K + S Salt Australia Pty Ltd

Acid Sulfate Soil and Sediment Management Plan (ASSSMP)

EPA Assessment No. 2101

EPBC Reference No. 2016/7793

May 2021

Table of contents

Table index

Figure index

Appendices

Abbreviations

Abbreviation	
AGIG	Australian Gas Infrastructure Group
AHD	Australian Height Datum
ANC	Acid neutralising capacity
ASS	Acid Sulfate Soils
ASSSMP	Acid Sulfate Soils and Sediment Management Plan
ASSS	Acid Sulfate Soils and Sediment
BoD	Basis of Design
CP	Concentration Pond
CRS	Chromium Reducible Sulfur
DBNGP	Dampier to Bunbury Natural Gas Pipeline
DER	Department of Environmental Regulation
DMIRS	Department of Mines, Industry Regulation and Safety
DO	Dissolved oxygen
DOW	Department of Water
DPLH	Department of Planning, Lands and Heritage
DWER	Department of Water and Environmental Regulation
EC	Electrical conductivity
ENV	Effective neutralisation value
EPA	Environmental Protection Authority
EP Act	Environmental Protection Act 1986
ERD	Environmental Review Document
ESD	Environmental Scoping Document
GHD	GHD Pty Ltd
H	Height
HDPE	High density polyethylene
Hectares	Ha
Kg	Kilograms
Km	Kilometre
K+S	K + S Salt Australia
LNG	Liquefied natural gas
M	Metres
MBO	Monosulfidic Black Oozes
MGA	Map Grid Australia
Mm	Millimetres
NASS	Non Acid Sulfate Soil
NATA	National Association of Testing Authorities
NPI	Non-process infrastructure
OEPA	Office of the Environmental Protection Authority
ORP	Oxidation-reduction potential
PFS	Preliminary Feasibility Study
pH_F	Soil pH
pH_{FOX}	Soil pH oxidised

Abbreviation	
PIS	Product information sheet
RL	Relative level
S_{NAS}	Net acid soluble sulfur
SWL	Static water level
TAA	Titratable actual acidity
TN	Total Nitrogen
TPA	Titratable Peroxide Acidity
V	Vertical

1. Introduction

1.1 General Overview

K + S Salt Australia (K + S) is the Australian entity of the international resources company K + S Group. K + S (**the Proponent**) have appointed GHD Pty Ltd (GHD) to undertake hydrogeological, geotechnical and Acid Sulfate Soil and Sediment (ASSS) investigations for Phase 2 of the Ashburton Solar Salt project (**the Proposal**).

This report presents the Acid Sulfate Soil and Sediment Management Plan (ASSSMP) to assist in providing information to inform the preparation of the Environmental Review Document (ERD), which will be assessed under Part IV of the Environmental Protection Act 1986 (EP Act).

The Proposal is located within the coastal region southwest of the town of Onslow, Western Australia), as shown on Figure 1.

GHD previously completed Phase 1 investigations in 2019, which included a site walkover inspection and preparation of a report (GHD 2019). The report presented the site inspection findings and potential Acid Sulfate Soils (ASS), geological and geotechnical issues that could impact the Proposal and also provided recommendations to assist with the mobilising of Phase 2.

The fieldwork component of the hydrogeological, geotechnical and ASSS site investigations for the Proposal was completed in April 2020 and represents the first ground intrusive works carried out in the Study Area (Figure 1).

The investigation was undertaken in accordance with GHD's proposal provided to the Proponent dated 13th September 2019. This report presents the ASSSMP (including a Development Strategy) based on the investigation findings obtained from the Phase 2 site investigation conducted between 28th October 2019 and 31st March 2020.

This document has been prepared using information available at the time of preparation. This document should be updated as additional information becomes available on construction elements relevant to the potential disturbance of ASS material.

1.2 Project Overview

The Proponent is developing a green field solar salt farm along the Western Australian coast, approximately 40 km south–west of the township of Onslow, within the Shire of Ashburton.

The Study Area consists of 67,570 hectares (ha).

The facility is planned to operate with a salt export capacity of 4.7 million tonnes per annum, harvested from the progressive evaporation of seawater in a series of Concentration and Crystalliser Ponds. The Study Area is illustrated on Figure 1. Further details relating to the proposed development are outlined in Section 3.

1.3 Purpose of Report

The Department of Water and Environmental Regulation (DWER) stipulate that activities with the potential to disturb ASS, directly or indirectly, need to be managed appropriately in order to avoid environmental harm. If ASS disturbance activities are not managed appropriately, environmental harm may occur, as defined by the Environmental Protection (EP) Act 1986. Additionally, in areas where ASS disturbance activities may mobilise contaminants to concentrations above background concentrations and present a risk to human or environmental

health, such areas may be classified under the Contaminated Sites Act 2014, subsequently requiring remediation.

The Office of the Environmental Protection Authority (OEPA) has determined that the Proposal is required to be assessed under Part IV of the EP Act. The Environmental Scoping Document (ESD) was endorsed by the Environmental Protection Authority (EPA) on 24 January 2018. The ESD has outlined the work and/or studies required to be undertaken and included within the ERD.

The purpose of this ASSSMP, in relation to the Proposal, is to provide appropriate guidance and management strategies regarding potential ASSS disturbance during proposed construction activities, to prevent environmental harm.

1.4 Scope of Works

Based on a review of the proposed disturbances and likelihood of ASSS risk, GHD undertook the following scope of works informed by the outcomes of the Phase 2 ASSS study:

- Prepare an ASSSMP (this report) to provide practical and concise mitigation and management measures including:
    - Outline an appropriate monitoring program for construction and commissioning including baseline information.
    - Outline trigger levels and action criteria (contingency planning) with appropriate contingency responses and measures.

This report is limited to the Study Area as defined by the Proposal and illustrated in Figure 1. A review of the finalised construction methodology and layout should be completed prior to ground disturbance works to confirm the assumptions throughout this report regarding disturbance and depth of excavation.

1.5 Summary of Previous Investigations

The site has previously been subject to ASS investigations during earlier phases of the proposal. GHD have completed the previous ASS works at the site, in the form of an ASS Desktop Assessment (GHD 2018) and ASS Site Walkover Inspection (GHD 2019).

The GHD desktop assessment identified that the project area is situated on an area of predominately *'High to moderate risk of ASS occurring within the first 3 m of natural soil surface (and beyond)'* according to ASS risk mapping data available for the area. This assessment also identified the supratidal flats, proposed dredging areas and elevations below 5 metres Australian Height Datum (m AHD) to present the highest ASS risk, as well as identifying the potential presence of Monosulfidic Black Oozes (MBO) in waterways.

During the GHD Site Walkover Inspection (between 4th and 6th June 2019) opportunistic sampling of the exposed supratidal flat within the development envelope was undertaken, followed by laboratory analysis of the samples which confirmed a net acidity value of 23 mol H^+/ tonne within the surficial soil surface. It was concluded that values may increase with depth and therefore were considered high risk within areas disturbed of that nature.

Generally, site features were found to be consistent with published ASS risk maps, however it was noted that the neutralising capacity of the naturally available calcareous materials may have been underestimated within some portions of the site.

More recently, with the commencement of the project Phase 2 works, GHD was engaged to complete a geotechnical, hydrogeological and ASSS ground intrusive investigation at the site. The data collected during this investigation forms the primary basis for this ASSSMP and is

therefore summarised within the subsequent sections of this report. A comprehensive report on the Phase 2 ASSS investigations is presented in the *Acid Sulfate Soil and Sediment Study* (GHD 2021).

The following report references indicate the ASS investigations for the proposal since 2018.

- GHD (2018), *Ashburton Salt Project, Geotechnical, Hydrogeological and Acid Sulfate Soil Desktop Assessment*, February 2018;
- GHD Pty Ltd (2019), *Ashburton Solar Salt Early Works – Phase 1, Geotechnical and Acid Sulfate Soil Site Walkover Inspection*, Report No. 6138358-REP_0, March 2020; and
- GHD Pty Ltd, (2021*), K + S Australia Pty Ltd, Acid Sulfate Soil and Sediment Study*, EPA Assessment No. 2101, EPBC reference no. 2016/7793*,* Report No. 12516706-99326, May 2021.

1.6 Contemporary Guidelines

The ASSSMP was completed with reference to, and in accordance, with the following national and West Australian contemporary guidelines (where appropriate):

- Department of Environment Regulation (DER) *Acid Sulfate Soil Guideline Series: Identification and investigation of acid sulfate soils and acidic landscapes* (DER 2015a);
- Department of Environment Regulation (DER) *Acid Sulfate Soil Guideline Series: Treatment and management of soil and water in acid sulfate soil landscapes* (DER 2015b); and
- Australian Government *National Assessment Guidelines for Dredging* (2009).

Additional ASS guidelines recently released by Water Quality Australia, an Australian Government initiative in partnership with state and territory governments, was also considered, particularly in the assessment of sediments and waterways:

- National Acid Sulfate Soils Guidance: *National acid sulfate soils sampling and identification methods manual* (2018);
- National Acid Sulfate Soils Guidance: *Overview and management of monosulfidic black ooze (MBO) accumulations in waterways and wetlands* (2018); and
- National Acid Sulfate Soils Guidance: *Guidelines for dredging of acid sulfate soil sediments and associated dredge spoil management* (2018).

The above national guideline documents are useful tools and endorsed by Department of Water and Environmental Regulation (DWER), Western Australia. However, jurisdictional guidance and regulations take precedence over the national guidance documents unless stated.

Due to the varied description and generalised terms regarding ASS, this management plan assumes that material requiring treatment is termed ASS regardless of properties (i.e. sulfidic, hyposulfidic and monosulfidic).

1.7 Scope and Limitations

This report has been prepared by GHD for K + S Salt Australia Pty Ltd and may only be used and relied on by K + S Salt Australia Pty Ltd for the purpose agreed between GHD and the K + S Salt Australia Pty Ltd as set out in Section 1.3 of this report.

