1. EXECUTIVE SUMMARY

1.1. Project Description

1.1.1. Overview

The Project involves a new build reverse osmosis (RO) seawater desalination plant, with a net potable water production capacity of one hundred and twenty (120) million imperial gallons per day (MIGD) in addition to associated infrastructure and facilities. The Project will be located within a brownfield site within the existing Al Mirfa Power and Water Complex, which is constructed, owned and operated by the Mirfa International Power and Water Company (MIPCO), situated approximately 5km northwest of the town of Mirfa, Abu Dhabi.

The Project location overview is illustrated below in Figure 2-1 below.

The Project is being developed by Emirates Water and Electricity Company (EWEC) to provide a standalone independent water and power plant (IWP) and will be developed on a build, own, operate, transfer ("BOO") basis by the Mirfa 2 RO Water Desalination Company LLC which is established as a limited liability company under the laws of the UAE and Abu Dhabi Emirates. The company consists of M2 RO Local Holding Company (60%) comprising Taqa and M2 RO international Holding Company (40%), namely Engie M2 Holding Company Limited.

The M2 RO IWP Plant will utilise the existing seawater intake structure previously part of the decommissioned plant at the Project site, which is currently in use by MIPCO. The key components of the Project are as follows:

- Modifications at existing intake structure;
- Seawater intake and pump system including seawater screening system;
- Pre-treatment works including mechanical screening, dissolved air flotation (DAF) and dual media filtration (DMF);
- Cartridge filter;
- RO system (1st Pass RO membrane and 2nd Pass RO membrane);
- Energy recovery device;
- Post-treatment system, including pH adjustment and disinfection;
- Chemical dosing system;
- Outfall (for brine discharge);
- Sludge treatment;
- Permeate / flushing tank
- Neutralisation system;
- Cleaning in place (CIP) system;
- Electrical systems;
- Electrical building including uninterruptible power supply (UPS) battery room;
- Instrumentation & Control (I&C) system;
- Metering system;
- Control room and offices
- Warehouse;

- Laboratory; and
- Workshop.

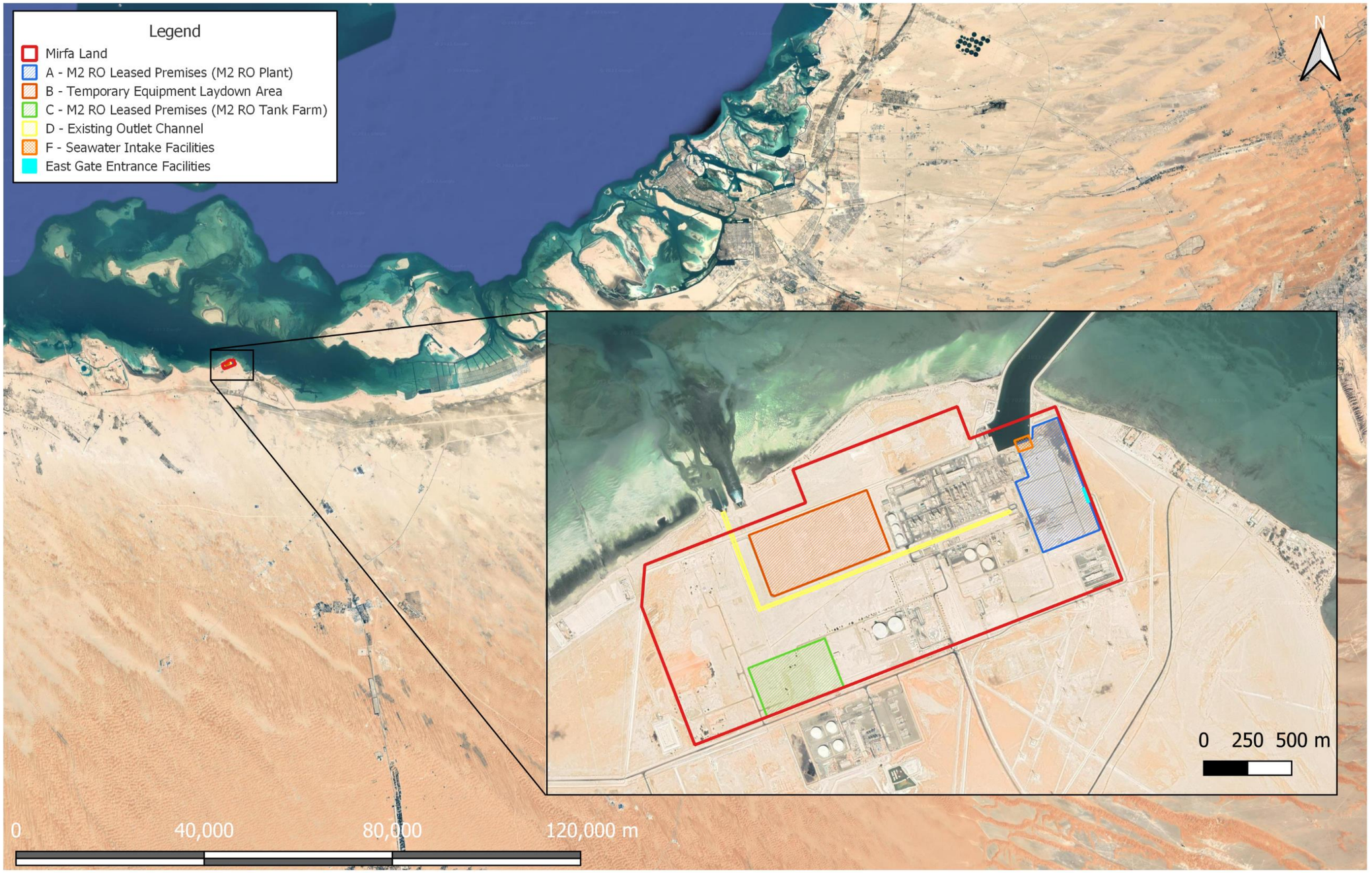
A tank farm area will also be constructed at a separate location within the wider Al Mirfa Power and Water Complex. This tank farm will feature a storage volume of a minimum of one day capacity for the Project. In addition, the following facilities will be included:

