CONSERVATION COUNCIL
OF WESTERN AUSTRALIA INC.

The Chairman
Environmental Protection Authority
PO Box K822
PERTH WA 6842

Attention: Sue Osborne

Dear Sir

RE: SUBMISSION ON THE YANNARIE SOLAR ERMP

The following is the Conservation Council submission on the Yannarie Salt Project. To avoid duplication we have not reproduced the technical supporting documents cited in the submission. These will be found as Appendices in the combined submission provided by the Halt the Salt campaign.

The Significance of Eastern Exmouth Gulf

The tidally-controlled southern and eastern sectors of Exmouth Gulf including the Yannarie wetland system have long been recognised as ecologically significant environments. The contiguous mangle fringing the eastern shore is the most extensive stand in the remarkable arid zone system of the Pilbara region and the only section lying in the sub-tropics (Semeniuk 1999, EPA 2001). It may well be that the mangle of the Yannarie wetland system is the largest, contiguous stand outside the wet tropics although this is difficult to confirm internationally.

The area including the extensive banks and shallows seaward of the mangle has long been closed to commercial fishing in recognition of its importance as a nursery for marine life, including many fish species and the prawn resources for the Exmouth Gulf trawl fishery. A progression of this level of protection to a Fish Habitat Protection Area was proposed by the Department of Fisheries in its Gascoyne Environmental Review (Shaw 2002).

The MPRSWG (1994) recommended that a marine reserve be established over the area, including the eastern waters of the Gulf and incorporating the wetland system including supra-tidal mudflats (ie. the location of the proposed solar salt complex).

The State Government's World Heritage Consultative Committee for the North West Cape Range -Ningaloo Area preferred boundaries included all of Exmouth Gulf incorporating the Yannarie wetland system including the supra-tidal mudflats. The entire area was considered to meet World Heritage criteria for 'biological evolution' and 'biological diversity' and parts of the area for 'superlative beauty' and 'geoevolutionary history'. The inclusion of the area was also considered necessary to meet World Heritage requirements for system integrity (World Heritage Consultative Committee 2004).

There is a clear case for the Yannarie River Delta including delta plain, supra-tidal flats and the intertidal algal mat, mangle and mudflat systems to recognised internationally as a geoheritage site (Semeniuk – Appendix **x**, Halt the Salt submission).

The marine waters of eastern Exmouth Gulf have been assigned the maximum level of environmental protection for ecosystem health under the interim Pilbara water quality policy. This level requires "no contaminants (pristine, no change from background conditions) and no detectable change from natural variation of biological indicators". The application of such criteria clearly prohibits the discharge of brine, bitterns or any other substances into the eastern Gulf.

Proponent's Responses to the Conservation Significance of the Area

There would appear on the face of it to no acceptable basis in terms of government policy for a solar salt project to be considered in this area. It is something of an indictment of the current governments approach to sustainability that this proponent has even been allowed to progress the proposal to this stage, especially given the heavy ongoing cost to business and community respondents.

The proponent has set out strategically to circumvent previous government recommendations, guidance statements and policy positions in a number of ways.

1) By claiming (erroneously – see Appendix **x** of the Halt the Salt Submission) that the partial, physical avoidance of the algal mats and mangroves by the salt pond footprint will prevent significant impacts on these habitats and therefore comply with EPA Guidance Statement 1.

2) By contesting the inclusion of the supra-tidal flats in the marine reserve and other conservation proposals by asserting (erroneously- see Appendices B**, C** & D of the HtS submission) that there are no significant hydrological / ecological connections between this feature and the inter-tidal and marine habitats of the eastern Gulf (**the vacant ecosystem hypothesis**).

3) By misrepresenting the reasons for the eastern Gulf not being included in the State's World Heritage proposal.

   Exmouth Gulf qualified in some way under all four of the natural values criteria. It was not included, along with other areas recommended by the Committee, because the then federal Minister for the Environment chose to support the interests of the pastoral industry and indicated to the State government that he would not progress the Committees preferred boundaries with the UN. The omission of the Gulf from the proposal was for political not technical reasons. This may well see the nomination fail at the World Heritage Committee because it now fails to meet the test for ecosystem integrity.

4) By claiming that bitterns stored in concentrator ponds will have an economic use and market within 10 years.

