Weston Aluminium Pty Ltd

31-Jun-2017

Weston Aluminium Thermal Waste Processing Project

Preliminary Hazard Analysis (PHA)

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Preliminary Hazard Analysis (PHA)

Client: Weston Aluminium Pty Ltd

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Table of Contents

List of Tables

List of Figures

Executive Summary

Weston Aluminium Pty Limited (WA) proposes to install thermal destruction equipment for the processing of medical and other waste at their existing aluminium recycling and refining facility in the Hunter Valley, NSW.

A hazard and risk assessment has been conducted for the WA Thermal Waste Processing Project, (the Project). Maximum threshold quantities of the anticipated types of hazardous materials stored at any one time have been estimated for the purpose of the assessment. Should the quantities to be stored exceed the quantities assessed in this PHA (Preliminary Hazard Analysis), the conclusions of the analysis could be affected and as such an updated PHA must be conducted.

The scope of this PHA includes the Project only, however, the assessment of cumulative risks at the site is included within the scope. Previous hazard and fire safety studies have been conducted for the existing operations and facilities on the site.

Hazardous Materials

The Project operations will introduce additional storage and handling of dangerous goods and hazardous chemicals in the form of wastes to be thermally treated. WA plans to process the following wastes at its proposed thermal processing plant. The corresponding NSW EPA waste codes are also included in parentheses:

- Clinical and related wastes NOS (R100);
- Pathogenic substances (R110);
- Wastes from the use of pharmaceutical products NOS (R120);
- Cytotoxic substances (R130);
- Waste from the production, preparation and use of pharmaceutical products NOS (R140);
- Waste chemical substances arising from research and development or teaching activities, NOS which are new or unidentified substances with unknown human health or environmental effects (T100);
- Solvents and Paints;
- Pitch sludge residues;
- Oily rags; and
- Documents and hard drives (data-based wastes).

Biomedical waste would be the key wastes managed, however other types of wastes could include:

- Quarantine wastes, usually received from international ports (shipping and air);
- Security wastes, including confidential documents; and
- Illicit materials, including drugs.

For clarification, the Project no longer proposes to store or process miscellaneous *scheduled wastes* as defined by the National Management Strategy for the Management of Scheduled Wastes (ANZECC, 1992). Examples of schedules wastes which would not be processed include Polychlorinated Biphenyls (PCBs), Hexachlororbenzene (HCB), and Organochlorine Pesticides (OCPs) such as may be found in farm chemicals. As these chemicals are now excluded from the Project, they require no further assessment as part of this PHA.

Additional hazardous chemicals such as diesel and natural gas are used for services supply.

The Project is a potentially hazardous and potentially offensive industry and subjected to the assessment requirements of SEPP 33. Due to the locational, technical, operational and organisational safeguards employed, the Project is not considered to pose a significant risk.

For a potentially hazardous development, the Secretary's Environmental Assessment Requirements (SEARs) required an assessment of the potential hazards and risks associated with the Project to be submitted with the Development Application in the form of a PHA. The assessment conducted as a part of this PHA found that the proposal meets the relevant risk criteria as set out in *Hazardous Industry Planning Advisory Paper (HIPAP) No 4.*

WA has a strong demonstrated history of planning approval and environmental license compliance with stringent environmental requirements currently enforced through a comprehensive environmental management system. A number of future risk minimisation opportunities have been identified.

This PHA Report should be read in conjunction with the following technical studies conducted for the Project:

- Human Health Risk Assessment Report;
- Air Quality Impact Assessment Report;
- Traffic Assessment Report;
- Water Impact Assessment Report; and
- Site Flood Risk and Impact Assessments.

1.0 Introduction

1.1 Weston Aluminium Thermal Waste Processing Project

1.1.1 Overview

Weston Aluminium (WA) proposes to install thermal destruction equipment for the processing of medical and other waste at its existing aluminium recycling and refining facility at 129 Mitchell Avenue, Kurri Kurri in the Hunter Valley, NSW (the Project). The regional context of the facility is shown in **Figure 1**.

The purpose of this report is to characterise the proposal and to provide an overview of the potential effects of the storage and handling of the dangerous goods and hazardous chemicals associated with the Project.

WA proposes to further adapt and diversify its plant, equipment and processes to enable the thermal processing of up to 8,000 tonnes per year of medical and other wastes. As part of the Project, WA proposes to construct and operate purpose-built infrastructure for the safe receipt, storage and processing of hazardous wastes.

Proposed thermal destruction/processing equipment will be incorporated into the existing facility footprint, using existing access and emission control systems. The proposed plant and equipment would be located within the northern end of the site. The Project Area for the proposed facility is shown in **Figure 2**.

1.1.2 Proponent

The plant is owned and operated by WA, which is majority owned by Watou Holdings and the balance by Ashai Seiren, a major secondary aluminium processor in the Japanese Aluminium industry. Both shareholders have an established track record in the operation of aluminium refining and recycling facilities through the operation of the existing development in Kurri Kurri and a number of facilities in Japan and Indonesia. WA has also more recently processed various pharmaceutical and illicit drug wastes within its existing furnace plant and equipment under regulatory approved trial conditions.

1.2 Purpose of the Report

1.2.1 Secretary's Environmental Assessment Requirements

In preparing this **Hazard and Risk Assessment**, the Secretary's Environmental Assessment Requirements (SEARs) issued for the Project (SSD_7349) on 16 December 2015 have been addressed as required by Clause 75F of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The key matters raised by the Secretary for consideration in the **Hazard and Risk Assessment** are outlined in **Table 1** along with a reference to where the requirements are addressed in this report.

Table 1 Secretary's Environmental Assessment Requirements - Hazards

Secretary's Environmental Assessment Requirement		Section Addressed
Hazards	· A preliminary risk screening undertaken in accordance with the State Environmental Planning Policy No. 33 – Hazardous and Offensive Development (SEPP 33) and Applying SEPP 33 (DoP, 2011) including consideration of likelihood and consequences of exposure of the facility to flood events, and if necessary, a Preliminary Hazard Analysis.	**Section 3.0** **Section 6.0 – Section 9.0**

1.2.2 Hazards and Risk Assessment Objectives

The objectives of the study have been based on the Department of Planning and Environment (DP&E) SEARs.

These requirements state that the proposed facility must be assessed against the requirements of State Environmental Planning Policy No.33 – Hazardous and Offensive Development (SEPP 33).

The objectives of this study are, therefore:

- To conduct a preliminary risk screening in accordance with the State Environmental Planning Policy No. 33 – Hazardous and Offensive Development (SEPP 33) and Applying SEPP 33 (DoP, 2011);
- To conduct a preliminary hazard analysis (PHA) of the proposed medical waste storage and processing facilities, at the WA site, in accordance with the NSW DPI Hazardous Industry Planning Advisory Papers (HIPAP) and “Multilevel Risk Assessment Approach” (Ref.4); and
- Prepare a report on the findings and recommendations for submission in support of the State significant development (SSD) application.

1.2.3 Scope of Work

The scope of work includes the proposed medical and other waste storage and associated processing facilities. The scope does not include the assessment of any existing facilities that have already been reviewed as part of previous PHA studies, however, the assessment of cumulative risks at the site is included within the scope.

2.0 Project Description

2.1 Surrounding Land Uses

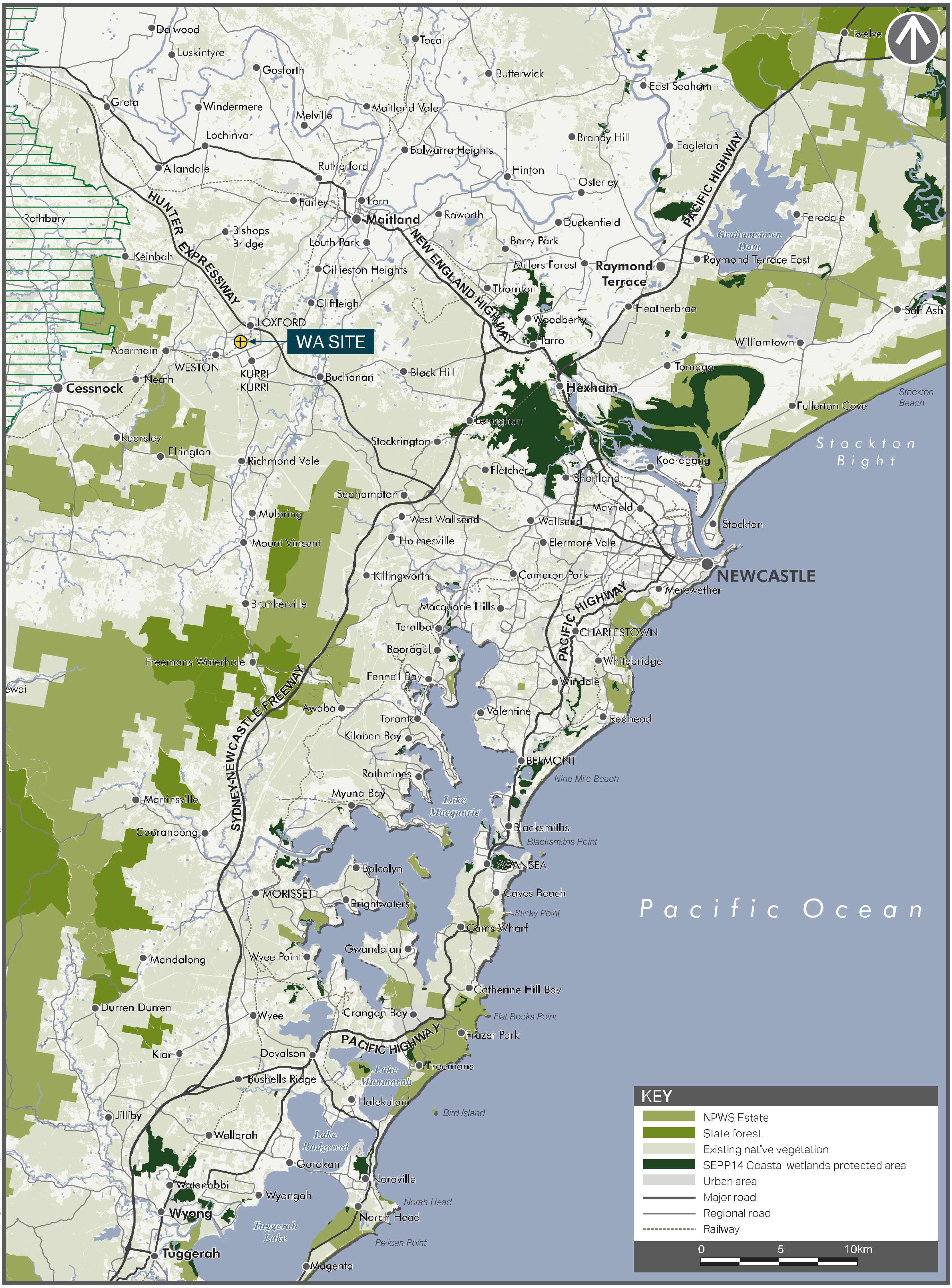
The WA facility is located on approximately 9.2 hectares of land on the northern side of Mitchell Avenue, Kurri Kurri, NSW. The regional and site locations are shown in **Figure 1** and **2**. The proposed site layout is shown in **Figure 3** in the following section.

The site is approximately 40km northwest of Newcastle and is located within an established industrial area. The footprint of the Hydro Aluminium Smelter, which ceased operation in October 2012 and was officially closed in May 2014, is located approximately 2km north of the site, and its buffer lands extend to WA's northern boundary.

The site is located in an area zoned 4(a) industrial. There are currently only three major industrial facilities in the vicinity of the plant site, two are steel fabrication industries and are over 200m from the plant, and Hydro Aluminium, which is located over 2km to the north of the site.

There is also a proposed development of a battery processing facility to the east of the WA facility. SEARs have been issued for this facility under application numbers SSD_7520.

Residential areas in Kurri Kurri and Weston are located to the south east and west of the site, respectively. The closest residential land use to the site is located more than 600m to the south east. The closest residence (which is understood by WA to be unoccupied) is located on land zoned rural, about 270m to the north (in the Hydro Aluminium Smelter buffer zone). The closest public place (the footpath passing the property) is at Mitchell Avenue, about 150m from the plant building.



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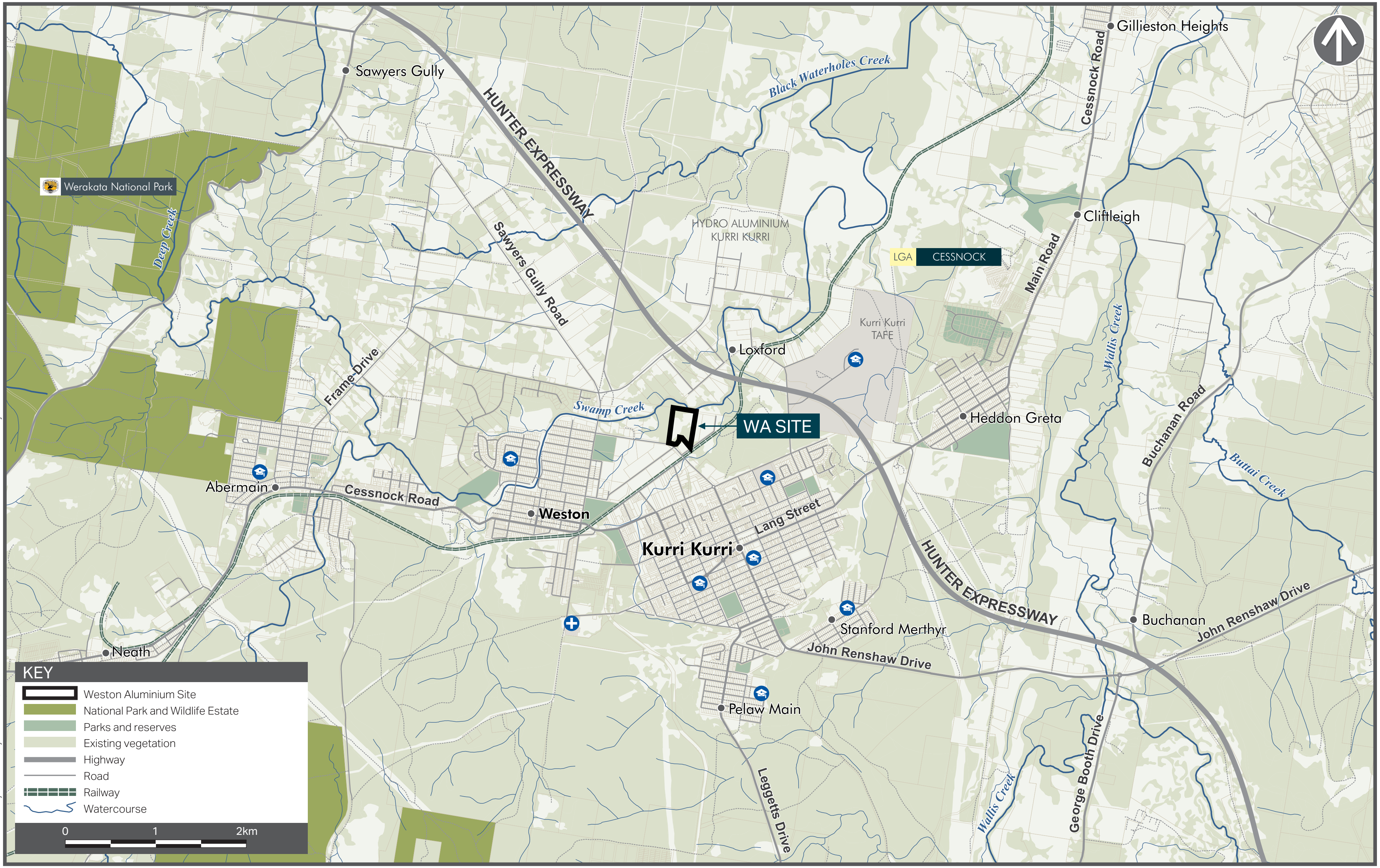
REGIONAL CONTEXT

Environmental Impact Statement
Weston Aluminium Recycling Facility

FIGURE 1



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PROJECT AREA
Environmental Impact Statement
Weston Aluminium Recycling Facility

FIGURE 2

G:\ENV\GIS\Projects\604 Projects\60486360 Weston Aluminium\FIGURES\Hazard and Risk\60486360 F3 Existing Site Layout 04 70 2016 TO

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EXISTING SITE LAYOUT

Environmental Impact Statement
Weston Aluminium Recycling Facility

FIGURE 3

3.0 Risk Screening (Applying SEPP 33)

A risk screening has been carried out as per the Department's *Applying SEPP 33 Application Guidelines* to determine whether or not SEPP 33 applies.

The following information was considered in the risk screening process:

- All dangerous goods and otherwise hazardous materials involved in the proposed development - including raw materials, intermediates, and products;
- Dangerous Goods classifications (including all subsidiary classes) for all dangerous goods held on site;
- Quantities of dangerous goods and otherwise hazardous materials stored, processed and produced in the proposed development;
- Distance from the boundary for each hazardous substance;
- Weekly and annual number of deliveries (and the quantities) of dangerous goods and otherwise hazardous materials to and from the facility;
- Potential flood impacts on the proposed development;
- Site layout plan showing proposed development and any existing development on site;
- Local layout plan showing immediate neighbours and their activities; and
- A locality plan showing the nearest residential property.

In order to identify hazards outside of the scope of the risk screening method, the following additional information was considered:

- Incompatible materials (hazardous and non-hazardous materials);
- Wastes that could be hazardous;
- The possible existence of dusts within confined areas;
- Types of activities the dangerous goods and otherwise hazardous materials are associated with (storage, processing, reaction, etc.);
- Incompatible, reactive or unstable materials and process conditions that could lead to uncontrolled reaction or decomposition; and
- Storage or processing operations involving high (or extremely low) temperatures and/or pressures.

3.1 Types and Quantities of Dangerous Goods Stored

WA plans to store and process the following wastes at its proposed thermal processing plant. The corresponding NSW EPA waste codes are also included in parentheses:

- Clinical and related wastes NOS (R100);
- Pathogenic substances (R110);
- Wastes from the use of pharmaceutical products NOS (R120);
- Cytotoxic substances (R130);
- Waste from the production, preparation and use of pharmaceutical products NOS (R140);
- Waste chemical substances arising from research and development or teaching activities, NOS which are new or unidentified substances with unknown human health or environmental effects (T100);
- Solvents and Paints;
- Pitch sludge residues;

- Oily rags; and
- Documents and hard drives.

Whilst medical waste would be the key wastes managed, other types of waste materials to be incinerated could include:

- Quarantine wastes, usually received from international ports;
- Security wastes, including confidential documents; and
- Illicit materials, including drugs.

For clarification, the Project no longer proposes to store or process miscellaneous *scheduled wastes* as defined by the National Management Strategy for the Management of Scheduled Wastes (ANZECC, 1992). Examples of scheduled wastes which would not be processed include Polychlorinated Biphenyls (PCBs), Hexachlororbenzene (HCB), and Organochlorine Pesticides (OCPs) such as may be found in farm chemicals. As these chemicals are excluded from the Project they require no further assessment as part of this PHA.

All materials received at the facility are to be stored undercover within a dedicated building shown in the proposed plant layout presented in **Figure 5**.

The following information is presented in **Table 2** below:

- The dangerous goods and otherwise hazardous chemicals involved in the proposed development - including raw materials, intermediates, and products;
- The NSW EPA waste codes;
- Dangerous goods classifications (including all subsidiary classes) for all dangerous goods held on site;
- Estimated quantities of dangerous goods and otherwise hazardous involved in the proposed development;
- Approximate location on site for each hazardous material; and
- Transport details.

Table 2 Materials at the Project

Materials	Description	Maximum Quantity of Materials Stored	DG class	Packing Group	UN No.	Storage Type	On-site Location	Transport
Clinical wastes (R100) including: · Clinical and related wastes · Sharps · Pathogenic substances	Waste resulting from medical, nursing, dental, skin penetration or other related clinical activity or biomedical research. Waste that has the potential to cause injury, infection or offence, e.g. human tissue, visibly blood-stained or bulk body fluids.	40 tonnes	Class 6.2	N/A	UN 3291	Sealed 240L wheelie bins, 660 L bins, 2m^3 bins, or similar.	Secure, undercover dedicated building - palletised store accessed by forklift. Refrigerated/ Cold store to be constructed for medium-term storage of medical waste, as appropriate.	Flat-top semis, pantech, taut liners, utilities.
Cytotoxic wastes (R100)	Wastes arising from medical or veterinary research or treatment that may be contaminated with Cytotoxic drugs. Cytotoxic waste is collected from hospitals in purple colour coded 120L and 240L bins. The waste is primarily plastic giving sets, syringes, tubes, absorbent paper towels, etc. that have been in contact with cytotoxic drugs. The primary use of these drugs is for cancer treatment.	20 tonnes	Class 6.2	N/A	UN 3291	Sealed 120L or 240L wheelie bins, 660 L bins, 2m^3 bins, or similar.	Secure, undercover dedicated building - palletised store accessed by forklift.	Flat-top semis, pantech, taut liners, utilities.

Materials	Description	Maximum Quantity of Materials Stored	DG class	Packing Group	UN No.	Storage Type	On-site Location	Transport
Cytotoxic Drugs (bulk) (R130)	Cytotoxic drugs (other than cytotoxic waste) e.g. · Pharmacy cyto waste · Unused · Outdated · Returns to Pharmacy	2 tonne	Class 6.1	PGI (Very Toxic)	UN 2811 (solids) UN 2810 (liquids)	Sealed 120L or 240L wheelie bins, or similar.	Secure, undercover dedicated building - palletised store accessed by forklift. Refrigerated/ Cold store to be constructed for medium-term storage of medical waste, as appropriate.	Flat-top semis, pantech, taut liners, utilities.
		20 tonne	Class 6.1	PG II or III (Toxic)				
Solvents and Paints	Solvents and paints	50 tonne	Class 3	Various	Various	Sealed packages and drums	Secure, undercover dedicated building - palletised store accessed by forklift.	Flat-top semis, pantech, taut liners, utilities.
Waste chemical substances arising from research and development or teaching activities, NOS which are new or unidentified substances with unknown human health or environmental effects (T100).	N/A	N/A	N/A	N/A	N/A	Sealed 240L wheelie bins, palletised cartons, pails or drums, or similar.	Secure, undercover dedicated building - palletised store accessed by forklift.	Flat-top semis, pantech, taut liners, utilities.

Materials	Description	Maximum Quantity of Materials Stored	DG class	Packing Group	UN No.	Storage Type	On-site Location	Transport
Pharmaceutical wastes including: · Wastes from the use of pharmaceutical products NOS (R120) (e.g. Pharmaceuticals and residues) · Waste from the production, preparation and use of pharmaceutical products NOS (R140)	Pharmaceutical wastes	20 tonnes	May be class 6.1, class 3, class 8 or class 9	Various	UN3249 or various other	Sealed 240L wheelie bins, palletised cartons, pails or drums, or similar.	Secure, undercover dedicated building - palletised store accessed by forklift.	Flat-top semis, pantech, taut liners, utilities.
Quarantine waste: As determined by the Australian Quarantine and Inspection Service (AQIS) and subject to and or identified under Commonwealth Legislation (Quarantine Act 1908) and associated regulations (Quarantine Regulations 2000) and proclamations.	· Material used to pack and stabilise imported goods · Galley food and other waste from overseas vessels · Human/ animal/ plant waste to Australia · Refuse or sweepings in hold of overseas vessel · Material in contact with Quarantine Waste · AQIS airport amnesty bins contents	40 tonnes	Can potentially be various classes but mostly contains non-hazardous material	N/A	N/A	Sealed 240L wheelie bins, palletised cartons, pails or drums, or similar.	Secure, undercover dedicated building - palletised store accessed by forklift.	Flat-top semis, pantech, taut liners, utilities.