- All required plant roads;
- Storm water collection and disposal;
- Wastewater handling and disposal;
- HVAC buildings; and
- Fire detection system for buildings.

The following existing facilities are currently in place at Al Mirfa Power and Water Complex and are under ownership of ADDC, ADNOC, ADSSC, CICPA, ADNOC Industrial Gases, Etisalat and Transco. These elements are excluded from the scope of the Project but will be required to be interconnected at the various interfaces:

- 33 kV ADDC Grid Substation, related auxiliary equipment and 33 kV power cables;
- ADNOC Facilities and related auxiliary equipment;
- ADSSC Sewerage Facilities and related auxiliary equipment;
- CICPA Facilities and related buildings, areas and equipment;
- ADNOC Industrial Gases facilities including seawater screening and pumping station and related pipelines and cables;
- Etisalat/telecom provider tower and related auxiliary equipment;
- Transco 33kV, 220kV and 400kV substation, related auxiliary equipment, cables and existing Transco overhead lines (OHL);
- Mirfa Intermediate Pumping Station, related auxiliary equipment and water transmission pipelines; and
- Transco Town Water Pumping Station, related auxiliary equipment and water transmission pipelines.

An overview of the proposed Project and its location is shown in the below figure.



Project Number: P-1007728
Project Name: Mirfa 2 RO IWP
Data sources: Various
Compiled By: AB

Scale: 1:1082405
Coordinate System: Mercator
Datum: WGS 84
Units: meters
Date: 09/07/23

Anthesis

Figure E-1-1: Project overview

1.1.2. Project Rationale

The UAE is an extremely arid desert country with limited precipitation averaging between 140 – 200 mm of rainfall annually (1). Freshwater resources within the country are limited and therefore there is a heavy reliance upon the 70 desalination plants present within the UAE, which meet most of the potable water demand and 42% of the country's total water production. This heavy reliance on desalinated water, coupled with the continuous population growth experienced within the UAE has driven the need to develop a sustainable desalination solution to achieve long term water security and reduce abstraction from natural groundwater. A number of Government strategies, frameworks and initiatives relating to water security have been implemented in recent years, including the development of The UAE Water Security Strategy 2036, construction of dams, wastewater reuse initiatives and development of desalination plants.

The UAE Water Security Strategy 2036 has been developed in light of the water scarcity pressures within the country and water requirements for not only the UAE, but also global potable water shortages; the UAE supports developing countries via Suqia – UAE Water Aid, which is a non-profit organisation established to provide international cooperation the objective of providing sustainable and secure access to water during both typical and emergency conditions (2). The key aims of the plan are:

- To reduce total demand for water resources by 21% through the implementation of integrated water resource management, increase the water productivity index of the UAE to USD 110 per cubic metre;
- Increase the efficiency of water use across all sectors to minimise the number of people experiencing water scarcity;
- Improve overall water quality; and
- Ensure equitable access to safe drinking water and increasing the national water storage capacity.

The potable water production capacity of the Project is 120 MIGD and therefore is expected to result in both economic and sustainability benefits to Abu Dhabi Emirate in terms of provision of freshwater. The Project is specifically expected to contribute to the water demands of agricultural farms in Liwa and reduce abstractions from aquifers in the region.

Additionally, the Project will enable the decoupling of water desalination from power generation which will reduce the reliance of this sector on natural gas, therefore reducing carbon emissions and providing economic benefits to the water sector. The current configuration of power facilities combined with the thermal desalination requirements, at times (particularly in winter) results in inefficient low load operations to produce adequate quantities of water.

Given the substantial national focus placed upon addressing water scarcity, it is considered that they Project will provide a significant contribution to this goal, through bolstering the country's desalination plant profile and the provision of additional potable water producing capacity.