   Our existing solar salt operations have explored the economic utilization of bitterns as an alternative to harmful discharge. The technologies and markets have hitherto not developed and it is highly unlikely that they will in the next ten years. It appears the proposed land-based storage of bitterns is a ploy to achieve project approval. The proponents may be banking on the probability

that in a decade, with the toxic legacy accumulating, the State Government will have no option but to compromise the community's water quality objective and allow bitterns discharge.

The proponent's erroneous assessment of the stratigraphy and groundwater hydrology of the site further increases the long-term ecological risks of bitterns storage within the salt field.

Impacts on the Yannarie Wetland System

The Straits Solar proponents claim that the impact on the wetland habitats of the eastern Gulf will be restricted to the direct removal or burial of 5.4 ha of mangroves and 31 hectares of algal mat. We will leave to the EPA to decide whether that can be accommodated under Guidance Statement No 1.

In our view however the longer term seepage from the salt bonds will cause irreparable damage to the producers in the inter-tidal zone over much of the area. Semeniuk (in Appendix C of the HtS submission) came to the following conclusion based on his first hand knowledge of the stratigraphy of the delta.

" *The development of a super-saline water body in the evaporation ponds, with a relatively high hydraulic head, will result in seepage plumes of dense saline water into the underlying sediments, which will discharge seawards emerging from under the tidal flats. East Exmouth Gulf will provide the first location in tropical Western Australia where a continuous fringe of mangroves will intersect the super-saline water discharge (essentially an effluent) from proposed solar salt ponds and where there also is an inherent natural stratigraphy that will result in the delivery of the anthropogenically formed saline plume (the effluent) to the tidal flats and their biota. This discharge will fundamentally alter the ecosystem of the tidal flats, from a microbial perspective, and from macrobiota such as invertebrate fauna and mangroves*".

The very limited (hand-auger?) core sampling of the materials underlying the supra-tidal flat was undertaken without any understanding of the stratigraphy of the shoreline resulting from a progression of sea levels. Bands of coarse, sandy sediment may be found in each sequence and these bands will conduct groundwater seaward relatively rapidly. The proponents have also ignored the presence of karst features within the proposed pond system, even though this outcrops obviously at Hope Point and on the near-shore islands. They have also missed that the pro-grading shoreline would have been vegetated potentially leaving root canals and other conduits (Walker Appendix B, HtS submission).

The loss of algal mats, to the hyper-saline halo that would probably develop at various points along the seawall, would reduce the supply of nitrogen and carbon to the mangle and to a host of inter-tidal consumer organisms (Paling & McComb 1994). The loss of mangle would not only reduce the productivity of the inshore (tidal creek) environments but would remove the critical structure of the marine nursery. The populations of mangrove specialist passerines and bats in the region would be decimated.

The outcomes from miscalculating the potential for the lateral movement of hyper-saline groundwater are likely to be catastrophic and there is a high probability that the proponents have got it wrong. The consequences of the escape of stored bitterns material via the groundwater system are likely to be extremely acute since these would not only be extremely concentrated in salts (osmolalities of 11000 mosm /kg of water verses 400 in sea

turtles-Tovar 2002) but would contain high concentrations of bio-accumulants including heavy metals and selenium and toxic concentrations of fluoride (eg. 60.5 times seawater – Tovar 2002).

Significant sea level rise is inevitable during the current century due to anthropogenic changes to the levels of greenhouse gases in the atmosphere. The most recent and authoritative estimates of change were provided in 2006 and range from 280 to 1400mm. The estimates used by the proponent, and adopted by DPI in 2003, are out of date and not precautionary with respect to more recent predictions (Walker, Appendix B HtS submission).

In any event the Bruun model and rule were never applicable to muddy shorelines (Bruun 1983). The model has never been validated and recent studies indicate that even for sandy shorelines (where it was intended to apply) it as little predictive value (Cooper & Orrin 2004). The model ignores the enormous local variations in sediment cell behaviour (Cooper & Orrin 2004) and inter-annual and longer variations in ocean climate (Meyers *et al*. 2003 and 2004). The proponent's analysis with respect to the environmental impacts of their positioning of the seawall barrier would appear to be flawed.

As sea-levels rise the algal mats and mangle may be able to retreat landward into what is currently the supra-tidal flat. One would expect an intermediate sea-level change of around 0.5 metres would drive significant changes in the tidal distribution of algal mats and mangrove species. However the presence of an uninterrupted 70 km seawall would prevent such a redistribution occurring. Should any mangrove habitat ultimately survive the chronic impacts of increasing groundwater salinity from brine and bitterns seepage it may ultimately be lost to changes in sea level.