Materials	Description	Maximum Quantity of Materials Stored	DG class	Packing Group	UN No.	Storage Type	On-site Location	Transport
	· Articles seized by AQIS and/or not collected by clients.							
Refrigerant Gas	Refrigerated/ cold store to be constructed for medium-term storage of medical waste, as appropriate.	-	Class.2.2 (No Class 2.3 refrigerant will be used)	N/A	UN 1013 or equivalent	-	-	N/A
Natural Gas	Existing Natural Gas Pipeline will supply fuel to the kiln.	N/A	Class 2.1	N/A	N/A	N/A	-	Underground Pipeline.
Activated Carbon	Used for pollutant absorption in emissions control system.	-	N/A	N/A	N/A	N/A	Bag house No. 5	Flat-top semis, pantech, taut liners, utilities

Chemical substances which are not subject to SEPP 33 potentially hazardous screening requirements are also likely to be stored and handled at the Project Facility include:

- Security Waste (Documents and hard drives);
- Pitch sludge residues (Class 9) transported in flat-top semi tippers;
- Oily rags (Combustible Materials) transported in flat-top semi, pantech, taut liners, utilities;
- Ash - Product material recovered from the kiln;
- Waste Water - Contaminated waste water from the bin wash down and other storage areas; and
- Baghouse Dust - Product material recovered from the Baghouse.

3.2 Preliminary Risk Screening

Applying SEPP33 (Ref.1), Section 7 and Appendix 4 provides a series of tables and graphs which can be used to determine screening thresholds for various types of dangerous goods, quantities below which it can be assumed there is unlikely to be a significant off-site risk.

A summary of the results of the screening assessment for the list of dangerous goods outlined in **Table 2** are outlined below:

Class 6.2 Infectious Substances (Clinical and related wastes and Pathogenic substances)

The storage and handling at the facility of infectious (Class 6.2) substances will be in accordance with:

- AS/NZS 3816, Management of clinical and related wastes; and
- HB 202-2000, A management system for clinical and related wastes – Guide to the application of AS/NZS 3816, Management of clinical and related wastes.

In accordance with Applying SEPP 3, Appendix 4, Table 3, the development is potentially hazardous if storing at any one time greater than the threshold quantity of 0.5 tonne of Class 6.2 clinical waste.

Based on preliminary market analysis, there is likely to be the storage of greater than 0.5 tonne at any one time. Therefore with respect to the potential storage of greater than 0.5 tonne of Class 6.2 materials at any one time, the development is considered to be potentially hazardous. As a result, a PHA is required to be conducted in accordance with Applying SEPP33.

Note: Class 6.2 Infectious substances are not Schedule 11 Chemicals therefore there are no manifest requirements for infectious substances in accordance with the WHS Regulations NSW. Infectious Substances are also not listed as Schedule 15 Chemical Major Hazard Facility (MHF) Chemicals and therefore there are no MHF notification requirements.

Class 6.1 Toxic substances (Cytotoxic drugs and some types of Pharmaceutical wastes)

The development is potentially hazardous if the facility plans to store greater than 2.5 tonne of class 6.1 (PG II or III) and 0.5 tonne of class 6.1 PG I at any one time.

Based on preliminary market analysis, there is potential for the storage of up to 20 tonne toxic or 2 tonne very toxic substances at any one time. Therefore with respect to Class 6.1 Dangerous Goods, the development is considered to be potentially hazardous and a PHA is required.

Manifest Quantities

There is a requirement to prepare a dangerous goods manifest and emergency plan in accordance with Schedule 12 of the NSW Workplace Health and Safety Regulation 2011, if the storage quantities exceed the manifest threshold outlined in Schedule 11 and below:

- Class 6.1 PGI 500kg or 500L;
- Class 6.1 PGII 2,500kg or 2,500L; and
- Class 6.1 PGIII 10,000kg or 10,000L.

Definitions of the classifications for Packing Group (PG) in accordance with Australian Dangerous Goods (ADG) Code (Ref 5) are provided in the table below.

Grouping criteria for administration through oral ingestion, dermal contact and inhalation of dusts and mists

Packing group	Oral toxicity LD_{50} (mg/kg)	Dermal toxicity LD_{50} (mg/kg)	Inhalation toxicity by dusts and mists LC_{50} (mg/L)
I	≤ 5.0	≤ 50	≤ 0.2
II	> 5 and ≤ 50	> 50 and ≤ 200	> 0.2 and ≤ 2.0
III [a.]	> 50 and ≤ 300	> 200 and ≤ 1000	> 2.0 and ≤ 4.0
Tables note:	**a** Tear gas substances are included in packing group II even if their toxicity data correspond to packing group III values.		

Definitions of the terms LD_{50} and LC_{50} used in the above table are provided below.

Definition of LD_{50}

LD stands for "Lethal Dose". LD_{50} is the amount of a material, given all at once, which causes the death of 50% (one half) of a group of test animals. The LD_{50} is one way to measure the short-term poisoning potential (acute toxicity) of a material. Toxicologists can use many kinds of animals but most often testing is done with rats and mice. It is usually expressed as the amount of chemical administered (e.g., milligrams) per 100 grams (for smaller animals) or per kilogram (for bigger test subjects) of the body weight of the test animal. The LD_{50} can be found for any route of entry or administration but dermal (applied to the skin) and oral (given by mouth) administration methods are the most common.

Definition of LC_{50}

LC stands for "Lethal Concentration". LC values usually refer to the concentration of a chemical in air but in environmental studies it can also mean the concentration of a chemical in water. According to the Organisation for Economic Cooperation and Development (OECD) Guidelines for the Testing of Chemicals, a traditional experiment involves groups of animals exposed to a concentration (or series of concentrations) for a set period of time (usually 4 hours). The animals are clinically observed for up to 14 days. The concentration of the chemical in air that kills 50% of the test animals during the observation period is the LC_{50} value. Other durations of exposure (versus the traditional 4 hours) may apply depending on specific laws.

Notification Requirements

There is a requirement to notify SafeWork NSW, if the storage at the site exceeds 10% of the MHF threshold outlined in Schedule 15 of the NSW Workplace Health and Safety Regulation 2011. For Class 6.1 goods the MHF thresholds are below:

- Class 6.1 Very Toxic* 20 tonnes (i.e. 10% of MHF threshold is 2 tonnes); and
- Class 6.1 Toxic* 200 tonnes (i.e. 10% of the MHF threshold is 20 tonnes).

*The definitions for Toxic and Very Toxic are presented in **Table 3** below.

Table 3 Toxic and Very Toxic Definitions

Description	Oral Toxicity In rats LD_{50} (mg/kg)	Dermal Toxicity In rats or rabbits LD_{50} (mg/kg)	Inhalation Toxicity 4 hours in rats LC_{50} (mg/L)
Very Toxic	$LD_{50} \leq 5$	$LD_{50} \leq 40$	$LC_{50} \leq 0.5$
Toxic	$5 < LD_{50} \leq 50$	$40 < LD_{50} \leq 200$	$0.5 < LC_{50} \leq 2$

Class 3 Flammable Liquid PGII or PG III (Paints and Solvents, some pharmaceuticals, some quarantine wastes)

The potential for significant off site risk for Class 3 is assessed based on the distance to the boundary and storage quantity. Figure 9 of Applying SEPP33 (Ref.1) outlines:

- Storage of less than 5 tonne of Class 3 is not considered to have significant off-site risk;

- Storage of up to 50 tonne of Class 3 that is 13m from the site boundary is not considered to have significant off-site risk; and
- Storage of up to 200 tonne of Class 3 that is 20m from the site boundary is not considered to have significant off-site risk.

Approximately 2% of the total wastes streams processed are expected to be solvents and paints. Pharmaceuticals and Quarantine wastes are not usually Dangerous Goods and only a small percentage of Pharmaceuticals and Quarantine wastes to be stored on site are potentially Class 8 materials. While the exact quantities of Class 3 materials required being stored is not known, the total storage of Class 3 materials is not expected to exceed a conservative 50 tonne. Due to the land size available, it is expected that any Class 3 materials will be stored at least 15m from the site boundary. Therefore, the development is not considered to be potential hazardous with regard to the storage of Class 3 materials.

Any paints, solvents, pharmaceutical and quarantine wastes classified as Class 3 materials will be stored in accordance with AS1940 and AS3833.

Class 8 Corrosives (Some Pharmaceuticals, some Quarantine Wastes)

Table 3 of Applying SEPP33 (Ref.1) shows the threshold for Class 8 corrosive substances. The storage of Class 8 is not considered to be potentially hazardous if storing quantities of less than:

- PGI 5 tonne;
- PGII 25 tonne; and
- PGIII 50 tonne.

Pharmaceuticals and Quarantine wastes are not usually Dangerous Goods. A small percentage of Pharmaceuticals and Quarantine wastes to be stored on site are potentially Class 8 materials. Therefore, the quantity of Class 8 corrosive substances stored on site is not expected to exceed the threshold quantity and it can be assumed there is unlikely to be a significant off-site risk.

Any pharmaceutical and quarantine wastes classified as Class 8 (corrosive) will be stored in accordance with AS3780 and AS3833.

3.3 Transportation Risk

The proposed development may be potentially hazardous if the number of traffic movements generated by the project for the transport of hazardous materials entering or leaving the site is considered significant for the surrounding road network. If the proposal is found to be potentially hazardous with respect to transportation, a route evaluation study should be completed in accordance with the Department of Planning's HIPAP 11: Route Selection.

The transport of all medical and other wastes to the facility will be in accordance with the Australian Transport of Dangerous Goods Code and in accordance with all relevant waste transport licence requirements.

3.3.1 Transport of Class 6.1

The development is considered to be potentially hazardous with respect to transportation, if there are planned vehicle movements of Class 6.1 DG's in quantities greater than 1 tonne (bulk) or 3 tonne in packages per vehicle.

The potential Class 6.1 materials to be transported to site include cytotoxic drugs [UN2811 (solids) and UN2810 (liquids)] and some types of pharmaceutical wastes (UN3249).

It is likely that the load size of deliveries of Class 6.1 materials will exceed 1 tonne bulk and 3 tonne in packages per vehicle. Therefore the development is considered to be potentially hazardous in regards to the transport of Class 6.1 materials.

3.3.2 Transport of Class 6.2

In accordance with, Applying SEPP 33, for Class 6.2 materials (i.e. clinical waste), to determine if a route evaluation study in accordance with HIPAP No. 11, is required, the DP&E will need to be consulted regardless of the number of vehicle movements and load size.

The total throughput of Class 6.2 materials for the facility is approx. 70% of the total annual throughput 8 000 tonne per annum i.e. the Class 6.2 throughput is approx. 5,600 tonne per annum.

In general, transport routes will use the Hunter Expressway (access to the WA facility via the route including the Hart Road exit to Government Road to Mitchell Ave, and therefore there will be no movements through the Kurri Kurri township). Further details on the Project potential road traffic impacts is provided in the Project Traffic Impact Assessment and considered separately in the EIS.

3.4 Potentially Offensive Industry Assessment

In addition to assessing hazards, *Applying SEPP 33 Guideline* (NSW DP&I, 2011) can be used to determine if the Project is potentially offensive. The key consideration in the assessment of a potentially offensive industry is to ensure that there are adequate safeguards. This is to ensure emissions from a facility can be controlled to a level that is not significant.

The following information was used in assessing offensiveness:

- A list of any materials or processes that could produce air, noise, water or other emissions with a potential for pollution; and
- Details of known requirements for compliance with DP&E consent conditions.

Possible impacts from the storage and thermal incineration of medical and other wastes includes emissions for air, noise, water and waste.

Applying SEPP 33 Guideline lists industry types with potential for significant environmental impact. These industries are further detailed in Part 2, Schedule 3 of the EP&A Regulation. This regulation identifies triggers for certain types of development which may be potentially offensive.

As the Project may be regarded as a potentially offensive industry under *Applying SEPP 33,* an analysis of the potential impacts to neighbouring facilities and land uses is required.

A detailed description of the quantity, nature and significance of all offences likely to be caused by the development that could produce air, noise, water or other emissions have been provided in the following technical studies.

- Surface Water and Ground Water Assessment;
- Waste Assessment;
- Air Quality Assessment;
- Human Health Assessment;
- Noise Assessment; and
- Environmental Management and Monitoring.

The technical studies also detail the safeguards that would be put in place to ensure potential offensives can be controlled to a level which is not significant. Compliance with DP&E consent conditions and the Environmental Protection Licences issued by the Environmental Protection Authority for the Project is sufficient to demonstrate the facility is not an ‘offensive industry’.

3.5 Flood Impact Assessment

The proposed site is located nearby to Swamp Creek. Based on the proximity to this waterway there is the potential for flood events to impact on the site. As the facility will store and process various types of dangerous goods, flood impacts are considered to introduce potential risks associated with mobilisation of dangerous goods and contamination of flood waters. Flood risks have been evaluated for the proposed facility to determine the flood risks and required floor levels.

A Site Flood Risk Assessment (Advisian, 2017) that included hydrologic and hydraulic modelling, has been prepared to evaluate potential impacts on the (Ref. 5). The Site Flood Risk Assessment forms the basis of the flood hazard assessment used in this report.

4.0 Methodology

4.1 Application of Risk Assessment Guidelines

The New South Wales guidelines are considered to provide the most comprehensive and robust assessment approach in the context of development control and land use planning within Australian jurisdictions.

In the context of new and upgraded / expanded development proposals, such as the Project, the following guidelines are relevant:

- *Hazardous and Offensive Development Guidelines: Applying SEPP 33* (DoP, 2011) – this guideline provides threshold requirements for dangerous goods and hazardous substances, above which a significant land use risk may be expected (and by corollary, below which no such significant risk is expected);
- *Assessment Guideline: Multi-Level Risk Assessment* (DoP, 2011) – this guideline includes a tiered approach to the assessment of land use planning risk depending on the likely significance of potential risks;
- *Hazardous Industry Planning Advisory Paper No. 3 – Risk Assessment* (DoP, 2011) – this guideline provides a general outline of the risk assessment approach, consistent with the requirements of AS/NZS ISO 31000;
- *Hazardous Industry Planning Advisory Paper No. 4 – Risk Criteria for Land Use Planning* (DoP, 2011) – this guideline specifies land use safety criteria according to affected land use, to be met at the proposed development boundary; and
- *Hazardous Industry Planning Advisory Paper No. 6 – Hazard Analysis* (DoP, 2011) – this guideline provides further detail in relation to the identification of hazards, the estimation of likelihood and consequence, and the quantification of risk.

Hazardous Industry Planning Advisory Papers (HIPAPs) other than those listed above relate to studies to be undertaken during the detailed design, implementation and operation of a development.

4.2 Method of Impact Assessment

Due to the likely presence of Class 6.2 Infectious Substances, it is stated in the guidance material Applying SEPP 33, the consultation is required with the Department, and accordingly AECOM will consult with DP&E and incorporate any specific requirements for the assessment.

This study follows the Multilevel Risk Assessment approach as outlined in the NSW Multilevel Risk Assessment Guidelines. The Multi-Level Risk Assessment approach is summarised in **Figure 4**. There are three levels of assessment, depending on the outcome of preliminary screening. These are:

- **Level 1** – Qualitative Analysis, primarily based on the hazard identification techniques and qualitative risk assessment of consequences, frequency and risk;
- **Level 2** – Partially Quantitative Analysis, using hazard identification and the focused quantification of key potential offsite risks; and
- **Level 3** – Quantitative Risk Analysis (QRA), based on the full detailed quantification of risks, consistent with Hazardous Industry Planning Advisory Paper (HIPAP) No.6 – Guidelines for Hazard Analysis.

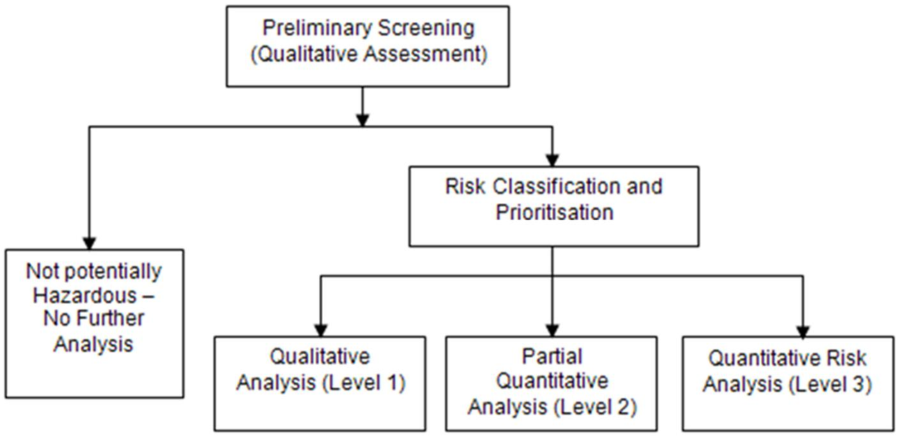


Figure 4 Multilevel Risk Assessment Approach

4.2.1 Methodology Offensive Industries

To determine if the Project is potentially offensive, a preliminary industry type screening was carried out in accordance with the requirements of the *Applying SEPP 33 Guideline* (NSW DP&I, 2011). The guideline provides a list of categories of industries with the potential for off-site offensive impacts. These impacts may include air emissions, water quality, noise or other environmental impacts.

For the assessment of potentially offensive industries, the quantity, nature and significance of the offences likely to be caused by the development should be provided as well as the need for any licences. It should be demonstrated that there are adequate safeguards in place to ensure that emissions from a facility can be controlled to a level such that they are not considered significant.

4.3 Detailed Approach

The detailed study approach follows that recommended in HIPAP No.6, "Hazard Analysis Guidelines" (Ref.2). The approach is summarised below.

4.3.1 Hazard Analysis

A detailed hazard identification was conducted for the clinical and other waste storage and processing facilities. Where an incident was identified to have potential off site impact, it was included in the recorded hazard identification table (**Appendix A**). The hazard identification table lists incident type, causes, consequences and safeguards. This was performed using the format suggested in HIPAP No.6 (Ref.2). Each postulated hazardous incident was assessed qualitatively in light of proposed safeguards (technical and management controls). Where a potential offsite impact was identified, the incident was carried into the main report for further analysis. Where the qualitative review in the main report determined that the safeguards were adequate to control the hazard, or that the consequence would obviously have no offsite impact, no further analysis was performed.

The hazard analysis and safety systems review was based on information provided by WA's Management team and the Project design team.

4.3.2 Consequence Analysis

For those incidents qualitatively identified in the hazard analysis to have a potential offsite impact, a more detailed consequence analysis was conducted. Where an incident was identified to have an offsite effect, and a simple solution was evident (i.e. move the proposed equipment further away from the site boundary), the solution was recommended and no further analysis was performed.

4.3.3 Frequency Analysis

In the event a simple solution for managing consequence impacts was not evident, any incident identified to have potential offsite impact would be subjected to a frequency analysis. The analysis would consider the initiating event and probability of failure of the safeguards (both hardware and software). The results of the frequency analysis would be carried forward to the risk assessment for combining with the consequence analysis results.

4.3.4 Risk Assessment

Where incidents were identified to impact offsite and where a consequence and frequency analysis was conducted, the consequence and frequency analysis for each incident would be combined and compared to the risk criteria published in HIPAP No.4 (Ref.3).

If the criteria were exceeded, a review of the major risk contributors would be performed. Recommendations would then be made regarding risk reduction measures.

5.0 Proposed Operations

5.1.1 Hours of Operation

Under the existing Development Consent, the facility is approved for operations 24 hours per day 7 days a week. No change to the existing operation hours is anticipated for the Project.

5.1.2 Integration with Existing Operations

The proposed thermal processing operations at the WA facility (the Project), includes the construction and operation of purpose built equipment for the safe receipt, storage and processing of medical and other wastes.

Proposed thermal destruction/processing equipment is to be incorporated within the existing facility footprint, using existing access, storage areas and emission control systems. Proposed plant and equipment is to be located within the northern end of the site. The location of the proposed facility is shown in **Figure 2**.

Waste delivered via road transport is unloaded into the waste handling area for storing and processing. The waste is anticipated to be processed as it is delivered reducing the storage retention time. Refrigerated storage is provided for Class 6.2 waste to allow for additional storage, as required.

The kiln is proposed to be established in an east-west orientation, with enclosed input storage facilities and a dedicated feeding system. The existing Baghouse 5 is to be used for emission capture and treatment of process emissions from the proposed plant and equipment before discharge to atmosphere via the existing Stack 5. This emission control system currently services Reverberatory Furnace process emissions, typically operated during one shift per day. A dry-lime scrubber system currently operates in conjunction with Baghouse 5 to treat acid gases and adsorb pollutants (e.g. PAHs and Dioxins/Furans). It is proposed that this scrubber system be upgraded to incorporate an activated carbon dosing system, with the activated carbon injected at the baghouse entry point.

The Project will use the site's existing access and emission control systems. The incinerator would be integrated with the site's existing Baghouse No. 5 Filtaire 4 module fabric filter. Following the completion of the Project Air Quality Impact Assessment (AECOM, 2016) more relevant air emissions criteria have been identified for some pollutants in accordance with the *Protection of the Environment (Clean Air) Regulation 2010*. Full discussion in regards to Project air quality potential impacts and mitigation is provided in the Air Quality Impact Assessment.

The general layout of the dedicated undercover waste storage and pre-treatment areas are shown in **Figure 5**.

The proposed thermal treatment plant would consist of:

- Waste storage;
- Solid wastes ram type loader system which is suitable for medical wastes;
- Liquid wastes feeding or reticulation systems;
- Co-current Rotary Kiln Primary Combustion Chamber complete with loading hood and Ash Burnout Zone;
- Ash handling and Quenching System;
- Refractory Lined Horizontal Secondary Combustion Chamber;
- Secondary Combustion Chamber suitable for natural gas;
- Incinerator Secondary Chamber Outlet Exhaust Gas Analysers measuring CO, CO_2 and O_2;
- Refractory lined bypass stack with failsafe bypass stack cap;
- Refractory lined preliminary heat exchanger complete with fan and ducting to provide preheated combustion air to Secondary Combustion Chamber;
- Refractory lined forced cooling zone complete with fan;

- Mild Steel ducting from cooling zone to existing fabric filter;
- Modification of existing fabric filter ducting with provision of isolation valves and controls to permit operation of either the incinerator or the existing furnace;
- Activated Carbon feeder and conveying plant;
- Variable Speed drive to suit existing fabric filter induced draft fan; and
- All necessary field electrical equipment, instrumentation and controls.

The proposed processing equipment shall consist of six basic sections, as follows:

- Solid Waste Loader and Bin Tippler;
- Primary Combustion Chamber;
- Ash discharge system;
- Secondary Combustion Chamber;
- By-pass, breeching and stack, and
- Waste Bin Washing Machine.

