ENVIRONMENTAL IMPACT ASSESSMENT REPORT
NON TECHNICAL SUMMARY (NTS)

IN RESPECT OF

PROPOSED BRDA RAISE DEVELOPMENT

AT

AUGHINISH, CO. LIMERICK
NOVEMBER 2021

Contents

1.0 INTRODUCTION

1.1 Preamble

This Environmental Impact Assessment Report (EIAR) relates to a Planning Application by *Aughinish Alumina Limited*[1] [AAL] (the Applicant) for development at an existing alumina facility located in the townlands of Aughinish East, Aughinish West, Island Mac Teige, Glenbane West, and Fawnamore at or adjacent to Aughinish Island, Askeaton, Co. Limerick.

The alumina facility is operated in accordance with the Conditions of the Industrial Emissions Licence (IEL) P0035-07 issued by the Environmental Protection Agency (EPA).

Figure 1.1: Aerial view of the site and its surrounding context (source: www.myplan.ie 2021, Annotated by TPA).

The lands subject to this current application measure c. 222 ha and currently accommodate processes associated with the operation of the adjoining refinery plant located to the north west of the subject site. The overall landholding of the Applicant including the subject site, the refinery plant, nature trails and ancillary areas extends to c. 601 ha.

The proposed development comprises of:

- An expansion of the Bauxite Residue Disposal Area (BRDA) to increase its disposal capacity in order to accommodate additional bauxite residue resulting in a proposed increase in height of c.12m (to c. 44m OD) above the currently permitted levels. No increase to the existing footprint of the BRDA is proposed.
- An extension to the existing Salt Cake Disposal Cell (SCDC) to accommodate further disposal of salt cake resulting in an increase in height of the cell by c.2.25m. The SCDC is located within the BRDA area. A description of the existing SCDC and its function is provided in Chapter 2 of this EIAR.

[1] Aughinish Island, Askeaton, Co. Limerick

- An extension of the permitted borrow pit, located to the east of the BRDA, is also proposed. This extension proposes to increase the footprint of the borrow pit from c.4.5ha to c.8.4ha. This extension will provide an additional 380,000m^3 of rock fill material which is needed to satisfy the requirements of the construction and operation of the BRDA.
- The continued use of an existing stockpile area at the south east of the subject site to store topsoil in order to satisfy the additional restoration requirements of the extended BRDA.
- Upgrades to the existing water management infrastructure to accommodate the BRDA development to Stage 16 which will also allow for greater Inflow Design Flood (IDF) capacity for the entirety of the BRDA.

A description of the BRDA and its function in the alumina production process is provided in Section 2 below.

As set out in Section 1.6 below, the proposed development is of a class that requires a mandatory Environmental Impact Assessment (EIA) and the preparation of an Environmental Impact Assessment Report (EIAR). This document is a Non-Technical Summary which provides a concise outline of the main topics covered within this EIAR. In addition, given the proximity to River Shannon and River Fergus Estuaries and the Lower River Shannon, which are Natura 2000 sites, a Natura Impact Statement (NIS) is also submitted with the planning application.

1.2 Need for Proposed Development

The existing alumina refinery at Aughinish is the largest of its kind in Europe and is thus of strategic national and continental importance. Aluminium, which is ultimately produced from alumina, is of increasing importance as economies transition towards a low carbon future. The metal's light-weight nature, corrosion resistant qualities, and recyclability are all characteristics which have resulted in its application in renewable technologies such as solar photovoltaic (PV) panels and electric vehicles.

The production of alumina is thus critical to facilitating the production of renewable technologies and thereby ensuring that a low carbon and green economy centred on renewable energy production and electric transport modes can be delivered.

Alumina plants are capital intensive because of the nature and size of equipment employed in the process of refining bauxite. Such major start-up capital investments invariably present significant challenges for development at new greenfield locations. As a result, the efficient operation and expansion of existing facilities is of critical importance in ensuring that alumina supply is maintained to satisfy worldwide demand.

The maximum production level permitted at the refinery plant is and will remain at c.1.95 million tonnes of alumina per annum. This represents 30% of the alumina produced in Europe. In order to protect such production levels, future disposal capacity for bauxite residue is required. This application seeks to ensure that such disposal capacity is appropriately accommodated on site to secure the continued operation of the alumina facility.

1.3 The Applicant

Aughinish Alumina Limited (the Applicant) operates a long-established alumina facility, located on Aughinish Island on the southern side of the Shannon Estuary near the industrial port of Foynes, Co. Limerick. The landholding extends to c. 601 ha.

The industrial activity undertaken at the facility comprises the processing of bauxite in order to extract alumina (aluminium oxide) which is required for the production of aluminium as well as having a number of other industrial uses. The bauxite, which is transported by ship from South America and West Africa, is unloaded at a dedicated Marine Terminal located in the Shannon Estuary, and transferred by enclosed conveyor to the plant, where the bauxite is refined to produce alumina, an operation known as the 'Bayer Process'.

The 'Bayer Process' results in the production of alumina and a bauxite residue, which is deposited in the Bauxite Residue Disposal Area ('BRDA'). The alumina refinery plant is permitted to produce up to 1.95 million tonnes of alumina per annum, which is exported to smelters where it is used to produce aluminium.

The alumina facility commenced operations in 1983, and has been the subject of considerable expansion and investment over the intervening years. The plant is now one of the most efficient alumina refineries in the world, and the state-of-the-art facilities provide a total of c. 482 jobs directly plus 385 maintenance and installation contractor employees, and considerable further employment for local service industries.

AAL is owned by RUSAL, a leading aluminium producer, with interests throughout the aluminium production process – from bauxite ore mines to alumina extraction plants to aluminium smelters.

1.4 Purpose of the Environmental Impact Assessment Report

In order to ensure that all potential impacts associated with the development proposal are identified and addressed, this EIAR provides a systematic and integrated evaluation of the direct, indirect and secondary effects (positive and negative) of the project on the natural and socio-economic environment.

The aim of the approach is to identify and predict (for a given proposed development) any impacts of consequence; to describe the means and extent by which they can be avoided in the first instance or reduced or ameliorated; to interpret and communicate information about the impacts; and to provide an input into the decision making and planning process.

The preparation of the *EIAR* has been co-ordinated by Tom Phillips + Associates, Town Planning Consultants,[2] in association with other members of the Project Team as identified in Section 1.8 below.

A copy of the full EIAR is available for reference/purchase at the offices of Limerick City and County Council, Dooradoyle, Limerick, at the offices of An Bord Pleanála and online at the dedicated website prepared in respect of this Strategic Infrastructure Development (SID) planning application – ***www.brdasid.ie.***

1.5 EIA Process

EIA requirements are governed by Directive 2011/92/EU as amended by Directive 2014/52/EU. The primary objective of the EIA Directive is to ensure that projects that are likely to have significant effects on the environment are subjected to an assessment of their likely impacts.

[2] Tom Phillips + Associates, Town Planning Consultants, 80 Harcourt Street, Dublin 2, D02 F449

EIA forms part of the planning consent process and is carried out by the Competent Authority. An EIAR is prepared by / on behalf of a Developer in respect of the proposed development. The EIAR thus becomes an integral informing element in the Competent Authority's EIA. Directive 2014/52/EU introduced strict new requirements in respect of the competency of experts responsible for the preparation of the EIAR (see Table 1.1 below and Appendix 1.1 for details on the experts involved in the preparation of this document).

1.6 Need for EIA

The proposed development is covered by the following classes of development in the EIA Directive.

- Schedule 5, Part 2 Class 11(b) of the *Planning and Development Regulations, 2001 (as amended),* an EIAR is a mandatory requirement for *"Installations for the disposal of waste with an annual intake greater than 25,000 tonnes not included in Part 1 of this Schedule".* The proposal seeks the disposal of c. 1.57 million tonnes of bauxite residue per annum which would exceed this threshold.

- Schedule 5, Part 2, 2(b) of the *Planning and Development Regulations, 2001 (as amended),* an EIAR is a mandatory requirement for the "*Extraction of stone, gravel, sand or clay, where the area of extraction would be greater than 5 hectares".* The proposal seeks to extend the permitted borrow pit by c. 3.9 hectares which would create an overall borrow put of c. 8.4 hectares and thus exceed the threshold.

1.7 EIAR Study Team and Guarantee of Competency and Independence

The EIAR was completed by a project team coordinated by Tom Phillips + Associates, who also prepared a number of the chapters.

The members of the team and their respective inputs are outlined below in Table 1.1. The EIAR Chapters as set out in Table 1.1.

In accordance with EIA Directive 2014/52/EU, we confirm that experts involved in the preparation of the EIAR are fully qualified and competent in their respective fields. Each has extensive proven expertise in the relevant field concerned, thus ensuring that the information provided herein is complete and of high quality. The professional competencies of the EIAR consultants involved in the preparation of each chapter are outlined in Appendix 1.1.

CHAPTER	ASPECT OF THE ENVIRONMENT ASSESSED	CONTRIBUTOR
Chapter 1	Introduction	TOM PHILLIPS + ASSOCIATES
Chapter 2	Site Location and Context	TOM PHILLIPS + ASSOCIATES
Chapter 3	Description of the Proposed Development	TOM PHILLIPS + ASSOCIATES, GOLDER ASSOCIATES, APPLICANT
Chapter 4	Examination of Alternatives	TOM PHILLIPS + ASSOCIATES, APPLICANT

CHAPTER	ASPECT OF THE ENVIRONMENT ASSESSED	CONTRIBUTOR
Chapter 5	Archaeology, Architectural and Cultural Heritage	IRISH ARCHAEOLOGICAL CONSULTANCY LTD
Chapter 6	Biodiversity	ECOLOGY IRELAND / RSK / IEH CONSULTING
Chapter 7	Population and Human Health	TOM PHILLIPS + ASSOCIATES / AWN CONSULTING / WSP
Chapter 8	Land and Soils (Geology and Hydrogeology)	GOLDER ASSOCIATES
Chapter 9	Landscape and Visual Impact	BRADY SHIPMAN MARTIN
Chapter 10	Hydrology	GOLDER ASSOCIATES
Chapter 11	Air Quality	AWN CONSULTING
Chapter 12	Noise and Vibration	AWN CONSULTING
Chapter 13	Material Assets – Waste	GOLDER ASSOCIATES
Chapter 14	Traffic and Transportation	TRANSPORT INSIGHTS
Chapter 15	Material Assets – Site Services	GOLDER ASSOCIATES
Chapter 16	Major Accidents and Disasters	GOLDER ASSOCIATES
Chapter 18	Climatic Factors	AWN CONSULTING
Chapter 17	Interactions and Cumulative Impacts	TOM PHILLIPS + ASSOCIATES
Chapter 18	Mitigation and Monitoring	TOM PHILLIPS + ASSOCIATES
Chapter 19	Difficulties Encountered	TOM PHILLIPS + ASSOCIATES

Table 1.1: EIAR Chapter Headings and Contributors

1.8 Stakeholder Consultation

The EPA's *Draft Guidelines on the Information to be Contained in an Environmental Impact Statements* (2017) highlight the importance to 'Facilitate Better Consultation' in the assessment process and it is noted that 'Consultation is a key element of each stage of the EIA process' in order to fully comply with the EIA Directive.

Accordingly, consultation in respect of the proposed development was undertaken with An Bord Pleanála, the relevant prescribed bodies and the local community. The details of this consultation process are outlined in Chapter 1 of the EIAR.

2.0 SITE LOCATION AND CONTEXT

2.1 Location of the Subject Site

Aughinish Alumina Limited (the Applicant) operates a long-established alumina facility, located on Aughinish Island on the southern side of the Shannon Estuary near the industrial port of Foynes, Co. Limerick. The AAL facility is located c. 6 km north-west of Askeaton and c. 30 km west of Limerick City Centre.

The lands subject to this current application measure c.222ha and are referred to throughout this EIAR as the **'subject site'**. The alumina refinery processing plant located at the north west of the facility is located outside of the subject site and is referred to throughout as the **'refinery plant'**. The total AAL landholding including the subject site and the refinery plant is referred to as the **'AAL facility'** or the **'facility'.**

Figure 2.1: Site Context Map with subject site highlighted in red (source: www.myplan.ie 2021, Annotated by TPA).

The Limerick – Foynes railway line (closed in 2002) runs to the south of the island, as does the N69 National Secondary Route between Limerick and Tarbert. Aughinish Island is accessed via the L1234 Aughinish Road, which is a two-way local road which connects with the N69.

As noted above the subject site measures c.222ha and is located at the western and south western portions of the wider AAL facility at Aughinish Island (see Figure 2.2). The subject site is bounded by grassland and vegetation to the north, beyond which lies the Shannon Estuary.

The refinery plant is located to the north east of the subject site with AAL Sports grounds, a Limerick City and County Council (LCCC) water treatment plant and main site access road all located to the east of the subject site.

The western boundary of the subject site runs parallel with the Robertstown River, the edge of which is defined by an existing flood tidal defence berm (FTDB) and drainage channel.

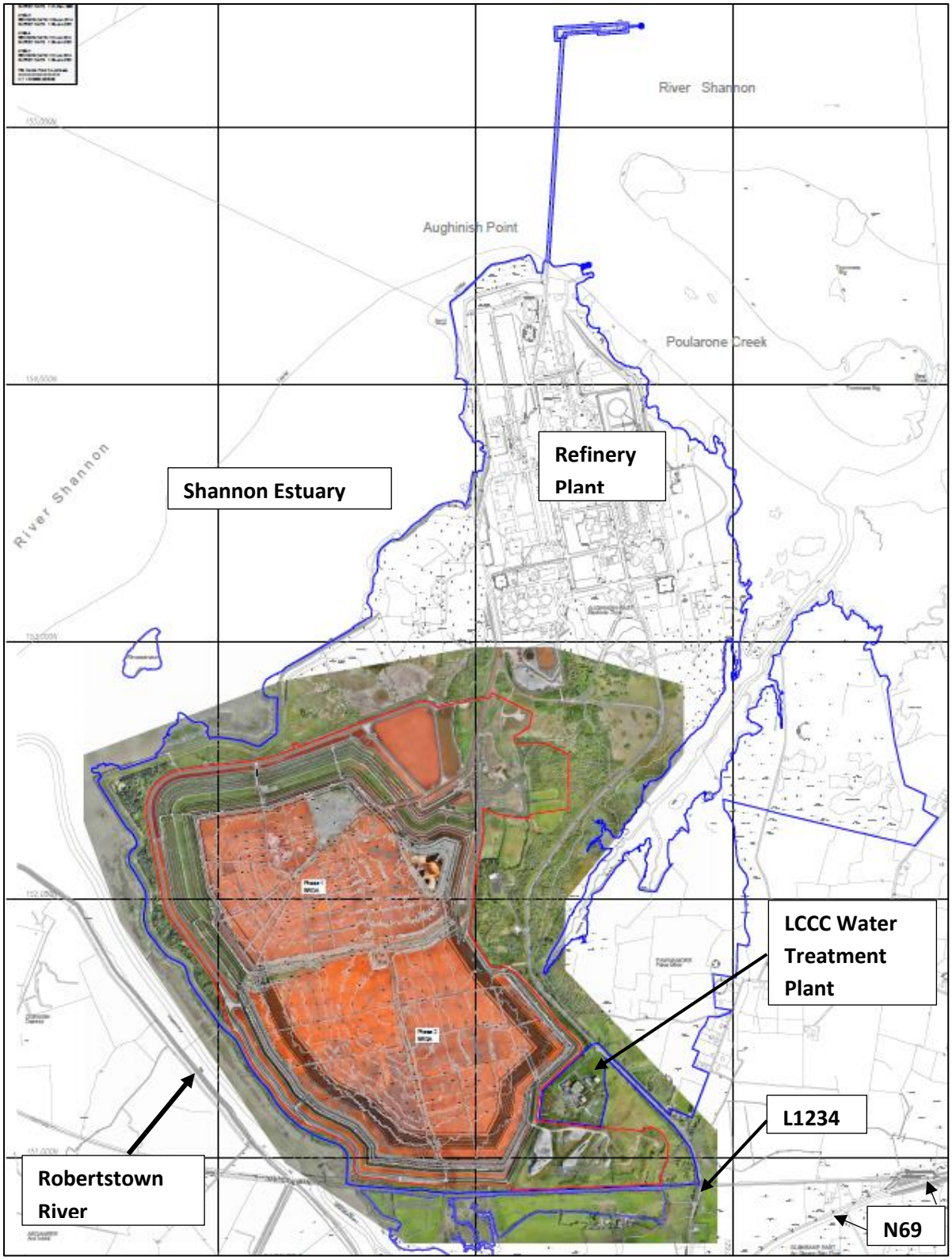

Figure 2.2: Aerial View of Subject Site and Wider AAL Facility (Source: Golder, 2021).

