Taweelah 200 MIGD IWP Seawater Reverse Osmosis Plant

Abu Dhabi, UAE

ESIA: Volume 1 – Non-Technical Summary

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1 INTRODUCTION

The Abu Dhabi Department of Energy (EWEC), formally Abu Dhabi Water and Electricity Authority (ADWEA), has authorised the development of a new Seawater Reverse Osmosis (SWRO) Plant within the Taweelah Power and Water Complex. The proposed development will have a production capacity of 200 million imperial gallons per day (MIGD), equivalent to 909,216 m^3/day.

Following the submission of bids to EWEC during 2018, ACWA Power was announced as the preferred bidder in January 2019. Following technical evaluation of the Bid and confirmation of compliance with the RFP and MFS, the Taweelah IWP Project was awarded to ACWA Power and a Water Purchase Agreement was signed with EWEC in March 2019.

The Taweelah RO Project will be structured as a standalone Independent Water Project (IWP) and will be developed on a build, own and operate basis by the Taweelah RO Project Company, which will be established as a joint stock company or LLC under the laws of the UAE and the Emirate of Abu Dhabi. ACWA Power will hold forty percent (40%) of the shares and Taweelah RO Local Holding Company sixty percent (60%) of the share capital.

1.1 Background and Context

In September 2017, EWEC submitted a proposal to the Executive Council for approval in principle to commence feasibility studies for 2 x 100 MIGD RO plants at Taweelah. EWEC then approached EAD regarding the proposed location and the potential environment impacts. EAD advised that they had no objection to the commencement of the project as long as an EIA was carried out to assess the cumulative impacts of existing projects in the area (Ref: letter ref: OUT-L/2017/EQS/0227).

In March 2018 EWEC appointed ILF as Technical Consultant for the Project and HDR was appointed as the Environmental Consultant. A draft EIA was prepared and submitted to EAD for comments which were addressed and subsequently a Conditional Approval was issued on 10th October 2018 (Ref: EMS/18/ESRF/10016).

ACWA Power appointed 5 Capitals Environmental & Management Consulting ("5 Capitals") to work with modellers HR Wallingford to assess a new optimal intake/outfall design for the ACWA Power Bid and subsequently to prepare the ESIA for submission to the Lenders. 5 Capitals has in turn appointed HDR in February 2019 to undertake the additional surveys requested by EAD and to submit an updated EIA with ACWA Power specific project design to the Abu Dhabi Environmental Regulator.

This document presents a 'non-technical summary' of the ESIA conducted for the proposed SWRO plant (the "Project").

2 CONTENT OF ESIA

The aim of the ESIA is to identify and assess potential environmental impacts that may occur as a result of the project's construction and operational activities, and to specify applicable mitigation and management measures to avoid or minimise such impacts wherever possible.

The process of completing the ESIA is comprised of the following key stages:

- Collation of baseline information through review of relevant desktop information, and compilation of relevant environmental and social data for the project site.
- Design, execution and analysis of scientifically robust field survey data and modelling of proposed project effluent discharges.
- Identification and evaluation of sensitive receptors.
- Identification, assessment and categorisation of IWP and cumulative impacts.
- Identification of appropriate mitigation, management and monitoring measures to effectively avoid, minimise or control identified potential impacts.
- Identification of any residual significant effects.

In order to present the ESIA in a logical format, it has been divided into several volumes:

- **Volume 1**: ESIA Non-Technical Summary;
- **Volume 2**: ESIA Main Text, Tables, Figures and Plates;
- **Volume 3**: ESIA Framework Environmental & Social Management and Monitoring Plan;
- **Volume 4**: ESIA Technical Appendices.

The ESIA follows on from the concept EIA prepared and submitted to EAD by HDR for comments which were addressed and subsequently a Conditional Approval was issued on 10th October 2018 (Ref: EMS/18/ESRF/10016).

The scope of the ESIA includes the following aspects: Air Quality, Marine Water, Sediment and Ecology, Waste Management, Geology, Seismicity, Soil and Groundwater, Terrestrial Ecology, Noise, Traffic, Archaeology and Cultural Heritage, Socio-Economic, Landscape and Visual Amenity, Community Health, Safety & Security and Workers Condition & Occupational Health & Safety.

3 LEGAL FRAMEWORK AND STANDARDS

Applicable environmental legislative framework considered includes:

- National and local environmental legislation, regulations and standards (UAE Federal Law and Abu Dhabi standards and guidelines);
- International Requirements, including:
    - Regional Conventions and Protocols signed/or ratified by the UAE;
    - Equator Principles III (2013);
    - IFC EHS Guidelines (2007);
    - EHS Guidelines for Water & Sanitation (2007);
    - IFC Performance Standards (2012);
    - IFC/EBRD Worker Accommodation Guidelines; and
    - ILO Conventions for Labour and Working Conditions (applicable to UAE).

