NON-TECHNICAL SUMMARY ESIA -RABIGH -IWP-4

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NON TECHNICAL SUMMARY

Background

This Environmental and Social Impact Assessment (ESIA) study for Rabigh -4 Independent Water Project 600 MLD Sea Water Reverse Osmosis Desalination Plant (Rabigh -4-IWP SWRODP) ESIA for the project has been prepared in compliance with the Appendix 2.4 of General Environmental Regulations and Rules for Implementation (GERRI, 2001) of NCEC -KSA and Equator Principles July 2020 -ESIA Guidelines (IFC Standards 2012). The environmental assessment study assures compliance with the regulatory requirements; identifies and analyzes sensitive components of the existing environment; determines the type, nature and importance of the probable environmental impacts during construction and operation; identifies and recommends practical effective mitigation measures; recommends a framework for an environmental management and monitoring plan for the Rabigh -4 Independent Water Project 600 MLD Sea Water Reverse Osmosis Desalination Plant (Rabigh -4-IWP SWRODP) Project; and ensures that all stakeholders deemed to be influenced by the projects or activities are fully considered.

Project Overview

ACWA Power Company (Saudi Listed Joint Stock Company), Saudi Arabia have commissioned the Environmental Balance Company to undertake an Environmental and Social Impact Assessment (ESIA) Study for the Rabigh -4 Independent Water Project 600 MLD Sea Water Reverse Osmosis Desalination Plant (Rabigh -4-IWP SWRODP) Project, Rabigh in conformity with Appendix 2.4 of GER-NCEC and Equator Principles July 2020 ESIA Procedure/IFC 2012; this project has been classified as category III and hence requires a comprehensive Environmental and Social Impact Assessment (ESIA) prior to commencement of the project execution. The main objective of this ESIA is to assess in advance the impacts from the construction and operation phases of the Rabigh -IWP 4 project and to identify mitigation and control measures.

This ESIA covers the construction and operation phases of the Rabigh -4 Independent Water Project 600 MLD Sea Water Reverse Osmosis Desalination Plant (Rabigh -4-IWP SWRODP) Project to meet the demand of Potable water service to, Makkah, KAEC Rabigh and nearby cities and townships due to progressive increased stress on existing Desalination Plants.

Project Description and Scope of Assessment

Saudi Water Partnership Company S.M.L.L.C (“SWPC”) have invited several multinational companies for tendering in respect of the potential development of an independent water project to

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be designed using reverse osmosis seawater desalination technology. The desalination plant will be located in Rabigh, 180 km northwest of Makkah, on the coast of the Red Sea in the Western Province of the Kingdom of Saudi Arabia (the "Project"). Power supply to the Project will be provided from the Saudi Electricity Company's high voltage network. The Project is to be constructed with a 600,000 m3/day potable water capacity and will include the desalination plant and all associated infrastructure and facilities.

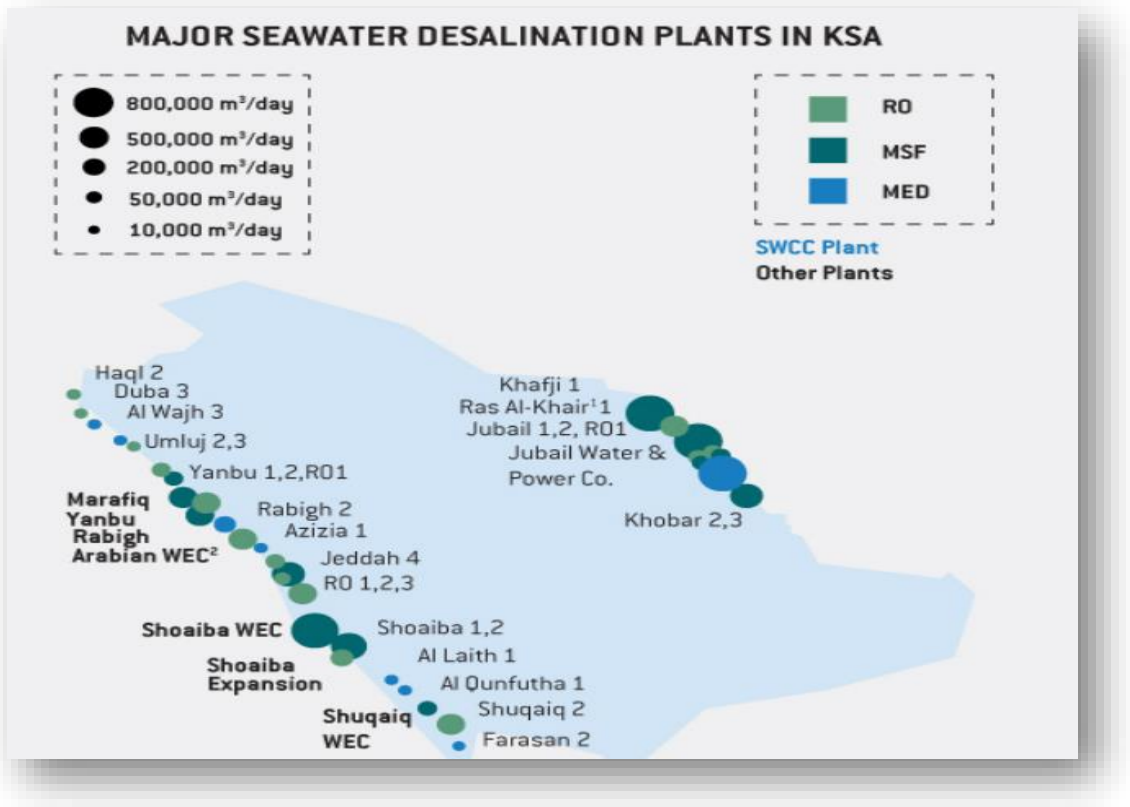

Figure : Desalinization Water supply in Saudi Arabia

In 2012, close to 1,545 mcm of desalinated water was supplied by public and private plants to major urban areas. The contribution of desalinated water to public supply has been increasing every year when compared to other sources (6 to 8 percent in the last two years). Percentages of desalinated water versus other sources supplied on each province are indicated in the following figure. Most notable are the Makkah figures, where public supply is based 100 percent on desalinated water. Two other provinces, Asir and Madinah, also rank very high in consumption of desalinated water, with 87 and 86 percent, respectively.