1.2. Summary of Findings

1.2.1. Methodology

Baseline data was collated and/or collected and reviewed and summarised within the baseline section of each technical chapter. The following baseline data was utilised:

- **General:** A general Project site visit was undertaken in September 2022 and February 2023 by Anthesis in order to provide an assessment of the Project site components and surroundings at Mirfa;
- **Air Quality:** Desk-based baseline studies of existing climatic data within published sources and existing data of nearby EAD air quality monitoring stations (AQMS) were collected. In addition, air quality monitoring was undertaken at two locations over a period of seven days;
- **Marine Water:** The results of a marine environmental baseline survey report (MEBS) undertaken by URS in 2013 and a gap analysis included within the ToR undertaken by Dome (3) were reviewed. In line with the Dome ToR (3), additional seasonal marine testing was undertaken in 2023 which included marine water and sediment sampling at 15 locations. In situ water was collected using an Aquaread probe while samples for ex situ analysis were collected using a Van Dorn sampling bottle. Sediment was collected using a Van Veen grab;
- **Waste management:** Desk-based baselines studies were undertaken to identify the current waste management framework within the UAE and Emirate of Abu Dhabi to enable the identification of current waste management opportunities and constraints, based on publicly available information. This desk-based research has been supplemented by a site visit undertaken on 1st February 2023 to gain an overall understanding of any existing waste management issues at the Project site;
- **Geology, Seismicity, Soil and Groundwater:** A review was made of decommissioning sampling undertaken in 2020 as part of the Decommissioning Plan relating to the previous Mirfa 2 Plant. Review of this hydrocarbon testing was undertaken, in addition to a review of geo-environmental testing undertaken by ERI (2021). Furthermore, a Phase 1 non-intrusive investigation was undertaken by Anthesis in 2023, in addition to six soil samples and one groundwater sample collected within the Project site by Element (2023);
- **Marine Ecology:** Seasonal marine ecology surveys were conducted at 15 locations using drop down video (DDV) transects, infauna sampling and underwater noise recordings. A further seven locations were assessed with DDV to determine whether any live coral was present. MMRO was conducted during all surveys and the results of the benthic surveys were used with satellite images to provide a habitat map;
- **Terrestrial and Intertidal Ecology:** Terrestrial ecology surveys were limited (due to CICPA restrictions) to seasonal single day, walkover surveys, vantage point counts for birds, vegetation surveys and active searching for fauna species;
- **Noise:** Noise monitoring was undertaken at 10 locations for daytime measurements, and two locations for night-time measurements within the Project site;
- **Traffic and Transportation:** Desk-based study and site visit were undertaken to determine the local conditions of the road network;

- **Socio-Economic:** A site visit of the Project sites at Mirfa was undertaken in September 2022 and February 2023 in order to identify the general site conditions and sensitive receptors within or adjacent to the Project site area. In addition, desk-based study was completed to determine the current socio-economic conditions and existing land uses within the Project site area;
- **Archaeology and Cultural Heritage:** Existing information held by Anthesis in the Mirfa area provided by the Abu Dhabi Department of Culture and Tourism (DCT) was reviewed; and
- **Climate Change:** A desktop survey was conducted to identify the future climatic trends based on climate simulations for the UAE and considerations made of the design specifications in relation to future proofing the Project in the face of future physical climate change impacts.

1.2.2. Baseline Studies Results

The results of the baseline investigations described above have enabled the enumeration of the existing baseline conditions within the Project site. The key findings of the baseline investigations are as follows:

- **Air Quality:** Air quality monitoring results identified that no parameters were found exceeding the UAE ambient air quality limits. When compared to WHO ambient air quality limits, two parameters were found exceeding: PM_{10} at both locations and O_3 at AQMS 2 only. Elevated PM_{10} and O_3 are typical exceedances occurring in this region as these are generally caused by natural sources such as windblown desert sand and sea spray. All other parameters (NO_2, SO_2 and CO) did not record any WHO ambient air quality limits exceedances. Overall, the Project site ambient air quality is considered to be an acceptable level;
- **Marine Water:** Within the water samples, exceedances were recorded in the metals Cadmium, Copper, Lead and Zinc as well as the microbial parameter Total Coliform. Within the sediment parameters, most of the parameters were in compliance with their applicable limit standards, except for two metals (i.e., Nickel and Chromium). Overall, the environmental baseline surveys found that marine water and sediment within the area was generally of good quality and considered to be uncontaminated. It was however noted that there is a clear influence from the existing Mirfa outfall, with temperature and salinity being elevated in proximity to the outfall;
- **Waste Management:** Visual inspections identified the presence of a variety of fly tipped wastes and flotsam within the Project site areas at Mirfa, although non appeared to be hazardous in nature;
- **Geology, Seismicity, Soil and Groundwater**: Visual inspections identified the presence of a variety of fly tipped wastes, although no obvious signs of potential sources of contamination were noted. Results of the soil and groundwater sampling during decommissioning, in 2021 and for this ESIA (2023) did not identify any exceedances or subsequently any contamination;
- **Marine Ecology:** Generally, the Project location was characterised by a shallow inshore area consisting of unconsolidated bottom and hard bottom. These shallow areas were generally devoid of cover apart from some sections with algal turf. The shallow area is bound by a fringing reef running parallel to the shoreline which has a defined drop off on the outer edge. No live coral was observed during the survey and this hard bottom structure provided by the reef was either devoid of cover or colonised by algal turf and macroalgae. The offshore area outside the reef was comprised of unconsolidated sediments that were colonised by seagrass

