9. SUMMARY OF ENVIRONMENTAL IMPACTS

9.1 INTRODUCTION

9.1.1 Table 9.1 summarises the impacts that have previously been identified, the key mitigation / control measures and the significance of the resulting (residual) impacts. This Table builds on and expands Table 4.1 – Potential Environmental Impacts. An equivalent Table summarising the social impacts of the Project can be found in Appendix G.

Table 9.1 – Summary of Impact Significance Assessment

Ref No	Activity / Source	Aspect	Potential Impact[a,b,c]	Mitigation / Control Measures	Residual Impact Significance	Comments
Typical Operation (main activities)						
1	Operation of Qatalum Project main plant	SO_2, NOx, HF, PM_{10}, PAH	Degradation in air quality – impacts on human health.	Through design (e.g. LNBs for power plant and furnaces, selection of pre-bake, open furnace technology for anode production, efficient off-gas collection systems, waste heat recovery for gas turbines etc.). Use of gas treatment systems (e.g. RTO for Paste Plant, dry scrubber systems for Bake Plant and Al Plant, seawater scrubber for Al Plant, baghouse for dust generating operations, oil scrubber for pitch storage etc.) Use of gas as fuel (rather than oil). Good operational and process optimisation controls, regular maintenance and testing. A regular emission monitoring programme will be put in place (see Table 8.1). Development and implementation of site specific EMS. See Table 8.1 and Sections 3.11 / 3.12 / 3.15 for full details.	NOx, PAH, HF: **Negligible** SO_2: **Negligible** (at residential receptors) to **Minor** (in the vicinity of the fenceline) PM_{10}: **Moderate**	PM_{10} emissions are only considered to have a "**Moderate**" significance on the basis of the existing high background concentrations; the contribution from the Qatalum Project alone is assessed as **Negligible**.
		HF, SO_2	Degradation in air quality – impacts on terrestrial habitat & flora.		HF: **Minor** SO_2: **Negligible** to **Minor**	The assessment indicated that any impacts would be most likely to occur to landscape planting within the MIC Industrial Area and that this would be highly localised to the roadside planting immediately adjacent to the site's south western boundary. Visual monitoring of plant species in the vicinity of the site will be undertaken on a regular basis. In the unexpected event that damage is observed or suspected, the monitoring programme may be elaborated and further mitigation, such as replanting with more hardy / tolerant species will be considered.

Ref No	Activity / Source	Aspect	Potential Impact[a,b,c]	Mitigation / Control Measures	Residual Impact Significance	Comments
	Operation of Qatalum Project main plant	CO, SO_2, NO_2	Contribution to ground level ozone formation		**Moderate**	The SCENR standards for ozone are already exceeded within MIC; thus any impact arising from the potential increase in ozone concentrations has been rated as having a **Moderate** significance. However, the Qatalum project has minimised emissions with the potential to result in ground level ozone creation so far as it possible.
		CO_2, PFCs	Contribution to global warming		**Minor**	-
		SO_2, NOx, HF, PM_{10}, PAH	Occupational health	Concentration of emissions in work areas will be kept as low as reasonably possible (ALARP). Design and organisational measures to ensure that occupational exposure will not exceed OELs. Buildings will be properly ventilated, with clean air and, where necessary, fitted with extraction systems. Protective equipment will be made available to personnel in the event of plant malfunction / accidents.	**Minor**	-

Ref No	Activity / Source	Aspect	Potential Impact[a,b,c]	Mitigation / Control Measures	Residual Impact Significance	Comments
2	Operation of the Qatalum Project	Noise generation	Disturbance to surrounding environment (residential populations, workers and fauna)	Through design (i.e. technology / plant selection). Regular maintenance and testing. A monitoring programme will developed. Development and implementation of site specific EMS. Design and organisational measures will ensure that occupational exposure limits will not be exceeded. Hearing protection zones will be designated as required.	Human Health: **Minor** Fauna: **Negligible**	There are no residential receptors in the vicinity of the site. No significant species or numbers of mammals, reptiles or invertebrates were observed at or around, the site; although birds use the reedbed area and part of the lagoon near the Original Port Area. The noise assessment determined that operation of the facilities will not breech the SCENR standards, thus the impact on off-site workers in the MIC Industrial Area should be minimal.
3	Aluminium Plant operation – seawater scrubber	Seawater discharge (heat load, COD, pH, residual chlorine)	Degradation in seawater quality	Through design. Good operational and management practices. Development and implementation of site specific EMS. A monitoring / control programme will be developed and implemented.	Temperature: **Minor** COD/DO: **Negligible** pH: **negligible** residual chlorine: **negligible**	There are no significant receptors within 500 m of the QASCO channel discharge point. Thermal plume modelling has indicated that the SCENR criteria will not be breached; even during the winter months when the Qatalum discharge ΔT is at its highest. An aeration system wil be installed to further reduce COD levels and to increase DO levels in accordance with the SCENR standard. Residual chlorine will be destroyed by the sulphites formed during the seawater scrubbing process.
4		Seawater discharge (sulphite)	Improvement in quality of QASCO discharge (residual chloride destruction)	Not applicable	**Beneficial**	The sulphite formed during the seawater scrubbing process will react with, and destroy, the residual chlorine in the QASCO discharge prior to its release to sea