GHD otherwise disclaims responsibility to any person other than K + S Salt Australia Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by K + S Salt Australia Pty Ltd and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

A review of the finalised construction methodology and layout should be completed prior to ground disturbance works to confirm the assumptions throughout this report regarding disturbance and depth of excavation.

2. Site Identification

2.1 Site Identification

The Proposal is located approximately 40 km south west of the town of Onslow, Western Australia. The Study Area is of 67,570 ha in size (Figure 1).

This area contains various physiographic features including coastal dunes, tidal creeks lined with mangroves, intertidal/supratidal flats, undulating sand plains, clay pans and the marine environment.

2.2 Mining Tenements

A search of the Department of Mines, Industry Regulation and Safety (DMIRS) MINEDEX and Materials Titles Online systems was completed in July 2020. The search indicated that in July 2020 K + S held exploration status on five mining tenements which form the preponderance of the Study Area.

A summary of mining tenement details is presented in Table 1 and the tenements are presented on Figure 2.

Table 1 Mining Tenement Details Summary

Tenement Identifier	Date Received	Commencement	Expiry	Area (ha)
E 08/1395	03/06/2003	15/06/2004	14/06/2020	22231
E 08/1396	03/06/2003	15/06/2004	14/06/2020	10807
E 08/1399	03/06/2003	15/06/2004	14/06/2020	8576
E 08/1421	15/10/2003	15/06/2004	14/06/2020	7306
E 08/2840	27/04/2016	25/01/2018	24/01/2023	13985

2.3 Zoning

According to the Department of Planning Lands and Heritage, the site is located on land parcels zoned as *'Rural'*, '*Tidal inundation special control area'* and '*Conservation, recreation and nature landscape'* (DPLH 2020).

2.4 Current Land Use

2.4.1 On Site Land Use

The Proposal site is situated on a region of intertidal/supratidal flats, with remnant islands and isolated sand dunes. The Study Area is currently on pastoral land associated with the Urala and Koodarrie Stations. The Study Area is predominately absent of any development, with the exception of an area in the northeast portion of the site that is shared land between the Proposal and the Australian Gas Infrastructure Group (AGIG) Tubridigi Gas Plant. An area of approximately 1,969 ha is shared by the Study Area and the AGIG Tubridigi Gas Plant site boundary. According to spatial information provided by AGIG, a single gas production well appears to be located within the Study Area, along with various access tracks and other minor

gas plant support infrastructure. The AGIG and aforementioned land uses are shown on Figure 2.

2.4.2 Surrounding Land Use

The AGIG Tubridgi Gas Plant is located approximately 2.5 km north-east of the site. The Tubridgi Gas Plant facilitates gas storage and delivery to the Dampier to Bunbury Natural Gas Pipeline (DBNGP). A further 13 km north-east of the Study Area is the Macedon Domestic Gas Plant operated by BHP Group Limited and beyond is the Wheatstone Liquefied Natural Gas (LNG) Plant operated by Chevron Australia Pty Ltd (see Figure 2).

The Study Area is also located 25 km south-west of the Onslow Salt project (see Figure 2). The Onslow Salt project is an active solar salt operation with an estimated production of 2.5 million tonnes per annum. Similar to the salt manufacturing process outlined in the Proposals Pre-Feasibility Study (Arcadis 2018a) (see further Section 3), the Onslow Salt project pumps seawater from Beadon Creek to concentration ponds, before passing material through a variety of handling methods and infrastructure to process the salt for conveyor loading onto ships from a jetty.

A review of available aerial imagery and online data indicates that no coastal or offshore development has occurred proximal to the Study Area. The coastal boundary of the Study Area is flanked by the Pilbara Inshore Islands, including the major islands of Thevenard, Bessieres, Serurier, Peak and Murion. These larger islands are located approximately 35 km offshore and are classed as nature reserves. Thevenard Island (35 km north-east) is the site of a former gas plant originally operated by Chevron Australia Pty Ltd which ceased operation in 2014 and is currently in a decommissioning phase. Closer to shore (<10 km), smaller nature reserve classed islands exist. Aerial imagery shows no obvious developments on these islands.

3. Proposed Development

3.1 Overview

The Study Area consists of 67,570 ha. The facility is planned to operate with a salt export capacity of 4.7 million tonnes per annum, harvested from the progressive evaporation of seawater in a series of concentration and crystalliser ponds. It is anticipated that the proposed salt facility will comprise the following infrastructure and/ or components:

- Seawater intake pump station and channel to the salt ponds;
- Salt concentration ponds (concentration ponds) ;
- Salt crystalliser ponds (crystalliser ponds) ;
- Brine pond and brine transfer structures including bitterns discharge infrastructure (dilution pond, pipeline and diffuser);
- Salt wash plant;
- Salt stockyard and reclaim conveyor system;
- Non-process infrastructure (NPI) including administration buildings, stores (including fuel stores), workshops, laydowns areas and internal access road network;
- A dedicated jetty and loading platform to facilitate the transport of salt to an offshore anchorage for seagoing vessels;
- Dredging of a small berthing pocket and onshore dredge disposal area;
- Drainage diversions; and
- Borrow pit areas for construction materials.

The Study Area and proposed layout is shown on Figure 3.

3.2 Proposed Infrastructure

Details of the proposed infrastructure have been obtained from the pre-feasibility study design report and pre-feasibility study basis of design prepared by Arcadis (2018a and 2018b) and from further design work conducted by K + S since 2018.

3.2.1 Seawater Intake

The proposed location of the seawater intake infrastructure is Urala Creek South due to preferable water chemistry and a flat downstream lake profile conducive to reduced scouring of the creek.

Preliminary designs propose multiple pumps installed to abstract water from a rock armoured sump in Urala Creek South. The pumps will transfer water through a channel which will discharge to Salt Concentration Pond (CP) 1.

3.2.2 Salt Concentration Ponds

The proposed Salt Concentration Ponds are predominately sited on intertidal/supratidal flats as shown on Figure 3. The intertidal/supratidal flats are typically between approximately RL 0.6 m AHD and RL 1.3 m AHD. The surrounding remnant islands to the east are undulating with elevations rising up to approximately RL 21 m AHD.

Table 2 Concentration Ponds Summary

Parameter	Estimated Import Volume (m^3)
External embankments crest level of RL+3.5 m AHD and width 3.5 m 1(V):1.5(H) slope batters	2,038,000 - 2,209,300
Internal embankments crest level of RL+3.0 m AHD, crest width of 3.5 m 1(V):1.5(H) slope batters	

Table 2. Table source: Arcadis 2018a

3.2.3 Crystalliser Ponds

The Crystalliser Ponds are proposed to be located on the intertidal flats, immediately north of the concentration ponds (Figure 3). The Crystalliser Ponds consist of 12 cells separated by internal embankments and designed in order to optimise existing topography and project operational efficiency. Both the internal and external embankments are proposed to tie into the mainland and the mainland remnant islands.

Approximate disturbance volumes and imported fill volumes are presented in Table 3.

Table 3 Crystalliser Ponds Summary

Parameter	Estimated Disturbance Volume (m^3)
External embankments crest level of RL3.5 m AHD and 1(V):1.5(H) slope batters	-
Berm on the pond side with a crest level of RL2.4 m AHD	-
Internal embankments crest level of RL2.4 m AHD and 1(V):1.5(H) slope batters	-
Earth working of in-situ material to facilitate achievement of design levels	850,000
General fill importation to facilitate achievement of design levels	1,400,000
Rock – scour armour	190,000

Table 3. Table source: Arcadis 2018a

3.2.4 Brine Ponds and Transfer Structures

The seawater intake pump will deliver seawater (brine) into the concentration ponds where it will flow in a north to south direction through Concentration Ponds 1 to 3. From Concentration Pond 3, the brine will be lifted up by a pump station located on the embankment of Concentration Pond 3 and 4 for return south to north flow to the salt crystalliser ponds (Arcadis 2018b).

As the brine progresses through the concentration ponds it increases to a critical density at which salt begins to crystallise from the solution. At this density, the brine is referred to as ‘maiden brine’ and this maiden brine is transferred from Concentration Pond 8 to the maiden brine feed channel via the maiden brine transfer pump station. The maiden brine feed channel (brine channel) is located along the southern boundary of the crystalliser ponds and has been

designed such that the maiden brine will gravity feed the salt crystalliser pond cells. Key design details of the brine pond and transfer infrastructure are as follows (Arcadis 2018b).

Table 4 Brine Pond and Transfer Structure Summary

Parameter	Details
Maiden Brine Feed Channel	5.1 km long, 13 m wide, 1.3 m peak brine depth 1.5 (H):1 (V) side slopes, clay lined
Brine Transfer Culverts	Barrel culverts: 3.5 m levee width, high density polyethylene (HDPE) piping flat on pond floor (RL 0.9 – 1.0 m AHD) Bridge structures: 3.5 m levee width
Maiden Brine Pump Station	Pump sump RL 0.168 m AHD, internal levee RL 5.0 m AHD, mudflat concentration pond 8 RL 1 m AHD

Table 4. Table source: Arcadis 2018a and 2018b

3.2.5 Bitterns Discharge

As the brine reaches the second row of the Crystalliser Ponds, it reaches a specific density at which contaminant salts cannot be readily removed by processing at the wash plant – it is at this density that the brine is referred to as 'raw bitterns'. The Bitterns Dilution Pond is located on the northern boundary of the Salt Crystalliser Ponds, it receives the raw bitterns from the Salt Crystalliser Ponds once the brine has deposited the salt and the specific bitterns density is reached.

Seawater will be pumped from Concentration Pond 1 into the bitterns dilution pond, prior to disposal of the bitterns. Bitterns disposal will occur via a bitterns pipeline that will run from the bitterns dilution pond to the jetty. The bitterns pipeline will be co-located with the conveyor, on a built-up embankment with culverts underneath the embankment to convey necessary surface water flows.