5.1.3 Solid Waste Loader and Bin Tippler

The function of the loader is to permit the introduction of solid waste materials directly into the primary chamber of the thermal processing plant in a safe and environmentally efficient manner.

The thermal processing plant would be equipped with a hydraulic powered bin tippler which is capable of lifting the following types of containers or any other designated type of container, tipping the contents directly into the loading hopper:

- 1 of 660 litre wheelie bin; or
- 2 of 240 litre wheelie bin.

The tippler would be capable of both automatic and manual control. The operation of the tippler would be through the thermal processing plant Programmable Logic Controller (PLC) system. Limit switches would be used to monitor the operation of the tippler to ensure that over travel of the tippler cannot occur. The waste loader tippler system would be equipped with an automated waste weighing and data logging system.

5.1.4 Waste Loader

The loader has been designed to allow the safe loading of waste materials into the thermal treatment plant whilst ensuring the following criteria:

- Minimal air leakage into the plant during load cycles;
- No fugitive emissions from loader during load cycles;
- No risk of contact between operator and waste inputs;
- Minimal risk of fire in the hopper; and
- Minimisation of molten plastic build-up in the loader area and subsequent jamming of fire doors.

To satisfy the above criteria the loader would be equipped with the following features:

- Conventional hydraulically operated loading ram;
- Conventional refractory lined fire door;
- Air cooled steel seal door;
- Waste loader hopper lid; and
- Exhaust gas extraction from loader area.

The use of the hopper lid provides an airlock which prevents the ingress of large quantities of air into the thermal processing plant which can result in the loss of controlled air operating conditions and a subsequent rapid increase in the primary chamber operating temperature. The use of a second seal door eliminates the common problem of plastic materials in contact with a conventional fire door melting and possibly igniting.

5.1.5 Solid Waste Loader and Tippler Operation

The load cycle can be started once the contents of two off wheelie bins have been deposited into the loader hopper. The loader is hydraulically controlled and of welded steel construction with a maximum capacity of 0.9 m^3. All waste arriving on-site is expected to be bagged, boxed, or provided in other suitable containers.

The loader is normally operated in automatic mode, but may be operated manually from a remote control station mounted on the side of the loader.

5.1.6 Rotary Kiln Primary Combustion Chamber

The proposed rotary kiln primary chamber is an ashing co-current design and is equipped with a final ash burnout zone. The waste materials are loaded into the kiln where initial combustion takes place. The ashes then discharged from the kiln are maintained on a stationary burnout hearth for a period of up to eight hours to ensure maximum burnout of all carbonaceous matter. The burnout hearth is equipped with an ash pusher which gradually pushes the waste ashes across the hearth into the ash pit.

The rotary kiln primary chamber is equipped with the following auxiliary items.

5.1.7 Combustion Air Fans

The combustion air necessary to thermally treat the waste materials is introduced into the primary chamber kiln by means of two independent fans. The first combustion air fan is used to supply combustion air to the kiln inlet hood whereas the second combustion air fan is used to supply air to the burnout zone.

5.1.8 Ash Pusher

The rotary kiln burnout zone is equipped with a hydraulically operated ash pusher. The ash pusher is operated in sequence at the start of every load cycle and is used to transfer waste ash materials from the burnout hearth directly into the ash trough for automatic removal.

5.1.9 Ash Discharge

WA proposes to remove ash by means of a water seal pit and drag type ash conveyor.

This unit would be of heavy duty mild steel construction and is equipped with a heavy loose-link drag conveyor chain. A series of mild steel flights are attached to the chain at regular intervals. The chain is supported on sprockets and a series of troughs attached to the main casing.

The trough would be fitted with bottom wear plates. The conveyor chain is driven intermittently by a separate hydraulic motor operating through a set of reduction gears. Operation of the conveyor is manual via a hand operated control valve.

5.1.10 Secondary Combustion Chamber

The function of the secondary chamber is to ensure maximum breakdown of all combustible gases generated in the thermal processing plant's primary chamber. This is achieved by maintaining the secondary chamber at a temperature of 1100^{o}C whilst ensuring an adequate supply of combustion air. An efficient secondary chamber is essential to minimise emissions of dioxins and other products of incomplete combustion.

The critical parameters when determining the efficiency of a secondary chamber are the combustion temperature, the chamber combustion time or retention time and the turbulence. Naturally all these parameters assume that sufficient combustion air is available to complete the combustion process.

The secondary chamber is designed to provide a secondary chamber retention time of 2.0 seconds at a temperature of 1100°C. The secondary chamber is of circular cross section and is fabricated from 6 mm thick welded mild steel plate and lined with high temperature refractory.

The secondary chamber would be equipped with natural gas burners and separate pilot burners. Burner flame viewing ports are to be provided in this chamber. The burners would be configured to operate using natural gas as a fuel.

Using these burners the combustible products from the primary chamber are mixed with excess air and ignited raising their temperature to over 1100°C.

Additional combustion air is mechanically induced under high pressure through a series of tangential ducts located along the chamber. This high velocity combustion air is used to provide counter-rotation mixing of the high temperature gas stream. After the high temperature gas stream is thoroughly mixed, the gases enter the combustion chamber retention zone, where the gases are held for a minimum time period of two seconds at a temperature of 1100°C. In order to minimize the use of fuel, the plant would utilize combustion air which has been preheated by passage through the preliminary heat exchanger located following the secondary chamber and prior to the main ceramic tube heat exchanger.

5.1.11 Plant Auxiliary Services

Burner Systems

The secondary combustion chamber burner system would be equipped with two natural gas fired burners. These burners would operate at full capacity during the initial preheat prior to the introduction of wastes. Once operating at full capacity under stable conditions these burners would automatically modulate to maintain the required chamber operating temperature.

To ensure satisfactory combustion of both waste materials and fuel the oxygen concentration at the outlet of the secondary chamber would be monitored and used to automatically control the addition of secondary combustion air. Carbon monoxide and carbon dioxide concentrations would also be monitored and used to give a continuous indication and recording of combustion efficiency.

Solvents and Paints Processing

Solvents and paints will be thermally destroyed in the facility via a customised injection system. Operators of similar facilities, including Ace Waste and Sterihealth, treat this material in this way.

The liquid waste injection system will consist of a supply tank with supply pump, reticulation piping with inline filtering and a liquid injection nozzle. Liquid waste types would be injected into the primary combustion chamber by an air atomized nozzle which uses compressed air to finely atomise the liquid wastes producing an extremely small liquid droplet size. This allows for rapid combustion when injected into the incinerator. Specific equipment sizing and type is subject to detailed design.

Solvents and paints typically have high calorific value relative to the other medical wastes would result in an immediate increase in the incineration temperature when introduced into the combustion process. Accordingly, the rate or quantity of such wastes that would be incinerated can readily be controlled by standard process instrumentation simply by monitoring the combustion temperature and modulating the quantity of materials introduced into the incinerator in accordance with the desired temperature.

The operation of the liquid waste injection system will be monitored by the plant supervisory, control and data acquisition (SCADA) system and controlled by the plant Programmable Logic Controller (PLC) and like the conventional solid waste loader shall be interlocked to operate only when the incinerator primary and secondary combustion chambers have achieved operational temperature and the air pollution control plant is online. The proposed waste incineration plant consists of a primary rotary kiln and a large secondary combustion chamber can readily handle the incineration of paint and solvent residues with no detrimental impact to the operation or environmental performance of the facility.

Hydraulic Systems

The following items are hydraulically operated:

- Loader Hopper Lid;
- Fire Door No.1;
- Fire Door No.2;

- Loading Ram;
- Rotary Kiln;
- Burnout Zone Ash Pusher;
- Burnout Zone Air Hole Cleaning Rods; and
- Ash Conveyor.

A multi pump hydraulic power unit would be used to ensure the ash conveyor and rotary kiln can operate simultaneously with all other functions.

Combustion Air and Fan System

All combustion fans would be equipped with a flow proving device and either variable speed drives or fully modulating control dampers. These dampers would be equipped with position proving switches and controlled directly from the PLC.

Computer Monitoring System

The thermal processing facility is equipped with conventional PLC controls supervising and controlling all aspects of the plant's operation.

In addition to these controls the thermal processing plant is also equipped with a custom designed graphical monitoring system (SCADA). This monitoring system greatly simplifies the operation of the facility and can be configured to provide real time monitoring of the facility, alarm monitoring and recording, data logging and detailed plant troubleshooting.

Control systems would operate in a manner which prevents the simultaneous operation of the project and the reverbratory furnace within the existing facility to prevent baghouse 5 receiving air streams from both sources at once.

Emission Monitoring

The thermal processing plant is equipped with an extractive emission monitoring system consisting of Oxygen, Carbon Monoxide and Carbon Dioxide analysers. Analogue signals from these analysers would be used for monitoring, combustion efficiency calculations and alarm generation.

Activated Carbon

The activated carbon injection system consists of a bulk bag discharge frame, variable speed volumetric feeder and pneumatic conveying system which injects the activated carbon to the fabric filter inlet duct.

The proposed system is similar to the existing WA hydrated lime conveying system. Subject to final design, the carbon bulk bag discharge frame and volumetric feeder may be incorporated into the existing pneumatic conveying system. The use of activated carbon for the control of combustion based air emissions is a well proven technology which has been utilised throughout Australia and numerous other countries for many years.

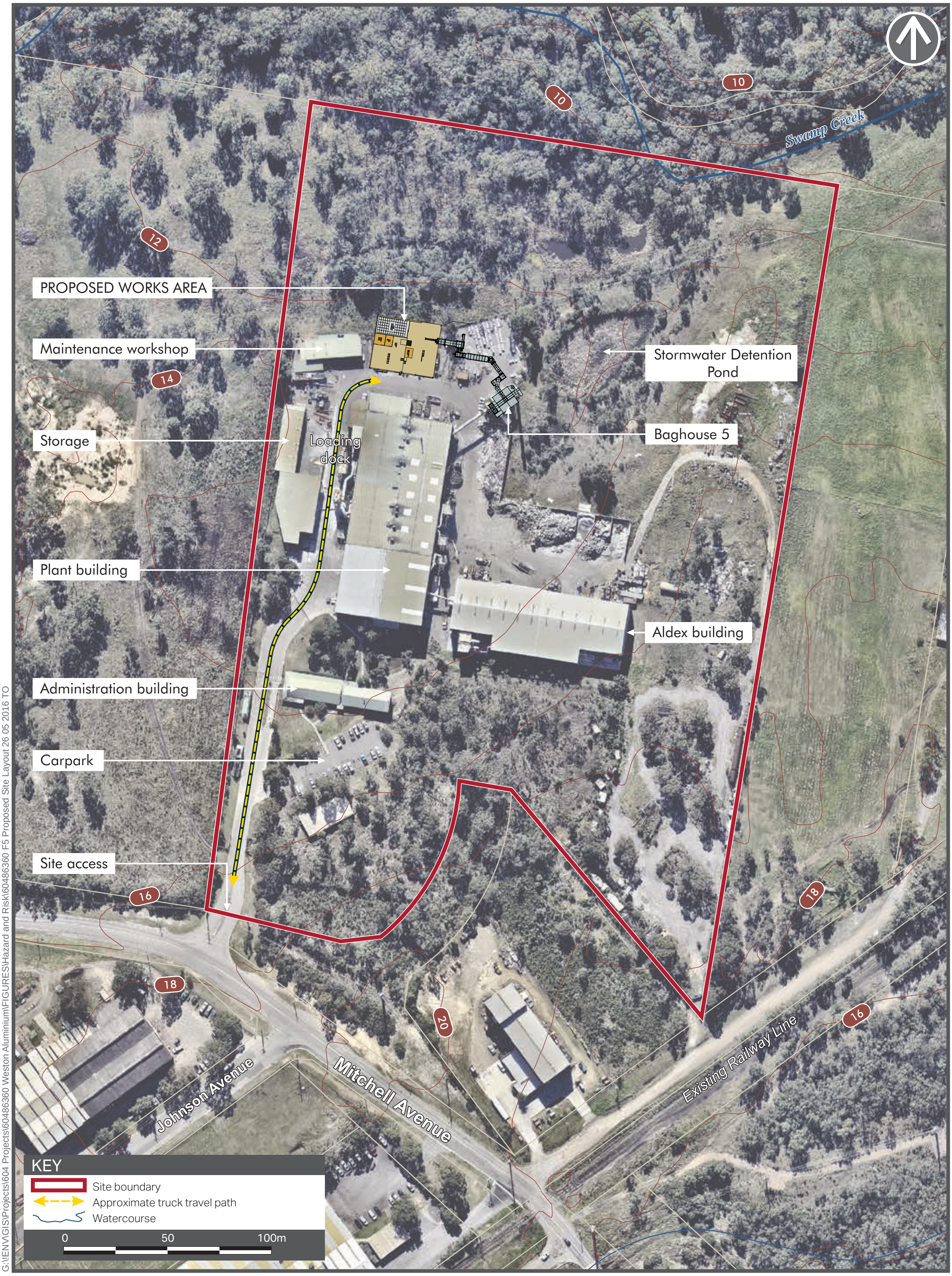
The function of the activated carbon is to reduce both dioxin and heavy metal pollutants which are adsorbed onto the activated carbon which is then collected and removed from the process gas by means of the fabric filter. The use of the fabric filter necessitates that the exhaust gases be cooled significantly and depending on the filter media used the exhaust gas temperature at the point of activated carbon injection is typically in the order of 150 to 250ºC.

The proposed WA thermal treatment plant would be equipped with a preliminary heat exchanger to cool the hot combustion gases from 1100 ºC to approximately 900ºC. At this point the exhaust gases enter the forced air cooler where ambient air is introduced to affectively cool the hot gases to an acceptable fabric filter inlet temperature. As an additional safeguard the exhaust gas cooling plant is also equipped with a water spray system which would automatic operate if the fabric filter inlet temperature were to exceed the deemed maximum operational temperature.

At the proposed process operating temperature combined with the use of a high quality, high ignition temperature activated carbon specifically designed for combustion flue gas applications the risk of fire or explosion within the fabric filter would be negligible.

If the exhaust gas process temperatures were to exceed 230ºC for any reason then the flow of activated carbon would automatically cease and the exhaust gases would bypass the fabric filter eliminating any risk of fire or explosion. This process would be PLC controlled in real-time.

The proposed equipment is similar that that utilised by both the Suez Perth facility and the Ace Waste Melbourne facility, and numerous other overseas facilities, which utilise activated carbon injection and have operated for many years respectively incident.



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PROPOSED SITE LAYOUT

Environmental Impact Statement
Weston Aluminium Recycling Facility

FIGURE 5

G:\!ENV\GIS\Projects\604 Projects\60486360 Weston Aluminium\FIGURES\Hazard and Risk\60486360 F6 Proposed Infrastructure 04 07 2016 TO Rev B

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PROPOSED INFRASTRUCTURE
Environmental Impact Statement
Weston Aluminium Recycling Facility

FIGURE 6

6.0 Existing and Proposed Safeguards

The following Design Standards would be incorporated into the design of the Project as applicable:

- There are no applicable Australian Standards specifically developed for the supply or design of the incineration equipment that would be used in the Project. There are however a number of related Australian Standards that would apply to the associated infrastructure, its design and installation. Key standard that would apply to the Project include:
    - Australian Standard 1375-2013 Industrial Fuel Fired Appliances;
    - Australian Standard 3814-2015 Industrial and Commercial Gas Fired Appliances;
    - Australian Standard 3000-2007 Wiring Rules;
    - Australian Standard 1657-2013 Fixed Platforms, Walkways, Stairways and ladders; and
    - Australian Standard 1554-2014 Structural Steel Welding.

The following process safeguards exist and/or are proposed:

- Bag-houses – all bag-houses are fitted with real-time, continuous particulate monitoring systems (existing);
- Bag-houses – all bag-houses are fitted with high differential pressure detection to activate bag pulsing and cleaning processes (existing);
- It is noted that the bag house emissions control systems are currently operating at the plant. These systems have proven successful in preventing the release of uncontrolled process emissions from the operational areas of the plant;
- Baghouse No.5 – Baghouse No. 5 is the proposed emission control system for Project. Exhaust gases from the furnace are directed to Baghouse No. 5 for treatment prior to release to atmosphere;
- The existing site Environmental Management System will be updated to incorporate the management requirements of the Proposed Thermal Processing Plant including:
    - Safety Management System; and
    - Environmental mitigation measures.
- The Safety Management System Manual (November 2015) will be updated to include the operations and materials associated with the Project prior to the commencement of operation in accordance with the requirements of the NSW Work Health and Safety Regulation 2011;
- The Emergency Response Plan (November 2015) will be updated to include specific responses to the hazard scenarios identified in this PHA and any other safety studies conducted for this Project;
- Safe guards identified in this hazard assessment will be implemented;
- WA has a strong demonstrated history of compliance with planning approval conditions and stringent environmental license requirements. These are reflected in WA's comprehensive environmental management system;
- WA will continue to comply with the conditions of the environment protection licence issued by the EPA under the Pr*otection of the Environment Operations Act 1997*;
- The transport of dangerous goods to and from site will be in accordance with the Australian Dangerous Goods Code of Practice/ NZ 5433;
- Design and installation of the waste storage, waste preparation, waste feeding or reticulation systems will be in accordance with the relevant Australian Standards including but not limited to the standards for each class outlined in **Table 4** below;

- As a part of the update to the safety management system manual, WA's dangerous goods policy, plans and procedures will be updated to include the requirement to store and handle all dangerous goods in accordance with the relevant Australian Standard for each class outlined in **Table 4** below. This will also include an update to the SafeWork NSW Notification of Dangerous Goods for manifest quantities;
- Waste storage and handling areas will be designed to have a minimum floor height of at least 13.0m AHD, and the proposed building will have dry flood proofing installed to a minimum height of at least 14.0m AHD. Fill requirements and flood proofing will be designed by a suitably qualified structural engineer (Refer **Appendix A**); and
- Measures will be implemented in the sites environmental, emergency and operational management plan to provide an appropriate level of flooding risk preparedness as described in **Section 9.1**.

Potential for accumulation of flammable gases in the event of a flameout:

- During normal operation the primary chamber temperature operates in the order of 900-1000°C and a secondary chamber temperatures in excess of 1100°C;
- In the event of an extended burner failure in which the incinerator temperatures might drop below acceptable limits then the waste gas feed between chambers would automatically stop, eliminating the potential for the accumulation of flammable gases; and
- The operating temperatures are well above the auto-ignition temperature of methane and also that of any hydrocarbon solvents that could be introduced in the waste stream that might be a potential source of flammable gases. Therefore, it would not be possible for flammable gases to accumulate within the incinerator regardless of whether the burners were on or off. Many incinerators, once at operational temperatures, can operate for extended periods of time without the use of any fuel burners utilising the energy release of the waste materials incinerated to maintain the required combustion temperatures.

Table 4 Australian Standards for Dangerous Goods

Class of Material	Type of Materials on site	Relevant Australian Standard for Storage and Handling
Class 3 Flammable (and combustible) Materials	Some types of Pharmaceutical wastes can be class 3 flammable substances Diesel	· AS 1940 – The Storage and Handling of Flammable and Combustible Liquids.
Class 2 Gases	Refrigerant Natural Gas	· AS 4332 The storage and handling of gases in cylinders.
Class 6 Toxic Substances	Some types of Pharmaceutical wastes can be class 6.1 toxic substances	· AS/NZS 4452, The storage and handling of toxic substances. · AS/NZS 3816, Management of clinical and related wastes. · HB 202, A management system for clinical and related wastes – Guide to the application of AS/NZS 3816, Management of clinical and related wastes.
Class 8 Corrosive Substances	Some types of pharmaceutical wastes can be class 8 corrosive substances	· AS 3780 – The storage and handling of corrosive substances.
Class 9 Miscellaneous Dangerous Goods	Some types of pharmaceutical wastes can be class 9 miscellaneous dangerous goods	· AS/NZS 4681 – The storage and handling of Class 9 miscellaneous dangerous goods.
Mixed classes of dangerous goods	Areas where various classes are stored on site such as waste preparation areas	· AS/NZS 3833 – The Storage and Handling of Mixed Classes of Goods, in Packages and Intermediate Bulk Containers.

7.0 Hazard Analysis

A hazard identification table was developed as part of the study; this is included at **Appendix A**. The analysis in this section is centred on the storage, handling and processing of toxic and infectious substances and the potential hazards posed by these materials. Where a hazard is identified to have a potential offsite impact the incident is carried forward for consequence analysis. Where no offsite impact is identified, no further analysis is conducted.

7.1 Hazardous Properties of Materials

Medical waste is a heterogeneous mixture of general refuse, laboratory and pharmaceutical chemicals and containers, pathological wastes and cytotoxic materials. All of these components are potentially infectious, meaning that they cannot simply be disposed of in a landfill. In NSW, these types of wastes must be either incinerated or autoclaved. Most biomedical waste produced in Australia is treated in controlled air type incinerators. As biomedical waste typically contains 2% chlorine by mass and a high proportion of organic carbon, the potential for dioxin formation has become a critical parameter in the design and operation of these units and associated pollution control equipment.

7.1.1 Class 6.1 - Toxic substances (Cytotoxic drugs and some types of Pharmaceutical wastes)

Class 6.1 Toxic substances are substances liable either to cause death or serious injury or to harm human health if swallowed or inhaled or by skin contact.

The release and dispersion of toxic material can adversely affect people and the biophysical environment. The consequences of such toxic releases may be particularly significant for sensitive areas of the biophysical environment.

7.1.2 Class 6.2 - Infectious Substances (Clinical and related wastes and Pathogenic substances)

Class 6.2 Infectious substances are substances known or reasonably expected to contain pathogens. Pathogens are defined as micro-organisms (including bacteria, viruses, rickettsia, parasites, and fungi) and other agents such as prions, which can cause disease in humans or animals. Refrigerated storage reduces the risk of the pathogens being active and allows for increased storage times.

7.2 Hazardous Incident Scenarios

The greatest potential for far field effects is generally associated with the evolution of toxic gas (***which is not considered a credible scenario for this facility***). However, toxic concentrations in the air can also result from a range of potential hazard scenarios as detailed in **Table 5.**

Table 5 Hazardous Incident Scenarios

Hazardous Scenarios	Hazard ID[1, 2]
Key Scenario	
Loss of containment of toxic emissions due to leak/hole in equipment or equipment failure resulting in an emergency release. The bag house emissions control system is robust and has proven to effectively mitigate the risk of emissions.	1, 2, 5, 6, & 7
Additional Scenarios	
Vapours from toxic liquids.	1, 4
Reactions of materials giving off toxic vapours or gases.	1, 4
Fire and the evolution of toxic combustion products or toxic products of thermal decomposition.	3, 6
Liquid spills entering watercourses or contaminating land and ground water.	5, 7
Spills of solids (particularly powders and dusts) being blown or washed into water or onto land.	5, 6
Flooding	7 – 11[3]

1. Hazard IDs for each identified scenario and corresponding, cause, effect and safeguards as listed in Appendix A;
2. Some scenarios can result from a multiple causes requiring multiple safeguards.
3. Analysis of flooding hazards is provided in a separate table in Appendix A and includes analysis of four separate flooding scenarios.
4.

Appendix A contains a full listing of the:

· Identified hazard scenarios;

· The process or area within the plant the hazard may arise;

· The cause of the hazard;

· The consequence of the hazard; and

· The safeguards which have been identified to manage the risk associated with each hazard.