KSA TRANSMISSION SYSTEM OVERVIEW

Pipeliness	Length (Km)	Pumping Stations
Jubail-Riyadh Line (A.B)	932	7
Jubai - Riyadh (J)	375	5
Riyadh - Sudair - Washim - Qasim Lines	132.5	
Riyadh City Feeding Line	897	6
Al Ramah line	118	2
Ras al Khair Line	1,250	3
Al Shabiyah Lines	960	10
Yunbuh - Madinah Line	545	5
Al Shuqeiq (Assir) Lines	1,176.7	14
Eastern Region Lines	393	11
Royal commissio Jubail Lines	87.8	4
Al Khafji line	10	1
Al Kanfaza line	64	
Al Rabigh line	130	
Al Laith lines	102.8	
Al Fursan lines	2	
Total	**7,175.5**	**56**

Project objectives

The Rabigh -4-IWP SWRODP, a reverse osmosis desalination plant to be located in the Western Province, North of Jeddah City (180 Km) south of Rabigh City, will have a **water production capacity of 600,000 m^3/day** and will serve mainly Makkah, KAEC, Rabigh with potable water. The project will also include solar energy units to reduce power consumption from the grid, as well as water tanks with a storage capacity of one operational day.

Disciplines Scoped into the ESIA

Based on the outcomes of the Scoping process, and Information furnished by ACWA Power Company (Saudi Listed Joint Stock Company), and Environmental Balance Company's (EBC) Project understanding and considerations of potential impacts and effects, the technical disciplines that are scoped-in for consideration during the ESIA are summarized below.

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Discipline /Component	Scoped In (Yes/No)	Justification
Climate	No	The Rabigh -4-IWP SWRODP construction Works activities will be undertaken over a short period and the associated GHG emissions are not of a scale that is considered to have the potential to result in a significant effect on climate. However, the contractor has a Policy to reduce the GHG emissions during construction. There is a proposal to establish Solar plant to feed Rabigh -4-IWP SWRODP
Air quality	Yes	Generation of dust and emissions during Rabigh -4-IWP SWRODP construction works has the potential to affect the workforce. Operation of construction machineries such as excavators, barges, dredgers, vessels compressors and generators and the daily vehicle movements that will be required to transport the construction workers during Rabigh -4-IWP SWRODP construction Works has the potential to result in significant effects for the Rabigh Desalination Plant's community in the area.
Sound	Yes	Operation of construction machineries such as excavators, barges, dredgers, vessels compressors and generators and the daily vehicle movements that will be required to transport the construction workers during Rabigh -4-IWP SWRODP construction works has the potential to result in significant effects.
Geology and Soils	Yes	Some ground stability concerns for the Rabigh -4-IWP SWRODP construction works where identified and if not managed appropriately could result in significant effects.
Topography	No	Excavation, infilling and sea bed trenching for intake and out fall pipes will be undertaken which will not change the topography of the area. There are no on shore construction works which affects topography are involved
Surface Water	Yes	Storm water discharge, current movements may affect the water quality and if not appropriately managed could result in significant effects.
Groundwater	Yes	Potential impacts to groundwater by creating preferential pathways for contaminants, through modifying the discharges and recharges to the groundwater require assessment.
Terrestrial ecology	Yes	Site clearance activities will not cause loss of habitats and vegetation, there is no impact on flora is anticipated and if not managed properly could harm fauna as the area is vacant and the vegetation is too sparse

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Marine ecology	Yes	Marine works and intake and outfall pipeline in the sea will result in underwater sound, which could be harmful to marine species if not managed properly. There could also be some habitat loss and disturbance to marine fauna.
Social	Yes	Rabigh -4-IWP SWRODP construction Works will result in employment opportunities, as well as an influx of people into the area which would change the socio-economic status of the area and could lead to pressure on local services/resources, conflict and competition with the incumbent population.
Waste management	Yes	It is anticipated that solid and liquid waste will be generated during Rabigh -4-IWP SWRODP construction Works, which if not appropriately managed have the potential to result in significant effects.
Archaeology and cultural heritage	Yes	Rabigh -4-IWP SWRODP construction Works may have direct physical impacts on Archaeological remains and could lead to significant effects if not managed appropriately.
Landscape and Visual	Yes	Landscape effects associated with the Project would relate to changes to the, character and quality of the landscape resource, and how it is experienced. However, it is confined only to construction duration. This effect is temporary

Table :-Summary of significant impacts and proposed mitigation measures

Activity causing impact	Predicted Impact	Significance	Proposed Mitigation and Enhancement Measures	Residual Impact Significance
Dredging /Trenching for laying of Intake and out fall pipes	Direct removal of coral reef if any. (There are no live corals in the vicinity of Rabigh -4-IWP SWRODP area as observed during the survey)	Minor	• None required as there are no live corals in the vicinity of Rabigh -4-IWP SWRODP area	Not significant
	Carryover of silt plume from the dredging of sea bed laying of intake and outfall pipes	Moderate	• Method of dredging • Emphasis on using best available technology (BAT) • Use of Silt curtains to minimize spreading of silt plume • Best equipment and barge used in the operation	Minor

Activity causing impact	Predicted Impact	Significance	Proposed Mitigation and Enhancement Measures	Residual Impact Significance
			• Limit the volume of onshore reclamation and instead plan to use large volume inland productively, i.e., for land scape, land reclamation, and backfilling	
	Reduced water quality by increase in turbidity and reduced dissolved oxygen due to re-suspension of sediments	Substantial	• Daily and monthly Environmental Monitoring	Negligible
			• Avoid sensitive areas	
			• Avoid trenching activities where there is nearby aquaculture	
			• Use of appropriate geotextile curtains to control spread of sediments	
			• Use of silt curtain	
			• Proper planning and scheduling on the dredging and filling to avoid strong wind, current and tides that will further add to widen the effect of spreading of sediment	
			• Used of best available method	
			• Testing and analysing the water column at upstream and downstream from all the dredging activities	
	Water contamination during dredging and stockpiling of dredged material	Substantial	• Method of Dredging and reclamation	Negligible
			• Daily and monthly Environmental Monitoring	
			• Sampling of sediment and water of the dredging site to determine compliance with the NCEC/RC standards before and during dredging	
			• Dredging site to determine compliance with the NCEC standards before and during dredging	

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Activity causing impact	Predicted Impact	Significance	Proposed Mitigation and Enhancement Measures	Residual Impact Significance
			• Apply Construction environmental management and Monitoring plan (CEMP) and Dredging Environmental Management Plan	
			• Ensure that all necessary permits prior to dredging and filling works has been acquired by Dredging contractor	
	Impact of noise (surface/underwater) from equipment	Negligible	• High maintenance standard of equipment	Negligible
			• Installation of noise suppressors in all the equipment	
			• Provision of silencer and muffler	
			• Limit the hours of operation	
			• Apply health and safety and environment manual (HSE)	
	Air contaminants due to transporting and disposal of dredged materials	Moderate	• Watering of pavement to minimize dust	Negligible
			• Use of Personal Protective Equipment (PPE) as per health & safety guidelines	
	Potential over-spill from split barge that handles dredged material	Negligible	• Limit the capacity to avoid overloading	Minor
			• Good housekeeping	
			• Use of well-maintained barge	
			• Daily monitoring and inspection	
	Workplace hazard	Negligible	• Good housekeeping	Negligible
			• Applying and enforcing the company's HSE system	
			• Safe operation through the use of safety management	