Table 5 Bitterns Channel and Discharge Structure Summary

Parameter	Details
Bitterns Dilution Pond	70 ha pond, with no liner, 2 m above ground level
Brine Discharge Channel	Co-located with the conveyor, on a built-up embankment with culverts underneath the embankment to convey necessary surface water flows

Table 5. Table source: Arcadis 2018a and 2018b

3.2.6 Salt Stockyard and Reclaim Conveyor System

The Salt Stockyard will store washed salt to allow for drying of the product prior to ship loading. A centralised rail mounted stacker and reclaimer is proposed. A centralised rail mounted stacker and reclaimer is proposed. The preferred location for the stockyard is one of the remnant islands (Figure 3). The design level for the salt wash plant was assumed to be approximately RL 6.0 m AHD and founded on shallow concrete strip footings.

3.2.7 Non-Process Infrastructure (NPI)

NPI is proposed on a remnant island close to the salt stockyard (Figure 3). The various components of the non-process infrastructure include:

- Administration building;
- Workshop and store facilities;
- Amenities and crib buildings;
- Refueling facilities;
- Laboratory facilities;
- Sewage treatment facilities; and
- Layout and parking provisions.

It is assumed that the NPI will be founded at a level determined by the detailed design and likely to take into consideration the storm surge height. For the purpose of this assessment, this infrastructure is assumed to be founded at approximately RL 6.0 m AHD.

The primary access road is proposed to extend north-east from the NPI area joining to a proposed third-party road (Figure 3). The road is proposed to be an 8 m wide unsealed roadway with 4(H):1(V) shoulder grade and a minimum of 0.9 m fill above the natural surface.

3.2.8 Marine Jetty and Loading Platform

The proposed jetty extends outwards approximately 700 m into the marine environment from the northern coastline and includes a loading platform towards the offshore portion of the jetty. The offshore structure is proposed to consist of a driven piled arrangement and the proposed location is shown on Figure 3.

3.2.9 Capital Dredging and Onshore Dredge Disposal Area

A small amount of dredging is proposed at the end of the jetty to accommodate a single berthing pocket for the trans-shipment barge, which will transport salt to an offshore ocean going vessel anchorage. The proposed area for dredging is approximately 200 m x 35 m and 6 m in total water depth (2.5 m seabed depth to be dredged), with dredged spoil (assumed to be 17,000 m^3) proposed to be disposed onshore. The onshore disposal area will be located immediately inshore from the jetty location (Figure 3). Neutralising material will be added to the dredged material as necessary to treat any ASSS detected. Decant water will be retained for a suitable time to allow appropriate water quality standards to be met (confirmed by monitoring) prior to release to the marine environment. Solids will be tested to ensure appropriate environmental standards are met, then will be reclaimed and used in on-site embankment construction.

3.2.10 Drainage Diversions

Water Technology (2021) have determined the locations of drainage diversions required upstream of the proposed concentration ponds, to direct surface water flows around the project area (Figure 3). These drainage diversions will require excavations to re-direct surface flows. The estimated volume of material to be excavated is 455,000 m^3. The majority of excavated material is unlikely to be acid generating as they are assumed to be significantly weathered and have historically been subject to oxidisation and leaching cycles. However, the net acid generating potential has not been accurately determined and pockets or lenses may contain acid generating material, particularly with depth. Further sampling will be conducted to confirm net acid generating potential prior to excavation and management implemented if necessary.

3.2.11 Borrow Pit Areas for Construction Materials

A summary of the Proposal material reuse potentials is presented in Table 6. Based on geotechnical studies conducted by GHD, the locations of borrow pits for project construction have been determined as shown on Figure 3. It is estimated that these borrow pits will cover a total area of 817 ha, be a maximum depth of 6 m and approximately 27 million m^3 of material will be excavated from them.

Borrow pits 1 and 2 (Figure 3) are considered unlikely to contain acid generating material given they occur on elevated sandy islands and ASS was not identified at 6.5 m depth (excavation will cease at 6 m depth). No further sampling is considered necessary if excavation depth remains no deeper than 6 m.

Borrow pits 3 and 4 (Figure 3) may contain acid generating material at depth, however, the depth of these borrow pits will be to a maximum of 2 m depth. Further sampling will be conducted to confirm net acid generating potential prior to excavation and management implemented if necessary.

Table 6 Summary of Potential Construction Materials

Domain / Material	Material Re-use Potential			
	General Fill	Select Fill	Low Permeability Fill	Rock Armour
Coastal Dune Sand (Qs)	Yes	Yes	No	No
Intertidal Flats (Qs)	No	No	No	No
Dune Field Sand (Qe)	Yes	Yes	No	No
Supratidal Flats (Qt)	Yes	No	Yes[1]	No
Claypan Terrain (Czp)	Yes	Yes[2]	Yes[3]	No
Outwash Plain Alluvium (Qza)	Yes	Yes	No	No
Coastal Limestone	Yes	Yes	No	No[4]

Table 6. Table source: Arcadis (2018b)

1) Subject to investigation and material characteristics assessment by laboratory testing

2) Borrow operations to target well graded soils with durable gravel and fines content < 12%

3) Borrow operations to target red-brown medium plasticity sandy clay

4) To be confirmed, existing data indicates limestone in coastal fringes is too fractured and of variable strength to generate blocks of sufficient size for rock armour

4. Development Strategy

The development strategy for the Study Area comprises a high level 'overall approach' to identify the ASSS risk areas and associated major aspects of the Proposal. The development strategy outlines the proposed infrastructure according to disturbance risk, which has been based on the available site investigation data and development information provided in Section 3.

Table 7 below provides a summary of proposed infrastructure, ASSS risk and development constraints. Figure 4 presents the proposed infrastructure and disturbance risk.

Table 8 provides a summary of the project areas which may result in excavation or spoil generation and recommended management of these areas. This ASSSMP has been prepared by GHD outlining specific and detailed management measures in Sections 5 to 9.

Table 7 Development Strategy

Proposed Infrastructure	Disturbance Risk	Development Constraints/ Strategy
Seawater Intake	High	Seawater Intake inlet well and pump station will require excavation of creek mudflat. Excavated spoil will require management
	Low	Intake channel will not require any excavation – it will be built on the natural ground surface using imported fill to construct embankments on either side
Salt Concentration Ponds, Crystalliser Ponds and Bitterns Pond	Moderate - High	Disturbance of natural ground within the concentration ponds is not proposed. The extent of displacement anticipated for earthen bunds and the neutralisation capacity will be confirmed prior to placement. Monitoring program including site observations for evidence of acid generation and neutralisation if required. To construct embankment, imported material will be placed directly on the supratidal flats or low-lying areas. A small surface scraping of 10-20 cm of the salt flat surface may occur prior to construction of embankments to "key in" walls into the clay layer. Testing of this material will be required and if necessary treatment will occur, prior to its use in construction of embankments.
Bitterns Transfer Structure	Low	The Maiden Brine Transfer Pump Station will be built into the pond embankment and sit on top of the natural ground surface (no excavation is required)
Bitterns Channel and Discharge	Low	The Bitterns Channel and Discharge will be built on top of the natural ground surface (no excavation is required)

Proposed Infrastructure	Disturbance Risk	Development Constraints/ Strategy
Salt Stockyard and Reclaim Conveyor System (elevated areas above 5 m AHD)	Low	Disturbance in the form of excavation for shallow foundations (less than 3 m depth) for stockyard and majority of the reclaim conveyor system located within the elevated regions of the site (> 5 m AHD) will not require treatment and management of ASS material
	High	Disturbance in low lying areas (<5 m AHD) and below natural soil surface will require treatment and management of ASS material.
Non-Process Infrastructure (NPI)	Low	Excavation will need to occur for shallow footings (less than 3 m depth) for the NPI infrastructure. NPI infrastructure is located on elevated area considered Non-ASS (NASS) and unlikely to disturb ASS material. Spoil will not require treatment or management of ASS material.
Jetty	Low	Jetty extends outwards approximately 700 m into the marine environment from the northern coastline and includes a loading platform Assumed to be installed via pile driving with no spoil generated.
Capital Dredging and Onshore Dredge Disposal Area	Moderate	The proposed area for dredging is approximately 200 m x 35 m and 6 m in depth, with dredged spoil (assumed to be less than 17,000 m^3) proposed to be disposed onshore. The onshore disposal area is shown in Figure 3. Dredge spoil will require management during dredge operation and for onshore disposal management.
Drainage Diversions	Low - Moderate	Will require excavations to re-direct surface flows. The estimated volume of material to be excavated is 455,000 m^3. The majority of excavated material is unlikely to be acid generating as they are assumed to be significantly weathered and have historically been subject to oxidisation and leaching cycles. However, the net acid generating potential has not been accurately determined and pockets or lenses may contain acid generating material, particularly with depth. Further sampling will be conducted to confirm net acid generating potential prior to excavation and management implemented if necessary.
Borrow Pit Areas for Construction Materials	Low - Moderate	Proposed borrow pit areas are shown on Figure 3. Approximately 38 million m^3 of material will be excavated from them. Borrow pits 1 and 2 are considered unlikely to contain acid generating material given they occur on elevated sandy islands and ASS was not identified at 6.5 m depth (excavation will cease at 6 m depth). No further sampling

Proposed Infrastructure	Disturbance Risk	Development Constraints/ Strategy
		is considered necessary if excavation depth remains no deeper than 6 m. Borrow pits 3 and 4 may contain acid generating material at depth, however, the depth of these borrow pits will be to a maximum of 2 m depth. Further sampling will be conducted to confirm net acid generating potential prior to excavation and management implemented if necessary.

