FEWA 150 MIGD SWRO Independent Water Project

Umm Al Quwain, UAE

Environmental & Social Impact Assessment

Volume 1 – Non-Technical Summary (NTS)

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CONTENTS

LIST OF ABBREVIATIONS

Abbreviation	Meaning
CEET	IFC Carbon Emissions Estimation Tool
CESMP	Construction Environmental and Social Management Plan
dB (A)	A-weighted decibels
ESIA	Environmental & Social Impact Assessment
ESMS	Environmental & Social Management System
FEWA	Federal Electricity and Water Authority
FNTP	Full Notice to Proceed
H&S	Health & Safety
IFC	International Finance Corporation
IFIs	International Financial Institutions
LNTP	Limited Notice to Proceed
MIGD	Million Imperial Gallons per Day
O&M	Operation & Maintenance
OESMP	Operational Environmental and Social Management Plan
OHSMP	Occupational Health & Safety Management Plan
PHED	Public Health Environmental Department
RAK	Ras Al Khaimah (Emirate)
RO	Reverse Osmosis
SWRO	Sea Water Reverse Osmosis
UAQ	Umm Al Quwain (Emirate)
VOC	Volatile Organic Compounds

1 INTRODUCTION

To meet the future potable water demand of the Emirate of Umm Al Quwain, the Federal Electricity and Water Authority (FEWA) is proposing to sponsor the development of a Sea Water Reverse Osmosis (SWRO) desalination plant neat Marjan Island, south of the border with the Emirate of Ras Al Khaimah. The proposed project, originally planned as Phase 1 (45 MIGD, 2018) has been increased this year to a capacity of 150 MIGD (including Phases 1 and 2) and will be owned and operated by a Consortium including ACWA Power, Mubadala and FEWA.

According to the Federal Law No. 24 of 1999, the project will be required to obtain a license from the Public Health and Environmental Department (PHED) of Umm Al Quwain Municipality prior to the commencement of the project. It is also understood that the project will seek an amount of its financing from International Financial Institutions (IFIs) who will likely be signatories of the Equator Principles (EP) or have their own internal Environmental and Social (E&S) investment guidelines such as the IFC. In line with their requirements and guidelines the IFIs will require the submission of an Environmental and Social Impact Assessment (ESIA).

As a result, 5 Capitals Environmental & Management Consulting (5 Capitals) has been commissioned by ACWA Power to prepare an Environmental & Social Impact Assessment (ESIA) Report for the proposed project. The ESIA has been informed by the Environmental Scoping Report (Ref. Appendix A) prepared by 5 Capitals and has been prepared in accordance with Umm Al Quwain PHED requirements.

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

1.1 Background and Context

On 13th June 2018, FEWA confirmed the appointment of ACWA-Tecton Consortium as a preferred bidder for the 45 MIGD SWRO IWP Desalination project. ACWA Power will hold forty percent (40%) share of the project equity while Mubadala Investment Company PJSC and FEWA will own forty percent (40%) and twenty percent (20%) shares respectively. The project is an Independent Water Project (IWP) and is expected to be commercially operational in the 2nd quarter of 2020.

The initial scope of works as per the 2018 bid (Tender 39EW/2016) included the installation of the plant along with the associated intake and outfall facilities to produce 45 MIGD (204,500 m^3/day) of desalinated water. However, in March 2019 under the UAE Ministerial Council for Development Decree No. 34M/10T/2018, FEWA invited ACWA Power & Mubadala under Tender 39E/2016 to submit a proposal for the best technical and commercial discounted proposal to upgrade the IWP 45 MIGD to 150 MIGD (681,900 m^3/day) SWRO desalination plant.

After the submission of the proposal by ACWA Power and Mubadala and its review by FEWA, the revised project agreement was signed on 30th May 2019.

As a result, 5 Capitals arranged a meeting with PHED on 13th June 2019 to discuss the change in the capacity of the project and determine whether PHED would require 5 Capitals to update the existing 45 MIGD Environmental Scoping Report (submitted to PHED on 14th August 2018 and approved on 10th October 2019) or whether PHED had new conditions for the ESIA. PHED informed 5 Capitals that a new Environmental Scoping Report would not be required and the only condition for preparing the project EISIA was to provide a discussion on why the project capacity was increased from 45 MIGD to 150 MIGD.

Additional meetings were also held with the Umm Al Quwain Department of Planning and Survey in November 2018, June and July 2019 to discuss the location of the project sites 1& 2 in relation to the boundary between the Emirates of Umm Al Quwain (UAQ) and Ras Al Khaimah (RAK). After the review of the project boundaries and site Affection Plan, the department instructed ACWA Power to shift the project sites 14m south of the UAQ boundary in order to adhere to the required 30m buffer zone between the two Emirates. This was facilitated by the issuance of new Affection Plans for sites 1 & 2 with revised coordinates reflecting a 30m buffer zone between the project boundary and the UAQ & RAK boundary.

