loirston EIA/ES, 2009

Project Management for the Loirston subsea tie-back to the Beryl Alpha platform; responsibilities included attendance at project kick-off, ENVID workshop, client liaison, EIA and production of the final ES.

BP Exploration Operating Company, Miller Decommissioning ENVID, 2009

- Chairing and facilitation of ENVID workshop
- Preparation of ENVID methodology and production of final ENVID report
- Environmental input into the decommissioning energy and emissions study

Dana Petroleum Plc, Barbara Phyllis Project Screening & CO2 Calculation Study, 2009

- Carbon Dioxide Emission Study for Barbara Phyllis subsea tieback options
- Environmental input into Barbara Phyllis Project Screening Report

BP Exploration Operating Company, Foinaven Subsea Module, 2009

Development of a produced sand technical note for proposed Foinaven subsea module.

PREVIOUS EXPERIENCE

Wood Group Engineering North Sea Oil & Gas, 2001 to 2005

Safety Loss Prevention Engineer

Wood Group / Numerous SIMCO (Venezuela), 2005

Responsibilities. To ensure that the Safety Critical Element's (SCE's) achieve their performance standard (PS) requirements. Identification of SCE's and corresponding PS's and development of a PS management procedure.

- Audits and safety inspections of onshore and offshore water injection facilities
- Participation in the preparation of Work Pack's and Work Pack reviews
- Review and update COSHH and noise risk maps and carry out H2S gas testing
- Site / work Risk Assessments
- Supervision of work activities (e.g. pipe laying barge)
- Review certification

BP, Magnus Extension Project

Responsible for managing the HSE activities required to maintain the HSE performance of the Project. Primary responsibilities included the provision of informed guidance and input to the Scope of Work and the Basis of Design, review and update of the HSE Plan for the Project and chairing and participation in Construction Risk Reviews and Work Pack Risk Reviews. Further responsibilities included the completion of the design safety assessment, offshore visits to the Magnus Platform during construction to carry out Advanced Safety Audit's & STOP tours, and logging and tracking of HSE activities, including maintenance and delivery of the HSE dossier.

Talisman, Clyde Helideck Review

Responsible for conducting a survey of the Clyde Helideck and surrounding area, with a view to developing the appropriate "As Built" drawings depicting the necessary Helideck Landing Area markings and identification of restrictions to helicopter flight paths. Responsibilities included the preparation of a Scope of Work, issue of a final report and financial control of the project.

Talisman, Safety Case Updating Contract

Responsible for providing Talisman with a service that evaluates the impact of offshore modifications and produces regular, auditable updates to the Safety Cases. Responsible for initial contract negotiation, engineering, management and financial control of the Safety Case update service.

Talisman, Tartan V4 Modifications

Project Engineer



Responsible for ensuring that work deliverables are achieved by the discipline engineers and contractors, responsible for raising material requisitions for construction, organisation of delivery details and management of design changes.

Chevron / BP / Talisman / Hess, Numerous

Safety Loss Prevention Engineer

- Responsible for the compilation, management & tracking of the Design Safety Assessment.
- Interface with WGE and client discipline engineers and management
- Safety input into the Scope of Work, Statement of Requirements, FEED Reports & Basis of Design
- Participation in HAZOP's, HAZID's and Design Reviews
- Completion of a Preliminary Environmental Impact Assessment for the identification, analysis & evaluation of potential environmental impacts at different stages within a project life cycle and their subsequent risk to Best

Practical Environmental Option

- Responsibilities also included notification to BP of any material change to the Safety Case, to identify potential safety impacts and to eliminate & reduce hazards during the detailed design process
- Responsible for ensuring that any changes conform to the performance standards where design impacts safety critical elements
- Responsible for determining cost, time & resource implications for each engineering modification, and raising change requests for design changes where applicable

Wood Group Engineering North Sea Ltd., Onsite Civil Engineering Modifications

Project Management

Responsible for managing, coordinating and supervising the design and construction of a civil engineering project on Wood Group premises. Work activities included compilation and management of the Health & Safety File, chairing meetings regular liaison with senior management, the planning supervisor, architects, contractors and sub-contractors

FURTHER INFORMATION

Training & Computer Skills

- Environmental Protection Agency Bootcamp (2015) (EPA Alliance)
- Mind-store (2012)
- OSCAR oil spill modelling training (2011)
- Zebedee and DREAM modelling training (2011)
- Consultancy skills training (2011)



CV – PERRY HANSON



Parry Hanson

Environmental Engineer/ Environmental Modelling Specialist

London

PROFILE

Number of years experience: 6

Genesis Grade: A4

Education and Qualifications: BSc Chemical Engineering (University of Idaho); MSc Chemical Process Engineering (University College London)

Professional Affiliations: IChemE Associate Member

Languages: English

Perry Hanson has over 6 years engineering experience and is one of our environmental modellers within the Environmental group. He has attended training courses for the MEMW software suite (OSCAR, DREAM, ParTrack) at SINTEF's Norwegian office and is certified by Sintef in the use of the DREAM software. He can provide modelling capabilities for produced water discharges and subsea drilling cuttings from offshore developments as part of developing environmental reporting plans for new offshore field developments. Perry also has experience with emissions inventories and holds a basic awareness of environmental requirements in the USA and UK. He joined Genesis coming from a background in municipal and industrial wastewater treatment.

Perry's modelling experience includes:

- Thermal dispersion from fluid discharges to sea using CORMIX software
- Produced water dispersion using DREAM software
- Subsea drill cuttings dispersion using PARTRACK software
- Noise propagation for in-air scenarios using Predictor
- Atmospheric emissions dispersion using Breeze AERMOD
- Field development estimating using in-house ADEPT software

CAREER HIGHLIGHTS

2013 - Present | Genesis

2008 - 2012 | KUBOTA Membrane USA; Redmond, WA, USA

KEY SKILLS

- ENVID Workshops
- Oil Spill Modelling
- Produced Water Discharge Modelling
- Noise Modelling
- Environmental Legislation
- Atmospheric Emissions Modelling

GENESIS SELECTED EXPERIENCE

Career Experience with Genesis | Dec 2013 – Present

Noble Energy, Inc.: Pre-ESIA Support - Israel - Offshore | Environmental Engineer



Genesis supported Noble Energy in an early engagement with the Israeli Regulators on the nearshore fixed platform development, through preparation of a Preliminary Environmental Review/Screening study. The scope of this study included:

- Project Description
- Regulatory Framework
- Environmental description (desktop study to environmentally sensitive receptors)
- Potential Environmental Significance (impacts to air, water, land) - a common starting point for such early assessment is a Leopold matrix.
- Preliminary Environmental Studies (Air, Noise, Oil spills dispersion work)
- Forward looking Environmental action plan

There was a significant modelling effort required to demonstrate impacts associated with the development which included:

- Deterministic Oil Spills Modelling (using OSCAR) for credible condensate release, chemical and diesel spill scenarios
- In-air Noise modelling (using NOISE Predictor™)
- Air Dispersion Modelling (using AERMOD) for normal operation

The delivery included:

A Summary report for submission as part of the Regulatory Permit application

A Preliminary Environmental Review/ Screening Report (including modelling results and contour maps)

Modelled various oil spill scenarios comparing environmental impact for multiple concepts based in multiple locations

Conducted stochastic modelling of oil spill scenarios

Assisted with in-air noise modelling for a fixed platform based development scenario

Assisted with atmospheric pollutant dispersion modelling for a fixed platform based development scenario

Abu Dhabi Gas Development Company Ltd.: NW Field Development Concept Definition - Abu Dhabi - Offshore | Environmental Engineer

After a lengthy bidding process Genesis and Technip in Abu Dhabi (TPAD) received confirmation from ZADCO of the award of the Conceptual Design stage of the North West Fields Development. This award follows the Conceptual Study recently completed by Genesis in London. The Conceptual Design developed the earlier work to a status suitable for the start of FEED, which will be executed by TPAD.

The facilities include:

- Offshore facilities at the Satah, Hair Dalma and Dalma fields.
- Well stream transfer from the fields tied back to Arzanah Island.
- Oil and gas processing facilities on Arzanah.
- Oil and gas export from Arzanah.

Calculated emissions inventories and compiled emissions reporting documents

Modelled atmospheric emissions dispersion using Breeze AERMOD software

Modelled in-air noise propagation using Predictor software

Advised other project disciplines on potential environmental impacts as a result of design decisions

Sasol Exploration and Production International: Sasol PSA Development FEED - Mozambique - Onshore | Lead Environmental Engineer

The PSA Development Project substantially expanded the Central Processing Facilities (CPF) operated by Sasol Exploration and Production International at Temane in Mozambique to include an additional gas processing and compression train and a new liquids stabilisation and LPG extraction plant, plus oil and gas gathering from nineteen new wells and all storage, loading, off-sites and utilities.

Genesis carried out the FEED and a Class 3 Cost Estimate for the PSA Development Project.

Acted as Environmental Lead for the project, which involved interfaced with other discipline leads during weekly progress meetings and managed usage of environmental discipline CTRs for the project



Provided input to documents prepared by other disciplines (SHE Plan and Philosophy)
Prepared ENVID Terms of Reference and ENVID workshop materials ahead of workshop
Acted as Lead Environmental Engineer during ENVID workshop
Prepared calculations and report for Environmental Discharges Register
Prepared Construction Waste Management Plan
Prepared calculations and report for Noise & Vibration Study

Premier Oil Exploration and Production Limited: ESIA Services for Premier Oil for the Sea Lion Development project - Falkland Islands - Offshore | Environmental Engineer

Genesis was awarded the ESIA Services Contract for the proposed Sea Lion Development Project, the first offshore oil and gas development in the Falklands Islands (FI). Sea Lion lies in a water depth of 450m and is 220 kilometres north of the FI. Oil was discovered in both the Sea Lion Main Complex and satellites with a recoverable total oil reserves estimated at 300-350 million barrels. Beverley to the south is a gas discovery. The basic concept is to produce the reservoir fluids via one subsea drill centre tied back to a TLP with artificial lift provided by gas lift. The TLP is connected to an FSU for oil storage and export. The anticipated peak throughput is around 120,000 barrels/day.

Along with new modelling work, previous work done during the Pre-FEED stage required updating to reflect the change in concept from FPSO to TLP.

Conducted drilling cuttings modelling in PARTRAK for phase 1 production wells

Reviewed and updated previous FPSO cooling water discharge thermal plume modelling study for new TLP concept

Conducted produced water modelling in DREAM for phase 1 production wells including the associated report

Khalda Petroleum Company: Hydra Phase IIIA FEED Compression Study - Egypt - Onshore | Process Engineer

Hydra is a hot, normally pressured gas condensate field located in the Western Desert of Egypt that is being developed by Khalda Petroleum Company (KPC), a joint-venture company between Apache Corporation and EGPC (Egyptian Government Petroleum Company). Hydra is located in the Western Egyptian Desert approximately 80km to the southwest of Matruh and 8km from the nearest tie-in location on the Shams-Obayied pipeline.

Hydra Phase III consists of installation of two new 12" CS schedule 80 pipelines to flow gas and recombined condensate between Hydra Facility and Shams Manifold with export compression and condensate pumping at Hydra Facility. The Hydra gas and condensate mix arriving at Shams Manifold will then flow through two existing 10" CS & 10" / 12" duplex pipelines to Salam Gas Plant Train 1&2 Manifold.

Phase IIIA is the Compression FEED and Studies for the gas compression, condensate pumping and associated utilities and infrastructure at Hydra.

Prepared sizing calculations for Instrument Air Receiver and Nitrogen Systems.

Khalda Petroleum Company: Hydra Phase IIID Pipeline Tie-ins - Detailed Design - Egypt - Onshore | Process Engineer

Hydra is a hot, normally pressured gas condensate field located in the Western Desert of Egypt that is being developed by Khalda Petroleum Company (KPC), a joint-venture company between Apache Corporation and EGPC (Egyptian Government Petroleum Company). Hydra is located in the Western Egyptian Desert approximately 80km to the southwest of Matruh and 8km from the nearest tie-in location on the Shams-Obayied pipeline.

Hydra Phase III consists of installation of two new 12" CS schedule 80 pipelines to flow gas and recombined condensate between Hydra Facility and Shams Manifold with export compression and condensate pumping at



Hydra Facility. The Hydra gas and condensate mix arriving at Shams Manifold will then flow through two existing 10" CS & 10" / 12" duplex pipelines to Salam Gas Plant Train 1&2 Manifold.

Phase IIID is the detailed design for the tie-in of the two new 12" CS pipelines at Shams Hub and Hydra Process Plant for initial and intermediate pipeline operations.

- Assisted with review of As-built P&IDs to identify Pipeline Tie-in locations
- Modified As-built P&IDs
- Reviewed P&IDs drafts
- Assembled documentation and drawings for HAZOP, HAZID and SIL review workshops
- Acted as scribe for HAZOP, HAZID and SIL review workshops

Duqm Refinery, LLC.: Environmental Support for Duqm Refinery Lender Compliance - Oman - Onshore | Environmental Engineer

Duqm Refinery is a joint venture between the state-owned Oman Oil Company (OOC) and the International Petroleum Investment Company (IPIC). The new Refinery is located approximately 600 km south of Muscat on the Arabian Sea coast of Oman. The Refinery is a Hydrocracker/Coker based distillates refinery and has been designed to process a range of Middle Eastern crude oils at a design rate of 230,000 BPSD.

To assist with external Project financing, Genesis were retained by Duqm Refinery to perform a gap analysis of the Development against an agreed set of applicable standards (including EPIII, IFC and various ECA requirements) to assist the Project in demonstrating their understanding and response to the Project Environmental and Social Risks.

Genesis is supporting Duqm Refinery by:

- Preparing a Corporate Level Environmental and Social Management System
- A competence and training plan for Environmental and Social personnel currently in position at Duqm Refinery as well as E&S Job descriptions
- Stakeholder engagement mapping of direct and indirect target groups for consultation.
- Creation of Corporate Environmental and Social Management System (ESMS) Manual
- Reviewing Duqm Refinery's existing policies /procedures to identify gaps related to environmental & social issues
- Creation of Operational Control Plan
- Compilation of Action Tracking Register
- Preparation for Environmental and Social Aspects and Impacts identification workshop

BG Group: Tanzanian Upstream SELECT Stage Study - Phase A5 - Tanzania - Onshore, Offshore, Subsea | Environmental Engineer

BG Tanzania as operator, with its partners, intend to develop the gas fields discovered in offshore Tanzania in Blocks 1 and 4. The major development challenges for the development are:

- Remote location devoid of infrastructure and local markets for gas
- Water depth between 1100-2200 m with distance from shore ranging from 50-120 km for the initial developments
- Challenging offshore bathymetry consisting of radially distributed canyons from near shore to deep water
- Areal extent of the discovered hydrocarbons; the initial development fields in Blocks 1 and 4 are approximately 200 km apart

Block 4 development option is offshore processing aboard FPSO with export to shore and via tanker vessel. Block 1 development option is either offshore processing aboard FPSO with export to shore and via tanker vessel or direct subsea tieback to an onshore Gas Processing Plant (GPP) which is integrated into an onshore LNG Plant to be designed and operated by others.

Phase A5 is the next phase in the BG Tanzania Select Phase Study and carries on from Phase A4. Whilst a final concept selection has yet to be made, this is primarily down to circumstances outside the project's control (e.g land access, low LNG price, and general governmental issues). Both FPSO and subsea multiphase tiebacks to onshore LNG plant remain as viable options.



Managed updating of Effluent and Emissions Inventory and the associated report, completed in Phase A1, to reflect status of concept designs in Phase A5
Managed updating of BAT Demonstration Report, completed in Phase A1, to reflect status of concept designs in Phase A5

Premier Oil Exploration and Production Limited: Sea Lion Pre-FEED Concept Engineering Study - Falkland Islands - Offshore | Environmental Engineer

Sea Lion lies in a water depth of 450m and is 220 kilometres north of the Falklands Islands (FI), the first offshore oil and gas development in the FI. Oil was discovered in both the Sea Lion Main Complex and satellites with a recoverable total oil reserves estimated at 300-350 million barrels. The preferred development concept was a Turret Moored FPSO with subsea wells artificially lifted by hot water driven Hydraulic Submersible Pumps (HSPs). Discharges of cooling water and produced water from the FPSO required analysis of the behaviour of the thermal plumes as these mixed with the ambient seawater to ensure that World Bank guidelines on discharge of heated water could be satisfied.

Modelled FPSO cooling water discharge thermal plume dispersion using CORMIX

Modelled FPSO produced water discharge plume dispersion using CORMIX

Carried out sensitivity analysis of discharge arrangement (pipe size, orientation)

Noble Energy, Inc.: Leviathan Development EIA - Israel - Offshore | Environmental Engineer

Genesis supported Noble Energy in an early engagement with the Israeli Regulators on the nearshore fixed platform development, through preparation of a Preliminary Environmental Review/Screening study. This work continues on from there with the preparation of the Production Development EIA for Leviathan Development. There was a significant modelling effort required to demonstrate impacts associated with the development which included:

- Deterministic Oil Spills Modelling (using OSCAR) for credible condensate release, chemical and diesel spill scenarios
- Air Dispersion Modelling (using AERMOD) for normal operation
- Provided guidance to project engineer on conducting subsea pipeline rupture gas and condensate release scenarios
- Assisted with modelled oil spill scenarios
- Assisted with atmospheric pollutant dispersion modelling for a fixed platform based development scenario

Noble Energy, Inc.: Leviathan Environmental Support (ESIA terrestrial scope) - Israel - Offshore | Environmental Engineer

The Leviathan FLNG is located in the Mediterranean Sea off the coast of Israel. The modelling work supported the ESIA being developed for this project. Multiple oil spill scenarios were modelled to compare the environmental impacts based on different concept locations.

Conducted oil spill modelling using OSCAR software to compare different FLNG concept locations

Conducted stochastic modelling of oil spill scenarios using OSCAR software

Presented modelling results to client management and provided recommendations for concept location

Tengizchevroil: LSP & KTS Project Phase 2A / 2B London - Kazakhstan - Onshore | Environmental Engineer

The purpose of the Korolev Improved Oil Recovery (IOR) Project is to increase the ultimate recovery from the Korolev and Tengiz oil fields by using water injection. The Korolev IOR Large Scale Pilot (LSP) is aimed at: Improving the robustness of the reservoir performance forecast by deriving reservoir matrix rock wettability and fracture connectivity from the field water injection response; validating facility requirements related to both the



injection system and production system. A phased implementation is currently planned for the Korolev IOR Project with early pilot testing followed by the LSP and Full Field Development.

Prepared ENVID ToR and pre-populated worksheets for the LSP ENVID workshop

Advised project engineers in conducting an environmental risk screening

Reviewed environmental risk screening results produced by project engineers

Abu Dhabi Company for Onshore Oil Operations: Hail & Ghasha Integrated Development Concept Study - Abu Dhabi - Offshore | Environmental Engineer

The Hail and Ghasha fields are situated offshore Abu Dhabi (AD) in water depths of 0 to 15 metres. Sour gas levels are in the range of 18 to 35% of H₂S and 5 to 10% CO₂ depending on the reservoir. The client requires the evaluation of various concepts for the optimal development of the fields to include a technical review of each of the options along with the preparation of high level cost estimates. Nine reservoir scenarios are to be evaluated and a short list of three will be selected for concept definition (pre-FEED). The expectation is that the short list for Concept Definition will comprise one option for each of Hail only, Ghasha only and Hail and Ghasha integrated. Conducted accidental MEG release modelling in DREAM to provide high level concept selection guidance. Provided guidance to project ENVID workshop on MEG release consequences

Noble Energy, Inc.: Cooling Water Temperature Dispersion Modelling for FLNG - Israel - Offshore | Environmental Engineer

The Leviathan FLNG is located in the Mediterranean Sea off the coast of Israel. This study was designed to model cooling water discharge from the topside of a FLNG and advised on the maximum discharge capacity which would satisfy World Bank guidelines on thermal plume dispersion in the marine environment. Scope included:

- Interfaced with the client to understand study requirements
- Modelled thermal plume dispersion characteristics using CORMIX software
- Discussed with client the limitations of CORMIX and revises model parameters accordingly
- Produced summary report according to client specifications
- Interfaced directly with client in ongoing fashion to determine additional model scenarios to be run in CORMIX

Al-Khafji Joint Operations: KJO MASTER PLAN PRODUCTION FACILITIES - Kuwait - Offshore, Subsea | Process Engineer

Aramco Gulf Operation Company Limited (AGOC) and Kuwait Gulf Oil Company (KGO) jointly worked as KJO at Al-Khafji-Saudi Arabia in the offshore area of the divided ex-Neutral Zone between Saudi Arabia and Kuwait. Many KJO production facilities, particularly offshore pipelines and structures have exceeded their design life (over 25 years) whilst some facilities have operated for more than 50 which in turn leads to obsolescence in terms of outdated design standards. As a result KJO have decided to begin work on an overall master plan for KJO production facilities (Offshore & Onshore) in order to meet KJO corporate objectives.

The scope included performing a high level assessment, feasibility study (+/- 50% cost estimate), and developing an overall master plan for KJO production facilities (onshore and offshore).

Assisted with understanding, sorting and manipulating large amounts of data provided by the client
Produced charts to assist with visualisation of production profiles, fluid flow rates, etc.

Assisted with developing field pipeline layouts, pipeline sizing, utility cable layout and sizing

Technip Angola - Engenharia Limitada: Greater Plutonio RSP Execute Phase - Angola - Offshore | Process Engineer

The Greater Plutonio development is located in deepwater offshore Angola, in approximately 1300 metre water depth. It has proven resources in six fields with an anticipated field life of 25 years.



The facility comprises a FPSO with facilities for three stage gas-oil separation plus oil desalting amenities sized to produce 200mbd of export quality oil. Associated gas is compressed and dehydrated to provide fuel gas and riser gas lift as an aid to production.

Reviewed PFDs, P&IDs and isometric drawings for the entire hull section of the FPSO

Provided drawing mark-ups of LP/HP interfaces for a senior engineer to review

Technip Malaysia: Maharaja Lela South GHG Emission Study - Malaysia - Offshore | Environmental Engineer

Study scope included a greenhouse gas (GHG) emission study scopes of work and the pipeline risk assessment for the Total E&P Borneo B.V owned, Maharaja Lela South Project - an offshore wellhead platform (MLJ3) and the associated onshore processing plant (OPP) respectively.

The GHG emissions study aimed to quantify the expected GHG emissions and estimated the associated GHG emission intensities for the MLJ3 platform.

Interfaced continually with client to acquire additional process information necessary to carry out calculations
Reviewed and updated Green House Gas (GHG) emissions calculations for equipment and operations/SIMOPS activities related to MLJ-3

Reviewed and updated GHG emissions report draft for client

New Age (African Global Energy) Ltd: Environmental Support Services - Cameroon - Offshore, Onshore | Environmental Engineer

The Etinde Field is located off the coast of Cameroon. Initial environmental due diligence was completed for several development options, both offshore and onshore facility options, examined during this stage of the project. Prepared Stakeholder Identification report. Responsibilities included:

- Scribed Pre-FEED Framing and Option ID workshop
- Contributed to Environmental Overview Report
- Prepared Environmental Roadmap of relevant legislation, permits and regulatory bodies
- Prepared ENVID Terms of Reference and ENVID workshop materials in support of the environmental study manager
- Scribed Environmental screening workshop
- Prepared Environmental screening report based on results of the Screening workshop
- Contributed to Environmental & Social Critical Factors Risk Register (Bow-Tie diagrams)

Quantum Power Services Ltd: Pipeline FEED Engineering for Ghana Gas Project - Ghana - Offshore, Onshore | Environmental Engineer

Quantum Power Services Ltd is the Owner of the Ghana LNG Import development which comprises an offshore floating regasification unit (FSRU) in a water depth of approximately 40m, a 12 km export pipeline, landfall, onshore pipeline and an onshore metering station with distribution to end users. The FSRU will re-gasify LNG and export at up to 600 MMscfd to an onshore metering station.

Genesis scope included the riser base/PLET, subsea pipeline, beach crossing and onshore metering station. Prepared the ENVID Terms of Reference and introductory presentation for the ENVID workshop.

Genesis Oil and Gas Consultants Pty Ltd: Environmental Support to (J40572A) Bowen TGS Dunk EWTI Study -Assess Phase - Australia - Onshore | Environmental Engineer

Genesis (Brisbane) assisted the Client (QGC) to identify and evaluate potential system configurations to eliminate flaring during extended well trials (EWT's). The Genesis (London) scope supported decision making related to noise emissions by determining the impact of this EWT programme on communities and other sensitive receptors in the vicinity of the EWT activities. Responsibilities included:



-
- Assisted with data collection and interpretation from client
 - Assisted primary study engineer with development of noise simulation model using Genesis in-house developed noise modelling tool
 - Reviewed final report
 - Assisted with re-modelling and re-writing of report following critical client feedback

FURTHER INFORMATION

Certifications

- SINTEF DREAM/ParTrack Modelling Tool
- Practical Air Dispersion Modelling Workshop

Training & Computer Skills

- Word, Excel, PowerPoint
- OSCAR
- DREAM/ParTrack
- Breeze AERMOD
- Predictor
- CORMIX
- ADEPT



CV – SAMUEL RICHARDSON



Samuel Richardson

Technical Safety Skills Group Manager/ Pipeline Rupture Modelling Specialist

London

PROFILE

Number of years' experience: 11

Genesis Grade: E0

Education and Qualifications: MEng Engineering (Mechanical Route) 1st Class

Professional Affiliations: CEng MIMechE CFSE

Languages: English

Samuel Richardson has over 11 years' experience in the oil and gas industry. Sam has carried out safety studies for onshore & offshore installations and possesses a good understanding of international safety codes & standards. Studies work includes: Escape, Evacuation and Rescue Analyses (EERA), Emergency Systems Survivability Assessments (ESSA), Offshore Ship and Helicopter Impact Assessments and Dropped Object Impact Assessments. He has significant experience of carrying out Fire, Explosion & Toxic Risk Assessments, Quantitative Risk Assessments and vent & flare dispersion and radiation studies, including consequence modelling using PHAST. He has also carried out Layers Of Protection Analysis and SIL Verification Studies, and is a Certified Functional Safety Expert (CFSE).

CAREER HIGHLIGHTS

2006 - Present | Genesis

2005 - 2006 | Advantica

SELECTED GENESIS EXPERIENCE

Career Experience with Genesis | Jun 2006 – Present

Nexen: Buzzard Phase II - - |

Safety assessment for concept selection, including assessment of separate LQ platform.

Supervision of consequence modelling for riser releases for concept options.

Khalda Petroleum Company: Hydra Gas Development - - |

Project Engineer and Lead HSE Engineer for onshore gas conditioning development, concept selection through to EPC

OMV: South Tunisia Oil Development - - |

Carried out a Preliminary Quantitative Risk Assessment for the expansion of the existing facilities. Also carried out QRA and ALARP Assessment of the oil trucking operations.

Total: MLJ3 - - |

Carried out safety studies for the MLJ3 platform development, including:



Dropped Object Risk Assessment
Ship Impact Risk Assessment
Technological Risk Assessment (QRA)

Nexen: Golden Eagle - - |

Carried out safety studies for Golden Eagle Area Development FEED and Detailed design, including:
Fire and Flammable Release Assessment
TR Integrity Assessment
Dropped Objects Study
Quantitative Risk Assessment
Safety Case Development

ZADCO: 7th Crude Oil Storage Tank Concept Selection - - |

Carried out safety and risk studies to facilitate option selection for 7th crude oil storage tank on Zirku Island.