Ref No	Activity / Source	Aspect	Potential Impact[a,b,c]	Mitigation / Control Measures	Residual Impact Significance	Comments
5	Aluminium Plant – fresh process water systems	Untreated process water	Contamination of soil and groundwater	No direct discharge, all fresh process water to be re-used for irrigation. Treatment of water to irrigation standards Monitoring to ensure irrigation standards are met prior to use. Development and implementation of site specific EMS.	**Negligible**	-
6	Cooling tower system	Salt aerosol	Increased corrosion potential	Efficient mist eliminators	**Negligible**	-
7	Generation, handling and storage of process specific wastes hazardous wastes (e.g. spent pot liner)	Spillage / leakage from inappropriate storage	Contamination of soil and groundwater	All storage areas holding materials with the potential to contaminate soil / groundwater will be constructed in accordance with international / Qatari standards, on impervious surfaces, including bunds, as necessary. Emergency response / spill clean up protocols will be in place. Wastes will be stored, handled and monitored in accordance with Qatari legislation / regulations. A Project specific EMS, based on the principles of ISO14001, will be developed and implemented; this will include a waste management plan. Groundwater will be monitored on site on a regular basis.	**Negligible**	-

Ref No	Activity / Source	Aspect	Potential Impact[a,b,c]	Mitigation / Control Measures	Residual Impact Significance	Comments
Abnormal / Upset Operational Conditions						
8	Initial start-up of pots	CO_2, CO, SO_2, NOx, HF, PM_{10}, PAH, traces of PFC)	Degradation in air quality Contribution to global warming and ground level ozone formation	In general, as for impact No. 1 above. Additionally, opening of the pots during start up will be minimised, so far as possible and increased suction from the pot-gas collection system will be applied to prevent pot off-gases escaping into the potrooms during the first 2 days.	**Minor**	This is a "one-off" infrequent event of limited duration and magnitude. During the initial start up only four pots will be started each day, thus only eight pots will be in preheating mode on a daily basis until all pots have been started.
9	Venting (power station start-up / shut down)	Natural gas	Contribution to global warming	None proposed	**Negligible**	This is a "one-off" infrequent event of limited duration and magnitude.
10	Emergency diesel generator / black start generators	CO_2, CO, SO_2, NOx, PM_{10}, VOC	Degradation in air quality Contribution to global warming and ground level ozone formation	The generators will be of a modern design to minimise emissions. Regular maintenance and testing will be undertaken to ensure good performance.	**Negligible**	Use of the generators will be an infrequent event of limited duration and magnitude.
11	Failure of supply of QASCO discharge	Acidic seawater discharge	Degradation in seawater quality	Discussions will be undertaken with QASCO and a communication system will be established regarding the discharge channel. Safeguards to further prevent / minimise any impact associated with this activity will be incorporated into the Qatalum EMS.	**Minor**	The discharge will be rapidly neutralised by the natural alkalinity of the seawater before it can reach any receptors that may be affected by an acidic environment.

Ref No	Activity / Source	Aspect	Potential Impact[a,b,c]	Mitigation / Control Measures	Residual Impact Significance	Comments
General Activities (Operational / Construction / Commissioning)						
12	Presence of facilities (construction workers camp, Aluminium Plant, Power Plant, Service Corridor, Port facilities, storage area for dredged fines)	Footprint (land-take)	Loss of terrestrial habitat / species	It is not possible to directly mitigate against this aspect.	**Minor**	None of the habitats or areas within the proposed Qatalum Site, or in the vicinity of the site, has legal status as a protected area, nor are they nominated for inclusion as Biosphere Reserves under UNESCO's programme. The artificially created reedbed appears to be drying out; nevertheless it is valuable as a habitat in its own right (providing habitat diversity within an area largely devoid of other vegetation. Compensation is recommended for the loss of the reedbed that is attributable to the Qatalum Project.
13		Visibility	Visual impact	Due consideration will be given to the colour of painted surfaces / buildings. Some areas of landscaping will be created at the site	**Negligible**	The Project site is located in a well established industrial area, the landscape of which is already dominated by industrial plant, stacks, flares and night time lighting systems. The scale of the development is small in the context of the overall MIC Industrial Area. There are no nearby residential receptors whose view would be impaired.
14		Lighting	Visual impact (night time)	None proposed	**Negligible**	See Ref. No. 13 above.