2.2 Processes Undertaken at Alumina Refinery Plant and Existing BRDA

The AAL facility, including the subject site area, operates in accordance with the Conditions of the Industrial Emissions Licence (IEL) P0035-07 issued by the Environmental Protection Agency (EPA).

At the refinery plant, alumina (also known as aluminium oxide) is extracted from bauxite raw material. The facility was principally constructed between 1978 and 1983. Plant production has been continually increased since the commissioning of the plant in 1983 up to its current maximum production of approximately 1.95 million tonnes of alumina per annum.

Bauxite, the raw material processed within the refinery plant, is a naturally dark red coloured earth which gets its colour from its iron content. It is imported by ship to the facility in bulk ore carriers from bauxite mines primarily located in West Africa and Brazil. The bauxite is then unloaded at the dedicated AAL marine terminal on the Shannon Estuary.

2.2.1 'Bayer Process'

Once the bauxite is received on site, the alumina is then extracted via what is known as the 'Bayer Process'. This five-step process is outlined below.

1. **Preparation:** The bauxite ore is crushed, ground and mixed with caustic soda solution and then pumped into digester pressure vessels.
2. **Digestion:** Under high pressure and heat, the alumina (within the bauxite slurry) is dissolved by and combines with the caustic soda to produce sodium aluminate.
3. **Clarification:** The solid residues (bauxite residue and process sand) in the digested bauxite slurry are separated by settling out of the sodium aluminate solution. The residues are then washed, and the bauxite residue is thickened by vacuum filtration and pumped to what is known as the Bauxite Residue Disposal Area (BRDA).
4. **Precipitation:** As the soluble sodium aluminate is cooled, it is agitated and seeded with aluminium hydroxide crystals. These form larger aluminium hydroxide crystals which gradually settle out of solution. Seed crystals and sodium aluminate remaining in solution are recirculated.
5. **Calcination:** The aluminium hydroxide crystals are calcined at over 1100 degrees Celsius to remove the water of crystallisation. A fine white powder, alumina (aluminium oxide), is produced and this product is exported by ship to overseas smelters.

2.2.2 Bauxite Residue Disposal Area (BRDA)

Bauxite residue from the above described process is pumped as a thickened residue to what is known as the Bauxite Residue Disposal Area (BRDA). Figure 2.3 outlines the location of this BRDA within the overall AAL facility. The bauxite residue can be directed into selected areas of the BRDA by valve operated piped discharge points. The bauxite residue is deposited to facilitate drying.

The placement and direction of movement of the bauxite residue is influenced by the level and distribution of the previously deposited material and position of residue berms.

As the bauxite residue dries, its moisture content and volume decreases while its density increases. The maturing of the bauxite residue is achieved by the following principal methods;

- Compaction of the residue by mechanical plant principally a series of amphirols and low ground pressure excavators,
- Air drying of the surface of the bauxite residue by evaporation
- Consolidation of the bauxite residue under its own weight.

Compaction of the residue by mechanical plant achieves the largest increase in density over a short period of time. Air drying by evaporation is the most important process in drying the bauxite residue and improving undrained shear strength. Self-weight consolidation of the residue achieves long term increases in density and strength.

The process sand, arising from the Bayer process, is transported from the plant by truck and is used to construct ramps and access roads within the BRDA. Other residues of the production process include salt cake, lime grits and process waste, which are deposited in the BRDA. The salt cake is stored within a separate specially engineered cell located within the BRDA (discussed further in Section 2.2.2.5.

Figure 2.3: Aerial View of part of Aughinish Alumina Site – BRDA (source: Golder Associates).

2.2.2.1 Characteristics of the Residue Deposits

As noted in Section 2.2.2 above, the residues deposited in the existing BRDA and those proposed to be deposited in the expanded BRDA include bauxite residue and salt cake.

Bauxite Residue

The farmed bauxite residue is classified as a solid non-hazardous material. There are 5 predominant compounds measured (Moisture, Aluminium Goethite, Hematite, Calcium Cancrinite, Bayer Sodalite) amounting to 75% of the overall content. A detailed description of all compounds identified in the bauxite residue and the classification of each is provided in Chapter 7 of the EIAR.

Mineral raw materials such as bauxite exhibit natural radioactivity slightly above the average level in the earth's crust. In bauxite, both thorium 232 and uranium 238 are present in measurable amounts. Material such as this is termed naturally occurring radioactive material (NORM).

The Radiological Protection Institute of Ireland (RPII) (merged into the EPA in 2014) is the competent Authority in Ireland with regulatory, monitoring and advisory responsibilities in matters pertaining to ionising radiation and radioactive contamination in the environment.

The RPII surveyed the Aughinish site and assessed the facility, raw materials (bauxite) and wastes (bauxite residue, process scales and effluent) for NORM properties. The RPII (2008) concluded that the (low) levels of NORM are in compliance with safe levels set out in S.I. No. 125/2000: Radiological Protection Act, 1991 (Ionising Radiation) Order, 2000 and are below the threshold at which the facility would come within the scope of the above Regulations. As such, the BRDA does not present a radiation hazard to either site operatives, visitors or the surrounding environment. Additional detail in this regard can be found in Chapter 8 of the EIAR.

Salt Cake

The salt cake is classified as hazardous according to the European Waste Catalogue, it is therefore deposited within a specially engineered cell (Salt Cake Disposal Cell, "SCDC") within the BRDA.

The salt cake deposits consist of the organic degradation products from naturally occurring humates in the bauxite.

2.2.2.2 Development of Existing BRDA

The existing BRDA at the subject site was constructed in three phases and comprises two disposal areas which are currently merging (see Figure 2.3). The combined total size of these areas is 184ha.

- The Phase 1 BRDA is formed from two areas, the original Phase 1 BRDA constructed in the early 1980s, covering an area of 72 ha., and the Phase 1 BRDA extension, constructed in the mid-to-late 1990s, covering an area of 32 ha. The initial design for the Phase 1 BRDA was to provide a disposal area to the year 2009 based on the BRDA constructed to Stage 7 (elevation 18m OD), which equates to a central dome elevation of 27.5m OD or 26m above original ground level.
- The Phase 2 BRDA is a southern extension of the Phase 1 BRDA that was permitted in 2007 (*Limerick County Council Reg. Ref. 05/1836; ABP Ref. PL13.217976*) to Stage 10 with a

maximum perimeter elevation of 24m OD and a maximum central elevation of 32m OD. The Phase 2 BRDA merges with the southern extent of the Phase 1 BRDA. The Phase 2 BRDA covers an area of approximately 80 ha. and was commissioned in 2011.

- The permitted BRDA provides a disposal area for Bauxite at the facility until c. 2030. The current level of the BRDA residue varies, from 22m OD to 32m OD in Phase 1 and from 11m OD to 20m OD in Phase 2.

2.2.2.3 BRDA Structure

As noted above in Section 2.2.2.2, the BRDA is comprised of two disposal areas – Phase 1 to the north and Phase 2 to the south. The perimeter structure of the existing/permitted BRDA is shown in Figure 2.4, below. This demonstrates that the structure is characterised by external perimeter walls within which the bauxite residue is stored in a terraced nature known as stage raises.

The BRDA is surrounded by composite lined Perimeter Interceptor Channels (PIC) which are formed by constructing the Inner Perimeter Wall (IPW) and the Outer Perimeter Wall (OPW).

The OPW is constructed of either till or rock fill and is composite lined on the upstream slope to form the PIC. The downstream slope has been overlain with a wire mesh gabion mattress for the northern and western extents of the Phase 1 BRDA. The IPW is constructed of permeable rock fill and provides the starter dam for the BRDA.

The lining system for the BRDA basin is a mixture of natural and geosynthetic materials which have very low hydraulic conductivity. These lining systems provide the short-term containment as the BRDA basin is filled, the depth of deposited bauxite residue is increased, and consolidation occurs.

Once a sufficient depth of bauxite residue has been deposited above the basal lining system, then the bauxite residue itself becomes the controlling containment and long-term containment, owing to the following characteristics:

- Bauxite residue has a low hydraulic conductivity
- Bauxite residue is farmed, and the consolidation benefits are achieved directly.
- No free water is stored on the BRDA.

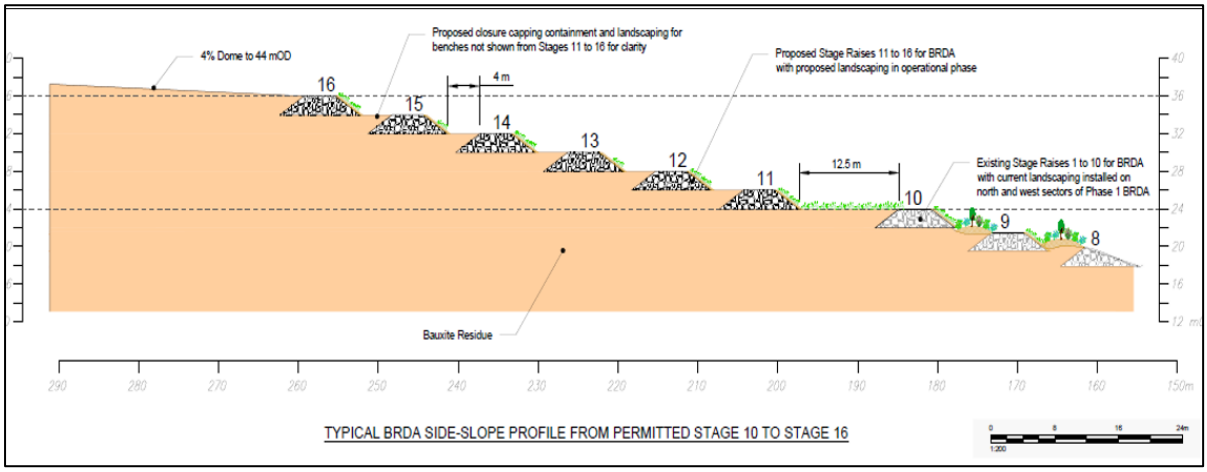

Figure 2.4: Typical BRDA Side-Slope Profile for Permitted BRDA

Permitted Drainage Arrangement

The BRDA is surrounded by the Perimeter Interceptor Channel (PIC) which collects water emerging from the BRDA (seepage, bleed water, sprinkler water and surface water runoff) and conveys it via pumps either to the Effluent Clarification System (ECS) located in the plant and/or to the Storm Water Pond (SWP).

The SWP is located in the north-east sector of the BRDA and its function is two-fold:

- To provide surge capacity for excess surface water prior to processing by the ECS; and
- To provide a continuous flow of water that is used for dilution or wash water within some parts of the processing plant.

Excess water from the SWP is pumped to the ECS via pumps. The SWP does not currently have an overflow spillway (during operation) but will be breached during the closure works for the post-closure period. Please refer to Chapter 10 of this EIAR for further detail.

The Liquid Waste Pond (LWP) is located adjacent to the SWP and receives treated water from the ECS and conditions this water (cooling and settlement) prior to discharging or re-use in the refinery.

Distribution of Bauxite Deposits

There are two discharge platforms located centrally in the Phase 1 and Phase 2 BRDA areas. These discharge platforms with valve manifold installation feed a network distribution of fixed piped spigot points called mud points (MPs) for residue deposition within controlled cells in layers sloped away from the discharge point for layered residue deposition. The cells have perimeter berms constructed from rock to a height of 2m.

Currently, there are 17 No. mud points in the BRDA with 9 number located in the Phase 1 BRDA and 8 number located in the Phase 2 BRDA. The distribution network for the discharge platforms and the MPs were installed at the base of the BRDA when the basin was constructed, and the MPs are raised vertically corresponding to the increase in height of the BRDA.

The deposited bauxite residue is farmed to enhance drying of the residue, promote densification and to enhance exposure of the residue to the atmospheric carbon dioxide to reduce the liquid phase alkalinity. The farmed bauxite residue is tested to achieve a pH < 11.5 and is subsequently graded and compacted in preparation for the next deposition layer.

The BRDA surface is managed via a system of sprinklers which cover the entire exposed bauxite residue surface on an approximately a 75m x 75m grid. Sprinkling of the Bauxite Residue surface is considered a Best Available Technique (BAT), as identified by the European Commission. The sprinkler guns rotate and distributes water up to 50m radius such that adjacent points in the grid form overlapping radii (max. 25m) to provide complete coverage.

During extended dry periods, the LWP provides a buffer storage for the sprinkler system. The sprinkler operational patterns and duration are decided daily based on an assessment of the weather forecasts and programmed by the BRDA Operations Department. In full operation, the sprinkler system can discharge at a rate of 650 to 750 m^3 / hour.

The Perimeter Access Road and internal road and ramps in the BRDA are maintained using road sweepers and dust suppression is achieved using tractor towed water bowsers.

Cell Layout

The current layout of layered deposition cells for the Phase 1 BRDA (Cells 1 to 24) and Phase 2 BRDA (Cells 26 to 46) is shown in Figure 2.5. Residue farming within the cells allows for the reduction of the pH to < 11.5 and for the increase in the density and strength parameters of the deposited bauxite residue layer. Areas for deposition are partitioned by up to 3m high berms of farmed bauxite residue formed using a dozer. Two layers are deposited in each cell annually, after which the cell bunds are then re-formed from farmed bauxite residue using a dozer.