BP Angola: PCC Tieback to Greater Plutonio FPSO - - |

Carried out safety engineering studies for Pre-FEED project including
Layers of Protection Analysis (LOPA)
Dropped Objects Study
Qualitative Safety Assessment

RWE Dea UK SNS Ltd.: Clipper Offshore Facilities Design - - |

Carried out a range of safety studies and assessments including:
Safety & Fire Fighting Equipment Specifications and Datasheets
Safety Equipment & Egress Route Layouts
Ship Impact Risk Assessment
Fire & Explosion Hazard Assessment
Quantitative Risk Analysis
ALARP Demonstration
Identification of Safety Critical Elements
Performance Standards
Emergency Systems Survivability Assessment

Nexen: Golden Eagle Area Development - - |

Provided safety engineering support for the Buzzard tie-back development option, including:
Revision of the offshore fire and toxic hazard assessment
Revision of the Passive Fire Protection Assessment
Development of a concept safety assessment

Nexen: Buzzard Enhanced Oil Recovery Project - - |

Provided safety engineering support for the concept design, including:
Revision of the offshore complex Quantitative Risk Assessment
Calculation of leak frequency data for detailed explosion modelling

Centrica: Baird Storage Project - - |

Developed the offshore and onshore Fire & Explosion Philosophies.
Carried out offshore vent/flare radiation modelling.

Centrica: York FEED Study - - |



Carried out consequence modelling for the fire and explosion hazard assessment.

Carried out the following:

Dropped object risk assessment

Riser impact risk assessment

ADMA-OPCO: SARB Zirku Full Field Development - - |

Developed Quantitative Risk Assessment model for onshore facilities and carried out consequence modelling for input into the QRA model.

Sonatrach & Rosneft-Stroytransgaz: Takouzet & North Tisselit Field Development - - |

Carried out Fire and Explosion Hazard Analysis for the Central Processing Facility.

Carried out flare and vent dispersion and thermal radiation assessment.

Sonatrach, PTTEP & PVEP: Bir Seba Field Development - - |

Carried out Fire and Explosion Hazard Analysis for the Central Processing Facility.

Carried out flare and vent dispersion and thermal radiation assessment.

BP: West Nile Delta Option Selection - - |

Carried out consequence modelling for onshore facility and pipelines using BP CIRBUS and proprietary BP Group Risk Models.

Nexen: Buzzard Enhancement Project - - |

Updated the Egress, Escape, Evacuation, Rescue & Recovery Assessment (EEERA) and Temporary Refuge impairment Assessment (TRIA)

Carried out consequence modelling in support of the revision of the Quantitative Risk Analysis and Safety Case documentation for the Buzzard offshore development.

PA Resources: Elyssa Concept Verification Study - - |

Carried out a plant layout assessment in order to optimise the layout of the onshore gas processing facilities with respect to Major Accident Hazards, operational and maintenance requirements, with due consideration of recommended and best practices.

Tengizchevroil: FGC Well Flowback Facilities Configuration Study - - |

Provided safety support to multi-wellhead production and re-injection layout design, including consequence modelling to assess required separation distances.

Tengizchevroil: Existing Firewater System Upgrade Project - - |

Revision of fire water demand calculations to international and local standards for a large central base operations area and associated offsite facilities.

KNOC: Donghae compression project - - |

Carried out a qualitative risk assessment to address concerns over possible gas releases from compression module and subsequent migration into nearby gas turbine generator units.

BP: Seth/Taurt Phase 2 - - |

Carried out risk based layout assessment to evaluate required separation distances between existing West Harbour plant equipment and new development equipment.



BP: West Nile Delta - - |

Carried out a plant layout assessment in order to optimise the layout of the onshore gas processing facilities in accordance with BP Group Practices and Inherently Safer Design requirements.

GASSCO: Dornum Gas Compression Project - - |

Prepared the following:

- Vent Consequence Study
- Firefighting systems criteria and calculations
- SIL Verification Report

KPDL: Karachaganak Gas Plant Feasibility Study - - |

Carried out PHAST consequence modelling to develop plant layout and location selection and also SIMOPS assessment.

Tengizchevroil: TCO Well Cleanup Project - - |

Prepared the following:

- Fire, Explosion & Toxic Risk Analysis
- Quantitative Risk Analysis
- Hazardous area drawings & schedules
- Escape route & safety equipment layouts
- Study Actions Close-Out Report
- Responsible for co-ordination of HSE deliverables and HSE technical review of other discipline deliverables.

NAOC: Samabri-Biseni Development Project - - |

Prepared the following:

- Hazardous area drawings & schedule
- Safety equipment & fireproofing specification
- Fire proofing layouts
- Escape route & safety equipment layouts
- Fire protection layouts
- Firefighting criteria and calculations
- Firefighting systems P&IDs

BG Tunisia: Miskar Infill Wells Project - - |

Created Terms of Reference for safety workshops (HAZID, HAZOP and SIL Review) to be carried out for the glycol reboiler and condensate coalescer projects, including identification of the instrumented loops to be included in the SIL Review.

Carried out the following reviews/assessments:

- Dropped Object Assessment for the glycol reboilers project.
- Riser location risk review.
- Review of firewater system and wellbay deluge.

Maersk: Danish Accident Statistics Review - - |

Carried out a review of various sources of industry statistics and compared with Danish sector and Maersk Company results.

GASSCO: Feasibility Study For Carbon Dioxide Blending at Dornum - - |



Carried out a Vent Radiation and Dispersion Analysis for the new vent including required stack heights and sterile area distances. Consideration was also given to interaction with existing vent and impact on personnel during construction.

BP: West Nile Delta Project - - |

Carried out a review of industry statistics to determine the major causes of accidents to personnel during oil and gas operations.

Developed a guideline Control of Work philosophy for the project to further develop based on BP corporate standards and current GUPCO operating procedures.

BG Tunisia: Hasdrubal Development - - |

Responsibilities included:

- Developed Performance Standards for the Hasdrubal offshore platform.
- Carried out the following design studies:
 - Escape, Evacuation and Rescue Analysis (EERA)
 - Vent Radiation and Dispersion Analysis
 - Emergency Systems Survivability Study (ESSA)
 - Ship and Helicopter Impact Assessment
 - Hydraulic analysis of the firewater system

NIPETCO: North Idku Development - - |

Dropped objects assessment for the two offshore installations in the North Idku Field Development.
Carried out Fire and Explosion Risk Analysis and Quantitative Risk Assessment for the offshore installations.

KPDL: Karachaganak SIMOPS - - |

Developed Quantitative Risk Assessment model for the Karachaganak Simultaneous Operations (SIMOPS) project.

Various Clients: HAZOP/HAZID Secretary - - |

Acted as secretary for several projects including:

- Maersk Esbjerg: Tyra South East Offshore facilities HAZOP
- Maersk Copenhagen: FPSO conversion HAZOP
- Shell Hague: Test Drilling Rig HAZID
- BG Tunisia: Miskar Combined Operations HAZID, Hasdrubal Safety Layout Review & HAZID
- Tullow Oil: Sub Sea HAZID for the Ettrick Project and onshore HAZID for the M'Putu Development
- NIPETCO: North Idku development onshore & offshore HAZID & HAZOP
- BP: Taurt development onshore and subsea HAZOPs
- BP: Shaz Deniz full field development HAZID
- PETROBRAS: Compact GTL HAZID
- SONATRACH & FCP: MLE HAZID
- TCO: Well Cleanup Project HAZID
- GASSCO: Dornum Gas Compression Project HAZID

Various Clients: Consequence Analysis - - |

Conducted PHAST runs and performed engineering studies in support of various projects, including fire and dispersion modelling.

Various Clients: SAMS System Development - - |



Developed Safety Action Monitoring System for managing and tracking safety actions for various projects including:

- Nexen: Ettrick
- NAOC: Brass LNG
- NIPETCO: North Idku
- BGT: Miskar and Hasdrubal Projects
- NOSPCO: Offshore North Sinai
- BP: Taurt development

Nexen: Ettrick Project - - |

Developed Performance Standards for subsea production and export system components.

PRIOR EXPERIENCE

ADVANTICA | Jan 2005 - May 2006

Safety Engineer within the Hazard and Risk Management group.

Pipeline Risk Assessment, -

Carried out numerous quantitative risk assessments of natural gas pipelines both in the UK and overseas.

Onshore Installations Risk Assessment, -

Carried out quantified risk assessments of various petrochemical installations, including natural gas compressor stations.

Miskar and Hannibal Safety Documentation Review, -

Revision of the Safety Critical Elements & Performance Standards documents for the BG Group onshore and offshore installations in Tunisia.

Revision of the Safety Case for the Hannibal Gas Treatment Plant.

Hasdrubal Development, -

Development of the design Safety Case for the Hasdrubal onshore installation.

Carried out construction and commissioning quantitative risk assessment for the Hasdrubal onshore facilities.



CV – LARRY REITSEMA, PH.D.



Dr Lawrence Reitsema

HSE Professional and Manager

US

PROFILE

Education and Qualifications: Doctor of Philosophy in Marine Biology/Toxicology, Texas A&M University, 1981
Master of Science in Fisheries, Texas A&M University, 1975; Bachelor of Science in Biology, Calvin College, 1969

Dr. Reitsema is an experienced Health, Safety, and Environment (HSE) professional and manager who has worked with environmental consulting and oilfield service companies prior to joining Marathon in 1990. His areas of expertise include management of HSE issues in the U.S. and international operations, primarily for upstream activities; due diligence and risk assessment activities for U.S. and international facilities and projects; environmental, social, and health impact assessments and associated studies; environmental damage assessments and remediation; marine discharges and spill response; ecological studies related to oil and gas operations in a wide range of environments; international HSE operations and project management; environmental and safety management system development and implementation; training and standards program management; and environmental surveys, sampling, and analyses.

CAREER HIGHLIGHTS

2014 - Present | CSA
1990-2013 | Marathon Oil Corporation

SELECTED EXPERIENCE

2014 to Present: CSA Ocean Sciences Inc. – HSE Professional and Manager

- Develops EIAs and other environmental assessments and reports for offshore projects for clients worldwide.
- Serves as the lead for the development and implementation of the CSA Health, Safety Environment and Quality Management System.

PRIOR EXPERIENCE

1990 to 2013: Marathon Oil Corporation – HES Corporate Support Advisor

- Active in the development and support of Marathon's HSE and Major Project Management Systems. Managed HSE Management System implementation throughout the company and supervised corporate staff dedicated to the Management System program. Integrated the Management System with other corporate programs including quality control, major projects, new ventures, emergency response, and other management system / corporate functions.

- Technical support for offshore platform permitting issues, representing Marathon to regulatory agencies overseeing discharge permits and requirements, managed the Technical Environmental Support Team for Emergency Response, and prepared a corporate Natural Resources Damage Assessment Process.

- Served as HSE Manager for several large international projects and consortiums, including an assignment seconded to Sakhalin Energy (1995 to 2001) as HSE Manager and HSE Technical Support Manager. Sakhalin Energy was required to comply with World Bank stipulations as well as those of Russia and required intensive



negotiations and studies to complete the permitting process for production. Developed and implemented an HES Management System for Sakhalin Energy.

-Responsible for oversight for all new international projects and provided technical support throughout Marathon with significant involvement in projects in Canada, Equatorial Guinea, Russia, Indonesia, Poland, Libya, Gabon, Kurdistan, the UK, Norway, and others as Manager of New Ventures and Business Support.

-Led a project to develop corporate ESHIA and HSE risk assessment programs.

-Served as an industry representative to numerous trade associations in the U.S. and worldwide, taking various leadership roles and working with the leadership groups to represent industry's interests to government agencies and regulatory bodies.

-Supported environmental personnel throughout the company and provided environmental expertise to international projects and due diligence activities.

-Served as HSE team member for project peer reviews and new country entries.

LGL Ecological Research Associates – Project Manager

-Project Manager for ecologic studies in the Gulf of Mexico focused on platforms, coral reefs, marsh reclamation, and the response of marine organisms to brine discharges.

Newpark Environmental Services – Regulatory Affairs and Government Relations Manager

-Managed permitting program for all operations, including handling, treating, and disposing of waste drilling fluids. Permits and activities included non-hazardous oilfield waste management, hazardous waste treatment and disposal, emergency response, facility permits, transportation permits, and facility siting and operations. Represented the company at public hearings and permit negotiations.

Southern Petroleum Laboratories – Environmental Lab Director

-Responsible for all activities for SPL's Houston full-service environmental sample analysis laboratory, including staffing, equipment, sales, and quality control. Led the laboratory into the EPA's certified lab program, supervised the transition to an electronic laboratory management system, and oversaw growth from 11 to over 50 employees.

ENSR – Project Manager

-Project manager for RCRA projects, site remediation, and due diligence for domestic and international real estate transactions.



CV – KATHLEEN GIFFORD



Kathleen Gifford

Project Scientist 1

US

PROFILE

Education and Qualifications: Master of Science in Chemical Oceanography, The Florida Institute of Technology, 2009; Bachelor of Science in Marine Sciences, The Richard Stockton College of New Jersey, 2007

Ms. Gifford is a chemical oceanographer with over 6 years of experience in field studies, including water quality identification and collection. She has served as a Vessel Manager, Lead Field Scientist, Field Scientist, and Safety Officer on numerous oceanographic studies. As a participating scientist on various projects, she has taken part in the collection and analysis of samples and data as well as reporting the results.

Prior to consulting, Ms. Gifford served as a Seasonal Naturalist for the Seacoast Center in Rye, New Hampshire. Her background involves an array of aquatic and terrestrial work with emphasis on nearshore water quality fieldwork. Her academic emphasis on Chemical Oceanography is supported by expertise in analysis of water quality parameters, and by proficiency in data management and analysis. She has experience obtaining and analyzing water and sediment samples from different aquatic environments, including creeks, rivers, estuaries, and beaches. Ms. Gifford has served as a Teaching Assistant to the Florida Institute of Technology for seven semesters, emphasizing a holistic approach connecting multiple disciplines of science. She ran three laboratory classes unsupervised; these classes focused on the analysis of the physical and chemical properties of local waterways, survey of air quality, and guiding students to build research ideas in biological, meteorological, chemical, and physical oceanography. Ms. Gifford is a certified National Association of Underwater Instructors (NAUI) Open Water SCUBA, Professional Association of Diving Instructors (PADI) Underwater Naturalist, Underwater Photographer, and Enriched Air Diver and has certifications in Divers Alert Network (DAN) O2 Provider. She also is trained in Red Cross cardiopulmonary resuscitation (CPR) and first aid.

CAREER HIGHLIGHTS

2010 - Present | CSA

SELECTED EXPERIENCE

2010 to Present: CSA Ocean Sciences Inc. – HSE Professional and Manager

-Quality Control Manager for CSA. Responsibilities include creating and updating standard operating procedures, creating project specific quality control plans, and reviewing and managing field collected data in Excel.

-Project Scientist for the Oil Spill Water Monitoring Equipment Program. Responsibilities included the maintenance of equipment and instrumentation in the mobile laboratory and operational units and report preparation. Assisted in the development of the maintenance documentation including plans, standard operating procedures, and logs. Also assisted in the development of a worldwide database to enable identification of appropriate analytical laboratories to be used during oil spill response.

-Conducted quality control for over 240 surveys. Responsibilities included client interaction, overseeing data migration process, using various spreadsheets and software for comprehensive data tracking, organization, and reporting with a heavy focus on metadata generation.



-Lead Field Scientist/Diver for Puerto Rico Aqueduct and Sewer Authority (PRASA) field sample and data collection, wet and dry season coral community monitoring surveys near the Bayamon and Carolina Regional Waste Water Treatment Plant outfalls offshore Puerto Rico. Surveys were conducted in compliance with 301(h) waiver demonstration. Responsibilities included client interaction, collection of sediment and fish samples, oversight of water sample collection, and collection of video and digital photographic data concerning pre-established coral transects, deck operations, data analysis, and report preparation.

-Lead Field Scientist/Diver for PRASA field sample and data collection, wet and dry season coral community monitoring surveys near the Aguadilla, Arecibo, and Ponce Regional Waste Water Treatment Plant outfalls offshore Puerto Rico. Surveys were conducted in compliance with 301(h) waiver demonstration. Responsibilities included client interaction, collection of sediment and fish samples, oversight of water sample collection, and collection of video and digital photographic data concerning pre-established coral transects, deck operations, data analysis, and report preparation.

-Field Scientist for a deep sediment survey. Responsibilities included overseeing deck operations; operating and maintaining a multicorer and boxcore sediment sampler; and assisting with sediment sample collection, processing, and cleaning/re-setting of sampling equipment.

-Field Scientist for a deepwater offshore survey cruise in the eastern Mediterranean focused on monitoring sediment and water quality as well as video documentation of benthic faunal assemblages.

-Lead Field Scientist for PRASA 301(h) outfall inspection and data collection for the Arecibo, Aguadilla, Ponce, Bayamon, and Carolina Regional Waste Water Treatment Plant outfalls offshore Puerto Rico. Responsibilities included oversight of video data quality, daily safety meetings, deck operations, data analysis, and report preparation.

-Field and safety diver for numerous Florida-based projects. Responsibilities included dive safety practices and assisting lead scientists in monitoring coral, coral relocation, planting seagrass, and mapping hard bottom edges.

-Lead Field Scientist for PRASA 301(h) Dye study: Mixing Zone validation data collection for the Bayamon and Carolina Regional Waste Water Treatment Plant outfalls offshore Puerto Rico. Responsibilities included oversight of data quality, daily safety meetings, and deck operations.

-Field Scientist for the RasGas Coral Relocation and Monitoring Project. Participated in the removal and transportation of corals as well as establishment of monitoring locations.

-Lead Field Scientist/Vessel Manager/Safety Officer for numerous oceanographic cruises in the Gulf of Mexico. Helped QA/QC scientific procedures and oversaw operations on some cruises by managing crew, care of instrumentation and net collection, navigation, and troubleshooting. Responsibilities included water quality collection using a Seabird CTD with the SeaSave Program and simple Hypack for navigation, water and plankton sample collection, rosette water collection, 1-m MOCNESS, Bongo, Neuston and Manta net collection, high-volume filtering methods, and safety procedures, including daily safety meetings with JSAs.

PRIOR EXPERIENCE

2010: Seacoast Science Center, Rye – Naturalist Teacher

-Educated school groups and the public on the importance of the Rocky Shore environment. Adaptations of the organisms that live and grow within the environment was heavily discussed as well as environmental protection.

2008 to 2009: Dr. John Trefry, Florida Institute of Technology – Grain Size Analyst

-Analyzed wet sediment samples from Lake Worth Lagoon, Florida and the Cheshki Sea, Alaska for grain sizes of gravel, sand, silt + clay and clay.



CV – ELAD MILLS



Elad Mills

Scientist, Marine Specialist – MVI Israel

Israel

PROFILE

Education and Qualifications: Master of Science in Chemical Oceanography, The Florida Institute of Technology, 2009; Bachelor of Science in Marine Sciences, The Richard Stockton College of New Jersey, 2007

Mr. Mills is a marine biologist with over 9 years of experience in marine environmental sciences. A decent portion of his time has been spent working in the oil and gas industry where he has gained valuable experience and knowledge in exploration and production (upstream) of crude oil and natural gas, including drilling of exploratory wells, well completion operations, well testing, production, and export of petroleum. Since joining CSA Ocean Sciences Inc. (CSA) in 2013, he has been engaged with multiple monitoring programs in the eastern Mediterranean Sea, where he served as a project manager and chief scientist on several research cruises evaluating the impact of anthropogenic disturbance on shallow-water and deep-sea ecosystems. He has prepared survey plans; supervised and conducted sample collection, processing, and analysis; and has been responsible for the interpretation and synthesis of data in conjunction with the preparation of various environmental documents.

Mr. Mills had the unique opportunity to get hands-on experience in field engineering work, practicing the principles of fluid dynamics, hydraulics, and three-phase separation. Through his training as a marine biologist and his studies in environmental sciences, he successfully implemented this knowledge and expertise into his work. When working as an environmental superintendent, Mr. Mills coordinated the onshore production operations with environmental regulations and promoted environmental awareness among his colleagues. Upon turning to offshore operations, he acquired expertise in the fields of Health, Safety, and Environment (HSE) and permitting while working actively under the Halliburton Project team for the Gabriella drilling project. There, Mr. Mills played an important role in promoting the environmental monitoring, discharge permit, and the oil spill contingency plan.

During his years at university, he gained experience in environmental, ecological, biological, physical, and chemical issues concerning coastal and oceanic problems. He participated in numerous projects testing water properties in the eastern Levant and characterizing seasonality in the planktonic community.

In his thesis dissertation, Mr. Mills investigated the role of microorganisms in bleaching of the Mediterranean coral *Oculina patagonica*. The purpose of this project was to elucidate the reason for seasonal bleaching in the coral and provide evidence for temperature-regulated infection by a *Vibrio* species. The research supported the bacterial bleaching hypothesis and included the utilization of advanced molecular techniques, classic microbiological tools, and frequent SCUBA diving under rough sea conditions.

CAREER HIGHLIGHTS

2010 - PRESENT | CSA

2014- PRESENT | TECHNION INSTITUTE OF TECHNOLOGY

2012 – 2013| ADIRA ENERGY ISRAEL LTD

2010 - 2012 | GIVOT OLAM OIL LTD,

2012 - 2014 | RUPPIN ACADEMIC CENTER

2010 – 2011 | ISRAEL OCEANOGRAPHIC & LIMNOLOGICAL RESEARCH INSTITUTION



SELECTED EXPERIENCE

2013 to Present: CSA Ocean Sciences Inc. – Deputy Branch Director, Marine Ventures International, Inc., Israel

-Project Manager for the preparation of Environmental Impact Assessment (EIA) for offshore Israel O & G drilling. Responsibilities included coordinating the completion the EIA among the client, EIA author, technical review, editing, and document production staff as well as budget management.

-Chief/Field scientist in multiple monitoring surveys for oil and gas operators within the eastern Mediterranean Sea to assess deep-sea benthic habitat prior to and after anthropogenic disturbances. Surveys include the collection of seawater and sediment samples from a vessel using common methodology and a remotely operated vehicle (ROV).

-Contributing author of Environmental Analysis Statement, including editing and in-depth preparation of the section related to air pollution regulation, process-derived air emissions impact, and waste management and resource exhaustion in Israel.

-Contributing author of Oil Contingency Spill Program, assisting in the preparation of coastal and nearshore habitat characterization.

-Regional and local lead for CSA business development. The goal was to develop and implement growth opportunities for the company in local industries and create a long term value from customers and markets. Focus was put into areas of expertise such as the O & G industry and ports development. Emphasis was also given to partnerships and collaborations with complementary services providers.

OTHER RELEVANT EXPERIENCE

2014 to Present: Nancy and Stephen Grand Technion Energy Program (GTEP), Technion Institute of Technology, Haifa – Adjunct Lecturer

-Taught and lectured a course on environmental control and oil and gas engineering to oil engineering students from the GTEP program.

2012 to 2013: Gabriella Offshore Drilling Project, Adira Energy Israel Ltd, Ramat-Gan – HSEQ Representative

-Assisted in the development, monitoring, and management of Health, Safety, Environment and Quality (HSEQ) Management Systems.

-Ensured compliance with the statutory requirements and promoting permits approval.

-Liaised with all contractors and sub-contractors to ensure that company requirements were followed.

-Assisted in HSEQ internal and external audits.

2010 to 2012: Meged-5 Crude Oil Production Site, Givot Olam Oil Ltd, Shoham – Environmental Superintendent

-Promoted an environmental agenda to reduce externalities.

-Implemented environmental regulatory requirements at the production site.

-Liaised with foreign well services companies and personnel to bridge environmental standards.

-Responsible for the proper maintenance of chemicals on site and assuring safe handling.



-Edited and reviewed standard operating procedures.

2012 to 2014: The School of Marine Sciences & Oceanic Environment, Ruppin Academic Center, Michmoret – Student Instructor

-Assisted in the coordination of planning and logistics of short courses dealing with the marine and coastal environment, including lecturing and frontal presentation of relevant topics in the fields of oceanography, zoology, botany, and geomorphology.

2010 to 2011: Marine Ecosystems Laboratory, Israel Oceanographic & Limnological Research Institution, Haifa, Israel – Ecological Research Assistant and Lab Technician

-Research Field: Abrasion Platforms habitat and benthic-pelagic coupling.

-Established experimental designs and setups specializing in coastal benthos ecology.

-Initiated and promoted advanced research ideas (i.e., ocean acidification effect on abrasion platforms and the imposed implications on coastal abrasion).

2008 to 2009: Ramat Hanadiv Forest Park, Binyamina, Israel – Ecological Research Assistant

-Devised and prepared ecological surveys of terrestrial vegetation in research on innovative environmental management programs and provided scientific data for educational activities. The research focused on the dispersion of pine trees in the southern end of Mount Carmel and their interactions with the Mediterranean shrub land.

PUBLICATIONS (PEER REVIEWED)

Mills, E., K. Shechtman, Y. Loya, and E. Rosenberg. 2013. Bacteria appear to play important roles in both causing and preventing the bleaching of the coral *Oculina patagonica*. *Marine Ecology Progress Series*. 489: 155-162.

PROFESSIONAL CERTIFICATIONS

Dive Master – World Underwater Federation (CMAS) and the Israeli Diving Federation

Enriched Air Nitrox Diver (36%)– Scuba School International (SSI) American Association of Underwater Sciences (AAUS)

Licensed Skipper for coastal and international waters (level 60) – State of Israel, Ministry of Transport (MOT)

First Aid, CPR and Oxygen Administration

PROFESSIONAL AFFILIATIONS

Society of Petroleum Engineers, Tel-Aviv Section Board Chairperson since 2014

Society of Conservation Biology, since 2014

Israeli Society of Microbiology, 2012

Israeli Diving Federation, since 2013

Israeli Association for Aquatic Sciences, since 2010



CV – JOHN TIGGELAAR



John Tiggerlaar II

Project Scientist

US

PROFILE

Education and Qualifications: Master of Science in Biology, Old Dominion University, 2012 and Bachelor of Arts in Biology, Wittenberg University, 2008

Mr. Tiggelaar is a marine ecologist with more than 7 years of biological project experience, with a focus on marine biological surveys and impact analysis. Since joining CSA Ocean Sciences Inc. (CSA) in 2013, he has served as Project Manager, Project Scientist, and/or Field Scientist for several environmental baseline surveys, habitat assessments, and marine monitoring programs. Mr. Tiggelaar has contributed as an author on numerous Environmental Impact Assessments (EIAs), field survey reports, monitoring reports, video reviews, and data analyses for numerous projects worldwide. His expansive project experience includes contributions as a lead author with several complex National Environmental Policy Act (NEPA)-related projects, including environmental analyses for projects in the mid-Atlantic, Gulf of Mexico, and Alaska. Notably, he has contributed to and served as project manager for more than 40 site-specific Gulf of Mexico EIAs.

Mr. Tiggelaar's field experience spans both nearshore and offshore projects in marine, freshwater, and terrestrial locations around the world, including fieldwork in coastal Florida, Alabama, and North Carolina; freshwater rivers of eastern Kentucky; the Gulf of Mexico; offshore Suriname; deepwater areas of the Levantine Basin in the eastern Mediterranean; offshore Ghana in the Gulf of Guinea; and the Bahamas.