2 CONTENT OF ESIA

The aim of the ESIA is to identify and categorise potential environmental impacts that may occur as a result of the project's construction and operation 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 potential 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 Appendices.

The ESIA follows on from the Scoping Study Report for the Project's conceptual design that was previously submitted to PHED for review and approved on 10th October 2018. The Scoping Study Report identified sensitive receptors and the key impact/risks associated with the construction and operation phases of the Project at an early stage therefor defining the required baseline surveys and level of assessment for the subsequent ESIA.

The outcome of the Scoping Report confirmed the primary assessment requirements for the ESIA for Marine Environment, Terrestrial Ecology, Soils, Geology and Groundwater, Air Quality, Noise and Vibration, Waste and Wastewater Management, Traffic and Transportation, Archaeology and Cultural Heritage, Socio-Economics, Landscape and Visual Amenity, Community Health, Safety and Security, Workers Conditions & 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 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 Umm Al Quwain Project for the last one year. The methods used for the on-going stakeholder engagement process include bilateral meetings, emails, telephone calls and letters. Public consultations and public meetings are not allowed under the UAE national law although for this project there has been in-depth consultation with government entities to ensure that any project concerns are addressed within the project design and this ESIA.

A stakeholder Engagement Plan (SEP) will be prepared for the project describing the proposed engagement process to be undertaken during the construction and operational phase of the project. The scope of the SEP will provide the project with methods of efficiently managing and facilitating future engagement with stakeholders through various stages of the project lifecycle.

The SEP will align with the requirements of Equator Principles 5 and 6 that describes Stakeholder Engagement and Grievance Mechanism respectively, and the IFC Performance Standards with particular relevance to IFC Performance Standard 1 on "Assessment and Management of Environmental and Social Risks and Impacts" which describes the stakeholder's engagement requirements in more depth. However, it is recognised that elements of stakeholder engagement are included in all IFC Performance Standards.

4 PROJECT INFORMATION

4.1 Project Location

The proposed Project will be located in the northern most extent of the Emirate of Umm Al Quwain in the United Arab Emirates. The specific plot of land has been allocated by FEWA and is immediately south of the Umm Al Quwain border with the Emirate of Ras Al Khaimah, approximately 20 km north of the city of Umm Al Quwain.

The Project will primarily be located on land with intake and outfall facilities extending into the marine environment. The land-based section of the project will be approximately 23.5 hectares in area in two plots of land adjacent to E11 carriageways. The smaller project site (Project site 1) which is located between the north and south flowing E11 carriageways will be approximately 6.9 hectares whereas the larger project site (project site 2) located east of the north flowing E11 carriageway will be approximately 16.6 hectares.

Figure 4-1 Location of the Proposed Project

4.2 Project Description

The proposed project will utilise Seawater Reverse Osmosis (SWRO) technology to produce up to 150 MIGD potable water, equivalent to 681,900 m^3/day. The principal project components include a 600m seawater open channel intake, a 3.6 km piped outfall, RO plant and potable water storage tanks.

The facility will have a seawater intake and pumping system which will include screening and 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 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.

4.3 Associated Facilities

Electrical System

The SWRO power supply will be supplied from FEWA's substations. The 132KV switchgear will be designed as the main station for FEWA network and it will be used for future interconnections to 132 Kv as well as 400 kV network. The power will be received from four (4) 132KVcable feeders (each of 100% rated power capacity) from FEWA's substations. In addition, there will be two (2) spare feeders (with switchgear) and two (2) reserved feeders as per FEWA's requirements.

Potable Water Tanks

During operation, there will be five (5) potable water storage tanks located to the south east of the project site 2.

Export of Potable Water

The export of potable water outside of the project site will be the responsibility of FEWA. There will be four (4) potable water pipelines with two (2) connecting to storage tanks located in the

Emirate of Ras Al Khaimah, one (1) connecting to Bultan Al Samar Distribution Network and the other connecting to Umm Al Quwain Water Distribution Centre.

Pipeline Works

The pipeline works will include but not limited to the following;

- Supply installation of GRP pipeline from permeate/flushing tank to storage water tank;
- Right of way construction;
- Pipeline crossing protection for powerline, road;
- Protection of pipeline; and
- Pipping support.

Access Roads

The proposed project sites will be accessed from the E11 highway which is along a north/south route. However, the Project Contractor will be required to construct access roads into and within the site. The roads will be designed of sufficient width and load as well as with regard to the frequency of traffic (such as heavy load transportation) and to satisfy local design standards and international best practice

Sewage Drainage, Storm Water and Other Waste Water Drainage Systems

Sewage wastewater will be treated by means of biological contact oxidation process and water obtained from the treatment process will be filtered to meet the relevant standards.