with extensive meadows being present. A total of seven subtidal marine habitats were recorded within the project location. Of the seven habitats, one is classed as Critical Habitat (Seagrass). The fringing reef and patch reef were considered to only be sensitive habitat and not critical due to the absence of live coral. However, the structure is still considered of value as it provides suitable substrate for many sessile and sedentary species as well as the heterogenous nature of the substrate attracts a number of fish. The infauna surveys identified a total of 578 (winter) and 778 (summer) individuals belonging to 10 (winter) and 18 (summer) taxonomic phyla/class/order. The diversity of the infauna community was low to medium with a low to moderate level of dominance. The samples are representative of sandy substrate where polychaetes are the dominant component. Dominant species included the amphipod *Ampelisca* sp. followed by the deposit feeder polychaete *Armandia brevis* and the polychaete Chrysopetalidae (*Bhawania goodei*). During the summer survey, polychaetae Nereididae (*Nereis* sp.) followed by Syllidae (*Syllis* sp.) and *Sabellidae* sp. Infauna abundance and diversity did show an increase in the summer season, compared to the winter season, and this could be linked to the increase in seagrass density throughout the Project location. Furthermore, this increase in infauna abundance also helps explain why there was an increase in the number of fish species observed during the summer season, as there was a clear increase in food sources attracting more fish species. Regarding marine mammals and reptiles, one turtle was observed during the winter survey at one location (MEBS10) and two dolphins were seen travelling east during the summer survey;

- **Terrestrial and Intertidal Ecology:** The following habitat types of conservation importance were identified within the Project site:
  - 1010 – Mudflats and sand exposed at low tide; and
  - 1050 – Storm Beach Ridges.

  The habitat types above were found to be in a state of moderate to low degradation but do support viable populations and are important for ecological sustainability, as well as maintenance of biodiversity of the area and even further afield. Mangrove habitat was identified outside the Project area so is not likely to be directly impacted but may fall within the zone of influence of Project activities. Avifauna species richness was found to be moderate with several of the bird species recorded being listed on the IUCN Red List. Of the mammal, reptile and arthropod species identified, none were species of conservation concern;
- **Noise:** No exceedances of the daytime or night-time EAD or IFC noise limits were recorded;
- **Traffic and Transportation:** The Project site and Mirfa town are accessed from the main E11 Highway – Sheikh Khalifa Bin Zayed Al Nahyan International Road via two possible access routes; E11 to an interchange with Qassar Al Mighayra Street or E11 to an interchange with Al Shaheed Ahmed Khamis Al Hammadi Street. Both routes then lead to Al Khor Street which is a local road leading to Al Mirfa Power and Water Complex. The Al Khor Street is an existing paved access roads currently serving the Al Mirfa Power and Water Complex;
- **Socio-Economic:** There are very limited socio-economic receptors near the Project site, and these are generally limited to operational staff at the adjacent power and water complex, in addition to a limited number of residential properties within 300m of the Project site at Mirfa. Beyond the Project site buffer area, sensitive

receptors are present within proximity to the construction traffic route, including commercial, residential, tourism and government facilities within Mirfa;

- **Cultural Heritage and Archaeology:** The Project site is a brownfield site, having been previously developed as part of the wider Al Mirfa Power and Water Complex. It is therefore considered unlikely that any archaeological features are present within the Project site. Furthermore, information provided by DCT to Anthesis show that there are no archaeological and cultural heritage sites located within proximity of the Project footprint; and
- **Climate Change:** It is estimated that average temperatures within Abu Dhabi will rise by 2.5°C by 2050, with increasing variations witnessed in temperature and abnormal rainfall events. Rainfall predications show variable outcomes for the UAE with some simulations indicating a likelihood of higher rainfall by 2080 whilst other simulations conversely indicate a dryer future with less precipitation which supports the prediction of more erratic weather patterns. Due to the shallow sloping of the UAE coastline, approximated to be 25cm per kilometre, a large proportion of the UAE coastline is vulnerable to sea-level rise. Abu Dhabi and Dubai have been identified as particularly vulnerable (4).