A full list of the proposed safeguards proposed by the project to appropriately manage hazards is contained in **Appendix A.**

The analysis of the effects of exposure to toxic substances is a complex and developing science. Toxic substances can affect people in many different ways and the seriousness of the exposure will be highly dependent on the sensitivity of the individual and on the duration of the exposure. The analysis of effects on other species and on ecosystems is even more complex than for humans, and knowledge is often even more limited. Effects can range from fatality or injury (e.g. damage to respiratory or nervous system, emphysema, etc.) to irritation of eyes, throat or skin, through to a nuisance effect. The analysis of toxic material effects is particularly difficult in the case of smoke from fires which may involve multiple and uncertain components. It is difficult to assess what effects such combinations of toxins might have. In such cases, conservative assumptions about the toxins involved and their concentration may be appropriate.

Although the precise nature of the materials stored cannot be detailed because of the continually changing nature of wastes likely to be accepted by the facility, it is generally not expected that significant quantities of materials with high volatility would be involved.

The air quality technical study and the human health risk assessment have assessed the potential operational and emergency release scenarios for toxic gases and their impacts to human health and the environment. The studies found that there were no significant consequences due to toxic releases.

8.0 Risk Assessment Against Criteria

It is essential that certain qualitative principles be adopted concerning the land use safety acceptability of development. The following qualitative criteria in accordance with Section 2.22 of HIPAP No. 4 are appropriate assessing the risk implications of a development project of a potentially hazardous nature or the locational safety suitability of a development in the vicinity of a potentially hazardous installation:

a. All 'avoidable' risks should be avoided. This necessitates the investigation of alternative locations and alternative technologies, wherever applicable, to ensure that risks are not introduced in an area where feasible alternatives are possible and justified.

b. The risk from a major hazard should be reduced wherever practicable, irrespective of the numerical value of the cumulative risk level from the whole installation. In all cases, if the consequences (effects) of an identified hazardous incident are significant to people and the environment, then all feasible measures (including alternative locations) should be adopted so that the likelihood of such an incident occurring is made very low. This necessitates the identification of all contributors to the resultant risk and the consequences of each potentially hazardous incident. The assessment process should address the adequacy and relevancy of safeguards (both technical and locational) as they relate to each risk contributor.

c. The consequences (effects) of the more likely hazardous events (i.e. those of high probability of occurrence) should, wherever possible, be contained within the boundaries of the installation.

d. Where there is an existing high risk from a hazardous installation, additional hazardous developments should not be allowed if they add significantly to that existing risk.

Relevant general principles are:

- The avoidance of all avoidable risks;
- The risk from a major hazard should be reduced wherever practicable, even where the likelihood of exposure is low;
- The effects of significant events should, wherever possible be contained within the site boundary; and
- Where the risk from an existing installation is already high, further development should not pose any incremental risk.

8.1 Summary of Consequence Impacts

8.1.1 Air Quality

A dispersion modelling assessment is included within the EIS for the proposed development to assess proposed management and mitigation measures, and potential impacts to the surrounding environment and community. The assessment of air quality has been prepared in accordance with the NSW EPA *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW*.

8.1.2 Water Environment

WA has in place a stormwater control system on site that segregates off-site stormwater entering the site, from uncontaminated on-site stormwater and potentially contaminated on-site stormwater. Potentially contaminated first flush water is fed through a constructed wetland to remove contaminants, and the resulting clean water is irrigated on site. Uncontaminated on-site stormwater entering the site is directed to a grass swale catch drain and directly discharges into Swamp Creek.

It is noted that process water used by the proposed Project such as bin wash water, would be managed via an approved trade waste connection to sewer. There would be no use of stormwater or release of any waste water to stormwater as part of the Project.

A water quality impact assessment has been included within the EIS to review the effectiveness of the current control system on-site to minimise the water quality impact from the proposed development.

8.1.3 Soil and Land Environment

The installation of the thermal processing plant and ancillary equipment will be located on a base of impermeable concrete designed to withstand the operational loads. All operational areas will be bunded with impermeable concrete walls that will contain all spillages and will drain to a collection system that will automatically pump free liquids to the sewer system. No activities will be required to be below ground. As such, no adverse impact on the soil environment from the proposed development/installation is expected.

8.1.4 Flood Impacts

A site Flood Risk Assessment(Refer **Appendix A**) has been conducted which assesses the impact of potential flood events on the facility, as described in the *Weston Aluminium – Proposed Medical and Other Waste Thermal Processing Facility – Site Flood Risk Assessment* prepared by Advisian (Refer to **Appendix B**). Based on the potentially hazardous nature of the facility, a range of flood levels were considered including the 1%, 0.5% and 0.05% Annual Exceedance Probability (AEP) floods.

The study identified a risk of inundation under the 0.5% and 0.05% AEP scenarios. Based on the modelling results, the study recommends the floor level for waste storage and handling areas be increased to a minimum of the 0.5% AEP flood level plus 0.5 m freeboard. It is likely that this level would also provide freeboard to the 0.05% AEP flood level. The study also recommends that dry flood proofing be considered to increase the flood immunity and provide additional protection.

The study also identified the ash handling area as requiring additional protection. It is recommended that flood proofing on the building should be provided to a height of 14.0m AHD to protect against the 0.05% AEP flood level. The ash handling area would also be protected by a sealed wall with a minimum height of 13.0m AHD to prevent inundation of the ash handling area. Suitable seals should be provided on all entrances to the area.

All equipment associated with the proposed facility should be designed to withstand the predicted 0.05% AEP flood, including the provision of adequate hold-down and protection structures to prevent the mobilisation of any site infrastructure in the event of flood.

The recommendations of the Flood Risk Assessment have been incorporated into the proposed risk mitigation measures for the Project as detailed in **Section 9.1.** With these measures in place, the risk assessment concludes that the Project is unlikely to result in significant offsite impacts, and that flood impacts to the project are suitably controlled and the risk reduced as far as reasonably practicable.

8.1.5 Human Health

A human health risk assessment has been conducted that considers the potential adverse effects from human exposure to project related environmental hazards including noise, air quality and contamination of drinking water conducted in accordance with the enHealth *Environmental Health Risk Assessment: Guidelines for assessing human health risk from environmental hazards (2012).* The study considers normal operating conditions, stack emissions, emergency by-pass operations and cumulative effects with the battery recycling facility.

8.1.6 Cumulative impacts

Based on the analysis conducted in this study, the hazards associated with the proposed thermal processing plant at the WA facility is not expected to significantly change the existing risk profile, hence, the risk criteria published by the NSW DPI in HIPAP No.4 (Ref.3) is not exceeded and the facility remains classified as potentially hazardous and not hazardous and would therefore be permitted to continue operations processing medical and other wastes in the existing land zoning.

9.0 Conclusion

The proposal was identified as a potentially hazardous and potentially offensive industry and was therefore subjected to the assessment requirements of SEPP 33. With all locational, technical, operational and organisational safeguards employed, the proposal is not considered to pose a significant risk.

For a potentially hazardous development, the SEARS required an assessment of the Project potential hazards and risks to be submitted with the Development Application. The assessment of the PHA finds that the proposal meets the relevant risk criteria as set out in *Hazardous Industry Planning Advisory Paper No 4.*

The criteria considered for the qualitative assessment conducted for the project includes:

- Hazard identification using summary diagram (refer to Risk Assessment table in **Appendix A**);
- Identification of key scenarios and qualitative estimate of risks (i.e. qualitative assessment of consequence and likelihood);
- Comparisons with qualitative criteria (in accordance with HIPAP No. 4); and
- Thorough discussion of protective technical and management measures, including codes and standards.

The basis of qualitative assessment includes:

- Appropriate methods used for identification;
- All key scenarios thoroughly examined;
- Realistic estimates of risk;
- Relevant qualitative criteria met;
- Proposed measures appropriate and sufficient; and
- Compliance with all relevant codes and standards.

The proposed thermal waste processing equipment would be incorporated into the existing facility using existing access and emission control systems.

WA has a strong demonstrated history of planning approval and environmental license compliance with stringent environmental requirements currently enforced through a comprehensive environmental management system.

The WA site is located in an industrial area. The closest residential area being over 600m to the south east. Detailed technical and management safeguards are proven at the WA site.

9.1 Future Risk Minimisation Opportunities

Potential control measures/environmental safeguards have been considered in identifying credible hazards scenarios (refer to **Appendix A**) and qualitatively analysing potential risks posed by those scenarios. Below is a summary of key control measures that are considered of importance in minimising and managing risks posed during the design, construction and operation of the Project. **Figure 7** illustrates the relevant studies and reviews to be undertaken at each stage of the Project lifecycle.

9.1.1 Design Phase Opportunities

To control, minimise and manage risks during all phases of the Project, through safety in design, the following measures would be implemented:

- In detailed design, locate product storage areas at separation distances with specific reference to the applicable Australian Standards;

- In detailed design, select floor levels as per Advisian (2017) to reduce the flood risk and provide appropriate engineered controls (such as fill material and dry waterproofing) where floor levels cannot eliminate flood risks:
  - A minimum design floor level shall be designed as 13.0m AHD for the waste handing area and all waste storage areas; and
  - The Project building shall be designed to have dry flood proofing designed into the facility to a height of 14.0m AHD.
- The ash handling area should be protected by a wall to a minimum height of 13.0 m AHD to prevent inundation in events up to and including the 0.05% AEP flood. Suitable seals should be placed on all entrances to the area. All machinery and materials that form part of the Project that have the potential to become buoyant shall be designed to be bolted own or otherwise fixed in place to prevent their movement in floodwater;
- Project infrastructure that is external to the Project building would be designed to withstand velocities and depths associated with s 0.05% Annual Exceedance Probability (APE) flood event;
- Update the existing Fire Safety Study to include the Project to determine appropriate fixed and portable fire protection systems for the Project Site to ensure the consequences of major fire incidents are adequately mitigated;
- In addition to this Preliminary Hazard Analysis, conduct a Final Hazard Analysis prior to construction;
- Develop a Traffic Risk Assessment and a detailed Route Selection study for the dangerous goods transport activities particularly for the transport of dangerous goods from the Project Site;
- Use the results of the PHA as inputs into other safety studies required to be developed as a part of the design, construction / commissioning and operations phases of The Project; and
- Carry out safety in Design Reviews in accordance with *WHS Regulations and Code of Practice – Safe Design of Structures*.

9.1.2 Construction Phase Opportunities

To control, minimise and manage risks during the construction phase of The Project, the following measures would be envisaged:

- Develop and implement an appropriate Safety Management Plan. This should include access by workers to a risk register for all construction activities;
- Develop an Emergency Response Plan, including actions to be taken in the event of an emergency;
- Ensure a permit to work system is implemented, in particular where workers may be exposed to high risk activities;
- Undertake audits on construction activities, and address and communicate any findings to the relevant workers;
- Ensure the workers have appropriate training and the necessary competencies;
- Implement actions / risk reduction strategies as identified through Safety in Design reviews; and
- As the construction phase would not result in the storage of any wastes classified as hazardous or dangerous standard measures for the management of flooding impacts during the construction phase would be suitable.

9.1.3 Operations Phase Opportunities

To control, minimise and manage risks during the operations phase of The Project, the following measures would be envisaged:

- Update the site Safety Management Plan. This should include access by workers to a risk register for all operational activities;

- Update the site Emergency Response Plan to ensure a co-ordinated response to the hazard scenarios identified in this assessment;
- Update the site Operational Environmental Management Plan;
  - Inclusion of specific measures and procedures for the storage, handling, including the process of inspection and quality control / checking of waste prior to acceptance at the site for processing to prevent any unwanted waste streams entering the facility;
  - Waste to be processed as soon as practical following arrival at site to minimise waste held in storage; and
  - Requirements for all wastes to be stored in dedicated internal secure waste storage areas with a minimum flood height of 13.0m AHD in the building with flood protection to 14.0m AHD. Waste storage areas to be sealed from flood water ingress to minimum height of 14.0m AHD; and
  - All wastes to be held in the secure waste storage areas until required for processing. No temporary storage of waste materials outside of the dedicated secure storage facilities would take place.
- Undertake audits on operational activities, and address and communicate any findings to the relevant workers;
- Ensure storage bins are stored in a location protected against flood impact as per the building design requirements detailed in **Section 9.1.1**.
- Provisions for staff training in the safe handling storage and spill response requirements for all proposed waste streams and residue ash;
- Notify SafeWork NSW of any Schedule 15 chemicals that are likely to exceed 10 percent of the threshold quantity and accordingly update existing manifests, risk assessments and emergency plans as required for chemicals exceeding manifest quantities; and
- Preparation and implementation of a Preventative Maintenance Program, including routine condition inspection / assessment of structural, waste processing and environmental control (air quality management) and flood protection elements of the Project.
- The following would be implemented to prevent cross contamination of waste streams:
  - Wastes associated with the project to be transported, stored and processed separately to SPL and dross material;
  - Separate processing facilities would be used to treat each waste stream. No dross or SPL material would be treated by the project and no medical waste would be treated in the existing facility; and
  - Storage and handling procedures unique to each waste type (including procedures currently in place at WA) would be implemented across the site to prevent loss of containment.
- To prevent fire or explosion resulting from excessively hot exhaust gas coming into contact with activated carbon the following would be implemented:
  - Preliminary heat exchanger to remove excess heat from exhaust gas following release from secondary combustion chamber;
  - Forced air cooler to inject ambient air to further reduce temperature of exhaust gas following the heat exchanger;
  - Water spray system would automatically operate if the fabric filter inlet temperature were to exceed the deemed maximum operate;
  - If the exhaust gas process temperatures were to exceed 230ºC at the baghouse for any reason then the flow of activated carbon would automatically cease and the exhaust gases would bypass the fabric filter eliminating any risk of fire or explosion;

- Programmable Logic Controller (PLC) would be utilised to monitor the operation of the plant in real-time allowing systems responses (shutdowns) to be implemented immediately in the event of 'upset' conditions; and
- The system would utilise high quality, high ignition temperature activated carbon specifically designed for combustion flue gas applications.

9.1.4 Post-closure Phase Opportunities

To control, minimise and manage risks during the post-closure phase of the Project, the following measures would be envisaged:

- Develop a decommissioning plan. This should include a project risk register that is available to all workers, including any risk items added during the construction and operations phases; and
- Keep records of all workplace health and safety related information relating to the Project post closure phase.

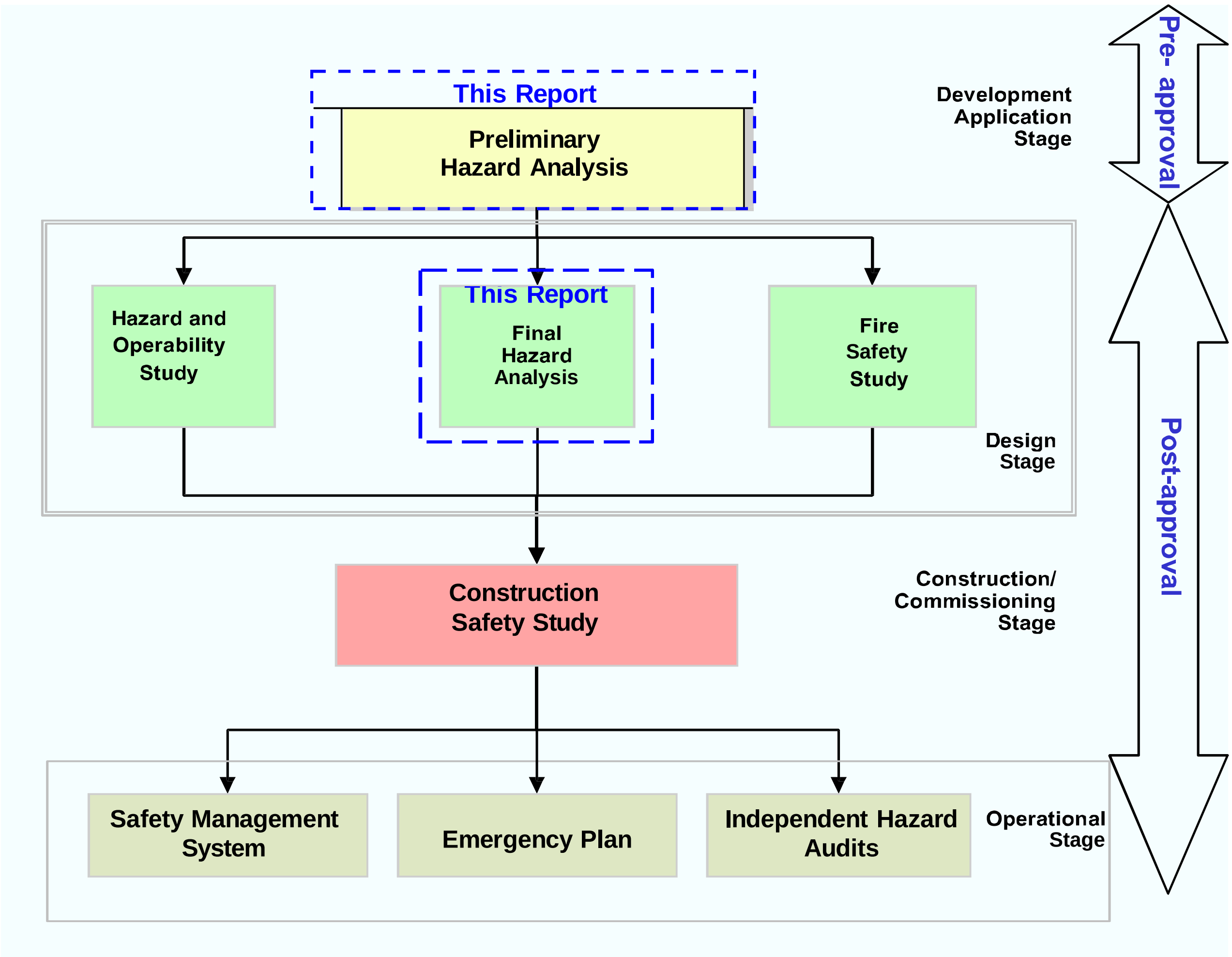


Figure 7 Hazard Studies to be conducted at phases of the development

10.0 References

1. DP&I (1994), “Applying SEPP 33”, Hazardous and Offensive Industry Development Application Guidelines.
2. NSW Government – Planning, Hazardous Industry Planning Advisory Paper (HIPAP) No. 6, “Hazard Analysis”, Jan 2011.
3. NSW Government – Planning, Hazardous Industry Planning Advisory Paper (HIPAP) No. 4, “Risk Criteria for Land Use Safety Planning”, Jan 2011.
4. NSW Government - Hazardous Industry Planning Advisory Papers (HIPAP) “Multilevel Risk Assessment Approach”, Jan 2011.
5. The Australian Code for the Transport of Dangerous Goods by Road and Rail (known as the Australian Dangerous Goods Code or ADG), Edition 7.4., Federal Office of Road Safety, Canberra, ACT (2016).
6. Weston Aluminium – Proposed Medical and Other Waste Thermal Processing Facility – Site Flood Risk Assessment, Advisian, Feb, 2017.

Appendix A

Hazard Identification

Appendix A Hazard Identification

Hazard Identification

Table A1 Hazard Identification

Hazard ID	Operation or Area	Hazard Cause	Hazard Consequence	Safeguards	Off-site Impact
1	Delivery of materials to/from site	Vehicle accident. Vehicle fire.	Loss of containment of Dangerous Goods. Toxic emissions (contact between incompatible materials).	· Transport of materials in accordance with the ADG Code. · Segregation of incompatible materials during transport. · Experience vehicle operators.	Unlikely
2	Dangerous Goods Storage Area	Major storm event causing building damage and leading to water ingress.	Loss of containment of Dangerous Goods.	· Site stormwater management. · Storage area building is bunded with spill containment capacity sufficient to hold the estimated storm-water ingress without release off-site · Preventative Maintenance program including inspections of building integrity. · Repairs and/or modifications are performed where required, · Facility floor level to be specified to control flood risk associated with 0.05% AEP flood level, with dry waterproofing where appropriate.	Unlikely
3	Gas Piping	Ignition of leak in gas supply pipeline.	Fire	· Design standards and correct selection of materials of construction. · Remotely operated automatic isolation at process plant. · Pipeline mainly buried. · Unconfined plant limits risk of explosion, increases rate of dispersion. · Follow ExP standards for all electrical equipment to minimise risk of ignition. · Operating and maintenance procedures and practices. · Low pressure distribution piping.	Unlikely

Hazard ID	Operation or Area	Hazard Cause	Hazard Consequence	Safeguards	Off-site Impact
				· Routine inspection, tuning and maintenance of combustion systems. · A strict smoking ban throughout the entire WA site	
4	Dangerous Goods Storage Area	Fire involving Class 3 Flammable materials and Class 6.1 toxic chemicals Static discharge during transfers, equipment malfunction, electrical equipment, other sources of ignition.	Loss of assets. Emission of toxic combustion products. Emission of parent material that survives fire. Risk to site personnel and off-site personnel from radiation, toxic combustion products	· No packages accepted that do not conform to ADG code. · Storage to AS standards- separation, segregation etc. · Good housekeeping. · Control of ignition sources (ExP methods, equipment maintenance, procedures, smoking ban). · Fire detection and control systems, emergency procedures. · Maximum inventory below threshold for Class 3 DGs for distance to nearest site boundary. · High toxicity materials separate. · Limit inventory of high toxicity materials · Surrounding land use is not sensitive · Occupants are likely to be able to avoid toxic emissions prior to exposure through evacuation · The bag house emissions control system is robust and has proven to effectively mitigate the risk of emissions	Unlikely
5	Dangerous Goods Storage Area - Storage, loading, unloading on-site	Class 6.1 or 6.2 solids or liquids escaping from containment due to a crack or hole in a wheelie bin. Other loss of containment due to a crack or hole in the delivery truck waste loader, tippler, kiln,	Loss of containment of Dangerous Goods.	· Design standards and correct selection of materials of construction. · Operating and maintenance procedures and practices. · Regular inspection and good housekeeping. · Refrigerated storage and limited retention time · Toxic (Class 6.1) substances stored and handled as outlined in AS/NZS 4452:1997, The storage and handling of toxic substances. · The storage and handling of infectious (Class 6.2) substances in accordance with AS/NZS 3816:1998,	Unlikely

Hazard ID	Operation or Area	Hazard Cause	Hazard Consequence	Safeguards	Off-site Impact
		bag house/ complete failure. Poor house keeping		Management of clinical and related wastes.	
6	Kiln Processing	Loss of containment of toxic emissions due to leak/hole in equipment or equipment failure resulting in an emergency release	Loss of containment of Dangerous Goods. Emission of toxic combustion products.	· Robust control system · Safety interlocks proven to effectively mitigate the risk of emissions · Emergency procedures · Preventative Maintenance program	Possible
7	Dangerous Goods (Waste) and ash Storage and handling areas	Flooding	Loss of containment of Dangerous Goods (mobilisation of stored waste) Damage to structure and equipment, loss of containment to environment / flood waters	· Facility floor level to be a minimum 13.0m AHD for all waste and ash handling areas. · Flood proofing to be applied to the building to a minimum height of 14.0m AHD. · Structure to be designed for expected stormwater and flood depths and velocities associated with a 0.05% AEP event. · Operational Management Measures to be applied (as per **Section 9.0** of the PHA) to manage potential flood risks during operation of the Project.	Unlikely
8	Waste cross contaminati on	DG Class 6.1 or 6.2 waste contaminating SPL and dross wastes	Potential generation of additional amounts of contaminated waste material or loss of containment.	· Wastes associated with the project to be transported, stored and processed separately to SPL and dross material. · Separate processing facilities would be used to treat each waste stream. No dross or SPL material would be treated by the project and no medical waste would be treated in the existing facility. · Storage and handling procedures unique to each waste type (including procedures currently in place at WA) would be implemented across the site to prevent loss of containment.	Unlikely
9	Bag House No. 5 –	Fire or explosion to to excessively hot	Failure of emissions control system.	· Preliminary heat exchanger to remove excess heat from exhaust gas.	Unlikely

Hazard ID	Operation or Area	Hazard Cause	Hazard Consequence	Safeguards	Off-site Impact
	Activated carbon	emissions gas interacting with activated carbon.	Damage to Baghouse No. 5 and connected structures and equipment.	· Forced air cooler to inject ambient air to further reduce temperature of exhaust gas following the heat exchanger. · Water spray system would automatic operate if the fabric filter inlet temperature were to exceed the deemed maximum operate · If the exhaust gas process temperatures were to exceed 230ºC at the baghouse for any reason then the flow of activated carbon would automatically cease and the exhaust gases would bypass the fabric filter eliminating any risk of fire or explosion. · Programmable Logic Controller (PLC) would be utilised to monitor the operation of the plant in real-time allowing systems responses (shutdowns) to be implemented immediately in the event of 'upset' conditions. · The system would utilise high quality, high ignition temperature activated carbon specifically designed for combustion flue gas applications.	