Prior to working as a consultant, Mr. Tiggelaar has held adjunct faculty posts at Old Dominion University and Tidewater Community College where he taught classes in marine ecology and introductory biology concurrent with earning his Master's degree from Old Dominion University. His work, supported by the National Science Foundation, entailed surveys and experiments designed to assess potential effects on the blue crab fishery in Chesapeake Bay from a parasitic dinoflagellate.

CAREER SUMMARY

2013 to Present | CSA Ocean Sciences Inc.
2012-2013 | Aquatic Innovations
2010-2012 | Old Dominion University Research Foundation
2008-2009 | Dauphin Island Sea Lab
2008-2009 | Kentucky State Nature Preserves Commission

SELECTED EXPERIENCE

2013 to Present: CSA Ocean Sciences Inc. – Project Scientist

-Project Manager for the preparation of multiple Environmental Impact Analyses for Anadarko prospects in the Gulf of Mexico. Responsibilities included preparing the EIA and coordinating the completion the EIA among the client, technical review, editing, and document production staff as well as budget management.

-Assistant Project Manager and Author on an Environmental and Social Impact Assessment for oil exploration offshore Suriname. Responsibilities included preparing the ESIA and coordinating the completion the ESIA



among the client, subcontractors, in-country representative, and technical review, editing, and document production staff as well as budget management.

-Assistant Project Manager for the preparation of Environmental Impact Assessment (EIA) for a BP prospect in the Gulf of Mexico. Responsibilities included coordinating the completion the EIA among the client, EIA author, technical review, editing, and document production staff as well as budget management.

-Lead Author for the preparation of multiple Environmental Impact Analyses for Shell Exploration & Production Company prospects in the Gulf of Mexico. The EIAs were prepared in accordance with the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) requirements in effect as of 14 December 2010. Responsibilities included coordinating the completion the EIAs, with up to four written concurrently, among the client, EIA authors, and technical editing and document production staff as well as budget management.

-Project Scientist for a Programmatic Environmental Impact Statement (PEIS) to analyze and evaluate the impacts of G&G (Geological and Geophysical) activities on the Atlantic Outer Continental Shelf (OCS).

-Project Scientist for a Programmatic Environmental Impact Statement to analyze and evaluate the impacts of G&G activities on the Gulf of Mexico OCS.

-Field Scientist for Brevard County Mid-Reach Beach Renourishment Monitoring Project.

Pre-construction nearshore hard bottom and reef characterization and monitoring surveys were conducted in association with a proposed beach renourishment project. Assisted in establishing transects to establish a baseline of intertidal and nearshore hard-bottom.

2012 to 2013: Aquatic Innovations – Aquarist

-Responsible for the maintenance of aquarium life-support equipment, animal husbandry, disease diagnosis, treatment, and public outreach.

2010 to 2012: Old Dominion University Research Foundation – Graduate Research Assistant

-Research Assistant for the Hematodinium perezii Ecology of Infectious Diseases grant from the National Research Foundation. Responsibilities included field survey design, scheduling and completing monthly surveys, laboratory sampling, and reporting.

2008: Dauphin Island Sea Lab – Marine Ecology Intern

-Monitored biodiversity on restored oyster reefs, laboratory sample processing and data analysis, including chlorophyll a and CNP analyses.

2008: Kentucky State Nature Preserves Commission – Assistant Aquatic Biologist

-Conducted population surveys of Unionid mussels in eastern Kentucky waterways to assess impacts of pollution and mining on endangered and threatened species.

RESEARCH

Butler IV, M.J., Tiggelaar II, J.M., Shields, J.D., and M.J. Butler V. 2014. Effects of the parasitic dinoflagellate Hematodinium perezii on blue crab (*Callinectes sapidus*) behavior and predation. *Journal of Experimental Marine Biology and Ecology*. 461:381-388.

Tiggelaar II, J.M. Effects of the parasitic dinoflagellate Hematodinium sp. on blue crab (*Callinectes sapidus*) activity, predation, and habitat selection. 2009 to 2012. Old Dominion University Master's thesis.

Tiggelaar II, J.M. Novel use of an existing restriction fragment length polymorphism to identify fiddler crabs *Uca pugnator* and *Uca panacea*. 2007 to 2008. Wittenberg University undergraduate thesis.



Tiggelaar II, J.M. Tidal effects on E. coli bacteria counts in a North Carolina saltmarsh. 2007. Duke University independent research project

Tiggelaar II, J.M. Microhabitat preferences of intertidal zone gastropods on San Salvador, The Bahamas. 2006. Wittenberg University

PROFESSIONAL PRESENTATIONS

Tiggelaar II, J.M., M.J. Butler, and J.D. Shields. 2012. Effects of the parasitic dinoflagellate *Hematodinium* sp. on blue crab population dynamics. Benthic Ecology Meeting, Norfolk, VA

Tiggelaar II, J.M., M.J. Butler, and J.D. Shields. 2011. Effects of the parasitic dinoflagellate *Hematodinium* sp. on population dynamics of the blue crab *Callinectes sapidus* in the seaside bays of Virginia's Eastern Shore. Anheuser Busch Coastal Research Center monthly seminar series

Tiggelaar II, J.M., M.J. Butler, and J.D. Shields. 2011. Effects of the parasitic dinoflagellate *Hematodinium* sp. on blue crab movement and mortality. Benthic Ecology Meeting, Mobile, Alabama

Tiggelaar II, J.M., J.M. Welch, and M. Goodman. 2008. Poster: Novel use of an existing RFLP to identify fiddler crabs *Uca pugilator* and *Uca panacea*. Benthic Ecology Meeting, Providence, RI

TEACHING

Tidewater Community College, Sciences Department, Norfolk, VA. 2013.

Old Dominion University, Department of Biological Sciences, Norfolk, VA. 2012.

Old Dominion University, Department of Biological Sciences, Norfolk, VA. 2009 to 2011.

PROFESSIONAL CERTIFICATIONS

NAUI Open Water SCUBA diver

AAUS Certification

First Aid/CPR/Oxygen Administration



CV – BRIAN BALCOM



Brian Balcom

Senior Scientist, Benthic Ecologist

California, US

PROFILE

Education and Qualifications: Master of Science in Biology (Marine Biology emphasis), University of Southern California, 1980; Bachelor of Science in Biological Sciences, University of Southern California, 1975; Post-graduate courses in environmental engineering (University of Southern California School of Engineering, 1980 to 1982) and CEQA (University of California Santa Barbara, 1994)

Mr. Balcom is a Senior Scientist in CSA Ocean Sciences Inc.'s (CSA's) Western Regional Office located in Salinas (Monterey County), California. He is a benthic ecologist with more than 30 years of experience in biological baseline studies and assessments of the potential effects of man's activities on the marine environment. With CSA since 1981, Mr. Balcom has provided marine biological technical expertise, environmental impact assessment (EIA) capabilities, and management oversight on numerous multidisciplinary assessments of proposed activities in U.S. domestic (i.e., federal and state) and international waters, including oil and gas exploration, development and abandonment activities, liquefied natural gas [LNG] terminal and pipeline installation and operation, and applied marine research efforts. He has managed EIAs for compliance with the National Environmental Protection Act (NEPA) and Council on Environmental Quality (CEQ), and protective regulations including the Endangered Species Act (ESA), Marine Mammal Protection Act (MMPA), and California Environmental Quality Act (CEQA).

Mr. Balcom has recent international experience assessing impacts of offshore oil and gas operations in the Mediterranean, Arabian Gulf, Caribbean waters, north Atlantic, Indian Ocean, and north Pacific as well as onshore operations in the Middle East and South America. Mr. Balcom has prepared assessments related to noise effects (e.g., from offshore operations, sonars, and explosives) on marine mammals and sea turtles, with an emphasis on endangered and threatened species. Additionally, he has managed a diverse series of applied science study efforts (e.g., platform characterization, oil and oil dispersant toxicity testing, and biological field surveys). His project managerial responsibilities typically have been coupled with senior editorial and technical author duties. Mr. Balcom's field experience as a biologist and survey cruise leader also has been used on numerous studies employing remote sampling devices (e.g., box corers), manned submersibles, and remotely operated vehicles. He has completed nearly 20 submersible dives to assess the nature and extent of hard bottom communities associated with natural and man-made reefs. He has also presented results of synthesis efforts, applied science study efforts, and project-specific surveys at scientific conferences, workshops, and seminars during his career. Mr. Balcom has managed large multidisciplinary teams during several contracts, including completion of Environmental Impact Statements (EISs), Environmental Assessments (EAs), Environmental Impact Reports, and biological surveys for various projects. Mr. Balcom has been responsible for organizing and coordinating benthic surveys, conducting literature and data synthesis studies, and assisting in various computer analyses and data reduction projects. He has considerable experience with federal (NEPA) and California state (CEQA) environmental regulations and legislation for listed and protected species, including incidental take and Level A and B harassment evaluations.

Prior to joining CSA, Mr. Balcom served as an oceanographer on the Environmental Studies Staff of the Pacific Outer Continental Shelf (OCS) office of the Minerals Management Service (MMS), where he was responsible for the analysis and interpretation of select marine environmental studies conducted within the Southern California Bight. He also was involved as a contributing author in the preparation of several EISs (Sales 53 and 68) pertaining to the benthos, marine mammals, seabirds, and fisheries of the California OCS. During his graduate studies, Mr. Balcom served as Benthic Biology Coordinator and Associate Marine Scientist on the Bureau of Land



Management-funded Benthic Macrofaunal Survey of the Southern California Bight, a multi-year study (1975 to 1978) of southern California's benthic biological communities.

SELECTED EXPERIENCE

1981 to Present: CSA Ocean Sciences Inc. – Senior Scientist

- Primary author and editor on three EIAs assessing the impacts of exploratory drilling operations, offshore Morocco (Client Confidential, 2013 to present).
- Primary author and editor on an EIA assessing the impacts of a seismic survey offshore Morocco (Client Confidential, 2013 to present).
- Contributing author and lead impact analyst on a programmatic EIS associated with geological and geophysical operations conducted in association with oil and gas exploration, marine minerals, and alternative energy surveys in the U.S. Gulf of Mexico (Bureau of Ocean Energy Management, 2013 to present).
- Contributing author on an analysis of decommissioning options associated with a deepwater platform in the Gulf of Mexico, with an emphasis on the current regulatory environment and platform disposal options (Client Confidential, 2012).
- Consultant to an ecosystems framework and scenario analysis conducted for ongoing offshore oil and gas operations in southern California oil and gas operations, identifying key environmental and socioeconomic resources potentially at risk (Client Confidential, 2012).
- Project manager and senior author on a series of EIAs, topic-specific white papers, environmental baseline study summaries, and simulation modelling analyses for oil and gas development in the Levantine Basin and continental slope, offshore Israel (Client Confidential, 2009 to present).
- Contributing author and lead impact analyst on a programmatic EIS associated with future geological and geophysical operations conducted in association with oil and gas exploration, marine minerals, and alternative energy surveys on the Atlantic OCS (Bureau of Ocean Energy Management, 2010 to 2014).
- Project manager and senior author on an environmental impact analysis of low energy seismic survey operations in California state waters (California State Lands Commission, 2011 to 2013).
- Project manager and senior author on a study to assess the impacts of drill cuttings and associated non-aqueous drilling fluids on benthic and pelagic systems offshore Ghana, including a literature review summarizing scientific and grey literature on drill cuttings discharge and related impacts, regulatory limits and accepted monitoring practices worldwide, and conducting and summarizing results from an OSPAR-compliant field survey to assess the impact of drill cuttings discharges on the Ghana marine environment (Tullow Ghana Ltd., 2009 to 2012).
- Contributing author and environmental session lead for the Atlantic Wind Energy Workshop, July 2011 (Bureau of Ocean Energy Management, 2011).
- Contributing author, impact analyst, and lead scientist on an EIA for proposed seismic operations offshore Mozambique (Client Confidential, 2008 to 2010).
- Contributing author, impact analyst, and lead scientist on marine biology and marine water and sediment quality issues for an EIS associated with proposed installation, commissioning, operation, and future decommissioning of an offshore LNG terminal and associated pipelines to shore off southern California (OceanWay Secure Energy) (AMEC, U.S. Coast Guard, U.S. Maritime Administration, 2007 to 2009).
- Project Manager and senior author on an EIA for proposed exploratory oil and gas operations offshore Tobago (Petro-Canada Trinidad and Tobago Block 22 Inc., 2006 to 2007).
- Project Manager and senior author on an EIA for proposed installation and operation of a production platform, offshore Trinidad (BG Trinidad and Tobago Limited, 2006 to 2007).



-Project Manager on wet and dry season survey efforts associated with proposed exploratory oil and gas operations offshore Tobago (Petro-Canada Trinidad and Tobago Block 22 Inc., 2006 to 2007).

-Project Manager and senior author on an EIA for proposed installation and operation of a production platform and associated pipelines, offshore Trinidad (BHP Billiton, 2006 to 2007).

-Project Manager and senior author on an EA for proposed research activities within Monterey Bay during summer 2006 (Monterey Bay 2006) (U.S. Department of the Navy and Office of Naval Research, 2006).

-Project Manager and senior author on feasibility and key issues analyses for a potential offshore natural gas pipeline to shore, San Luis Obispo County, California (Client Confidential, 2005).

-Contributing author and senior editor for an EIS that assesses the impacts of shock testing the U.S. Navy's newest surface vessel (LPD-17) on the marine environment offshore Norfolk, Virginia; Mayport, Florida; and Pascagoula, Mississippi (U.S. Department of the Navy, 2003 to present).

-Project Manager, senior author, and editor on a multi-year study to survey and characterize the invertebrate and algal communities on offshore oil and gas platforms in southern California" (MMS, 1998 to 2006).

-Contributing author, impact analyst, and lead scientist on marine water quality issues for an EIS associated with proposed installation, commissioning, operation, and future decommissioning of an offshore LNG terminal and associated pipelines to shore in the U.S. Gulf of Mexico (Main Pass Energy Hub) (e2M, U.S. Coast Guard, U.S. Maritime Administration, 2004 to 2006).

-Contributing author and senior editor of an Environmental Review associated with proposed installation, commissioning, operation, and future decommissioning of an offshore LNG terminal and associated pipelines to shore in the U.S. Gulf of Mexico, including utilization of open rack vaporization and high seawater usage requirements (Pearl Crossing) (ExxonMobil U.S. LNG, 2003 to 2005).

-Senior author of a Negative Decision prepared to support the second phase of the underwater search for the USS Alligator in the vicinity of Ocracoke Island, North Carolina (U.S. Department of the Navy, 2005).

1980 to 1981: Bureau of Land Management – Oceanographer

-Worked for the U.S. Department of the Interior, Bureau of Land Management, Pacific Outer Continental Shelf Office as an Oceanographer. Conducted analyses of marine environmental studies of the Southern California Bight. Synthesized scientific summaries and public briefing packages. Wrote and researched on fisheries and benthos of the California OCS for EISs. Author and editorial reviewer of EIS material on marine mammals and seabirds of California, with emphasis on endangered and threatened species. Evaluated the impact of pipeline placement on the fauna and flora of sensitive coastal and offshore areas.

1977 to 1979: University of Southern California – Associate Marine Scientist

-Participated in the Benthic Macrofaunal Survey of the Southern California Borderland, Year II. Coordinated seasonal sampling cruises, served as Senior Biologist on a summer cruise, and managed the field activities of 6 to 12 biological and geological personnel. Performed taxonomic identification of benthic gammarid amphipods. Processed, printed, and interpreted benthic photographs. Drafted charts and figures for the final report.

1975 to 1977: University of Southern California – Benthic Biology Coordinator

-Participated in the Benthic Macrofaunal Survey of the Southern California Borderland, Year I. Organized 12 benthic sampling cruises, served as Senior Biologist on several cruises, and managed field activities of biological and geological personnel.

1975: University of Southern California – Research Assistant



-Participated in the Benthic Macrofaunal Survey of the Southern California Borderland, Year I. Procured sampling equipment and supplies for the initial cruises.

1976 to 1977: National Science Foundation/U.S.C. – Technician

-Participated in the Geological Sciences Cruises, Southern California Borderland. Conducted box coring, piston coring, and acoustic profiling of the San Pedro and Santa Cruz Basins.

PUBLICATIONS (Corporate)

CSA Ocean Sciences Inc. (B.J. Balcom, senior author). 2014. Environmental Impact Assessment for Seismic Survey Operations, Cap Boujdour Block, Offshore Morocco. March 2014. Prepared for Kosmos Energy Deepwater Morocco, Dallas, TX. 367 pp.

CSA Ocean Sciences Inc. (B.J. Balcom, senior author). 2014. Environmental Impact Assessment for Exploratory Drilling, Fom Assaka Block, Offshore Morocco. January 2014. Prepared for Kosmos Energy Deepwater Morocco, Dallas, TX. 302 pp.

CSA Ocean Sciences Inc. (B.J. Balcom, contributing author, lead impact analyst). 2014. Atlantic OCS, Proposed Geological and Geophysical Activities, Mid-Atlantic and South Atlantic Planning Areas. Final Programmatic Environmental Impact Statement. Prepared for Bureau of Ocean Energy Management, Herndon, VA. OCS EIS/EA BOEM 2012-005 (draft) and 2014-001 (final). 2 volumes.

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CSA Ocean Sciences Inc. (B.J. Balcom, co-author). 2013. Karish-1 EA. Final. March 2013. Prepared for Noble Energy Mediterranean, Houston, TX.

CSA International, Inc. (B.J. Balcom, lead author). 2012. Tamar Gas Development Project EIA. Draft. January 2012. Prepared for Noble Energy Mediterranean, Houston, TX.

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CSA International, Inc. (B.J. Balcom, contributing author). 2008. Final Environmental Impact Statement//Overseas Environmental Impact Statement. Shock Trial of the Mesa Verde (LPD 19). Prepared by Booz Allen Hamilton for the U.S. Department of the Navy. June 2008.

CSA International, Inc. (B.J. Balcom, senior author). 2007. Final Survey Report – 12 to 13 February 2007. Block 2(c) Environmental Baseline Survey. Prepared for BHP Billiton Trinidad and Tobago. August 2007.

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CSA International, Inc. (B.J. Balcom, contributing author). 2007. Block 22 Environmental Baseline Survey Dry Season - May to June 2006. Prepared for Petro-Canada Trinidad and Tobago Block 22 Inc. May 2007.

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Continental Shelf Associates, Inc. (B.J. Balcom, contributing author). 2006. Final Environmental Impact Statement for the Main Pass Energy Hub deepwater port license application. Prepared by e2M (subcontractor: CSA) for the U.S. Coast Guard and the U.S. Maritime Administration. February 2006. 2 volumes.

Continental Shelf Associates, Inc. (B.J. Balcom, senior author, editor). 2005. Survey of invertebrate and algal communities on offshore oil and gas platforms in southern California. December 2005. Report prepared for the U.S. Department of the Interior, Minerals Management Service, Pacific OCS Region, Camarillo, CA. MMS OCS Study 2005-070.454 pp.

Continental Shelf Associates, Inc. (B.J. Balcom, author). 2005. Background for a negative decision, search for the USS Alligator using side-scan sonar in the vicinity of Ocracoke Island, North Carolina. Prepared for the U.S. Navy, Office Of Naval Research, Arlington, VA. September 2005. 31 pp.

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Continental Shelf Associates, Inc. (B.J. Balcom, co-author and editor). 1991. A comparison of marine productivity among outer continental shelf planning areas. Supplement - An Evaluation of Benthic Habitat Primary Productivity. Report for the U.S. Department of the Interior, Minerals Management Service, Herndon, VA. Contract No. 14-35-0001-30487. OCS Study MMS 91-0001. 245 pp. + app.

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Advanced Technology, Inc. and Continental Shelf Associates, Inc. (B.J. Balcom, editor). 1990. An evaluation of cleanup technologies potentially applicable to Exxon Valdez oil spill cleanup operations in 1990. Final Report. Report for the National Oceanic and Atmospheric Administration, Office of Oceanography and Marine Assessment, Hazardous Materials Response Branch, Seattle, WA. 31 pp. + app.

Advanced Technology, Inc. and Continental Shelf Associates, Inc. (B.J. Balcom, editor). 1990. The physical persistence of spilled oil: An analysis of oil spills previous to Exxon Valdez. Final Report. Report for the National Oceanic and Atmospheric Administration, Office of Oceanography and Marine Assessment, Hazardous Materials Response Branch, Seattle, WA. 68 pp. + app.

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Continental Shelf Associates, Inc. (B.J. Balcom, contributing author and editor). 1989. Draft Environmental Impact Report, exploratory drilling for oil and gas resources, Parcel 1, Pt. Conception Area, Santa Barbara County, California. April 1989. Report for the California State Lands Commission, Sacramento, CA. 367 pp. + app.

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Continental Shelf Associates, Inc. (B.J. Balcom, author). 1988. Permitting costs and critical path time estimates for several Sale 91 exploratory and development scenarios. October 1988. Report for Mobil Oil Exploration & Producing U.S., Inc., Bakersfield, CA. 15 pp.

Continental Shelf Associates, Inc. (B.J. Balcom, author). 1988. Milestones and schedule adjustments realized for proposed Sale 91, with an analysis of energy development policy changes projected for a new Federal administration. June 1988. Report for Mobil Oil Exploration & Producing U.S., Inc., Bakersfield, CA. 27 pp.

Continental Shelf Associates, Inc. (B.J. Balcom, author). 1988. A synopsis of major air quality rules and regulations for Humboldt and Mendocino Counties, with an overview of California's air quality regulatory environment and proposed changes to Federal air quality regulations.

June 1988. Report for Mobil Oil Exploration & Producing U.S., Inc., Bakersfield, CA. 21 pp.

Continental Shelf Associates, Inc. (B.J. Balcom, author). 1988. Summary of air quality emission offsets for several California OCS platforms and associated facilities. May 1988. Report for Mobil Oil Exploration & Producing U.S., Inc., Bakersfield, CA. 15 pp.

Continental Shelf Associates, Inc. (B.J. Balcom, author). 1988. Schedule and cost considerations, proposed Sale 91, northern California. April 1988. Report for Mobil Oil Exploration & Producing U.S., Inc., Bakersfield, CA. 15 pp.

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Continental Shelf Associates, Inc. (B.J. Balcom, co-author). 1988. Review of potential stipulations, proposed Lease Sale 91, northern California. March 1988. Report for Mobil Oil Exploration & Producing U.S., Inc., Bakersfield, CA. 13 pp.

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CURRENT AND PREVIOUS PROFESSIONAL AFFILIATIONS

- American Society of Limnology and Oceanography
- American Society of Zoologists
- International Association for Impact Assessment



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PROFILE

Education: Master of Science in Marine Science, University of South Alabama, 2003; Bachelor of Arts in Biology, Wittenberg University, 2000

Ms. Fawcett is a marine biologist with over 12 years of experience in marine and freshwater biology. She has served as Project Manager, Project Scientist, and/or Field Scientist on several coral relocation programs; environmental baseline surveys; habitat assessments; and restoration and monitoring programs in coral reefs, seagrass beds, hard bottom, and estuarine habitats. She has served as Project Manager, Project Scientist, and/or Lead Author on numerous environmental impact assessments (EIAs), monitoring and implementation plans, field survey reports, and decommissioning projects; supervised field staff in data collection; and provided assistance in the collection and analysis of samples and data for numerous environmental field studies, including both multidisciplinary baseline studies and environmental monitoring programs in the coastal areas of Florida, New Jersey, Puerto Rico, Qatar, and the United Arab Emirates and deep water habitats in the Gulf of Mexico and the Mediterranean Ocean.

Prior to environmental consulting, Ms. Fawcett was a Senior Scientific Associate with the South Florida Water Management District–Everglades Division. She was responsible for logistical and field support, field sampling, and project management of a mandated bimonthly monitoring program. Other responsibilities included Hydrolab and YSI maintenance, data collection, quality assurance/quality control (QA/QC), data analysis, permit renewal, and preparing and editing grant proposals and annual reports. Ms. Fawcett contributed to the preparation of Everglades National Park Comprehensive Annual Reports.

Ms. Fawcett is a certified National Association of Underwater Instructors Advanced Open Water SCUBA diver and is trained in Red Cross cardiopulmonary resuscitation (CPR) and first aid. She has been active in the Palm Beach County, Florida Artificial Reef Program by conducting biological monitoring and co-authoring grant proposals for successful procurement of funding from the Florida Fish and Wildlife Conservation Commission. She is skilled in small boat operations and has completed the U.S. Coast Guard Auxiliary Boating Skills and Seamanship Course.

SELECTED EXPERIENCE

2006 to Present: CSA Ocean Sciences Inc. – Project Scientist II, Benthic Ecologist

Project Manager for the preparation of multiple Environmental Impact Analyses for ConocoPhillips prospects in the Gulf of Mexico. Responsibilities included preparing the EIA and coordinating the completion the EIA among the client, technical review, editing, and document production staff as well as budget management.

Co-Project Manager and contributing author on an analysis of decommissioning options associated with a deepwater platform in the Gulf of Mexico, with an emphasis on the current regulatory environment and platform disposal options.

Project Manager and Lead Author on an Environmental and Social Impact Assessment for an oil and gas development offshore of Cameroon. Responsibilities included preparing the ESIA and coordinating the



completion the ESIA among the client, subcontractors, in-country representative, technical review, editing, and document production staff as well as budget management.

Project Manager for the preparation of Environmental Impact Assessment (EIA) for a Hess prospect in the Gulf of Mexico. Responsibilities included coordinating the completion the EIA among the client, EIA author, technical review, editing, and document production staff as well as budget management.

Project Manager for the preparation of 25 Environmental Impact Analyses for Shell Exploration & Production Company prospects in the Gulf of Mexico. The EIAs were prepared in accordance with the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) requirements in effect as of 14 December 2010. Responsibilities included coordinating the completion the EIAs, with up to four written concurrently, among the client, EIA authors, technical editing, and document production staff as well as budget management.

Field Manager and Lead Field Scientist for the RasGas Coral Relocation and Monitoring Project.

Lead Field Scientist for Bahia Icacos Environmental Survey and Habitat Mapping Project.

Field Scientist for environmental surveys off Indian River County, Florida, to assess nearshore hard bottom habitat prior to and after construction of three beach nourishment projects. Establish permanent transects and collect close-up video and repetitive in situ quadrat data to characterize and monitor hard bottom communities.

Field Scientist for Hillsboro/Deerfield Beach Renourishment Monitoring Project. Pre-, during, and post-construction nearshore hard bottom and reef characterization and monitoring surveys were conducted in association with the beach renourishment project. Assisted in establishing permanent transects, measuring sediment accumulation, assessing permanent quadrats, and collecting data on sand-hard bottom intercept positions and coral stress observations.

Lead Field Scientist for Puerto Rico Aqueduct and Sewer Authority (PRASA) wet season coral community monitoring surveys near the Arecibo and Aquadilla Regional Waste Water Treatment Plant outfalls offshore Puerto Rico. Surveys were conducted in compliance with 301(h) waiver demonstration. Responsibilities included video and digital photographic data collection of pre-established transects, data analysis, and report preparation.

Project Manager/Lead Field Scientist for Biscayne National Park (BISC) Seagrass Restoration Project at No Name Shoal. Restoration activities conducted at two orphan seagrass injuries on No Name Shoal included: a) the placement of approximately 350 yd³ of loose fill and b) the installation 80 bird roosting stakes. Approximately 272 m² of seagrass habitat was returned to grade to improve the likelihood of natural seagrass colonization. Responsibilities included participation in a planning meeting and site assessment survey, seagrass injury mapping, preparation and implementation of a seagrass restoration plan, field oversight of restoration activities, on-sight coordination with BISC staff and sub-contractors, turbidity monitoring, and report preparation.