Table 8 Summary of Recommended ASS Management

Infrastructure	Excavation Required	Approx. Max. Depth of Excavation	Excavation Floor Depth mAHD	Estimated Amount of Material	ASS Risk Map Rating	Treatment Required (yes, no or specific comment)
Jetty Berthing Pocket	Dredging of Berthing Pocket	2.5 m of seabed	-7.2	17,000 m^3	N/A mapping – sampling indicates Moderate to High risk	Yes – marine sediment sampling indicates likely to be acid generating. Will be contained and treated in land disposal area.
Jetty	Piles	Assume driven with no spoil	N/A	Assume driven with no spoil	Low – Moderate	No – no excavation required.
Plant Site (NPI Infrastructure)	Shallow footings	3 m	1.1	Included in Borrow Pit A	Low – Moderate	No – elevated sandy island. ASS not identified at 6.5 m via sampling.
Borrow Pit 1	Excavation of construction material	6 m from highest point of island	0.8	10.6 million m^3	Low – Moderate	
Borrow Pit 2	Excavation of construction material	6 m from highest point of island	0.8	4.9 million m^3	Low – Moderate	
Borrow Pit 3	Excavation of construction material	2 m	2.0	1.3 million m^3	Low – Moderate	Likely to be acid generating at depth, however surface soils may have completed previous oxidation and leaching cycles resulting in lower risk or net acid generating potential. Further sampling will be conducted to confirm prior to excavation.
Borrow Pit 4	Excavation of construction material	2 m	1.0	9.8 million m^3	Low – Moderate	
Drainage Diversion A	Excavation of material for drainage diversion (to be used as fill)	2 m	5.5	330,000 m^3	Low - High	Likely to be acid generating at depth, however surface soils may have completed previous oxidation and leaching cycles resulting in lower risk or net acid generating potential. Further sampling will be conducted to confirm prior to excavation.
Drainage Diversion B	Excavation of material for drainage diversion (to be used as fill)	2 m	6.0	21,000 m^3	Low - High	
Drainage Diversion C	Excavation of material for drainage diversion (to be used as fill)	2 m	8.0	104,000 m^3	Low - High	
Evaporation Ponds External Walls	Excavation to “key” walls into clay layer	10 – 20 cm	0.75	N/A surface only	Moderate – High	Yes – materials will require confirmatory testing to ascertain acid generating potential prior to re-use.

Infrastructure	Excavation Required	Approx. Max. Depth of Excavation	Excavation Floor Depth mAHD	Estimated Amount of Material	ASS Risk Map Rating	Treatment Required (yes, no or specific comment)
Crystalliser Ponds External Walls	Excavation to “key” walls into clay layer	10 – 20 cm	0.65	N/A surface only	Moderate - High	Confirmation of the extent of displacement anticipated for earthen bunds to confirm existing neutralisation prior to placement.
Bitterns Pond External Walls	Excavation to “key” walls into clay layer	10 – 20 cm	0.55	N/A surface only	Moderate - High	
Seawater Intake Channel	None – assumed built on top of mudflat	N/A	N/A	N/A	Moderate – High	No – no excavation required.
Seawater Intake Inlet Well and Pump Station	Excavation of creek bank required for inlet well	3 m	-2.04	Up to 20,000 m^3	Moderate - High	Yes – creek sediment sampling indicates likely to be acid generating. Will be contained and treated within intake channel.

5. Spoil Management

5.1 Definition of Responsible Parties

The management strategies outlined below are required to mitigate, where possible, adverse impacts to sensitive environmental receptors within the vicinity of the site. As the construction tender has not yet been awarded, the following text includes generic terms for the parties that will be involved, as defined below.

- *Contractor:* Earthworks contractor to be appointed by K + S Australia Pty Ltd;

  The Contractor must provide suitably qualified Environmental Personnel during ground disturbance works, with the ability to implement and interpret the requirements within this Management Plan;

- *Environmental Specialist:* Environmental Professional appointed by K + S Australia Pty Ltd or a K + S Australia Pty Ltd Environmental Specialist; and

- *Superintendent:* Supervising engineer appointed by K + S Australia Pty Ltd.

The Contractor will be responsible for ensuring that all management measures outlined in this section (or as agreed otherwise) are adhered to for the duration of their contract.

5.2 Spoil Requiring Management

Spoil requiring management (as outlined within ASSS study and as per management requirements below) is required for the following infrastructure construction:

- **Seawater Intake Inlet Well and Pump Station**. Defined as any excavation in natural ground for infrastructure associated with the abstraction of water from Urala Creek South.
- **Capital Dredging**. Defined as all material recovered and placed onshore from the berthing pocket and dredging activities. All dredging activities will comply with a Dredge Management Plan to inform the offshore management strategies.

The following proposed areas of excavation will require further testing to determine if the spoil generated will likely contain acid generating material, and if so, any potentially acid generating spoil will be managed in accordance with the requirements of this document:

- Drainage Diversions A, B and C. The majority of excavated material is unlikely to be acid generating as they are assumed to be significantly weathered and have historically been subject to oxidization and leaching cycles. However, the net acid generating potential has not been accurately determined and pockets or lenses may contain acid generating material, particularly with depth. Further sampling will be conducted to confirm net acid generating potential prior to excavation and management implemented if necessary;
- Borrow Pits 3 and 4 may contain acid generating material at depth, however, the depth of these borrow pits is expected to be a maximum of 2 m depth. Further sampling will be conducted to confirm net acid generating potential prior to excavation and management implemented if necessary;
- A small surface scraping of 10-20 cm of the salt flat surface may occur prior to construction of embankments to “key in” walls into the clay layer. Testing of this material will be required and if necessary treatment will occur, prior to its use in construction of embankments; and

- Any additional proposed excavation lower than the surface level of the salt flats and mud flats.

5.3 Spoil Treatment Method

5.3.1 Management of Spoil

The management of excavated spoil deemed as ASS can be implemented through an on-site and/or off-site methods depending on factors including site constraints, requirement for material and geotechnical suitability.

For the basis of this ASSSMP and due to the location constraints, it is assumed that spoil requiring treatment will be treated onsite.

5.3.2 Storage and Treatment Area

The Contractor will inform the Environmental Specialist within 24 hours of excavating spoil deemed as ASS. The Contractor will provide an estimate of ASS spoil based on observation(s) within open excavations within 24 hours to ensure a sufficient treatment area can be located. The Contractor may nominate a location subject to approval by the Environmental Specialist to suit the staging of the Project to prevent double handling and extra over transportation.

All disturbed material deemed to be ASS (refer to Section 5.2) must be stockpiled on a bunded limestone treatment pad after excavation and during the neutralisation process until confirmation that neutralisation has been achieved.

The storage and treatment area must comprise the following components:

- A compacted crushed limestone pad of not less than 300 mm in thickness. The pad shall be graded to ensure good drainage towards the back of the pad to ensure runoff and any leachate is collected within the collection basin/sump;
- Three (3) sides will be bunded with limestone, or a similar alkaline material, to a minimum height of approximately 150 mm above the surface of the pad to prevent lateral run-off. A leachate collection basin/sump will also be required to manage run-off during winter periods or rainfall events; and
- Leachate collection basin should be lined with a low permeability liner (synthetic) or crushed limestone. The leachate collection basin should be of sufficient size to retain tailwater, stormwater events and inclement weather events prior to discharge, if neutralisation of leachate is required. The leachate basin/sump will be monitored daily as per Section 5.8.4.

The volume of the excavated material will not exceed the capacity of the storage and treatment area, will not exceed more than one week's excavation volume and stockpiles should not be greater than 2.5 m in height, to prevent material being stored without treatment for excessive periods. Excavated soil may be temporarily stockpiled pending treatment on the bunded treatment pad for a maximum of fourteen (14) days. The storage and treatment area will not be located within areas susceptible to inundation from tidal events or meteorological events (i.e. above storm surge levels and away from flood zones).

The Contractor is to provide a description of their proposed methodology for neutralisation prior to the commencement of works. The method is to be approved by the Environmental Specialist prior to the commencement of the soil treatment operations, and may require adjustment during works, if validation results indicate the methodology is not effective.

5.3.3 Spoil Neutralisation Method

The Contractor will be responsible for the blending of spoil on the storage and treatment area.

The methodology regarding the blending of spoil and neutralisation will be at the discretion of the Contractor, however spoil must be adequately and evenly blended to the satisfaction of the Environmental Specialist prior to validation.

Spoil not achieving the validation criteria (Section 5.7) will be required to be re-blended and neutralised prior to re-testing.

5.4 Neutralisation Material

Neutralisation material generally consists of lime with a pH 8.2 and is considered the safer option for the natural environment.

The Contractor will inform the Environmental Specialist prior to commencement of neutralisation and provide the Product Information Sheet (PIS) from the supplier to ensure the liming rate can be corrected prior to application.

5.5 Neutralisation Rate

All soil considered to be ASS must be treated and blended with a neutralisation material and subsequently validated (refer to Section 5.6) prior to reuse.

The uncorrected liming rate calculation (adopted from DER 2015) is presented in Table 9 and assumes the following.

- Maximum net acidity value;
- Safety factor of 1.5;
- Conservative bulk density; and
- ENV of neutralising material is 50%.

Table 9 Calculated Neutralisation Rate

Infrastructure	Maximum Net Acidity Result (mol H^+/tonne/ %S)	Assumed Bulk Density (Tonne/m^3)	Uncorrected Liming Rate (kg/m^3)[1]
Seawater Intake	170/ 0.27	1.6	40.4
Salt Stockyard and Reclaim Conveyor System	360/ 0.58	1.6	86.9
Jetty and Capital Dredging (offshore materials)	220/ 0.35	1.6	52.4

5.6 Validation Procedure

The Contractor will be responsible for the sampling and testing of the neutralised material prior to re-use or disposal. However, the results of the testing procedure and programme must be sent to the Environmental Specialist for approval prior to transportation of material and re-use or disposal.

[1] Uncorrected liming rate assumes Aglime has 50% ENV, liming rate to be corrected prior to construction.

The Environmental Specialist will verify if material was neutralised correctly and their notification of this must be received by the contractor prior to removing material from the storage area.

The validation sampling will be undertaken in accordance with *Landfill Waste Classifications and Waste Definitions 1996* (As amended 2019) (DWER 2019). A summary of the required sampling programme is summarised in Table 10.