Ref No	Activity / Source	Aspect	Potential Impact[a,b,c]	Mitigation / Control Measures	Residual Impact Significance	Comments
15	Presence of Port facilities	Footprint (seabed)	Loss of marine habitat	It is not possible to directly mitigate against this aspect.	Original Port: **Minor** Alternative Port: **Negligible**	-
16	Construction of facilities and operation of plant	Use of raw materials	Depletion of natural resources	Construction and process "wastes" will be re-used / recycled as far as possible. Power will be generated from an efficient gas-fired CCGT with heat recovery Potable water use has been minimised through the selection of seawater cooling systems. Operational potable wastewater streams will be reused within the process, or used to irrigate landscaping. Seawater use has been optimised and the majority will be returned to sea. The EMS for operation of the installation will identify opportunities to further minimise the use of natural resources. The Contractor(s) EMP is expected to include plans for minimising the use of natural resources / raw materials.	**Minor**	The use of natural resources (raw materials, fuels and water) is inevitable for a manufacturing process and for construction; however, the Project has been designed to minimise raw material use and wastage during construction and operation and to optimise process efficiency.

Ref No	Activity / Source	Aspect	Potential Impact[a,b,c]	Mitigation / Control Measures	Residual Impact Significance	Comments
17	Materials use, storage and handling	Dust generation and deposition	Smothering of flora and fauna	During operation, baghouses will be used to collect dust emissions from dust generating activities. For operation, a Project specific EMS, based on the principles of ISO14001, will be developed and implemented. For construction, Contractor(s) will develop and implement an EMP. Dust control measures, such as damping down and covering stockpiles of dusty materials will be considered in the Contractor(s) EMP	**Negligible**	There are no sensitive receptors in the vicinity of dust generating activities.
18		Dust generation	Degradation in air quality	As per 17 above.	**Negligible** to **Minor**	As per 17 above
19		Spillage / leakage from inappropriate storage / handling	Soil and groundwater contamination	All materials to be stored and handled in accordance with international / Qatari standards / regulations. For operation, a Project specific EMS, based on the principles of ISO14001, will be developed and implemented. For construction, Contractor(s) will develop and implement an EMP. Emergency response / spill clean up protocols will be in place.	**Negligible**	-
20			Contamination of seawater and sediment	As per Ref No 19 above.	**Negligible**	-

Ref No	Activity / Source	Aspect	Potential Impact[a,b,c]	Mitigation / Control Measures	Residual Impact Significance	Comments
21			Physical disturbance of the seabed, loss of habitat, damage to marine flora and fauna	As per Ref No 19 above.	**Negligible**	-
22	Maintenance and use of plant, equipment and transport	Dust generation and deposition	Smothering of flora and fauna	For operation, a Project specific EMS, based on the principles of ISO14001, will be developed and implemented. For construction, Contractor(s) will develop and implement an EMP.	**Negligible**	There are no sensitive receptors in the proximity of dust generating activities.
23		Combustion gases (vehicle exhaust) and dust	Degradation in air quality Contribution to global warming and ground level ozone formation	As per Ref. No. 17 above. Equipment, plant and vehicles will be of a recent design and will be regularly maintained and tested. All vehicles / equipment will be operated in accordance with the manufacturers instructions. Speed limits will be observed.	**Negligible** to **Minor**	-

Ref No	Activity / Source	Aspect	Potential Impact[a,b,c]	Mitigation / Control Measures	Residual Impact Significance	Comments
24		Noise generation	Disturbance to surrounding environment (residential populations, workers and terrestrial fauna)	For operation, a Project specific EMS, based on the principles of ISO14001, will be developed and implemented. Hearing protection zones will be designated as required. For construction, Contractor(s) will develop and implement an EMP. Equipment, plant and vehicles will be of a recent design and will be regularly maintained and tested. Occupational exposure limits will not be exceeded. All vehicles / equipment will be operated in accordance with the manufacturers instructions. Speed limits will be observed.	Humans: **Negligible** to **Minor** Fauna: **Negligible**	There are no residential receptors in the vicinity of the site. No significant species or numbers of mammals, reptiles or invertebrates were observed at or around, the site; although birds use the reedbed area and part of the lagoon near the Original Port Area. The noise assessment determined that operation and construction of the facilities will not breech the SCENR standards, thus there should be no notable impact on off-site workers in the MIC Industrial Area.
25		Fuel leaks, particularly when refuelling / servicing	Soil and groundwater contamination	As per Ref No 19 above.	**Negligible**	-
26			Degradation in marine water and sediment quality	As per Ref No 19 above.	**Negligible**	No refuelling of ships will take place at the Qatalum Berth(s).