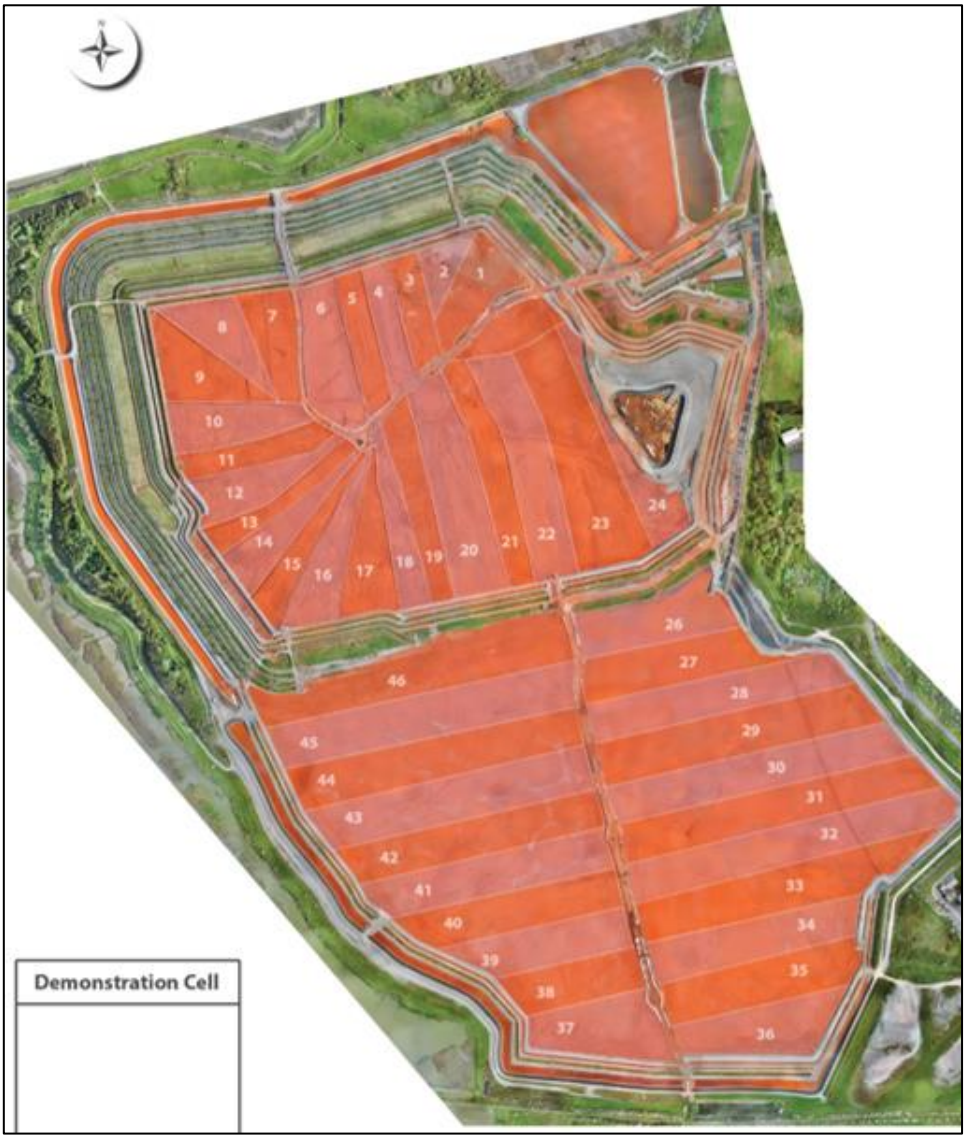

Figure 2.5: BRDA Layered Deposition Cell Layout – December 2020 (Source: Golder, 2021).

BRDA Raise

The approximate rate of rise of the BRDA was 12m in 14 years (0.86m / year from 2005 to 2019) for the Phase 1 BRDA and 14m in 14 years (1.00m / year from 2005 to 2019) for the Phase 1 BRDA Extension. This represents a reduction in the pre-2005 rate of the raising of the Phase 1 BRDA that can be attributed to the additional footprint provided by the Phase 2 BRDA since 2011.

The majority of bauxite residue is being placed within the Phase 2 BRDA in recent years (80% in 2018 and 82.5% in 2019), the rate of rise in the Phase 2 BRDA has been slightly greater than the Phase 1

BRDA with an average depth of 14m placed alongside the centre of the North-South Road during the 10 years of operation (1.75 m / year). An average depth of 10m has been placed at the perimeters (east, west and south) during the 10 years of operation (1.0m / year).

Raising of the Existing BRDA

The BRDA is progressively raised by the upstream method, identified by the European Commission as the 'Best Available Technique'[3]. The upstream method involves constructing a permeable rock fill berm (stage raise) at the perimeter which is founded on the previously deposited and farmed bauxite residue. The stage raises are constructed in 2m vertical lifts (4m crest width, side-slopes of 1.5(H):1(V) and typically offset from inner crest to starting toe by a 4m wide bench), thus forming a supporting face to the overall structure, whilst also allowing drainage.

Unlike tailings facilities or water retaining dams, the BRDA retains little to no surface water on the surface. The bauxite residue is discharged as a thickened slurry from several near central discharge points and migrates to the perimeter stage raises to form a dome which typically has the apex some 6m to 8m above the perimeter stage raise elevation. The slope produced averages grades between 2 % and 4 %. As noted above in Section 2.2.2.2, the permitted final elevation of the perimeter stack wall is 24m OD at the final stage, Stage 10, and the highest elevation of stacked residue for the dome is 32m OD.

A collection drain has been formed in the bench of the uppermost stage raise to collect seepage and runoff and divert the waters towards a piped drainage system (300mm and 450mm OD twin-walled HDPE pipes at max. 100m centres) leading directly to the PIC. This system allows for the progressive restoration of lower benches as the BRDA increases in height by eliminating the trickle down of the alkaline water over vegetation.

Downstream side slope restoration, comprising side-slope drainage and planting berms, was completed during 2013 along the northern and western sectors of the Phase 1 BRDA from Stage 1 to Stage 8. Interim side-slope restoration, comprising drainage between toe drains of stage raises and hydroseeding of the upstream faces of the stage raises, is ongoing, and has been completed along the northern and western sectors of Phase 1 BRDA to Stage 10 and along the western flanks of the Phase 2 BRDA to Stage 3.

2.2.2.4 Current Status of BRDA

AAL have successfully raised the Phase 1 BRDA to Stage 10 along the east, north-east and north-west sectors and also are currently constructing the south-west and south sectors to Stage 10. The elevation of bauxite residue deposited varies from approx. 32m OD at the centre to approx. 22m OD to 24m OD at the perimeter stage raises.

For the Phase 2 BRDA, AAL have constructed to Stage 4 (12m OD) along the west and south boundaries. Bauxite residue has been placed to approx. 11m OD along the east perimeter wall, which will subsequently form the base of the internal perimeter interceptor channel (PIC) along this extent. The crest of east perimeter wall currently varies in elevation from Stage 6 (16m OD) to Stage 4 (12m OD) from its north-eastern extent to its eastern extent and transitions into the external PIC at the Observation Area located centrally on the east perimeter wall. The elevation of the bauxite residue deposited varies from approx. 20mOD centrally along the internal access road (north-south road), splitting

[3] Best Available Techniques (BAT) Reference Document for the Management of Waste from Extractive Industries in accordance with Directive 2006/21/EC (European Commission, 2018)

the Phase 2 BRDA into east and west sectors. The elevation of bauxite residue at the east, south and west perimeter stages raises is at approx. 11m OD.

The Phase 1 and Phase 2 BRDAs are being progressively merged, with the Phase 2 BRDA overlapping on the upstream raises on the south face of the Phase 1 BRDA to a current elevation of approx. 15m OD.

The current average rate of production of bauxite residue is c.1.57 million tonnes / year (dependent on grade of ore) and is deposited at a characteristic dry density 1.63 tonnes / m^3, following mud-farming activities. The planned rate of void consumption is 0.9 to 1 million m^3 / year for bauxite residue and approx. 35,000 m^3 / year for rock fill.

2.2.2.5 Salt Cake Disposal Cell

Salt cake is classified as a hazardous waste that is required to be segregated from the other BRDA deposits.

As such, a dedicated Salt Cake Disposal Cell (SCDC) is located to the east of the main Phase 1 BRDA area. This SCDC is an independent, composite lined cell with a triangular shape characterised by north, east and west dam walls. The permitted maximum height of the SCDC is 29m OD at crest level.

The SCDC is accessed from the central access ramp to the Phase 1 BRDA, via a turn-off to the south onto the access ramp leading to a turning point, which is at the crest elevation of the cell. The salt cake is produced in the adjoining refinery plant and hauled to the SCDC in dumpers, where it is tipped into the cell at designated 'Tipping Points'. The west dam wall is the 'Tipping Wall' and has a width of 23.5m. The north and east dam walls measure 8.0m in width and they provide through access around the crest of the cell and to a Decant Tower.

The total storage volume of the SCDC is estimated to be 72,800m^3 at the crest level (29m OD). The current cell capacity is expected to expire during 2023.

AAL has developed, in conjunction with a number of laboratories and technology suppliers, a process modification to avoid the production of saltcake from its facility. The research at AAL identified that the most suitable way of modifying the process was to install a Wet Air Oxidation (WAO) system within the refinery (located outside of the subject site). WAO was chosen because it was a mature technology with hundreds of installations worldwide which allows the oxidation products to be recovered to the refinery without any gaseous, liquid or solid emissions. The WAO will be fully integrated into the alumina production process, operate continuously and allow recovery of the process stream.

In summary this process involves oxidizing the saltcake with dissolved oxygen at an elevated temperature and will be used as a method of treatment for saltcake. There are no environmental emissions associated with this process and it is fully compliant with all relevant EPA 'Best Available Technique' (BAT) Guidance Notes. A detailed project schedule has been developed with commissioning to be completed by 2023.

Further detail regarding the SCDC can be found in Section 6.13 of the Engineering Design Report, prepared by Golder (Appendix A of the EIAR).

2.3 Description of the Subject Site

The lands subject to this current application are located to the west and south west of the overall AAL facility. The subject site measures c. 222 ha and comprises three main elements - the BRDA area (including ancillary elements and Salt Cake Disposal Cell) which itself comprises c.184ha, the Borrow Pit area and the Stockpile area (see Figure 2.6). Access to the subject site is provided from the existing access infrastructure associated with the wider facility.

Figure 2.6: Aerial View of the Subject Site (Source: Golder, 2021 – Cropped and Annotated by Tom Phillips + Associates).

2.3.1 BRDA (Including SCDC)

As noted above in Section 2.2, the BRDA comprises the majority of the subject site area. The Phase 1 BRDA area, located at the north of the application site measures c.104ha. The Phase 2 BRDA area, located at the south of the subject site measures c.80ha.

As outlined in earlier sections of this chapter, the BRDA areas are principally comprised of perimeter walls and channels enclosing a basin of bauxite residue which is stored in a terraced form structure comprising 10 no. permitted terraces known as stage raises. Deposits within the phase 1 area are at the stage 10 level, whilst deposits within the Phase 2 area, which has been in operation for a shorter time period is deposited at stage levels 4.

Ancillary infrastructure located within the BRDA area includes a Salt Cake Disposal Cell, located at the east of the phase 1 area and a Storm Water Pond (SWP) and Liquid Waste Pond located to the north

east of the phase 1 BRDA area. Further detail in relation to the BRDA and its function is contained in Section 2.2 of this chapter.

2.3.2 Borrow Pit Area

The permitted borrow pit area is located at the north east of the application site and its extraction area is c.4.5ha in size (LCCC Reg. Ref. 17/714; ABP Ref. 301011-18). It will serve the construction and operation of the permitted BRDA by providing processed rock which is required to build up the stage raises before residue is deposited and then contained by the rock-fill.

The permitted borrow pit area has a depth of c.8.5m OD. Rock extraction and the initial blasts at this borrow pit are expected to take place during April 2022. The permitted borrow pit area is expected to provide 375,000 m^3 of rock fill material which is considered to be sufficient to construct the existing BRDA to Stage 10 (220,000 m^3), to implement the closure design (105,000 m^3) and miscellaneous rock fill (50,000 m^3).

Adjacent to the permitted borrow pit area to the east is an area which is currently covered in vegetation. It is proposed that the borrow pit will extend eastwards into this area to facilitate the expansion and raising of the BRDA. Details in this regard are provided in Chapter 3 of this EIAR. The total extraction area of this planned extension to the borrow pit amounts to c.3.9ha.

2.3.3 Stockpile Area

A stockpile area is located at the south east of the application site. This area measures c.12.5ha. The area currently accommodates rock and topsoil which is used to construct and progressively restore the BRDA. In addition, portions of the area are covered in vegetation at present.

2.4 Reasonably Foreseeable Projects

In addition to the current operations which are ongoing at the subject site and wider AAL facility, there are also three projects which are currently envisioned to take place in the coming years. The required planning approvals for these projects will be sought once greater certainty regarding their progression/necessity is known. Details pertaining to these projects are outlined below.

1. Mill Building

It is proposed to install a mill building (Building No. 5) within the existing refinery plant area which is located to the north east of the subject site. This new building will facilitate the grinding of materials and will also contain a storage tank known as a bin which will facilitate bauxite storage of varying moisture. It should be noted that the mill building will not facilitate additional bauxite to be milled but rather facilitate more efficient handling of varying bauxite moisture contents. The new mill building will be similar in size and shape to the existing mill building no. 4 whilst the proposed bin will be similar in shape to the existing bin no. 6. bin (bin No. 6). Sound insulated cladding will be used in the construction of the building, similar to that which has already been utilised in the construction of the existing mill building no. 4.

2. Electric Boiler

A High Pressure Electric Boiler is also envisioned to be installed at the refinery plant in the coming years. This boiler will be the first of its kind in Ireland and will facilitate efforts to further decarbonise the facility by enabling the combustion process currently used for steam generation to be replaced by electrification. The high-pressure electric boiler will have a 25

MegaWatt (MW) rating and capability to generate 40 tonnes per hour of high pressure steam. The electric boiler will be operated in times of excess renewable electrical power on the grid (i.e. high wind periods).

The operation of the 25MW electric boiler in the electricity market has been modelled by a third party Baringa Consultants. Based on these modelled operating hours the electric boiler would be in use 23% of the time on average. During this time 40 tonnes per hour of steam would be generated by the electric boiler instead of the gas boilers. This would result in an average emissions saving of 10,000 tonnes CO^2 per year. The utilisation in the market is forecast to increase in later years resulting in further emissions savings. The CO^2 saving comes from the reduction of natural gas use on site and through providing system services to the electricity grid Transmission System Operator that would otherwise be provided by fossil fuel generators.

The electric boiler would provide large scale grid services reducing curtailment on the grid and increasing the usage of renewable energy.

This boiler represents the Best Available Technology (BAT), for the carbon free production of high temperature heat for energy intensive industry. It is envisioned that the electric boiler will be housed within the existing gas boiler building.