The Project will comply with applicable local, national and international lending regulations and standards, above and in each case the most stringent standard will apply.

3.1 Stakeholder Consultations

Stakeholder identification and consultation has been an ongoing process for the Taweelah Project for the last two years, even before the project bidding stage. The methods used for the on-going stakeholder engagement process have included bilateral meetings, emails and telephone calls. Public consultations and direct engagement with the public is not permitted under UAE national law, although for this project there has been in-depth consultation with government entities and commercial interested parties to ensure that any project concerns are addressed within the project design and ESIA.

Since the IWP will be located within the Taweelah Complex under the security of Critical Infrastructure & Coastal Protection Authority (CICPA) there are few sensitive receptors. Therefore, the impact on local receptors other than commercial/industrial is limited to Al Hanjurah Estate, which is understood to be under the Abu Dhabi Royal family and as such, consultation is expected to have occurred at the highest government level. Access to this estate is restricted and occupancy is unknown although nearest buildings are between 400m and 500m from the south-western boundary with the IWP site, beyond the cooling water channel for the Taweelah Complex. The feedback on sensitive ecological receptors such as the Ras Ghanada Marine Protection Area has been through feedback from the Environmental Regulator EAD.

4 PROJECT SUMMARY

4.1 Project Location

The proposed development site is situated within the southern portion of the Taweelah Power and Water Complex with a footprint area of approximately 379,000 m^2. The site surface soil profile, floral community and elevation of the site has been altered during site clearance and placement of excavated marine material excavated from the current Taweelah Complex outfall channel. All sites within the Complex are of similar make-up.

Figure 4-1 Project Location in relation to Taweelah Complex

4.2 Project Description

The proposed Project will utilise Seawater Reverse Osmosis (SWRO) technology to produce up to 200 MIGD potable water, equivalent to 909,216 m^3/day, with production capacity of 37,884 m^3/hr. The principal project components include a seawater open channel intake, a 3km piped outfall, RO plant, potable water storage tanks and solar PV panels.

The facility will have a seawater intake and pumping system, which will include breakwater facilities, screening including a filtration system. In order to ensure the seawater is of suitably

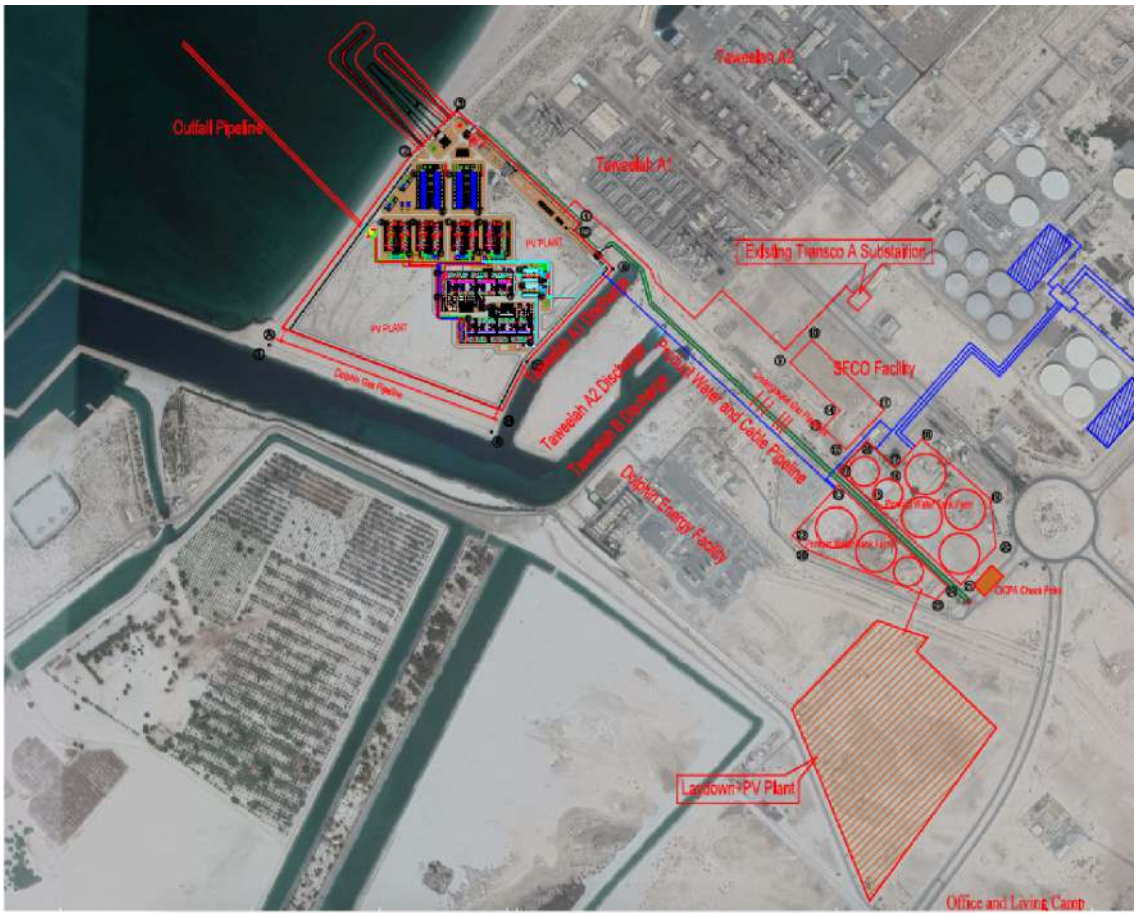
high quality for use in the RO Plant, the pre-treatment will be composed of at least coagulation, dosing and mixing, flocculation, high rate Dissolved Air Flotation (DAF) and Dual Media Filters (DMF).