Impacts on Exmouth Gulf

The concentrator pond complex proposed would occupy the supra-tidal flats behind the mangle over most of the spatial extent of the Yannarie wetland system. All potential connection through surface hydrology, between the tidal distributaries and the Gulf, and the eastern catchment would be severed by a 70km long seawall. Floodwater discharges would be focussed through diversion channels at the northern and southern ends of the complex.

According to the Australian Institute of Marine Science Exmouth Gulf is the most productive natural embayment yet studied in Australian waters. However phytoplankton abundance is low compared to the biomass of grazing zooplankton (McKinnon and Ayukai 1996), suggesting that the Gulf must receive carbon and nitrogen subsidies from non-oceanic sources or from pulses of nutrients (eg. from upwellings or floods). The ERMP suggests that nitrogen and carbon fixed by the algal mats drive the productivity of Exmouth Gulf and that flood-out events through the Yannarie Delta would occur too infrequently to be ecologically significant. The proponents also suggest that the focussed discharge of floodwaters to the central Gulf would have the same effect as the sheet flow through the myriad of mangrove lined, distributary channels and across the shallow sediment banks vegetated with macro-algae and seagrasses. The respondents find this position implausible and suggest that the benthic producers of the eastern Gulf are likely to be very important for the retention and re-supply of nutrients to the system. Focal discharges to the deeper waters of the Gulf are likely to see nutrients lost from the system.

<u>Surface Hydrology & Terrigenous Inputs</u>

The proponents have excluded the catchment and terrigenous inputs as a significant contributor to the productivity of Exmouth Gulf based largely on their modelling of surface

hydrology. They concluded that rainfall and storm surge events sufficient to generate a hydrological connection between the Gulf and the catchment across the supra-tidal flat had a return period of 20 years. Long-term local experience suggests otherwise. The only space photography following a cyclone passage (Cyclone Bobby 1995) available clearly shows complete sheet flow across the supra-tidal flats discharging to the Gulf through all the mangrove line distributary channels. The physical evidence does not validate the modelling. The presence of fresh terrigenous sediment and chemical markers for terrestrial vegetation (glomalin) in the mangroves (Dr Catherine Lovelock, Exmouth Gulf Forum).also suggests that the models predictive capacity, at least in this context, is unacceptable.

Walker (Geo & Hydro Appendix B**,** HtS Submission) found that the steps in the modelling process were impossible to track, the rainfall inputs were inappropriate and out of date and various parameters utilised were not justified. Such models are very poor at predicting infrequent, aperiodic events. It would be interesting to see if modelling of the Cyclone Bobby storm event would have predicted the observed hydrological connection between the eastern Gulf and its catchment. Unfortunately the respondents did not have access to the model used to test it.

Sources of Productivity in Exmouth Gulf

At the scoping document stage the proponent was suggesting that a recently discovered up-welling feature off North West Cape may subsidize the nutrient pool in Exmouth Gulf and be the source of its estuarine productivity. Latterly, in the ERMP, it is suggested that the nitrogen-fixing mats of cyanobacteria in the spring tidal area behind the mangle may account for much of this productivity.

Exmouth Gulf is for most of the time a reverse estuary with elevated salinities in the shallow, tidally controlled waters along the eastern and southern shores. It probably however functions as an arid zone estuary, receiving sediment and nutrients from its catchments, during infrequent, aperiodic flood-out events. The proponents have ruled out terrigenous inputs to productivity as such sources would be blocked by the 70km long solar salt pond complex (they might constitute an inconvenient truth!).

In November 2005 the HtS campaign organised a snapshot stable-isotope survey of Exmouth Gulf to examine the macro-scale structure of its food chains and the potential sources of nitrogen (Appendix D, HtS submission). This brief investigation made the following conclusions:

- Representative groups of consumers in Exmouth Gulf were deriving their energy primarily from macro-algae and to a lesser extent seagrasses.

- These producers were obtaining most of their nitrogen from recycled, organic forms (eg. ammonia).

- The spring - tidal microbial mat material was not contributing carbon or nitrogen directly to the open water consumers of the Gulf.

- Oceanic sources of nitrate nitrogen were probably contributing to the phytoplankton biomass of the Gulf waters but not directly to the estuarine food-chain.

- For much of the time the production in the Gulf appears to be based on recycling of nutrients. However it seems probable that the nutrient pool would have to be

recharged at some stage. The potential importance of infrequent, aperiodic terrigenous inputs cannot be discounted with our current level of knowledge.