Table 10 Stockpile Validation Sampling Programme

Volume of Stockpile (m^3)	Number of Samples	Sample Suite
<200	4	All samples: pH_F and pH_{FOX}. 20% of samples: Chromium Reducible Sulfur suite (pH_{KCL}, TAA, S_{CR}, ANC and S_{NAS}) with the inclusion of a measurement for Titratable Peroxide Acidity (TPA).
200-500	6	
500 – 1,000	8	
1,000-2,000	11	
2,000-3,000	15	
3,000-4,000	18	
4,000-5,000	20	
5,000-10,000	24	
>10,000	24 plus 4 for each additional 10,000 m^3	

Table 10 referenced from (DWER, 2019)

Representative soil samples will be collected from the treated stockpile(s), i.e. from points distributed at different elevations and locations around the stockpile perimeter, and from at least 300 mm within the stockpile surface.

Samples will be collected in a zip-lock plastic bag and will be stored on ice immediately and transported to a National Association of Testing Authorities (NATA) accredited laboratory for analysis as soon after collection as possible.

5.7 Validation Criteria

The treated soils will be assessed with reference to DER (2015):

- The neutralising capacity of the treated soil must exceed the existing plus potential acidity of the soil (e.g. pH_{FOX} must be greater than 5.0);
- The neutralising material has been thoroughly mixed with the soil;
- Soil pH (pH_F) must be between 6.0 and 8.5. Organic soils will be assessed on laboratory results (Chromium Reducible Sulfur suite and TPA in the first instance); and
- Excess neutralising material must remain within the soil until all acid generation reactions are complete and the soil has no further capacity to generate acidity (i.e. net acidity <0.03 %S).

If the validation results do not comply with the criteria, and if any confirmatory results indicate neutralising capacity less than the existing plus potential acidity, then additional treatment by the Contractor will be required. Subsequent, re-testing will be undertaken, and adequate validation results will be required before the material can be re-used.

5.8 Dredge Spoil Requirements

5.8.1 Dredge Spoil Considerations

The following considerations, with regards to operations and transportation, will be considered and implemented (if applicable) to reduce the potential acid generation impacts during the berthing pocket dredging operations.

The management procedures related to the offshore activities will be included in a Dredge Management Plan and will detail the operations below and appropriate offshore and transportation measures. The dredge procedures will be reviewed and revised as additional information becomes available.

5.8.2 Transportation of Dredged Spoil

Typically dredge spoil will be transported as a slurry via a pipeline to the onshore disposal facility. This transportation time from initial exposure to atmospheric oxygen and disposal/ treatment site onshore will be a critical factor for consideration.

Transportation timeframes should be kept to a minimum and contingency measures for equipment failure taking longer than 24 hours should be included in the Dredge Management Plan.

Additionally, contingency measures for onshore incidences such as spillage and pipe breakages should be included. Whilst initially, saturated sediments (i.e., slurry with a high water content) will have a lower risk of acid generation, contingency measures to address the dredge spoil and prevention of sulfuric acid release will need to be considered and addressed.

5.8.3 Treatment of Dredge Spoil Onshore

Approximately 17,000 m^3 of dredge spoil is expected to be delivered via slurry through a pipeline to the onshore disposal site. The seepage rate and tailwater from the dredged spoil has not been calculated to date, however, the tailwater will be collected and managed to ensure discharge of tailwater does not occur.

Seepage will be monitored and shall conform with tailwater quality objectives, as outlined in Section 5.8.4.

A designated area(s) will be prepared to contain the dredged spoil and tailwater (draw off water) to allow the dredged spoil to become ‘spadable’ and enable it to be blended and neutralised as per Section 5 prior to re-use. Tailwater will be collected and contained within an impermeable lined sump and treated with neutralising material such as lime.

For any circumstance which does not include tailwater contained within the lined sump, the following water quality objectives must be implemented:

- pH between 7.0 and 8.5;
- Total titratable acidity less than 40 mg/L;
- Suspended sediment concentration measured as turbidity with appropriate limits set during the approvals process;
- Tailwater monitoring locations must be established; and
- Tailwater will be monitored on a daily basis in the field prior to discharge (outlet) to ensure compliance with the above water quality objectives.

5.8.4 Tailwater Water Quality Objectives

Tailwater water quality objectives for ASS listed below will be confirmed by baseline assessment prior to dredging operations to enable determination of site-specific water quality objectives:

- pH between 7.0 and 8.5; and
- Total titratable acidity less than 40 mg/L.

Tailwater Monitoring Locations

Tailwater will be monitored on a daily basis in the field prior to discharge (outlet) to ensure compliance with the above water quality objectives.

5.9 Seawater Intake Spoil Requirements

5.9.1 Considerations for Seawater Intake

The following considerations with regards to operations and transportation will be considered and implemented (if applicable) to reduce the potential acid generation impacts during the seawater intake inlet well and pump station construction operations.

5.9.2 Transportation of Spoil

This transportation time from initial exposure to atmospheric oxygen and disposal/treatment site onshore will be critical factor for consideration.

Transportation timeframes should be kept to a minimum and contingency measures for equipment failure taking longer than 24 hours should be included.

Additionally, contingency measures for onshore incidences such as spillage and pipe breakages should be included. Whilst initially, saturated sediments (i.e. slurry with a high water content) will have a lower risk of acid generation, contingency measures to address the spoil and prevention of sulfuric acid release will need to be considered and addressed.

5.9.3 Treatment of Spoil

Up to 20,000 m^3 of spoil is anticipated to be delivered onshore into the proposed seawater intake channel and contained within its embankments. The seepage rate and tailwater from the spoil has not been calculated to date, however, the tailwater will be managed as outlined below.

A designated area(s) will be prepared to contain the spoil and tailwater (draw off water) to allow the spoil to become ‘spadable’ and enable it to be blended and neutralised as per Section 5 prior to re-use. Tailwater will be collected and contained within an impermeable lined sump and treated with neutralising material such as lime. The treated tailwater will be retained within the treatment area and allowed to evaporate. Remaining spoil will be managed in accordance with Section 5.3 of this ASSSMP.

5.9.4 Tailwater Management

No tailwater will be discharged from the treatment area. The treated tailwater will be retained within the treatment area and allowed to evaporate.

For any circumstance which does not include tailwater contained within the lined sump, the following water quality objectives must be implemented:

- pH between 7.0 and 8.5;
- Total titratable acidity less than 40 mg/L;
- Suspended sediment concentration measured as turbidity with appropriate limits set during the approvals process;
- Tailwater monitoring locations must be established; and
- Tailwater will be monitored on a daily basis in the field prior to discharge (outlet) to ensure compliance with the above water quality objectives.

5.10 Reporting Requirements

5.10.1 Contractor

The Contractor is required to prepare the following information and provide to the Environmental Specialist and Superintendent on a weekly basis to form a log of treatment operations:

- Total volume of excavated soil;
- Quantity and type of neutralising material utilised;
- Dates of excavation and treatment of ASS material;
- Date of validation and approval from Environmental Specialist;
- If validation criteria are achieved; and
- Approximate location of neutralised ASS material once approved for re-use.

5.10.2 Environmental Specialist

The Environmental Specialist will provide written advice as to the results of validation testing to include:

- Information about the volume of material tested;
- The analytical results (pH screen within 24 hours); and
- Confirmation that the excavated material is suitable for re-use and meets the neutralisation criteria.

6. Monitoring Program

6.1 Daily Site Observations

Daily observations will be completed by the Contractor within areas of disturbance. Daily observations will be formally recorded and provided as a written record on a monthly basis and include the following information as minimum:

- Daily site activity and operations (i.e. excavation areas, fill importation areas);
- Visual observation record including as a minimum:
    - Unusually clear or milky blue-green drainage water within or, flowing from, areas of excavation or fill importation areas;
    - Extensive iron (red staining) on any drains or pond surfaces;
    - Visual observations within natural excavated material that include pale, yellow mottling (Jarosite);
    - Hydrogen sulfide or sulfur odour (rotten eggs) during excavations;
    - Blackened to coloured surface water indicating de-oxygenation;
    - Crystalline formation indicating gypsum formation, which may inhibit neutralisation of spoil;
    - Unexplained scalding, degradation or death of vegetation;
- Spoil management records and treatment process as per Section 5; and
- Daily leachate collection basin and tailwater measurements during dredge operation as per Section 5.8.3.

A field observation daily record sheet has been included as an example (Appendix A) and maybe utilised in the documentation process.

6.2 Monthly Environmental Auditing

Monthly audits of the information provided by the Contractor will be undertaken by the Environmental Specialist to review the site environmental conditions, spoil management and adherence to the overall ASSSMP.

The Contractor will submit all data in a timely manner at the commencement of each month or at an agreed date by all parties.

The Environmental Specialist will prepare a technical note or memorandum providing a summary of the review, actions required to be completed or amendments required to be undertaken as a management response to the environmental conditions documented. The technical note or memorandum will form part of the post construction and/or commissioning phase of the project.

6.3 Dredging Tailwater Monitoring

Tailwater discharged to the marine environment will be monitored on a daily basis in the field prior to discharge (outlet) to ensure compliance with the water quality objectives set during the environmental approvals process.

6.4 Groundwater Monitoring Program

6.4.1 Monitoring Requirements

The below monitoring program has been outlined due to the possible disturbance of potential ASS material during the construction and commissioning of the Proposal. The monitoring program is proposed to detect long term changes or deterioration of the groundwater quality within the Study Area, rather than as a required aspect due to the disturbance of soils during the construction and commissioning phase.

6.4.2 Baseline Monitoring Wells

The Environmental Specialist will conduct a pre-construction groundwater monitoring event for the groundwater wells outlined in Table 11 and shown on Figure 5.

Replacement monitoring wells will be installed by the Contractor, to the same specification as existing wells, if the existing wells in the network are damaged or destroyed during the construction program.