Project Manager/Lead Field Scientist for BISC 2010 Derelict Trap and Debris Removal Project. Over a 16-day period, approximately 697 trap equivalents were removed from 1.9 km² of shallow patch reef areas east of Elliot Key. Responsibilities included the preparation and implementation of a debris removal plan, field survey oversight, on-sight coordination with BISC staff oversight, and report preparation.

Supporting Scientist and Field Scientist during emergency coral reef restoration efforts associated with the grounding of the naval destroyer USS PORT ROYAL approximately 0.5 mi offshore of Honolulu International Airport's Reef Runway. Member of field team responsible for damage assessment and reattachment of over 5,300 coral colonies.

Lead Field Scientist for the Village of Key Biscayne Seagrass Restoration and Mitigation Project. Responsibilities included preparation of a restoration and mitigation plan, field implementation of baseline and biannual monitoring surveys, data collection and analysis, and report preparation.

Lead Field Scientist for a confidential client for a deep water port and preferred route survey offshore northeastern USA. Survey tasks included collection of towed video and digital photographic data, habitat characterization within the survey area, and QA/QC of data.



-Project Scientist for the Shell Pearl GTL Proposed Pipelines Coral Relocation Project. Responsible for scientific oversight and support for the removal, transportation, reattachment, installation and preparation of monitoring sites, and baseline monitoring of approximately 600 corals as mitigation for pipeline installation activities offshore the State of Qatar.

-Project Manager/Field Scientist for the Qatargas Coral Relocation Project. Responsibilities included supervising and conducting the removal, transportation, and reattachment of 4,500 hard corals as mitigation for pipeline installation activities offshore the State of Qatar and the selection, installation, and monitoring of six reattachment sites at 6 and 12 months post-reattachment. Compiled and prepared a coral management plan, project report, monitoring survey reports, documentary video, and several presentations.

-Field Scientist for the Dolphin Energy Limited Mitigation and Coral Recruitment Study. Responsibilities included installation of monitoring stations at the EcoReef, concrete-coated pipeline, rock pile, and control habitats and conduction of baseline monitoring.

Field Scientist for the Biscayne National Park Seagrass Restoration Project. Responsibilities included oversight and photographic documentation of turbidity screen installation and removal, sediment bag placement, and installation of bird stakes in selected orphan grounding sites on Middle Featherbeds in Biscayne National Park.

Lead Scientist for Leif Hoegh Re-route Survey in Tampa Bay. Survey tasks included collection of towed video data and habitat characterization within the survey area and delineation of seagrass habitat. Responsible for towed video data collection, QA/QC of data, and seagrass assessment.

Field Scientist for the Texas Reef Year 4 Monitoring Survey to document temporal and spatial changes of the epibenthic and ichthyofaunal assemblages associated with the artificial reef offshore Hutchinson Island, Martin County, Florida. Responsibilities included conducting qualitative and quantitative diver video transects.

Field Scientist/Diver for monitoring coral and seagrass health and levels of sedimentation in association with the maintenance dredging of Truman Harbor, the turning basin, and the Key West Ship Channel (U.S. Department of the Navy, 2002 to 2007).

Project Manager/Field Scientist for Shell Pearl GTL Proposed Pipelines Coral and Seagrass Survey. Survey tasks included collection of towed video data providing complete coverage of the survey area, habitat delineation from review of the towed video data, and quantitative characterization of coral and seagrass habitats encountered within the survey area. Responsibilities included project oversight, scheduling of field survey, data collection, and preparation of Dive Plan, Health, Safety, and Environment (HSE) Plan, Survey Methodologies Plan, survey report, Power Point presentation, and Coral Mitigation Plan,

Field Scientist for M/V MARGARA Restoration Project. Assisted in in-situ baseline data collection of hard and soft corals in emergency restoration and control areas for identification, reattachment status, coral size, and coral health.

Chief Field Scientist/Diver for a field sample and data collection effort for a 301(h) waiver demonstration and Mixing Zone Validation Study at the Aguadilla, Arecibo, and Ponce Regional Wastewater Treatment Plant outfalls off the coast of Puerto Rico. Tasks included collection of sediment and fish samples, oversight of water sample collection, and collection of permanent coral transect diver video data. Survey reports and the results of video and still photograph analyses are being submitted to CH2M Hill (Puerto Rico Aqueduct and Sewer Authority, 2005 to present).

Project Manager for the New Doha International Airport Mitigation project. Project oversight of harvest and transplant of hard corals and pearl oysters conducted as mitigation for the New Doha International Airport, State of Qatar.

Project Manager for the North Field Bravo Environmental Baseline Survey offshore the State of Qatar. Responsibilities included project oversight, data analysis, and report preparation.

Project Manager/Author of the Environmental Assessment of Exploration Drilling, West Cape Three Points Block, offshore Ghana.



Project Manager/Co-author of environmental impact assessments (EIAs) for the Gumusut-Kakap Field Development Project and Export Pipeline Project offshore Sabah, Malaysia. Responsibilities included project oversight, preparation of two EIAs and preparation and presentation of impact analysis to the client.

Field Scientist for the M/V EASTWIND Restoration Project offshore Broward County, Florida. Assisted in impact assessment, restoration, report preparation, and data assembly.

Project Manager for the M/V DEBBET Restoration and Monitoring Project in Biscayne National Park, Florida. Supervised and conducted restoration and monitoring activities, data analysis, and report preparation.

Field Scientist for the Texas Reef Year 2 Monitoring Survey to document temporal and spatial changes of the epibenthic and ichthyofaunal assemblages associated with the artificial reef offshore Hutchinson Island, Martin County, Florida. Responsibilities included conducting qualitative and quantitative diver video transects, roving diver fish counts, data analysis, and report preparation.

Field Scientist for the Florida Power & Light Broward County Subbottom Survey and Sediment Grain Size Analysis projects. Responsibilities included preparation of report and Sediment Sampling Plan.
2005 to 2006: Marine Resources, Inc. – Staff Scientist

Project Manager of the HEIDI BABY Seagrass Restoration Project. Project consisted of filling a 98.3 m³ blowhole and inbound trench created by a 44-ft Sportfisher that ran aground on a *Thalassia testudinum* shoal outside of Whale Harbor Channel in Islamorada, Florida. Responsibilities included oversight of material placement within the injury area, photo and video documentation of restoration activities, and document preparation.

Field Scientist during the benthic survey to generally characterize the substrate and associated macro-benthic community for the Fort Pierce Marina project.

Staff Scientist/National Environmental Policy Act (NEPA) Specialist for the ALLIE B Grounding Site Restoration Plan and Environmental Assessment and the IGLOO MOON Grounding Site Restoration Plan and Environmental Assessment. Responsibilities included documentation and quantification of current site conditions of the injuries, compilation of a visual time-series presentation of temporal changes in the condition of the injury site, and document preparation.

Staff Scientist/NEPA Specialist for the Habitat Suitability Analysis: Compensation for Injured Reef in Support of Restoration Planning for the Berman Oil Spill (San Juan, Puerto Rico) conducted to identify marine habitats that could be utilized as compensation for lost ecological services provided by the hard bottom reef injured by the vessel grounding.
Responsible for conducting a literature search, data compilation, and document preparation.

Field Scientist for the Texas Reef Year 1 Monitoring Survey to document temporal and spatial changes of the epibenthic and ichthyofaunal assemblages associated with the artificial reef offshore Hutchinson Island, Martin County, Florida. Responsibilities included conducting qualitative and quantitative dive transects, video transects, and report preparation.

2003 to 2004: South Florida Water Management District – Senior Scientific Associate

Project Manager of bimonthly transect monitoring of dissolved oxygen (DO), temperature, specific conductivity, and pH in the Everglades. Responsibilities included deployment and retrieval of Hydrolabs and YSIs by helicopter, Hydrolab and YSI maintenance, data acquisition, QA/QC, data analysis, permit renewal, and end-of-year report preparation.

Senior Scientific Associate involved in the Periphyton Project to better understand the primary production of various systems within the Everglades ecosystem. Responsibilities included determining the primary production of periphyton mats using a DO micro-profiling system, completing trend analyses of multiple long term databases, and logistical and field support for a short term stable isotope pulse-chase experiment within the Everglades.



2000 to 2003: University of South Alabama – Graduate Research Assistant

Project Manager of the Harmful Algal Bloom Monitoring Program in Mobile Bay, Alabama. Responsibilities included scheduling monthly sampling cruises; collecting water samples from 10 offshore sites; chlorophyll a analysis; creating a database and inputting nutrient, chlorophyll a, and harmful algal bloom counts from sampling cruises; and coordinating efforts with the Alabama Department of Public Health.

Research Assistant for benthic field studies sampling in natural and artificial seagrass beds of various sizes, processing of samples, and species identification.

Research Assistant for Alabama Center for Estuarine Studies: Top Down Trophic Cascade Project. Responsibilities included collection of benthic macrofauna and seagrass samples, sample processing, and species identification.

PRESENTATIONS

Kilbane-Fawcett, D.A., B.D. Graham, R.D. Mulcahy, A. Onder, and M. Pratt. 2008. Coral Relocation for Impact Mitigation in Northern Qatar. The 11th International Coral Reef Symposium (Abstract). Mini-Symposium 24: Reef Restoration, Fort Lauderdale, FL.

Gottlieb, A., S. Hagerthey, R. Shuford, D. Kilbane-Fawcett, and S. Newman. 2004. The effects of varying conductivity on Everglades' periphyton community structure. Society of Wetland Scientists. Seattle, WA. July 19 to 23. Poster presentation.

Kilbane-Fawcett, D. 2004. Monitoring artificial reefs in Palm Beach County: October 1, 2000 to September 30, 2002. Florida Artificial Reef Summit. Sarasota, FL. April 27 to 28. Poster presentation.

Kilbane-Fawcett, D. 2004. The status of artificial reefs in Palm Beach County: October 1, 2000 to September 30, 2002. Benthic Ecology Meeting. Mobile, AL. March 25 to 28. Oral presentation.

PROFESSIONAL CERTIFICATIONS

NAUI Advanced SCUBA Diver PADI open water SCUBA Diver AAUS Certification

First Aid/CPR/DAN Oxygen Administration

Nitrox Certified

Certified USCG Safe Boating and Seamanship Skills



CV – SHELLEY WACHSMANN, PH.D.



Shelley Wachsmann

Archaeology and Antiquities Specialist

Texas, US

EDUCATION

1984 to 1990 | Ph.D. in Near Eastern Archaeology, at the Institute of Archaeology, Hebrew University, Jerusalem. Dissertation: Seagoing Ships and Seamanship in the Late Bronze Age Levant. Dissertation advisors: Professor Trude Dothan and Professor George F. Bass.

1974 to 1984 | MA in Near Eastern Archaeology, cum laude, the Institute of Archaeology, Hebrew University, Jerusalem. Thesis: Toward a Better Understanding of the Historical Significance of Aegeans Depicted in the Theban Tombs. Thesis advisor: Professor Trude Dothan.

1970 to 1974 | BA in Near Eastern and Classical Archaeology, cum laude, at the Institute of Archaeology, Hebrew University, Jerusalem.

CAREER SUMMARY

2010-present | Meadows Professor of Biblical Archaeology, Nautical Archaeology Program, Texas A&M University.

2009-2012 | Coordinator, Nautical Archaeology Program.

1999-2010 | Meadows Associate Professor of Biblical Archaeology, Nautical Archaeology Program, Texas A&M University.

1993-1999 | Meadows Assistant Professor of Biblical Archaeology, Nautical Archaeology Program, Texas A&M University.

1990-1993 | Meadows Visiting Assistant Professor of Biblical Archaeology, Nautical Archaeology Program, Texas A&M University.

1990 | Archaeologist/Researcher: Israel Antiquities Authority (formerly Israel Department of Antiquities and Museums [IDAM])

1976-1989 | Inspector of Underwater Antiquities, IDAM.

1975 | Assistant to Dr. Amos Kloner, Field Archaeologist in charge of Jerusalem region for IDAM. Assistant to Professor Yigael Yadin preparing excavation material from Tel Hazor for publication (Institute of Archaeology, Hebrew University, Jerusalem).

1974 | Tel Lahav excavation, directed by Mr. David Alon (IDAM); Assistant Excavator.

1972 | Office of the Staff Officer in Charge of Archaeology in Judea and Samaria (Director: Dr. Zeev Yeivin); Inspector of Antiquities.



SELECTED FIELD EXPERIENCE

2014 | Ioppa Maritima Project. Reconstructing the maritime aspects of ancient Jaffa, Israel. Geoarchaeological/geophysical survey of Greonigen Park, Jaffa, and regional deep-water survey (50-250 meters). Principal Investigator.

2013 | Easter Island. Reconstructing the Palaeo environment of the Moai Quarry inside Rano Raraku. March 07-20, 2013. In collaboration with Dr. Jo Anne Van Tilburg, Cotson Institute, UCLA.

2012 | 2012 INA/EISP Rano Raraku Crater Lake Survey, Easter Island. Sidescan and bottom-penetrating sonar survey. March 09-26, 2012. In collaboration with Dr. Jo Anne Van Tilburg, Cotson Institute, UCLA.

2010 | The 2010 Eratosthenes Seamount Expedition (Geological survey of the seamount located between Cyprus and Egypt led by Dr. Robert D. Ballard; Archaeological observer.)

2007-2009 | The Danaos Project (Deep-water survey of the ancient sea route between Crete to Egypt); Project Archaeological Principal Investigator.

2003-2006 | The Persian War Shipwreck Survey; Canadian Team Archaeological Principal Investigator.

2005 | Documented Gurob ship-cart model at the Petrie Museum of Egyptology, London.

2002 | The 2002 INA/CNANS Joint Expedition: (Study of maritime aspects of Phoenician penetration into Portugal in the 7th-6th centuries BC.); Principal Investigator.

1999 | The ROBO Israel Deep-Water Shipwreck Survey: (Sidescan Sonar Survey opposite Tantura Lagoon); Principal Investigator. The 1999 Ashkelon Deep-Water Shipwreck Survey: (Survey of two 8th-century BC Phoenician Shipwrecks, directed by Dr. Robert Ballard and Professor Lawrence E. Stager; member of the archaeological team.

1998 | Abu-el Haggag Festival in Luxor, Egypt; recorded the festival and carried out interviews.

1997 | The Leon Levy Shipwreck Survey, Ashkelon Israel: (Sidescan Sonar and Diving Survey). In cooperation with the Leon Levy Expedition to Ashkelon and Haifa University's Center for Maritime Studies; Principal Investigator.

1996 | To the Sea of the Philistines: (Sidescan Sonar Survey Opposite Ashkelon). In cooperation with the Leon Levy Expedition to Ashkelon; Principal Investigator.

1994-1996 | INA/CMS Joint Expedition to Tantura Lagoon, Israel; Principal Investigator.

1992 | Sea of Galilee Archaeological Research Project (sub-bottom profiling sonar survey); Principal Investigator.

1986 | Excavation of the Galilee Boat; Principal Investigator.

1985 | Probe excavation of fifth-century BC Ma'agan Mikhael; Principal Investigator. Land excavation in the Crusader city of Caesarea; Principal Investigator. Excavation of a Byzantine wreck at Dor; Principal Investigator.

1980 | Excavation of a Late Bronze Age cargo found underwater near Kibbutz Hahotrim; Principal Investigator.

1978-1985 | Survey for Napoleonic remains jettisoned into the sea at Tantura during Bonaparte's retreat from Acre; Principal Investigator.

MILITARY SERVICE (ISRAEL DEFENSE FORCE) Final rank First Sergeant (Rav Samal). (Ret.)

1973-1990 | Active reservist (55th Paratrooper Reserve Brigade, 28th Battalion, Company A).

1969-1970 | MAHA'L (Mitnadvei Chutz L'Aretz: Foreign Volunteers Unit) Completed paratrooper training. Ribbons Yom Kippur War Ribbon, Lebanese War Ribbon.



FIELDS QUALIFIED TO TEACH, INCLUDING AREAS OF SPECIAL INTEREST ANTH/RELS 317 -

Introduction to Biblical Archaeology

ANTH/RELS	489 Ancient Egypt
ANTH 612	Preclassical Seafaring
ANTH 613	Classical Seafaring
ANTH 633	Deep-Submergence Archaeology
ANTH 660	Field Archaeology
ANTH 689	Near Eastern Seafaring

RECORD OF PUBLICATIONS BOOKS

2013 | The Gurob Ship-Card Model and Its Mediterranean Context. College Station, Texas A&M University Press.

1998| Seagoing Ships and Seamanship in the Bronze Age Levant. College Station & London, Texas A&M University Press & Chatham Publishing. Second printing, 2009.

1995 |The Sea of Galilee Boat: An Extraordinary 2000 Year Old Discovery. New York, Plenum. Second edition, 2000 by Perseus Press, Cambridge. Third edition, 2009 by Texas A&M University Press.

1990 |The Excavations of an Ancient Boat from the Sea of Galilee (Lake Kinneret). (cAtiqot 19). Jerusalem, Israel Antiquities Authority. With contributors.

1987| Aegeans in the Theban Tombs. (Orientalia Lovaniensia Analecta 20). Leuven, Uitgeverij Peters.

BOOK AWARDS

2013 Joint winner of the Nautical Archaeology Society's Keith Muckelroy Award for published works on maritime archaeology for The Gurob Ship-Card Model and Its Mediterranean Context with Professor Sir Barry Cunliffe's Britain Begins. Oxford, Oxford University Press.

2000| The Irene Levi-Sala Book Prize in the Archaeology of Israel in the popular book category for 1998-1999 for Seagoing Ships and Seamanship in the Bronze Age Levant.

1997 | The Biblical Archaeology Society's Award for Best Popular Book on Archaeology for 1995-1996 for The Sea of Galilee Boat: An Extraordinary 2000 Year Old Discovery. REFEREED CHAPTERS IN BOOKS

2011 | Deep-Submergence Archaeology. In The Oxford Handbook of Marine Archaeology. A. Catsambis, B. Ford and D. Hamilton, ed. New York: Oxford University Press: 202-231.

2009 | On Drawing the Bow. In Eretz-Israel 29 (In Honor of Ephraim Stern). J. Aviram, A. Ben-Tor, I. Ephàl, S. Gitin and R. Reich, eds. Jerusalem, Israel Exploration Society: 238*-257*.

2000 | To the Sea of the Philistines. In The Sea Peoples and Their World: A Reassessment. (University Museum Monograph 108. University Museum Symposium Series 11). Ed. E.D. Oren. The University Museum, University of Pennsylvania, Philadelphia: 103-143.

1990 | Concerning Syro-Canaanite Sea Trade in the Late Bronze Age. In Commerce in Palestine Throughout the Ages: Studies. Eds. B.Z. Kedari, T. Dothan and S. Safrai. Yad Yitzchak Ben Zvi, Jerusalem: 42-66. (in Hebrew)

INVITED CHAPTERS IN BOOKS

In press The 2012 INA/EISP Rano Raraku Crater Lake Survey. In Easter Island Statue Quarry Excavations: From Stone to Sculpture. J. Van Tilburg and C. Arévalo Pakarati, eds. Los Angeles, The Cotsen Institute of Archaeology Press, University of California, Los Angeles. (5 pages and 8 figures) With J. Morris. (Submitted July 17, 2013).



- 2008 Underwater Survey, 1996-1997. In Ashkelon Excavation Report I: Introduction and Overview (1985-2006). L. E. Stager, J. D. Schloen and D. M. Master, eds. Winona Lake, Eisenbauns: 97-100.
- 2005 The Graveyard of Ships: Tantura Lagoon, Israel. In Beneath the Seven Seas. Ed. G.F. Bass. Thames & Hudson, London: 98-99.
- 2002 Nautical Archaeology in Israel. In International Handbook of Underwater Archaeology. Eds. C.V. Ruppé and J.F. Barstad. (Plenum Series of Underwater Archaeology, General ed., J.B. Arnold III). Plenum, New York: cover, 499-517. With D. Davis. First author.
- 1995 Earliest Mediterranean Paddled and Oared Ships to the Beginning of the Iron Age. In Conway's History of the Ship: The Age of the Galley. Conway, London: 10-35.
- 1987 The Galilee Boat. In History from the Sea. Ed. P. Throckmorton. Mitchell Beazley International, Ltd., London: 81-83. Napoleon's Guns. In History from the Sea. Ed. P. Throckmorton. Mitchell Beazley International, Ltd., London: 202-205.
- 1985 Finds from the Late Canaanite (Bronze) Period. In From the Depths of the Sea. (Israel Museum Catalogue no. 263, Summer 1985). Israel Museum, Jerusalem: 7-11 and pls. 1-7. With O. Misch-Brandl and E. Galili. Third author. n.d. Some remarks on Archery. In In the Footsteps of Early Hunters: Arrowheads from the Collection of F. Burian and E. Friedman (Israel Museum Catalogue, no. 151). Israel Museum, Jerusalem.

REFEREED ARTICLES

- 2012 Panathenaic Ships: The Iconographic Evidence. *Hesperia* 81: 237-266.
- 2010 Ahhotep's Silver Ship Model: The Minoan Context. *Journal of Ancient Egyptian Interconnections* 2/3: 31-41.
- 2009 The Paleoenvironmental Contexts of Three Possible Phoenician Anchorages in Portugal. *International Journal of Nautical Archaeology* 38(2): 221-253. First author, with R.K. Dunn, J. Hale, R.L. Hohlfelder, L.B. Conyers, E.G. Ernenwein, P. Sheets, M.L. Pienheiro Blot, F. Castro, D. Davis.
- 1995 Zeevaarders in Het Oude Nabije Oosten. *Phœnix* (Bulletin uitgegeven door het Vooraziatisch-Egyptisch Genootschap, Ex Oriente Lux. Leiden.) 41/2: 72-80.
- 1987 The Kinneret Boat Project: Part I. The Excavation and the Conservation of the Kinneret Boat. *International Journal of Nautical Archaeology* 16: 233- 245. Primary author, with K. Raveh and O. Cohen.
- 1984 A Concise Nautical History of Dor/Tantura. *International Journal of Nautical Archaeology* 13: 223-241. Primary author, with K. Raveh.
- 1982 The Ships of the Sea Peoples (IJNA 10.3: 187-220). *International Journal of Nautical Archaeology* 11: 297-304.
- 1981 The Ships of the Sea Peoples. *International Journal of Nautical Archaeology* 10: 187-220.
- 1980 The Thera Waterborne Procession Reconsidered. *International Journal of Nautical Archaeology* 9: 287-295.
- 1978 A Ship Graffito from Khirbet Rafi. *International Journal of Nautical Archaeology* 7: 227-232. Secondary author, with A. Kloner.

NON-REFEREED ARTICLES

- In press The 2014 Ioppa Maritima, Part I: Introduction & The Land Survey. *INA Quarterly*. (9 pages and 10 illustrations.) (Submitted November 6, 2014)
- 2011 Which Way Forward? On the Directionality of Minoan/Cycladic Ships. *Skyllis* (Deutsche Gesellschaft zur Förderung der Unterwasserarchäologie e.V.) (Proceedings of In Poseidons Reich XII) 11(2): 12-18.



2011 Wachsmann, S., 2011. Innovations in Ship Construction at Tantura Lagoon, Israel: Results of the INA/CMS Joint Expeditions (1994-1996). *Skyllis Deutsche Gesellschaft zur Förderung der Unterwasserarchäologie e.V.* (Proceedings of In Poseidons Reich XV) 11(1): 83-93.

Archaeological Discoveries on Eratosthenes Seamount. In *New Frontiers in Ocean Exploration: The E/V Nautilus 2010 Field Season*. *Oceanography* 24(1), Supplement: 30. First author, with S. Demesticha, I. Chrysoheri, and K.L. Croff Bell.

2007- 2008 Deep Submergence Archaeology: The Final Frontier. *Skyllis (Deutsche Gesellschaft zur Förderung der Unterwasserarchäologie e.V.)* (Proceedings of In Poseidons Reich XII) 8(1-2): 130-154.

2002 Sailing into Egypt's Past: Does a Celebration of Luxor's Patron Saint Echo Ancient Pharaonic Traditions? *Archaeology Magazine* 55/4: 36-39.

1997 Shipwreck Fall: The 1995 INA/CMS Joint Expedition to Tantura Lagoon, Israel. *INA Quarterly* 24/1: cover, 3-18. First author, with Y. Kahanov.

The Tantura B Shipwreck: The 1996 INA/CMS Joint Expedition to Tantura Lagoon, Israel. *INA Quarterly* 24/4: cover, 3-15. First author, with Y. Kahanov and J. Hall.

1996 Technology Before its Time: A Byzantine Shipwreck from Tantura Lagoon. *The Explorers Journal* 74/1: 19-23.

1995 The 1994 INA/CMS Joint Expedition to Tantura Lagoon. *INA Quarterly* 22/2: 3-9.

1991 Ancient Seafaring on the Sea of Galilee. *INA Newsletter* 18/3: cover, 4-9, 12. Reprinted in *Seaways* 4/1(1993): 16-21.

1990 On Sea-Going Vessels Depicted in Egyptian Art. *Qadmoniot* 23 (89-90): 2- 20, back cover. (in Hebrew) *Una barca nel Mare di Galilea*. *Archeologia Viva* 9/11 (N.S.): 10-17. *Ships of Tarshish to the Land of Ophir: Seafaring in the Bible*. *Oceanus* 33/1: 70-82.

1988 The Galilee Boat: 2,000-Year-Old Hull Recovered Intact. *Biblical Archaeology Review* 14/5: 18-33. Reprinted in 1990 as a chapter in *Archaeology in the World of Herod, Jesus and Paul II (Archaeology and the Bible: The Best of BAR)*. Eds. H. Shanks and D.P. Cole. *Biblical Archaeology Society*, Washington: 208-223. Reprinted in 2006 as a chapter (The "Jesus" Boat: Sunk in the Sea of Galilee) in *Where Christianity was Born*. Ed. H. Shanks. *Biblical Archaeology Society*, Washington: 48-65.

1986 Is Cyprus Ancient Alashiya? New Evidence from an Egyptian Tablet. *Biblical Archaeologist* 49: 37-40.

1984 A Bronze Napoleonic Mortar from the Tantura/Dor Coast. *Qadmoniot* 17: 33-34. With K. Raveh. First author. (in Hebrew) *In the Footsteps of Napoleon at Tantura, Israel*. *Archaeology Magazine* 37/5: 58-59, 76 and 17. With K. Raveh. First author.

1981 Graffito of a War Galley from Horvat Rafi. *Qadmoniot* 14: 43-46. With A. Kloner. First author. (in Hebrew) *The Search for Napoleon's Lost Ordnance in the Sea of Tantura/Dor*. *Qadmoniot* 15: 87-91. With K. Raveh. First author. (in Hebrew)

CHAPTERS IN PROCEEDINGS OF PROFESSIONAL MEETINGS

In press: *In Search of Lost Fleets: A Preliminary Report on the Persian War Shipwreck Survey, 2003-2005 Expeditions*. In *Tropis IX*. (IXth International Symposium on Ship Construction in Antiquity, Agia Napa, Cyprus, August 25-30, 2005).

Ed. H. Tzalas. *Hellenic Institute for the Preservation of Nautical Tradition*, Athens. (21 pages and 13 illustrations) (Submitted October 2005) With J.R. Hale, R.L. Hohlfelder, D. Yoerger, D. Davis and D. Bartoli. First author.