- Repeating the stable isotope survey with a few months of a flood-out event may be useful in testing for intermittent terrigenous nutrient subsidies.

The only longitudinal study primary production available for the Gulf comes from the monitoring of seagrass regeneration since Cyclone Vance in 1999, initially by CSIRO and since 2003 by Department of Fisheries staff (Kangas *et al.* 2007). Cyclone Vance was an extreme (category 5) event that passed through the centre of the Gulf, stripping sediment from the deeper waters and depositing it in the inter-tidal and shallows. Much of the mangle, seagrass and macro-algae cover of the eastern Gulf was smothered. It may therefore not be a good model for other cycles triggered by cyclones.

Seagrasses all but disappeared from the floor of eastern Exmouth Gulf after Cyclone Vance. In subsequent years the cover increased rapidly peaking in 2003 due primarily to the biomass of *Halophila spinulosa* which appears to be a disturbance opportunist. Since that time other seagrasses previously recorded as the more abundant species in Exmouth Gulf re-established, these included *Halodule uninervis*, *Cymodocea serrulata* and *Syringodium isoetifolium*. At most study sites the biomass / cover of seagrasses and algae declined sharply between 2003 and 2005 and remained low in 2006. This suggests that there is a seagrass regeneration cycle, triggered by cyclone or other storm events. The regeneration of colonizing species, and then longer lived species, may be driven by a pulse of nutrients supplied by the storm event. Some of these may be mobilized from the disturbed sediments but terrigenous inputs are also probable. The decline in seagrass / algae biomass 4-5 years after the cyclone suggest that such events, with a return period of less than a decade, may be important in maintaining the productivity of the Gulf.

Overall the conceptual model of Exmouth Gulf (the battery model) is one of a system where productivity is controlled by a nutrient pool. This pool appears to require infrequent nutrient recharge from flows associated with storm events and in all probability including a terrigenous subsidy from the catchment (ie. eastern Exmouth Gulf is an arid zone estuary).

Potential Changes in Salinity

Exmouth Gulf is a reverse estuary with elevated salinities of up to 40 ppt in the shallow near-shore waters along the eastern and southern coasts. The higher salinity zones appear to be an important feature of the prawn and fish nursery, presumably because they are something of a osmoregulatory barrier to larger predatory fish. This salinity regime is maintained by the high evaporation the shallows, inter-tidal and supra-tidal flats. Periodic flooding of the super-tidal (algal mats area), during spring tides, and supra-tidal, during storm surges, would presumably return stored salt to the Gulf.

The solar salt complex could alter the salinity regime of the nursery in several ways. These include:

1. the predicted seepage of brine from numerous points along the seawall,

2. the extraction of large quantities of high salinity water from the eastern Gulf waters by the pumping and its replacement with lower salinity oceanic water and

3. the isolation of the supra-tidal salt store from storm surges by the 70km seawall.

The long-term consequences of these potential alterations to the salinity balance were not considered in the ERMP and the impacts have not been assessed.

Impacts on Marine Wildlife

The protected species of the Gulf would be impacted by the broad threats posed by the project to the Yannarie Wetland System and the marine ecosystem of the Gulf as discussed in the preceding sections. Other, more direct, impacts on wildlife can also be identified.

Dugongs

The seagrass cover that develops on the inter-tidal and sub-tidal sediment banks on the eastern side of Exmouth Gulf, particularly south of Simpson Island, are known to be an important foraging habitat for Dugong. These animals are part of west coast population that occupies Shark Bay, Exmouth Gulf and the Pilbara coast. Segments of the population (at least) are highly mobile, responding to losses and gains of foraging grounds entrained by the impact of tropical cyclones (Bob Prince, HtS Forum).

During periods of food shortage (eg. after Cyclone Vance in Exmouth Gulf) the Dugongs may concentrate on the remaining "pastures" particularly in Shark Bay. There appears then to be a density dependent reduction in the birth-rate that may ultimately influence overall population size. Put another way the condition and extent of the seagrass cover in Exmouth Gulf may have an impact on the size of the dugong population as a whole.

The dredging impacts (habitat removal and smothering) associated with establishing and maintaining the barge channels for the project will remove seagrass habitat from the banks, at least in the important Hope Point area.