Table 11 Summary of Groundwater Monitoring Bores

Borehole ID	Coordinates (MGA Zone 50)[1]		Ground Surface Level (m AHD)	Depth of Screened Zone (m)
	Easting	Northing		
BH01	269887	7581719	+7.2	2.0 – 8.0
BH02	272595	7585346	+2.1	12.25 – 18.25
BH02A	272595	7585351	+2.2	5.0 – 8.0
BH03	267805	7587157	+1.6	11.0 – 14.0
BH03A	267803	7587157	+1.5	2.0 – 5.0
BH04	272867	7580738	+3.4	3.2 - 8.2
BH05	266675	7578586	+0.7	12.0 – 15.0
BH05A	266675	7578587	+0.7	1.0 – 2.0
BH07	262938	7573345	+1.8	10.6 – 13.6
BH07A	262938	7573346	+1.8	1.7 – 7.7
BH08	263029	7573316	+5.5	5.6 – 10.1
BH09A	268003	7572195	+3.5	6.0 – 9.0
BH09B	268003	7572197	+3.5	0.5 – 3.0
BH10	266494	7572270	+0.9	2.0 – 5.0
BH10A	266494	7572272	+0.9	2.0 – 5.0
BH11	260260	7569715	+1.2	6.0 – 9.0
BH11A	260263	7569718	+1.2	1.6 – 4.6
BH12	261195	7565602	+8.7	3.0 – 10.0
BH13	271735	7563998	+6.2	3.0 – 6.0
BH14	259892	7565531	+1.0	11.0 – 12.5
BH14A	259892	7565533	+1.0	2.0 – 6.0
BH15	265126	7565578	+1.6	9.0 – 12.0
BH15A	265126	7565580	+1.6	2.0 – 5.0

Table 11. Table notes:

[1]) MGA50 : Map Grid Australia 1994 Zone 50

[2] Pump test bore

6.4.3 Groundwater Monitoring Methodology

Prior to collecting a groundwater sample, the static water level (SWL) and water column will be measured using a water level meter from the top of the casing and a purge volume calculated.

Purging and sampling of groundwater monitoring wells will be undertaken in accordance with AS 5667.11 – 1998 (AS 1998).

Following purging, the groundwater samples will be collected using a low-flow pump. Field quality measurements for pH, temperature, oxidation-reduction potential (ORP or Eh), dissolved oxygen (DO), and electrical conductivity (EC) will be recorded following each purged well volume to assess stabilisation of the groundwater.

Groundwater samples will be collected into laboratory supplied bottles that contain laboratory prepared preservative chemicals. Sample bottles will be placed immediately into a chilled container and maintained chilled until couriered to the laboratory for analysis.

6.4.4 Monitoring Program

Groundwater monitoring will be undertaken in order to assess static water levels and quality trends. Table 12 outlines a summary of the monitoring program.

Table 12 Groundwater Monitoring Program

Frequency	Analysis Suite	Responsibility
Pre-construction		
One month prior to commencing ground disturbance works	Field measurements & laboratory analysis	Environmental Specialist
Construction Period		
Bi-Monthly	Field measurements & laboratory analysis	Contractor (or delegated authority)
Commissioning Period		
Commissioning period (or post construction phase)	Field measurements & laboratory analysis	Environmental Specialist
Analysis suites		
Field measurements: Static Water Level, pH, EC (and specific conductivity), ORP and DO **Laboratory analysis:** pH, EC, total dissolved salts, dissolved solids. Major cations: sodium, potassium, calcium, magnesium. Major anions: chloride, sulfate, bicarbonate. Dissolved metals: aluminium, arsenic, cadmium, chromium, iron, manganese, nickel, selenium, zinc. Total metals: aluminium, iron. Nutrients: total nitrogen (TN), total oxidised nitrogen, ammonia as N, total phosphorus, reactive phosphorus		

6.4.5 Groundwater Performance Criteria

The baseline values (pre-construction) will form the basis of the performance criteria for the Study Area and utilised in the review of groundwater data received on an on-going basis to assess and detect physiochemical changes within the groundwater.

A review of the baseline monitoring program (bi-monthly) by the Environmental Specialist including a comparison to baseline values will be undertaken for every monitoring event to assess and evaluate any changes in physicochemical properties detected within the groundwater wells.

7. Training and Awareness

All personnel, subcontractors and consultants undertaking any site works will receive an induction regarding the environmental obligations prior to commencing on site. All environmental inductions will be conducted as part of the Health and Safety Environmental requirements for the site. It is anticipated that project induction and training will fall under the following categories:

- General induction; and
- Job specific environmental training.

Information specific to the occurrence and management of ASS will be included in the general project induction:

- Working within or in close proximity to water including watercourses and coastal environments;
- Protecting waterways and riparian zones (including sediment and erosion control);
- Indicator of ASS and impacted water;
- Reporting and responsibilities; and
- Spills and leaks (including the application of spill response products).

8. Contingency Planning

Contingency measures are outlined in Table 13 and should be consulted in the first instance in the event of a system failure. The Contractor is expected to inform all parties immediately, if the contingency measures are required to be implemented. Significant delays in the implementation of contingency measures, could result in unacceptable degradation to the landscape, groundwater quality and sensitive environmental receptors.

Table 13 Contingency Planning

Activity	Issue	Potential impact to environment	Mitigation Strategy	Contingency Option
Excavation or disturbance of ASS	Oxidisation of ASS materials.	Low potential for environmental impact due to coastal location of most significant excavation (Seawater Intake).	Spoil management (Section 5).	Commence neutralisation of spoil or porewater and re-validation procedure (if applicable).
	Acid generation from ASS materials released to overland flow and in groundwater.	Low to moderate potential for environmental degradation, if containment practices such as spoil treatment pad and effluent sump/ basin not implemented.	Spoil management (Section 5) and groundwater monitoring (Section 6).	Containment and neutralisation of overland flows. Discharge only when water quality objectives satifsfied.
Dredging of marine sediments	Aeration of ASS materials during dredging operation.	Marine sediment disturbed but not recovered for onshore disposal will settle to the bottom of the ocean and return to an anoxic or reducing environment. Sediment will not generate acidity and do not pose significant threat to the environment. Suspended sediments may oxidise and generate acid, however available oxygen below water is to a lesser extent that atmospheric exposure. In the open ocean environment, the buffering capacity of seawater is immense with almost instanteous neutralisation likely. Therefore suspended sediments are unlikely to present as a risk to the marine environment.	Water quality monitoring and management as per Dredge Management Plan.	Outlined in the Dredge Management Plan.
	Oxidisation of ASS materials in dredge hopper.	Sediments in hopper on dredge barge are likely to remain saturated during normal operating conditions whilst being transported to onshore disposal area. Oxidisation of materials and generation of acid is perceived as low.	Dredge material will not be stored in the hopper or offshore for greater than 24 hours.	Contingency measures to include operational failure and equipment breakdown to be included in the Dredge Management Plan.
	Onshore malfunction including spillage of slurry or pipeline failure.	Dredge spoil is likely to contain a ‘blend’ of calcareous sands and ASS. Short terms sediments will be saturated (slurry).	Dredge Management Plan will include measures for the containment of	Contingency measures to include operational failure and equipment breakdown to be

Activity	Issue	Potential impact to environment	Mitigation Strategy	Contingency Option
			spillages and unexpected discharges of slurry to onshore surfaces. Accidental or unforeseen discharges will be remediated within 48 hours by removal and transportation to treatment area.	included in the Dredge Management Plan.
Dredge spoil onshore treatment	Acid generation from dredged ASS and release to groundwater (due to not following treatment and validation process).	Dredged spoil will be placed or pumped onto the treatment area and tailwater dewatered. Materials will be neutralised as soon as 'spadeable'. Dredged spoil will undergo treatment as a suitable for blending.	Spoil will be treated once onshore in accordance with this management plan.	Lime dosing of tailwater to meet water quality objectives.
	Release of acidic and / or elevated metals within tailwater to groundwater or overland flow.	Dredged spoil will be neutralised and validated prior to re-use to ensure acid generating potential does not acid neutralising capacity.	Spoil and tailwater will be treated once onshore in accordance with this management plan. Tailwater will be treated to meet water quality objectives outlined in Section 5.8.4.	Re-neutralisation of dredge spoil prior to removal from storage area prior to re-use. Spoil will not be re-used without appropriate validation.

9. Post Construction Reporting

The closure report will include the following components to assist in the documentation of the spoil operations for construction program, which will be made available to the regulatory authorities, if and when requested.

- Monthly audit technical note or memorandum;
- Spoil management and treatment records;
- Groundwater data trends observed and recorded;
- Compliance and/ or adherence to permit(s) conditions;
- Site audits and attendance by Environmental Specialist;
- Any other correspondence and site issues relating to spoil and groundwater; and
- Appendices to include all raw data and licenses.

10. References

Arcadis (2018a), K+S Ashburton Salt Project Pre-Feasibility Study (PFS): Pre-Feasibility Study (PFS) Design Report, Report No. 10015696-EA-RP-003, May 2018.

Arcadis (2018b), K+S Ashburton Salt Project Pre-Feasibility Study (PFS): Preliminary Basis of Design (BoD) Report, Report No. 10015696-EA-RP-001, May 2018.

Australian Government (2009), National Assessment Guideline for Dredging, Commonwealth of Australia, Canberra, 2009.

DER (2015a), Identification and investigation of acid sulfate soils and acidic landscapes, Department of Environment Regulation, Western Australia, June 2015.

DER (2015b), Treatment and management of soil and water in acid sulfate soil landscape, Department of Environment Regulation, Western Australia, June 2015.

DMIRS (2020), Mine and Mineral Deposits (MINEDEX), Department of Mines, Industry Regulation and Safety, Western Australia, https://minedex.dmirs.wa.gov.au/Web/home.

DPLH (2020), PlanWA interactive map, Department of Planning, Lands and Heritage, Western Australia, https://www.dplh.wa.gov.au/planwa.

DWER (2019), Landfill Waste Classification and Waste Definitions 1996 (as amended 2019): Environmental Protection Act 1986, Department of Water and Environmental Regulation, Western Australia, December 2019.

GHD (2018), Ashburton Salt Project, Geotechnical, Hydrogeological and Acid Sulfate Soil Desktop Assessment, February 2018.

GHD Pty Ltd (2019), Ashburton Solar Salt Early Works – Phase 1, Geotechnical and Acid Sulfate Soil Site Walkover Inspection, Report No. 6138358-REP_0, March 2020.

GHD Pty Ltd, (2021), K + S Australia Pty Ltd, Acid Sulfate Soil and Sediment Study, EPA Assessment No. 2101, EPBC reference no. 2016/7793, Report No. 12516706-99326, September 2020.