3. Electrical Switch Room

An electrical switch room is currently located within the refinery plant area. This is a dedicated room to accommodate electrical equipment in the best possible conditions: cool, clean and dry with medium voltage and low voltage switchboards supplying electrical loads for steam generating equipment are located there. This switch room is currently at capacity and thus needs to be extended to allow for supply of further medium and load voltage electrical loads for steam generation and the associated control interconnection panels to allow control from the plant Distributed Control System (DCS). As such, it is envisioned that this switch room will be expanded to deliver additional capacity for the refinery plant.

The above works are intended to improve efficiencies at the facility. They are forecast to be undertaken within the next 5 years and are thus considered likely to occur. As such, these works have been considered in the cumulative impact analysis of the proposed development. Further detail in this regard is provided in Chapter 18 of this EIAR.

3.0 DESCRIPTION OF PROPOSED DEVELOPMENT

3.1 Introduction

As set out above, the subject site at Aughinish Island, Askeaton, Co. Limerick, is approximately 222ha and comprises a Bauxite Residue Disposal Area (BRDA) including Salt Cake Disposal Cell (SCDC), Borrow Pit, Stockpile Area and related ancillary infrastructure.

In summary, the Applicant is applying for planning permission for development comprising the expansion of the BRDA (including SCDC), Borrow Pit and Stockpile Area to facilitate the continued disposal of bauxite residue on site arising from the continued operation of the adjoining alumina refinery plant located on the wider AAL facility.

3.2 Overview of Proposed Development

The proposed development consists of works to the Bauxite Residue Disposal Area (BRDA) comprising of an expansion to increase its disposal capacity to accommodate additional bauxite residue arising from the continued operation of the permitted alumina refinery plant located on the wider AAL facility. The proposed increase in disposal capacity to the BRDA will result in a proposed increase in height of c.12m above the currently permitted stage 10 level (c. 32m OD) to a final stage 16 level (c. 44m OD). No increase to the existing footprint of the BRDA is proposed.

The proposed method of raising the BRDA will be the upstream method, consistent with the construction methodology for the permitted BRDA and involves the construction of rock fill embankments (Stages), offset internally and founded on the previously deposited and farmed bauxite residue, in 2 m high vertical lifts. The overall BRDA is raised systematically as the stages are filled with bauxite residue, farmed, carbonated and compacted, prior to deposition of the next layer.

Additional works proposed as part of this application include the following:

- A vertical extension to the existing Salt Cake Disposal Cell (SCDC) to accommodate further disposal of salt cake resulting in an increase in height of c.2.25m. The SCDC is located within the BRDA. A description of the SCDC and its function is provided in Chapter 2 of this EIAR.
- An extension of the existing borrow pit, located to the east of the BRDA, is also proposed. This extension proposes to increase the footprint of the borrow pit from c.4.5ha to c.8.4ha. This expansion will provide an additional 380,000m^3 of rock fill material which is needed to satisfy the requirements of the construction and operation of the BRDA.
- The continued use of an existing stockpile area at the south east of the subject site to store topsoil in order to satisfy the additional restoration requirements of the extended BRDA.
- Modifications to the existing water management infrastructure to accommodate the BRDA development to Stage 16 which will also allow for greater Inflow Design Flood (IDF) capacity for the entirety of the BRDA.

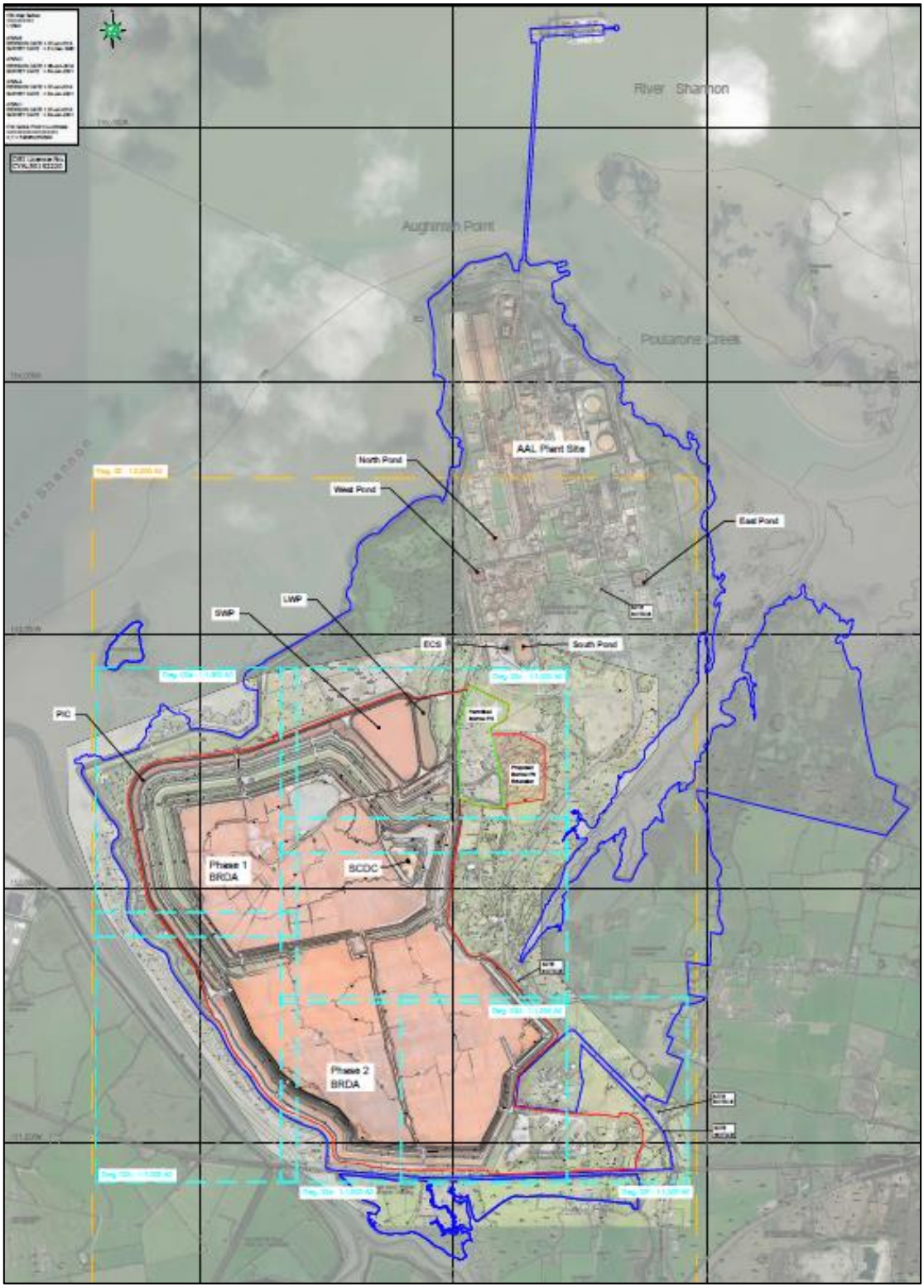

Figure 3.1: Subject Site Boundary Outlined in Red [Wider AAL Facility Outlined in Blue] (Source: Extract from Golder Associates Dwg. No. 01a).

3.3 Proposed Works to the BRDA

As noted in Section 2 above, the permitted BRDA has capacity to provide a disposal area for bauxite residue until c.2030, for the current rate of alumina production (1.95 million tonnes per annum) at the adjoining refinery plant. As currently permitted, the BRDA will have a final perimeter elevation of 24m OD and a maximum dome crown elevation of 32m OD.

The subject application proposes that the permitted height of the overall BRDA (Phase 1 and 2 BRDA) be increased to accommodate additional bauxite residue disposal capacity. It is intended that this additional disposal capacity will extend the lifetime of the currently permitted BRDA up to c.2039 – an extension of approximately 9 no. years based on current residue disposal and production rates. The raising of the BRDA does not require any amendments to the existing BRDA footprint.

It is proposed that the existing BRDA can facilitate an increase in height to Stage 16 (currently permitted to Stage 10) which would provide a perimeter elevation of 36mOD and a maximum dome crown elevation of 44m OD. The proposed development will provide for the deposition of circa 0.9 to 1.0 million m^3 / year of bauxite residue and total of circa 8.0 million m^3 over the lifetime of the development (at current residue disposal and production rates).

The proposed method of raising the BRDA from Stage 10 to Stage 16 will be the upstream method, consistent with the construction methodology for the current BRDA and involves the construction of rock fill embankments (Stages), offset internally and founded on the previously deposited and farmed bauxite residue, in 2m high vertical lifts.

The proposed increased in height is 12m which will comprise 6 x 2m high stages raises (Stages 11 to 16), to provide a new perimeter crest elevation of 36m OD and a maximum dome crown elevation of 44m OD. The total area enclosed by the toe of the perimeter Stage 11 raise is 96.37ha. The Stage 10 bench is 12.5m wide bench, and subsequent benches from Stage 11 to Stage 16 are the standard 4m width, to form a new upper gradient of 4.83(H):1(V) and an overall BRDA wall gradient of 6.8(H):1(V).

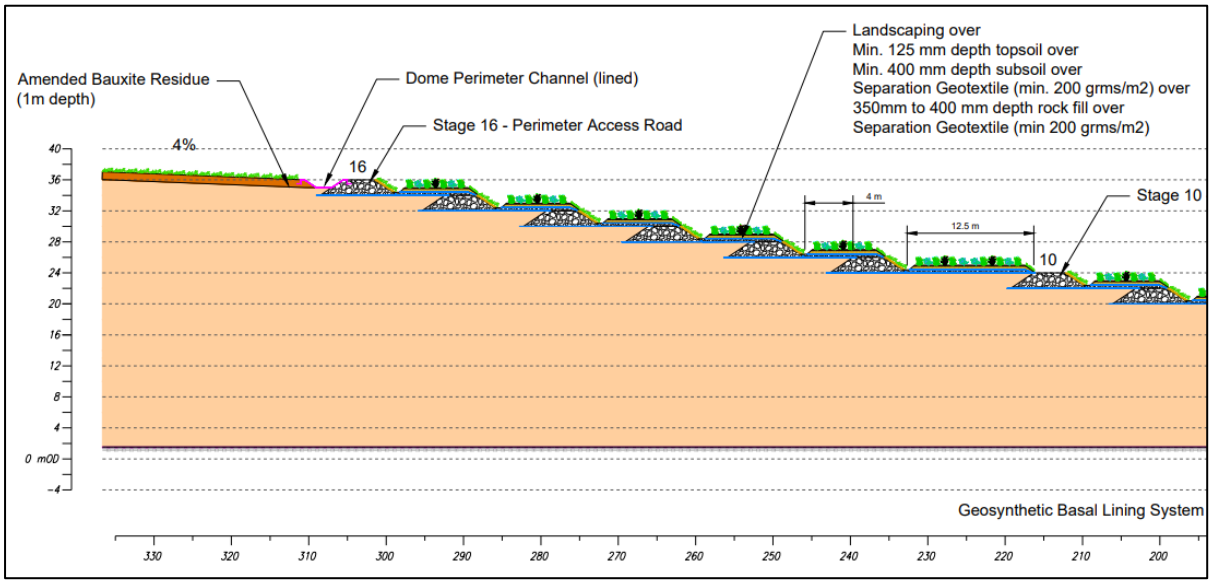

Figure 3.2: Section of Proposed BRDA Raise from Stage 11 to Stage 16 (Source: Golder, 2021).

The proposed BRDA Raise Development will provide an additional estimated 8.04 million m^3 of void for bauxite residue disposal (discounted for volume of rock fill stage raises) following from the April 2021 aerial survey, which represents an additional c. 13.1 million tonnes of bauxite residue disposal.

The estimated total remaining void for bauxite residue disposal is proposed to increase to c. 17.16 million m^3 (discounted for volume of rock fill stage raises) following from the April 2021 aerial survey, which would represent an additional c. 28 million tonnes of bauxite residue capacity and a remaining life of c. 18 years up to 2039, based on the current rate of residue disposal and production.

The current BRDA water management infrastructure was designed to accommodate the BRDA development to Stage 10 and for an inflow design flood (IDF) with a return period of 1 in 200 years. As outlined in chapter 10 of this EIAR, it is proposed to modify the existing water management infrastructure to accommodate the BRDA development to Stage 16 and for an IDF of a greater return period, in accordance with Canadian Dam Association (CDA) guidelines, based on the classification of the BRDA.

3.3.1 Stage Raise Construction Methodology

The stage raises are constructed of hard, durable, well graded limestone rock fill, free of deleterious materials and with a maximum particle size of 300mm that is termed Type B material. The Type B material is sufficiently permeable to permit the initial draining of the bauxite residue paste and surface water runoff but becomes less effective as the deposition elevation increases due to fines content of the bauxite residue.

The required rock fill will be sourced from the permitted borrow pit and the proposed expanded borrow pit located at the north east of the subject site.

As noted in Chapter 2 of this EIAR, the rate of consumption of rock fill for stage raise construction in recent years has been in the 30,000 to 40,000 m^3 / year range. The permitted Borrow Pit footprint will provide 374,000 m^3 of rock fill material which is considered to be sufficient to construct the permitted BRDA to Stage 10 (198,000 m^3), to implement the closure design (106,000 m^3) with a contingency available (70,000 m^3).

The rock fill for the proposed BRDA Raise Development is expected to be sourced from the permitted Borrow Pit and the proposed Borrow Pit Extension and an estimated volume of 380,000m^3 is required to construct the BRDA to Stage 16. Additional volumes are required to implement the closure design (62,000 m^3) and raise the SCDC (27,000m^3), above the rock fill requirements for the construction of the BRDA to Stage 10. The total rock fill demand for the BRDA constructed to Stage 16 and for closure requirements is 778,000m^3 (from April 2021). The existing and proposed Borrow Pits will provide 754,000m^3 and there is 30,000m^3 currently stockpiled on site.

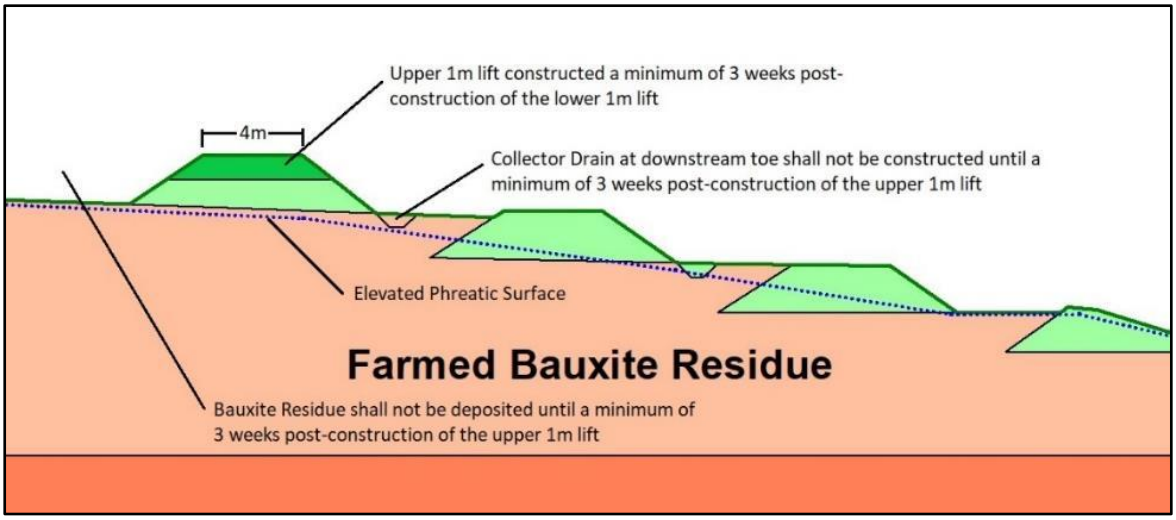

Figure 3.3: Stage Raise Construction Methodology (Source: Golder, 2021).