The Reverse Osmosis (RO) plant will perform the main function of separating the seawater into two streams by removing the salt from the seawater. The separation is achieved by pushing the water through membranes, with high pressure being used in the process. The two streams include;

- The permeate- which has passed through the membrane and has had most of the dissolved constituents removed and;
- The remaining brine-which contains dissolved solids.

The seawater concentrate/brine is returned to the sea to meet UAE Federal and Lenders requirements, while the permeate will be treated in a second pass. The wastewater streams will be treated on site and no sludge will be disposed to the sea.

The figure below shows the Taweelah IWP site layout and interface with Taweelah Complex.



4.3 Associated Facilities

Temporary Construction Facilities

The construction laydown area will be located southeast of the project site. The laydown area is expected to include temporary construction facilities required to enable works (materials storage, staging areas), as well as construction administration facilities.

Power Requirements and On-site Power Generation

During operation the project will have an anticipated energy demand of 4.2 – 4. kWh / m^3 depending on seawater conditions. Renewable Power generation capacity has been incorporated into the plant design through the installation of both ground and roof-mounted PhotoVoltaic (PV) power generation modules. This will account for approximately 10% of the energy requirements at the plant, while the rest will be supplied by the neighbouring Taweelah Power Generation Complex.

Potable Water Storage Tanks (to be operated by EWEC)

During operation, there will be 9 potable water storage tanks located east of the project site. the potable water quality will be in accordance with General Technical Specifications issued by the Department of Energy and with Water Quality Regulations-Forth Edition as issued by the Department of Energy (formerly RSB) in July 2013.

4.4 Project Schedule

An outline delivery schedule highlighting important milestones for the project is provided in the table below.

Table 4-1 Outline of the Project Schedule

IMPLEMENTATION MILESTONE	TENTATIVE DATE*
Effective Date of Taweelah WPA	28th February 2019
WPA Closing Date	28th May 2019
Financial Closing Date	28th May 2019
Notice to Proceed to EPC Contractor	28th May 2019
Start of Mobilization	26th June 2019
Start of Site Installation	31st July 2019
Scheduled Project Commercial Operation Date	31st October 2022
Scheduled Provisional Acceptance Date	31st October 2022

5 OVERVIEW OF LOCAL ENVIRONMENT

The proposed project development site is situated within the Taweelah Power and Water Complex, located in the Al Taweelah area of the Emirate of Abu Dhabi. The site is bordered to the south and west by the Taweelah Complex outfall channel that transports thermal and brine effluent from the power generation and desalination process to the Arabian Gulf, located approximately 50 metres to the northwest of the site boundary.

Land use surrounding the Taweelah Complex is predominantly industrial to the north and east. The Khalifa Port is 2 km to the north whilst the Emirates Global Aluminium (EGA) aluminium refinery is located 4 km northeast of Taweelah. Immediately to the west of the EGA refinery, the Shaheen Bauxite Refinery is currently under construction. Immediately to the north of the Taweelah Complex boundary is the Emirates Heritage Club marina that occupies a small parcel of land between the Taweelah complex and the Khalifa Port.

To the south of the Taweelah Complex boundary is the area of Al Hanjurah which is predominantly privately-owned land that includes forestry plantations and private residences believed to belong to members of the Abu Dhabi Royal Family.

Satellite imagery and site visits undertaken at the project site identified commercial, residential and industrial receptors external to the SWRO project as shown in the table below.