1.2.3. Key Identified Impacts

The impact assessments conducted within the ESIA have identified that as the Project comprises of industrial infrastructure comprising a desalination plant and associated facilities including a tank farm, interconnecting facilities and pipelines, the majority of impacts are expected during the construction phase although operational impacts are also anticipated. The key identified impacts include the following:

- **Air Quality:** Construction dust and gaseous emissions which would result in impacts upon nearby receptors, particularly residential properties at Mirfa and operational workers associated with the adjacent water and power complex. Operational traffic emissions associated with the Project sites are expected to be minimal. Largely, operational impacts are considered to be positive due to the Project enabling the decoupling of water desalination from water generation and therefore reducing reliance of the desalination sector upon natural gas. Emissions from emergency back-up generators are expected to be negligible;
- **Marine Water:** During construction, key impacts are expected to indirect impacts associated with turbidity plumes during construction of effluent outfalls, accidental spills of waste, fuels and chemicals during coastal construction and discharge of contaminated water, including dewatering effluent.

  As part of the ESIA process, to inform operational impacts and ensure selecting the best design, hydrodynamic modelling was undertaken for the following four scenarios:

  - Scenario 1: Base case scenario;
  - Scenario 2: Open channel outfall scenario including additional 80 MIGD effluent is discharged from existing outfall and an additional 40 MIGD is discharged through a new open outfall 1.2km towards the east;
  - Scenario 3: Alternative open channel scenario, in which the addition 40 MIGD in excess of the 80MIGD discharge via the existing channel, is discharged through a new outfall in close proximity to the existing outfall; and
  - Scenario 3B (**Selected Option**): open channel scenario, in which the additional effluent from the Project is discharged through the existing open channel outfall.

Each scenario assessed the potential for recirculation and extent to which ambient water quality criteria may be exceeded. The results of the hydrodynamic modelling show clear and significant exceedances of water quality criteria, including exceedances for temperature and salinity exceedances and the significant area of ambient guidance limits is likely due to the inefficiency of the outfall design. The accumulation of additional volumes of brine and larger masses of salt to the existing effluent discharge are anticipated to significantly increase the area of non-compliance against ambient salinity guidelines. It was necessary to include the outfall structure associate with the adjacent (and unrelated) Project Wave. This structure is anticipated to significantly reduce current speeds within the confined area between the Project Wave intake structure and the existing Mirfa intake structure, further reducing the energy for far-field mixing processes. The additional volume of RO reject dilutes the existing effluent stream, which is partially made up of cooling water, resulting in an overall reduction of discharge temperature, which represents an improvement compared to the existing situation. No significant impacts associated with the use of biocides is predicted. Overall, given the significant exceedances in salinity criteria, the impacts are of major negative significance for the existing and future scenarios with all plants at Mirfa operating. Note however that the regulatory exceedances which are predicted are likely to fall below a threshold whereby impacts upon sensitive or critical benthic habitats such as seagrass would be impacted;

- **Waste Management:** Impacts are expected in relation to waste streams arising from the construction and operation phase particularly upon the local waste infrastructure and health impacts upon construction workers e.g. exposure to harmful waste materials and fire events resulting from inadequate management and storage of flammable materials. The presence of the Project site adjacent to the sensitive intertidal and marine environment also renders the potential for contamination via waste pathways e.g. hazardous solid or liquid wastes as a significant impact;
- **Geology, Seismicity, Soil and Groundwater:** There is the potential for soil and groundwater contamination as a result of construction and operation activities. Due to the proximity of the sensitive intertidal and marine environment containing sensitive habitats, potentially major impacts were predicted prior to the implementation of mitigation measures e.g. accidental leaks and spillages, mobilisation of existing contamination or during dewatering activities and/or accidental release of effluents;
- **Marine Ecology:** Key construction impacts are expected to be direct loss of intertidal habitat during construction of effluent outfalls, indirect impacts associated with turbidity plumes during construction of effluent outfalls, potential disturbance to marine mammals and reptiles due to noise pollution and indirect impacts associated with localised contamination events. During operation a number of potential impacts have been identified as follows:
  - Impacts to critical seagrass habitat due to salinity and temperature changes;
  - Mudflats and Sand Exposed at Low Tide (Habitat 1010) will be permanently loss due to scour from the new outfall location; and
  - Impacts to a small patch of critical live coral habitats due to salinity and temperature changes;

Other impacts, such as impacts upon seagrass and other benthic habitats are not considered to be significant as the salinity threshold for an impact is not exceeded;