Ref No	Activity / Source	Aspect	Potential Impact[a,b,c]	Mitigation / Control Measures	Residual Impact Significance	Comments
27	Transport (material delivery, workers etc)	Increased traffic (use of roadways and shipping lanes)	Traffic disruption	Centralised control of ships in and out of MIC. A road Traffic Management Plan will be prepared as part of the construction EMP and the Project EMS. The construction TMP will be agreed and coordinated with MIC.	Operation & construction - Shipping: **Minor** Operation – Roads: **Negligible** Construction - Roads (Original Port): **Minor** Construction - Roads (Alternative Port): Not assessed	Ships using the Mesaieed Ports will be under the control of the MIC Harbour Master Qatalum shipping numbers are less than 8% of projected total vessel numbers. With the exception of the Alternative Port concept scenarios, most raw materials and equipment during construction and operation will arrive by ship and the main issue will be commuter traffic within MIC. Further evaluation of traffic impacts will need to be addressed for the Alternative Port concept. Further details relating to the Qatalum Port concept will be submitted when selection decisions have been finalised and the engineering works are more advanced.
28	Shipping movements	Ballast water	Degradation in marine water and sediment quality	None proposed.	**Negligible**	No ballast water will be discharged in the MIC Port Area.
29	Use and storage of hazardous materials / wastes (e.g. diesel, oils, paints, lubrication fluids)	Accidental spillage	Soil and groundwater contamination	As per Ref No 7 above. For construction, Contractor(s) will develop and implement an EMP, which will include a WMP, spill protocols and emergency response plans.	**Negligible**	-
30		Spillage / leakage from inappropriate storage	Soil and groundwater contamination	As per Ref No 29 above.	**Negligible**	-

Ref No	Activity / Source	Aspect	Potential Impact[a,b,c]	Mitigation / Control Measures	Residual Impact Significance	Comments
31	Production, handling and storage of non-hazardous liquid waste (e.g. domestic / kitchen waste, etc)	Spillage / leakage from inappropriate storage	Soil and groundwater contamination	As per Ref No 29 above.	**Negligible**	-
32		Inappropriate storage	Increase of pests / vermin	As per Ref No 29 above.	**Negligible**	-
33	Heavy rainfall	Stormwater	Soil and groundwater contamination	Design of surface drainage system. Retention basin. Potentially contaminated rainwater will be collected separately and treated prior to disposal / re-use.	**Negligible**	Heavy rainstorms are infrequent events in Qatar.
Construction Specific Activities						
34	Site preparation, filling, grading, levelling and compacting, creation of temporary roadways / access routes etc.	Disturbance to land surface and vegetation	Loss of / damage to terrestrial habitat, flora and fauna	Contractor(s) will develop and implement an EMP, which will ensure minimal disturbance to off-site areas.	**Minor**	None of the habitats or areas within the proposed Qatalum Site, or in the vicinity of the site, has legal status as a protected area. The impact of disturbance would be temporary.
35		Disturbance to land surface	Disturbance of archaeological remains	None proposed	**Negligible**	Much of the Project area comprises made ground or has been disturbed. The Community Area Master Plan for MIC established that no sites of archaeological importance exist in the industrial area.