RECEPTOR	RECEPTOR TYPE	DISTANCE FROM THE PROJECT SITE
Taweelah Complex	Industrial	Borders the project site to the north.
Khalifa Port	Commercial	Approximately 2km north of the project site.
Emirates Global Aluminium (EGA) alumina refinery	Industrial	Approximately 4km northeast of the project site.
KIZAD Area A	Commercial	Approximately 2.5 km northeast of the project site
CICPA/Etisalat submarine	Commercial	Approximately 45 m northwest of the project site
Dolphin Gas Pipeline	Industrial	Cuts across the extreme south of the project site
Emirates Heritage Club marina	Commercial	Approximately 3km north of the project site
Al Hanjurah	Residential	Buildings within Hunjura are located approximately 400-500 m south of the project site.
Marine Protected Area	Ecological	Approximately 7 km north east of the project site

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6 ENVIRONMENTAL & SOCIAL ISSUES

6.1 Climate, Meteorology and Ambient Air Quality

An Air Quality Monitoring Station was deployed at the project site for 4 weeks of continuous monitoring commencing 18th of June 2018. The AQMS recorded the following parameters: Carbon Monoxide (CO), Nitrogen Dioxide NO_2, Ozone (O_3), Sulphur Dioxide (SO_2), Hydrogen Sulphide (H_2S), Volatile Organic Compounds (VOC) and Particulate Matter (PM_{10}, $PM_{2.5}$).

The results of ambient air quality monitoring indicate that the hourly concentrations of CO, NO_2, and SO_2 were all below the UAE Federal standards. However, periodic exceedances were recorded for hourly O_3 and PM_{10} during the monitoring period. The National Ambient Air Quality Standards for the UAE do not include guideline limits or standards for $PM_{2.5}$. Occasional failure of WHO hourly ambient air quality standards for NO2 was recorded during the survey.

Temporary construction impacts as a result of the project may result in increased dust generation, gaseous and volatile organic compounds emissions and odours. These impacts will be mitigated by means of good site practices such as daily dust suppression on roads and management of stockpiles. All vehicles will undergo maintenance checks before being allowed on site and black smoke from exhaust will be forbidden. The potential emission from volatile organic compounds will be minimised by storage in air-conditioned chemical stores and suitable storage of empty cans prior to disposal.

As the project is a SWRO desalination plant it will not include combustion related activities or any direct (Scope 1) air emissions to the local airshed. However, a footprint of GHG emissions is expected due to the SWRO electricity consumption from the grid. The Scope 2 emissions related to the project operation phase is 529,018 tonnes/year, which is derived from the amount of electricity drawn from the grid 100.94 MW.

It should be noted that this is a worst-case scenario as it does not take into account the renewable energy within the Abu Dhabi power mix and that which is under development (i.e. Abu Dhabi nuclear power plant). Therefore, the above emissions are considered as a worst-case scenario and are expected to be slightly lower (and decreasing over time) during the operational phase of the project, as additional renewable energy is added to the grid electrical generation mix.

6.2 Marine Water, Sediment and Ecology

Marine Modelling

HR Wallingford were commissioned by ACWA Power to undertake hydrodynamic dispersion modelling study to optimise the intake/outfall configuration for the bid submission in October 2018 and to refine the modelling in 2019 for the EIA to the Regulators and ESIA for the Lenders.

The ACWA Power/HR Wallingford's design process, enabled the length of the outfall to be optimized from 7 km (concept design length) to 3 km, due to the enhanced diffuser design and the existing Port configuration and future expansion. Within the 3 km outfall corridor, it is proposed that there will be 2 outfall lines, with the first pipe 2.5 km in length, and the second line 3 km in length. Both lines will be fitted with a diffuser section over the final 500 m comprising a total of 61ports to maximize initial dilution, which in the absence of Taweelah Complex, would achieve salinity levels of <2 PSU well within the 500m Mixing Zone.

The effluent discharge from the existing Taweelah Complex facility exerts a significant influence over the waters adjacent to Taweelah, meaning background conditions frequently exceed the Federal mixing zone requirements for temperature and salinity. HR Wallingford considered the feasibility of shoreline versus long piped outfall and favoured an intermediate scheme with multiple diffusers to avoid impacts to existing/future intake facilities, avoid recirculation due to Khalifa Port expansion and take advantage of current flows through the existing Port. Due to the existing impacts from the Taweelah Complex which already elevates the background salinity at the edge of a 500m Mixing Zone, this approach assessed the potential cumulative impacts at designated ecologically sensitive sites beyond the immediate point of discharge.

In order to assess degree of impact associated with the brine plume dispersion, and thereby calibrate the location of the effluent outfall, the following were considered in the modelling report:

- Maximum and average extents of the plume, showing the size of the areas above +2 ppt (including the cumulative impact from the Taweelah Complex discharge);
- Predicted brine plume extents and concentrations at 15 sensitive sites; and
- Excess salinities at the edge of a nominal 500 m mixing zone around the SWRO outfall.