Stage raise construction follows the methodology described below and shown in Figure 3.3 above:

- As outlined in Chapter 2 of this EIAR, bauxite residue is pumped from the alumina refinery plant to the BRDA area. The bauxite residue can be directed into selected areas of the BRDA by valve operated piped discharge points.
- The farmed and compacted bauxite residue is filled to the elevation of the inner crest of a constructed stage raise.
- A minimum 14m width of subgrade, for the lateral extent of the stage raise to be constructed, is prepared for the construction of the subsequent stage raise, allowing 4m offset for the bench, 3m for the downstream slope at 1.5(H):1(V), 4m crest width and 1.5(H):1(V) upstream slope. Additional farmed mud is bulldozed into place and compacted to provide a level sub-grade and/or to fill any low spots.
- A minimum 200 grms/m^2 separation geotextile is placed on the subgrade in the footprint of the proposed stage raise, approx. 10m width.
- The lower 1m lift of the stage raise is constructed with Type B rock fill and trimmed to the design profile. The rock fill is nominally compacted by tracking over with heavy mechanical plant.
- The upper 1m lift of the stage raise is constructed in a similar fashion following a minimum of 3 weeks has passed to allow for pore pressure dissipation. The final crest width is 4m at the design elevation.
- The excavation of the collector drain at the toe of the downstream slope and the deposition of bauxite residue ensues after a minimum of 3 weeks has passed since the construction of the upper 1m lift.

In addition to the deposition of the bauxite residue in the BRDA area, process sand which is also a by-product of the alumina production process, will be used to construct additional ramps and access roads within the expanded BRDA. The process sand will be transported from the refinery plant by truck using the existing road network at the subject site and the wider AAL facility.

Please refer to the enclosed Engineering Design Report, prepared by Golder Associates and enclosed in Appendix A of this EIAR.

3.3.2 Phasing of Stage Raise Construction/Operation

It is expected that the Phase 1 BRDA will be fully constructed to Stage 10 and that all of Phase 2 BRDA will be raised to Stage 4 by the end of 2021.

For the permitted BRDA development to Stage 10, the bulk of bauxite residue will continue to be deposited in the Phase 2 BRDA (90%) and the rate of rise can be expected to be approximately 2m per year or one stage raise per year constructed in the Phase 2 BRDA until 2027.

The phasing for the BRDA Raise Development would allow a more balanced deposition strategy as the availability of capacity in the phase 1 BRDA area would reduce the reliance on the phase 2 BRDA area.

Under the proposed development strategy, the stage raise construction for the Phase 2 BRDA will continue to lag behind that of the Phase 1 BRDA by 4m to 6m (2 to 3 stage raises) until the Phase 1 BRDA reaches its design perimeter elevation of 36m OD (Stage 16). The bulk of the bauxite residue deposition will then be deposited in the Phase 2 BRDA until the Stage 16 elevation is reached.

Detail regarding the proposed construction phasing of the stage raises can be found in the Engineering Design Report enclosed in Appendix A of the EIAR. This phasing approach is based on the following assumptions:

- Approval for BRDA Raise Development.
- 14 m^3 of rock fill required per metre length of stage raise constructed.
- Internal stage raises will continue to be constructed in Phase 1 in the zone north of the Phase 2 BRDA.
- Bauxite residue is deposited in approximately equal thickness layers in both the Phase 1 BRDA and Phase 2 BRDA.

3.3.4 Proposed Water Management Works

The existing drainage arrangement related to the BRDA is outlined in Chapter 2 of this EIAR. In summary, the BRDA is surrounded by the Perimeter Interceptor Channel (PIC) which collects water emerging from the BRDA (seepage, bleed water, sprinkler water and surface water runoff) and conveys it via pumps either to the Effluent Clarification System (ECS) located in the plant and/or to the Storm Water Pond (SWP) / Liquid Waste Pond (LWP).

Golder Associates has undertaken a hydrological assessment to appraise the capacities of the existing water management structures, to inform the feasibility level design of the proposed BRDA Raise Development constructed to Stage 16.

Arising from this assessment, a number of improvements to the water management system for the proposed BRDA development will be implemented to allow for the existing water management system to accommodate an Inflow Design Flood (IDF) of a greater return period, in accordance with Canadian Dam Association (CDA) guidelines. At present the IDF allows for a 1 in 200 year flood event; the proposed modifications will allow for a revised IDF which will be 1/3 between the 1,000-year and the probable maximum flood (PMF)[4] event.

Proposed modifications to the water management system are outlined in full within Section 7.8.2 of the Engineering Design Report enclosed in Appendix A of this EIAR. In summary, these upgrades will consist of modifications to existing perimeter interceptor channels (PICs), construction of additional PICs, alterations to culverts, increased crest elevations on PICs, installation of a pump and overflow culverts, alterations to discharge points and upgrades to pump arrangements.

Further details in relation to hydrology and the proposed development including details of the hydrological assessment undertaken by Golder Associates can be found in Chapter 10 of this EIAR.

In addition to the above, the existing sprinkler system network installed to manage the surface of the BRDA will be extended to serve the raised BRDA. As is currently the case, this revised system will use treated BRDA run-off water which will be distributed to separate sprinkler rows each with fixed point sprinkler heads. As outlined in further detail within Chapter 11 of this EIAR, this system minimises dust generation across the BRDA.

[4] The PMF is the most extreme meteorological event, among extreme events, corresponding to a theoretical maximum flood with an undefined return period (i.e., greater than 1 in 10,000 years). The methods for estimating the PMF include accounting for climate change (WMO 2009) and no additional factors are required to be applied to the PMF or the IDF (which is derived from the PMF).

3.3.5 Landscaping and Restoration of the BRDA

As the bauxite residue is deposited and the stages are raised, it is intended that the side slopes and terraces of the BRDA will be progressively restored. This progressive restoration will consist of the installation of a permeable rock filter layer and the deposition of subsoil and topsoil to provide general cover. This subsoil and topsoil deposition will also consist of localised building up and profiling of BRDA stage raises to provide pockets of more organic terrain to mitigate the linear character of the underlying rock stages.

The final restoration will include the completion of the proposed side slope restoration planting scheme and the implementation of grassland and planting on the BRDA dome. Upon final restoration, the industrial character of the BRDA will be greatly reduced and the subject site will integrate sensitively into the surrounding green pastoral landscape.

Further details regarding the proposed landscaping and restoration of the BRDA can be found in Chapter 9 of this EIAR.

3.4 Proposed Works to Salt Cake Disposal Cell (SCDC)

As noted in Chapter 2 of this EIAR, salt cake consists of the organic degradation products from naturally occurring humates in the bauxite, including sodium hydroxide, aluminium oxide, sodium carbonate, sodium sulphate and sodium oxalate.

As salt cake is classified as hazardous according to the European Waste Catalogue, it is therefore deposited within a specially engineered composite lined cell (Salt Cake Disposal Cell, "SCDC") within the BRDA.

As noted in Chapter 2, a Wet Air Oxidation (WAO) System has been developed to avoid the production of salt cake from the bauxite refinery process. A detailed project schedule has been developed with commissioning to be completed in the first half of 2023. In the interim and during periods of maintenance necessitating the down time of the WAO system, an extension to the SCDC is proposed as part of this application to provide headroom disposal.

The total current volume of the SCDC is estimated to be 72,800m^3 at the crest level. The remaining capacity of the SCDC is expected to expire during 2023. The existing crest height of the SCDC is 29.00m OD which ties into the overall height of the permitted BRDA at 32.00m OD. The proposed development comprises the vertical extension of the existing SCDC to a crest height of c. 31.25m OD which will have a maximum overall height of c. 35.50mOD when capped at cell closure. The extension of the SCDC will accommodate disposal for an additional c. 22,500 m^3 of salt cake in total.

The construction of the SCDC extension will be undertaken in one step as opposed to the staged BRDA construction. Approximately 27,000m^3 of processed rock fill material will be required to construct the perimeter wall of the SCDC raise. It is proposed that this rock material will be sourced from the adjoining borrow pit. The composite lining which will be placed inside the raised SCDC will comprise 4,500m^2 of a mixture of geosynthetic materials.

Additional ancillary materials which will be used in the construction of the SCDC include a non-calcareous drainage and gabion rock fill, a decant tower consisting of a high density polyethelene (HDPE) structured wall pipe, a crash barrier, concrete for posts, plinths and paths, and a conveyor belt.

3.4.1 Transportation of Salt Cake

As is currently the case, salt cake will be loaded at the refinery plant with a loading shovel into a dumper truck and transported to the composite lined SCDC by a designated Process Material and Handling Contractor (PMHC). This activity currently occurs approx. 3 days per week, however as the WAO system is commissioned, the frequency of this activity will decrease.

In order to ensure that the risk of potential spillages is ameliorated the transportation process of the salt cake will continue to be closely monitored with all movements logged and recorded. Taking into consideration the geometry and gradient of the route to the SCDC within the BRDA a free board of at least 300mm will continue to be maintained on all sides of the truck and the tailboard will be sealed closed with a hydraulic locking ram to prevent spillages. In the unlikely event of a spillage occurring during transportation the PMHC must immediately cordon off the area and recover the spillage by scraping the road surface with mechanical plant and removing the material in a sealed truck to the SCDC.

3.4.2 Deposition of Salt Cake within the SCDC

Once transported to the SCDC, the salt cake will be tipped by a dumper truck into the cell. This operation is carried out by the driver reversing the dumper truck onto a stop-end steel tipping plate (see Figure 3.4 below). Once the vehicle has reversed to the stop-end the driver raises the tipper body and empties the contents of the truck in to the designated cell. Once the dumper truck has tipped all of its content the tipper body is lowered and the tailboard sealed shut before returning to the refinery plant for loading or final washing. Three tipping plates are located on the west side of the SCDC to avoid salt cake build up, a long reach excavator operated by the designated BRDA Contractor pushes the salt cake in to the cell following tipping in order to keep the tipping plates clear.

As protection to the SCDC lining system along the tipping edge, tyres are positioned over a protection geotextile for the footprint of the three tipping areas. The tyres are tied together with a continuous length of nylon rope. In addition, re-used conveyor belts are deployed over the tyres giving extra protection at the designated tipping locations. Materials used are not impacted by the waste material itself.

A sprinkler ring main is currently placed around the perimeter of the SCDC. This sprinkler system will be maintained within the expanded SCDC which is proposed as part of this application and is purely a precautionary measure for dust suppression, despite the high moisture content of the salt cake. Further detail regarding dust suppression measures in the SCDC is contained in Chapter 11 of this EIAR.

When rain water or sprinkler system water comes in contact with salt cake, leachate is generated which is contained within the cell and is collected in a decant chamber (Volume capacity of 8.6m^3) within the SCDC. The leachate is then transferred by an enclosed pipeline to a holding Tank (Volume capacity of 28m^3) From here the leachate is pumped back to the plant via enclosed pipeline as a caustic recovery stream.

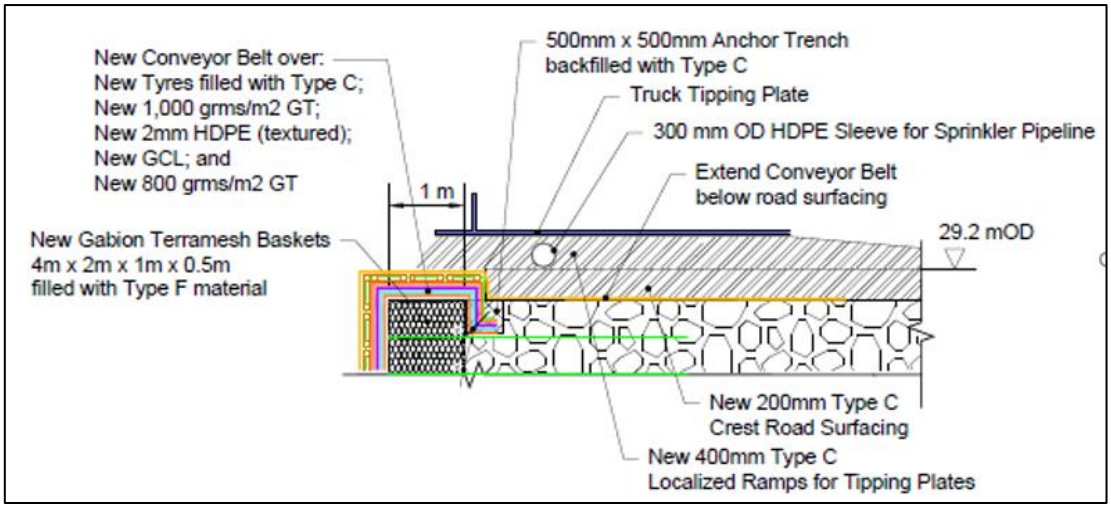

Figure 3.4: Typical Tipping Plate Section at SCDC (Source: AAL, 2021).

3.4.3 Cleaning of Equipment

As is currently the case, all equipment will be cleaned each day following task completion. The loading shovel and dumper truck will be washed at three designated hosing points which are located within a contained area beside the refinery plant. All washings will be collected in a collection sump and returned to the process preventing any contamination to ground.

Following contact with salt cake the long reach excavator located within the BRDA will be washed with a mobile water bowser, the excavator arm and bucket will be suspended over the designated salt cake and cleaned with the pressure washer from the tank, all washing will therefore be contained within the SCDC.

3.4.4 Closure Plan

A specific capping containment design, appropriate for the capping of a hazardous waste material, is proposed for the SCDC Raise which is in accordance with the EPA approved design for the current SCDC (Golder Associates, 2017B).

The proposed capping containment design takes into account Condition 8.5.21 of the licence (IEL P0035-07) requiring the final 1m of all exposed bauxite residue deposited in Phases 1 and 2 of the BRDA shall comprise 'amended mud' and the on-going 'amended' layer trials at Aughinish.