Ref No	Activity / Source	Aspect	Potential Impact[a,b,c]	Mitigation / Control Measures	Residual Impact Significance	Comments
36		Dust generation and deposition	Smothering of flora and fauna	Contractor(s) will develop and implement an EMP, which will address dust control. Dust control measures, such as damping down and covering stockpiles of dusty materials will be considered in the Contractor(s) EMP	**Negligible**	There are no sensitive receptors in the proximity of dust generating activities. Any impacts would be temporary.
37		Dust generation	Degradation in air quality	As per 36 above.	**Negligible** to **Minor**	There are no sensitive receptors in the proximity of dust generating activities.
38		Noise generation	Disturbance to surrounding environment (residential populations, workers and fauna)	For construction, Contractor(s) will develop and implement an EMP, which will include measures to minimise and control construction noise. Equipment / plant will be of a recent design and will be regularly maintained and tested. Occupational exposure limits will not be exceeded. All equipment / plant will be operated in accordance with the manufacturers instructions.	Humans: **Negligible** to **Minor** Fauna: **Negligible**	As per 24 above.
39	Dredging	Disturbance of the seabed, flora and fauna	Loss of / damage to marine habitat and flora	The dredging Contractor will produce and implement an EMP to reduce and minimise the impacts of dredging. Monitoring will be undertaken as described in Section 6.5.	Original Port: **Moderate** Alternative Port: **Minor**	Compensatory measures for loss of the seagrass area due to may be considered if the Original Port concept is pursued. On the basis that the dredge contractors EMP incorporates and implements all the measures suggested in Section 6.5, the significance residual impact of for both Port concepts and all dredging scenarios would be reduced.
			Loss / damage to fish / fauna		**Minor**	

Ref No	Activity / Source	Aspect	Potential Impact[a,b,c]	Mitigation / Control Measures	Residual Impact Significance	Comments
40		Disturbance and re-suspension of contaminated sediment	Degradation of water and sediment quality	As per 39 above	Original Port: **Negligible** Alternative Port: **Minor** to **Major**	On the basis that the dredge contractors EMP incorporates and implements all the measures suggested in Section 6.5, as appropriate, the significance residual impact of the Alternative Port concept and all dredging scenarios would be reduced to **Minor**.
41		Disturbance and re-suspension of sediment	Smothering of marine flora and fauna and increased turbidity	As per 39 above	Original Port: **Moderate** Alternative Port: Dredge scenarios 1 & 2: **Minor** Dredge scenario 3: **Minor** to **Moderate**	As per 40 above.
42	Preparation of dredged materials - dewatering	Run-off water containing fine sediment	Smothering of marine flora and fauna and increased turbidity	As per 39 above	**Minor**	There is only sparse seagrass coverage and low species numbers and diversity in the vicinity of the anticipated water run-off discharge.

Ref No	Activity / Source	Aspect	Potential Impact[a,b,c]	Mitigation / Control Measures	Residual Impact Significance	Comments
43	Preparation, storage and use of dredged materials	Contaminated sediment	Degradation of soil and groundwater	The dredging Contractor will produce and implement an EMP to reduce and minimise the impacts of dredging. For the Alternative Port concept, a pre-dredge sediment survey will be carried out to identify any contamination hotspots; to be avoided during dredging. Monitoring of dredged material prior to use.	Original Port: **Negligible** Alternative Port: **Minor**	The dredge areas for the Original Port concept are uncontaminated; the possible dredge areas for the Alternative Port may contain hotspot areas of localised TPH / metals contamination.
Commissioning						
44	In situ testing of gas fired turbines and furnaces	Combustion gases (CO_2, CO, NOx and water vapour)	Degradation in air quality Contribution to global warming and ground level ozone	Other than ensuring that the amount of testing is kept to the minimum requirement, no specific measures are proposed.	**Negligible**	Magnitude and duration of emissions is expected to be trivial relative to those from operation.
45	In situ testing of Power Plant	Natural gas venting	Contribution to global warming and ground level ozone	Other than ensuring that the amount of testing is kept to the minimum requirement, no specific measures are proposed.	**Negligible**	Magnitude and duration of event is expected to be trivial relative to operation.
46	In situ testing of main plant	SO_2, fluorides, PAH, particulates, traces of PFC	Degradation in air quality Contribution to global warming and ground level ozone	Other than ensuring that the amount of testing is kept to the minimum requirement, no specific measures are proposed.	**Negligible**	Magnitude and duration of emissions is expected to be trivial relative to those from operation.
47		Noise generation	Disturbance to surrounding environment (residential populations, workers and fauna)	Other than ensuring that the amount of testing is kept to the minimum requirement, no specific measures are proposed.	Humans: **Negligible** to **Minor** Fauna: **Negligible**	Duration of event is expected to be trivial relative to operation.

Ref No	Activity / Source	Aspect	Potential Impact[a,b,c]	Mitigation / Control Measures	Residual Impact Significance	Comments
48		Process water effluent	Soil and groundwater contamination	No untreated effluents will be discharged to the environment. The Contractor(s) will develop and implement an EMP, which will include plans to minimise and dispose of any aqueous wastes. Where necessary, permits / approvals for the discharge of process effluent from testing activities will be obtained by the Contactor(s).	**Negligible**	-
49		Seawater discharge	Degradation of seawater quality	As per 48 above.	**Negligible**	-