Following assessment of the above criteria, and consideration of siting criteria set in place by EWEC at the concept design phase (i.e. outfall line to be to the east of the existing submarine cable and Dolphin gas pipeline), baseline plume dispersion patterns were considered. Using established formulae and the latest research on brine jet dispersion

dynamics in shallow waters, HR Wallingford produced a design that specified the length of diffuser, number of discharge ports, the minimum port separation distance, anticipated distances to impact with the seabed, impact dilution rates and near-field extents.

The modelled baseline, showing existing conditions at the site, indicate that the current Taweelah Complex operations exert a significant influence over the coastal waters at Taweelah and beyond. Within the footprint of the effluent dispersion, waters are characterized by elevated salinities and temperature considerably higher than ambient levels. The zone of impact – the area impacted by the above average conditions - extends many kilometres to the northeast and southwest of the point of discharge from the Taweelah Complex. The effects of the effluent plume are also most significant at the seabed, where the effluent, characterized by a greater density than the receiving waters, is closer to the seabed.

The baseline brine dispersion patterns from Taweelah Complex influence the ambient water quality at the following ecological receptors:

- Average increases of salinity up to 2 PSU above ambient with maximum increases up to 5 PSU at seagrass beds adjacent to the existing Taweelah Complex and within the footprint of Khalifa Port;
- Average increases of salinity up to 1 PSU at the Ras Ghanada Marine Protected Area, and infrequently, maximum increases of up to 4 PSU above ambient during periods of strong winds;
- Average increases of salinity of between to 2 -3 PSU above ambient with maximum increases up to 5 PSU on the intertidal mudflats to the southwest of the existing Taweelah Complex outfalls.

The IWP operational phase modelling together with the existing Taweelah Complex has been modelled at 15 ecological receptors including Ras Ghanada Marine Protected Area (coral, searass, mangrove and mudflats) and reported as Time Series plots over 30 days which in comparison with the baseline, show on average an increase over the background of 10% (i.e. 0.2PSU). The maximum compared with baseline may reach 2 PSU, although this will be highly infrequent. This is also the case for stronger wind condition scenario. It is noted that the fringing reef to the south of the existing outfall is already heavily impacted by the thermal and brine discharge from the Taweelah Complex.

Marine Habitats and Ecology

The construction phase of the SWRO will result in direct habitat loss during dredging works. However, at the diffuser location, the habitat is predominantly of low sensitivity comprising of unconsolidated sediment with algae. An area of seagrass within the footprint of the intake structure is <5% of the overall seagrass bed adjacent to the Port. The proposed mitigation including deployment of high-quality silt curtains and construction/dredging management

plans will minimize further disturbance or impacts caused by silt settling onto sessile benthic communities. A Dredging Management Plan will detail the proposed side casting and identify the extent to which temporary storage of some material can be accommodated on land within the Taweelah Complex.

Construction noise will generate short-term disturbance to marine ecological receptors and will likely displace more mobile marine fauna, such as fish, from the area. Benthic infaunal communities are expected to recolonise areas excavated during the construction works, though areas within the mixing zone, which are subjected to elevated salinities, are likely to recover slowly and be of lower diversity as a consequence of the cumulative impact of the Taweelah Complex and IWP, although the increase in the overall salinity at the designated sensitive receptor locations will on average be no more than10 %.

Impacts to ecological receptors, beyond the direct mortality caused by excavation works, will be mitigated through the implementation of targeted management measures stated in Volume 2 of the ESIA. Effluent outfalls are expected to increase salinities at the seagrass beds within Taweelah, however the modelling assessment does not suggest that this will exceed salinity thresholds above those tolerated by the three seagrass species recorded in the UAE.

The Ras Ghanada MPA fringing reefs support regionally significant communities of corals. These areas were heavily impacted by a naturally elevated sea temperatures in 2017 that resulted in mass bleaching of coral. The cumulative modelling studies suggest only relatively small increases in salinity (0.2PSU) at the seabed in these areas. The changes to the ambient conditions at the MPA should not result in mortality, but may slow or limit the recovery of the site from the coral bleaching events such as the one recorded in 2017.

Monitoring surveys are proposed at the Ras Ghanada MPA and Taweelah seagrass beds with a view to monitoring the effectiveness of the proposed construction and operational mitigation measures.

Protected Species

Intertidal beach surveys undertaken in May 2019 identified several tracks and two nest sites, of Hawksbill Turtles, which are classified under IUCN as being "*critically endangered*". It is evident that this beach has been used by nesting turtles prior to and during the development of the Taweelah Complex, although these are believed to be the first recorded sightings. A Biodiversity Action Plan will be required under IFC PS 6 to ensure that the construction and operation of the IWP will minimise the loss of beach habitat and provide mitigation and monitoring measures. During turtle nesting season (March to June) there will be restricted access to the beach and measures will be taken to ensure that turtles are not endangered by the IWP intake system. Experience from operating the Taweelah Complex may be adopted where beneficial in avoiding/minimising entrainment of fauna.