Activity causing impact	Predicted Impact	Significance	Proposed Mitigation and Enhancement Measures	Residual Impact Significance
			• system, protective equipment daily site inspection and safety training	
Operation	Re-colonization build-up of benthic communities within the sea bed of Rabigh -4-IWP SWRODP area and adjacent areas.	Negligible	• No need for any mitigation	Positive Impact
	Socio-economic development	Negligible	• Local Saudi companies should be contracted to supply construction and operation goods and services wherever practicable. • Economic impacts of Rabigh -4-IWP operations are characterized by Rabigh -4-IWP SWRODP 's direct impact—that is, the number of jobs and labour income that are directly related to the Rabigh -4-IWP and its operations—and its employment and labour income multiplier effects.	Positive Impact
	Waste	Negligible	• Rabigh -4-IWP SWRODP Waste Management Plan	Minor

Rabigh -4 Independent Water Project (600 MLD Sea Water Reverse Osmosis Desalination Plant) construction Works Overview

The project includes as part of this scope of work the Potable Water Storage Facilities including potable water storage tanks designed for one (1) day storage capacity and all the necessary facilities (valves, pipes, overflow, etc.).

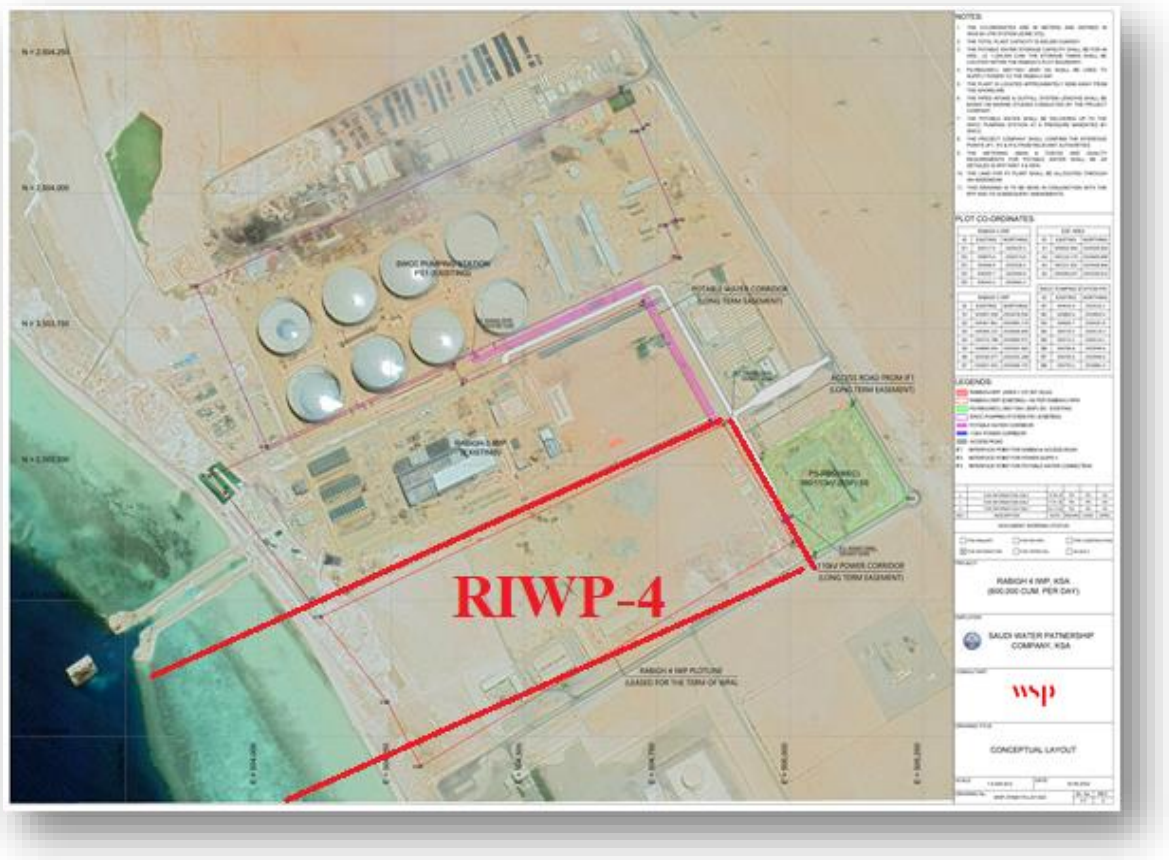

Figure – Allocated land area for Rabigh -4-IWP SWRODP

Project Alternatives

If no Rabigh -4-IWP SWRODP development occur there will be increased stress on the existing Desalination Plants due to progressive increased demand of potable water at Makkah for the pilgrims visiting from all over the world which is likely to create huge problems in KSA. The Rabigh -4-IWP SWRODP Project aims to conserve and protect the areas natural beauty through sustainable development mechanism and as result contributing to the realization of the Vision 2030. As such a 'No Project Alternative' option would not be in line with country's vision.

Description of the Environment

Air Quality

Background air quality monitoring data, was collected in May 2023 within the Project site and a reference location. The conditions can be generally described as follows:

- SO2, H2S, CO, NOx, O_3 and PM_{10} concentrations were all low with an average well within the NCEC air quality standards. The main sources of emission in and around the project area are from vehicles / vessel movement, desalination plants and the traffic near by the Rabigh -4-IWP SWRODP area.
- Monitored daily maximum PM_{10} concentration were below the daily and annual average NCEC air quality standards, because of site is open and covered by Rabigh 3 IWP and fencing in south. The site is flat and with hard soil.

Noise

Given the Urban nature of the Project area in KSA, there are notable sources of anthropogenic sound such as industrial facilities, busy traffic routes, or ports were identified. The main sound sources at the locations of Rabigh -4-IWP SWRODP construction works activities are therefore considered to be natural and anthropogenic noise generation. There are no other Noise sources

Geology & Soils

The predominant landforms at the proposed Rabigh -4-IWP SWRODP Project area could be Categorized as follows:

- Beach and dry and wet coastal sands
- Sand dunes
- Tidal flats

The Project area Soils and Geology is presented in detail in Section 5.0 Environmental Baseline of Rabigh -4-IWP SWRODP Project

Hydrogeology

A hydrogeological and hydro chemical study showed that a shallow alluvial aquifer, in western Saudi Arabia to assess the influence of protection measures on groundwater quality. The hydrochemistry was assessed up-gradient and down-gradient from potential contamination sources in the main city in dry and wet seasons prior to and after the installation of major drainage and wastewater facilities.