Rainwater in the plant will be collected by rainwater pipeline through roadside rainwater drop inlets, then flow by gravity along the pipeline to the rainwater pump station. Storm water will be stored in the storm water collection pit and will be discharged according to local regulations.

Temporary Construction Facilities

The proposed laydown areas will be located south of project site 1 & 2 with an additional strip east of the project site 2. However, this is subject to the approval of FEWA who is the Project Proponent. The laydown area is expected to include temporary construction facilities required to enable works (materials storage, staging areas), as well as construction administration facilities.

Worker Accommodation and Facilities

The workers accommodation facilities will be located off the project site at established labour camps within a 10km radius from the project site. The worker accommodation will be according to the standards specified by the Project Company and with relevant worker accommodation regulations and guidelines as set out in the respective section of this ESIA.

Manpower Requirements

It is estimated that there will be approximately 80 management staff members and 1200 workers during construction phase peak time. The workers will be housed in existing labour camps within a 10km radius from the project site.

Electricity Supply

During the construction phase of the project, power supply for the project is expected to be from FEWA's power grid or through the use of generators.

Sanitary Facilities

The site will require on site sanitation facilities for the construction workers (expected to be toilets with collection septic tanks). Sanitary waste will be stored in bunded septic tanks on-site, prior to removal by a licensed contractor.

Water Supply

During the construction phase of the project, it is expected that the EPC Contractor will apply for the necessary permits in order to be able to use the groundwater for construction purposes. In addition, water for use by the workers (i.e. for drinking) will be supplied to the project site by authorised water supply companies.

4.4 Construction Timeline

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

Table 4-1 Outline of the Project Schedule

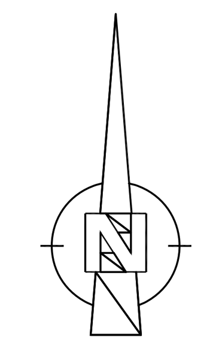
Implementation Milestone	Tentative Date*
Effective Date (Limited Notice to Proceed)	LNTP
Financial Closing Date (Full Notice to Proceed)	FNTP (LNTP+2.5 M)
Start of site mobilization	LNTP+ 2 M
Site Preparation	LNTP+2 M
Mechanical Completion Date of Plant	
Completion of seawater intake structure (onshore civil works)	FNTP+13 M
Completion of outfall structure (marine works)	FNTP +17 M
Completion of sea water pumps installations	FNTP+16 M
Completion of pre-treatment	FNTP+29 M
Completion of RO trains	FNTP+29 M
Completion of Desalination Units 50 MIGD	FNTP+22 M
Completion of Desalination Units 150 MIGD	FNTP+29 M
Completion of Connection to related Facilities	