Flooding Hazard Risk and Consequence Analysis.

The following flood hazard risk assessment and consequence analysis has been prepared to provide specific detail of the potential risks to the project as a result of flood events. The risk assessment has been based on the Flood Risk Assessment (Advisian, 2017), risk consequence assessment as outlined in **Table A2** and subsequent likelihood and consequence definitions.

This flooding hazard and consequence analysis has been prepared as requested by OEH to provide further consideration of potential flood hazards and related mitigation. Assessed flood levels have been identified by OEH. This hazard identification, likelihood and consequence analysis has been based on the hazard analysis methodology as detailed in *Hazardous Industry Planning Advisory Paper No. 6: Hazard Analysis,* as described further in **Section 4.0** of the PHA.

Table A2 Hazard Identification

Likelihood of Effect	Consequence of Effect		
	Minor	Moderate	Major
Improbable	Very Low	Low	Medium
Possible	Low	Medium	High
Probable	Medium	High	Very High

The allocation of risk is based upon the following considerations:

- Likelihood of effect:
  - Improbable: imperceptible or short term impacts to the project. Unlikely to occur during facility design life: ≤ 0.001% annual occurrence probability;
  - Possible: modest or medium term impacts to the project. Likelihood to occur during facility design life between 1% and 0.001% annual occurrence probability; and
  - Probable: serious or long term impacts to the project. Likely to occur during facility design life: ≥1% annual occurrence probability.
- Consequences of unmitigated effect:
  - Minor: minor impacts to the project, community or environment. No offsite impacts;
  - Moderate: moderate adverse impacts to the project, community or environment. Possible offsite impacts; and
  - Major: significant impacts to the project, community or environment. Probable offsite impacts.

The flooding hazard risk and consequence analysis is provided in **Table A3** including consideration of pre and post migration risks.

Table A3 Flooding Risk and Consequence Assessment

Hazard ID	Flood Level[1,2]	Unmitigated Project Impacts / Consequences	Unmitigated Risk Rating	Mitigation Measures[3]	Final Risk Rating
8	1% AEP (1 in 100 year flooding event)	· Potential inundation of a small section of the WA site, however no direct impacts to the project footprint. · No impacts to WA site access / egress points. · Negligible impacts to proposed project. Minimum proposed floor level (13.0m) would be above the 1% AEP flood level with an additional 1.2m freeboard. · No direct or indirect offsite impacts as a result of project flooding.	Very Low	· The proposed building floor level (minimum of 13.0m) will be 1.2m above (freeboard) the 1% AEP flood level. · Waste-handling and processing plant and equipment will be fixed to building floor/structure. · Wastes to be contained within dedicated and lined bins, and located within dedicated bunded storage areas. · Preparation and implementation of Safety Management Plan[4], Emergency Management Plan[5] and Operational Management Plan[6] in consultation with relevant agencies.	Very low
9	0.5% AEP (1 in 200 year flooding event)	· Potential inundation of a small section of the WA site, however no direct impacts to the project footprint. · No impacts to WA site access / egress points. · Negligible impacts to proposed project. Minimum proposed floor level (13.0m) would be 0.5m above the 0.5% flood level. · No direct or indirect offsite impacts as a result of project flooding.	Low	· The proposed building floor level (minimum 13.0m) will be 0.5m (freeboard) above the 0.5% AEP flood level. · Waste-handling and processing plant and equipment will be fixed to building floor/structure. · Wastes to be contained within dedicated and lined bins, and located within dedicated bunded storage areas. · Preparation and implementation of Safety Management Plan[4], Emergency Management Plan[5] and Operational Management Plan[6] in consultation with relevant agencies.	Very low
10	0.05% AEP (1 in 2000 year flooding event)	· Minor. Minimum proposed floor level (13.0m) would be above the 0.05% flood level with an additional 0.1m freeboard. · Potential for overtopping of 0.1m freeboard depending on flood water behaviour. · Potential water ingress in building however depths are unlikely to mobilise plant or unsecured items. · Potential for minor structural damage to project	Low	· Preparation and implementation of Safety Management Plan[4], Emergency Management Plan[5] and Operational Management Plan[6] in consultation with relevant agencies. · Dry flood proofing will be installed to a minimum of 14.0 m AHD to provide building flood immunity. · Dry flood proofing will be designed by an appropriately qualified structural engineer to relevant specifications in consultation with DP&E.	Very low

Hazard ID	Flood Level[1,2]	Unmitigated Project Impacts / Consequences	Unmitigated Risk Rating	Mitigation Measures[3]	Final Risk Rating
		building. · Potential damage to project infrastructure external to building (i.e. kiln elements). · Potential mobilisation of materials not stored within dedicated storage areas with required flood protection.		· Building pad and fill to be designed by an appropriately qualified structural engineer to relevant specifications in consultation with DP&E. · Waste-handling and processing plant and equipment will be fixed to building floor/structure. · Wastes to be contained within dedicated and lined bins, and located within dedicated bunded storage areas. · All fixed plant and equipment to be designed and constructed to withstand velocities and inundation associated with a 0.05% AEP flood event. · When not being processed, all waste materials to be securely stored in dedicated areas with appropriate flood proofing to prevent mobilisation by floodwater. Specific procedures for storage and handling to be included in management plans as prepared in consultation with agencies including DP&E, OEH and CCC.	
11	Probable Maximum Flood (PMF)	· Water level of between 16.6m and 16.8m AHD in the project footprint – several metres of inundation possible. · Major damage to project elements of low structural integrity. · Minor – moderate damage to reinforced structures. · Mobilisation of unsecured materials (waste materials, storage bins and ash), plant and unsecured machinery. · Ash mobilisation. · Risk of exposure of offsite to hazardous materials.	Medium	· Waste materials would be stored in sealed and secured storage facility minimising potential for environmental release during PMF event. · Waste materials stored in sealed containers minimising potential release to the environment even if mobilised by floodwater. · Any fugitive waste materials if released during the PMF would be subject to significant dilution factors reducing hazardous potential. · Ash material is benign (not a classified dangerous or hazardous material) and not a risk to human or environmental health should it be mobilised by floodwater. · Waste materials will be processed as soon as practical	Low

Hazard ID	Flood Level[1,2]	Unmitigated Project Impacts / Consequences	Unmitigated Risk Rating	Mitigation Measures[3]	Final Risk Rating
				following delivery to site to minimise quantities in storage that could be impacted by flooding. · Flood velocities reduced within the proposed building compared to external reducing internal damage and waste mobilisation potential.	

1. AEP = Annual Exceedance Probability: The probability that a given rainfall total accumulated over a given duration will be exceeded in any one year.
2. Management plans to be prepared in consultation with relevant agencies and stakeholders including the following as a minimum:
   - Operational Management Plan - DP&E, EPA, OEH and Cessnock City Council;
   - Safety Management Plan - DP&E, EPA, OEH, Cessnock City Council and NSW Fire and Rescue; and
   - Emergency Management Plan - DP&E, EPA, OEH and NSW Fire and Rescue.
3. Key Safety Management Plan elements:
   - Identification of specific safety hazards related to flooding;
   - Identification of management measures to be implemented to address each identified flood safety hazard, including design and procedural;
   - Identification of maintenance measures to be implemented to address each identified flood safety hazard, including routine inspections, measurement/testing and preventative maintenance regimes;
   - Details of regular inspections, investigations or audits to be undertaken to monitor safety systems (including flood safety management systems) to an appropriate level of readiness;
   - Outline staff safety training to be undertaken to ensure that staff are suitably informed in regards to flood safety management, preparedness and response.
4. Key Emergency Management Plan elements:
   - Details site emergency management systems and measures for regular inspection and maintaining emergency management systems and equipment;
   - Identification of potential emergency situation i.e. flood events or varying depths;
   - Identification of potential emergency events associated with flooding e.g. loss of containment or mobilisation of dangerous goods, plant or equipment;
   - Define procedures for emergency response;
   - Outline staff training to be undertaken to ensure that staff are suitably informed in regards to emergency identification, preparedness and response;

- Measures to be implemented to:
  - § i) prevent emergency situations occurring in the first instance; or
  - § ii) address an emergency situation with an appropriate response strategy;

5. Key Operational Environmental Management Plan elements:

- Procedures for the operation of the project including the safe storage, handling and transport of classified materials such that they do not represent a risk of mobilisation as a result of flooding; and
- Provisions for annual reporting and regular audits of site operations including auditing of flood specific management requirements.

Appendix B

Flood Risk Assessment

Appendix B Flood Risk Assessment

7th February 2017

Christopher McClung
Plant Manager, Weston Aluminium Pty Ltd
C/O Simon Murphey (Principal Environmental Planner)
AECOM, 17 Warabrook Boulevard
WARABROOK NSW 2304

Dear Mr McClung

WESTON ALUMINIUM- PROPOSED MEDICAL AND OTHER WASTE THERMAL PROCESSING FACILITY – SITE FLOOD RISK ASSESSMENT

We are pleased to provide in the following the Site Flood Risk Assessment (*FRA*) for the Weston Aluminium site at Kurri Kurri. We understand that this report has been requested to inform the potential construction of a waste servicing facility at the site.

This site FRA is based on the results of hydraulic modelling (using Council's two-dimensional *RMA-2 model*) undertaken previously by Advisian (*WorleyParsons*) for Cessnock City Council. The modelling was completed as part of the Swamp Creek Floodplain Risk Management Study and Plan (*November, 2013*).

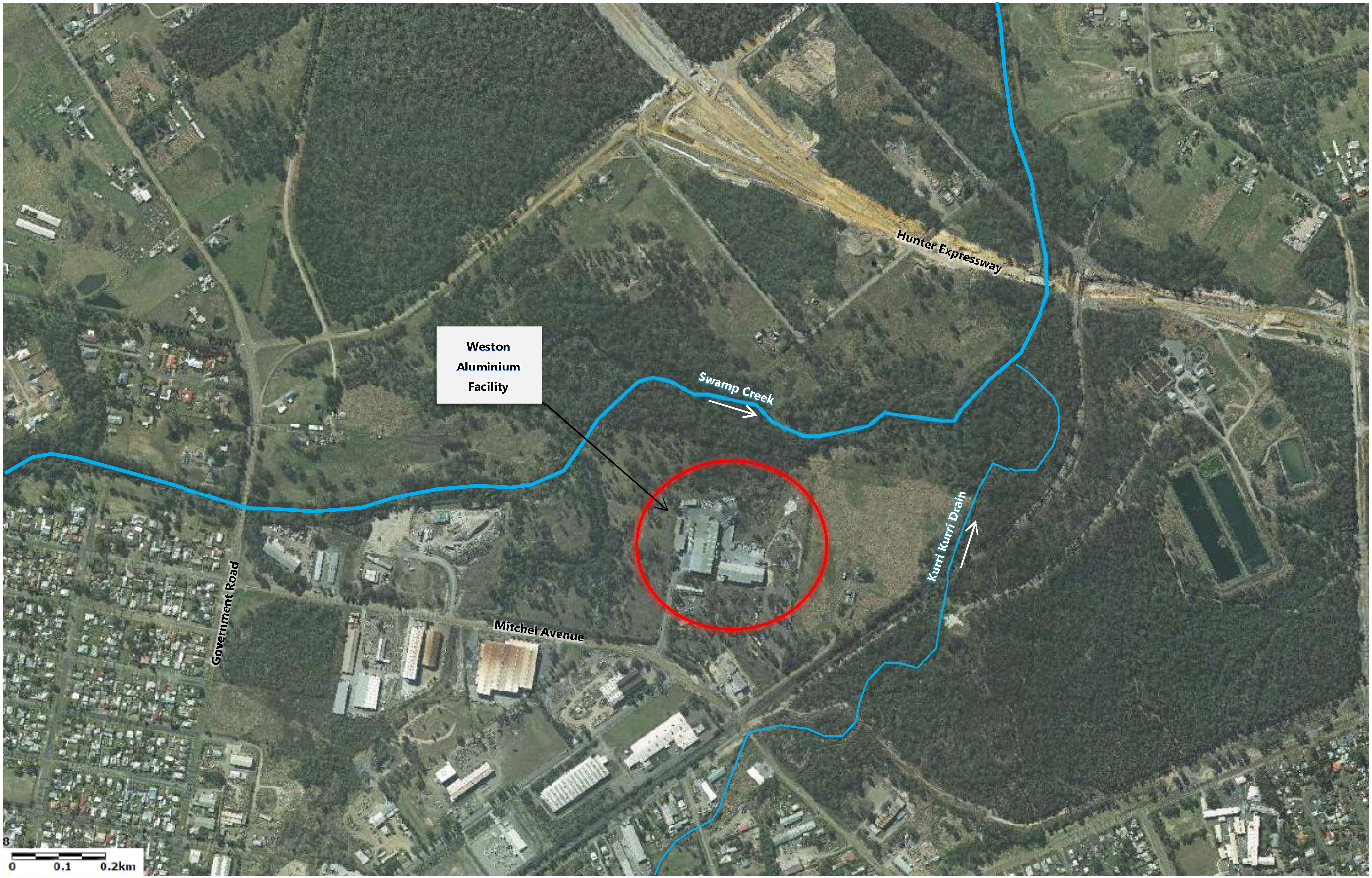
Additional hydrologic and hydraulic modelling was also undertaken specifically for this report, in order to establish the predicted flood behaviour for the 0.05% Annual Exceedance Probability (*AEP*) event; i.e., *equivalent to a 1 in 2000 year flood event.*

1 Introduction

The Weston Aluminium site is located at 129 Mitchell Avenue, Kurri Kurri. The location of the site relative to Swamp Creek is shown in **Figure 1-1**.

It is understood that Weston Aluminium proposes to install and operate thermal processing equipment for the safe disposal of medical and other wastes such as clinical, pharmaceutical, pathogenic and cytotoxic-related wastes. As shown in **Figure 1-2**, the proposed facility will be constructed to the north of the existing Weston Aluminium plant and infrastructure. The proposed thermal oxidiser and feeding systems will be integrated within the existing site, and access will be via the existing internal access ways. Operations are to occur 24 hours per day, 7 days per week, processing up to 8,000 tonnes of waste per annum.

FIGURE 1-1



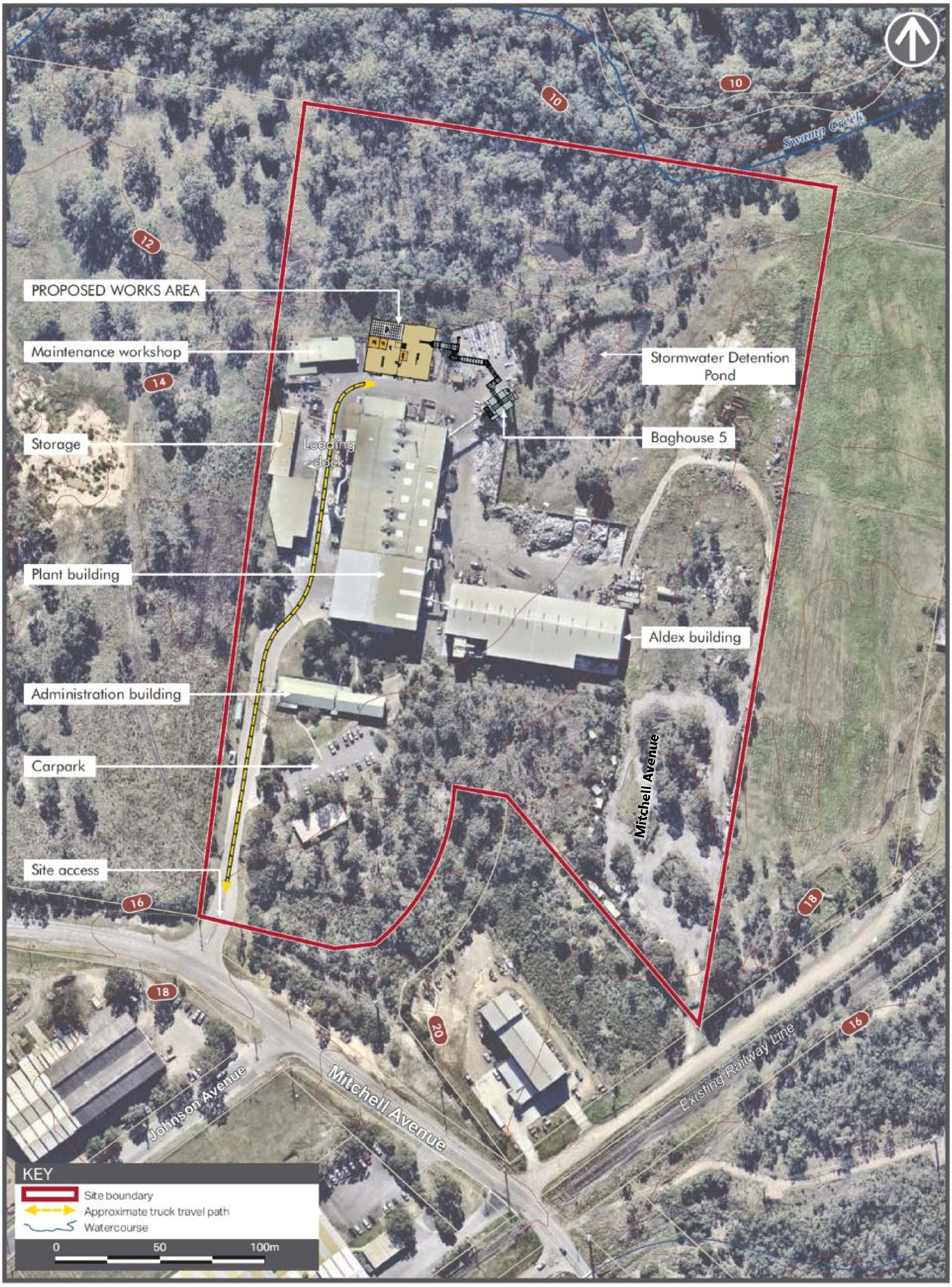
SITE LOCATION PLAN

Advisian
WorleyParsons Group

301311-14629 Weston Aluminium
Fig1-1_Site_Location.docx

FIGURE 1-2

LOCATION OF THE PROPOSED WASTE FACILITY



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SITE LAYOUT OF PROPOSED PROJECT AREA
Environmental Impact Statement
Weston Aluminium Recycling Facility

Figure extracted from Figure 6-1, Weston Aluminium Recycling Facility EIS, AECOM, 2016

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We understand that the development proposal comprises a building with dimensions of approximately 25 m by 30 m. This will contain the waste handling and processing areas and an area for refrigerated storage (*refer* **Figure 1-3**). To raise the building above flood levels, it is intended that the ground levels at the proposed building footprint be raised via imported fill material. Additional infrastructure is also proposed comprising an air treatment and cooling system, combustion chamber and ash handling area, which are all to be connected to the existing baghouse located to the east of the proposed waste facility building.

As shown in **Figure 1-1**, the site is located approximately 150 m from Swamp Creek, which flows in a west-to-east direction to the north of the site. Swamp Creek is a tributary of Wallis Creek which flows to the Hunter River at Maitland. A Floodplain Risk Management Study and Plan (*FRMS&P*) was completed for Swamp Creek by WorleyParsons (*now Advisian*) in 2013 and has since been adopted by Cessnock City Council. As part of the FRMS&P, flood modelling of Swamp Creek was completed for a range of design flood events ranging between the 10% AEP event (*1 in 10 year recurrence interval*) to the Probable Maximum Flood (*PMF*).

The proposed works comprise State Significant Development (*SSD*) and an Environmental Impact Assessment (*EIS*) for the proposed development was submitted in 2016 (*AECOM, 2016*). In plans provided in the EIS and shown in **Figure 1-3**, the facility is proposed to be developed with floor levels at 12.55 mAHD (refrigerated storage area and waste processing area) and 13.00 mAHD (waste handling area). We understand these floor levels were adopted to ensure the facility could operate efficiently, whilst also being above the 1% AEP flood level (*11.8 mAHD*) plus 0.5 m freeboard.

The Office of Environment and Heritage (*OEH*) submitted a letter dated 24th October 2016 in response to the development application. The letter indicates that OEH considers the EIS to have limited information on flood behaviour and potential flood impacts and as such did not adequately address the SEARS for the development. OEH has requested that the following matters be addressed for the development:

- Likelihood and consequences of exposure of the facility to flood events including the 1% AEP, 0.5% AEP and PMF events;
- Management of the risk of mobilisation of stored dangerous / hazardous goods during flood events;
- Risk of contamination to waterways from dangerous / hazardous goods and waste ash product; and
- Impact of the proposed fill on flood behaviour for design events up to, and including, the PMF.

In addition, OEH makes comments in regard to the proposed floor levels, suggesting that these are too low considering the development use and exposure to inundation. OEH references the 0.05% AEP (*2000 year ARI*) flood event in terms of the assessment of structural stability and the potential mobilisation of materials.