The final 1m depth of all exposed bauxite residue is required to comprise 'amended mud' or the 'amended layer'. As outlined in Section 8.2 of the Engineering Design Report, contained in Appendix A, large scale trials were carried out on the wide Stage 5 bench on the north and west sides of the Phase 1 BRDA. These trials determined that the current specification for the amended layer meet the following requirements:

- Farmed or carbonated bauxite residue that has a pH < 11.5.
- Addition of washed process sand at rate of 1,250 m3 / hectare / 0.5m depth layer and mixed thoroughly using a spader.
- Addition of gypsum at a rate of 90 tonnes / hectare / 0.5m depth layer and mixed thoroughly using a spader.
- Addition of approved organic soil improver / compost at a rate of 550 tonnes / hectare / 0.5m depth layer and mixed thoroughly using a spader.

- Rotovation of the top surface prior to grass seeding.

The proposed SCDC Raise dome blends into the overall BRDA dome at Stage 16. Further detail regarding the closure plan can be found in the Engineering Design Report prepared by Golder Associates and enclosed in Appendix A of this EIAR.

3.5 Proposed Borrow Pit Extension

As outlined in Chapter 2 of this EIAR, a borrow pit is located at the north east of the application site with an extraction area measuring c.4.5ha in size. This borrow pit is permitted under LCCC Reg. Ref. 17/714; ABP Ref. 301011-18 and serves the construction and operation of the BRDA by providing processed rock which is required to cover and build up the stage raises as residue is deposited.

The current borrow pit area has a permitted depth of c.8.5m OD and is expected to provide 374,000 m^3 of rock fill material which is considered to be sufficient to construct the permitted BRDA to Stage 10.

As part of the current application and in order to serve the expanded BRDA volume, it is proposed to extend the existing borrow pit eastwards into the adjoining areas which are currently covered in vegetation. The extended borrow pit extraction area will measure a total of 8.4ha in size, an increase in area of 3.9ha. This expansion will provide an additional 380,000m^3 of rock fill material which is needed to satisfy the requirements of the construction and operation of the BRDA.

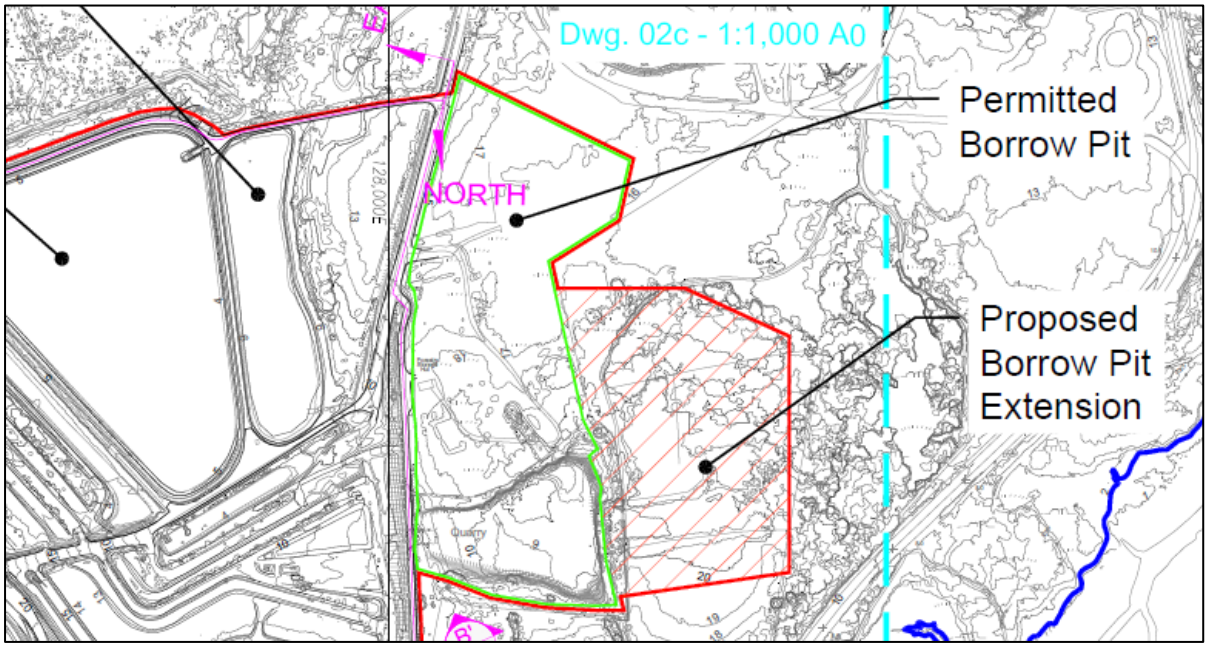

Figure 3.5 Permitted and Proposed Borrow Pit Extension (Source: Golder Associates – Drawing No. 02).

3.5.1 Phasing

It is proposed that the Borrow Pit will be extracted over a number of phases during the lifetime of the development. The Pit will be extracted first in a northern direction, from the existing former Borrow Pit area toward the plant after which the pit will be extracted alternately in an easterly direction. It is expected that the extraction of the Pit will be phased over the lifetime of the adjoining BRDA operations.

3.5.2 Volume Calculations

The volume of material to be extracted from the proposed extension to the Borrow Pit site has been calculated by Golder Associates. The calculations indicate that there is 380,000m^3 of material to be extracted within the proposed extension area. The extended and existing borrow pit will have a depth of 8.5m OD and provide a total of c. 754,000m^3 of rock.

An extraction rate of c.50,000m^3 is expected per annum for the ongoing raising of the BRDA. As such, it is requested that the lifetime of the borrow pit runs in parallel to the lifetime of the proposed BRDA (based on current residue disposal and production rates).

3.5.3 The Quarrying Process

The quarrying process in the extended borrow pit will mirror the permitted processes ongoing at the existing borrow pit. There are three broad stages in this quarrying process:

1) Blasting of rock faces;
2) Crushing and screening of Rock; and
3) Stockpiling of Rockfill.

Each of these steps is summarised below.

3.5.3.1 Blasting of Rock Faces

In order to extract the limestone, the active rock face must be blasted using explosives. The blast charges will be placed at regular intervals with no more than one blast per week. The operational period of the Borrow Pit (blasting, crushing and stockpiling) will be restricted to between April and September each year.

The Applicant will employ specialist blasting contractors to design and carry out each blast in the Borrow Pit. All blasts at the site are subject to a specific design, which is carried out in accordance with the relevant design standards, which establish best practice and safety, and has regard to the built environment.

A site-specific protocol for blasting in cooperation with the blasting contractor and in accordance with current international best practice has been developed as part of the operation of the existing borrow pit and will be amended to apply to the extended borrow pit area. The protocol will consider all activities related to blasting, especially the selection of explosives (including forms such as slurries or emulsions), storage and handling controls, blast design considerations and loading controls.

Details in relation to the blasting on site are provided in the Engineering Design Report, enclosed in Appendix A of this EIAR.

3.5.3.1 Crushing of Rock

Once blasting has occurred, the blasted rock is fed into the mobile primary crusher (by way of a wheel loading shovel), which is located on the Borrow Pit floor. There are two crushing stages, primary crushing and secondary crushing. Each crusher consists of a set of electrically operated rotating drums, which function to reduce the particle size of the rock to a scale that can be easily transported using belt conveyors. The crushing and screening rate is expected to be c. 450 to 550m^3 per day.

3.5.5 Stockpiling of Rock

The crushed rock will be stockpiled to the south of the proposed extraction area (within the existing former Borrow Pit area) using a wheeled loading shovel. The stockpiles rockfill will excavated out and loaded into dumper trucks as required to be deposited on site in the ongoing construction of the BRDA and other associated works within the Applicant's landholding. None of the rock will be transported for use off site.

3.5.6 Borrow Pit Operations

In this regard, the operation of the Borrow Pit will normally take place between 08:00 and 18:00 hours on Monday to Friday. No operations will take place on site on Saturdays, Sundays and Public Holidays.

3.5.7 Borrow Pit Safety and Security Infrastructure

In order to ensure that access to the borrow pit is restricted for safety and security reasons fences and landscaping berms will be located and regularly maintained along all boundaries of the extended borrow pit area, thereby discouraging inadvertent access to the Borrow Pit.

3.5.8 Borrow Pit Landscaping and Restoration Plan

A restoration landscaping proposal was prepared by Brady Shipman Martin Landscape Architects (BSM) for the original Borrow Pit development which comprised a combination of natural regeneration of vegetation with additional hedge and tree planting.

BSM have updated the restoration landscaping proposal to encompass the enlarged footprint provided by Borrow Pit Extension and the drawing and details are provided in Chapter 9.0 of the EIAR.

3.6 Works at Existing Stockpile Area

Existing rockfill stockpiles area are located at the southeast of the application site. This area is accessed via a security gate in the perimeter fencing. These rockfill stockpiles will be depleted for BRDA Stage raising. This area also has existing stockpiles of soil which are used in the progressive restoration of the adjoining BRDA. As part of the subject application, it is proposed to continue the use of the soil from this area to satisfy the additional restoration requirements of the extended BRDA.

3.7 Site Access and Access Road

The proposed development including the borrow pit and BRDA area will be accessed via the existing access arrangements. Access to the proposed development will thus be provided from the L1234 Aughinish Road to the south east of the application site which links to the N69. The Borrow Pit itself can only be accessed via the internal road system with the Applicant's landholding.

The extracted rock will not be transported outside of the Applicant's landholding and will be used solely for construction projects within the applicant's landholding. The haul route associated with the proposed development will relate to trucks exiting the application site and turning left (south) and joining the one-way internal haul route which runs around the perimeter of the BRDA.

Vehicles exiting the AAL facility (from the application site) shall make use of the existing wheel wash facilities within the plant area.

Similarly, access to the BRDA area will be possible through the existing internal road system on the wider AAL facility. Further detail regarding the proposed traffic arrangements on site can be found in Chapter 14 of this EIAR.

4.0 EXAMINATION OF ALTERNATIVES

4.1 Introduction

The EIA Directive 2011/92/EU as amended by Directive 2014/52/EU requires an EIAR to contain:

> *'A description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studies by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for electing the chosen option, including a comparison of the environmental effects.'*

The EPA's 2017 draft Guidelines further state:

> *'The objective is for the developer to present a representative range of the practicable alternatives considered. The alternatives should be described with 'an indication of the main reasons for selecting the chosen option'. It is generally sufficient to provide a broad description of each main alternative and the key issues associated with each, showing how environmental considerations were taken into account deciding on the selected option. A detailed assessment (or mini – EIA) of each alternative is not required'.*

Arising from the above policy context, an examination of alternatives formed a central feature of the EIAR process.

4.2 Main Alternatives Studied

4.2.1 Alternative Locations and Designs

The Applicant has already provided significant capital investment in the operation of the alumina refinery facility at Aughinish Island. The location of the BRDA and SCDC at the south-west of the facility minimises transit requirements of residue and therefore maximises the efficiency of the overall operation. Given the existing infrastructure in place and the advantages of locating storage capacity adjacent to the refinery facility, an alternative location removed from the AAL landholding was considered to be inappropriate and unfeasible given the large capital investments it would require. As such, the primary design researched was whether additional BRDA and SCDC storage volume could be accommodated in the lands surrounding the AAL refinery facility.

A horizontal expansion of the existing BRDA and the development of a new BRDA area (including a new SCDC) on the overall AAL landholding were considered. Such a horizontal expansion would necessitate additional infrastructure to be constructed rather than the utilisation of existing infrastructure in the case of a vertical expansion. As it was determined in this instance that it would also be feasible to provide additional disposal capacity by means of a vertical expansion, this was considered to be a preferable design option. Further detail in relation to the feasibility of the vertical expansion design can be found in the Engineering Design Report appended to this EIAR.

The chosen design of the proposed development facilitates the expansion of the existing BRDA and SCDC storage capacity whilst also ensuring that the existing footprint of the BRDA and SCDC remains the same and that existing infrastructure is fully utilised. It also ensures that disposal capacity is delivered in a location directly adjoining the alumina refinery facility and thus negates the need for more distant transport movements away from the AAL landholding.

The proposed development will increase the height of the existing BRDA, however and as demonstrated within this EIAR, this will not result in any significant negative impacts. It should further be noted that the visual impact of the increased BRDA and SCDC height has been fully assessed in Chapter 9 of this EIAR which concludes that no significant negative effects will arise resulting from the proposed development.

With regard to the proposed extension to the existing borrow pit area, alternative sources of rock fill were considered. Such sources could potentially have been secured from quarries in the area such as the nearby Roadstone Quarry at Barrigone located approx. 2.5km from the subject site. However, the expansion of the permitted borrow pit (due to be in operation in April 2022) was considered more beneficial given that it would minimise impacts on the surrounding traffic network and also minimise dust / noise impacts arising from traffic movements to and from surrounding quarries and provide future security of supply from within the site.

4.2.2 Alternative Bauxite Residue and Salt Cake Management Methods

Bauxite Residue

Given that bauxite residue is the principal waste by-product of the Alumina refinery process, extensive research has been and is being undertaken in respect of its management with a view to minimising the volume required to be disposed of.

The alumina refinery industry as a whole continues to search with growing interest and success, for technically and economically viable options for residue critical element extraction and residue bulk utilisation, with the overall objective of producing less residue and contributing more to the circular economy. Innovative residue treatments can change residue properties, potentially allowing different long-term storage, rehabilitation and utilisation options.

However, it should be noted that bauxite residue management is not “one-size fits all” and technology selection and management practices have to be adapted to local circumstances. The solutions and practices used at each refinery are further influenced by local climatic, geographic and environmental conditions, as well as government policies, regulatory frameworks and community factors.

In this regard, AAL have, since 2015, been involved in research and developing technological options for bauxite residue reuse at the Aughinish facility, in collaboration with industry partners, European Universities and Research Institutes. Examples of these research projects include Al Geopolymer, Al Source, RECOVER, RemovAl, and ReActiv.

The Al Geopolymer project carried out by the University of Limerick for the EPA, involved a desk-based study focused on a state-of-the-art review related to geopolymers, including a technology overview. The objective of the research was to investigate the potential for wastes at the AAL facility (bauxite residues, etc.) to be used in geopolymer applications and the opportunities for these geopolymer applications within Ireland.

The Al Source project carried out by the University of Limerick for the EPA, examined bauxite residue as a potential source for Critical Raw Materials or CRMs, which are fundamental to Europe's economy, growth and jobs and are essential for maintaining and improving our quality of life.

The RECOVER, RemovAl and ReActiv projects are three EU funded projects, which AAL are involved in. These projects study the potential for the re-use of bauxite residue, at a pilot scale, in the construction sector, as an alternative raw material. These projects, as well as potentially finding a use for bauxite residue, aim to enable the construction sector to reduce their CO_2 emissions by utilising secondary raw materials in production. Research in this area is ongoing.

Notwithstanding the ongoing research efforts outlined above and AAL's continued commitment to exploring alternative uses and applications for bauxite residue, there are at present no alternative methods which would eliminate the existence of bauxite residue as a by-product from the alumina refinery process. As such, there is a need to facilitate the storage of bauxite residue. The current BRDA storage arrangement of the bauxite residue represents best practice in the industry and ensures that the bauxite residue is fully secured and risks of spillage or leakage of the residue beyond the BRDA is fully ameliorated.