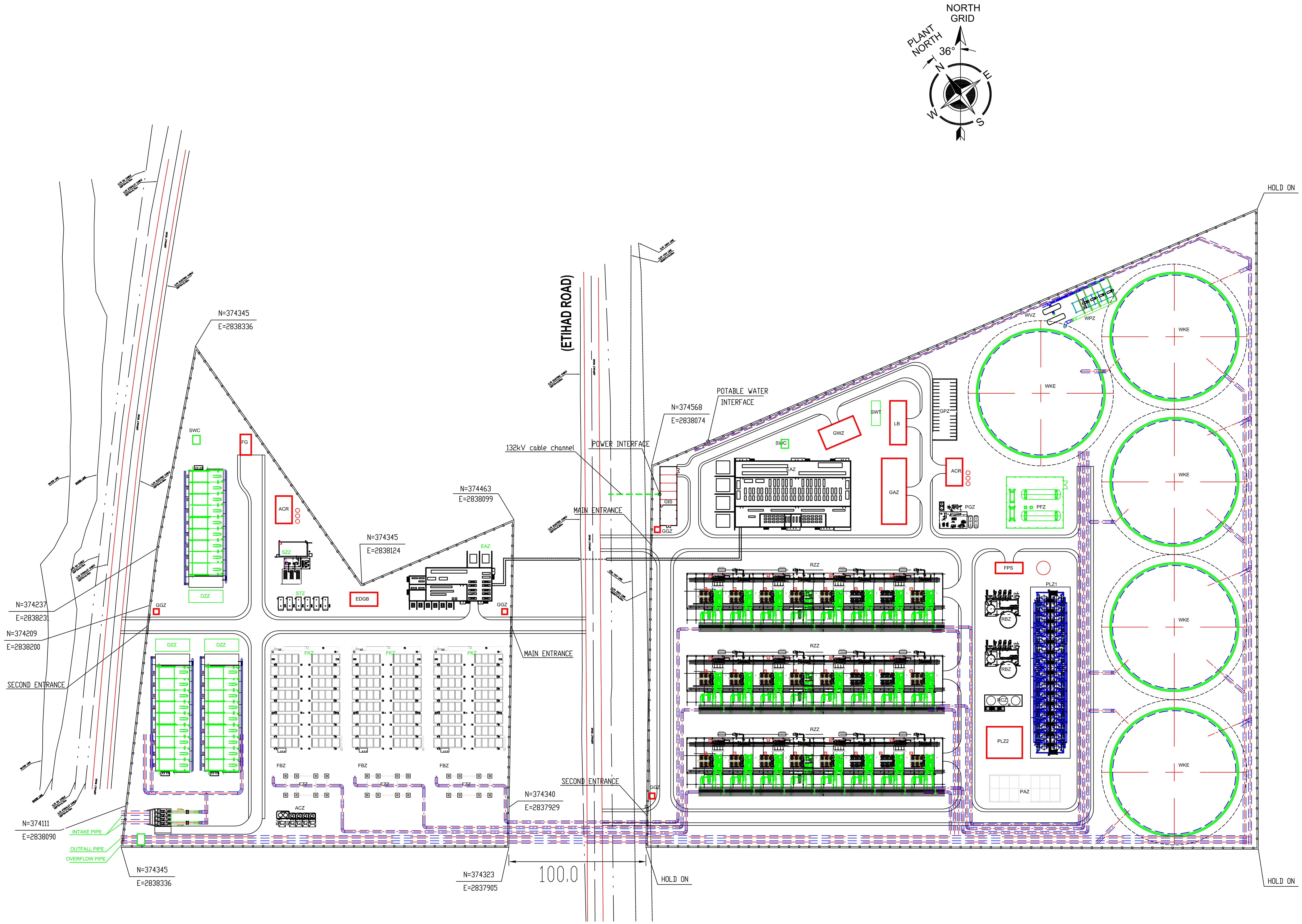
Electrical substation	FNTP+15 M
Potable Water Facilities	FNTP+22 M
Seawater Pumping Station	FNTP+17 M
Commissioning of Desalination Units	
Desalination Unit 50 MIGD	
First seawater feed to RO system available	FNTP+21 M
First permeate production	FNTP+22 M
Performance test	FNTP+23.5 M
Reliability test run	FNTP+24.5 M
Net Dependable Capacity Test	FNTP+25.5 M
Early Water 50 MIGD	FNTP+25.5 M
Desalination Unit 150 MIGD	
First seawater feed to RO system available	FNTP+21 M
First permeate production	FNTP+22 M
Performance test	FNTP+31 M
Reliability test run	FNTP+32 M
Net Dependable Capacity Test	FNTP+33 M
Scheduled Commercial Operation Date	Fntp+33 M
Commissioning of the Entire Plant	
Start of Reliability Test Run	FNTP+32 M
Net Dependable Capacity Tests	FNTP+33 M
Scheduled Project Commercial Operation Date	FNTP+33 M

Figure 4-2 Overall project layout

1. Coordinates are according to UTM coordinate system.
2. Official Coordinates yet to be identified and demarcated jointly by UAQ-EC, Municipality, FEWA & Topographic subcontractor.
3. The coast area shall foresee shore protection system as required.

LEGEND:





LEGEND

	FENCE
	ROAD
	CABLE TRENCH

ZONE	DESCRIPTION
AZZ	INTAKE SYSTEM
ACZ	INTAKE CHEMICALS GENERAL
DZZ	DAF GENERAL
EAZ	ELECTRICAL BUILDING
FKZ	DMGF
FBZ	BACKWASH SYSTEM GENERAL
FWZ	WASTEWATER SYSTEM GENERAL
FZZ	CARTRIDGE FILTERS SYSTEM
GAZ	ADMINISTRATION BUILDING
GGZ	GATE HOUSES
GPZ	CAR PARK
GWZ	WORKSHOP & WAREHOUSE
PLZ1	LIMESTONE FILTERS
PLZ2	LIMESTONE FILTERS AUXILIARIES
PAZ	STORAGE LIMESTONE FILTERS
PFZ	CO2 SYSTEM
PGZ	PLANT CO2 SYSTEM
RZZ	RO GENERAL
RBZ	RO FLUSHING-CIP-NEUTRALISATION SYSTEMS
RCZ	RO CIP / NEUTRALISATION CHEMICALS SYSTEMS GENERAL
STZ	SLUDGE THICKENING SYSTEM
SZZ	SLUDGE TREATMENT GENERAL
WKZ	POTABLE WATER TANKS
WPZ	POTABLE WATER PUMPING STATION
WVZ	SURGE SYSTEM
FPS	FIRE PUMP STATION
SWC	STORM WATER COLLEXTION PIT
SWT	SEWAGE WASTEWATER TREATMENT
ACR	AIR COMPRESSOR ROOM
EDGB	EMERGENCY DIESEL GENERATOR BUILDING
GIS	132 kV GIS
FG	FIRE GARAGE
LB	LABORATORY BUILDING

中国葛洲坝集团国际工程有限公司
CHINA GEZHOUBA GROUP INTERNATIONAL ENGINEERING CO.,LTD.