Previous modelling of dredging impacts in WA has proved to be unreliable (eg. Geraldton Port) and there is no particular reason why respondent's should take the results presented in this ERMP as credible. But even if one accepts the stated magnitude and duration of seagrass loss there would appear to be the potential for a reduction in the Dugong population size. The data presented on impacts to Dugong in the ERMP is adequate given the risk to a discrete population highly threatened marine mammal. Dugong are also very vulnerable to boat strike and the presence of a barge route across an important feeding ground will probably lead to ongoing collision mortality.

Sea Turtles

The eastern side of Exmouth Gulf is an important foraging ground for Green Turtles including for adult females breeding on the Islands of the North West Shelf (eg. Barrow Island, Bob Prince pers.comm). The adults are mostly observed feeding on macro-algae and seagrass on the banks. The more carnivorous juveniles are common within the mangle and along the tidal creeks. Adult foraging habitat will be lost to dredging and associated smothering of the bank habitats. The impact of this on provisioning, pre-laying females is unknown.

Humpback Whales

Exmouth Gulf is an important rest area for Humpback Whales on their southward migration, presumably because it provides sheltered water for the calves. Communication between animals is likely to be very important in maintaining social relationships at this stage in the migration.

If this project proceeds there will be continuous shifts of barges loading up to three Panamex Carriers at the anchorage in the central Gulf. This location is itself an important staging area for Cows and calves. Curt Jenner (HtS forum) indicated that such operations would generate significant underwater noise and at least some displacement. The consequences of this on Humpback Whale behaviour and calf survivorship were unknown would take at least 5 years (prior to operations commencing) to determine. Collisions between barges and whales could also be an issue.

A similar arid zone solar salt project in Baja California had been stopped primarily because of projected impacts on Gray Whales.

Migratory Shorebirds

The eastern side of Exmouth Gulf is currently used by a high diversity of migratory shorebirds but the numbers are relatively low (except for Grey-tailed Tattler) compared to the Pilbara coast and Lake Macleod. This was attributed to a lack of secure, open high tide roost sites. The salt pond complex will probably provide the habitat image of such roost sites and the lower salinity ponds will provide feeding habitat for surface picking and swimming / sieving shorebirds that will make use of *Artemia*. The proponents make much of these "new" habitats for shorebirds as an environmental selling point.

Supplementary feeding habitats will probably do little to increase migratory shorebird populations as these are determined by factors on their northern hemisphere breeding grounds and at diminishing staging areas on the asian flyway. They may however divert shorebirds from established feeding areas such as Lake McCleod (a far more significant, self sustaining shorebird habitat).

There would also appear to be a significant risk to shorebirds and terns attracted to potential roosting habitats amongst these concentrator ponds. Unlike the other solar salt fields these will include vast areas of bitterns storage ponds, containing highly toxic (high specific gravity fluids). Birds alighting on this medium are likely to be caked with adhesive bitterns fluids that bind the feathers of stick to the legs. This material could have the physical effect of binding the feathers and preventing flight. Bitterns is also highly toxic (eg. to marine vertebrates such as Green Turtles – Tovar *et al*. 2002) and the shorebirds may die as the result of ingestion during preening. The bitterns storage ponds may constitute a significant hazard to migratory shorebirds attracted to the concentrator complex. This risk was not identified in the ERMP and has not been assessed.

Decommissioning

This project is based on the production of very high tonnages of a low value commodity. The huge scale of the project is evidently necessary for it to be economically viable. The projected market is dependent on a long term continuation of the Chinese economic bubble and the ongoing sustainability of petrochemical industries dependent on petroleum consumption. Should Chinese growth moderate it is likely that the Straits Salt project would come into direct competition with other WA salt producers perhaps leading to closures.

The Yannarie Salt project if implemented would be vulnerable to economic and / or environmental failure at anytime. The cost of appropriate remediation would be enormous at least of the order of half a billion dollars. In the event of business collapse due to environmental failure the costs of remediation will fall on the taxpayer, as the project will have been approved by the State. In the event of business collapse due to economic failure

the costs would only fall on the developer to the extent of any bond required by the government. It is hard to imagine any bond large enough to properly remediate and remediate 411km^2 of concentrator ponds and other infrastructure.

No decommissioning plan (including a costing) has been prepared as part of the ERMP. The so-called 'Preliminary Closure Management Plan' ignores the most significant environmental issue. This is the remediation of many metres of brine (and in this case highly toxic bitterns) saturating the soil profile and groundwater beneath the pond complex. Remediation of solar salt ponds to allow for subsequent land-uses, or to protect the environment from long term emmissions, is extremely difficult if not impossible (Walker HtS Forum Appendix **y**). In situations where it has been attempted budgets in excess of US $250m have left the task incomplete (Cargill North & South Bay City State USA).