For new developments, flood impacts are typically assessed using the 1% AEP (*1 in 100 year*) event, with floor levels based on providing an additional 0.5 metres of freeboard. This assessment criteria is usually taken in reference to both residential and commercial/industrial development. However, the Floodplain Development Manual (*NSW Government, 2005*) discusses the use of a freeboard appropriate to the level of risk to the proposed development. In that regard, as the proposed waste

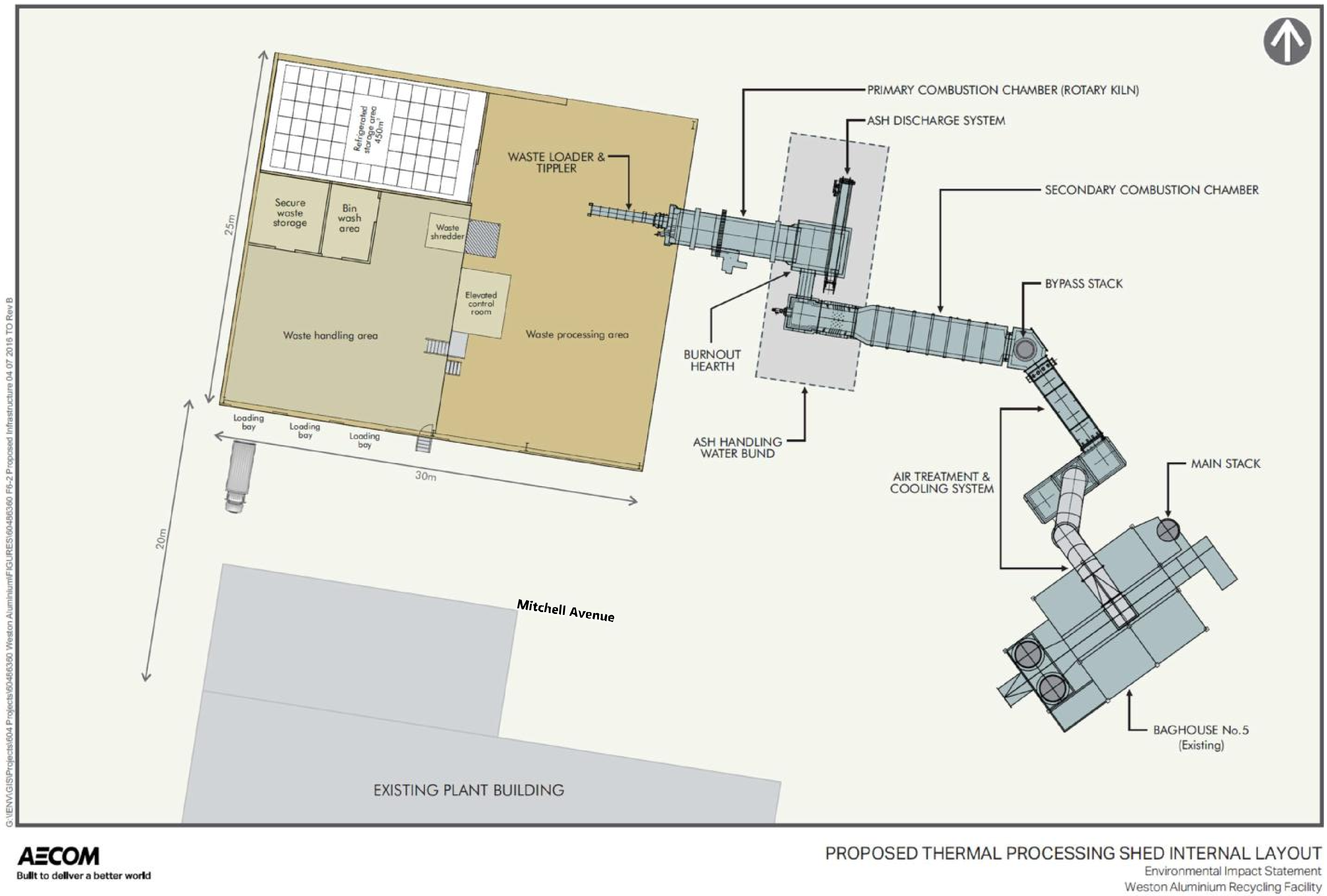


Figure extracted from Figure 6-2, Weston Aluminium Recycling Facility EIS, AECOM, 2016

PROPOSED DEVELOPMENT LAYOUT

facility is a potentiality hazardous use, it is reasonable that higher flood standards should be applied. This recognises the potential environmental and health hazards should the development become inundated and the contents be exposed to the outside environment.

The following site FRA has been prepared in order to provide recommendation on suitable floor levels for the proposed facility. The assessment describes the flood behaviour at the site under pre-development conditions for a range of design flood events and discusses the appropriateness of raising floor levels and/or developing flood-proof structures.

2 Site Flood Behaviour

Modelling results from the Swamp Creek FRMS&P (*WorleyParsons, 2013*) were relied upon to assess the existing flood behaviour in the vicinity of the site. Only the 1% AEP flood and larger events have been considered in this FRA, as smaller design events from Swamp Creek are not predicted to inundate those parts of the site across which the development is proposed. The FRMS&P included modelling for the 1% AEP, 0.5% AEP and PMF events. To meet the requirements of OEH, an assessment for the 0.05% AEP event has also been undertaken specifically for this report.

It should be noted that the RMA-2 model developed as part of the FRMS&P, and subsequently used for this assessment to simulate the 0.05% AEP event, does not include the Hunter Expressway bridge crossing of Swamp Creek. The bridge design was not yet finalised during the FRMS model development and hence was not included.

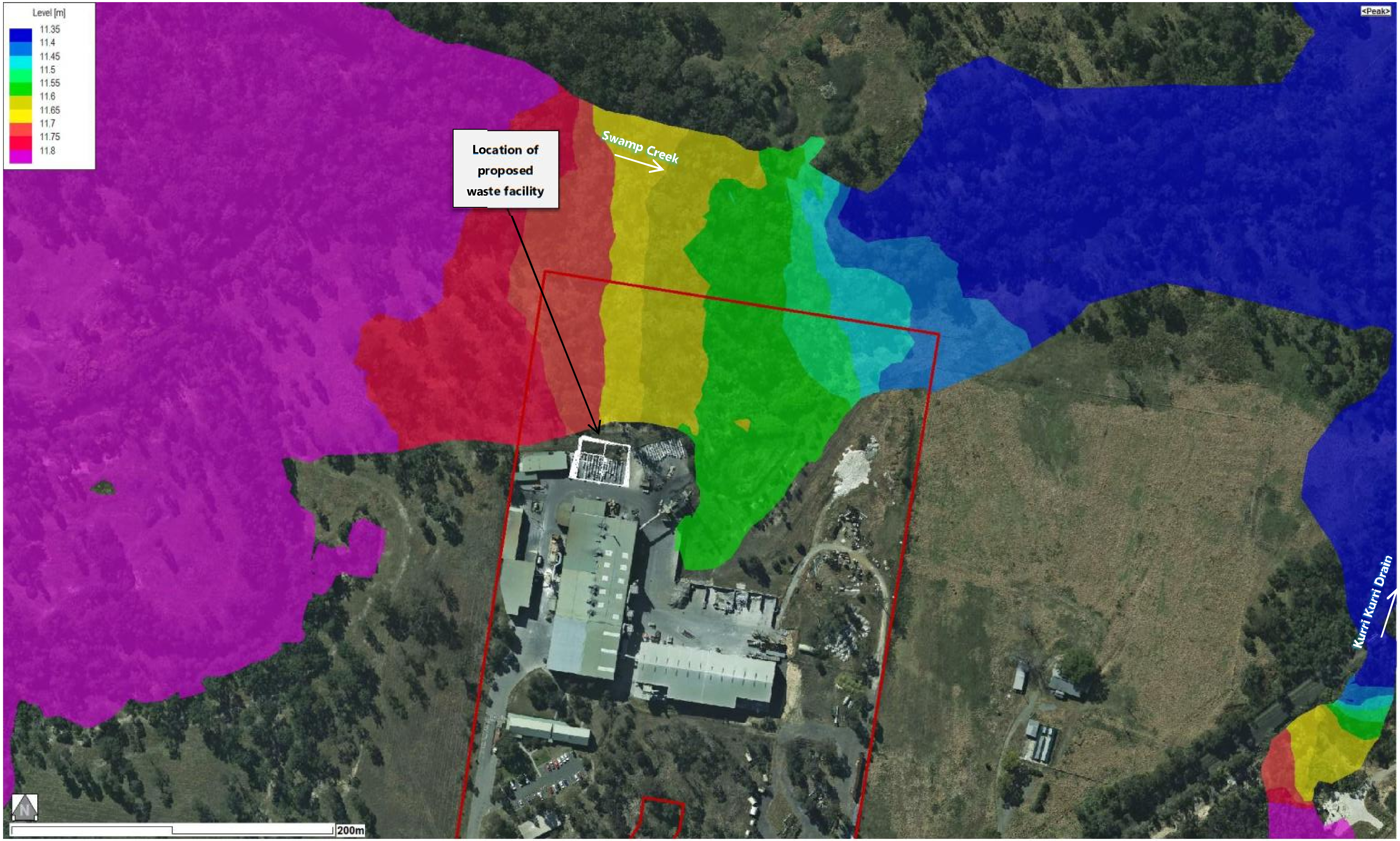
At the time of preparing this report the Roads and Maritime Services (*RMS*) modelling of the bridge crossing was not available to Advisian for review. It is understood however, that the crossing has minimal impact during flood events up to and including the 1% AEP flood (*i.e., less than 50mm*) in the vicinity of the site. During larger events such as the 0.5% AEP and PMF, it is understood the impact is predicted to be substantially higher and in the order of 0.27 and 1.05 metres at the site, respectively. These impacts are based on flood modelling completed for the adjacent site by consultants Royal Haskoning DHV using a localised TUFLOW model.

There is no apparent reference in the Royal Haskoning DHV report to the modelling undertaken by RMS as part of the Hunter Expressway design process. Therefore, there is no verification of their model against that on which the bridge was designed. In recognition of this, it is considered appropriate to proceed with this site FRA based on the modelling completed as part of the FRMS&P and that is currently adopted by Council for planning purposes. It is recommended however that the RMS modelling relied upon for the bridge design be requested prior to proceeding with any further modelling investigations for the site. This will ensure that the potential impacts associated with the crossing can be captured as part of the final investigations and design of the facility.

2.1 1% AEP Event

Mapping of the predicted peak flood levels during the 1% AEP flood event on Swamp Creek is shown in **Figure 2-1**. The mapping indicates that floodwaters during the 1% AEP event would inundate the site but would not reach the proposed waste facility.

FIGURE 2-1



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PREDICTED PEAK FLOOD LEVELS FOR A 1% AEP FLOOD EVENT ON SWAMP CREEK

The maximum flood level in the vicinity of the proposed waste facility is predicted to be 11.75 mAHD. As shown in **Figure 2-1**, this maximum flood level occurs near the north-western corner of the facility.

2.2 0.5% AEP Event

Flood levels in the vicinity of the proposed waste facility at the peak of the 0.5% AEP event are predicted to range between 12.45 mAHD and 12.50 mAHD along the western and eastern edges of the facility, respectively (refer **Figure 2-2**). Flood levels are predicted to be higher elsewhere in the site, with floodwaters entering the site to the south of the proposed facility via a high-flow breakout to the west. This results in peak 0.5% AEP flood levels at the south-western corner of the Weston Aluminium facility of 12.65 mAHD.

The modelling also indicates that peak 0.5% AEP flood depths and velocities of 0.8 metres and 0.5 m/s, respectively, could occur in the vicinity of the proposed facility (*refer* **Figure 2-3** *and* **2-4**). Depths and velocities are generally predicted to be higher to the south of the proposed facility along the site entry/exit road. As shown in **Figure 2-3** and **Figure 2-4**, depths and velocities are predicted to be typically above 0.6 metres and 0.3 m/s along the internal road.

Provisional hydraulic hazard is estimated by the magnitude of velocities and depths as well as the product of velocity and depth (*VD*). Flow hazard regimes for people presented in ARR 2016 (*after Cox et al, 2010, refer ARR 2016 Book 6: Flood Hydraulics, Chapter 7: Safety Design Criteria*) suggest that large passenger vehicles can become buoyant in flood conditions with a VD of more than 0.4 m^2/s. Mapping in **Figure 2-5** shows that the VD during the 0.5% AEP flood is generally between 0.2 m^2/s and 0.3 m^2/s in the vicinity of the facility and entry/exit road. Across the greater Weston Aluminium site the VD product is typically less than 0.2 m^2/s in a 0.5% AEP event.

2.3 0.05% AEP Event

Predicted peak flood levels for the 0.05% AEP event are shown in **Figure 2-6**. At the location of the proposed waste facility the peak flood level is predicted to be about 12.9 mAHD, which equates to a depth of about 1.2 m based on survey data (*refer* **Attachment A**). Depths around the existing plant building are predicted to be typically no more than 1.0 m (*refer* **Figure 2-7**).

As occurs in the other design events assessed, the maximum velocities are the result of floodwaters entering the site via the high-flow path to the south of the proposed facility. **Figure 2-8** shows that localised areas of high velocity up to 0.7 m/s could occur in this area. However, at the location of the proposed waste facility velocities are expected to be around 0.4 to 0.6 m/s. It should be noted however that, once constructed, the proposed facility has the potential to modify local flood behaviour and therefore potentially increase localised velocities and flood depths in the vicinity of the development.

VD mapping for the 0.05% AEP event is shown in **Figure 2-9**. The mapping indicates the VD to be generally less than 0.6 m^2/s in the vicinity of the proposed facility and less than 0.4 to 0.6 m^2/s for most of the yard areas.

FIGURE 2-2

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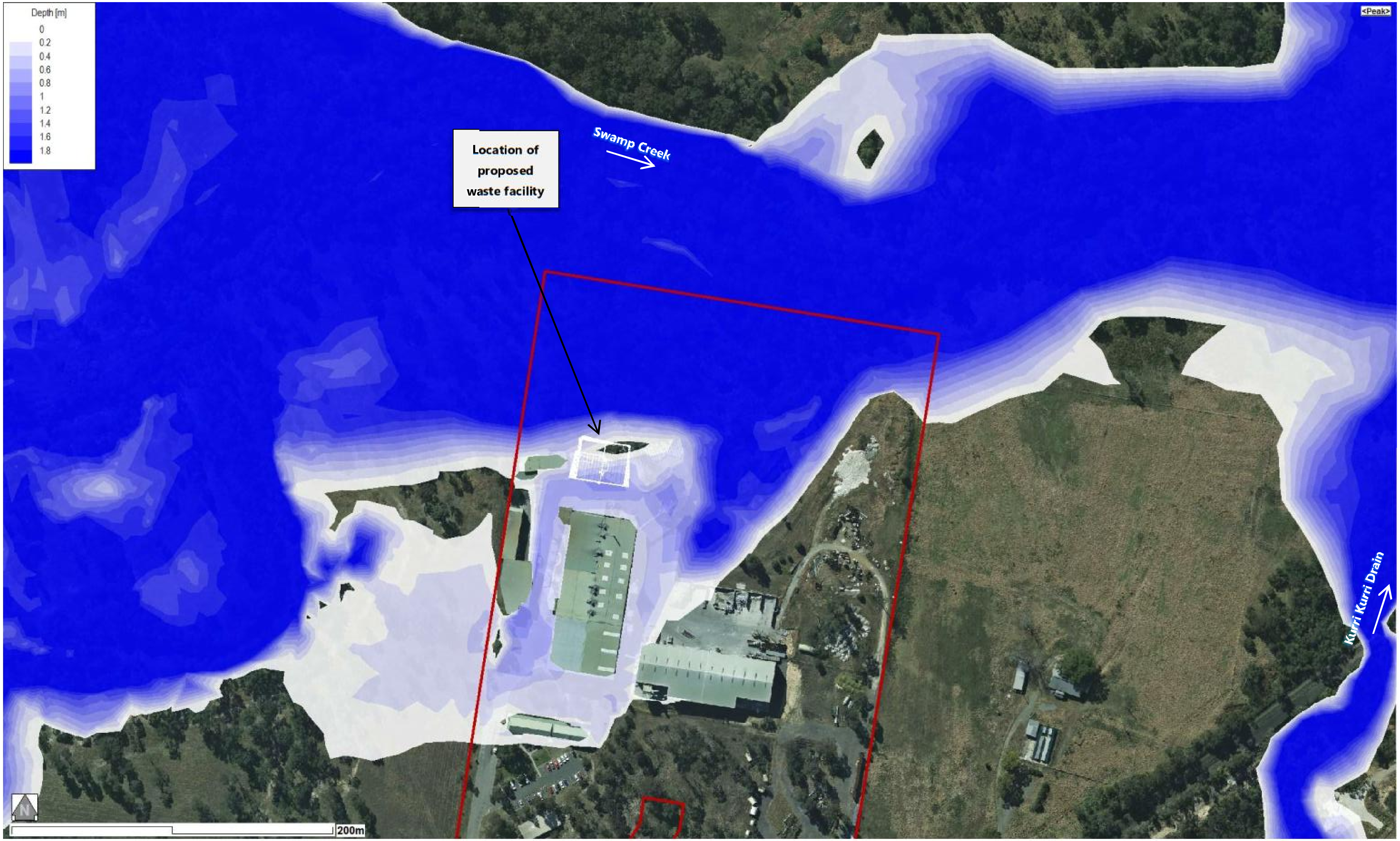
PREDICTED FLOOD LEVELS AT THE PEAK OF THE 0.5% AEP EVENT ALONG SWAMP CREEK

FIGURE 2-3



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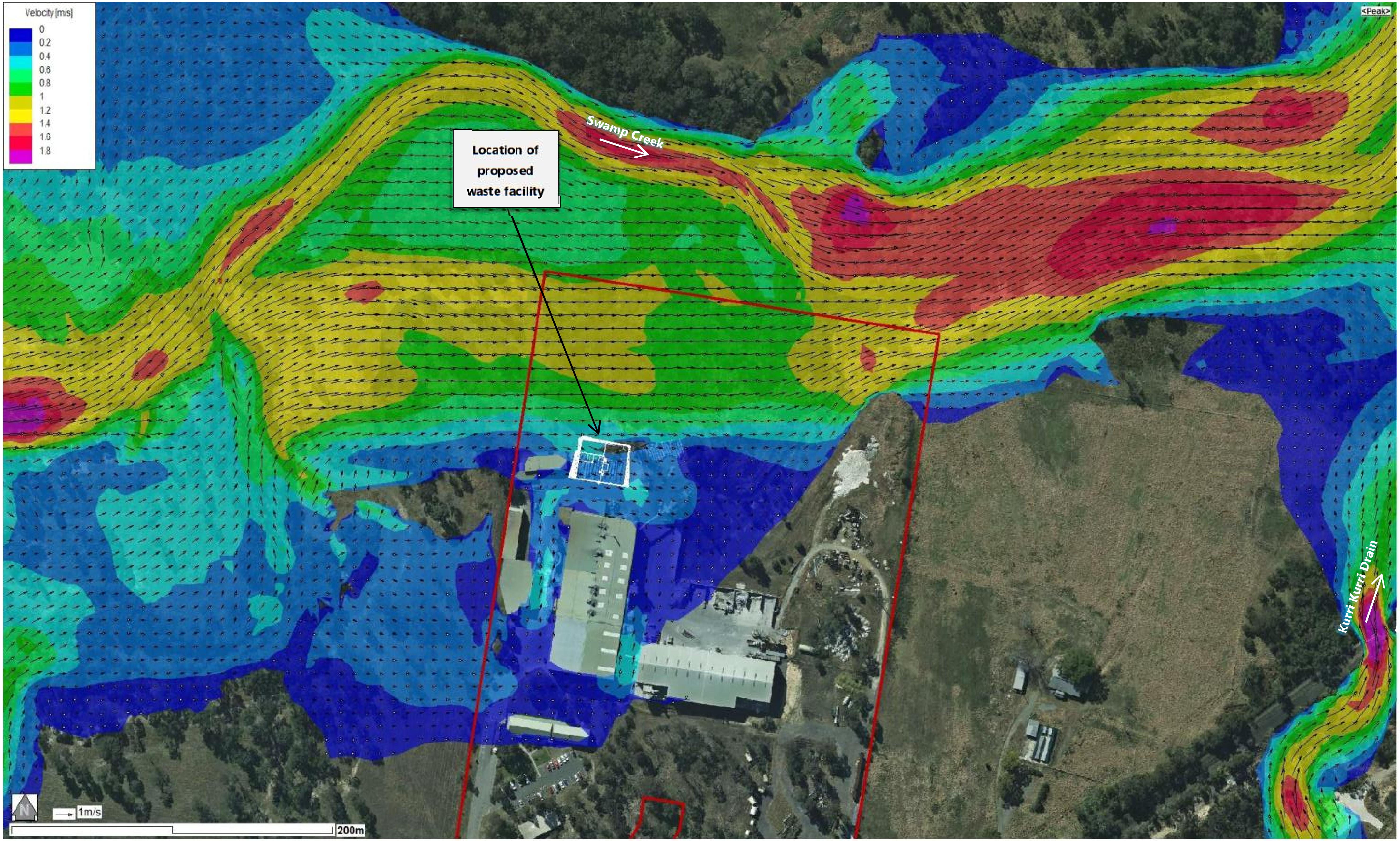
PREDICTED FLOOD DEPTHS AT THE PEAK OF THE 0.5% AEP EVENT ALONG SWAMP CREEK



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PREDICTED FLOW VELOCITIES AT THE PEAK OF THE 0.5% AEP EVENT ALONG SWAMP CREEK