CHINA ENERGY ENGINEERING GROUP
ZHEJIANG ELECTRIC POWER DESGIN INSTITUTE CO., LTD.

APP'D BY		DSN'D BY		TITLE: GENERAL PLAN OF SWRO DESALINATION PLANT
REV'D BY		SCALE		
CHK'D BY		DATE	2019.04.12	DWG NO Z-01 REV 0

SIZE A0

5 OVERVIEW OF LOCAL ENVIRONMENT

The area of the project sites 1 & 2 and laydown area 1 & 2 is owned by FEWA. FEWA will grant lease over the site to the Project Company (ACWA Power). This will allow the Project Company to build and own the Plant on the site independent of FEWA's ownership of the land.

Land use surrounding the proposed project sites is predominantly industrial and commercial. The closest residential receptor is located approximately 779m south east and an agricultural receptor (camel holding area) at 128m south of the laydown area 2 while the closest commercial and industrial receptors are located approximately 431m north (RAK Tourism Development Authority) and 106.3m north east (wastewater treatment plant) respectively from the project site one (1) boundary.

Satellite imagery and site visits undertaken at the project site identified commercial, residential and industrial receptors external to the SWRO project within a 5 km radius as shown in the table below.

Table 5-1 Potential Local Receptors

Receptor	Receptor Type	Distance from the Project Site
Waldorf Astoria Ras Al Khaimah (RAK)	Commercial	Approximately 4 km north east of the project site 1
Al Hamra Village Townhouses (RAK)	Residential	Approximately 3.9 km north east of the project site 1
Smartline Bin Majid Beach Resort (RAK)	Commercial	Approximately 1.6 km north west of the project site 2
Ras Al Khaimah Industrial Zone (RAK)	Industrial	Approximately 1.2 km north east of the project site 2
Park Inn by Radisson Resort Ras Al Khaimah (RAK)	Commercial	Approximately 2.5 km north of the project site 1
Rakystay Marjan Island (RAK)	Commercial	Approximately 2.8 north west of the project site 1
Pacific Development (RAK)	Commercial	Approximately 3.6 km north west of the project site 1
DIC Hotel Resort Project (RAK)	Commercial	Approximately 4km north west of the project site 1
Double Tree by Hilton Resort and SPA (RAK)	Commercial	Approximately 1.4 km north west of the project site 1
Ras Al Khaimah Convention Centre (RAK)	Commercial	Approximately 1.4 km north west of the project site 1
Brasserie (RAK)	Commercial	Approximately 1.2 km north west of the project site 1
Ras Al Khaimah Tourism Development Authority (RAK)	Commercial	Approximately 431 m north of the project site 1
Rixos Bab Al Bahr Resort (RAK)	Commercial	Approximately 475.9 m north west of the project site 1

Receptor	Receptor Type	Distance from the Project Site
Wastewater Treatment Plant (RAK)	Industrial	Approximately 106.3 m north east of the project site 1
Al Sinniyah Island (north) (UAQ)	Commercial/Recreational	Approximately 2.4 km south west of laydown area 1
Commercial Compounds 1 (UAQ)	Commercial	Approximately 1.2 km south west of laydown area 1.
Commercial Compound 2 (RAK)	Commercial	Approximately 474 m north east of the project site 2
Commercial Compound 3 (UAQ)	Commercial	Approximately 3.5 km south west of laydown area 1
Commercial Compounds 4 (RAK)	Commercial	Approximately 2.4 km south east of laydown area 1
Residential Compounds 1 (UAQ)	Residential	Approximately 2 km south east of laydown area 1
Residential Compound 2 (RAK)	Residential	Approximately 2.1 km north west of the project site 2
Residential Compound 3 (UAQ)	Residential	Approximately 3.4 km south west of laydown area 1
Residential Compound 4 (UAQ)	Residential	Approximately 779 m south east of laydown area 2
Residential Compound 5 (UAQ)	Residential	Approximately 5 km south west of the laydown area 1
Residential Compound 6 (UAQ)	Residential	Approximately 3.9 km south west of laydown area 1
Residential Compound 7 (UAQ)	Residential	Approximately 2.7 km south east of laydown area 2
Rocky Intertidal Habitat (UAQ)	Ecological	Approximately 45 m west of the project site 1
Camel Holding Area (UAQ)	Agricultural	Approximately 128 m south of laydown area 2
Construction & Demolition Waste Plant / Waste water Treatment Plant (UAQ)	Industrial	Approximately 3.3 km east of laydown area 2