Salt Cake

With regard to the expansion of the SCDC, ongoing investigations into the alternative treatment of Salt Cake have determined that a Wet Air Oxidation (WAO) System would eliminate the need for Salt Cake storage within the SCDC. Arising from this, a project schedule relating to the installation of this system has been developed with commissioning to be completed in 2023.

A description of this process is contained within Chapter 2 of this EIAR. There are no additional environmental emissions associated with this process and it is fully compliant with all relevant EU 'Best Available Technique'. The EPA have approved the operation of the process under Condition 1 of AAL's existing IE Licence. It is anticipated that this process will be integrated into the Plant in 2023. Until such time, the current SCDC is required to provide Salt Cake disposal capacity. The proposed SCDC extension will also facilitate salt cake disposal during periods of maintenance necessitating the down-time of the WAO system.

4.2.3 Borrow Pit Extension

The preliminary design of the borrow pit extension provided for a larger extraction area of c. 4.5ha which projected further to the south of that now proposed. In the preparation of the EIAR, a recorded monument (LI010-108; Enclosure; Chapter 5 refers) which may have been intersected by the application boundary was identified. Associated with this, it was also calculated that the rockfill requirements for construction of the proposed development were less than previously anticipated (due to the ongoing importation of rockfill from a local quarry up to and including Quarter 1 of 2022 and the existing stockpile of rock on site).

The revised design of the borrow pit extension area now ensures that there is a set-back from the boundary of the recorded monument to ensure there is no direct impact on this enclosure. Section 5.4 states that *'The recorded enclosure (LI010-108) possesses no surface expression; however, the proximity of the development will result in a slight negative indirect impact on the setting of the monument.'*

4.2.4 "Do Nothing" Alternative

In the event that AAL do not expand the capacity of the existing BRDA and SCDC, with the associated borrow pit extension, the wider alumina refinery facility would cease operations in c.2030 based on current production levels. Bauxite residue deposition would cease at the subject site and the restoration plan (permitted under ABP Ref. PL13.217976; LCC Reg. Ref. 05/1836) would be implemented. The closure of the facility at Aughinish would result in a significant loss in highly skilled employment opportunities in the wider area and result in the loss of one of the state's major industrial manufacturing facilities. This would have a significant negative impact on the local economy and also negatively impact on the diversification of the state's economic base.

Given the existing and forecast high levels of demand for alumina worldwide, particularly in the production of renewable energy technologies, additional alumina production capacity will likely be delivered at existing alternative alumina refinery facilities worldwide. The Aughinish facility operates in compliance with stringent environmental regulations and continued monitoring by the EPA.

The Aughinish facility thus represents the highest standards in excellence in alumina production. This is demonstrated by the findings of the Commodity Research Unit (CRU) which ranks the AAL facility within the top 10% of alumina refineries globally with respect to minimising carbon emissions. Furthermore, the AAL refinery is recognised as the most efficient high temperature refinery globally.

The expansion of existing facilities or the development of new facilities to replace the alumina refining capacity required in the event of the potential future closure of the Aughinish facility in locations (principally in Asia) where less stringent environmental protections and regulations exist, would likely result in an overall increase in emissions and wastes.

The replacement production of alumina to compensate for the loss of production capacity at Aughinish may be satisfied by the development of a new alumina refinery facility on a greenfield site. This would be a complex undertaking requiring significant capital investment. As stated above, there is also no guarantee that such a development would be subject to the stringent environmental protection measures which are in place at Aughinish. As such, pollutant emissions and wastes from the production of the displaced alumina produced at Aughinish are likely to rise in a 'do nothing' scenario where the development of a greenfield site is progressed. It is certain the amount of bauxite residue would not reduce as an alumina refinery on a greenfield site would still be dependent on bauxite as an ore.

Given the fact that best available techniques are currently employed at the Aughinish facility to minimise pollutant emissions and wastes at all times, replacement alumina production at alternative facilities will not therefore result in any environmental benefits overall. Indeed, it is likely that replacement production at alternative facilities which operate in less stringent environmental protection contexts will result in negative long-term environmental impacts.

In addition, and as stated above, a 'do nothing' scenario will also adversely impact on both the local economy of Limerick and also the economic diversification of the state.

With regard to the proposed extension to the Borrow Pit area, in a 'do nothing' scenario this development would no longer be required resulting in a positive environmental impact as the existing landform would remain in place. However, it should be noted that the extension of the proposed borrow pit is assessed fully in this EIAR and no significant negative impacts are identified.

4.3 Conclusion

The location and design of the proposed development represents the most appropriate option to ensure the ongoing operation of the alumina refinery facility adjoining the application site. The

proposed development will ensure that high levels of demand for alumina for use in products such as renewable energy technologies is secured and satisfied within Europe into the future beyond 2030.

5.0 ARCHAEOLOGY

5.1 Receiving Environment

The planning application site is located within the townlands of Aughinish West, Aughinish East, Island Macteige, Glenbane West and Fawnamore south of the River Shannon. There are 19 archaeological sites within the planning application site and the study area, ten of which are recorded monuments. Of the archaeological sites, the most significant is enclosure LI010-108, immediately south of the north-eastern section of the planning application site. Enclosure LI010-014 within the planning application site has previously been proven to be non-archaeological in origin (licence 96E0168, Bennett 1996:232), but has not yet been delisted or reclassified within the current record as being non-archaeological. The nine Site and Monuments Sites represent features which have been excavated and recorded within the planning application site and the study area as part of previous archaeological works.

There are no recorded structures of built heritage merit located within 500m of the site. There are also no features or sites of specific cultural heritage identified within the planning application site and study area. The townland boundaries that once traversed the western section of the planning application site have been removed as part of previous approved industrial development works. In the wider region, the use of the River Shannon as a means of enabling industry is evident from the mid-19th century to the modern day.

A geophysical survey carried out as part of this assessment (Licence 21R0086, Leigh 2021) has confirmed the presence of a sub-rectangular enclosure to the immediate south of the north-eastern section of the planning application site (LI010-108). In addition to the enclosure, possible internal features, a possible associated land division boundary and isolated responses which may represent archaeological features, (the latter of which are located within the planning application site) have been identified.

5.2 Description of Potential Impacts

Recorded enclosure site (LI010-108), is located outside of the proposed development boundary. As a result, there is no predicted direct impact on the recorded monument. However, the geophysical survey (Licence 21R0086, Leigh 2021) identified isolated anomalies to the north of the enclosure and within the planning application site. It is possible that these anomalies represent small-scale archaeological features. There is also potential for previously unidentified archaeological features of deposits to survive within the planning application site, which were not indicated in the geophysical survey. Groundworks associated with the proposed development (prior to the application of mitigation) may have a direct significant negative impact on the archaeological features or deposits, if they survive. The recorded enclosure (LI010-108) possesses no surface expression; however, the proximity of the development will result in a slight negative indirect impact on the setting of the monument.

5.3 Mitigation Measures

A programme of targeted archaeological test-trenching will be carried out within the north-eastern, previously undisturbed, section of the planning application site. These works will be carried out under

licence to the National Monuments Service. If any features of archaeological potential are discovered during the course of the works further archaeological mitigation may be required, such as preservation in-situ or by record and/or monitoring. Any further mitigation will require approval from the National Monuments Service of the Department of Housing, Local Government and Heritage. The record (both geophysical survey and photographic) presented within this assessment is considered to be an appropriate record of the current setting and extent of recorded enclosure LI010- 108.

5.4 Conclusion

No impacts upon the architectural or cultural heritage resource have been identified in relation to proposed development. The western and south-eastern sections of the planning application site have been fully resolved of archaeology and subsequently developed as part of an industrial complex. No potential impacts on the archaeological, architectural or cultural heritage resource have been identified within these areas.

Following the implementation of the above mitigation measures, no significant residual impacts are predicted upon the archaeological, architectural or cultural heritage resource.

6.0 BIODIVERSITY

6.1 Introduction

The Biodiversity Chapter of the EIAR provides an evaluation of the potential impacts on the existing ecology arising from the proposed development. The assessment considers the potential impacts of the proposed development on the local flora, habitats and fauna.

6.2 Receiving Environment

A team of specialist ecologists carried out extensive surveys at the Aughinish site and surrounding lands. These surveys recorded the fauna, flora and habitats that are present in the receiving environment. Walkover surveys for mammals and birds were supplemented by deployment of multiple passive recording detectors and trail cameras.

The BRDA surface is farmed bauxite residue (ED5/ED2) with no vegetative cover. The BRDA surface is of negligible ecological value. There are no areas of Annex I habitat located within the overall application site boundary. No botanical species protected under the Flora (Protection) Order (1999), listed in the EU Habitats Directive (92/43/EEC), or listed in the Irish Red Data Books are present within the application site boundary. No Third Schedule Invasive Plant Species are present within the application site. Habitats represented include Dry meadow and Grassy Verges (GS2) and Scrub (WS1). There are habitats of importance in the wider receiving environment, including areas of Annex I grassland within the AAL land holding and the estuarine habitats of importance for a wide range of species.

Areas within the development site were not found to be important for waterbirds such as the special conservation interest species of the nearby SPA. The terrestrial farmland and scrub habitats had a typical farmland/woodland edge bird community. The nearby estuaries including Poulaweala Creek, Robertstown Estuary and the River Shannon Estuary are all important sites for wintering bird species. No breeding or resting places of rare or protected mammal species were recorded within the proposed development site. Both Badger and Otter were recorded in the wider area. A diverse bat community is present on Aughinish Island, associated particularly with the woodland and nature trails

that have been established as part of the plant operation. No bat roosts were present within the proposed development site. Marsh Fritillary was not recorded in the vicinity of the proposed development during the walkover surveys from 2019-2021.

6.3 Description of Potential Impacts

The Biodiversity assessment considered the potential for direct and indirect impacts upon sensitive habitats and species. The whole lifetime of the development including the closure and post-closure phases were considered. In the operational phase the extended borrow pit will operate under very similar environmental commitments to the permitted borrow pit. This will see the blasting restricted to outside the overwintering period for birds. This will effectively minimise the risk of disturbance and displacement impacts on protected waterbird species for which the SPA is designated. Extraction works and material handling at the borrow pit will take place during the hours of daylight, minimising disturbances to roosting birds and mammals and birds active in the nocturnal/crepuscular period. A Marine Mammal Risk Assessment concluded that there was no risk of death, injury or disturbance to any marine mammal individuals as a result of the operation of the borrow pit at this location.

The proposed development is to occur within an area which is heavily modified and industrialised, and disturbed by human activities. The overall AAL facility is subject to strict emission limits, as set out in the EPA IEL conditions. It is required to produce regular detailed environmental monitoring reports. The proposed development will facilitate an extension of life of the overall AAL facility and therefore increase the period during which there will be high-levels of anthropogenic activity in the area and also the duration for which there will be emissions associated with the operation of the plant. The nature of the activities in the processing area will be essentially unchanged but the increase in storage capacity in the BRDA will extend the lifetime of the overall facility. The accumulated scientific information of the receiving environment over the lifetime of the AAL facility to date provides a considerable amount of information on the local environment. A Conceptual Site Model (CSM) was prepared to assess whether there was potential for bioaccumulation in the sensitive marine environment as a result of the emissions from the plant, particularly over the extended period that the proposed development would allow. The model considered the available scientific evidence and the fundamental source-pathway-receptor model to evaluate the potential pathways that could connect activities at the plant and the immediate marine and terrestrial environments. These data indicated that there is no pathway from the AAL activity producing a negative impact on the invertebrate prey species of higher faunal organisms, including for instance intertidal feeding birds in the SPA designated habitat.

6.4 Mitigation

Detailed mitigation measures have been provided and assessed as part of the EIAR. In relation to Biodiversity, AAL has recently implemented a formal Biodiversity Management Plan for their lands and were also successful in being granted permission to develop a new Nature Trail Amenity on the island. Mitigation specific to the proposed project includes a commitment to carry out vegetation clearance only outside of the bird breeding season. Lighting has been minimised and where necessary has been specified in keeping with the current guidance on Bat friendly lighting design. The progressive restoration and closure plan has integrated pollinator friendly and preference for native species.

6.5 Potential Impacts on European Conservation 'Natura 2000' sites

The potential impacts of the proposed development on European Conservation 'Natura 2000' sites in the surrounding area is considered in detail in the Natura Impact Statement which accompanies the planning application. The site is not located within any Natura 2000 site but is located proximate to

several designated conservation areas which are considered within the zone of influence of the proposed development (i.e. indirect hydrological impact and ex-situ disturbance impacts).

6.6 Conclusion

With the implementation of the environmental controls and mitigation described in the EIAR it is concluded that the residual impacts on habitats, birds, mammals (including bats) and other fauna will be at most slight neutral in the medium to longer term. In the longer term the landscaping and other mitigation (including the creation of grassland with hedgerows on the capped BRDA) are likely to see a moderate to significant positive effect on local biodiversity, particularly in the BRDA area. Similarly, the NIS which accompanies the EIAR has objectively concluded that the proposed project will not adversely affect the integrity of any Natura 2000 site, and there is no reasonable scientific doubt in relation to this conclusion.

7.0 POPULATION, HUMAN HEALTH & AGRICULTURE

7.1 Introduction

The chapter is separated into three sections dealing with population, human health and agriculture and animal health.

7.2 Population – Key Factors and Likely Impacts

The baseline situation and trends of the following key factors were established in the first instance.

- Population
- Employment
- Economy
- Services and Amenities

In order to inform this assessment, a Socio-Economic Impact Statement was undertaken by KPMG Consultants in respect of the current AAL facility and the potential future impact of the continuation of the AAL facility. The Socio-Economic Impact Statement is included in Appendix 7.1 of the EIAR.

The likely impacts on these factors in a 'do nothing' and 'do something' scenario were subsequently described.

7.2.1 POPULATION

Do Nothing Scenario
In the absence of the proposed development, the alumina refinery facility would continue to operate at existing levels until c.2030 when the capacity of the permitted BRDA would be reached. In the longer term however, the facility would have to close as there would be no disposal area available to accommodate the bauxite residue deposits arising from the production process.

The closure of the facility would reduce the number of people employed in the area and employment prospects generally in the wider area, thereby decreasing the attractiveness of the area to potential new residents and also to existing residents who may be forced to relocate in order to find employment. The closure of the facility is thus likely to have a negative impact on population trends in the wider area.

Do Something Scenario
Were the proposed development to proceed, it would facilitate the ongoing operation of the wider refinery facility beyond 2030. Thus, the current significant levels of employment provided by the facility would be maintained into the longer term. This would likely ensure that current population trends would remain stable and continue to increase as a secure source of employment would remain in the locality attracting residents to the wider area.

7.2.2 Employment

Do Nothing Scenario
Were the development not to proceed, the BRDA would reach full capacity in c.2030 and the adjoining refinery facility would be forced to close as there would no longer be an area in which bauxite residue could be deposited. As such, whilst there would be minimal short-term impacts on employment as the facility continued to operate, there would be significant loss of employment in the wider area in the longer term.