FIGURE 2-5

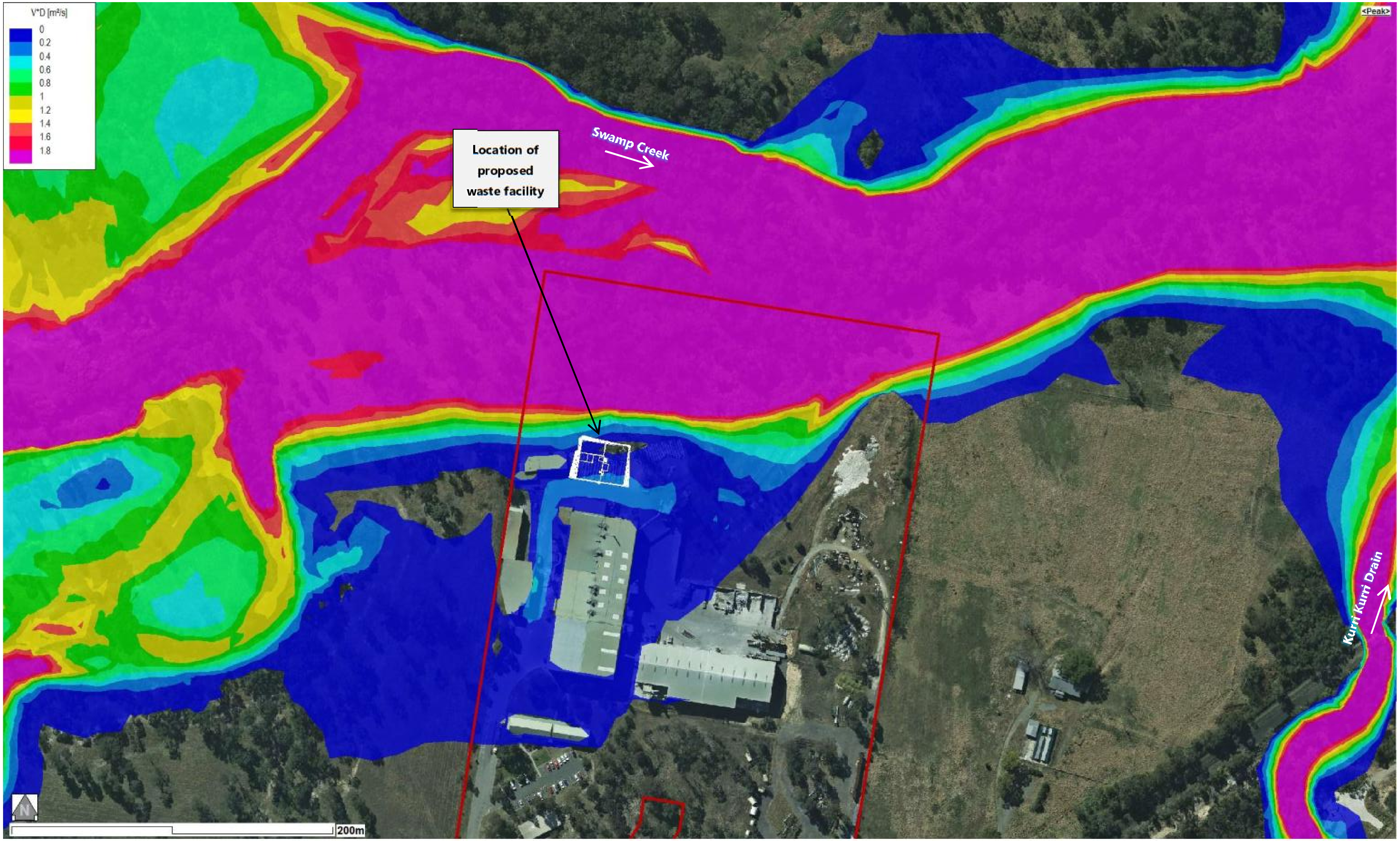

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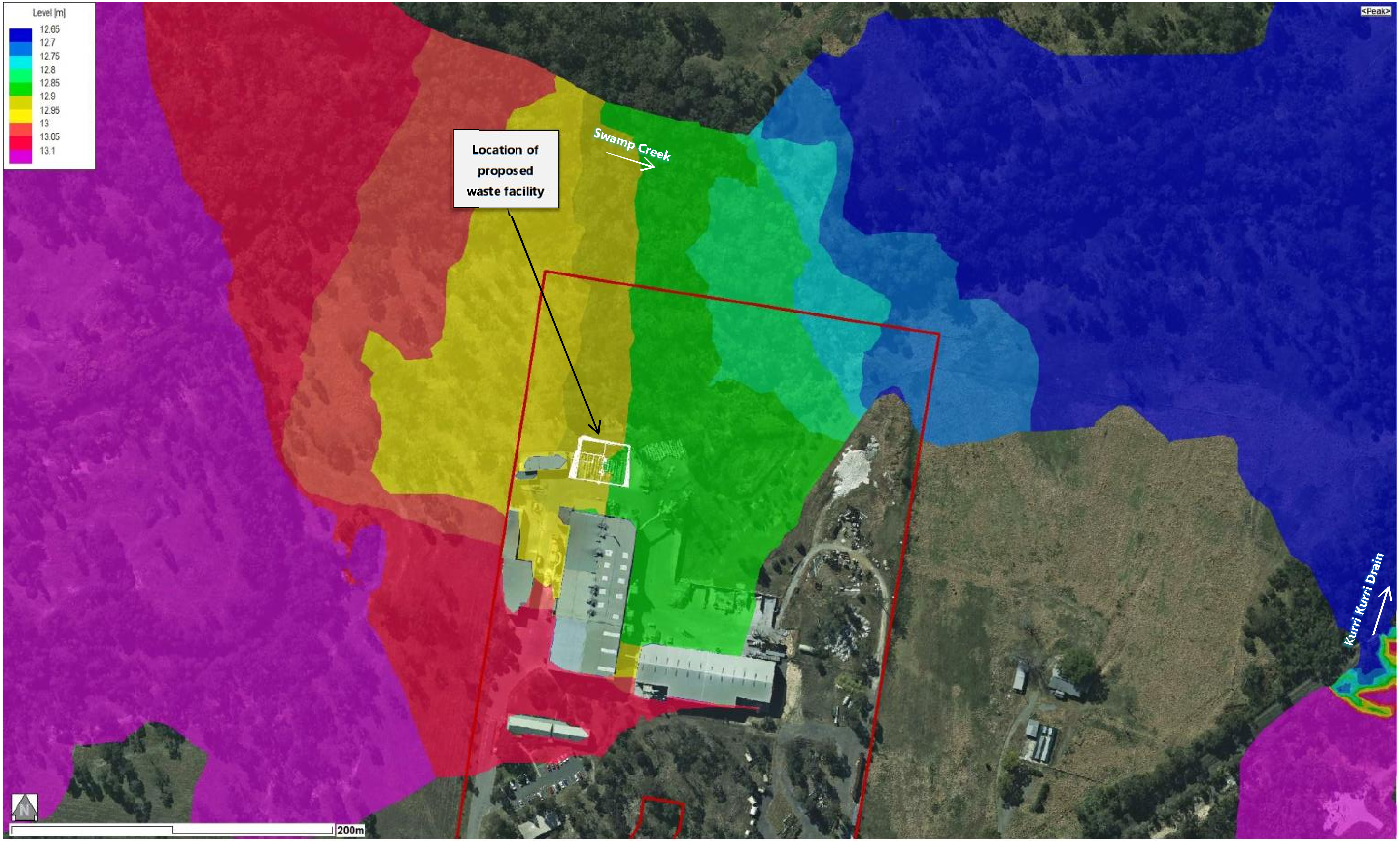
Fig2-5_200y_VD.docx

PREDICTED VELOCITY-DEPTH PRODUCT AT THE PEAK OF THE 0.5% AEP EVENT ALONG SWAMP CREEK

FIGURE 2-6



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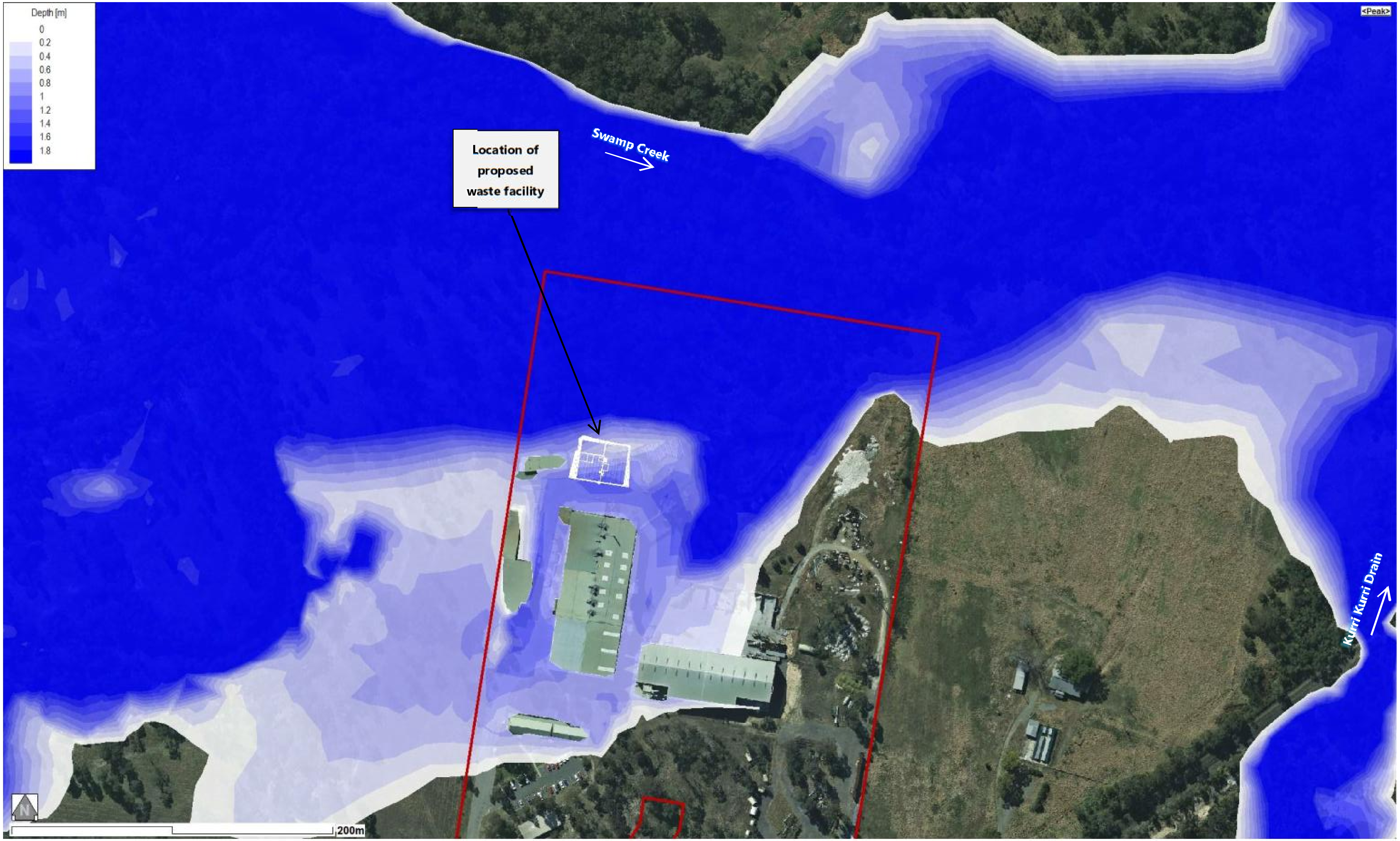
PREDICTED FLOOD LEVELS AT THE PEAK OF THE 0.05% AEP EVENT ALONG SWAMP CREEK

FIGURE 2-7



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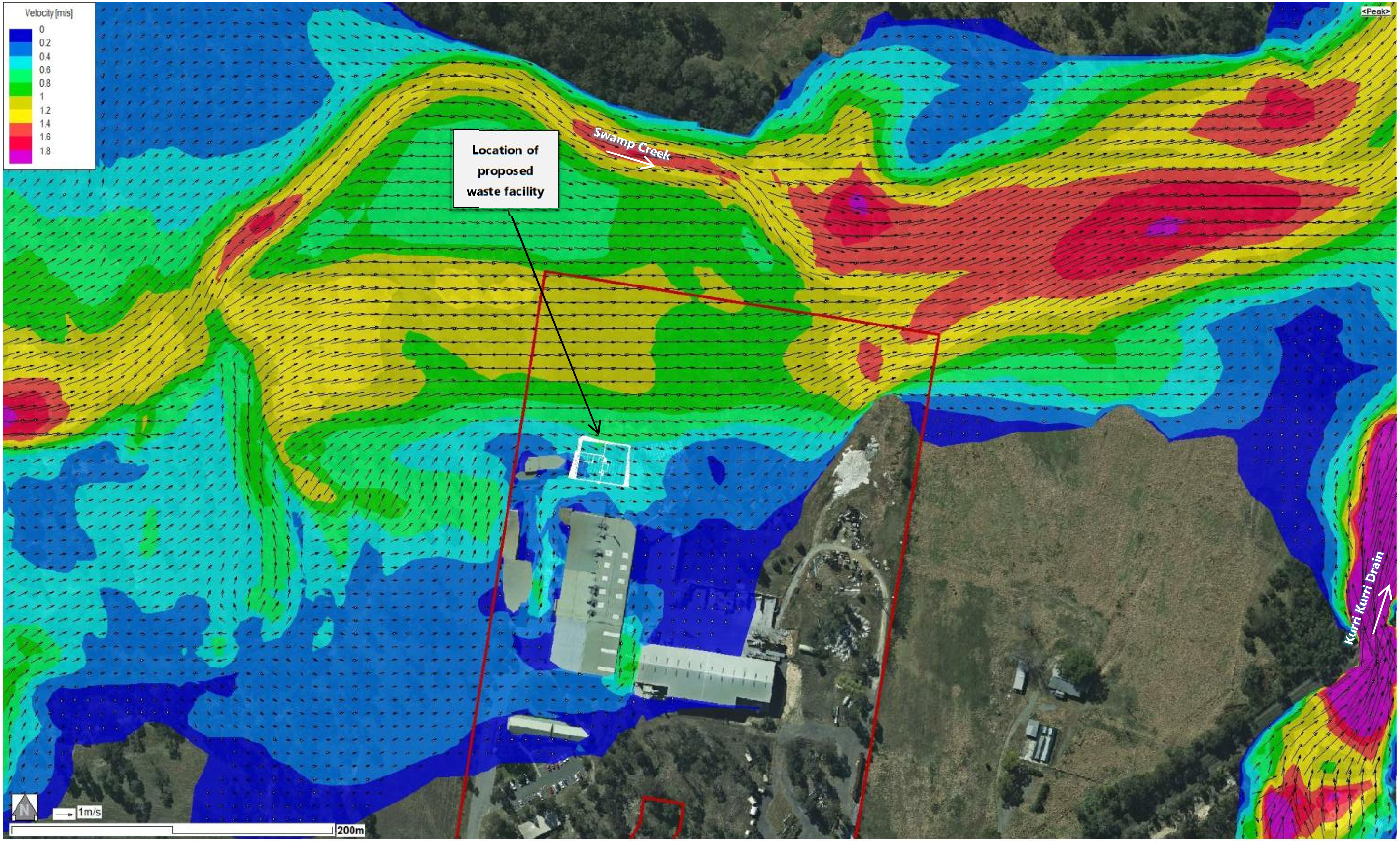
PREDICTED FLOOD DEPTHS AT THE PEAK OF THE 0.05% AEP EVENT ALONG SWAMP CREEK

FIGURE 2-8



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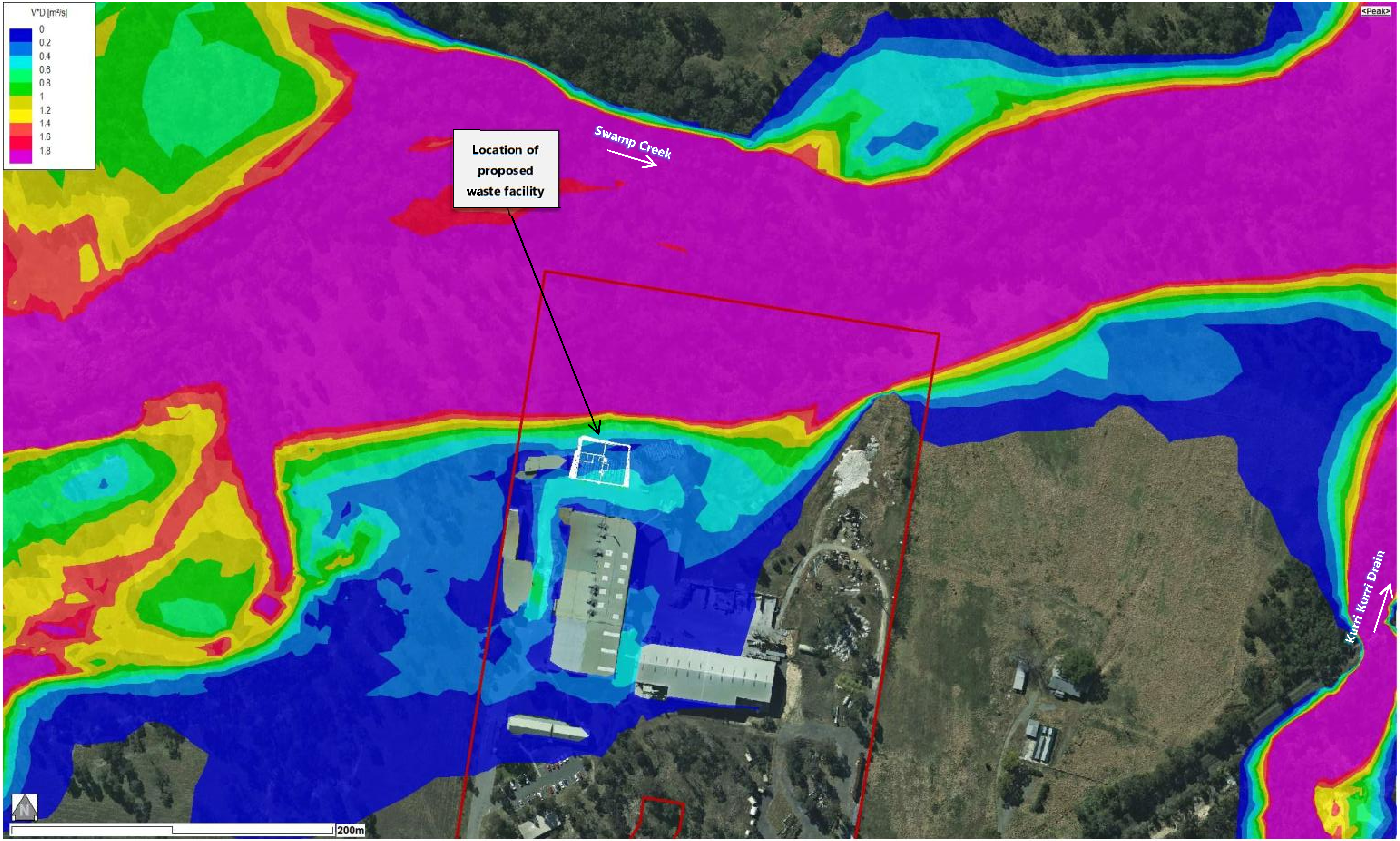
PREDICTED FLOW VELOCITIES AT THE PEAK OF THE 0.05% AEP EVENT ALONG SWAMP CREEK

FIGURE 2-9



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PREDICTED VELOCITY-DEPTH PRODUCT AT THE PEAK OF THE 0.05% AEP EVENT ALONG SWAMP CREEK

2.4 Probable Maximum Flood

Peak flood levels at the site during the PMF event are predicted to be in the order of 16.6 mAHD to 16.8 mAHD (*refer* **Figure 2-10**) resulting in depths in excess of 4.5 m (*refer* **Figure 2-11**). As shown in **Figure 2-12**, predicted maximum velocities are generally below 0.8 m/s and are greatest in the areas where flow is forced around the existing plant building.

The predicted maximum VD is generally between 1.5 and 4.0 m^2/s as shown in **Figure 2-13**. This is considered to be unsafe for all people and vehicles, and buildings are considered vulnerable to structural damage and/or failure (*ARR, 2016*).

2.5 Flood Behaviour Summary

A summary of flood characteristics at the location of the proposed waste facility is provided in **Table 2-1** below.

As discussed above, the modelling does not include the recently constructed Hunter Expressway crossing of Swamp Creek and, as such, the potential impact on flood behaviour is not captured in the modelling. Based on the modelling completed by Royal Haskoning DHV in 2016, it is likely that the crossing will cause an increase in the flood levels listed in **Table 2-1**. This in turn may translate into a reduction in the peak flow velocities predicted without the bridge, reflective of the backing-up of floodwaters likely against the crossing.

Table 2-1 Flood Characteristics at the Location of the Proposed Waste Facility

Design Flood Event	Peak water Level * (mAHD)	Max. Depth** (m)	Max. Velocity (m/s)	Max. Hydraulic Hazard (VxD) (m^2/s)
1% AEP	11.75	n/a	n/a	n/a
0.5% AEP	12.5	0.8	0.5	0.3
0.05% AEP	12.9	1.2	0.6	0.6
PMF	16.6	4.9	0.8	4.0

** Peak water level in the floodplain nearest to the location of the proposed waste facility*

*** Ground levels at the location of the proposed waste facility vary from 11.7 to 12.2 mAHD (refer **Attachment A**)*

NOTE: Modelling does not include the recently constructed Hunter Expressway crossing located downstream of the subject site.

FIGURE 2-10

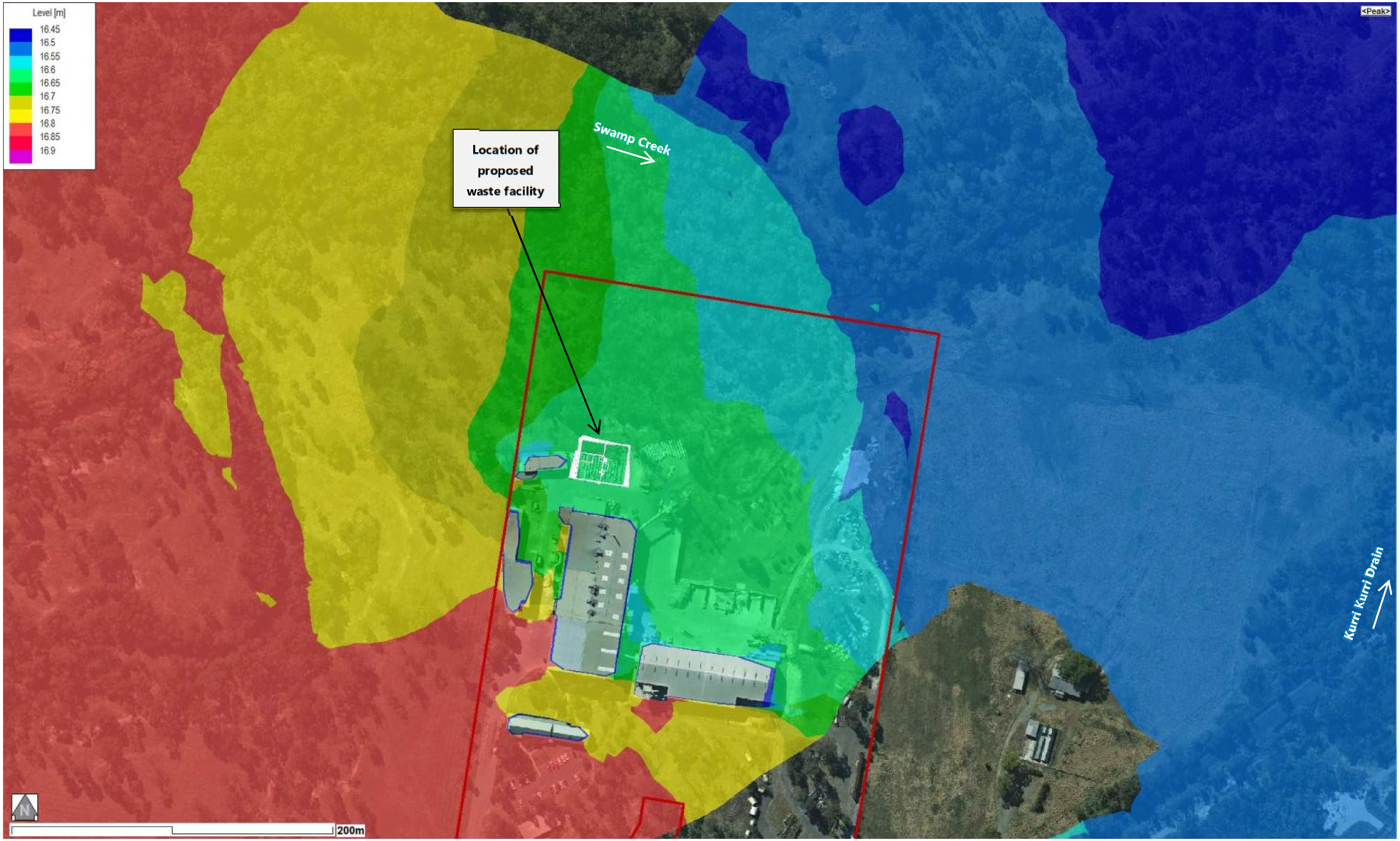

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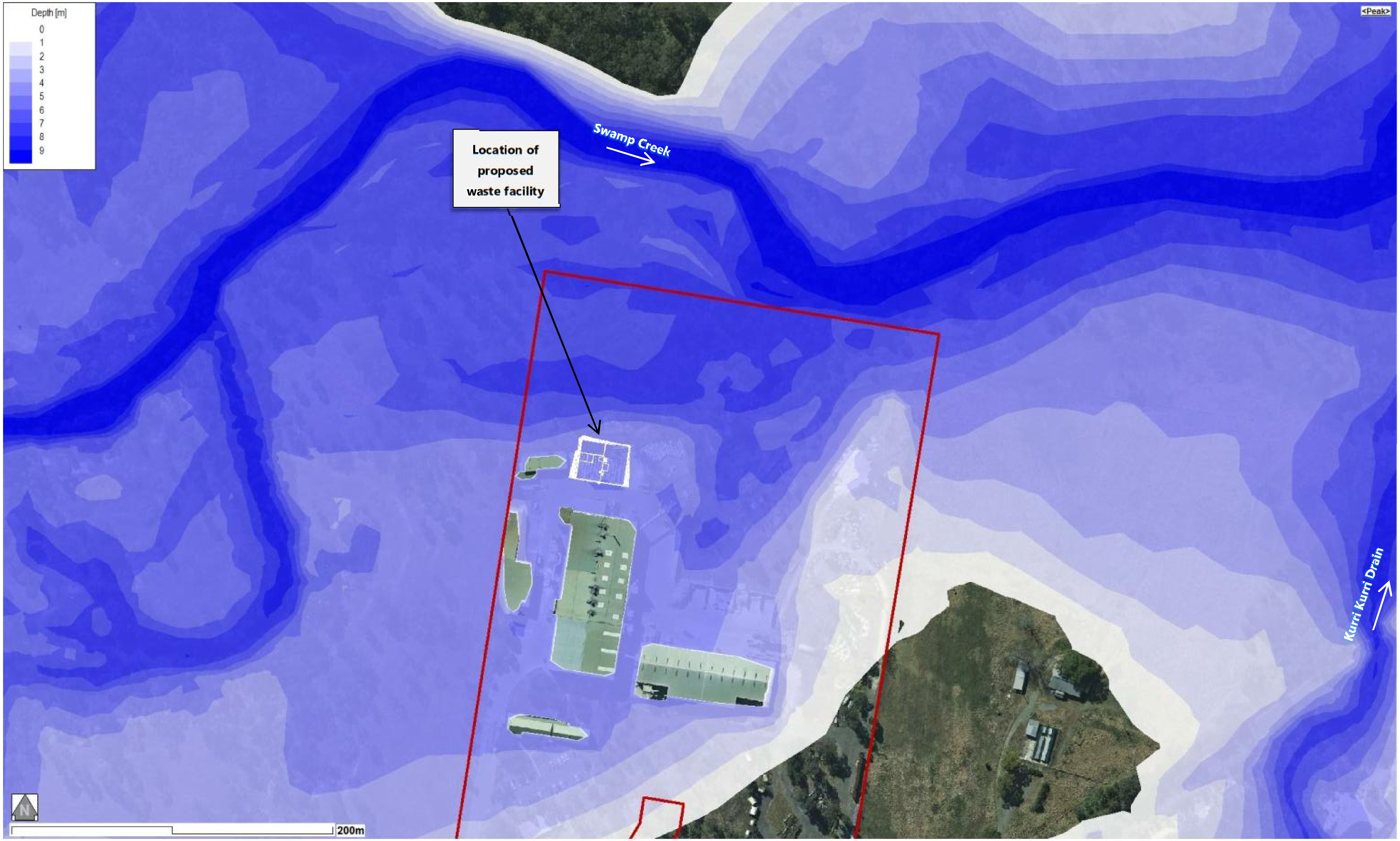
Fig2-10_PMF_H.docx