Recirculation

A summary of the change in brine recirculation at the existing and proposed intakes are summarised in the table below. These are within acceptable operational limits for both intakes.

At existing Taweelah Complex intake

wind condition	ΔS (ppt), red is including IWP outfall average	95th-percentile	maximum
typical	1.2 (1.8)	2.5 (2.8)	3.7 (4.0)
stronger	1.2 (1.6)	3.1 (3.2)	3.9 (4.1)

At proposed IWP intake

wind condition	ΔS (ppt), red is including IWP outfall average	95th-percentile	maximum
typical	1.4 (2.1)	3.1 (4.0)	3.6 (4.9)
stronger	1.4 (2.0)	3.8 (4.1)	4.5 (5.0)

Additional ADCP Deployment and Model Calibration

After the submission of the EIA to EAD on 05/29/2019, comments were received on 7th July 2019 (Ref: EMS/16/ESRF/11095). As part of the comments, EAD requested additional data collection and model calibration to give further confidence to the existing model prediction. Following discussions and meetings with EAD (22nd May and 18th June 2019), three ADCP devices were deployed between 17th August and 6th August 2019 to record depth, current speed and direction. Comparison with the model reinforced the original conclusions that the model is aligned with observed data and that the model is well suited for use in the plume dispersion assessments of reject brine from the outfall. HR Wallingford prepared a modelling addendum report and this is provided in Volume 4 (Appendices) of this ESIA.

6.3 Waste Management

Waste materials generated during construction are expected to include aggregate, wood, steel, packaging wastes and other unused materials. As per the mitigation stated in the ESIA, these will be segregated for re-use or recycling wherever possible. The small quantities of hazardous wastes (such as paint, used oil cans chemicals and contaminated materials such as oily rags and any affected soils) will be temporarily stored inside impermeable bunded areas in accordance with the mitigation and management measures stated in the ESIA, for the collection by licensed waste transporters and taken to approved licensed facilities.

Sanitary wastewater generated during construction will be stored in septic tanks prior to removal by a CWM-accredited ESP. No untreated wastewater or contaminants will be discharged or allowed to drain to the coastal waters. No sludge will be discharged to coastal waters at any time. Groundwater dewatering effluent will comply with Federal standards and IFC guidelines, prior to discharge.

During operation there will be relatively small quantities of solid waste arising from planned maintenance work, administration facilities and activities of the employees which will not be directly associated with the production processes. Waste segregation for re-use or recycling will be undertaken where practical.

The ESIA outlines appropriate mitigation and management measures that will be implemented to ensure effective management of waste during both construction and operational phases.

6.4 Geology, Seismicity, Soil & Groundwater

Groundwater samples from 4 boreholes within the project site and 5 surface soil samples were collected on 13th June 2018 and 28th April 2019 respectively. Analysis of the groundwater samples confirmed compliance with Dutch Groundwater Standards for heavy metals.

The analytical laboratory results of the detected parameters in the soil samples indicate that barium, chromium, copper, manganese and zinc were the only parameters detected in all 4 soil samples. However, none of the metal concentrations exceeded the screening level values provided by the 2017 Abu Dhabi Environmental Specification for Soil Contamination and the Dutch soil target values.

The construction works have potential to affect soil quality and potentially impact groundwater quality prior to mitigation. Such potential impacts may result from spills and leaks of hazardous liquids and materials, inadequate waste & wastewater management, as well as any impacts relating to importation of contaminated fills to the site.

During the operational phase, potential risks to soil & groundwater will be managed and mitigated via the design of effective materials and waste storage areas and implementation of an effective Waste Management Plan,

Such impacts are typical for construction and operation of this kind and can be readily managed by the effective implementation of a CESMP and OESMP respectively. An Emergency Response Plan (ERP) and Spill Response Contingency will be prepared to ensure that in the highly unlikely event of a significant spill, any affected area can be isolated and restored effectively without delay.

6.5 Terrestrial Ecology

The site consists of made ground with the original soil profile, floral community and elevation of the site altered during site clearance and placement of excavated marine material. The site was originally utilized as a storage site for dredged material with the material excavated from the current Taweelah outfall channel. A portion of the material is still stored at the site, and this provides an area of higher elevation in the centre of the Project site. As such, the site is classified as "Urban Habitat" type in accordance with the classifications set out in Brown and Boer (2004).

The site was found to support sixteen (16) different species of coastal flora, whch are widespread in UAE and none of high conservation importance. Though the majority of the site is generally sparse, the perennial halophytic species *Zygophyllum qatarense* is the dominant specie across the site. The site also supports *Cyperus* sp. grass growth with localised abundance of *Heliotropium kotschyii*, particularly in the northern corner of the site.