Phoenicians in Portugal: The 2002 INA/CNANS Joint Expedition. In *Tropis VIII*. (VIIIth International Symposium on Ship Construction in Antiquity, Hydra, August 26-31, 2002). Ed. H. Tzalas. *Hellenic Institute for the Preservation of Nautical Tradition*, Athens. (21 pages and 15 illustrations) (Submitted June 2004)



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1996 Bird-Head Devices on Mediterranean Ships. In Tropis IV (IVth International Symposium on Ship Construction in Antiquity, Athens, August, 28-31, 1991). Ed. H. Tzalas. Hellenic Institute for the Preservation of Nautical Tradition, Athens: 539-572.

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NOTES AND COMMENTS

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2014 Review: The Oxford Handbook of the Bronze Age Aegean. Ed. Eric Cline. International Journal of Nautical Archaeology 43: 203-206.

2005 Review: Sailors in the Holy Land: The 1848 American Expedition to the Dead Sea in Search of Sodom and Gomorrah. By Andrew C.A. Jampoler. The Northern Mariner 15/2: 66-67.

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1992 Review: The Athlit Ram. Eds. L. Casson and J. Richard Steffy. American Neptune 52: 204-206.

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ARTICLES IN POPULAR MAGAZINES

1991 Hatshepsut's Guide to Red Sea Marine Life. *IsraEl AI* 40: 19-20, 22.

1990 The Ancient Hiding Systems: And Men Shall Enter the Caves of the Rocks and the Holes of the Ground... (Isaiah 2: 19). *IsraEl AI* 32: 22-28.

The Island of Legend. *IsraEl AI* 31: 54-53. (in Hebrew)

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Raiders of the Past. *IsraEl AI* 29: 16-19.

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1987-1988 A Not-So-Innocent Abroad. *The Dan Magazine* (Winter): 4-6.

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- Caesarea. Israel Hiltons Magazine (Winter): 32-34.
- The Once and Future Acco. IsraEl AI 21: 39-42.
- Yaffo. Isrotel Magazine (Winter): 14-16.
- 1987 Luxor. IsraEl AI 18: 61-60. (in Hebrew)
- The Old Sea and the Man. IsraEl AI 18: cover, 17-26.
- The Woeful Tale of Wenamon. The Israel Hiltons Magazine: 26-28.
- 19th Century Visitors to Jerusalem. IsraEl AI 19: 12-14.
- Venice. IsraEl AI 18: 59-58. (in Hebrew)
- 1986-1987 Diplomats Dig In. Keeping Posted 6 (Winter): 62.
- 1986 An Encounter with Napoleon at Tantura. IsraEl AI 16: cover, 7-17. Primary author, with K. Raveh.
- Raiders of the Lost Boat. IsraEl AI 15: cover, 6-11. Primary author, with K. Raveh.
- 1983-1984 The Guns of Tantura: Napoleonic Weaponry From Beneath the Sea. Israel - Land and Nature 9: 56-60. Primary author, with K. Raveh.
- 1983 Stone Anchors. El Ha-Yam 17 (September-October): 33-34; 18 (November- December): 28-29. Primary author, with K. Raveh. (in Hebrew)
- The Discovery of Antiquities in the Sea. El Ha-Yam 16 (July- August): 34-36. (in Hebrew)
- To the Mystery Wreck at the Habonim Coast. El Ha-Yam 18 (November- December): 20-23. Primary author, with K. Raveh and N. Lisovski. (in Hebrew)

ARTICLES FOR CHILDREN

In press How Deep Can They Go? DIG Magazine (4 pages and 5 figures) Submitted September 9th, 2013)

2011 Tracking Waterways. DIG Magazine 13(8 May/June): 22-25.

1993 A Special Sunken Treasure: Excavating a 2,000-Year-Old Boat. Faces (October): cover, 1, 4-8.

REPORTS ON GRANTS/PROJECTS

1999 The 1999 INA/ROBO Remote Sensing Survey opposite Tantura Lagoon, Israel. (Final Report)

1998 The 1997 Leon Levy Shipwreck Survey, Ashkelon, Israel. (Final Report) With the assistance of P. Sibella, D. Carlson and D. Davis.

1997 National Geographic Society Grant #5766-96. Exploration of Tantura Lagoon: Four Millennia of Seafaring. (Final Report).

1996 National Geographic Society Grant #5571-95. Excavation of a Byzantine-Period Shipwreck, Tantura Lagoon, Israel. (Final Report).

To the Sea of the Philistines: The Ashkelon Sidescan Sonar Shipwreck Survey (May 1996). (Final Report).



1995 National Geographic Society Grant #5322-94. The INA/CMS Joint Expedition to Tantara Lagoon, Israel. (Final Report).

COLLOQUIA & SESSIONS CHAIRED

2014 IKUWA 5 (International Conference on Underwater Archaeology), October 15-19, 2014 at Cartagena, Spain. Title: Methodology: Conservation & Analyses

2011 In Poseidons Reich XVI. Organized by the Deutsche Gesellschaft zur Förderung der Unterwasserarchäologie e. V. (DEGUWA) in Heidelberg Germany, February 18-20. Session title: Akkulturation und Besiedlung.

American Institute of Archaeology Annual Meeting, San Antonio, January. Session title: A Half Century of Nautical Archaeology: Revisiting Excavations. Chair.

2009 American Institute of Archaeology Annual Meeting, Philadelphia, PA, January.

Session title: Ancient Mediterranean Ship Construction: A Colloquium in Honor of J. Richard "Dick" Steffy. Chair.

American Institute of Archaeology Annual Meeting, Philadelphia, PA, January. Session title: Crete and Thera. Chair.

2008 Xth International Symposium on Ship Construction in Antiquity, Hydra, Greece, August-September. Session title: Ports. Chair.

2007 In Poseidons Reich XII. Organized by the Deutsche Gesellschaft zur Förderung der Unterwasserarchäologie e. V. (DEGUWA) in Cologne, Germany, February. Session title: Atlantic, North Sea & Baltic Sea. Chair.

American Institute of Archaeology Annual Meeting, San Diego, CA, January. Session title: Ships and Shipwrecks. Chair.

2006 American Institute of Archaeology Annual Meeting, Montreal, Canada, January. Session title: Deep-Submergence Archaeology: The Aegean and the Eastern Mediterranean Seas. Chair.

2005 American Institute of Archaeology Annual Meeting, Boston, MA, January. Session title: Deep-Submergence Archaeology: The Final Frontier. Chair.

IXth Symposium on Ship Construction in Antiquity, Agia Napa, Cyprus, August. Session title: Sails/Rigging & Ship Graffiti. Co-Chair.

PAPERS PRESENTED AT PROFESSIONAL MEETINGS

2014 IKUWA 5 (International Conference on Underwater Archaeology), October 15- 19, 2014 at Cartagena, Spain. Title: On Digital Nautical Archaeology.

2013 Italy, Mediterranean and Europe in the Bronze Age: Trade, Travels and Migrations in the Mid to Late 2nd Millennium BC. International Conference at the University of Göthenborg, Sweden, April 26th, 2013. Title: Sea Peoples in Egypt.

American Institute of Archaeology Annual Meeting, Seattle, WA, January 3-6, 2013. Title: Dionysian Ship Carts: Iconography and Context.

2012 ASOR 2009 Annual Meeting. Chicago, IL, November 14-17, 2012. Title: Innovation in Ship Construction at Tantara Lagoon, Israel: results of the INA/CMS Joint Expedition.

2012 Smithsonian Resident Associates Program: Easter Island's Secrets Revealed (All day Seminar). Smithsonian National Museum, September 22, 2012. Title: Rapa Nui Culture: The View from the Ocean (with J. Morris).



2011 Offshore Technology Conference (OTC) 2011, May 2nd-5th, Houston, Texas. Title: Deep Submergence Archaeology: The Final Frontier. (Breakfast Topical Lecture)

The Underwater Archaeology Society of BC 25th Annual Conference in Fort Langley National Historic Site, British Columbia, Canada. April 30th, 2011. Title: The Sea of Galilee Boat. (Conference keynote lecture)

The Underwater Archaeology Society of BC 25th Annual Conference in Fort Langley National Historic Site, British Columbia, Canada. April 30th, 2011. Title: Deep Submergence Archaeology: Fleets of Antiquity.

In Poseidons Reich XVI. Organized by the Deutsche Gesellschaft zur Förderung der Unterwasserarchäologie e. V. (DEGUWA) in Heidelberg Germany, February 18-20. Title: Minoan/Cycladic Ships: An Overview.

2010 ASOR 2010 Annual Meeting. Atlanta, GA, November 17-20 2010. Title: Ahhotep's Silver Model Reconsidered.

In Poseidons Reich XV. Organized by the Deutsche Gesellschaft zur Förderung der Unterwasserarchäologie e. V. (DEGUWA) in Vienna, Austria, February 19- 21. Title: Innovation in Ship construction at Tantura Lagoon, Israel: Results of the INA/CMS Joint Expedition.

American Institute of Archaeology Annual Meeting, Anaheim, CA, January 6-9, 2010. Title: The Panathenaic Ship.

2009 ASOR 2009 Annual Meeting. New Orleans, LA, November 18-21 2009. Title: A Helladic-Style Wooden Ship Model from Gurob, Egypt.

International Symposium on Underwater Vehicles Technologies (Anavissos, Greece 26-27 March 2009). Organized by the Hellenic Centre for Marine Research. Title: The Forensics of Deep-Water Shipwrecks.

American Institute of Archaeology Annual Meeting, Philadelphia, PA, January. Workshop title: Deep Submergence Archaeology Revisiting the Final Frontier. Panelist.

2008 Xth International Symposium on Ship Construction in Antiquity, Hydra, Greece, August 27-September 2. Title: The Danaos Project (2007-2008).

Xth International Congress of Egyptologists. Rhodes, Greece, May 22nd-29th, 2008). Title: The Gurob Ship Model

1200 BC: War, Climate Change & Cultural Catastrophe. Organized by the Schools of Archaeology and Classics at University College Dublin, Ireland, (7-9 March 2008). Title: On Helladic Galleys and Sea Peoples.
Title: Deep Submergence Archaeology: The Final Frontier.

American Institute of Archaeology Annual Meeting, San Diego, CA, January. Title: The Gurob Model.

2005 IXth International Symposium on Ship Construction in Antiquity, Agia Napa, Cyprus, August. Title: In Search of Lost Fleets: A Preliminary Report on the Persian War Shipwreck Survey, 2003-2005 Expeditions. (Presenter, with J. Hale & R.L. Hohlfelder)

Keynote lecturer, student conference under the auspices of the Canadian Archaeological Institute at Athens and Concordia University at Concordia University, September. Title: Deep-Submergence Archaeology: The Persian War Shipwreck Survey.

2004 American Institute of Archaeology Annual Meeting, San Francisco, CA, January. Title: Visualizing Shipwrecks at Tantura Lagoon, Israel. (Co-presenter with D. Sanders). Also co-author with J. Hale (presenter) and R.L. Hohlfelder for presentation entitled The Persian War Shipwreck Project 2003: Deep-Water Survey Off Mt. Athos.

Cyprus American Archaeological Research Institute (CAARI) Workshop: Cyprus and Underwater Archaeology, Nicosia, Cyprus, January. Title: Deep- Submergence Archaeology. (Co-presenter with J. Morris)



- First Conference on Deep-Water Archaeological Exploration: Technology and Perspectives, Athens, Greece, September. Title: The Persian War Shipwreck Survey 2003-2004: Preliminary Report.
- American Schools of Oriental Research Annual Meeting, San Antonio, TX, November. Title: The 2004 Persian War Shipwreck Survey. (Presenter with J. Hale and R.L. Hohlfelder)
- 2003 American Schools of Oriental Research Annual Meeting, Atlanta, GA, November. Title: The 2003 Persian War Shipwreck Survey. (Presenter with J. Hale and R.L. Hohlfelder)
- 2002 American Institute of Archaeology Annual Meeting, Philadelphia, PA, January.
Title: The Galilee Boat: A Porthole into the Past.
- VIIIth Symposium on Ship Construction in Antiquity, Hydra, Greece, August. Title: Phoenicians in Portugal.
- Communications in the Mediterranean from Paleolithic to Early Roman Times, Melos, Greece, September. Title: Ancient Mediterranean Navigation & the Promise of Deep-Submergence Archaeology.
- 2001 Seminar on Sediment Moving and Imaging (discussions on the design of an excavating tool for deep-submergence archaeology); participant.
- American Institute of Archaeology Annual Meeting, San Diego, CA, January. Title: Near and Far: The Case for Deep-Water Shipwrecks off Israel's Mediterranean Coast.
- 2000 Travel and Trade in the Ancient World, Wheaton College 45th Annual Archaeology Conference, November. Title: Ancient Seafaring in the Eastern Mediterranean.
- 1999 Technology and Archaeology in the Deep Sea: Towards a New Synthesis, Massachusetts Institute of Technology, Cambridge, MA. Panelist.
- VIIth Symposium on Ship Construction in Antiquity, Pylos, Greece, August. Title: The Mould of Abu Haggag and Boat Festivals in Egypt.
- 1998 Thirty-Sixth Annual Briefing: New Horizons in Science (Council for the Advancement of Science Writing), Cambridge, MA, November. Topic: Bronze Age Seafaring.
- 1997 First International Symposium "The Wall Paintings of Thera," Thera, Greece, August-September. Title: Some Notes on Mediterranean Seafaring During the Second Millennium B.C.
- 1996 VIth Symposium on Ship Construction in Antiquity, Lamia, Greece, August. Title: The INA/CMS Joint Expedition to Tantara Lagoon, Israel: Report on the 1994-1995 Seasons of Excavation.
- Symposium on Underwater Archaeology, (Marine Branch of the Israel Antiquities Authority), Athlit, Israel, October. Title: Underwater Excavations and Surveys at Tel Dor.
- 1995 Invited lecturer for a seminar concerning "Cultural Interconnections in the Ancient Near East: The Sea Peoples," by the Near Eastern Section at The University Museum, University of Pennsylvania. Title: The Naval Battle at Medinet Habu: Concerning the Ships of the Sea Peoples and their Relation to Contemporaneous Mycenaean Ships.
- 1994 Res Maritimae: Cyprus and the Eastern Mediterranean. Prehistory Through the Roman Period, Nicosia, Cyprus, October. Title: Were the Sea Peoples Fleeing Mycenaean? The Evidence from Ship Iconography.
- 1993 Vth Symposium on Ship Construction in Antiquity, Nauplion, Greece, August.
Title: The Pylos Rower Tablets Reconsidered.
- XIth Naval History Symposium Held with the Classical Association of the Atlantic States, United States Naval Academy, Annapolis, MD, October. Respondent to the session on Underwater Archaeology.



American Schools of Oriental Research Annual Meeting, Washington, DC, November. Title: Ethnicity and Late Bronze Age Shipwrecks.

1992 Conference of the Society for Historical Archaeology and the Council for Underwater Archaeology, Kingston, Jamaica, January. Title: The Battle of Migdal Reconsidered.

1991 Southwest Regional American Schools of Oriental Research Convention, Dallas, TX, March. Title: The Galilee Boat: Conclusions.

Thalassa II, Department of Classics, University of Texas, Austin, TX, October. Title: Aegeans in the Theban Tombs.

IVth Symposium on Ship Construction in Antiquity, Athens, Greece, August. Title: Bird-Head Devices on Mediterranean Ships.

1989 First Joint Archaeological Congress, Baltimore, MD, January. Title: The Kinneret Boat: Excavation and Conclusions.

IIIrd Symposium on Ship Construction in Antiquity, Athens, Greece, August. Title: The Kinneret Boat: The Excavation Report.

IV rassegna di archeologia subacquea, IV premio Franco Papò, Giardini-Naxos, Sicily, October. Title: The Discovery and Excavation of the Kinneret Boat.

1987 Seaborne Trade in Metals and Ingots, Oxford, England, January. Title: The Seaborne Late Bronze Age Metals Trade in Retrospect.

IInd Symposium on Ship Construction in Antiquity, Athens, Greece, August. Title: The Kinneret Boat: The Discovery and Excavation.

1985 Society and Economy in the Eastern Mediterranean, c. 1500-1000 B.C., Haifa, Israel, April-May. Title: Observations on Two Nautical Aspects of Canaanite Late Bronze Age Trade.

IIIrd International Symposium Thracia Pontica, Sozopol, Bulgaria, October. Title: Shfifons—Early Bronze Age Anchor-Shaped Cult Stones from the Sea of Galilee Region.

1982 VIth International Congress of Underwater Archaeology, Cartagena, Spain, March-April. Title: A Bronze Age Cargo off Hahotrim, Israel.

IXth Archaeological Conference in Israel, Jerusalem, Israel, April. Title: Cultic Anchor-Like Stones from Bikat Kinarot Dating to the Early Bronze Age.



CV – YOSSI AZOV



Yossi Azov

Managing Director – MVI Israel

Israel

PROFILE

Education: Doctor of Science in Environmental & Water Resources Engineering, Technion – Israel Institute of Technology, Haifa, Israel, 1979; Master of Human Environmental Sciences, Hebrew University of Jerusalem, Israel, 1975; Bachelor in Biology, Hebrew University of Jerusalem, Israel, 1973

An expert on the environmental impacts of marine pollution associated with eutrophication and effects on marine food chain, Dr. Azov has over 30 years of experience with environmental, ecological, biological, and engineering issues concerning oceanic, coastal, and land problems. He has published over 30 papers in scientific journals in his field. Relevant experience includes Dr. Azov's participation in the environmental impact assessment of proposed marine outfall for the wastes of Industrial plants in Haifa Bay and his role as scientific coordinator for a project concerning the monitoring of sea water during marine works conducted by Noble Energy. In addition, he has evaluated the biological effects of the marine sludge outfall of Greater Tel-Aviv wastewater treatment plant and evaluated the effects of brine from effluent desalination on marine life. He has also evaluated the causes for phytoplankton bloom in artificial marine lagoon in Eilat as well as the effects of heated water on the fauna and flora of the Hertzelia Marina. In addition, he participated in a specialist forum at the Grand Water Research Institute – Technion concerning water desalination plants.

Dr. Azov has served as a scientific advisor for a number of projects throughout the proposed project area. He served as the scientific advisor to the Israel Rivers Remediation Authority concerning remediation of Hadera River; for bi-national research conducted at the Technion concerning CO₂ mitigation by algae; and for numerous plants, including the Greater Haifa wastewater treatment plant, the Arad wastewater treatment plant, the construction of a demonstration plant in Thessaloniki, Greece for wastewater treatment in South Europe sponsored by E.E.C., the construction of a demonstration plant in Sau-Paulo, Brazil for wastewater treatment in small municipalities, the Greater Tel-Aviv wastewater treatment plant concerning the effects of lagoon drying on the surrounding area, and the Bet Jan wastewater treatment plant in case of photosynthetic bacteria bloom. In addition, Dr. Azov has served as the Coordinator of many monitoring projects, including the Caesarea Industrial Park monitoring program concerning effects on groundwater quality, the Greater Tel-Aviv wastewater reclamation program, and the Haifa Complex wastewater reclamation program

RELEVANT EXPERIENCE

2013 to Present: CSA Ocean Sciences Inc. – Managing Director – Marine Ventures Intl. – Israel

-Responsible for the general management of the Israel CSA operations and office.

1997 to Present: Private Consultant

-Numerous consulting contracts in areas of marine pollutions, water quality, water treatment, groundwater quality, wastewater treatment, algal growth and production, etc.

1996 to 1997: Environmental and Water Resources Engineering Department, Technion, Haifa – Senior Research Fellow



-Research involved wastewater treatment and effluent quality. Monitoring of groundwater quality.
1987 to 1996: Environmental and Water Resources Engineering Department, Technion, Haifa – Senior Research Associate

-Research involved wastewater treatment and effluent quality.
1984 to 1987: Environmental and Water Resources Engineering Department, Technion, Haifa, Israel – Research Associate and Project Engineer

-Research field: "Effluent supply for irrigation in northern Israel."

1981 to 1984: Israel Oceanographic & Limnological Research Institution, Haifa – Scientist

Main research fields: Marine phytoplankton, Marine food chain, Primary production in Eastern Mediterranean. Research conducted both on board ship and in the laboratory.

1980 to 1981: Woods Hole Oceanographic Institution, U.S.A. – Post-Doctoral Researcher

Research field: "Effect of ammonia on marine and fresh water algae."

1976 to 1980: Environmental and Water Resources Engineering Department, Technion, Haifa – Head of Biological Research Group

Research field: "Algal growth and production for animal feed."

1973 to 1975: Human Environmental Sciences Department, Hebrew University of Jerusalem, Israel – Research Assistant

Research field: "Ammonia toxicity to algae."

1997 to Present: Technion – Israel Institute of Technology, Haifa, Israel – Adjunct Senior Teaching Fellow

Graduate course in "Hydrobiology."

2005 to Present: Haifa University, Haifa, Israel – Adjunct Senior Teaching Fellow

Graduate course in "Water and Wastewater Treatment."

PUBLICATIONS (Corporate)

Abeliovich, A. and Y. Azov. 1976. Toxicity of ammonia to algae in sewage oxidation ponds. Appl. Environ. Microbiol. 31:801-806.

Oron, G., G. Shelef, A. Levi, A. Meydan, and Y. Azov, Y. 1979. Algae bacteria ratio in high- rate ponds used for waste treatment. Appl. Environ. Microbiol. 38:570-576.

Shelef, G., Y. Azov, R. Moraine, and G. Oron. 1980. Algal mass production as an integral part of a wastewater treatment and reclamation system. In:Algae Biomass, Production and Use (G. Shelef and C.J. Soeder, eds.), Elsevier Biomedical Press, pp. 163-189.

Azov, Y., G. Shelef, R. Moraine, and A. Levi. 1980. Controlling algal genera in high-rate oxidation ponds. In: Algae Biomass, Production and Use (G. Shelef and C.J. Soeder, eds.), Elsevier Biomedical Press, pp. 245-253.

Azov, Y., G. Shelef, R. Moraine, and A. Levi. 1980. Controlling algal genera in high-rate oxidation ponds. In: Algae Biomass, Production and Use (G. Shelef and C.J. Soeder, eds.), Elsevier Biomedical Press, pp. 245-253.

Azov, Y., G. Shelef, R. Moraine, and G. Oron. 1980. Alternative operating strategies of high-rate sewage oxidation ponds. In: Algae Biomass, Production and Use (G. Shelef and C.J. Soeder, eds.), Elsevier Biomedical Press, pp. 523-529.



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- Azov, Y., G. Shelef, and N. Narkis. 1982. Effect of hard detergents on algae in a high-rate oxidation pond. *Appl. Environ. Microbiol.* 43:491-492.
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- Berman, T., Y. Azov, and D.W. Townsend. 1984. Understanding oligotrophic oceans: Can Eastern Mediterranean be a useful model? In: *Lecture Notes on Coastal and Estuarine Studies, 8: Marine Phytoplankton and Productivity* (O. Holm-Hansen et al., eds.) Springer Verlag Publs., pp. 101-112.
- Azov, Y. 1986. Seasonal patterns of phytoplankton productivity and abundance in near shore oligotrophic waters of the Levant Basin (Mediterranean). *J. Plankton. Res.* 8:41-53.
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- Azov, Y. and G. Shelef. 1991. Effluents quality along a multiple-stage wastewater reclamation system for agricultural reuse. *Wat. Sci. Tech.* 23:2119-2126.
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- Teltsch, B., Y. Azov, M. Juanico, and G. Shelef. 1992. Plankton community changes due to effluents addition to a freshwater reservoir used for drip irrigation. *Water Res.* 26:657-666.
- Azov, Y., M. Juanico, and G. Shelef. 1992. Monitoring large scale wastewater reclamation systems - policy and experience. *Wat. Sci. Tech.* 26:1,545-1,553.
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- Armon, R., K. Dozoretz, Y. Azov, and G. Shelef. 1995. Residual contamination of crops irrigated with different effluent quality: A field study. *Wat. Sci. Tech.* 31:239-248.



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- Juanico, M., R. Ravid, Y. Azov, and B. Teltsch. 1995. Removal of trace metals from wastewater during long-term storage in seasonal reservoirs. *Water, Air & Soil Pollution*. 82:617-633.
- Azov, Y. and T. Tregubova. 1995. Nitrification processes in stabilization reservoirs. *Wat. Sci. Tech.* 31:313-319.
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- Juanico, M., R. Ravid, Y. Azov, and B. Teltsch. 1999. Trace metals. In: *Reservoirs for Wastewater Storage and Reuse* (I. Dor and M. Juanico, eds.). Springer Publs. pp. 219-232.
- Shelef, G. and Y. Azov. 2000. Meeting stringent environmental and reuse requirements by an integrated pond system at the 21st century. *Wat. Sci. Tech.* 42 (10-11) pp. 299-305.
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CV – BRENT GORE



Brent Gore

Lead GIS Analyst/Cartographer

US

PROFILE

Education: Master of Arts in Geography, East Carolina University, 2013; Bachelor of Arts in Geography, University of North Carolina at Wilmington, 2009

Mr. Gore is a professional geographer and certified GIS Professional (GISP) whose main areas of expertise include geospatial analysis and data management, cartography, and remote sensing. His research interests include geospatial analysis and remote sensing of estuarine and marine environments, cartography, and geovisualization, and he has been recognized for his exceptional work in the geospatial sciences through various research publications and cartographic awards. Mr. Gore serves as Lead GIS Analyst/Cartographer for CSA's Environmental Data and Geospatial Services (EDGS), and since joining CSA Ocean Sciences, Inc. in 2012, he has directed and supported various GIS-related projects with professional-quality geospatial and remote sensing analysis, cartographic products, and database management. These projects include environmental impact assessments (EIA) and environmental baseline and monitoring surveys (EBS/EMS) of marine environments, digital image classification and interpretation of benthic and terrestrial environments, and natural resource damage assessments, restoration, and relocation projects.

RELEVANT EXPERIENCE

2012 to Present: CSA Ocean Sciences Inc. – GIS Analyst/Cartographer

-In-house cartographer and GIS analyst for CSA's EDGS team. Responsible for producing and managing maps, geospatial data, metadata, images, and documents for various GIS-related projects. Conducts quality assurance/quality control (QA/QC) on maps, geospatial data, and documents for GIS-related projects.

-Analysis, management, and production of data and figures to support EIA, EBS, and EMS reports for proposed drilling operations offshore United States, Cyprus, Israel, Qatar, Suriname, Brazil, Trinidad and Tobago, Morocco, Ghana, Cameroon, and New Zealand.

-Classified shoreline and created an environmental sensitivity index (ESI) map for a portion of Israel and Cyprus coastlines utilizing both satellite imagery and geo-coded ground-truth photos.

-Analysis, management, and production of data and figures to support annual nearshore hardbottom monitoring and artificial reef surveys for Martin, St. Lucie, and Indian River Counties, FL. Performed remote sensing image classification to determine the spatial extent of nearshore hardbottom benthic habitats.

-Analysis, management, and production of data and figures to support a sand trap and reef survey, Ft. Pierce Inlet, FL. Used ground-truth field data and aerial imagery to characterize the spatial location of various benthic habitats within Ft. Pierce Inlet.



-Collection, analysis, management, and production of data and figures to support outer continental shelf (OCS) environmental impact survey (EIS) and programmatic environmental impact statement (PEIS) reports for geological and geophysical (G&G) activities in the U.S. Atlantic Ocean, Gulf of Mexico, and Alaska.

-Analysis, management, and production of data and figures to support seagrass and coral mitigation, relocation, and restoration projects in Miami Harbour, FL and offshore Qatar.