Terrestrial Ecology

Fauna

As the area is currently developed for Desalination Plant complex and ecologically disturbed due to the ongoing anthropogenic activities, there is no major faunal occurrence was found in the area. The presence of animal burrows indicates reptile activity in the area, there were no wild / domestic fauna was observed during the surveys. It seems that animals have migrated from this area.

Flora

There is no diverse and abundant natural vegetation found at Rabigh -4-IWP SWRODP. The existing plant communities observed near Rabigh -4-IWP SWRODP Project area during Terrestrial Ecological survey were small herbs were found occupying 5% Rabigh -4-IWP SWRODP

Marine Ecology

The Rabigh -4-IWP SWRODP will be one of the man-made areas breaking the continuous fringing reef. The present project of the drawing sea water converting to fresh water will play an important role in the Saudi national economy taking into consideration the necessity of making a balance between environmental conservation and economic development. However, Saudi Arabia has been making a lot of efforts to make this balance between environmental conservation and economic expansion through strengthening the legal and institutional basis for coordination and implementation of necessary economic expansion in a sustainable manner.

The project site is devoid of coral reefs and the reef fishes observed at the site were reef fishes that occasionally visit the area searching for food, but not permanent dwellers of the area. The conditions of turbidity and previous development made the area unfavorable for coral growth and concentration of reef organisms with the exception of very few invertebrates seen at the sampling sites. However, water and sediment samples did not show any signs of pollution as indicated by the analytical results conducted at NCEC Certified Laboratory.

Social

Socio Economic Effects Assessment

In order to assess the potential social and economic impact due to the construction and operational phases of Rabigh -4-IWP SWRODP Project, the following monitoring and survey activities are conducted during the study period.

Assessment of Project skill requirement in relation to Local Skill Availability

Rabigh -4-IWP SWRODP Project will generate employment opportunities that will influences territorial and local labour market. To fulfill the possible demands of labour and suppliers the

surrounding territorial area will response. From socio-economic point of view this is a positive improvement of social as well as labour market.

Employment and Regional Economic Effects

Rabigh -4-IWP SWRODP Project will generate a number of jobs scopes as well as the economic activities that will increase people's procurement power. The local and regional demand and supply will get forces. The employment opportunities from the Rabigh -4-IWP SWRODP Project will influences territorial and local labour market. To fulfill the possible demands of labour and suppliers of goods and services the surrounding territorial area will response. Due to water supply from Rabigh -4-IWP SWRODP, new settlement and industries in the region will increase gradually. Mainly adequate water supply will be for the pilgrims to Makkah. The positive social and economic impact is expected from the Rabigh -4-IWP SWRODP Project establishment.

Demography

Rabigh -4-IWP SWRODP Project will generate attractable economic benefits that will affect community populations. It is expected that existing birth and death rates will be improved due to improvement of infrastructures and healthcare provider. All aspects of field the project will create demands for labour and local business opportunities, and thus tend to encourage migration to regional and other centers of business activity.

Residential

Rabigh -4-IWP SWRODP Project effects on housing and accommodation will include direct and indirect demands for short- and long-term accommodation. There is no short-term accommodation effect because the project is providing housing for its employees. However, effects on housing are expected to be adverse in the Rabigh & Makkah area because of less housing is available there. Table below shows expected housing effects. These effects are expected to be low magnitude, because it is expected that the local housing business sectors will generate sufficient quantity of housing facilities.

Summary

A summary of the key impacts, associated with social and economy for the Rabigh -4-IWP SWRODP Project are provided in below. The potential overall impact includes impacts that would arise in the construction phase and in the operational phase of the Rabigh -4-IWP SWRODP Project.

Potential Impact	**Nature of Impact** (Permanent or Temporary) (Direct or Indirect)	**Significance** (Major, Moderate or Minor) (Positive or Negative)	**Mitigation / Enhancement Measures**
During the construction and operational phase of the Rabigh -4-IWP SWRODP Project is likely to benefit the local economy in terms of the provision of water supply to the Rabigh area	Permanent	Major Positive	• No Mitigation Measures Required
The potential impacts from the presence of worker, like housing pressure on local area, and resources.	Temporary	Minor Negative	• The assessment has identified the lack of local provisions, in the form of housing, school facilities, because work force which are likely to have families. • It is expected the housing provision for the area will be solved by local business immediately.
The potential impact of the Rabigh -4-IWP SWRODP Project operations on social health and safety (Ships Idle)	Temporary	Minor Negative	• the implementation of appropriate measures as part of the Health, Safety and Environment Management Plan during the operational phase of the Rabigh -4-IWP SWRODP plant will ensure that occupational health and safety risks are minimised
Noise	Temporary, Direct	Minor Negative	• Application of best practicable means

Archaeology

During the surveys undertaken in March 2023 -April 2023 for archaeological and cultural heritage sites near to the Rabigh -4-IWP SWRODP site none were recorded. No impacts are anticipated.

Indigenous Communities

There were no Bedouin communities existed around 10 kms of the Rabigh -4-IWP SWRODP sites. There is no displacement required.

Land Ownership.

The land for Rabigh -4-IWP SWRODP belongs to SWPC. There is no requirement of acquisition of land for Rabigh -4-IWP SWRODP

Landscape & Visual Amenity

The landscape will not be impacted due to Rabigh -4-IWP SWRODP construction works. But the cranes, construction equipment, will affect the land scape which is temporary in nature.

Potential Impacts

Climate Change

Due to the short duration nature of activities associated with the Rabigh -4-IWP SWRODP construction works and the associated GHG emissions have a moderate at a scale considered to have less significant effect on climate. M/s ACWA Power submitted Guaranteed Air emissions which is presented in Volume 2 B of the submittals

Air quality

Emissions from onsite and offsite construction plant and vehicles: Onsite plant and vehicles and offsite vehicles will generate emissions of NOx/NO2, PM10, PM2.5, SO2, CO and VOCs within the vicinity of the Rabigh -4-IWP SWRODP Construction site. Currently the air quality is fine and requires regular monitoring during the construction duration.

Noise

Predicted construction noise levels are below 44 dB LAeq, 1h at all receptors, which is considered negligible impact during both daytime, evening and night-time periods. The Rabigh -4-IWP SWRODP construction s programme is envisaged to be 32 months and as such any noise impacts might not be significant, be of a temporary nature and have no lasting residual impact. However, any increases in road traffic noise levels during Rabigh -4-IWP SWRODP construction will be temporary, short term, and although the effect will be dependent on the actual number of traffic movements, it is

considered that adverse effects can be managed and avoided. The equipment should be maintained properly and adhere to KSA –NCEC standards

Geology

Both, construction and operational phases impacts of the project were assessed as a negligible effect. For the Project the vast majority of the potential residual effects identified for soils and geology, if realized, would occur at discrete locations and not continually or extensively across the Rabigh -4-IWP SWRODP Project and are therefore unlikely to have an overlapping zone of influences.