6 SUMMARY OF MAIN ENVIRONMENTAL & SOCIAL IMPACTS

6.1 Marine Environment

Marine surveys undertaken between October 2017 and November 2018 have been reviewed as part of the marine ecology, sediment and water quality assessment within the project area. Water quality in 2017 was assessed as part of the Preliminary EIA and for the project-specific scheme in 2018 and these indicate good water quality with concentrations of heavy metals below the detectable limits or within the applicable regulatory standards. The results for sediment quality analyses also indicate that the concentrations of heavy metals were below the Dutch Sediment Guidelines.

The marine habitat along the routes of the proposed intake/outfall can broadly be categorised under one habitat type; that of "*unconsolidated sediments with limited seagrass*" cover and a high percentage of sediment cover. The site is not considered to be of high ecological value based on its low diversity and paucity of species sighted during the surveys.

An intertidal marine survey was also carried out in September 2018 to assess the biodiversity of flora and fauna within the intertidal habitat. Small quantities of seagrass and filamentous algae were identified as having being washed to the beach while the rock outcrop at the beach was observed to support a relatively biodiverse community including at least 20 species of gastropods.

Marine modelling for the operation phase of the RO Plant has been undertaken as part of the feasibility study to assess the dispersion of brine, which becomes more concentrated during the membrane desalination process. This has demonstrated that a diffuser pipeline with a number of ports can safely discharge the brine into sea at a distance of approximately 3.6 km offshore and meet the required mixing zone standards detailed in UAE Federal Law, Iranian and international Lender requirements.

Marine modelling was undertaken by HR Wallingford using a TELEMAC-3D model which assessed the brine discharge from the RO Plant under different scenarios. The following conclusions were reached based on the results of the near-field and far-field behaviour of the discharging brine plume:

- The proposed outfall discharge configuration is predicted to sufficiently mix the brine with ambient seawater. Excess salinity is reduced to 5 % of the ambient values (2.1 ppt) within the near-field area which extends about 30-40 m from the outfall. This is in compliance with the most stringent of the environmental standards that the project is required to adhere to.

- On average, excess salinities are predicted to exceed 1 ppt up to 1 km from the outfall and maximum excess salinities are predicted between 1.3 to 1.6 parts per thousand (ppt) at commercial receptors.
- Excess salinities are predicted to be between 0.1 and 0.8ppt at ecological receptors, except for the sparse seagrass habitat adjacent to the pipeline (1.4ppt);
- For both types of intake tested (pipeline and open channel), similar excess salinities of up to 0.8 ppt were predicted at the IWP intake which is suitable for operations.

The selected dredging technique will be required to minimise any impacts from sediment dispersion, suspension and increased turbidity through the application of suitable dredging technology methods and secondary containment controlled by silt curtains. Dewatered effluent will be processed using a settlement tank to reduce suspended sediments prior to discharge into the marine environment. Continuous water quality monitors will be installed to provide real time monitoring data for the Regulator during dredging and to ensure compliant effluent discharge from dewatered effluent and the protection of nearby sensitive receptors.

6.2 Terrestrial Ecology

With reference to the Interpretation Manual of the Major Terrestrial Natural and Semi Natural Habitat (Brown & Böer, 2004) and the Abu Dhabi Emirate Habitat Classification and Protection Guideline (Al Dhaher et al (2017)), the project and laydown areas can be broadly categorised into the following categories:

- Non-vegetated, exposed sandy beaches with coastal development, recreational activities and trash.
- Sand sheets and dunes with perennial herbs and graminoids with dunes less than 20 m in elevation, and without significant cover of trees, shrubs and dwarf shrubs. Vegetated to non-vegetated sand and dune areas colonised by perennial herbs and/or graminoids.
- Sand sheets and dunes with distinct dwarf shrub cover with *Haxolylon salicornium, Zygophyllum qatarense*

The project sites and the laydown areas were found to support different species of flora, which are widespread in the UAE and none of high conservation importance apart from three (3) Ghaf tree "bushes" in laydown area 1 which are locally protected. The predominant species found at the project sites and laydown areas include *Tetraena qatarense*, *Cornulaca monacantha* and *Stippa agrostis*.

In addition, a total of approximately nine (9) bird species were recorded on the project sites and surrounding areas. All these species identified and recorded are common in the UAE such as *Passer simplex*, *Merops persicus* and *Spilopelia senegalensis* etc.