-Analysis, management, and production of data and figures to support cable repair projects in Miami, FL and offshore Israel and Cyprus.

- Analysis, management, and production of data and figures to support a benthic habitat characterization study offshore Key West, FL.

-Analysis, management, and production of data and figures to support an offshore heated water plant study for the St. Lucie Nuclear Power Plant, FL. Created temperature surface rasters by interpolating field points containing temperature data collected around offshore discharge pipes.

2010 to 2012: Renaissance Computing Institute (RENCI) at East Carolina University – GIS Analyst/Graduate Research Assistant

-Assisted Dr. Thomas Allen with remote sensing research for the U.S. Fish and Wildlife Service to determine the effectiveness of Synthetic Aperture Radar (SAR) to delineate the locations of coastal wetlands in the Alligator River and Cedar Island National Wildlife Refuges, North Carolina.

-Developed an award-winning mapping project dealing with future sea-level rise in the Albemarle-Pamlico Estuarine System, North Carolina; data resulting from the project will be utilized by the Albemarle-Pamlico National Estuarine Program for further research, outreach, and publication.

-Produced maps and posters for various professional conferences, presentations, and publications.

2010: University of North Carolina at Wilmington – Volunteer Teaching/Research Assistant

-Used Google Earth to digitize polygons and assign values to damaged or collapsed structures outside Port-au-Prince, Haiti for a Haiti Damage Assessment project.

-Assisted Dr. Joanne Halls with Introduction to GIS course labs.

-Assisted Dr. Joanne Halls with a Masonboro Island, North Carolina research project gathering, organizing, and analyzing GPS and LIDAR data.

2008: U.S. Army Corps of Engineers – GIS Technician (Undergraduate Internship)

-Prepared digital North Carolina county maps using ESRI's ArcMap.

-Acquired, updated, and managed geospatial data using ESRI's ArcCatalog.

-Reviewed and organized CAMA (Coastal Area Management Act) permits.

-Obtained low-level government security clearance.

-Determined areas of possible wetland disruption by matching the positions on satellite images to those on site plans for various development projects.

PUBLICATIONS

Allen, T.R., Y. Wang, and B. Gore. 2013. Coastal wetland mapping combining multi-date SAR and LiDAR, *Geocarto International*, 28:7, 616-631, DOI: 10.1080/10106049.2013.768297



Gore, Brent R. 2013. Modeling Wetland Response to Future Sea-Level Rise in the Pamlico and Croatan Sounds, North Carolina (Master's thesis). East Carolina University, Greenville, North Carolina.

Sea-Level Rise Vulnerability in the Albemarle-Pamlico Estuarine System, 2012 ESRI Map Book, Volume 27.

Allen, T.R., Y. Wang, B. Gore, J. Swords, and D. Newcomb. 2011. Coastal wetland mapping and monitoring using time series SAR imagery and LiDAR: Alligator River National Wildlife Refuge, North Carolina. 18th William T. Pecora Remote Sensing Symposium, American Society for Photogrammetry and Remote Sensing, Herndon, Virginia, November 14-17.

HONORS AND AWARDS

1st Place, Outstanding Use of Cartographic Practices in a GIS Environment, Central Florida GIS Workshop Map Gallery Contest 2013; Sea-Level Rise Vulnerability in the Albemarle-Pamlico Estuarine System

3rd Place, Best Map Product in a Digital Display Format, ESRI Map Gallery Contest 2011; Sea-Level Rise Vulnerability in the Albemarle-Pamlico Estuarine System

2nd Place, Battle of the GeoMaps, North Carolina Arc Users Conference 2011; Potential Sea-Level Rise Inundation In the Albemarle-Pamlico Estuarine System

2011 North Carolina Space Grant Graduate Research Fellowship; Satellite Remote Sensing of Wetlands in the Albemarle-Pamlico Estuarine System using Synthetic Aperture Radar for Sea-Level Rise Modeling

PROFESSIONAL CERTIFICATIONS

GISP (GIS Professional) – GIS Certification Institute (GISCI), Certification number: 91316; 2015
Graduate Certificate in Geographic Information Science and Technology (GIST) – East Carolina University; 2012
Undergraduate Certificate in Geographic Information Science (GIS) – University of North Carolina at Wilmington; 2009

COMPUTER SKILLS

Proficient in ESRI ArcGIS 10.3, ArcView, ArcMap, ArcInfo, Arc Catalog, ERDAS Imagine 2011, Adobe Photoshop CS5, Sea-Level Affecting Marshes Model v6 (SLAMM), Global Mapper v12, HYPACK 2013



CV – KIM DUNLEAVY



Kim Dunleavy

Technical Editor

US

PROFILE

Education: Associate of Applied Science in Electrical Engineering, S.U.N.Y. Farmingdale, 1990

Ms. Dunleavy is a technical writer and editor with nearly 20 years experience in a diverse range of industries including marine environmental consulting, medical instrumentation, clinical research, technology transfer, and product safety and compliance. Since joining CSA Ocean Sciences Inc. (CSA) in 2006, she has been responsible for proofreading, copy editing, organizing, and standardizing scientific reports and proposals, primarily for major oil and gas clients. Ms. Dunleavy has edited reports pertaining to multidisciplinary baseline studies, monitoring surveys, and environmental impact assessments. Monitoring program reports Ms. Dunleavy has edited include beach nourishment projects, offshore oil and gas drilling, ship grounding sites, and coral relocation studies.

Prior to joining CSA, Ms. Dunleavy was a Technical Writer for a medical instrumentation manufacturer where she was responsible for creating and maintaining complex service manuals, production procedures, and kit installation brochures. As a Branch Report Writer for a major clinical research organization she assisted in compiling, analyzing, and summarizing data for safety and efficacy, and microbiology trials for consumer products. She closely collaborated with principal investigators, biostatisticians, multi-site study managers, and the Institutional Review Board to ensure accurate and comprehensive reports that reflected high ethical standards.

Ms. Dunleavy also has over 10 years experience working as a Technical Correspondent for a major product safety and compliance testing organization. She was responsible for evaluating fire and casualty hazards of electrical products for compliance with UL standard 1492 – Audio Video Products and Accessories. She spent one year as a freelance Technical Research Writer conducting patent research on novel semiconductor memory technology that could be cross-licensed for technology transfer.

EXPERIENCE

2006 to Present: CSA Ocean Sciences Inc. – Technical Editor

- Technical editing and proofreading of scientific reports for spelling, grammar, consistent logic and style, and parallel structure throughout the document.
- Preparation of tables, figures, and illustrations for presentation in reports.
- Cross-check data/information in text with that in tables/figures for accuracy and quality control.

2000 to 2002: Awareness Technology

-Wrote and maintained service manuals, production procedures, and kit installation brochures for chemical analyzers used in the health care/clinical diagnosis industry.

-Implemented multi-platform legacy document conversions to facilitate compliance with

U.S. Food and Drug Administration (FDA) regulations.

-Designed templates to standardize efficient document creation, editing, and minimum maintenance.

1998 to 2000: Hill Top Research

-Wrote clinical research reports and abstracts for industry conferences.



-Managed multi-site clinical study reports – gathered, interpreted, and categorized biostatistical data to assist principal investigator in drawing conclusions.

-Reconstructed and documented time-line through entire duration of study: Institutional Review Board approvals, protocol compliance, stratification of product-related adverse events, and demographic attrition.

-Collaborated with study personnel to ensure accurate, honest, and objective presentation of clinical study results and conclusions.

1994 to 1995: Technical Insights

-Authored weekly Semiconductor Memory Technology Alert column for senior research and development executives worldwide.

-Researched latest patents in submicron technology to uncover emerging, innovative trends that could be exploited in novel ways within current markets

-Reviewed complex scientific journals and consolidated into significant findings for product development managers.

1977 to 1986 and 1991 to 1994: Underwriters Laboratories

-Managed all phases of product safety submittals on audio and video products: budget estimation, power circuit analysis, and test program development.

-Drafted criticism letters detailing noncompliant issues of product construction and/or test performance.

-Wrote descriptive reports for compliance with American National Standards Institute (ANSI). Authored a laboratory procedural guide for Federal Communications Commission (FCC) Part 68 while working in the electromagnetic compatibility (EMC) laboratory.

1989 to 1991: Gernsback Publications

-Edited/rewrote feature articles for Radio Electronics magazine. Directed graphic artists for accurate design and presentation of electronic schematics and illustrations. Condensed and simplified complex subject matter for audience with varied technical experience.

REPRESENTATIVE CORPORATE PUBLICATIONS TECHNICALLY EDITED

Indian River County Beach Restoration Project Sector 7: Immediate Post-Construction

Monitoring Report (Applied Technology and Management, 2008).

Indian River County Beach Restoration Project Sector 3: Beach Restoration Project Report (Coastal Technology Corporation, 2008).

Environmental Impact Study for a Proposed Offshore Seismic Survey in Rovuma Offshore Area 1 (Anadarko Moçambique Área 1, Lda).

Environmental Impact Analysis - Initial Exploration Plan, DeSoto Canyon Area Block 838 (Murphy Exploration & Production Company).

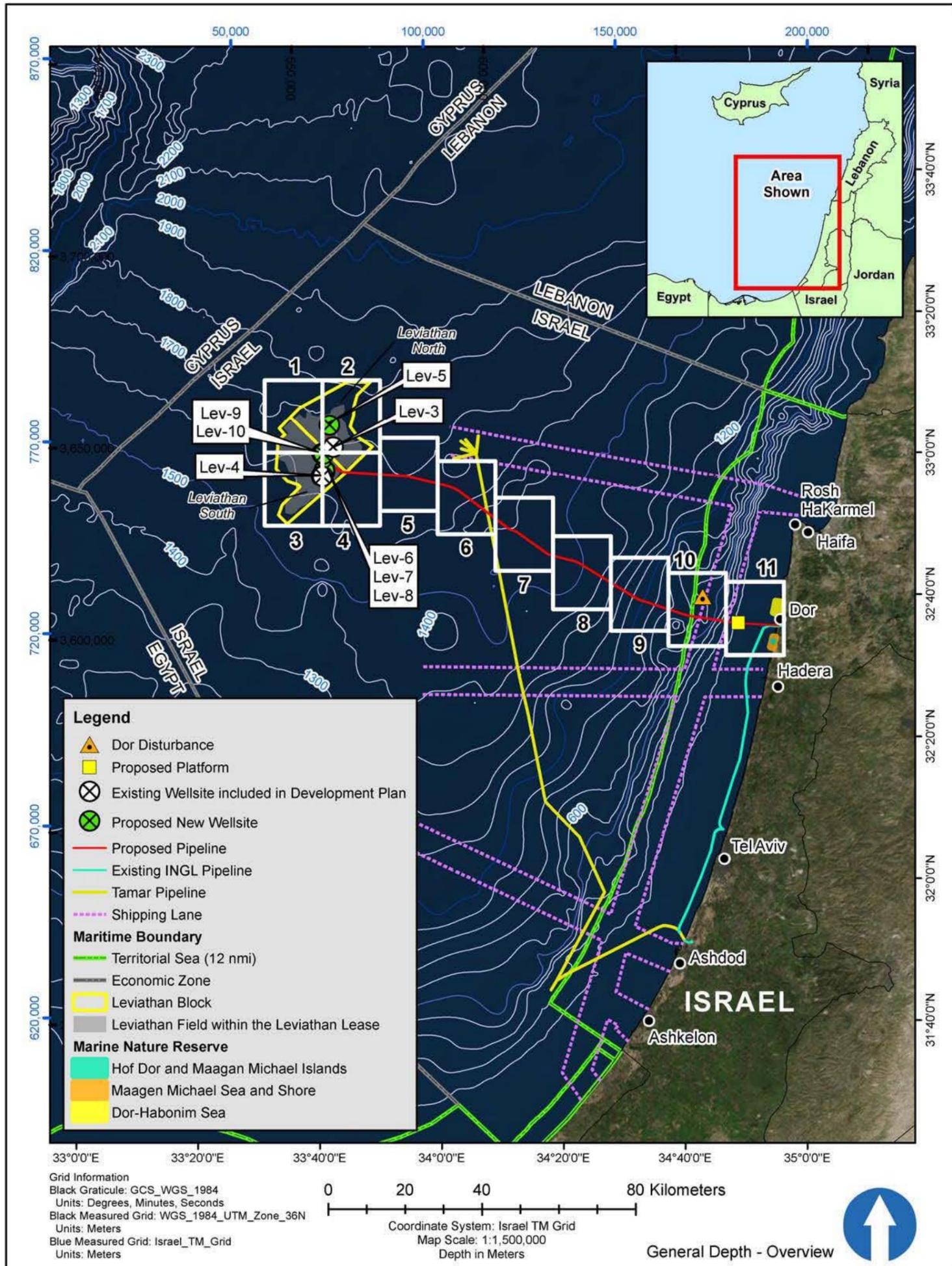
Qatargas II and Qatargas 3&4 Coral Relocation Monitoring Survey (Qatar Liquefied Gas Company Limited)

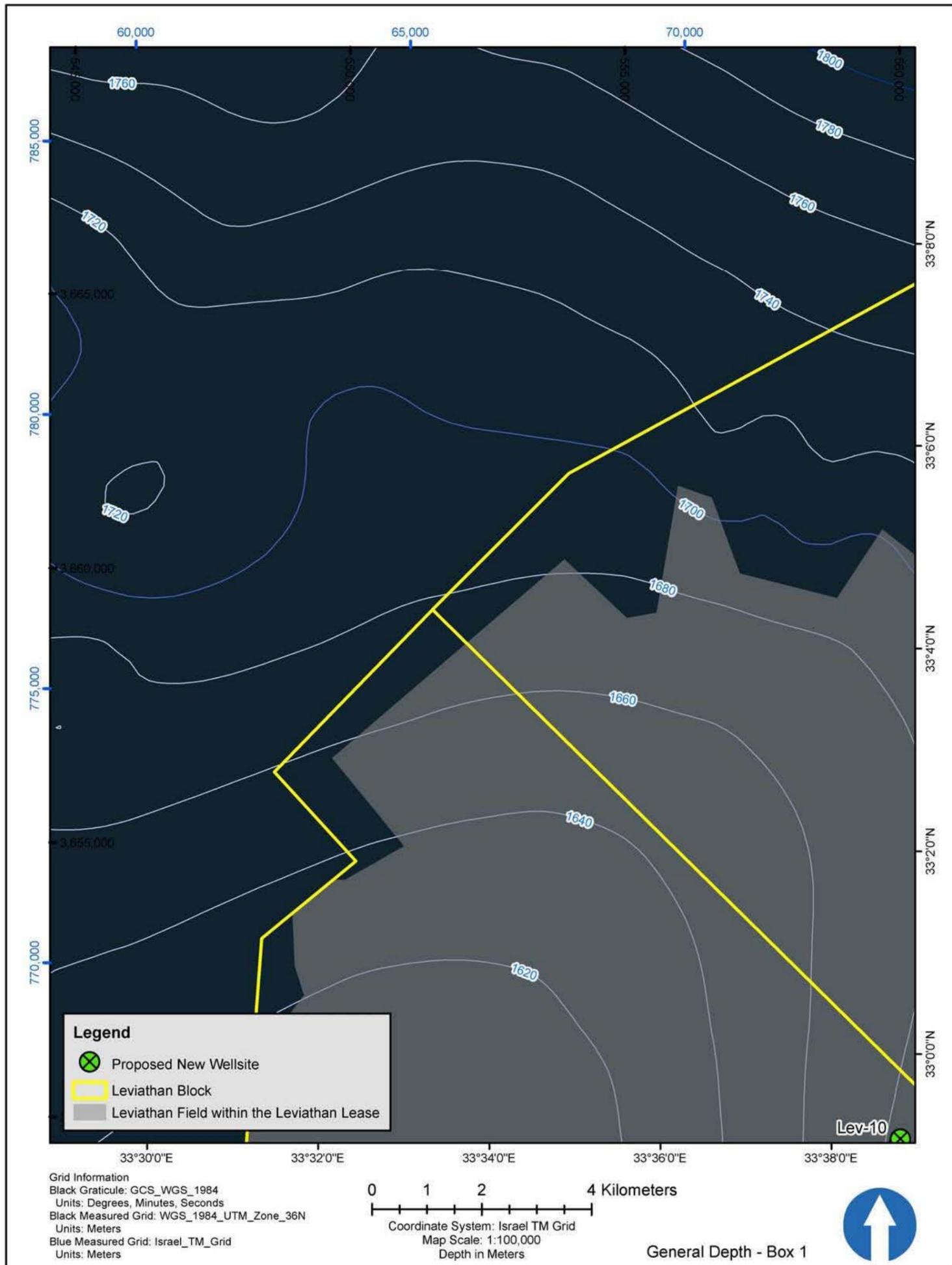


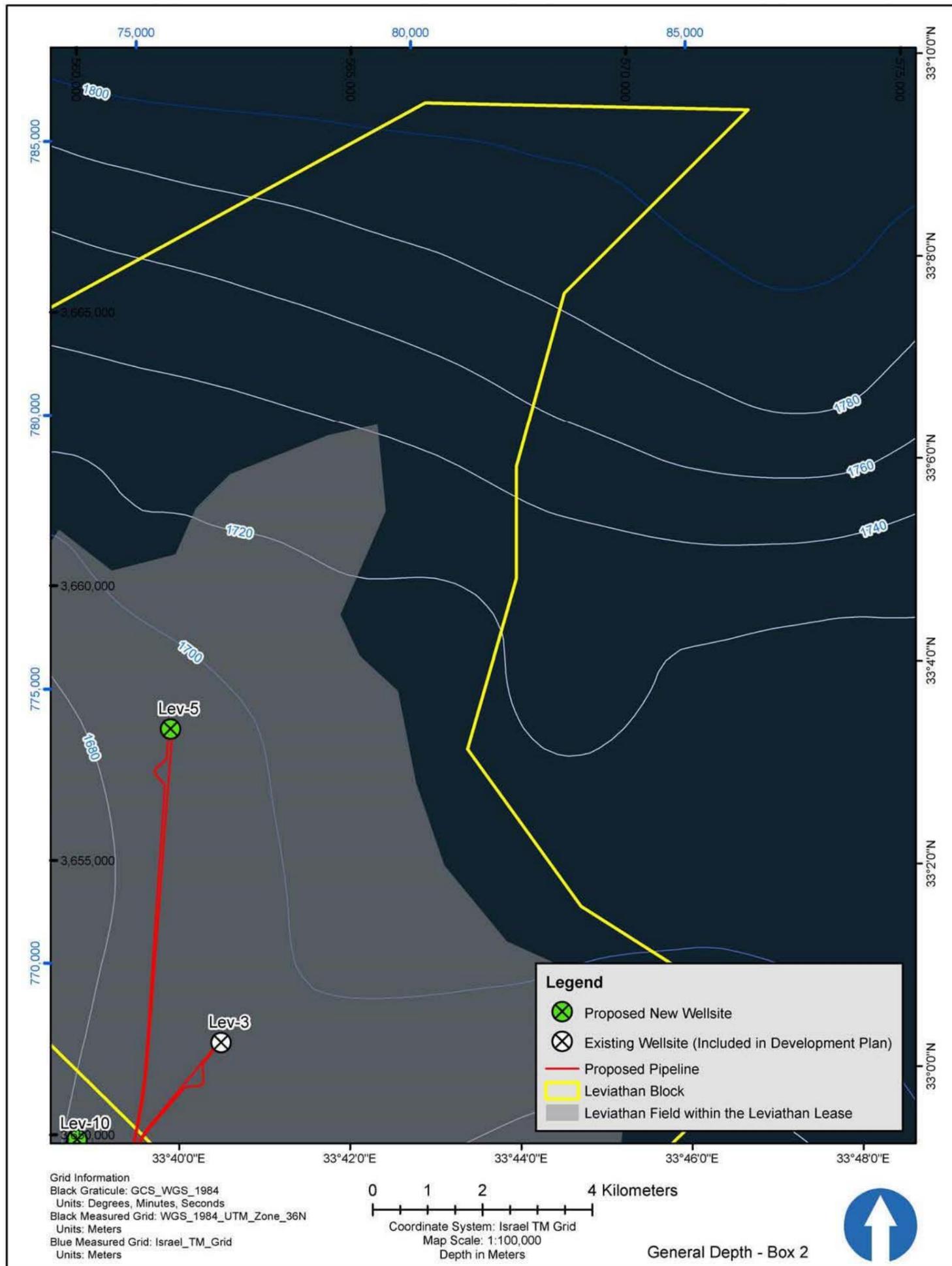
APPENDIX A.3

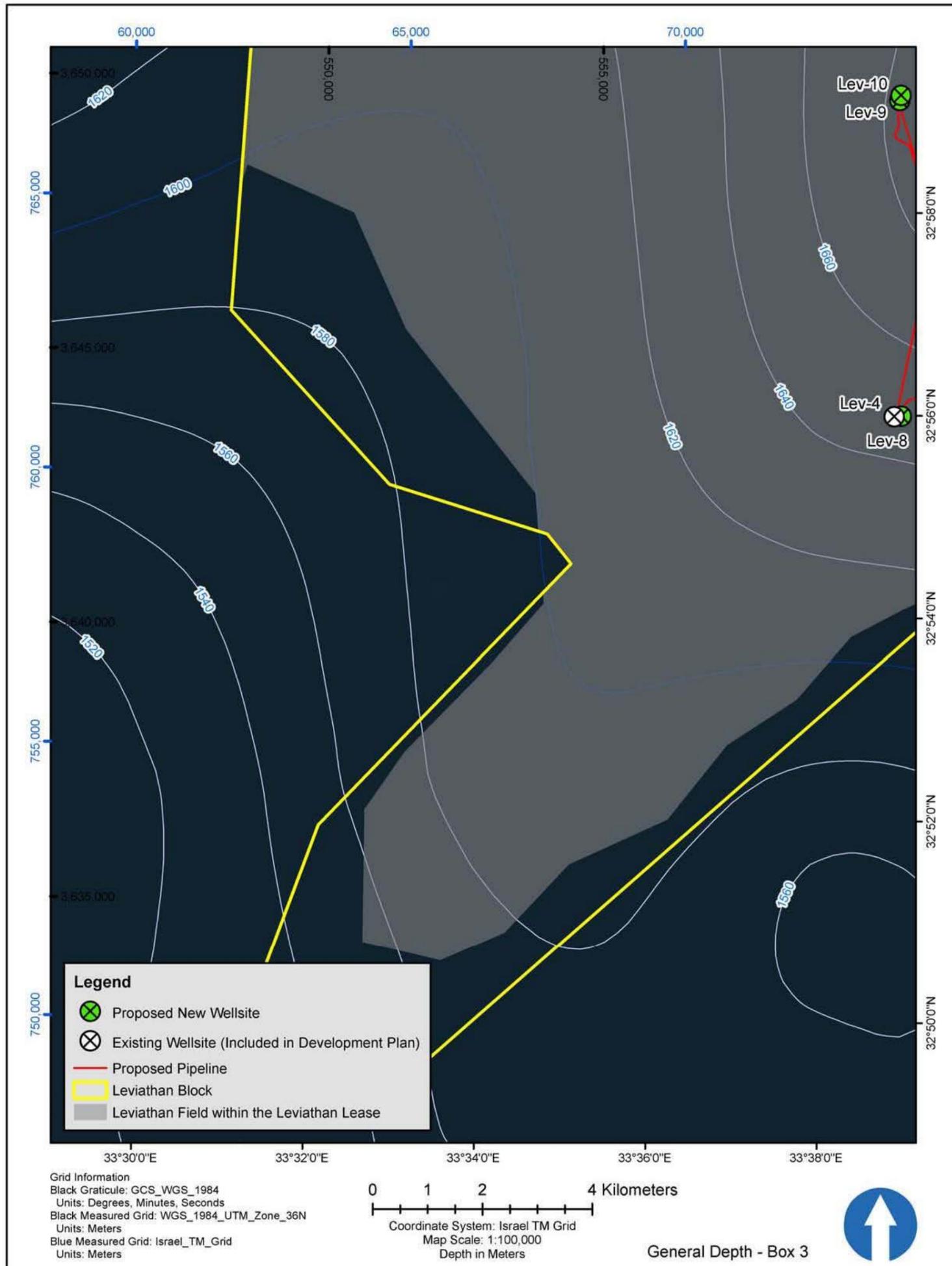
Environmental Baseline Supporting Documentation and Maps