Hydrology

In general, the significance of residual flood risk related impacts is negligible. Cumulative impacts on the storm water systems might occur if more than one rainfall event occurs within a short timeframe or if regular maintenance procedures are not conducted adequately. In general, the significance of residual impacts caused by water utilities impacts is negligible. Storm water discharge is infrequent and for a limited duration. The impact would be local and not very severe; however, impacts could have a lasting effect. M/s ACWA power's EPC Contractor will develop a storm water management Plan and implement during construction and Operation.

Terrestrial Ecology

There are no ecologically important habitats within the Rabigh -4-IWP SWRODP site boundaries which may be directly or indirectly impacted by the proposed Rabigh -4-IWP SWRODP construction works. The mitigation measures during construction will include translocation of any fauna encountered and control of light and noise impacts to sensitive coastal habitats for marine fauna.

Marine Ecology

Due to Rabigh -4-IWP SWRODP being both onshore and off shore with few near shore activities the significance of impacts to the marine environment at this stage is considered Moderate to minor. Caution in the proximity of defined buffer areas to the shoreline must be considered as general disturbance, noise, vibration and lighting in these areas can still impact on the marine fauna.

Social

Socio-economic benefits of the project to the region are good at this Rabigh -4-IWP SWRODP Construction stage which provide benefits from employment opportunities and improved infrastructure opening further opportunities for increased capital expenditure and associated economic effects. With employment opportunities attracting workforces from other parts of KSA and

beyond brings with a range of potentially negative impacts as well as general disturbance and disruptions to movement patterns.

The project is located in an isolated area designated only for Desalination and Power plants R-IWP-3 and RO-1 where there are no communities existed. There is no requirement of resettlement.

Waste

Given the commitments to minimize, reuse and recycle the demand on existing waste management infrastructure is considered negligible. Detailed and specific controls on waste separation and storage need to be included in the specifications for all contractors and monitored throughout construction to ensure targets are met. Spoil material from excavation will be used for fill and it is expected a deficit of material is likely through further phases of the project. Spoil areas will require specific management procedures to ensure wind erosion is limited.

Flood risks:

The history of flood events reveals that there was a flood event in 2009 at Jeddah- Yanbu Highway near Rabigh which did not affect the R-IWP area. However, M/s ACWA power's EPC Contractor has to prepare a Flood Risk Assessment Study /Storm Water Management plan before the construction works and implement it during Construction and Operation.

Archaeology

It is not expected that any superficial or buried archaeological sites within the study area which classed according to IFC criteria as 'replicable cultural heritage' (IFC, 2012), If found during construction it can be mitigated by appropriate archaeological investigation, recording and dissemination undertaken in line with national guidance and international best practice. This should be agreed in discussion with and approved by, Saudi Commission for Tourism and National Heritage, as well as other relevant stakeholders in advance of construction, work being undertaken.

Landscape and visual

Views from Jeddah -Yanbu Highways towards the Project activities would be partially screened and restricted by intervening scenic views within the expansive views. On balance it is considered that the magnitude of change on users of these Highways would be of low significance, and minor.

Cumulative Impact

The M/s ACWA power's EPC Contractor Impact assessment spatial and temporal scope is limited to a short period of low impacts terrestrial temporary construction works only. Given this, it is not anticipated that any significant cumulative impacts would occur during this period.

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Mitigation

A number of key mitigation measures are prescribed in this study that allows the residual risks to be minimized to a large extent. These mitigation measures are transcribed to the CESMP and monitoring throughout the Rabigh -4-IWP SWRODP construction Works is required to determine the effectiveness of these measures to achieve the necessary Project targets.

Stakeholder Engagement

Stakeholder engagement that has occurred to date is presented in this ESIA process, between EBC, M/S ACWA Power Company and respective stakeholder groups.

ESIA process stakeholder engagement has many benefits as it allows transparency in decision-making, good relations with host communities and it often builds a positive reputation for the developer nationally and potentially internationally.

- Ministry of Environment Water and Agriculture (MEWA)
- Ministry of Transport
- Ministry of Finance
- Municipality of Rabigh
- NCWCD/National Center for Wild life
- NCEC
- Saudi Geological Survey
- Coast guard
- Ministry of Interior
- Saudi Commission for Tourism and National Heritage (SCTH)

Conclusion

ACWA Power Company Construction works by nature are limited in temporal and spatial scope. Key impacts result from on shore Environment and marine ecology natural habitat areas and Sea water Quality. With the appropriate presented measures in place, these impacts can be adequately mitigated or offset. Careful consideration in terms of ACWA Power Company –EPC contractor M/S ACWA Power Company site management and practices will ensure these receptors are protected. Specific site training and Tool Box Talks by competent experts will be needed. This forms a key part of the Framework CESMP.

Although setbacks are in place, these are largely for design. Appropriate measures will need to consider for noise and light spill impacts on bordering marine sensitive habitats for turtles. It is

recommended that a marine/terrestrial ecologist is consulted in the development of the associated construction management plans for these issues. Consultation with the SCTH should be taken place and further consultation is needed to agree and define measures to mitigate and manage potential archaeological features of the project. The project entails numerable positive impact benefits which include the socio-economic through alignment with national and regional development plans (Vision 2030) general investment, employment and environmental conservation.

Recommendations

During Dredging/excavation fine sediments are likely to be released into the water column during the dredging/trenching of intake and outfall pipe routes and stockpiling of excavated material until the installation of pipelines. These will be transported by the waves and currents and makes large amount of water turbid. Due to waves and currents this may dispersed to a quite long distance deposited onto live coral reef (if any) under certain environmental conditions which are far away from the Rabigh -4-IWP SWRODP. The turbid water reduces light penetration and resulting in reduced photosynthesis which is detrimental to phyto planktons. The sediments will be suspended; either partially or fully and dispersed over a substantial area due to magnitude of the sheer stress of waves and currents. It is highly recommended that silt curtains and geotextiles to be used, which will form as a physical barrier to the transport of fine sediments. The use of best equipment and barges will also minimize this impact dramatically. Timing is also playing an important role in controlling the transport of sediments as the impact will multiply when the waves are strong. Complete mitigations are discussed in the respective sections of this ESIA study. The sediment quality is fine and well below the NCEC and RC Standards. There is a possibility of increase of Turbidity during the dredging operations. In view of the above findings, proper protective measures need to be carried out during the days of operation, to settle down the exceeding TSS within short distances of dredging. Similarly, for on shore works the Air pollution and Noise mitigation plans of CESMP (Volume 3 of this ESIA –Standalone document) required to be implemented.

Silt Curtains (Sand Bags /Geotextiles)

Silt curtains are vertical barriers positioned within the water to contain fine material (sediment) introduced into the water column by dredging or other engineering construction activities. A definition of a silt curtain is “A floating geotextile material which minimizes sediment transport from a disturbed area adjacent to or within a body of water” (USACE, 2007).