- **Terrestrial Ecology**: Two main habitats of conservation concern will be impacted, including intertidal mudflats and storm beach ridges. This would impact upon an estimated maximum of 6Ha of Mudflats and Sand Exposed at Low Tide (Habitat 1010) will be permanently loss due to scour from the new outfall location. This habitat is listed in the Abu Dhabi Emirate Habitat Classification & Protection Guideline as a critical habitat and supports avifauna species which would also trigger the Critical Habitat designation set out within the IFC Standards and will therefore require mitigation and compensation, which is detailed further below;
- **Noise:** Construction noise impacts were largely considered to be negligible with the exception of at nearby residential properties, which are likely to be significant prior to the implementation of mitigation measures. During operation, noise levels at the residential properties are expected to be within EAD limits, with the exception of night-time noise at one receptor location;
- **Traffic and Transportation:** Impacts upon the local traffic network are expected to be minor negative at Mirfa during construction. A detailed operational assessment relating to traffic levels has been scoped out as the predicted impacts were deemed insignificant;
- **Socio-economic:** Impacts upon sensitive receptors within the local project areas at Mirfa e,g. residents, businesses and commercial properties are likely during construction due to degradation of local conditions relating to air quality, noise and traffic impacts, in addition to potential health and safety issues. In addition, positive impacts may result, for example from the increased revenue generated for local businesses dur to the influx of workers;
- **Cultural Heritage and Archaeology:** No direct impacts upon known archaeological or cultural heritage sites are predicted, although the potential for undiscovered buried artefacts to be present within the Project footprint is acknowledged, the disturbance of which could potentially be significant; and
- **Climate Change:** Potential impacts resulting from climate change related variations in local conditions e.g. flooding events, extreme temperature or sea level rise may damage the Project infrastructure. During operation, GHG emissions from the expected electricity consumption for the Project are calculated to range from 280,757 tCO_2 to 355,625 tCO_2 which has been calculated to represent a significant impact. Nevertheless, as this number is fully dependent on the current power mix from the UAE, it is expected that in future years, as UAE and Abu Dhabi Emirate brings more renewable energy sources online, that this number will be reduced significantly during the Project's lifecycle. However, positive impacts are also predicted in relation to the Project enabling the reduction of reliance upon natural gas due to decoupling desalination activities from power generation activities.

1.2.4. Cumulative Impacts

The potential for cumulative impacts is limited as few sensitive receptors are present within the local area other than a small number of residential properties at Mirfa. The key cumulative impacts identified as part of the study include:

- During construction:
  - Potential Type 1 cumulative effects upon nearby receptors based upon multiple impacts from noise, dust and traffic nuisance;
  - Potential Type 2 cumulative effects associated with impacts resulting from the concurrent construction of adjacent projects, namely, Project Wave and Project Lightning. For example, concurrent construction activities at nearby project sites may amplify a number of impacts such as dust generation, gaseous emissions, noise levels and traffic on the local road networks, cumulatively resulting in more significant impact levels.
- During operation:
  - There is the potential for Type 2 cumulative impacts relating to marine water quality and marine and terrestrial ecology. The existing water quality environment, although relatively free of contaminants, has been shown via modelling to be heavily impacted by the existing Mirfa outfall. The addition of the proposed Mirfa IWP RO plant, along with the proposed Project Wave, will result in a cumulative impact to marine ecology resources, with particular impact caused by scour of mudflats. The use of this mudflats habitat also has a cumulative impact on terrestrial ecology, in particular avifauna. In addition, a reduction in water quality, particularly in relation to excess salinity is predicted.

1.2.5. Key Mitigation and Monitoring Measures

The key mitigation measures which have been identified are as follows:

- An estimated maximum of 6Ha of Mudflats and Sand Exposed at Low Tide (Habitat 1010) will be permanently loss due to scour from the new outfall location, which is listed by EAD and IFC as a critical habitat. Two mitigation options have been considered as follows:
  - Option 1 – dredging a 20m wide channel – which would result in an approximate minimum loss of 7,700 m2 (0.77 Ha) (although this excludes a temporary working area which would presumably be required to dredge the channel resulting in a temporary loss of additional habitat)
  - Option 2 – relocating the outfall - whereby only a very small area of dredging would be required to direct the flow into the channel which has already been scoured by the large adjacent outfall. The area of dredging required would be approximately 400 m_2 (0.04 Ha), although this excludes a temporary working area which would presumably be required to dredge the channel resulting in a temporary loss of additional habitat; and
  - Option 3 - utilise the existing nearshore outfall, which would significantly limitthe potential for additional scour impacts to occur.
- It is therefore concluded that relocation of the outfall (Option 2 or Option 3) would have a clear improvement upon environmental performance by significantly minimizing the loss of critical intertidal habitats to the largest extent possible (up to a 98.8% reduction in impact upon intertidal habitats compared to the current outfall location) and would not result in additional significant impacts upon marine water quality or marine ecology. This will also reduce impacts upon the Storm beach ridge habitat, which is an environmentally sensitive habitat. Option 3 has now been selected (referred to as Scenario 3B) as the preferred avoidance and mitigation measure. Additionally, monitoring of habitat loss during construction and within the first 2-years of operation will be undertaken to quantify the actual area of intertidal habitats impacted, which will feed into a compensation strategy and, in order to demonstrate a positive biodiversity impact, Engie will undertake mangrove planting as compensation which will be set out within a Biodiversity Action Plan (BAP);
- A BAP will be developed to set out in detail the proposed compensation strategy. It is not considered possible to compensate for the loss of intertidal feeding areas in the local area as any areas suitable already support

his habitat type. It is therefore proposed that compensation is provided on a non like-for-like basis. Engie have undertaken a number of biodiversity and carbon sequestration projects globally as part of their internal sustainability policies. It is proposed to undertake a similar process again here to provide appropriate levels of compensation. A site will be identified close to the Mirfa site which will be planted with mangrove seeds and managed and protected in the long-term to create mangrove habitats. The ultimate aim of this would be to demonstrate a significant ecological benefit and, in accordance with IFC requirements, a net positive impact upon biodiversity. The BAP will include for monitoring during the establishment phase of the mangroves to demonstrate that the habitats have been established and required management actions;