PREDICTED FLOOD LEVELS AT THE PEAK OF THE PROBABLE MAXIMUM FLOOD ALONG SWAMP CREEK

FIGURE 2-11



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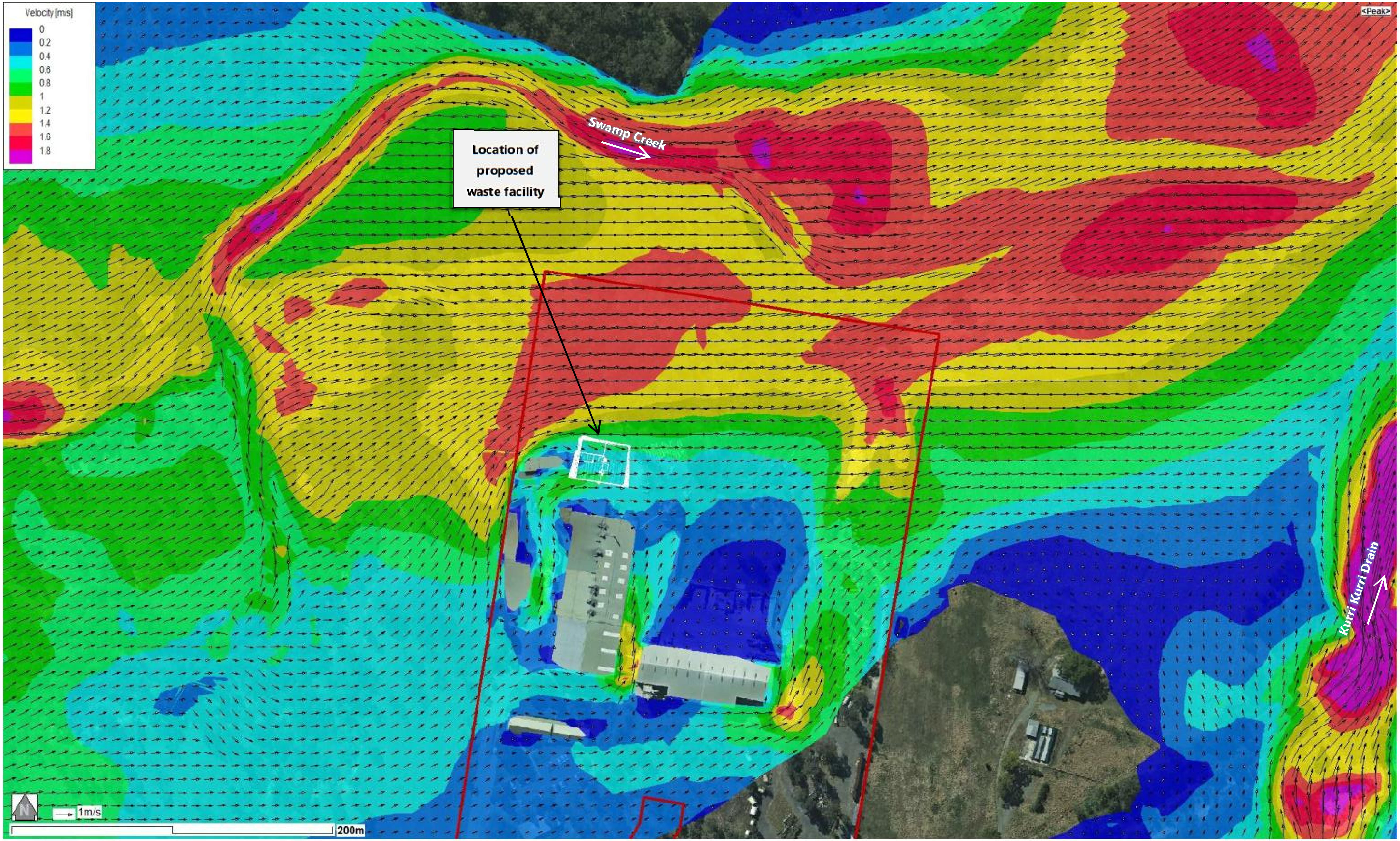
PREDICTED FLOOD DEPTHS AT THE PEAK OF THE PROBABLE MAXIMUM FLOOD ALONG SWAMP CREEK

FIGURE 2-12



PREDICTED FLOW VELOCITIES AT THE PEAK OF THE PMF EVENT ALONG SWAMP CREEK

FIGURE 2-13

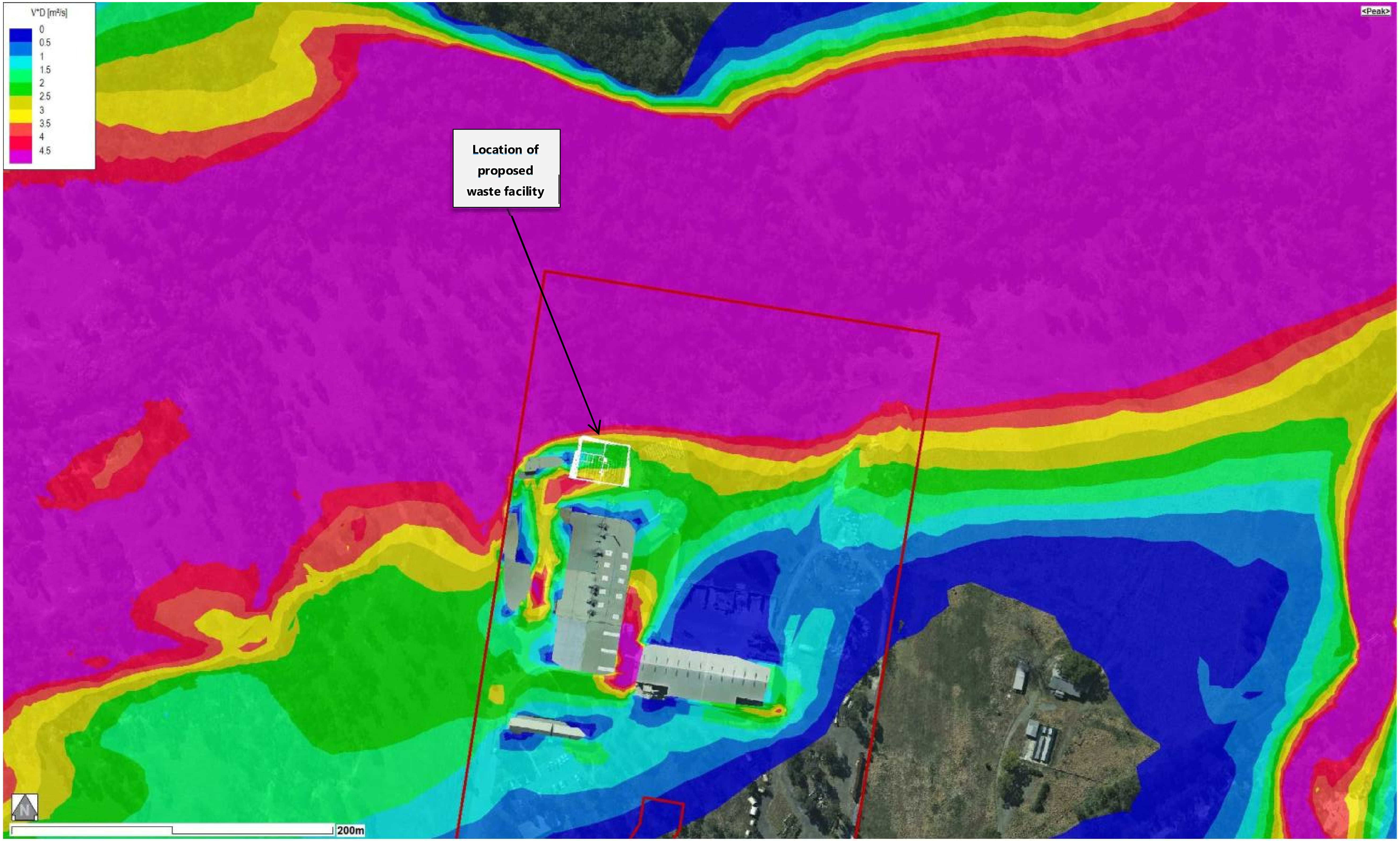


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Fig2-13_PMF_VD.docx

PREDICTED MAXIMUM FLOOD VELOCITY-DEPTH PRODUCT FOR A PMF EVENT ON SWAMP CREEK

3 Assessment of Flood Risk for the Proposed Development

3.1 Building Floor Levels

As noted in **Section 1**, for new development in flood prone land it is typically a requirement for finished floor levels to be at or above the 1% AEP flood level plus 0.5 m (*freeboard allowance*). However, where new development has potential to cause environmental and health hazards if it was to become inundated, then it is necessary to consider higher floor levels to reduce the risk. When establishing the recommended floor levels it is important to take into account the expected frequency of inundation whilst also considering the practical operational requirements of the development.

Existing ground levels at the location of the proposed waste facility are in the order of 11.7 mAHD to 12.2 mAHD (*refer* **Attachment A**). Flood depths at the location of the proposed waste facility are expected to be in the order of 4.5 metres at the peak of the PMF. Should floor levels be set at the PMF level (*with no freeboard*) then this would result in floor levels significantly above surrounding ground levels. This would require a significant volume of fill and is unlikely to be practicable for operation of the facility. Suitable access from the existing site road (*at elevations of 11.9 mAHD*) to the loading docks on the southern side of the proposed waste facility building is also needed.

Current proposals for the waste facility incorporate a floor level of 12.55 mAHD in the refrigerated storage area and waste processing area and 13 mAHD in the waste handling area. Although both floor levels are above the 1% AEP flood level plus 0.5 m freeboard, inundation in events greater than the 0.5% AEP event would cause over floor flooding. As such, it is recommended that the currently proposed floor levels are increased to a higher flood standard.

To reduce the potential environment and health risk of the facility, it is recommended that floor levels are raised to a minimum of 13 mAHD, which is equivalent to the predicted 0.5% AEP peak flood level plus 0.5 m freeboard. A floor level of 13 mAHD would also provide 1.2 m freeboard above the 1% AEP flood level and 0.1 m freeboard above the predicted 0.05% AEP flood level. Over a 50 year lifetime of the development this would mean that there is less than 2.5% chance of inundation above floor level. For additional risk reduction (*if required by OEH*), it may be necessary to incorporate flood proofing measures into the building construction above the floor level.

3.2 Building Flood Proofing

Flood proofing methods typically fall under one of two principles; dry flood proofing and wet flood proofing (*ABCB, 2012*). 'Dry flood proofing' aims to keep water from entering a building and uses methods such as waterproof membranes and ensuring seals around all potential water entry points. 'Wet flood proofing' methods allow water to enter the building, however, materials and contents of the building are constructed and managed in such a way that damage to the building and contents is minimised. When using the wet flood proofing principle non-structural materials (*such as fittings*) can be either water resistant materials or 'sacrificial'. Sacrificial materials are non-water-resistant, such as ordinary plasterboard, which would be removed to allow the building to dry out and then replaced with new material.

Wet flood proofing is not considered appropriate for the proposed waste facility due to the nature of the material to be processed and handled. Inundation has the potential to mobilise stored goods and material thus potentially contaminating floodwaters.

Flood proof structures need to be designed and constructed to consider hydrodynamic forces arising from the movement of water. As well as this, consideration of the hydrostatic pressure upon the structural stability of the building is important. Hydrostatic pressure is the force exerted on the building caused by the differential in the water level either side of the external building walls. As the differential in water level increases, the force exerted on the building is also increased. This leads to damage of the structure and eventually failure. For example, a water differential level of about 1 metre can cause damage to a standard brick wall (*ABCB, 2012*).

In that regard, dry flood proofing is most suitable for areas within the floodplain where flood depths are shallow and the hydrostatic pressure does not present a significant risk to the structural stability of the building. Notwithstanding, through the use of construction measures suitable for industrial buildings, it may still be possible to dry flood proof the building in depths such as those predicted during a 0.05% AEP event. Accordingly, given that the proposed waste facility building will be constructed on fill to a level of about 13 mAHD, it may be possible to dry flood proof the building to prevent water ingress in flooding up to 14 mAHD.

There is no specific flood warning system for Swamp Creek and the effective warning time tends to be reliant on realisation of flooding in upstream areas of the catchment. For this reason the use of temporary measures (*such as flood barriers*) alone for dry flood proofing is not recommended. Suitable dry flood proof construction methods should be used and there should be no potential entrance points for water into the building with the exception of the entrance points required for operational requirements. Temporary flood gates should be fitted to all doors, loading docks and other potential entry points when a flood is expected.

3.3 Suitable Design of Building and Platform

Design of the fill pad and building structure should take into account the potential flood depths and velocities likely to occur in all design events up to the PMF i.e. hydrodynamic and hydrostatic forces. High velocities, such as those occurring in the PMF have the potential to scour the fill platform causing structural damage to the building. Suitable engineering design of the building and fill platform should ensure the building would not become unstable in extreme flood events.

4 Recommendations

Based on the information provided above, the following recommendations are made:

- A minimum floor level of 13.0 mAHD is recommended (*assuming on ground construction*) so that the facility is raised above the 0.5% AEP flood level plus 0.5 m freeboard. This would also be 0.1 m above the predicted 0.05% AEP flood level and would provide a 1.2 m freeboard above the peak 1% AEP flood level.
- It is also recommended that dry flood proofing be considered to raise the flood immunity of the facility to a level of approximately 14 mAHD. Based on the recommended floor level this would require approximately 1 metre high waterproofing of the facility. This would also provide additional freeboard to account for potential flood level increases associated with the recently constructed Hunter Expressway crossing.
- It is recommended that a suitably qualified structural engineer is engaged to develop a design that can be achieved to dry flood proofing the building and provide specifications for the engineered fill required to construct the building platform.
- All machinery and equipment which have the potential to become buoyant in the case that floodwaters enter the building should be bolted to the ground to prevent movement. This is to prevent damage to the structure of the building. All storage bins are to be secured safely to reduce the risk of movement and overtopping.
- External infrastructure must be designed to withstand the predicted velocities and depths of a 0.05% AEP event.
- The ash handling area should be protected by a wall to a minimum height of 13.0 mAHD to prevent inundation in events up to and including the 0.05% AEP flood. Suitable seals should be placed on all entrances to the area.

4.1 Potential Flood Impacts of the Proposed Development

Given the location of the proposed development there would be no impact on flood behaviour along Swamp Creek during the 1% AEP event. However, in events greater than the 1% AEP flood event, the proposed development may have potential to cause increases in peak flood levels to the west and to the south of the development due to the restriction to flood flows that would occur. It is expected that increases in peak flood levels as a result of the fill would be minor and occur predominantly within the Weston Aluminium site boundary. Therefore it is likely impacts would be considered acceptable across all adjoining properties. Notwithstanding this, the potential impacts should be confirmed for the proposed development through detailed hydraulic modelling as part of a Flood Impact Assessment.

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WorleyParsons Group

5 References

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Nathan, RJ and Weinmann, PE (1998), '*Estimation of Large to Extreme Floods*', Book VI: Australian Rainfall and Runoff (1998 revision), Commonwealth of Australia

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Royal HaskoningDHV (October 2016), *Battery Recycling Project, Surface Water Assessment*', Prepared for Pymore Recyclers International Pty Ltd

Smith, G and Cox, R (2016), '*Chapter 7: Safety Design Criteria*', Book 6: Flood Hydraulics in Australian Rainfall and Runoff – A guide to Flood Estimation, Commonwealth of Australia (Advanced Draft updated 06/07/2016)

We trust that the above Flood Risk Assessment has suitably outlined the existing flood behaviour at the site and identified likely requirements of the proposed development to reduce flood risk where necessary. If you have any further questions or comments please do not hesitate to contact me or my colleague Roy Golaszewski on (02) 9495 0500.

Yours sincerely

L. Baxter

Laura Baxter
Senior Environmental Engineer

Reviewed By:

Roy Golaszewski
Senior Water Resource Engineer

Approved By:

Warick Honour
Principal Water Resource Engineer

ATTACHMENT A

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SITE SURVEY

FIGURE A1

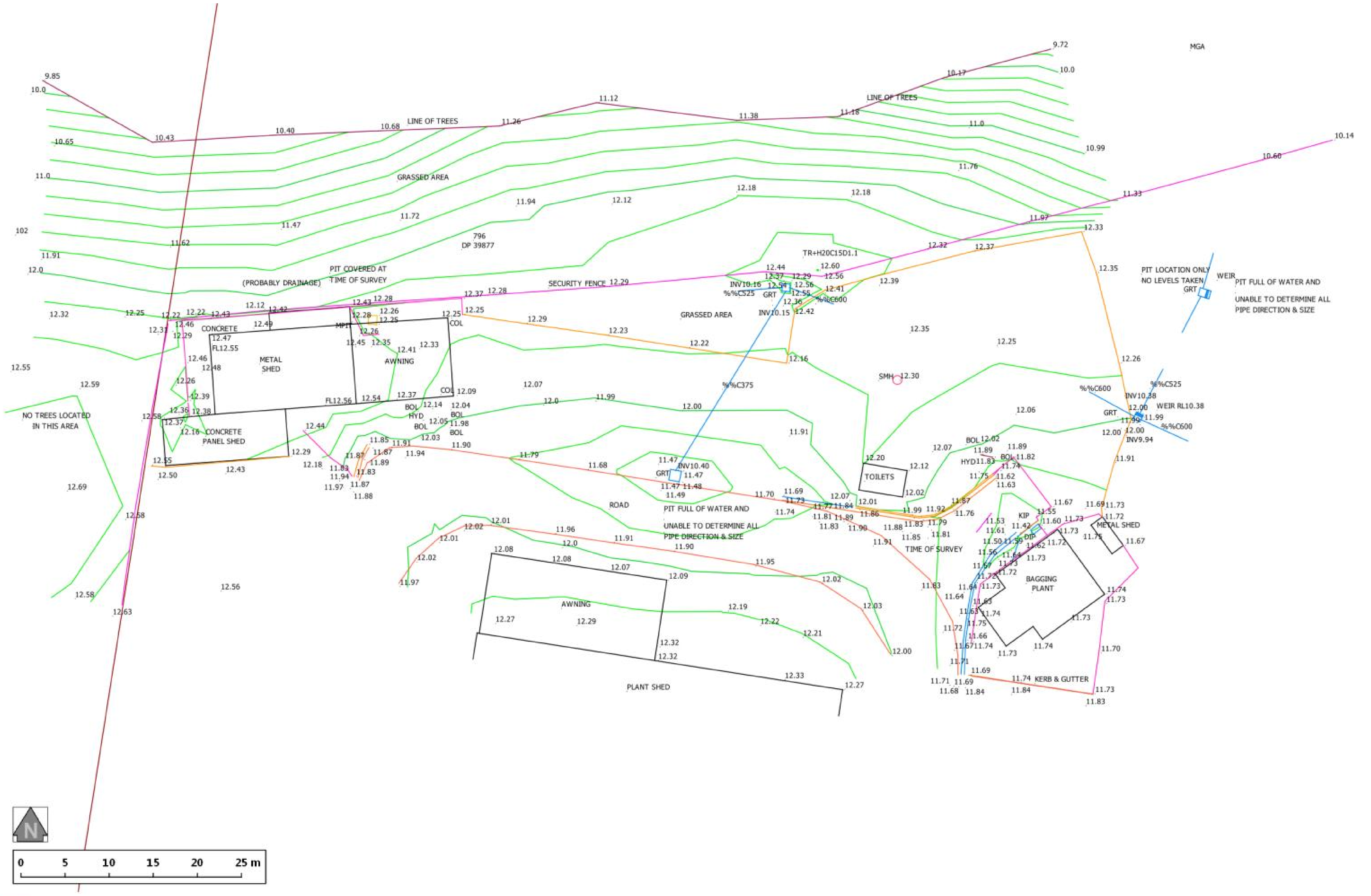

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Fig1-4_Survey.docx

SURVEY DATA IN THE VICINITY OF THE PROPOSED WASTE FACILITY