The principal purpose of a silt curtain is to provide a barrier from the water's surface to the required depth; in most cases this will be the seabed, but in deeper waters this may not be possible. This barrier aims to prevent the fine-grained suspended material from migrating by advection and diffusion from the point of generation at the work site and into the wider environment. This fine-grained material may reduce water quality and impact upon sensitive receivers in the vicinity of the work site area. Sensitive receivers in this context may be ecology that is sensitive to light attenuation and / or sediment deposition, for example mangroves, corals, sea grass and cockles which are not existed in Rabigh -4-IWP SWRODP site. Some regard silt curtains as primarily an aesthetic measure with limited practical value. In some instances, the use of silt curtains does result in appreciable visual differences between low turbidity 'background' water on one side of a curtain and turbid water generated by dredging on the other. These very distinct visual differences may truly reflect a significant reduction in turbidity via the use of the curtain or the difference between inside and outside the curtain may be very limited when the whole of the water column is considered, particularly if the curtain does not extend all the way to the seabed or it is poorly maintained.

Retention Ponds

A retention pond, sometimes called a "wet pond," has a permanent pool of water with capacity above the permanent pool designed to capture and slowly release the water quality capture volume. The pond acts as a collector to trap sediment from seeping into the sea, and degrades the environment for birds, fish and other wildlife.

Continuous Water Quality Monitoring

The objective of marine water quality monitoring is to list out the changes in the water quality during the dredging of sea bed for laying of intake and outfall pipelines and use the results in planning the respective operations.

During the construction phase, an environmental monitoring and audit programme should be implemented in accordance with the procedures and requirements in the Project Monitoring Report and the relevant legislations to address the potential water pollution generated by the dredging and laying of intake and outfall pipeline and associates installation activities. An Environmental Team from M/s ACWA POWER Saudi Arabia shall be employed to carry out the monitoring and audit works.

M/s ACWA POWER Saudi Arabia Environmental Team will:

- Undertake an Environmental Monitoring programme during the construction phase of the Project;
- A third party independent Environmental Consultant should be appointed to conduct Environmental Audit
- Carry out regular environmental monitoring and audits, and ensure that environmental mitigation measures recommended in the Contract Specifications are enforced;
- Implement corrective actions and other mitigation measures to reduce impacts where environmental non-compliance findings are identified in the course of the regular EM&A and other inspections; and,
- Preparing monthly environmental monitoring and audit report and submission to NCEC to obtain their approval.

In accordance with the requirements of the project monthly report, water quality sampling stations have been established around the Rabigh -4-IWP SWRODP off shore dredging areas. The frequency of the routine water measurement and sediment sampling will depend upon the site activities, environmental variations and the requirements of NCEC during the construction period. However, it will be at least once a week in the beginning. Water samples at identified station at mid depth shall be collected and analyzed for the water parameters. Measurements should be taken using a portable, laser monitoring water meter. NCEC certified laboratory should be employed for full suite of physical-chemical and biological analysis. The analytical methods shall be explained through the reporting procedure and each sample shall have a chain of custody that shall be available for auditing purposes should the need arise.

Habitat Monitoring

Seawater Monitoring: Periodic Sea water monitoring is recommended every Month during the off shore construction phase. The samples should be collected from the marine survey locations near the work site and analyzed against NCEC's receiving water guidelines.

Marine Habitat

- Periodic marine surveys are recommended at sites where sea grass and algae have been recorded to monitor any changes as a result of the construction activities. At least once in a month.

- Quarterly environmental audits are recommended to ensure the project is carried out in compliance to applicable requirements. Audit criteria include the recommendations in this report and requirements specified by the NCEC guidelines.
- The audit reports along the monitoring data above should be submitted to NCEC.

Underwater Noise and Vibration Monitoring

Noise

There is a possibility of increase in Noise level during the piling activities for the dredging/excavation of intake and outfall pipeline routes and installation of intake and outfall pipes; Care should be taken to avoid the dispersion of underwater noise which may affect the marine fauna by implementing the underwater noise barriers

According to all the studies and legislative trends, the impact of anthropogenic noise during dredging needs to be monitored and presumably reduced. In this contribution, a methodology to estimate the impact of dredging is established. The measurement set up and the data processing shall design and successfully employed to provide received levels at different depths and distances from the source. A virtual image propagation model that considers source and receiver depths, sea depth and salinity, water and seabed density, and sound speed in both the water and in the sediment, should programmed to estimate the propagation losses, and adjusted to fit the measured levels at various distances from the source. Finally, estimations of the source levels should obtain, that can be used to analyze different operation modes of the dredger/excavator, as well as areas affected by the noise it produces.

Coral Reefs

Within the Red Sea, arrays of anthropogenic impacts have left their mark on the integrity and productivity of marine ecosystems with once complex marine habitats now reduced to rubble. During recent decades, extensive areas of benthic habitat in the Red Sea have been decimated, not only by intense land reclamation and dredging activities, but also as a result of destructive and illegal fishing practices. During the survey Rabigh -4-IWP SWRODP it was observed that there are no live corals existed.

Environmental Monitoring during construction phase of Rabigh -4-IWP SWRODP works

To accumulate relevant data during dredging of sea bed for laying intake and out fall pipes, M/s ACWA POWER and Saudi Arabia ‘s Environmental Consultant and their environmental staff shall witness such activities and record the data by using “Environmental Monitoring Report”. This collected information shall be used to create an overall Monthly Environmental Report that will be

produced by M/s ACWA POWER's Environmental Consultant and submitted to NCEC for their review and approval.

SECTION 17. OF ESIA CLIMATE CHANGE AND GREEN HOUSE GASES

SECTION 17. CLIMATE CHANGE AND GREEN HOUSE GASES

17.1 Introduction

This chapter describes the assessment outcomes of the potential impacts of the Project on the climate and its contribution of greenhouse gases (GHG) to the atmosphere.

The scope of the assessment of impacts is defined in section 5 ESIA Methodology concluding the following impacts are scoped in for assessment:

Construction Phase:

- GHG from on-site power generators, heavy machinery and vehicle/vessel movement
- GHG from embodied carbon through material extraction and manufacturing processes

Operational Phase:

- GHG from vehicle/vessel movements
- GHG from wastewater treatment and water supply
- GHG from waste management

GHG from maintenance of buildings and infrastructure assets

- Impacts to the Project powered by climate change

In line with the IEMA guidance (2015 and 2017); this assessment looks at the Lifecycle greenhouse gas (GHG) impact - the impact of GHG emissions arising from the Project on the climate during the lifecycle stages within the scope of the assessment

17.2 Legislative Framework

This section outlines the international and national standards relevant to the climate change assessment. These standards and guidelines have been used to identify appropriate methodologies, receptors, environmental impacts and relevant mitigation measure.