- Other ecological mitigation measures will also be implemented, including:
  - Pre-construction surveys should be undertaken in order to remove any less-mobile species from the area before vegetation clearing begins and make sure that no species of conservation importance are present;
  - Avoidance of vegetation clearing during the peak breeding season (April to July) unless a pre-construction survey is undertaken just before the clearance work. If any active nests are present, these cannot be disturbed and these areas must be protected, with a 300m stand-off until such time as the nest is no longer active. Once surveys by a qualified ecologist have confirmed that the nests are no longer active, vegetation can also be cleared (subject to the necessary Authority permits being in place) and these areas will be considered to be clear for the remainder of the construction phase and no further restrictions would apply;
  - Rehabilitation of the area surrounding the infrastructure through the replanting of vegetation will allow a thoroughfare around the built infrastructure thereby minimising the impact; and
  - A land bridge can be constructed over the infrastructure to allow for passage over it without having to break their vegetative cover and so doing become vulnerable to predators.

- In relation to marine ecology and water quality, the following will be implemented:
  - Recommended mitigation measures during the construction phase include design-related measures, as well as the selection of dredging practices which minimise the risk or effect of liquid emissions to the marine environment, selection of construction methods/equipment to minimise impacts to marine habitats;
  - Measures to minimise the potential for accidental spills and discharges to the marine environment during construction activities;
  - Minimisation of marine construction duration and extent by design;
  - Outfall design has been selected to have minimal impact upon the marine environment. The selection of Scenario 3B, which is using only the existing outfall for the entire 120 MIGD brine effluent, has been assessed as the best environmental solution compared to Scenario 2, which would cause a direct loss on a critical habitat (mudflats) due to the construction of a new separate outfall and subsequent scouring during operation and Scenario 3 (albeit this scenario significantly reduced impacts upon critical habitats compared to Scenario 2);
  - Selection of design practices to enhance dilution to ensure complained with regulatory criteria. A costs benefit analysis has been conducted, and concluded that the shoreline discharge (which does not promote efficient mixing) is the optimal selection for the Project due to financial concerns;
  - The exception being that the design engineers have designed the outfall with the intent to not use biocide (e.g. chlorine) within the effluent plume.

A detailed Construction Environmental and Social Management Plan (CESMP) will be prepared based upon the identified mitigation measures set out within this ESIA by the construction contractor(s). Due to the sensitivity of the surrounding environment, particularly the marine environment and associated habitats, it is also recommended to prepare an Operational Environmental and Social Management Plan (OESMP) to ensure the effective management of all Project components during operation.

During construction, the following detailed control plans are proposed:

- Dust control plan;
- Dredging control plan;
- Dewatering control plan;
- Contamination control plan;
- Spill control plan;
- Site waste management plan;
- Erosion control plan;
- Noise control plan;
- Biodiversity management plan for terrestrial and marine environments;
- Archaeological chance finds procedure;
- Stakeholder engagement plan, to ensure that affected residents are consulted; and
- A monitoring programme for each of the above;

Key monitoring recommendations include the following:

- Daily visual dust monitoring during construction;
- Regular dust monitoring should be conducted adjacent to the holiday / weekend homes located at Al Mirfa, close to the construction site;
- Night-time noise monitoring is considered necessary throughout the duration of the construction phase. During operation, noise monitoring will be undertaken at affected sensitive receptor locations for the purposes of verifying operational phase noise levels. Monitoring requirements should comply with IFC general EHS guidelines;
- Implementation of an archaeological watching brief during ground clearance and earthworks;
- Monitoring and auditing of all waste streams generated;
- Pre-construction terrestrial ecology surveys should be undertaken in order to remove any less-mobile species from the area before vegetation clearing begins and make sure that no species of conservation importance are present;
- Restoration of the storm beach ridge areas should be monitored for a period of two years in order to ensure restoration success;
- Establishment of a community complaints procedure and grievance mechanism for construction workers;
- Marine water monitoring during the construction phase will involve in situ measurements of marine water, the collection of samples for ex situ analysis of water and sediment as well as daily visual observations to ensure good housekeeping and practices by the contractors to prevent spills. In situ water quality will be conducted weekly at five locations while ex situ sampling for water and sediment will be conducted bi-monthly during the construction phase. Visual observations will be done daily especially along the shore. Monitoring shall commence one week prior to the commencement of marine construction works. During operation marine water and sediment quality monitoring is proposed quarterly - in situ and ex situ analysis of marine water quality will

be conducted at mid-depth at five locations and marine sediment will be collected for ex situ analysis at the same five locations; and