Solar salt pond remediation has only been attempted in situations where the concentrator pond system was built substantially in the inter-tidal and a phased resumption of tidal flushing is possible. The concentrator system proposed for this project will be built in the supra-tidal where flushing and wetland habitat construction and maintenance are much more problematic. Interestingly the Port Hedland solar salt fields now support most of the wintering habitat for the eastern population of the Broad-billed Sandpiper. It will be interesting to see how the decommissioning of these 'pump-maintained' habitats would be managed in the event of closure. Attracting migratory shorebirds to solar salt project may carry with it perpetual long-term conservation responsibilities.

Aesthetic Impacts

Exmouth and Cape Range, in association with Ningaloo Reef, are becoming focal nature-based tourism assets for the State of Western Australia. Panamex bulk carriers and loading barges will be clearly visible at sea-level from Exmouth and intrude on the vista of Exmouth Gulf from lookouts in Cape Range National Park. Lights from the vessels will be evident at night. The salt concentrator complex itself may be visible from the top of Cape Range. These aesthetic impacts will change the perception of the region from one of an unspoilt wilderness environment to an industrial port. The resulting negative perceptions are likely to harm the planned development of the area as a core tourism asset.

Conclusion

- The eastern side of Exmouth Gulf, including the supra-tidal flats, has been identified as a environmentally significant area warranting special conservation measures by a range of agencies / planning committees.

- The proponent has attempted to downplay and misrepresent the significance of the area and the potential impacts of the project. To do this the proponent has promulgated a "**vacant ecosystem hypothesis**" for the supra-tidal flats.

- The proponent's proposal to store bitterns for the first 10 years until the material can be fully processed and marketed is holding position aimed at obtaining environmental report. It is evident, even from the content of the CSIRO consultancy, that the proponent will be seeking approval to discharge bitterns as soon as the storage capacity within the concentrator field is reached.

- The proponent has not acknowledged the significance of the Yannarie Wetland System (including the supra-tidal flats) as geoheritage.

- The proponent has not understood the stratigraphy of the supra-tidal flat leading to fatal flaws in understanding the hydrology. Contrary to the proponents assertions seepage of brine and bitterns from the concentrators is likely to destroy significant areas of algal mat and mangal and contaminate the waters of the Gulf.

- The proponent has not taken a precautionary design approach to sea-level rise and ignored the impact of the seawall in preventing the redistribution of the algal mats and mangroves in response to changes in sea-level of between 35 and 140 cm this century.

- The use of the Bruun Rule for muddy shorelines is invalid and meaningless.

- The concentrator complex is located over a variety of potential conduits of brine to the ocean and to deeper karst aquifers (one or regional water supply significance).

- The concentrator complex is so vast that it could potentially change local climate and cause coastal subsidence.

- The proponent claims that there is no hydrological connection between the catchment east of the Gulf and the Gulf waters based on flawed modelling of surface hydrology. Other evidence, including space photography during Cyclone Bobby indicates that this is not the case.

- The proponent infers that terrigenous inputs are unimportant for maintaining the high biological productivity of the Gulf. This position is not supported by measures of biological productivity following rainfall events.

- For much of the time the production in the Gulf appears to be based on the recycling of nutrients. However it seems probable that the nutrient pool would have to be recharged at some stage. The potential importance of infrequent, aperiodic terrigenous inputs cannot be discounted with our current level of knowledge.

- The combination of heavy seawater extraction from the shallow tidal environment of the eastern Gulf and the isolation of the supra-tidal salt store from flood tides could lead to a major shift in the salinity regime. This would have a major impact on the prawn and fish nursery habitat.

- The direct loss of seagrass and macro-algae cover to dredging in the eastern Gulf will have unquantified impacts on Dugong and Green Turtle populations over an area much grater than Exmouth Gulf.

- Increased dugong mortality associated with vessel collisions is expected.

- The potential impact of noisy ship-loading / barge transfer operations on Humpback Whales cows / halves remain unkown.

- The toxic bitterns storage within the concentrator field may become a death-trap for migratory shorebirds.

- There is no viable method of remediating a solar salt pond constructed in the supra-tidal zone and there is no decommissioning plan. The environment and taxpayers of

Western Australia may be dealt a significant legacy by this project in the event of economic failure at any stage.

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Director

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