17.2.1 International Standards

17.2.1.1. The Equator Principles Version 4 (EP4)

The Equator Principles (EPs) are a risk management framework adopted by financial institutions for determining, assessing and managing environmental and social risk in projects. Currently, over 100 EP Financial Institutions (EPFIs) in 38 countries have officially adopted the EPs. The effective date for EP4 on all mandated transactions will be 1 July 2020 (Equator Principles, 2020).

The EPFIs will only provide financing to projects that meet the relevant requirements of Principles 1 to 10. The requirements of the principles of direct relevance to the Project are described below:

- P2 – Environmental and Social Assessment – Category A and, as appropriate, Category B projects53, as defined using the IFC environmental and social categorization process (IFC, 2020), will be required to undertake an environmental and social risk assessment, the documentation of which must include an ESIA.
    - *A Climate Change Risk Assessment is also required for "all Projects, in all locations, when combined Scope 1 and Scope 2 Emissions are expected to be more than 100,000 tonnes of carbon dioxide equivalent (tCO2e) annually. Consideration must be given to relevant Climate Transition Risks (as defined by the TCFD54) and an alternatives analysis completed which evaluates lower Greenhouse Gas (GHG) intensive alternatives."*

(According to the EP4, "there can be a range in the scale of potential environmental and social risks and impacts within Projects classified as Category B. In general terms, higher risk Category B Projects will be treated similarly to Category A Projects, and lower risk Category B Projects could be treated in a lighter regime. The EPFI shall, at their own discretion, determine the appropriate level of Assessment Documentation, review, and/or monitoring required to address these risks and impacts in accordance with Principles 1-10.")

- P4 - Environmental and Social Management System and Equator Principles Action Plan - For all Category A and Category B Projects, the EPFI will require the development of an Environmental and Social Management System (ESMS) and of an Environmental and Social Management Plan (ESMP) to address issues raised in the assessment process, incorporating actions required to comply with the applicable standards.

17.2.1.2 Paris Agreement

The central aim of the Paris Agreement, published by the United Nations Framework Convention on Climate Change (UNFCC), is to facilitate a global response to the threat of climate change and to keep global temperature rise this century well below 2ºC above pre-industrial levels (UNFCC, 2015). A more ambitious aim within the Paris Agreement includes limiting the temperature increase even further to 1.5ºC.

17.2.1.3 Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance

In the absence of any widely accepted guidance on assessing the significance of the impact of GHG emissions, guidance published by IEMA in 2017 has been followed as it provides a framework for

taking GHG emissions into account in the ESIA process (IEMA, 2017), in line with the 2014 European Union (EU) Directive (Directive 2014/52/EU; European Union, 2014). The guidance sets out how to:

- Identify the GHG emissions baseline in terms of current and future emissions;
- Identify key contributing GHG sources and establish the scope and methodology of the assessment;
- Assess the impact of potential GHG emissions and evaluate their significance; and
- Consider mitigation in accordance with the hierarchy for managing project related GHG emissions - avoid, reduce, substitute, and compensate.

17.2.1.4 Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation

IEMA guidance has also been followed as it provides guidance for taking the impacts of climate change in to account within the project design (IEMA, 2015). The guidance sets out how to:

- Define climate change concerns and environmental receptors vulnerable to climate factors;
- Define the environmental baseline with changing future climate parameters; and
- Determine the resilience of project design and define appropriate mitigation measures to increase resilience.

17.2.2 National Standards

17.2.2.1 Saudi Vision 2030

The Saudi Vision 2030 highlights the importance of moving towards a greater uptake of renewable energy production and use and outlines an initial target of generating 9.5 gigawatts of renewable energy by 2030 (KSA, 2016a).

17.3 Spatial and Temporal Boundaries

The spatial study area covers direct GHG emissions arising from activities undertaken within the Project boundary during the construction and operation of the Project. It also includes indirect embodied emissions within construction materials, arising as a result of the energy used for their production, including extraction, processing, manufacture and transportation.

The temporal study period is the next 60 years up to 2080. However, no emissions inventory projections or Paris Agreement targets are available beyond 2050 within the Climate Action Tracker (Climate Action Tracker, 2019).

17.4 Baseline

This section describes the baseline environmental characteristics for the Project and surrounding environment with specific reference to GHG emissions and climatic conditions.

17.4.1 Lifecycle GHG Impact Assessment

This is a business as usual, or 'do-nothing' scenario, whereby the Project is not consented, for those lifecycle stages within the scope of the assessment, outlined in section 17.7.1. The quantity of GHG emissions would, therefore, remain unchanged from the current level.

As the current land use of the site is undeveloped land, and there is currently no consented development within the site boundary, the baseline emissions for the lifecycle GHG impact assessment are zero.

17.5 Receptors

Based on a review of the baseline conditions, the global climate is the receptor for the lifecycle GHG impact assessment. The sensitivity of this receptor is high, in line with the IEMA guidance (IEMA, 2017) that highlights the importance of mitigating GHG emissions to reduce the impacts of climate change.

17.6 Impact Assessment and Mitigation

In line with the World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI) GHG Protocol guidelines (WBCSD & WRI, 2004), GHG emissions are reported as tonnes of carbon dioxide equivalent (tCO_2e), which takes into account the seven Kyoto Protocol gases:

- Carbon dioxide (CO_2).
- Methane (CH_4).
- Nitrous oxide (N_2O).
- Sulphur hexafluoride (SF_6).
- Hydrofluorocarbons (HFCs).
- Perfluorocarbons (PFCs).
- Nitrogen trifluoride (NF_3).

Where activity data has allowed, expected construction and operational GHG emissions have been quantified using a calculation-based methodology as per the following equation.

- *Activity data x GHG emissions factor = GHG emissions value*

A combination of following relevant emissions factors have been used for the purpose of this assessment:

- UK Department for Environment, Food and Rural Affairs (DEFRA) and the Department of Business, Energy and Industrial Strategy (DBEIS) (DEFRA & DBEIS, 2019) GHG reporting conversion factors;
- Embodied carbon benchmark data from the RICS Global Methodology to Calculate Embodied Carbon (RICS, 2012); and
- EU Commission guidelines for the calculation of land carbon stocks (EU Commission, 2010).

17.6.1 In-built Design Mitigation

In-built mitigation has been factored, where possible, into the CO_2e emissions values presented below. However, while carbon offsetting will be undertaken in line with the Net Zero Carbon requirement. As a result of the uncertainty around the specific approach at this stage, this assessment includes all emissions prior to carbon offsetting, and therefore presents a worst case scenario.