Sullivan, L, Ward, N, Toppler, N and Lancaster, G (2018a), National Acid Sulfate Soils guidance: National acid sulfate soils sampling and identification methods manual, Department of Agriculture and Water Resources, Canberra, CC BY 4.0, June 2018

Sullivan, LA, Ward, NJ, Bush, RT, Toppler, NR, Choppala, G (2018b), National Acid Sulfate soils Guidance: Overview and management of monosulfidic black ooze (MBO) accumulations in waterways and wetlands, Department of Agriculture and Water Resources, Canberra, CC BY 4.0, June 2018.

Simpson, SL, Mosley, L, Batley, GE and Shand, P (2018), National Acid sulfate soils guidance: Guidelines for the dredging of acid sulfate soil sediments and associated dredge spoil management, Department of Agriculture and Water Resources, Canberra, CC BY 4.0, June 2018.

Standards Australia / Standards New Zealand (AS) (1998) AS 5667.11:1998 Water Quality Sampling - Part 11: Guidance on sampling of groundwaters. Standards Australia / Standards New Zealand, Sydney and Wellington.

Water Technology (2021), Ashburton Salt Project Surface Water Assessment and Modelling. Perth: Unpublished Report Prepared for K+S Salt Australia.

Figures

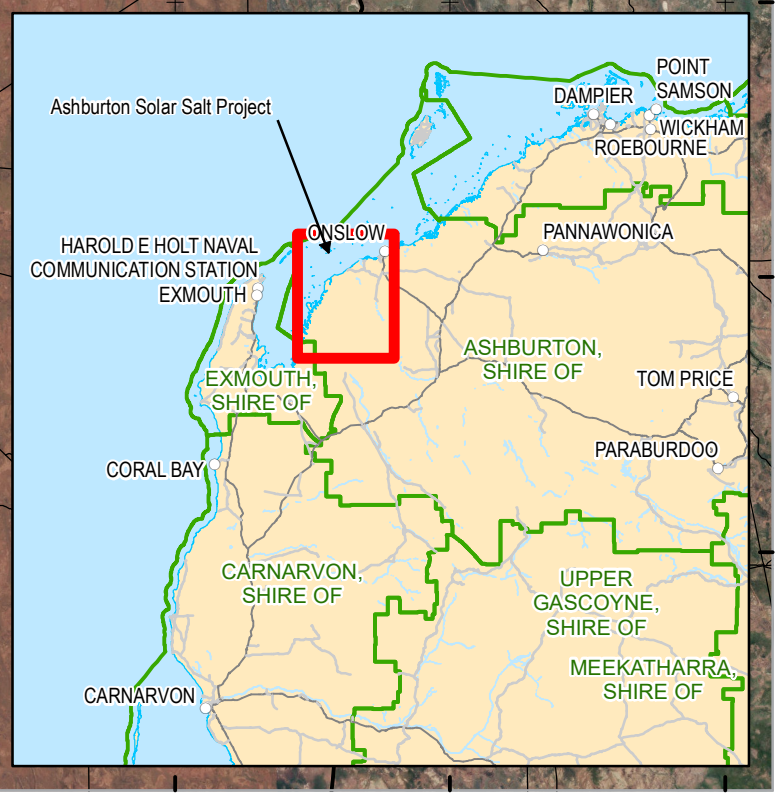
240000 250000 260000 270000 280000 290000 300000 310000

7610000 7600000 7590000 7580000 7570000 7560000 7550000 7540000 7530000

LEGEND

- Study Area
- Road
- Track

Second Av
ONSLOW
Seaview Dr
Onslow Rd
Urala Rd
Old Onslow Rd
Onslow-Peedamulla Rd
Onslow Rd



SLIP

240000 250000 260000 270000 280000 290000 300000 310000

Paper Size ISO A3

0 2 4 6

Kilometres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

GHD

K + S Salt Australia Pty Ltd
Ashburton Solar Salt Project
Phase 2 Site Investigation

Project No. **12516706**
Revision No. **1**
Date **22 Apr 2021**

Site Plan

FIGURE 1

G:\61\12516706\GIS\Maps\Working\ASS_Study\12516706_001_SitePlan_rev1.mxd
Print date: 22 Apr 2021 - 15:24

Data source: SLIP: - accessed 20200724, GHD: Access Roads, Pond Layout - 20190927, Infrastructure Layout - 20190320, GHD: Channels, Proposed Main Access Road - 20200518 Landgate: Imagery - September 2013 to Jan 2018 (accessed - 20200518) . Created by: htaniza

LEGEND

- Study Area
- **Local Planning Scheme - Zones and Reserves (DPLH-071)**
  - Rural
  - Conservation, recreation and nature landscape
  - Other purposes
  - Locations of Interest
  - AGIG Tubridgi Gas Plant
- **K + S Salt Australia Pty Ltd Mining Tenements (DMIRS-003)**
  - Live
  - Pending
- **Other Mining Tenements (DMIRS-003)**
  - Live
  - Pending
  - Pastoral Lease Boundary (DRIRD-18)

240000 250000 260000 270000 280000 290000 300000 310000

7610000 7600000 7590000 7580000 7570000 7560000 7550000 7540000 7530000

AG 7000009 AG 7000007 AG 7000008 AG 7000013 AG 7000011 ONSLOW 1500360 PEEDAMULLA STATION G 0800046A G 0800043 G 0800038 M 0800311 E 0802328 E 0802642 Wheatstone LNG Plants 1500630 URALA STATION AM 7000273 E 0802329 M 0800487 L 0800071 Macedon Domestic Gas Plant 15007,10 L 0800180 1500630 URALA STATION 1500710 MINDEROO STATION P 0800740 1500360 PEEDAMULLA STATION E 0802868 Wheatstone Village M 0800471 M 0800488 G 0800080 L 0800115 E 0803181 AGIG Tubridgi Gas Plant E 0802911 L 0800047 E 0802986 E 0802851 E 0802714 P 0800692 TR 7005350 E 0802714 P 0800691 P 0800682 1500710 MINDEROO STATION L 0800052 1500360 PEEDAMULLA STATION E 0802862 L 0800132 Minderoo Station E 0802717 E 0802852 E 0801728 1500630 URALA STATION P 0800684 E 0802718 1500710 MINDEROO STATION M 0800461 E 0802853 P 0800687 E 0802840 P 0800683 E 0802863 E 0802714 E 0801728 P 0800688 P 0800685 E 0802714 E 0802719 1500710 MINDEROO STATION E 0801395 P 0800686 L 0800143 E 0802863 E 0802053 1500710 MINDEROO STATION E 0801396 E 0802863 E 0803083 1500710 MINDEROO STATION 1500710 MINDEROO STATION E 0801421 E 0802051 E 0801399 E 0802799 TR 7005350 1500710 MINDEROO STATION E 0802385 1500320 KOORDARRIE STATION E 0802929 E 0802934 1500290 YANREY STATION YANREY STATION E 0802386 E 0800086

SLIP

Ashburton Solar Salt Project

POINT SAMSON WICKHAM KARRATHA ROEBOURNE KARRATHA, CITY OF HAROLD E HOLT NAVAL COMMUNICATION STATION ONSLOW PANNAWONICA EXMOUTH EXMOUTH, SHIRE OF ASHBURTON, SHIRE OF TOM PRICE CORAL BAY PARABURDOO CARNARVON, SHIRE OF UPPER GASCOYNE, SHIRE OF MEEKATHARRA, SHIRE OF CARNARVON SHARK BAY, SHIRE OF

Paper Size ISO A3

0 2 4 6

Kilometres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

GHD

K + S Salt Australia Pty Ltd
Ashburton Solar Salt Project
Phase 2 Site Investigation

Project No. **12516706**
Revision No. **1**
Date **22 Apr 2021**

Proposal Location and Land Use

FIGURE 2

Data source: SLIP: - accessed 20200724, GHD: Access Roads, Pond Layout - 20190927, Infrastructure Layout - 20190320, GHD: Channels, Proposed Main Access Road - 20200518 Landgate: Imagery - September 2013 to Jan 2018 (accessed - 20200518) SLIP / LANDGATE. Created by: htaniza

255000 260000 265000 270000 275000 280000 285000

7595000 7590000 7585000 7580000 7575000 7570000 7565000 7560000 7555000

Jetty
Berthing Pocket
Reclaim Conveyor System
Salt Wash Plant
Salt Stockyard
Urala Creek North
NPI
Salt Crystalliser Ponds
Maiden Brine Transfer Structure
Seawater Intake Channel
CP8
CP7
CP6
CP1
CP5
Urala Creek South
Seawater Intake Pump Station
CP2
Salt Concentration Ponds
CP4
CP3
1
2
3
4
A
B
C

LEGEND

- Study Area
- Maiden Brine Transfer Structure
- Brine/Bitterns Channel (and Transfer Station/Structures)
- Drainage Channel
- 3rd Party Proposed Road
- Salt Concentration Pond Embankments
- Reclaim Conveyor System
- Jetty
- Salt Crystalliser Ponds
- Salt Stockyard
- Salt Wash Plant
- Non Process Infrastructure/Buildings
- Salt Concentration Ponds
- Berthing Pocket
- Borrow Pits
- Dredge Spoil Disposal Area
- Seawater Intake Channel
- Seawater Intake Pump Station