Evidence of some fauna species such as reptiles (*Stenodactylus arabicus and Stenodactylus leptocosymbotes*), spiders (*Sicarius hahni*), grasshoppers and beetles (*Tenebrionidae, Tiger beetle sp.), Neuroptera and* feral dogs were noted during the site surveys. Fauna tracks across the undisturbed dunes in both 2018/19 indicated the likely presence of the Dhub spiny-tailed lizard which is listed as "Vulnerable" on the IUCN Red List and is protected in the UAE. Additional evidence of fauna species such as reptile sand print and burrows of lizards and small mammals were also noted.

Construction works will result in the loss of habitat, disturbance and direct mortality of fauna within the project footprint due to the removal of all the vegetation and construction activities. It is therefore anticipated that a fauna and flora translocation programme will be required prior to any site clearance to remove low growing ghaf trees, mammals and reptiles. Following completion of the project construction, the laydown areas will be restored to the pre-development dune habitats.

The operational phase of the project will not result in any direct impact to ecology of the project sites 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).

6.3 Soils, Geology and Groundwater

Four soil samples, two groundwater and one pond water sample were collected on 4th September 2018 from the project sites 1 & 2. Additional two soil samples were collected on June 24th 2019 at the project site 2 and four at the laydown areas 1 & 2 on 30th July 2019 due to an increase in the size of the project footprint. Analysis for all the soil samples and pond water for heavy metals revealed compliance with the Dutch Soil and Groundwater Standard.

Micro-organisms were detected in the groundwater sample from the project site 1 which could be likely attributed to possible groundwater contamination originating from the Wastewater Treatment Plant that is approximately 103.6 m from the project site 1. However, when compared to locally relevant (Dubai) Environmental Standards and Allowable Limits of Pollutants on Land, water, and Environment, May 2003' at 200 CFU/100 ml and the 'Directive 2006/7/EC of the European Parliament and the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC' at 500 CFU/100ml the *Escherichia coli* present in the groundwater is within the allowable limits.

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 also 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.

6.4 Air Quality

Continuous ambient air quality monitoring for carbon monoxide (CO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), Ozone (O_3) and VOCs was undertaken between 4th September and 7th September 2018 at two representative accessible locations within the project site and the laydown area to establish the background gaseous ambient air quality in the area of the project. In addition, dust particles ($PM_{2.5}$ and PM_{10}) were also measured.

The results of ambient air quality monitoring indicate that the hourly concentrations of CO, NO_2, SO_2, O_3, the 8 hours average for CO and O_3 and the 24-hour average for NO_2, SO_2 were all within the UAE Federal Standards. In addition, the 24-hours monitoring results for PM_{10} were also within the Federal standard of 150 µg/m^3.

Temporary construction impacts as a result of the project may result in increased dust generation, gaseous, volatile organic compounds and GHG 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 (e.g. solvents and paints) 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 are expected due to the SWRO electricity consumption from the grid. The Scope 2 emissions related to the project operation phase is 611,689 tonnes/year which is derived from the amount of electricity (1,023,200MWh) drawn from the grid using the IFC Carbon Emissions Estimation Tool (CEET).

It should be noted that the CEET was last updated in 2013 and therefore it does not account for the renewable energy that has been developed and put online in the UAE between 2013-2019. 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.

6.5 Noise and Vibration

A noise survey was undertaken at five representative locations of the project sites 1 & 2 between 5th and 7th September and between 19th and 20th November 2018. In addition, two additional noise surveys were undertaken between 24th and 25th June and between 5th and 6th July 2019 due to the increase in the project footprint.

Noise levels were measured to confirm the baseline conditions within the project sites 1 and 2, near from Ras Al Khaimah Tourism Development Authority and the camel holding area. the results show that daytime monitoring results are compliant with the Federal requirements of 50dB(A)-60dB(A) apart from N-6 (near the camel holding area) with 62 dB(A) for peak and 61 dB(A) for interpeak hours. The evening/night results for N-4, N-6 and N-7 were within the Federal requirements of 40 dB(A) and 50 dB (A) while N-1, N-2, N-3 and N-5 were above the maximum allowable limits. However, this can be explained by the fact that the project sites 1 & 2 and the laydown areas 1 & 2 are located adjacent to the E11 highway dual carriageway which is the main route connecting Abu Dhabi to Ras Al Khaimah and the access roads connecting to Marjan island. No discernible vibration has been detected during all the site visits.

The construction phase will result in temporary and short duration increases in the noise levels at the project site and this will primarily arise from earthworks for site preparation as well as movement and the operation of vehicles and/or equipment. However, noise impact assessment using an assumed worst-case scenario with all potential construction equipment operating at full power at the same time and at the same location (100% factor), increase in noise levels is only anticipated to receptors located close to the project plot boundary.