17.6.2 Assessment of Impacts

17.6.2.1Greenhouse Gas (GHG) Emissions
Construction Phase

The primary GHG emissions sources and the breakdown of the calculated GHG emissions during construction are shown in Table 17-1. A number of assumptions regarding construction GHG emissions, embodied carbon and carbon sinks have made with detailed construction methods and landscaping plans not being fully developed at the time of this report. These are noted here:

- No estimates for energy and fuel use, material transportation, waste transportation and disposal have been developed for the construction stage. Emissions associated with these activities have therefore not been quantitatively assessed. These aspects have instead been considered qualitatively and it is anticipated that their exclusion will not have an impact on the overall outcome of the assessment.
- The vegetation in Rabigh -4-IWP SWRODP is too sparse.
- There are no specific carbon factors available for embodied carbon, vehicle use, water use, and waste disposal specific to KSA. The RICS embodied carbon benchmark (RICS, 2012) and various emissions factors used (DEFRA & DBEIS, 2019) are based on UK construction and energy use data. While they will not directly represent the embodied carbon emissions associated with processes within KSA, they provide a reasonable indication. It is not

anticipated that any inaccuracies inherent within these factors will affect the outcome of the overall assessment.

- The construction workers have been assumed to be transported 1km from their accommodation to the site by Bus and cars each day. The emissions factor for Bus/Cars has been applied, accounting for WTT losses.
- The emissions factors applied are outlined below:

Table 17-1 Construction GHG Emissions

Project Activity/Emissions Source	Annual Emissions (tCO2e)
GHGs from on-site power generators, heavy machinery and vessel/vehicle movements	485
Worker transportation	29
Trenching in the Sea transportation	456
Embodied carbon	**6880**
Total	**6982**56

**The total may not equate to the sum of the emissions reported due to rounding of the decimals*

The overall construction emissions equate to approximately 6981tCO2e over the 30 Months construction period of the Project between 2023 and 2025, resulting in 3491tCO2e emissions annually. (The calculation is approximate based on the example of a Desalination Plant equivalent to Rabigh -4-IWP SWRODP capacity. This may slightly varies with the equipment and Technology, energy source etc.) EBC requested ACWA POWER to provide the list of equipment and the Green House gas emissions

Table 17-2 Impact Assessment for the Lifecycle GHG Emissions during Construction

Impact	Project Phase	Impact Magnitude Ranking	Receptors Sensitivity Ranking	Impact Significance	Residual Impact
GHG emissions from on-site power generators, heavy machinery and vessels/vehicle movements	Construction	Low	Low	Minor	Minor
GHG emissions from embodied carbon through material extraction and manufacturing processes	Construction	Low	Low	Moderate	Minor

Mitigation:

Enhance:

- Changes in current land use through landscaping and golf course will positively impact on carbon sinks. Of course, this enhancement must be assessed in conjunction to the impact on natural habitats and species but where these areas can be mutually beneficial these should be strengthened and maximized.

Avoid:

- The choices of materials and products to be used should be reconsidered through the design development and procurement strategies, particularly in terms of embodied carbon and lifecycle GHG.

Minimize:

- As quantification details emerge, these should be tested against the assumption made in the section as it is critical to the assessment of the carbon offset projects and the commitments made by M/S International Company for water and power projects – (ACWA Power) KSA to net zero carbon.

The circular economy principles must be embedded in procurement.

Operational Phase

In accordance with the EP4 climate risk management framework the following Green Element (2017) definitions of scope 1, scope 2 and scope 3 climate change emissions have been applied in this assessment:

Scope 1 – **All Direct emissions** from the activities of an organization under their control. This includes fuel combustion on site, from owned vehicles and fugitive emissions.

Scope 2 – **Indirect emissions** from electricity purchased and used by the organization.

Scope 3 – **All other indirect emissions** from activities of the organization, but those occurring from sources they do not own or control, including emissions associated with business travel, procurement, waste and water.

The primary GHG emissions sources and the breakdown of the calculated GHG emissions during operation is shown in Table 17-3. A number of assumptions regarding operation GHG emissions have had to be made due to the lack of detailed operational plan information. These are noted here:

- It has also not been possible to quantify GHG emissions associated with building and infrastructure maintenance during operation due to data limitations at this stage of the design. This aspect has instead been considered qualitatively in section 19.6, and it is not anticipated that this exclusion will have an impact on the overall outcome of the assessment.

For operational vehicle use, the following assumptions have been made:

- Organic waste is assumed to be composted, while residual waste is assumed to be sent to landfill. For mixed recycling, an average emissions factor for the recycling of glass, metal, plastics and paper/board has been applied.

Table 17-3 Operation GHG Emission

Project Activity/Emissions Source		Annual Emissions (tCO2e)
Vehicle journeys	37 105	4123
Waste disposal	528	44
Water use		718
Total		3674[57]

The operational GHG emissions from vehicle journeys, waste disposal and water use equate to approximately 3674tCO2e annually . Exact data has been requested by EBC from ACWA POWER

Avoid:

The choices of materials to be used should be reconsidered through the design development in particularly in terms of embodied carbon, this is a commitment that emanates through M/S International Company for water and power projects – (ACWA Power) KSA choice to embody Green Building and Sustainability Benchmark requirements in their operations.

Minimize:

As quantification details emerge, these should be tested against the assumption made in the section as it is critical to the assessment of the carbon offset projects and the commitments made by M/S International Company for water and power projects – (ACWA Power) KSA to net zero carbon.

The circular economy principles must be embedded in procurement.

Table 17-4 Contribution of the Rabigh -4-IWP SWRODP Operational GHG Emissions to KSA's Emissions Inventory (Approximate figures)

Project Phase	Relevant Reporting Year	Annual Emissions Inventory (tCO2e)[58]	Annual GHG Emissions for Reporting Year (tCO2e)	% of Emissions Inventory
Construction	2022	563 333 33	6982	0.00077

Operation	2024	407 500 00	3674	0.00045

17.7 Conclusions

Approximate GHG emissions associated with the construction phase equate to approximately 6981CO_2e over the 30 months construction period of the Project between 2023 and 2025, resulting in 3491tCO_2e emissions annually. Annually, operational GHG emissions equate to approximately 3674tCO_2e.

When these GHG emissions are contextualized using KSA's emissions inventory, they account for 0.00077% of annual emissions during the construction phase (2023), and 0.00045% of annual emissions during operation (2025).

Although many assumptions have been made regarding fuel use, transport of waste and materials as well as infrastructure maintenance, once further information becomes available these assumptions must continue to be checked to ensure that the commitments to zero carbon operational energy are upheld.

As construction and operational GHG emissions equate to less than 0.1% of the annual national emissions inventory for KSA, and Scope 1 and Scope 2 emissions are below the threshold of 100 000tCO_2e per annum, the magnitude of impact is low and therefore the construction and operational GHG impact is of minor adverse significance, both in the context of KSA's national emissions inventory and in terms of Scope 1 and Scope 2 emissions arising from a single development.

As the GHG emissions are of minor adverse significance, no additional mitigation and monitoring is required during the construction or operation of the Project.