In addition, a total of thirteen (13) bird species were recorded on the project site and in the surrounding areas. All the species identified and recorded are common in the Emirate of Abu Dhabi and the UAE such as the Eurasian Collared Dove (*Streptopelia decaocto*) and House Sparrow (*Passer domesticus*) etc. Western Osprey (*Pandion haliaetus haliaetus*) were recorded transiting over the site and utilizing the boundary fence for perches. There was no evidence of nesting recorded during either of the surveys and no suitable habitat was recorded during the investigations in April and May, 2019.

Evidence of some fauna species such as reptiles (Slevin's Sand Gecko), burrows of lizards and small mammals were noted including animal paw prints. The surveys also established that there are no suitable structures on the site that may be utilized as bat roosts,

Construction works will result in the loss of habitat, disturbance and possibly direct mortality of fauna within the project footprint due to the removal of all the vegetation and construction activities. It is therefore proposed that a fauna translocation programme will be required prior to any site clearance to remove mammals and reptiles.

The operational phase of the project is not expected to result in further direct impacts to terrestrial ecology at or around the project site, which will be fenced. Impacts to terrestrial ecology will be effectively managed through the implementation of a robust Operational Environmental and Social Management Plan (OESMP).

6.6 Noise

Noise monitoring was undertaken at 5 receptor locations near the proposed SWRO plant between 29th June and 1st July 2018. The monitoring survey was carried out during the day and night times continuously for 30-minutes at each location.

The Federal 60dBA and WHO limit of 70dbA for industrial areas (sites N1, N2, N3 and N4) was not exceeded during the daytime monitoring during the weekend and weekday. Similarly, at site N1, the Federal & WHO limit was not exceeded during the daytime on the weekend and weekday. The night time ambient noise levels at sites N1, N2, N3 and N4, exceeded the Federal Limit of 60 dB(A) but were within the WHO limit of 70 dB(A). Noise levels at N5 (located near Emirates Heritage Club) exceeded the Federal Residential areas with light traffic Limit of 50dB (A) during the day and 40 dB(A) during night time. However, when compared to WHO ambient noise levels of 55 dB(A) for residential areas, the results obtained at N5 did not exceed the WHO limit.

Construction activities will likely result in temporary and short duration increases in the noise and vibration levels emanating from the project site, access roads and the laydown areas: dependant on the type of works being undertaken. Compliance with Federal Maximum Allowable Limits for Noise in Different Areas and WHO Noise Standards (At off-site receptors) will be monitored as well as the implementation of a wide range of best practice measures to control noise and vibration sources. These are detailed in Volume 2 of the ESIA. Vibration during construction works is expected to be limited to short term soil stabilization and piling work. Specific mitigation measures will be detailed in the CESMP.

The operational phase of the project will have relatively few noise sources. The principle noise source during operation will be associated with the seawater pumping station which will be housed and afforded additional attenuation from walled structures. In addition, due to the background noise sources already present locally, it is unlikely that there will be any discernible operation noise impact at the receptor locations. The SWRO project is not anticipated to generate any significant vibration sources that will be discernible beyond the boundaries of the project site.

6.7 Traffic

The main access routes to the project site are from the E 11 highway through KIZAD industrial area through Zirarah Street and Al Yal Street.

During construction, the volume of traffic will vary according to the phases of construction and the demand for materials, removals and construction personnel on site. Impacts related to additional vehicular transportation are not expected to be significant due to the existing low traffic flows and the carrying capacity existing roads but it may be noticeable.

Transportation impacts during the operational phase of the project are not expected to be significant, as the operation of the SWRO will require periodic delivery of materials, or other equipment as part of the operation and maintenance programme

6.8 Archaeology and Cultural Heritage

Based on the observations made during the site visits and through secondary research, there are no features of cultural value evidence suggesting the presence of archaeological features within the project footprint. In addition, the project will be located in a designated industrial area.

However, as the potential for encountering buried archaeology remains or artefacts during excavation and earthworks activities cannot be completely ruled out, the ESIA states that a "Chance Find Procedure" shall be developed alongside the CESMP to address this in the unlikely event of discovering any historical finds.

During the operational phase of the project, there will be no further excavations on the project site so the risk of uncovering or disturbing any further historical finds is considered highly unlikely.

6.9 Socio-Economics

The development of the 200 MIGD RO Desalination Plant in Taweelah, Abu Dhabi is one of the primary components of EWEC's strategy to diversify the water generation sector and meet the anticipated growth in potable water demand. The additional potable water added will supply industrial, commercial and residential needs, thereby contributing towards economic development.