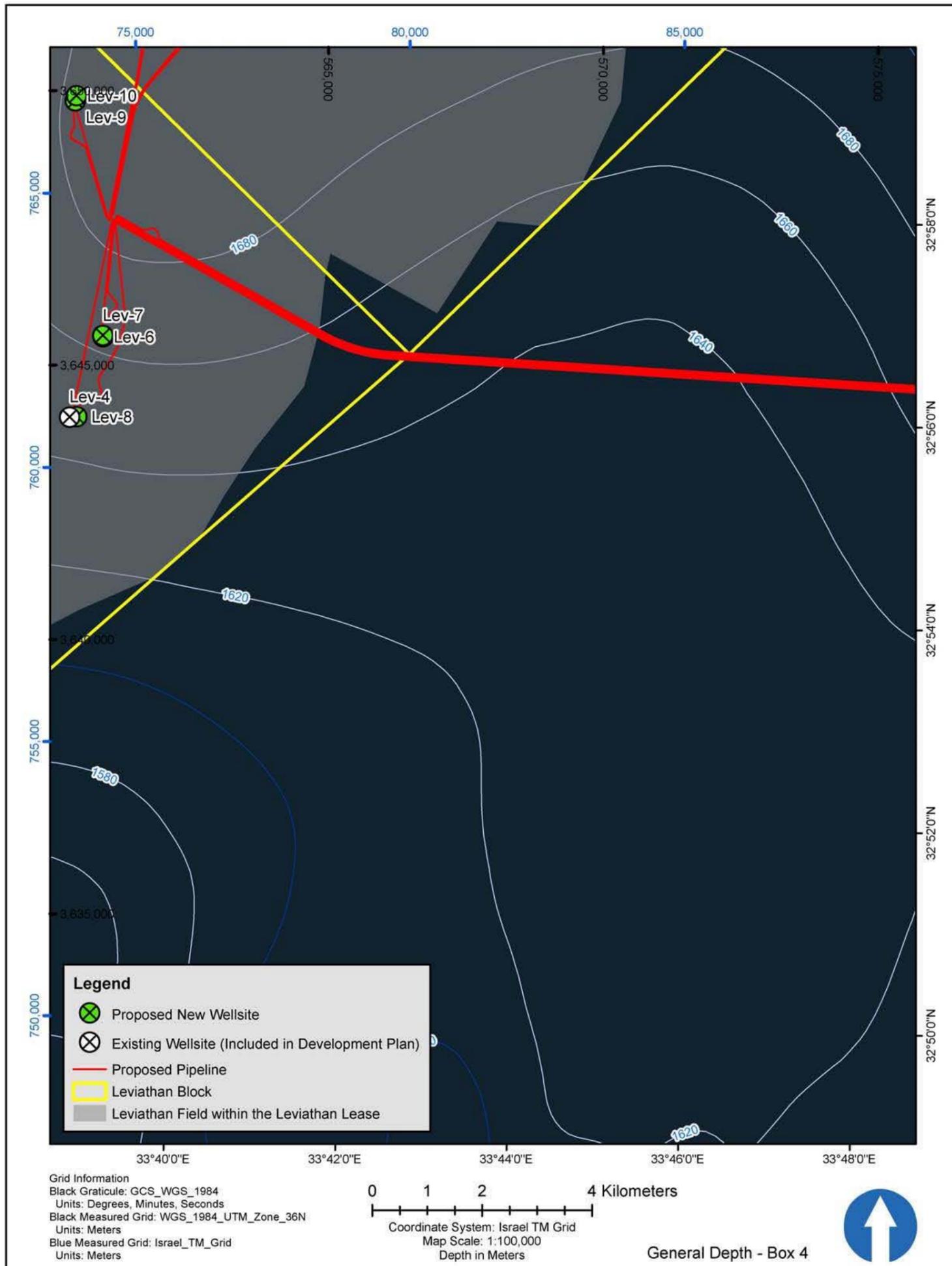
General Depth Maps

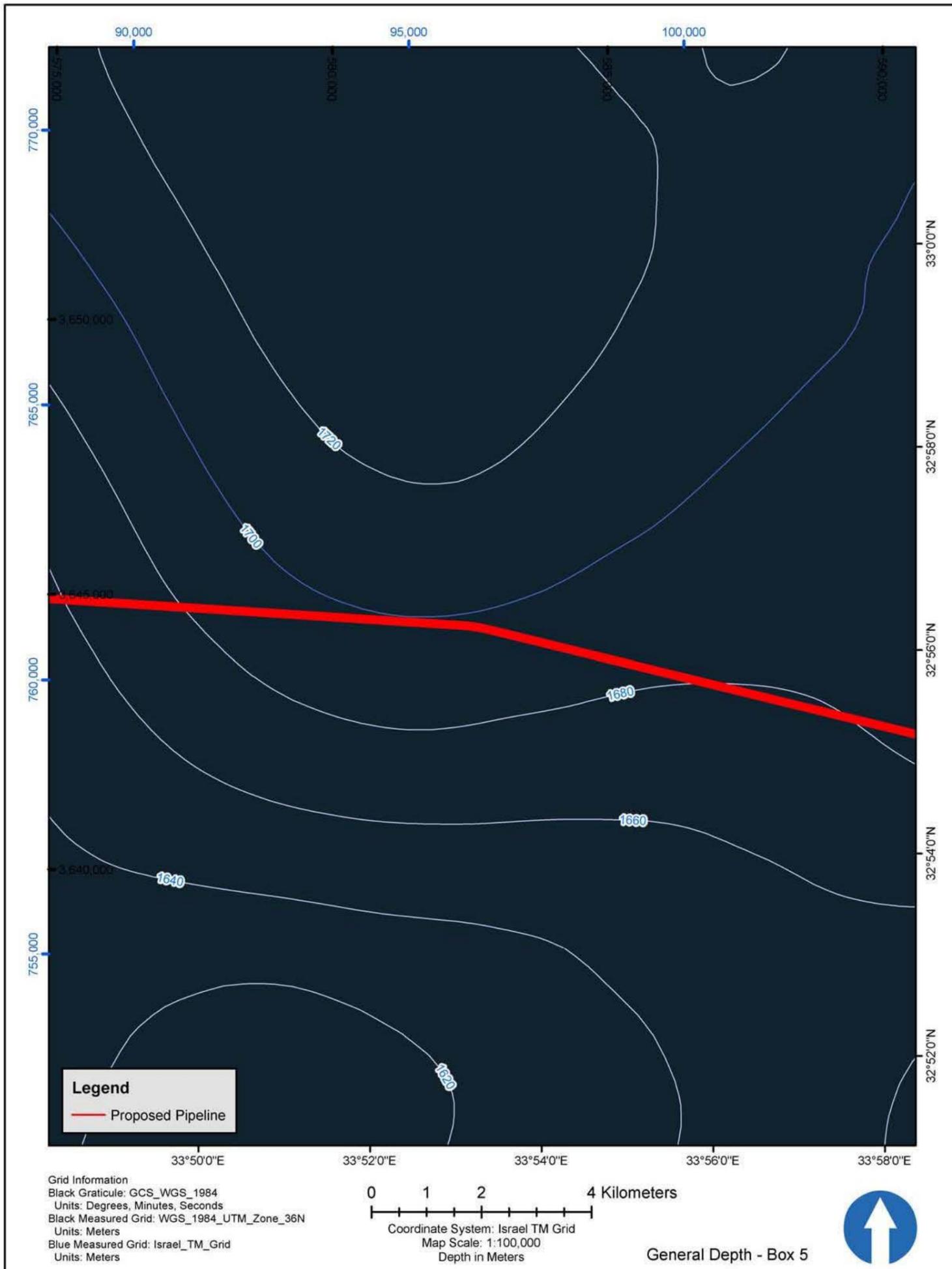


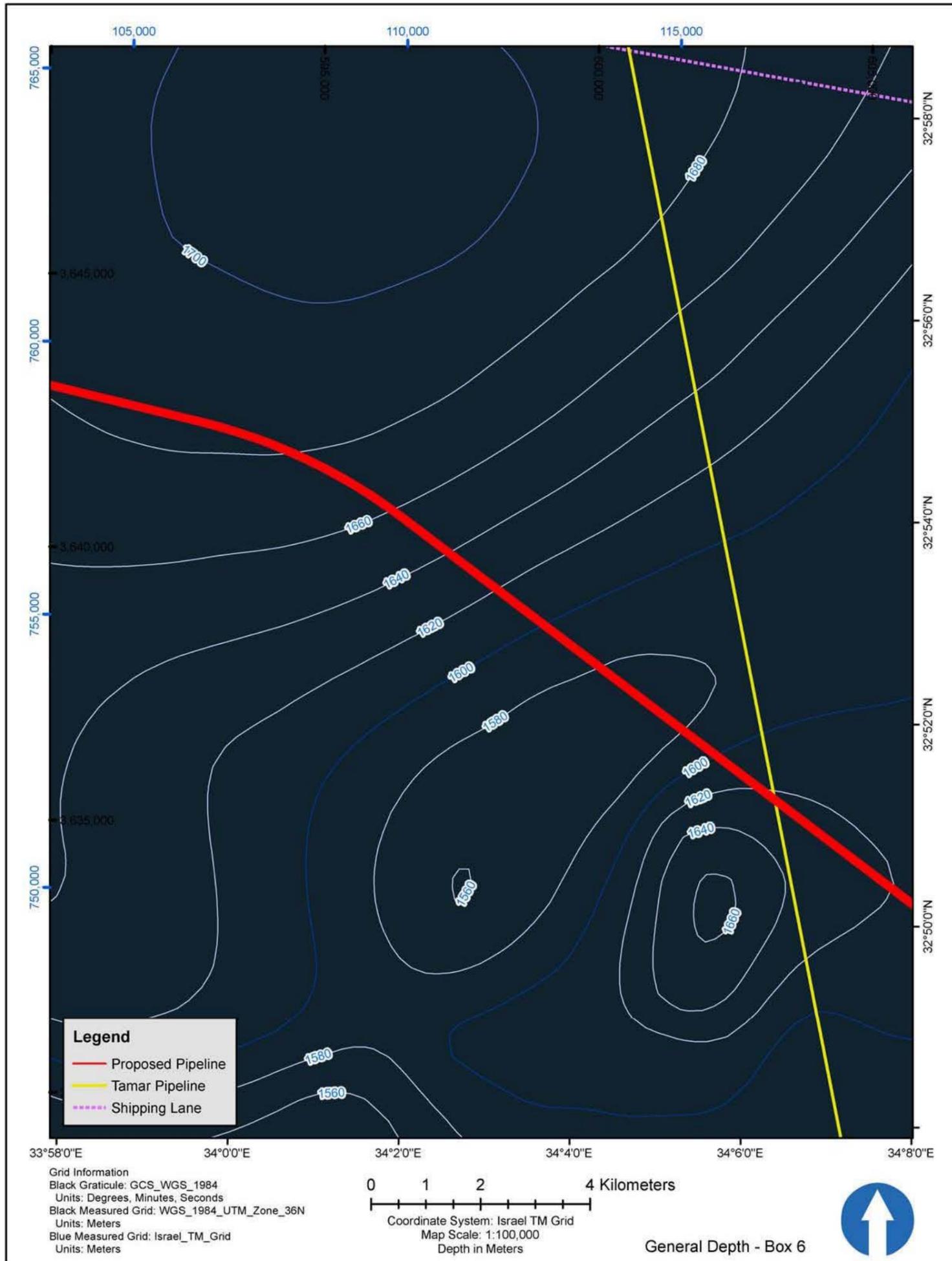


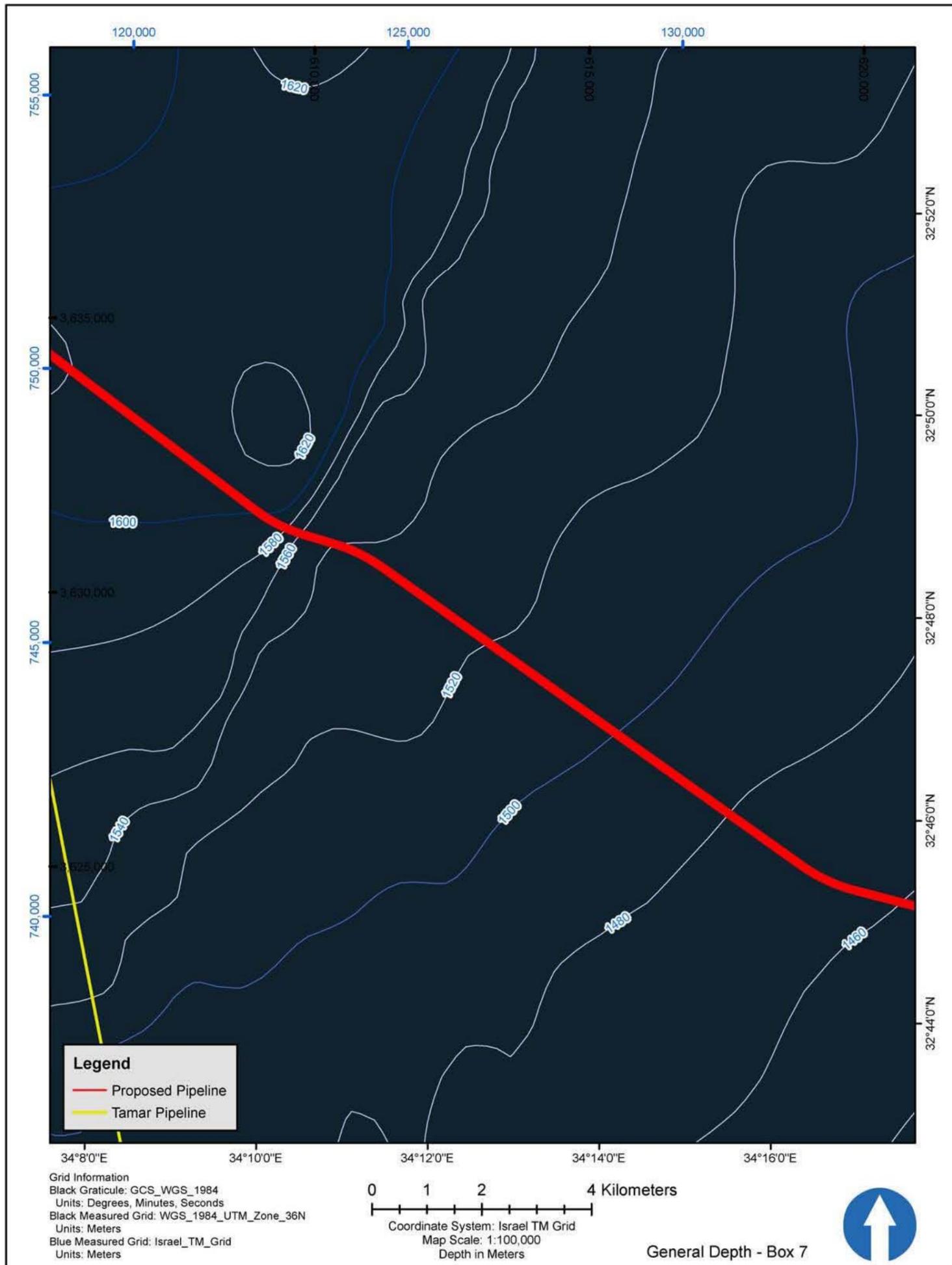


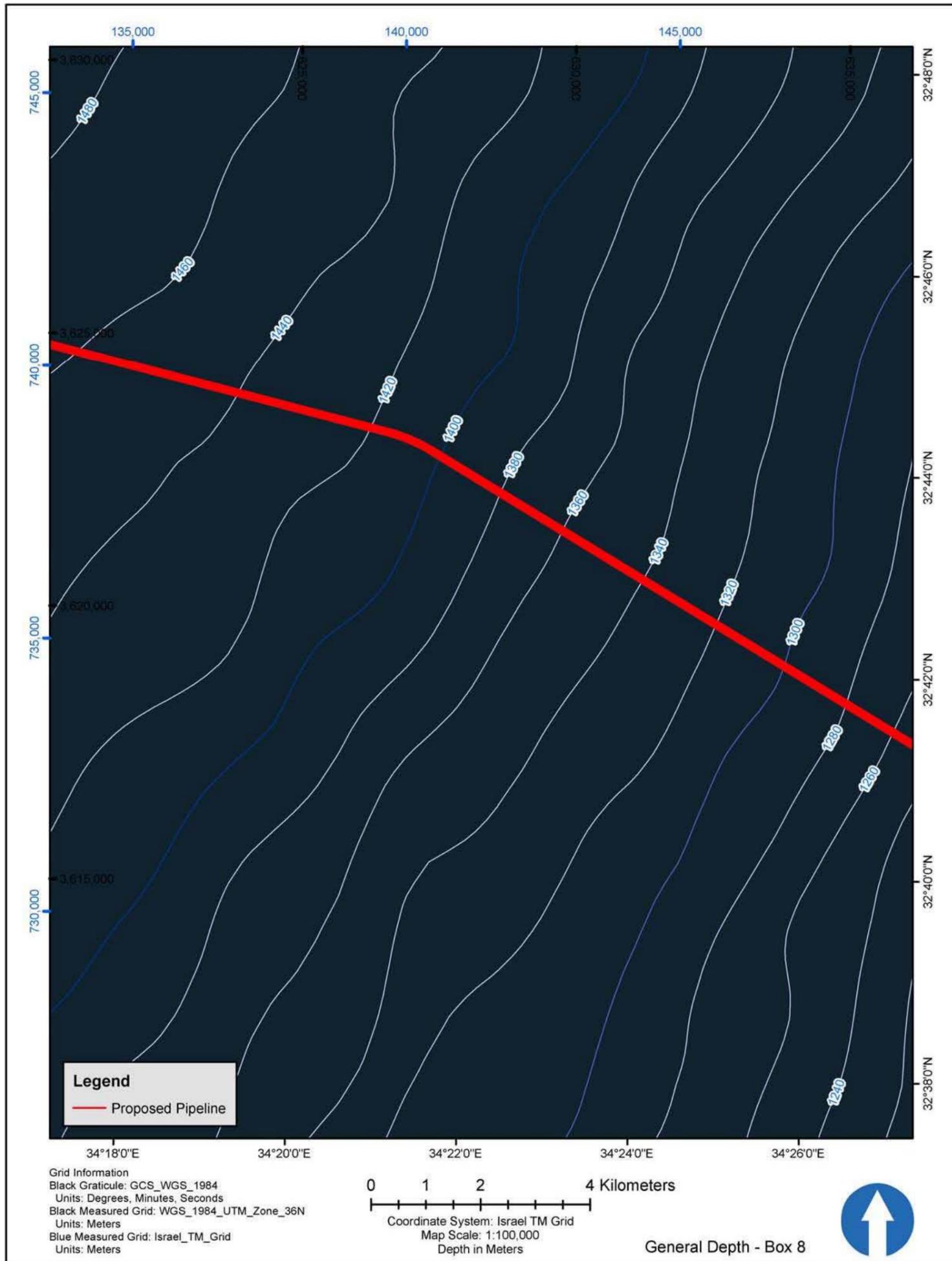


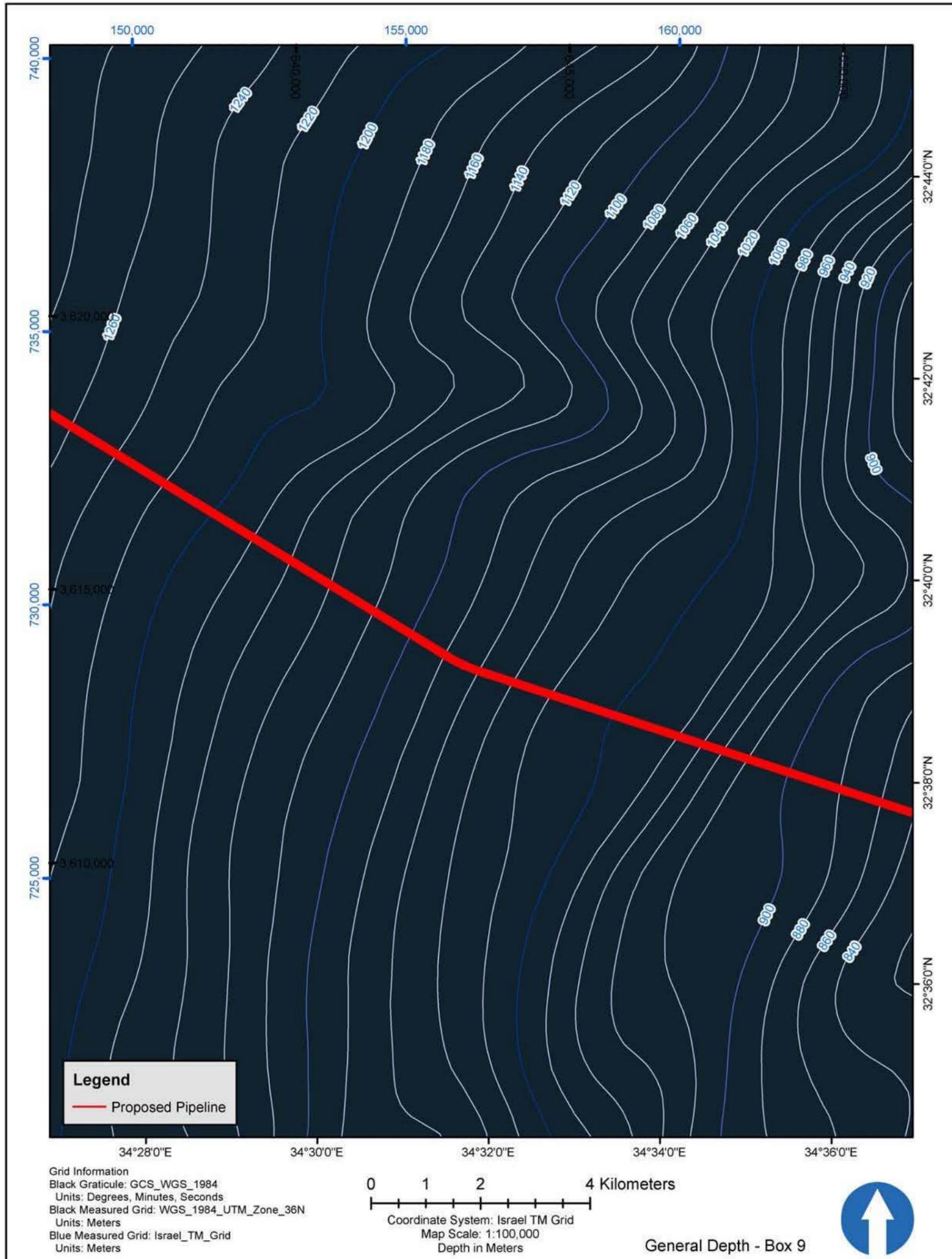


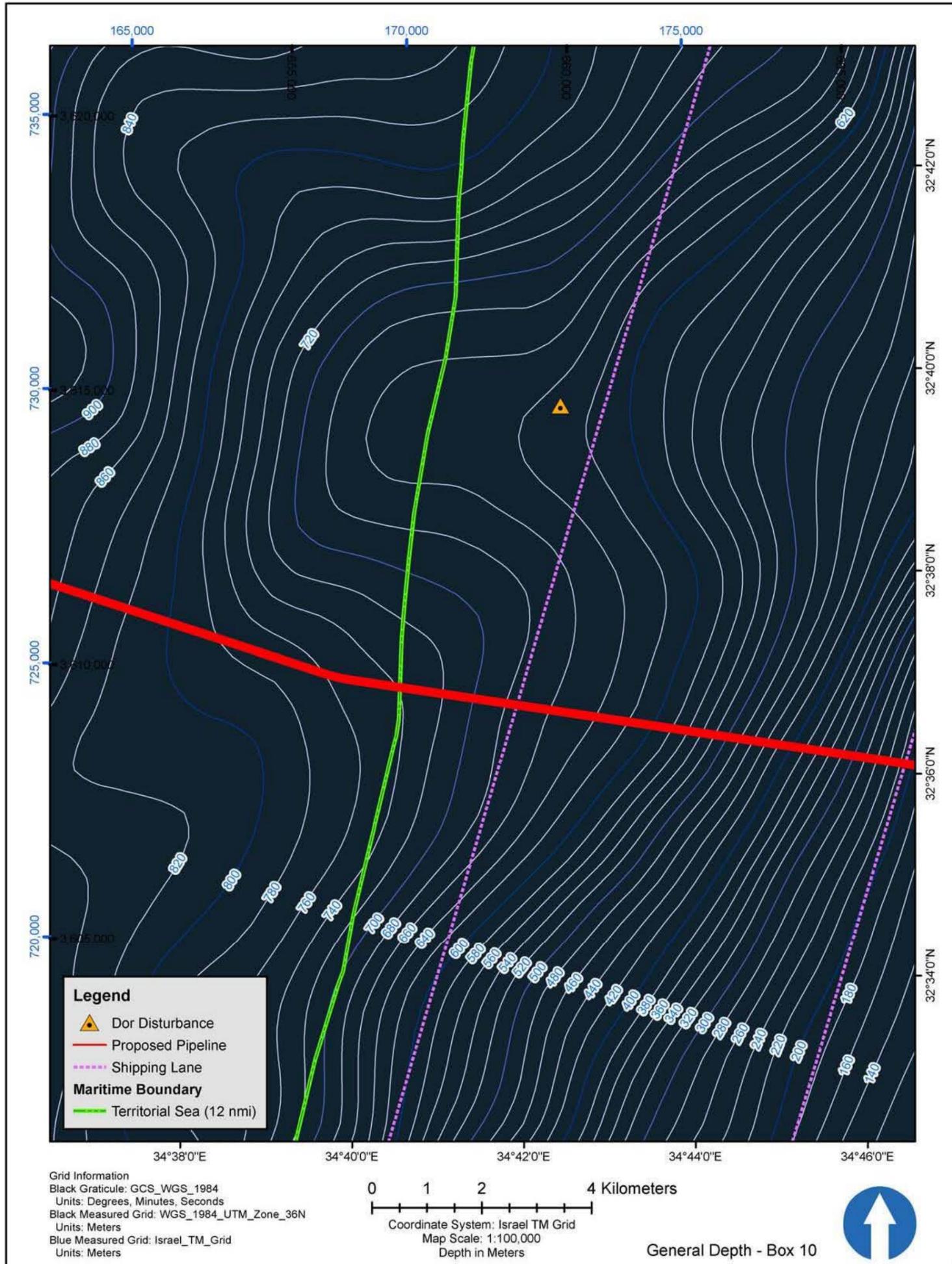


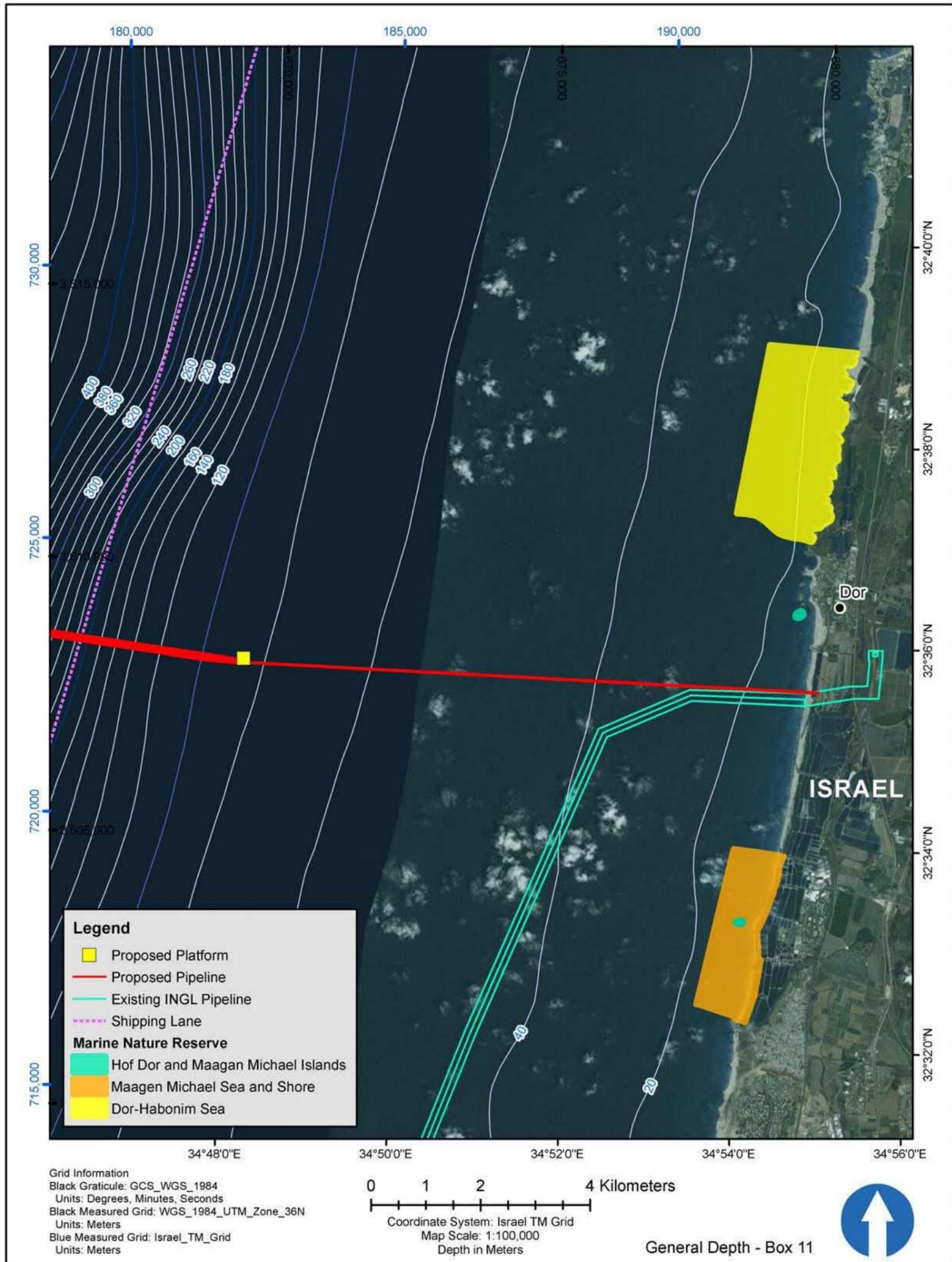










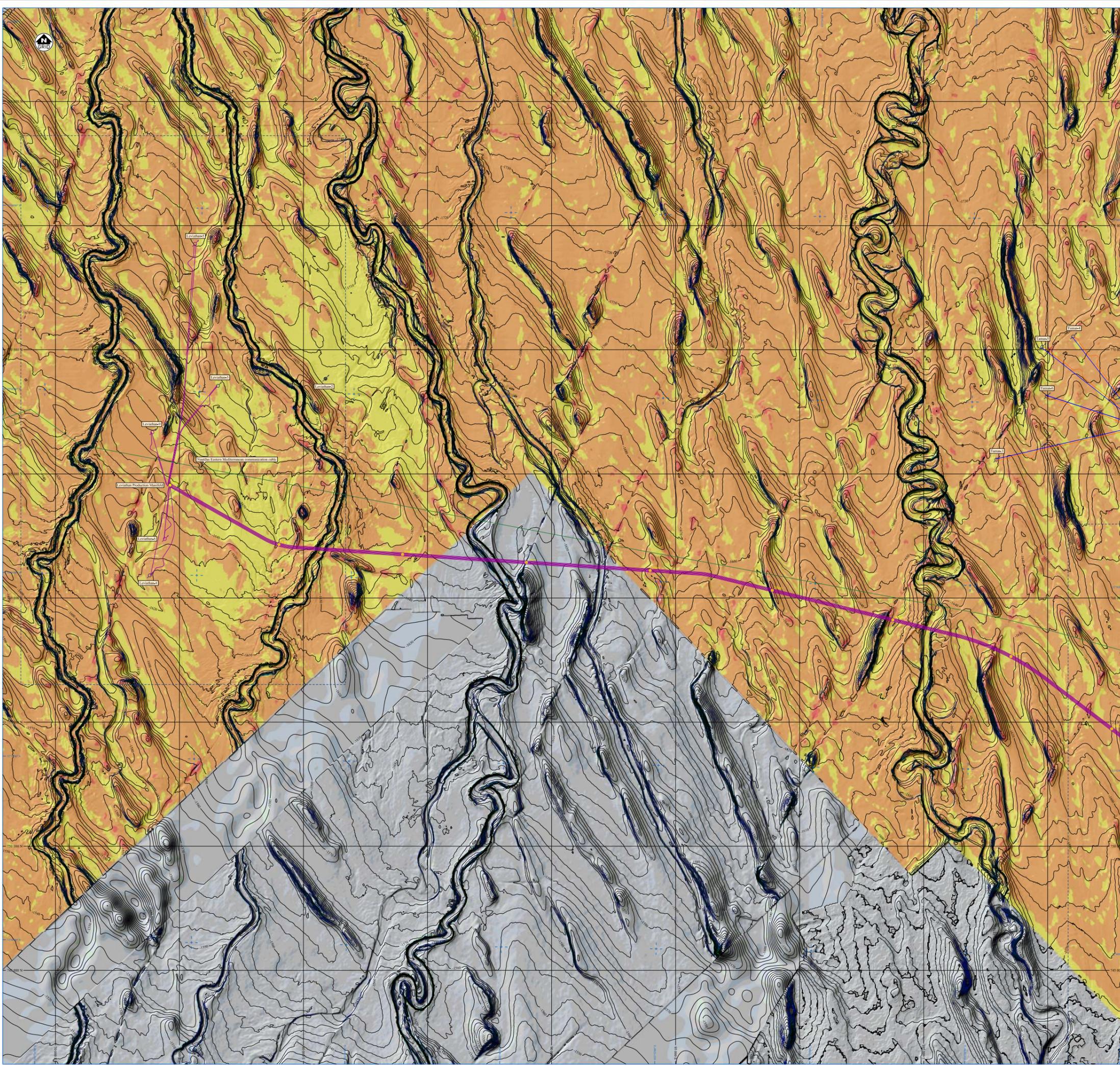




APPENDIX A.4

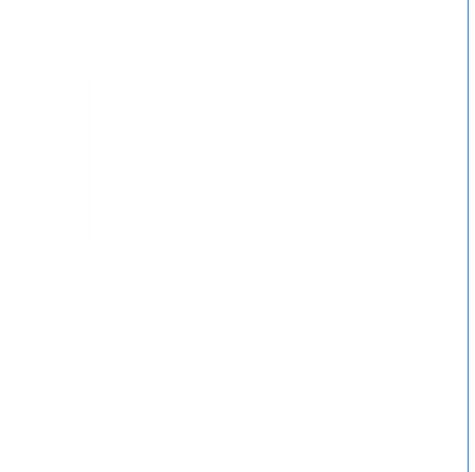
Environmental Baseline Supporting Documentation and Maps

Regional Depth Maps



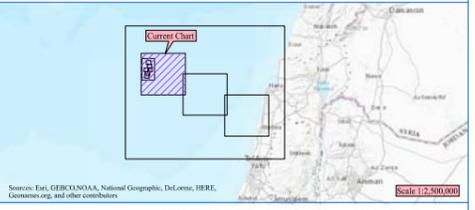
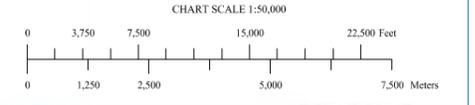
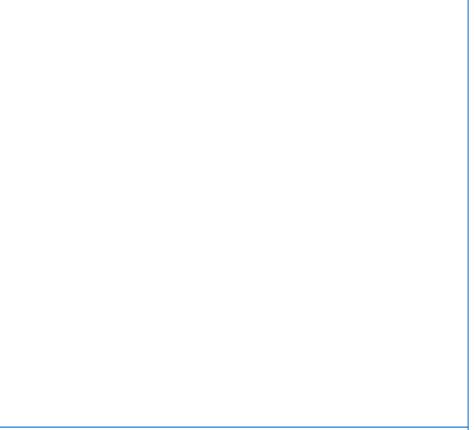
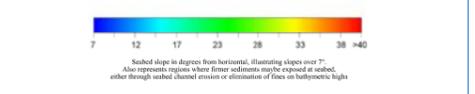
LEGEND

- Leviathan Production Manifold (1:42,000 - 1:64,000)
- Existing well
- Proposed well
- KP points
- Tumor existing flowlines
- Tumor existing umbilicals
- Proposed Leviathan Field to Leviathan Production Platform flowlines, umbilicals and pipelines
- Subsea communication cable
- Matchlines 1:50,000
- Depth below sea surface to seabed, contoured at 5m intervals
- Under consolidated (soft) mostly clays with some silts (generally bathymetric lows)
Normally consolidated clays and silts
Over consolidated (firm) mostly silts with some clays (generally bathymetric highs)



NOTES

Data sourced from a combination of existing 3D seismic, AUV multibeam and surface multibeam echo sounder illuminated from northwest at 45° above horizontal



GEODEIC INFORMATION

Israel TM Grid
WKID: 2679 Authority: EPSG
EPSG Code: 6141

Projection: Transverse Mercator
False_Easting: 219529.384
False_Northing: 626917.39
Central_Meridian: 35.2845169444444
Scale_Factor: 1.0000067
Latitude_Of_Origin: 31.7349936111111
Linear Unit: Meter (1.0)

Geographic Coordinate System: GCS_Israel
Angular Unit: Degree (0.0174532925199433)
Prime Meridian: Greenwich (0.0)
Datum: D_Israel
Spheroid: GRS_1980
SemiMajor Axis: 6378137.0
SemiMinor Axis: 6356752.314140356
Inverse Flattening: 296.257222101



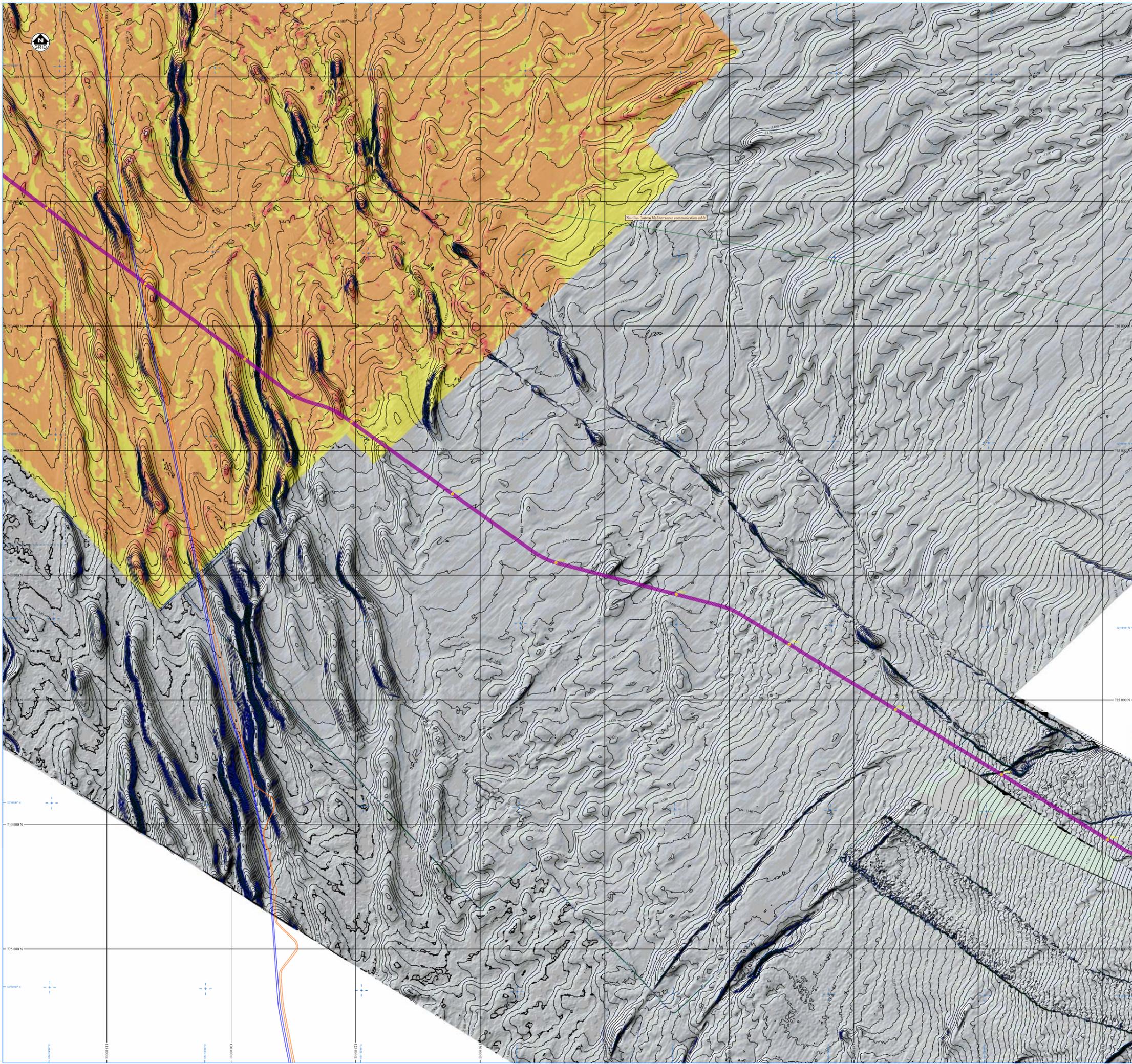
**GEOLOGICAL CONDITIONS
OFFSHORE ISRAEL
LEVIATHAN AREA
LEVIATHAN FIELD TO LEVIATHAN PRODUCTION PLATFORM
GEOLOGICAL SETTING**

SET 1 - CHART 1

Prepared by: Gardline Services, Inc. 1300 Bridge Road, Houston, Texas, 77055 Telephone: 713.461.4620

REV	DATE	REMARKS	DRAWN	CHECKED
0	May 11, 2016	DRAFT	JE	KB
1	May 16, 2016	2 nd DRAFT	JE	KB
2	July 11, 2016	FINAL	JE	KB/PS

SURVEY DATE: N/A REPORT REF: 1073 REF NO: 1073.01



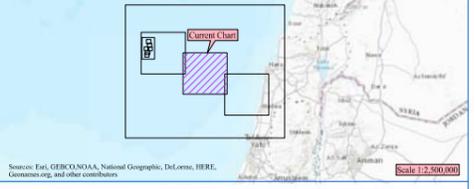
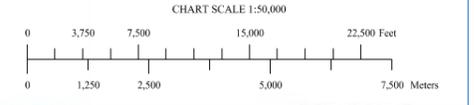
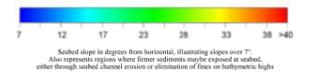
LEGEND

- Existing well
- KP points
- Tenser existing flowlines
- Tenser existing umbilicals
- Proposed Leviathan Field to Leviathan Production Platform Rowlines, umbilicals and pipelines
- Subsea communications cable
- Matchlines 1:50,000
- Depth below sea surface to seabed, contoured at 5m intervals
- Under consolidated (soft) muddy clays with some silt (generally bathymetric highs)
- Normally consolidated clays and silts
- Over consolidated (firm) muddy silts with some clays (primarily bathymetric highs)

NOTES

Data sourced from a combination of existing 3D seismic, AUV multibeam and surface multibeam echo sounder. Illuminated from southwest at 45° above horizontal.

Seabed sediment characterization could not be completed beyond KP 57 due to no seabed backscatter / reflectivity being available.



GEODETTIC INFORMATION

Israel TM Grid
 WKID 2079 Authority: EPSG
 EPSG Code 6141

Projection: Transverse Mercator
 False_Easting: 2195297.584
 False_Northing: 626917.39
 Central_Meridian: 35.28451694444445
 Scale_Factor: 1.0000067
 Latitude_Of_Origin: 31.73499361111111
 Linear Unit: Meter (1.0)

Geographic Coordinate System: GCS_Israel
 Angular Unit: Degree (0.0174532925199433)
 Prime Meridian: Greenwich (0.0)
 Datum: D_Israel
 Spheroid: GRS_1980
 Semimajor Axis: 6378137.0
 Semiminor Axis: 6356752.314140356
 Inverse Flattening: 296.257222101

Gardline **noble energy**

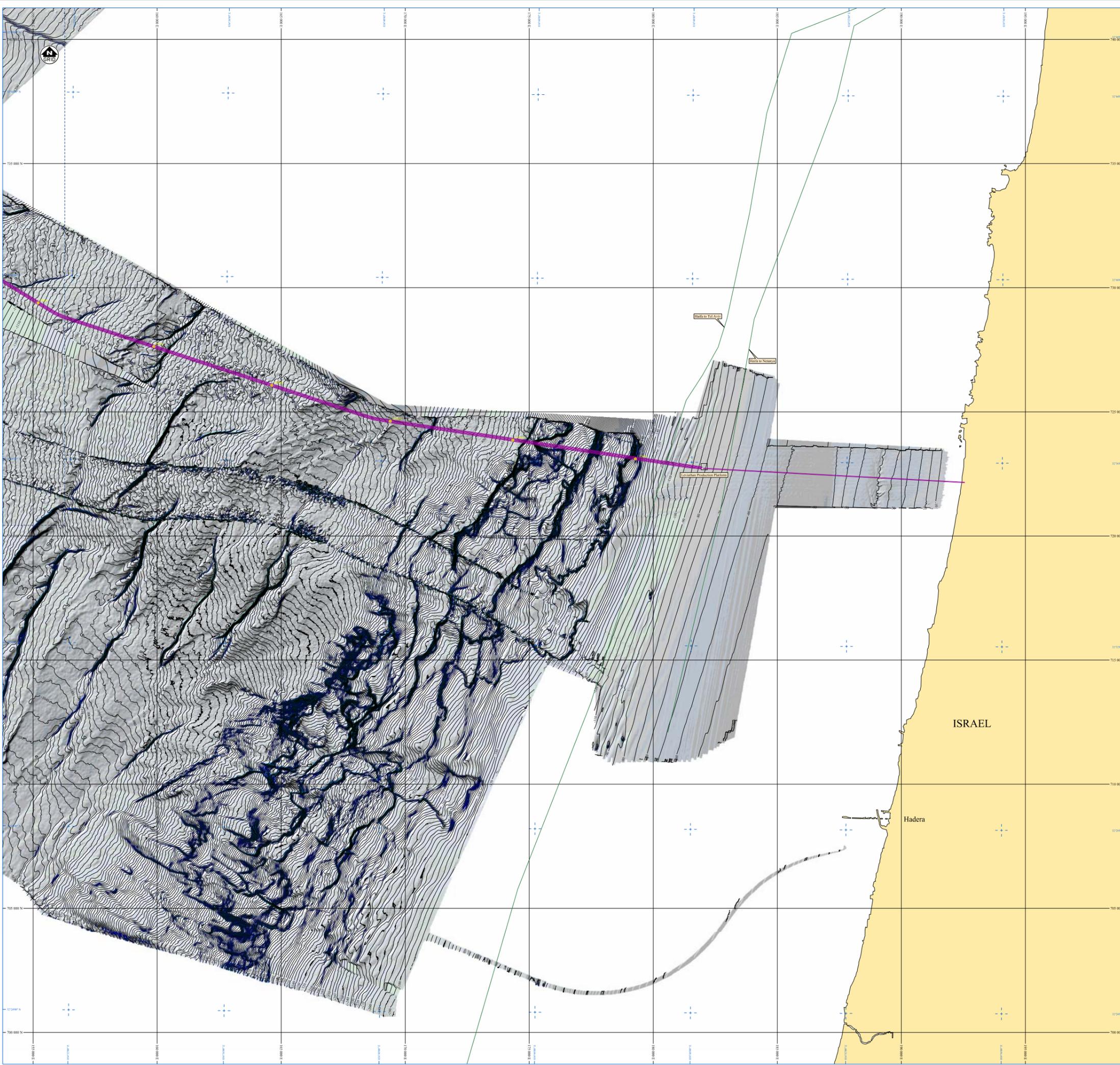
**GEOLOGICAL CONDITIONS
 OFFSHORE ISRAEL
 LEVIATHAN AREA