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 implementation of a wide range of best practice measures to control noise sources. These are detailed in Volume 2 of the ESIA. Vibration during construction works will 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 principal 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's locations. The RO project is not anticipated to generate any significant vibration sources that will be discernible beyond the boundaries of the project site.

6.6 Waste and Wastewater Management

Waste materials generated during construction including aggregate, wood, steel, packaging wastes, unused materials, will be segregated for re-use or recycling wherever possible. The small quantities of hazardous wastes (such as paint and oil cans and oily rags and soils) will be stored inside bunds with an impermeable base and be collected by an Umm Al Quwain approved waste management contractors for disposal at UAQ authorised facilities.

Wastewater generated during construction will be stored in bunded septic tanks prior to removal by an UAQ approved waste contractor for disposal at UAQ authorised reception or treatment works. No wastewater or contaminants will be discharged or allowed to drain to the coastal waters. Groundwater dewatering effluent will comply with Federal standards prior to discharge.

During operations, there will be relatively small quantities of solid waste arising from planned maintenance works, administration facilities and activities of the employees which are not 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 operation phases.

6.7 Traffic and Transportation

The proposed sites 1 & 2 and laydown areas will be accessed through the E11 highway which is directed to both the north and south. The E11 highway near the project site can be accessed through the Sheikh Mohammed Bin Zayed road, Emirates road which are located to the east and an unnamed road north of the project site. Importation of construction materials will be through the Port of Jebel Ali in the Emirate of Dubai and the Port of Umm Al Quwain before being transported to the project site by road.

During construction, the volume of traffic will vary over the course of construction, in accordance 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 traffic flows and the carrying capacity of E11 highway, but it may be noticeable.

The construction of the intake and outfall pipes and project facilities connecting between project site 1 & 2 have been designed to go under E 11 highway through tunnelling which may lead to traffic management on one or both carriageways resulting to reduced vehicle speed along the project site though this is not expected to result into congestion.

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

6.8 Archaeology and Cultural Heritage

Site visits undertaken to date confirm that there are no surface features of potential archaeological importance identified within the project footprint. However, there are two boundary markers between Umm Al Quwain and Ras Al Khaimah north of project site 1 & 2 which are approximately 35 m and 175 m respectively from the proposed sites boundary. Consultation meetings with Umm Al Quwain Department of Planning and Survey have confirmed that the boundary markers are of political significance for the two Emirates and must be preserved throughout the project cycle.

The potential for encountering buried archaeological remains or artefacts during excavation and earthworks activities cannot be completely ruled out, and although this remains extremely low, a 'Chance Finds Procedure' in the CEMP will be prepared to address this in the unlikely event of uncovering any historical finds.

During the operational phase of the project, there will be no further excavations on the project sites so the risk of uncovering any historical finds not found during construction is negligible.

6.9 Socio-Economics

FEWA's development of the 150 MIG D RO Desalination Plant in Umm Al Quwain will have far reaching benefits to new business development in Umm Al Quwain and neighbouring emirates. 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 in the project area, or nearby. However, during the site visits, camels from the camel holding area were observed grazing near the laydown area 2 where majority of the existing vegetation has been eaten back by the camels. Consultation with the Municipality and/or camel holding area owners will be required before the commencement of the construction phase of the project in order to inform them about the project and restrictions

from accessing the site. This is not envisioned to create a shortage of grazing land for the camels since the areas surrounding the project sites 1 & 2 to the south are open and undeveloped.

In addition, some of the existing infrastructure (fibre optic cables, water pipeline and power transmission lines) may need to be relocated before the commencement of construction works. The coordination between the EPC Contractor and the relevant stakeholders (service providers) will ensure minimal service disruption.

The construction phase is also expected to have negligible socio-economic impacts on the tourist activities in the Al Marjan Island. In addition, it was observed during the site visits that construction works are ongoing in different areas of the island.

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 FEWA's network.

6.10 Landscape and Visual Amenity

The wider landscape of the project sites 1 & 2 and the laydown areas 1 & 2 is characterised by different commercial and industrial developments such as the Rixos Bab Al Bahr resort, E11 highway, Ras Al Khaimah Tourism Authority, wastewater treatment plant, Ras Al Khaimah industrial area and a camel holding area which is considered as an agricultural receptor. The natural features include the desert, 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. In addition, the EPC Contractor will be required to restore the laydown areas to their original sate before the beginning of construction works.

The development of the RO plant will not result in a prominent change in landscape character that will significantly affect the nearby receptors. In addition, there will be no additional changes in the built environment during operations. 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 sky glow.

6.11 Community Health, Safety & Security

The construction phase of the projects 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:

- 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 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.
- The RO Plant product is potable drinking water in compliance with safe drinking water standards, for consumption by the people in UAQ.
- 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 openly air their complaints or anonymously, 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 (PHED) 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 Auditing and 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.