SLIP

255000 260000 265000 270000 275000 280000 285000

Paper Size ISO A3

0 1 2 3
Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

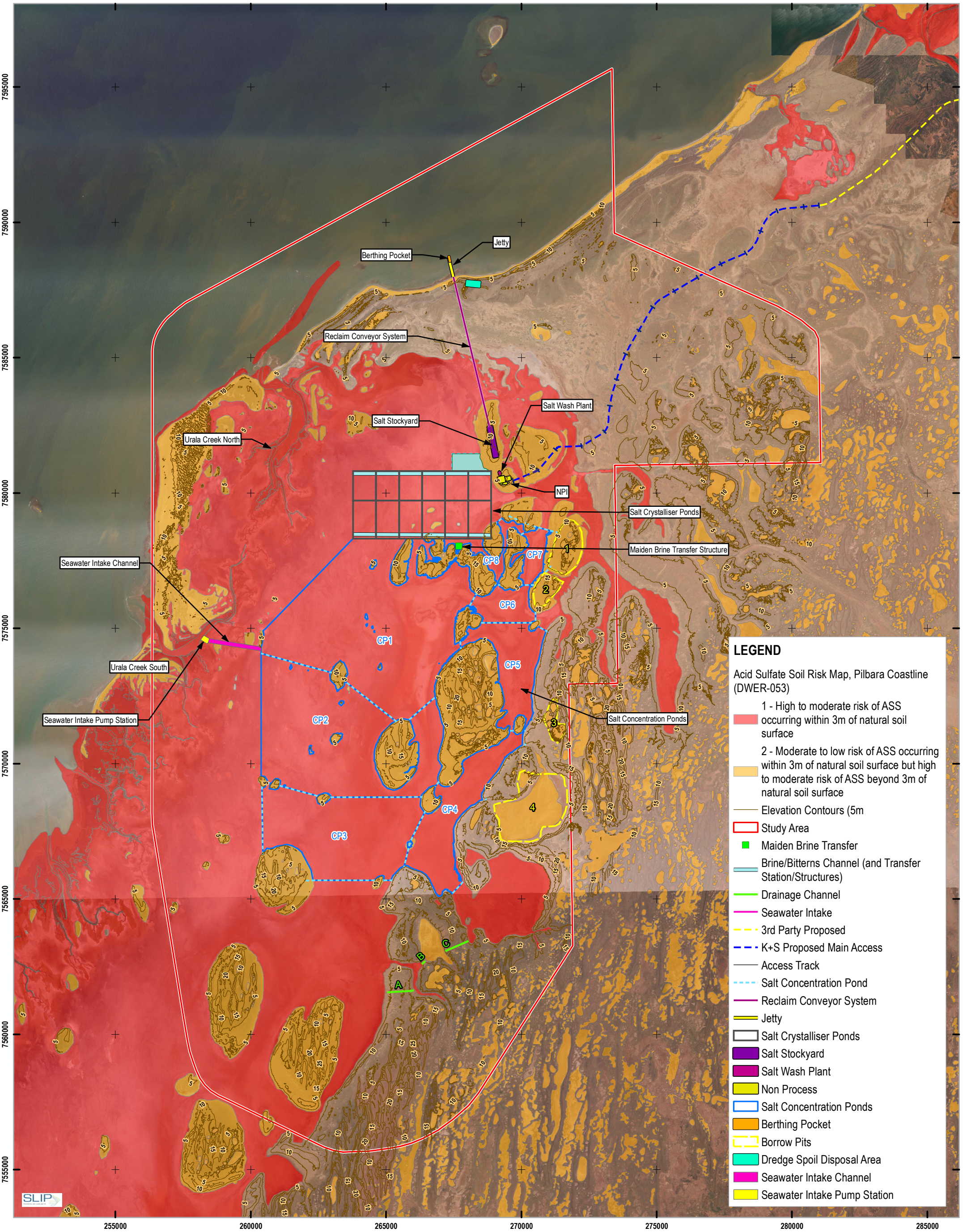
K + S Salt Australia Pty Ltd
Ashburton Solar Salt Project
Phase 2 Site Investigation

Project No. **12516706**
Revision No. **2**
Date **22 Apr 2021**

Proposal Layout

FIGURE 3

Data source: SLIP: - accessed 20200729, GHD: Access Roads, Pond Layout - 20190927, Infrastructure Layout - 20190320, GHD: Channels, Proposed Main Access Road - 20200518 Landgate: Imagery - September 2013 to Jan 2018 (accessed - 20200518) . Created by: htaniza



Paper Size ISO A3

0 1 2 3

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

K + S Salt Australia Pty Ltd
Ashburton Solar Salt Project
Phase 2 Site Investigation

Project No. **12516706**
Revision No. **2**
Date **22 Apr 2021**

Acid Sulfate Soils Risk Map

FIGURE 4

G:\61\12516706\GIS\Maps\Working\ASS_Study\12516706_004_ASS_Study_AcidSulfateSoilRiskMap_rev2.mxd
Print date: 22 Apr 2021 - 13:56

Data source: SLIP: - accessed 20200729, GHD: Access Roads, Pond Layout - 20190927, Infrastructure Layout - 20190320, GHD: Channels, Proposed Main Access Road - 20200518 Landgate: Imagery - September 2013 to Jan 2018 (accessed - 20200518) . Created by: htaniza

LEGEND

- Groundwater Monitoring Wells
- Test Pit
- Sediment Sampling
- Hand Auger Locations
- Study Area
- Maiden Brine Transfer Structure
- Brine/Bitterns Channel (and Transfer Station/Structures)
- Drainage Channel
- Seawater Intake Pipeline
- 3rd Party Proposed Road
- K+S Proposed Main Access
- Access Track
- Salt Concentration Pond Embankments
- Reclaim Conveyor System
- Jetty
- Salt Crystalliser Ponds
- Salt Stockyard
- Salt Wash Plant
- Non Process Infrastructure/Buildings
- Salt Concentration Ponds
- Berthing Pocket
- Borrow Pits
- Dredge Spoil Disposal Area
- Seawater Intake Channel
- Seawater Intake Pump Station

255000 260000 265000 270000 275000 280000 285000

7595000 7590000 7585000 7580000 7575000 7570000 7565000 7560000 7555000

Jetty
See Inset 1
SED01
SED02
SED04
SED05
SED03
SED07
Berthing Pocket
TP Au-01
BH-03
TP Au-30
BH-03A
TP Au-101
Reclaim Conveyor System
BH-02A
TP Au-02
TP Au-33
BH-02
TP Au-22
TP Au-03
TP Au-36
TP Au-20
Salt Wash Plant
Salt Stockyard
TP Au-19
BH-01
Urala Creek North
BH-04
TP Au-60
NPI
BH-05B
BH-05
BH-05A
Salt Crystalliser Ponds
Maiden Brine Transfer Structure
1
2
3
4
CP1
CP2
CP3
CP4
CP5
CP6
CP7
CP8
Seawater Intake Channel
See Inset 2
TP Au-66
TP Au-70
BH-07B
BH-08
BH-07
BH-07A
BH-10
BH-09
BH-09A
BH-09B
BH-10A
BH-10B
TP Au-102
Urala Creek South
Seawater Intake Pump Station
Salt Concentration Ponds
TP Au-74
BH-11A
BH-11
TP Au-75
BH-14
BH-14A
BH-12A
BH-12
BH-15
BH-15A
BH-13
BH-13
C
B
A

Inset 1 - Offshore Sediment Sample Points

SED01, SED04, SED02, SED03, SED05, SED06, SED10, SED11, SED07, SED08, SED08A, SED09, SED12

Inset 2 - Seawater Intake Sample Points

SWI-HA01, SWI-HA02, SWI-HA04, SWI-HA06, SWI-HA03, SWI-HA05, SWI-HA07, SWI-HA08, SWI-HA10, SWI-HA09

SLIP

Paper Size ISO A3

0 1 2 3

Kilometres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

GHD

K + S Salt Australia Pty Ltd
Ashburton Solar Salt Project
Phase 2 Site Investigation

Project No. **12516706**
Revision No. **2**
Date **22 Apr 2021**

Monitoring Locations

FIGURE 5

Data source: SLIP: - accessed 20200729, GHD: Access Roads, Pond Layout - 20190927, Infrastructure Layout - 20190320, GHD: Channels, Proposed Main Access Road - 20200518 Landgate: Imagery - September 2013 to Jan 2018 (accessed - 20200518) . Created by: htaniza

Appendices

Appendix A – Daily Observation Checklist

ASS Field Observation Daily Record Sheet

Client: K + S Salt Australia Pty Ltd		**Job No:**	
Job Name:			
Site representative		**Date:**	**Sheet____ of ____**
Weather conditions:	(Please circle) Fine Overcast Light Rain Heavy Rain Other_____		
	Wind direction: Morning Afternoon		
	Wind strength:		
Daily site management and observations			
Location of excavation			
Visual observations	**Things to note below.**		
	Unusually clear or milky blue-green drainage water within or flowing from areas of excavation or dewatering disposal? Extensive iron (red staining) on any drains or pond surfaces? Surface water with pH <4? Visual observations within natural excavated material that include pale, yellow mottling (Jarosite)? Hydrogen sulfide or sulfur odour (rotten eggs) during excavations and/ or dewatering? Blackened to coloured surface water indicating de-oxygenation? Unexplained scalding, degradation or death of vegetation?		
Excavated volume (if applicable)			
Quantity and type of neutralising material utilised			
Dates of excavation and treatment of ASS material;			
Approx. location of neutralised ASS material (re-use)			
Stockpile observations			
Tailwater monitoring (outlet)	**Tailwater suitable for discharge**		
	Turbidity less than 140 NTU? pH between 7.0 and 8.5? Total Titratable Acidity (TTA) less than 40 mg/L?		
Tailwater disposal location			
Leachate collection basin monitoring	Turbidity less than 140 NTU? pH between 7.0 and 8.5? Total Titratable Acidity (TTA) less than 40 mg/L?		

GHD

Level 10
999 Hay Street
T: 61 8 6222 8222 F: 61 8 9463 6012 E: permail@ghd.com

12516706-31698-69/G:\61\12516706\Tech\Acid Sulfate Soils\WP\Management Plan\12516706-RPT-ASSMP_Rev3.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	D. Haddrill	L. Cockerton				6/10/2020
B	D. Haddrill	L. Cockerton				20/10/2020
0	D. Haddrill	L. Cockerton		A. Jennings		26/03/2021
1	D. Haddrill	L. Cockerton		A. Jennings		23/04/2021
2	D. Haddrill	L. Cockerton P. Baker		A. Jennings		13/05/2021
3	D. Haddrill	L. Cockerton		A. Jennings		31/05/2021

www.ghd.com