 LEVIATHAN FIELD TO LEVIATHAN PRODUCTION PLATFORM
 GEOLOGICAL SETTING**

SET 1 - CHART 2

Prepared by Gardline Services, Inc. 1300 Bridge Road, Houston, Texas, 77055 Telephone: 713.461.4630

REV	DATE	REMARKS	DRAWN	CHECKED
0	May 11, 2016	DRAFT	JE	KB
1	May 16, 2016	2 nd DRAFT	JE	KB
2	July 11, 2016	FINAL	JE	KB/JPB

SURVEY DATE: N/A REPORT REF: 10773 CHECKED: ARH



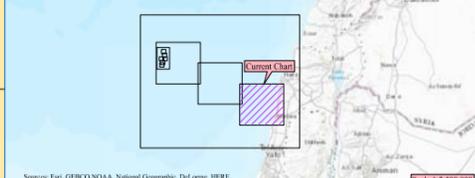
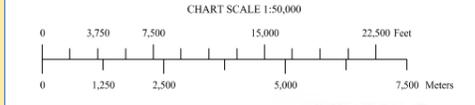
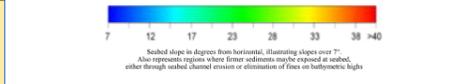
LEGEND

- Leviathan Production Platform (182,000 x 725,700 N)
- Proposed Leviathan Field to Leviathan Production Platform flowlines, umbilicals and pipelines
- Subsea communications cable
- Machlines 1:50,000
- Shoreline
- Depth below sea surface to seabed, contoured at 1m intervals
- Under consolidated (soft) mostly clays with some chis (generally bathymetric highs)
- Normally consolidated clays and silts
- Over consolidated (firm) mostly silts with some clays (generally bathymetric highs)

NOTES

Data sourced from a combination of existing 3D seismic, AUV multibeam and surface multibeam echo sounder. Illuminated from southeast at 45° above horizontal.

Seabed sediment characterization could not be completed beyond KP 57 due to no seabed backscatter - reflectivity being available.



GEODEIC INFORMATION

Israel TM Grid
 WKID: 2679 Authority: EPSG
 EPSG Code: 6141

Projection: Transverse Mercator
 False_Easting: 219527.584
 False_Northing: 626917.39
 Central_Meridian: 35.28451694444445
 Scale_Factor: 1.0000067
 Latitude_Of_Origin: 31.73499361111111
 Linear Unit: Meter (1.0)

Geographic Coordinate System: GCS_Israel
 Angular Unit: Degree (0.0174532925199433)
 Prime Meridian: Greenwich (0.0)
 Datum: D_Israel
 Spheroid: GRS_1980
 Semimajor Axis: 6378137.0
 Semiminor Axis: 6356752.314140356
 Inverse Flattening: 298.257222101



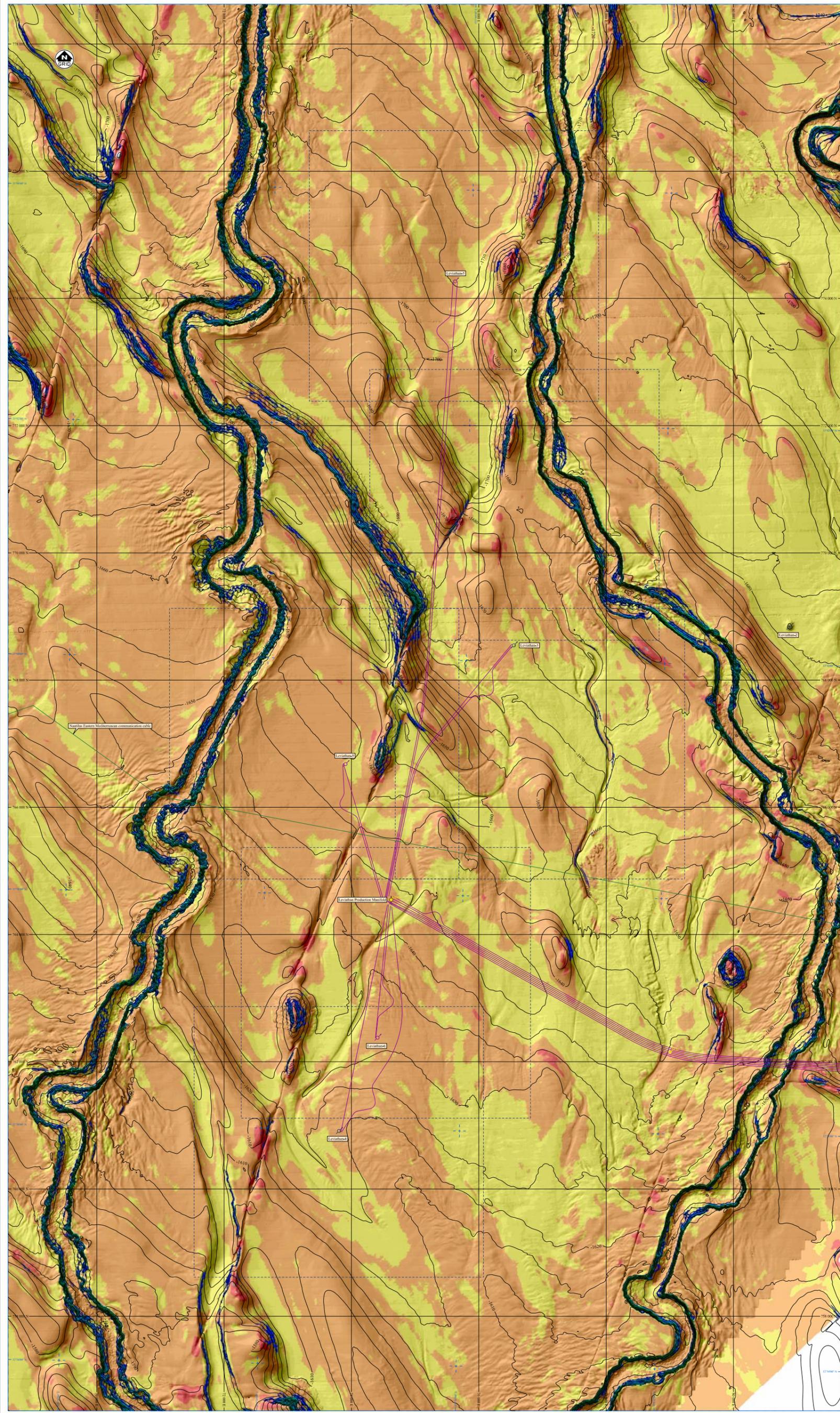
**GEOLOGICAL CONDITIONS
 OFFSHORE ISRAEL
 LEVIATHAN AREA
 LEVIATHAN FIELD TO LEVIATHAN PRODUCTION PLATFORM
 GEOLOGICAL SETTING**

SET 1 - CHART 3

Prepared by Gardline Services, Inc. 1390 Single Road, Houston, Texas, 77055 Telephone: 713.461.4633

REV	DATE	REMARKS	DRAWN	CHECKED	APPROVED
0	May 11, 2016	DRAFT	JE	KB	ARR
1	May 16, 2016	2 nd DRAFT	JE	KB	ARR
2	July 11, 2016	FINAL	JE	KB/JPB	ARR

SURVEY DATE: N/A REPORT REF: 10773 CHECKED REF NO: 10773.03

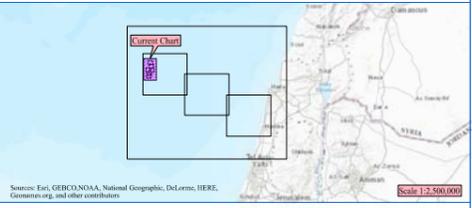
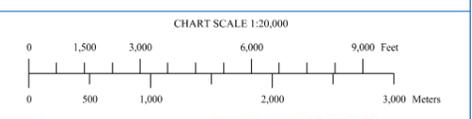
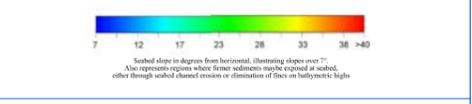


LEGEND

- Leviathan Production Platform (74,622mL, 764,245m N)
- Existing well
- Proposed well
- KP points
- Proposed Leviathan Field to Leviathan Production Platform flowlines, umbilicals and pipelines
- Subsea communication cable
- Chart outline 1:5,000
- Depth below sea surface to seabed, contoured at 5m intervals
- Under consolidated (soft) muddy clays with some silts (primarily bathymetric lows)
- Normally consolidated clays and silts
- Over consolidated (firm) muddy silts with some clays (primarily bathymetric highs)

NOTES

Data created from a combination of existing 3D seismic, AUV multibeam and surface multibeam echo sounder illuminated from northwest at 45° above horizontal



GEODETTIC INFORMATION

Israel_T.M_Grid	Projection: Transverse Mercator	Geographic Coordinate System: GCS_Israel
WKID: 2079	False_Easting: 219529.584	Angular Unit: Degree (0.0174532925199433)
Authority: EPSG	False_Northing: 62097.39	Prime Meridian: Greenwich (0.0)
Code: 6141	Central_Meridian: 35.20451694444445	Datum: D_Israel
	Scale_Factor: 1.0000067	Spheroid: GRS_1980
	Latitude_Of_Origin: 31.73439361111111	SemiMajor Axis: 6378137.0
	Linear Unit: Meter (1.0)	SemiMinor Axis: 6356752.314140356
		Inverse Flattening: 298.257222101



GEOLOGICAL CONDITIONS OFFSHORE ISRAEL LEVIATHAN AREA LEVIATHAN FIELD TO LEVIATHAN PRODUCTION PLATFORM GEOLOGICAL SETTING

SET 1 - CHART 4

Prepared by: Gardline Services, Inc. 1580 High Road, Houston, Texas, 77055 Telephone: 713-461-4639

REV	DATE	REVISION	AUTHOR	DR/AN	CHK/ED
0	May 21, 2016	ISSUE	JH	SR	ABH
1	May 26, 2016	2 nd DRAFT	JH	SR	ABH
2	July 31, 2016	FINAL	JH	KR/JS	ABH

SURVEY DATE: N/A REPORT REF: 10773 REF NO: 10773.04