- Marine ecology pre- and post-construction monitoring will be undertaken. The marine ecology survey should include DDV and photo-quadrats of seagrass and coral habitat at a distance of 50m and 100m either side of the existing outfall as well as a control location (five for each habitat). The survey should also sample infauna at five locations around the existing outfall. During operation, quarterly monitoring will be undertaken at five locations for seagrass coral and infauna to include benthic habitat assessment using DDV and photo-quadrats, infauna sampling and an intertidal walkover to directly observe any impacts to mudflat habitat from scour. Additionally, review of high-resolution satellite imagery and spectral habitat mapping will be undertaken annually for five years during operation.

1.2.6. Residual impacts

Following the implementation of all recommended mitigation and monitoring measures, all impacts including cumulative impacts will be reduced to acceptable significance (negligible to moderate negative). Table 1-1 provides an overview of the impact significance identified for this Project prior and after mitigation and monitoring measures.

Table 1-1: Residual impacts summary

Environmental Component	Impact Significance Prior to Mitigation Measures	Impact Significance After Mitigation (Residual Impacts)
Construction Phase		
Air Quality	Minor to Major negative	Negligible to Minor negative
Marine Water	Minor negative	Negligible
Waste Management	Negligible to Major negative	Negligible to Minor negative
Soil and Groundwater	Minor to Major negative	Negligible to Minor negative
Marine Ecology	Minor to Moderate negative	Negligible to Minor negative
Terrestrial Ecology	Negligible to Major negative	Negligible
Noise	Minor negative to Moderate negative	Negligible to Minor negative
Traffic and Transportation	Negligible to Minor negative	Negligible
Socio-economic	Negligible to Major Negative	Negligible to Minor negative and Minor positive
Cultural Heritage & Archaeology	Negligible to Major negative	Negligible to Minor negative

Environmental Component	Impact Significance Prior to Mitigation Measures	Impact Significance After Mitigation (Residual Impacts)
Climate Change	Moderate negative	Minor negative
Operation Phase		
Air Quality	Negligible to Moderate negative	Negligible to Moderate negative
Marine Water	Minor positive to Major negative	Minor positive to Major negative
Waste Management	Negligible to Major negative	Negligible to Minor negative
Soil and Groundwater	Moderate to Major negative	Minor negative
Marine Ecology	Moderate Positive to Major negative	Moderate Positive to Minor negative
Terrestrial Ecology	Minor negative to Major negative	Negligible
Noise	Negligible to Moderate negative	Negligible to Minor negative
Traffic and Transportation	Negligible	Negligible
Socio-economic	Negligible to Major negative	Negligible and Minor positive
Cultural Heritage & Archaeology	Negligible	Negligible
Climate Change	Minor negative and Major positive	Negligible and Moderate positive

1.2.7. Project Advantages and Disadvantages

1.2.7.1. Project Advantages

The proposed Project site is located within the footprint of an existing industrial power and water complex on the site of an old power plant which has since been decommissioned. The Project site is therefore considered to be brownfield, and impacts upon the surrounding environment are subsequently considered to be minimal due to the industrial nature of the Project surroundings in addition to the limited biodiversity value of the Project site, although the marine and intertidal habitats are of significant conservation value.

The current Mirfa site has significant advantages through the avoidance of having to construct extensive infrastructure for electricity supply and water distribution (which would also have their own environmental impacts in addition to significant cost), added to which the environmental impacts are not likely to be significantly reduced with the selection of an alternative site given that the sensitive habitats and species identified at the Mirfa site are present throughout the Abu Dhabi Western Region coastal and nearshore areas. It is therefore concluded that the Mirfa site is a clear preferred alternative.

The potable water production capacity of the Project is estimated to be 120 MIGD and therefore is expected to result in both economic and sustainability benefits to Abu Dhabi Emirate in terms of provision of freshwater. Given the substantial national focus placed upon addressing water scarcity, it is considered that the no development option is not feasible as the Project represents the opportunity to provide a significant contribution to this goal, through bolstering the country's desalination plant profile and the provision of additional potable water producing capacity.

Additionally, the Project will enable the decoupling of water desalination from power generation which will reduce the reliance of this sector on natural gas, therefore reducing carbon emissions and providing economic benefits to the water sector. The current configuration of power facilities combined with the thermal desalination requirements, at times (particularly in winter) results in inefficient low load operations to produce adequate quantities of water.

1.2.7.2. Project Disadvantages

Disadvantages associated with the Project relate to the sensitive nature of the marine and intertidal environment adjacent to which the Project is located. The expected impacts resulting from construction activities associated with the Plant, outfall and tank farm, prior to the implementation of mitigation measures, may be significant.