The development of the project will also give rise to various positive socio-economic benefits such as direct employment creation, which will further stimulate the local economy via the multiplier effect. In addition, to the direct monetary impact of employment created during construction, there also exists the potential for the project to promote the dissemination of construction skills from expatriate workers into the local labour force.

The development of the project will not give rise to any involuntary resettlement of local population or direct displacement as no ethnic minorities, indigenous peoples or internally displaced people are in the project area, or nearby. In addition, there will be no economic displacement as the project site and associated facilities are within the CICPA controlled site as part of the secure Taweelah Complex.

The operation of the SWRO Plant offers potential to support the continued growth of the local and national economies, through the ability to provide an additional source of potable water to EWEC's network.

6.10 Landscape and Visual Amenity

The wider landscape of the project site is characterised mainly by industrial and commercial zones such as the Taweelah Complex and Khalifa Port with limited private residential land such as Al Hamjurah etc. The natural features include the coastal plain, open sea and the coastline.

Construction activities (e.g. levelling, grading) will eventually result in land use changes, with subsequent construction of small buildings and the construction of the SWRO Plant. The construction of pipeline corridors for the intake/outfall will be covered once complete and the beach area will be restored to its pre-development state. The development of the RO plant is not expected to result in significant changes to the future landscape character, as the new structures to be constructed will be low rise buildings and appropriate for existing industrial land-uses. Differences at night-time may be discernible where lighting is required for project operations, however mitigations measures have been included in the ESIA to limit the effects of light spill, glare and skyglow.

6.11 Community Health, Safety & Security

The construction phase of the project has the potential to result in impacts to the community, health and safety, although in the case of the RO plant, this will be negligible for the following reasons:

- The risk of disease being spread to any local communities due to influx of migrant workforce to the local area is prevented through the UAE visa system which includes health screening and the accommodation of workers in labour camps rather than being housed within local communities.
- The project will not result in release of pollutant emissions during construction or operation other than exhaust emissions from vehicles. All solid waste will be segregated for re-use, recycling or disposal and removed from site. All waste water streams will be treated on site and re-used for landscaping or industrial used or tinkered off site but none will be discharged to the marine environment. The only discharge will be a concentrated salt water (brine) produced through the desalination of seawater.
- Site access during construction and operation will be controlled by security on the gates to prevent members of the public from entering the site. The site will be fenced to avoid any members of the community from straying into an active site with heavy machinery and equipment.
- The RO Plant product is potable drinking water in compliance with safe drinking water standards, for consumption by the people in Abu Dhabi.
- An Emergency Preparedness Plan will be prepared in readiness for the construction and operational phases to address any possible emergency situations that could impact site workers, the environment or the community.

6.12 Workers Condition & Occupational Health & Safety

An Occupational Health and Safety Management Plan will be prepared at the start of the construction phase to address the many H&S risks that occur on a construction site. These will include physical risks such as traffic on site, working at height, movement of heavy machinery, excavations, scaffolding etc. other risks may include handling of fuels, chemicals, paints and solvents, noise and emissions from machinery and generators etc.

Health and safety risks to the site workforce will be managed effectively through specific risk assessments, development of appropriate method statements and procedures, emergency and disaster planning and the communication of specific health and safety planning requirements and training sessions.

The working conditions and labour accommodation will also comply with UAE laws as well as ILO requirements and UN conventions to which UAE is signatory to. The requirements will additionally be met in regard to working conditions of site workforce and such conditions will be managed through effective project planning, and the implementation of a grievance mechanism to ensure that workers can raise complaints, without fear of being dismissed, should they consider conditions to be unsafe or culturally damaging.

An OHSMP will also be prepared at the start of the operation phase to address relevant H&S issues for workers during the routine management, maintenance and possible emergency scenarios that could arise on the Project site.

7 ENVIRONMENTAL & SOCIAL MANAGEMENT & MONITORING

Volume 3 of the ESIA provides a framework for the development of the Environmental and Social Management System (ESMS) for the construction and operational phases of the project. The framework has been developed to ensure that all Environmental & Social impacts identified for both construction and operational phases are appropriately identified and controlled through the development of a robust construction and operational phase ESMS.

Both the construction and operational phase of ESMS will need to incorporate mitigation and monitoring requirements established within Volume 2 of the ESIA as well as requirements set out by Federal Authority, Local Authority (EAD) and the Lenders.

The primary documents guiding the environmental and social management of the construction and operational phases will be the Construction Environmental and Social Management Plan (CESMP) and Operational Environmental & Social Management Plan (OESMP) respectively.

7.1 Independent Monitoring

The project will be subject to periodic independent monitoring in accordance with the requirements of the lenders, as per Equator Principle 9. The scope of the independent audits will include the implementation of the project ESMS and will evaluate on-site activities and documented controls and monitoring efforts, with respect to the project's compliance obligations.