Given the specialist nature of the facility and the large numbers employed, it is likely that replacement employment would be difficult to attain in the local area. As such, it is likely that there would be significant negative impacts on employment in a 'do nothing' scenario.

Do Something Scenario
The proposed development would facilitate the ongoing operation of the existing refinery facility and would thus ensure that the existing high levels of employment at the site were maintained. The continuation of the current high employment levels would represent a significant positive impact on employment figures in the area in the longer term.

7.2.3 Economy

Do Nothing Scenario
As noted above, the facility would be required to close in a 'do nothing' scenario. This would result in a large loss of employment and investment for the wider area and would thus have a significant direct negative impact on the economy of the wider area.

Indirectly, the loss of employment, wages and investment resulting from the closure of the facility would negatively impact upon businesses in the area which rely upon workers at the facility to purchase their goods and services.

Do Something Scenario
The progression of the proposed development would facilitate the ongoing operation of the facility into the longer term. It would thus secure investment and employment in the area and ensure that businesses in the area continued to indirectly benefit from the spending of well-paid workers at the facility. The proposed development would thus have a significant positive impact on the economy of the wider area.

7.2.4 Services and Amenities

Do Nothing Scenario
In a 'do nothing' scenario, there would be a significant loss of employment and investment in the wider area. This would have a significant negative impact on business owners in the area who are reliant on the custom of well-paid employees hired at the facility and who also rely on the custom of

the facility itself for sub-contracting work. The loss of this customer base would have a significant negative impact on local businesses in Askeaton and Foynes and may result in some service and goods providers having to close as a result.

Do Something Scenario
In a 'do something' scenario, the facility would continue to operate, employment levels would remain strong and investment would continue to be directed into the wider area. This would ensure that there would continue to be a large pool of well-paid persons in the wider area with incomes to spend on services and goods in the locality. This would result in a significant positive impact on the provision of services in the wider area.

7.2.5 Population - Additional Considerations

In addition to the above factors, the potential for other factors including landscape & visual impact and traffic & transportation to have interaction impacts on population are also acknowledged. Based upon the expert assessments undertaken in respect of each of these factors within chapters 9 and 14, respectively, it is concluded that the proposed development will not result in significant impacts for the surrounding population in traffic terms or in terms of landscape and visual impact.

It is further noted that a safety management system currently operates successfully at the AAL facility and that an External Emergency Plan for the BRDA is in place. As a result of these measures, no residual health and safety concerns are anticipated.

7.3 HUMAN HEALTH

This section addresses the likely significant direct and indirect effects of the proposed development on human health. A separate "Human Health Assessment for Bauxite Residue and Salt Cake" has been prepared by Theresa Rapaso-Subang, Senior Technical Lead, Toxicology and Risk Assessment, WSP Canada Inc. (WSP) and a copy of that Human Health Assessment is appended to this Chapter as Appendix 7.3.

The Human Health Assessment (HHA) prepared by WSP evaluated the toxicity of bauxite residue and salt cake by-products, assessed the source-pathway-receptor linkage to understand causal relationship between predicted exposures and bauxite residues / salt cake, as well as characterized health risks, if any, of nearby human populations with potential exposures released from the Project. The conclusions of the Human Health Assessment have been incorporated into this Chapter in the EIAR (Chapter 7).

7.3.1 Receiving Environment

The identified study area for the HHA is a 10km square area which is centred on the proposed development site. The human receptors evaluated in the HHA were identified on land uses within the project study area. The human receptors associated with the identified land uses are intended to be inclusive of human populations including sensitive subpopulations such as children and residents. As such, the following human receptors were identified within the Project Study Area in the HHA:

- **Schools** – Scoil Naisiunta Sheanain, a primary school with approximately 90 students, is the closest school located 1.9 km to the west of the BRDA. The HHA evaluated children, aged 5 to 13 years old, who are attending this school for a typical nine-hour day (including before and after school programs), five days per week, for 10 months (i.e., school year);

- **Workers** – Workers are considered to be adult teachers who work at the Scoil Naisiunta Sheanain primary school for a typical nine-hour work shift, five days per week, for 48 weeks of the year (i.e., assuming 4 weeks of vacation per year); and
- **Residential Community** –individuals who live in the residential communities near the Project. As was noted earlier, there are no residential receptors in the vicinity of the proposed development with the nearest receptor being over 900 metres away.

The HHA appended to the EIAR also characterises the health of the existing community in the vicinity of AAL by reference to County and National Level health studies and assessments (see Section 4.2.1 of the HHA – Appendix 7.3).

7.3.2 Assessment of Impacts

The likely potential pathways for human health impacts from the construction and operation of the BRDA are:

- Dust generation and transmission through the air
- Noise and Vibration
- Impacts on the Water Environment

The likely receptors are:

- Residents of nearby properties - Dust and Heavy Metal
- Residents of nearby properties - Noise and Vibration
- Water Environment Impacts – no water abstraction point exists down-river of the AAL site, and groundwater beneath or in the immediate vicinity of the site is not used for drinking water purposes. As presented in Chapter 10 of this EIAR (the Hydrology and Hydrogeology Chapter the groundwater aquifer underneath the BRDA does not flow towards the farms or residences located inland of the Aughinish site.

Air Quality

The Air Quality Chapter of the EIAR concluded that the likelihood of effects from PM_{10}/$PM_{2.5}$ emissions, dust deposition and heavy metals emissions, from the operation of the BRDA raise, salt cake cell raise and borrow pit, after mitigation is applied, are low and are summarised as quality: negative, significance: slight and duration: long term. Having regard to the mitigation measures outlined in Chapter 11 Air Quality, the risk to human health is considered negligible and no additional mitigation measures are required over and above those listed in Chapter 11.

Noise and Vibration

The sensitivity of the human residential receptors to noise and air quality impacts is considered high, however based on the assessment set out in Chapter 12 of the EIAR it can be concluded that as the magnitude of the noise impacts from the proposed development is negligible. Having regard to the mitigation measures outlined in Chapter 12 Noise, the risk to human health is considered negligible and no additional mitigation measures are required over and above those listed in Chapter 12.

Water Environment

With regard to impacts on the water environment it is concluded in Chapter 10 of the EIAR that the potential pathways for water-runoff from the BRDA to interact with groundwater or surface water are

intercepted by appropriate barrier and drainage systems to intercept any run-off, subject it to treatment and prevent it from entering groundwater or surface water. There are no licensed discharges to surface water or groundwater from the BRDA. Given the Proposed Borrow Pit's design the predicted impact on groundwater flows and levels is considered to be negligible (adverse).

The nearest mapped water borehole is located over 1.7 km from the Proposed Development and the area is known to have mains water supplies. With the Proposed Development design measures in place, the predicted magnitude of impact is considered to be negligible (adverse). In this regard, the risk to human health is considered negligible and no additional mitigation measures are required over and above those listed in Chapter 10.

7.3.2.1 Human Health Assessment

As noted in Section 7.5 above, a "Human Health Assessment for Bauxite Residue and Salt Cake" has been prepared by Theresa Rapaso-Subang, WSP. A copy of this report is provided as an appendix to Chapter 7 of the EIAR. The HHA Executive Summary states:

> *'Based on the findings of this HHA based on the use of maximum predicted exposure concentrations of PM10 and PM2.5, and in combination with the use of overly conservative exposure assumptions applied in the risk analysis, bauxite residue and salt cake do not pose a health concern to human receptors in the nearby primary school and nearby residences.'*

7.3.3 Mitigation Measures

Mitigation measures to control dust are presented in the EIAR Air Quality Chapter 11. Mitigation measures to control noise, vibration and blasting are presented in EIAR Chapter 12. Mitigation measures to manage impacts to groundwater and surface water are presented in EIAR Chapter 10. No additional mitigation measures are required over and above these to protect human health.

7.4 AGRICULTURE AND ANIMAL HEALTH

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A consideration of the potential significant effects of the proposed development on agricultural activities and animal health was conducted by Dr Vivian Gath, B.Sc, MVB, PhD, Herd Health and Animal Husbandry, School of Veterinary Medicine UCD and Prof. Kevin McDonnell, B.Agr.Sc, M.Eng.Sc, PhD, Ag Systems Technology, School of Agriculture & Food Science and School of Biosystems & Food Engineering, UCD.

7.4.1 Receiving Environment

The assessment considered the existing baseline of agricultural resources and the agricultural environment in the area, drawing upon relevant agricultural census data and taking account of the different land uses, soil types, agricultural practices and farm locations in the vicinity of the Proposed Development. The assessment considered the potential for impacts such as loss of agricultural land and the potential for any noise, dust, odour and discharges associated with the proposed development to reach and to impact adversely on agricultural resources, in particular farm animals.

The area of the proposed borrow pit extension has been used in the past as an occasional hay meadow for a local farmer when the weather allows for a crop of hay to be made. As extraction activity proceeds within the borrow pit extension area, the availability of this land as an occasional hay

meadow will correspondingly decrease. There will be no other loss of agricultural land. The extension to the BRDA and to the SCDC is located within the footprint of the existing BRDA.

7.4.2 Assessment of Impacts

It is considered that there will be no effects on agriculture or on animal health arising from noise emissions. The noise generated from borrow pit activities, as assessed in the Noise Chapter of this EIAR, will not be significant in relation to agriculture and animal health having regard to the distance to the nearest agricultural receptors and, as regards blasting specifically, having regard to the fact that blasting will be limited to April to September and will be of a limited duration. The level of noise generated by the proposed BRDA activity would not be significantly different than existing noise levels generated from current BRDA activities.

It is considered that dust emissions arising from the Proposed Development are unlikely to have any significant effect on animal health or agricultural practices, having regard to BRDA dust dispersion modelling that has been conducted. Dust monitoring conducted in relation to the current activity indicates dust levels at the boundary of the AAL Facility are well within the TA Luft Dust Deposition Guideline Value. In relation to emissions from the Alumina Plant operations (a potential indirect effect given that, if permission is granted for the Proposed Development, that would facilitate continued Alumina Plant operations) compliance with the limit values that govern such Plant emissions serves to protect animal health as well as human health as does the separation distance to the nearest farm activity.

It is considered that there is no potential for water quality impacts that could adversely affect agricultural resources. The AAL site discharges to water consist of clean storm water (discharged into the estuary under the site's EPA Licence P0035-07 at emission points SS1, SS2, SS3, SS4 and SS5) and the treated effluent discharge at emission point W1-1 (also controlled by the EPA Licence). There are no discharges to ground water.

7.4.3 Mitigation Measures

Mitigation measures to control dust are presented in the EIAR Air Quality Chapter 11. Mitigation measures to control noise, vibration and blasting are presented in EIAR Chapter 12. Mitigation measures to manage impacts to groundwater and surface water are presented in EIAR Chapter 10. No additional mitigation measures are required over and above these to protect agriculture or animal health.

8.0 SOILS, LAND & GEOLOGY

Golder Associates Ireland Limited (Golder) has been commissioned by AAL to prepare an Environmental Impact Assessment Report (EIAR) Soils, Land and Geology Chapter in support of the Proposed Development at Aughinish Alumina Limited (AAL), Aughinish Island, Askeaton, Co. Limerick. This note provides a Non-Technical Summary (NTS) for the above assessment.

8.1 Introduction

The assessment considers the potential direct and indirect significant effects, and the significance of these effects, of the Proposed Development on soils, land and geology receptors located in the vicinity of the Application Site.The Study Area extends 2 km from the Application Site boundary.

Figure 8.1: Study Area (Red Line is the Application Boundary and Yellow Line is a 2 km offset) Image taken from Bing Maps (2013)

The Proposed Development involves construction activities as an intrinsic part of the preparatory, construction, operational and closure phases, as the facility is progressively raised in elevation as it is filled with bauxite residue and is progressively restored on the side-slopes. Therefore, this assessment considers an overall construction phase encompassing the preparatory construction activities, construction activities during general operations and the closure construction activities.

The assessment of potential effects has been undertaken using the qualitative assessment method outlined below and is supported by the baseline condition information, the preliminary Construction Environmental Management Plan (CEMP) and the Proposed Development design.

The Proposed Development design is understood to comprise the project design principles and standards adopted to avoid or prevent adverse safety and environmental effects, construction and

operation to appropriate codes of practice and guidelines, and including fixed procedural commitments such as instrumentation and monitoring. This measure provides the baseline for the assessment of impacts.

The assessment follows a staged approach.

1) Confirm baseline conditions.
2) Confirm the key receptors and their value/importance.
3) Qualitatively characterise the magnitude of impacts on the receptors.
4) Determine the initial effect significance of each potential impact on each sensitive receptor.
5) Consider the need for additional mitigation.
6) Assess the residual impact magnitude and residual effect significance.

8.2 Existing Conditions

Soils

Prior to the construction of the BRDA site, the area was a green field site, and the natural topography of the area was low lying. Planning permission for the original BRDA was granted by Limerick County Council (LCC) in February 1979 and the BRDA commenced operations following commissioning of the plant in 1983. Figure 8.2 below shows the quaternary soil mapping for the Study Area (GSI 2020).

Historical mapping by Ordnance Survey Ireland (OSI) indicates that the bulk of the Phase 1 BRDA and the western sector of the Phase 2 BRDA is constructed over relatively flat, low-lying and poorly drained farmland (elevations between 0 mOD and 2 mOD), with the underlying soils comprising estuarine silts and clays with intermittent overlying thin till layers (sandy gravelly CLAY to silty sandy gravelly CLAY of low plasticity, typically 8% to 10%). The estuarine silts and clays vary in depth from ca. 10m to 30m along the northern perimeter of the Phase 1 BRDA (greatest depth at the north-east and north-west sectors), from ca. 4m to 10m along the western perimeter of the Phase 1 BRDA, from ca. < 1m to 8m along the north-western perimeter of the Phase 2 BRDA and are largely absent under the centre of the Phase 1 BRDA, under the Phase 1 BRDA Extension and under the bulk of the Phase 2 BRDA.

The eastern sector of the BRDA (Phase 1 BRDA Extension and the eastern sector of the Phase 2 BRDA) is constructed over a ridge of outcropping crop, sloping upwards from west to east, which had intermittent cover of till material in minor depths. Mechanical grading was undertaken for the Phase 1 BRDA Extension and blasting and mechanical grading was carried out for the eastern sector of the Phase 2 BRDA, prior to the placement of a compacted layer of till (minimum 1m depth) to provide a subgrade for the installation of the composite lining system (geomembrane underlain by GCL) during construction (1996 - 1998 for the Phase 1 BRDA Extension, and 2010 - 2011 for the Phase 2 BRDA). The original Phase 1 BRDA, underlain by the in-situ low hydraulic conductivity estuarine deposits, is unlined.

Soil mapping from An Foras Taluntais (1979) indicates that the soils at the permitted Borrow Pit and proposed Borrow Pit Extension site are composed of shallow, drained till derived from limestones and karstified bedrock outcrop. The soil cover for the permitted Borrow Pit has been removed due to previous construction and operational activities. The soil cover for the proposed Borrow Pit Extension is undisturbed and is described as shallow, pale or pale to medium grey, silty gravelly overburden.

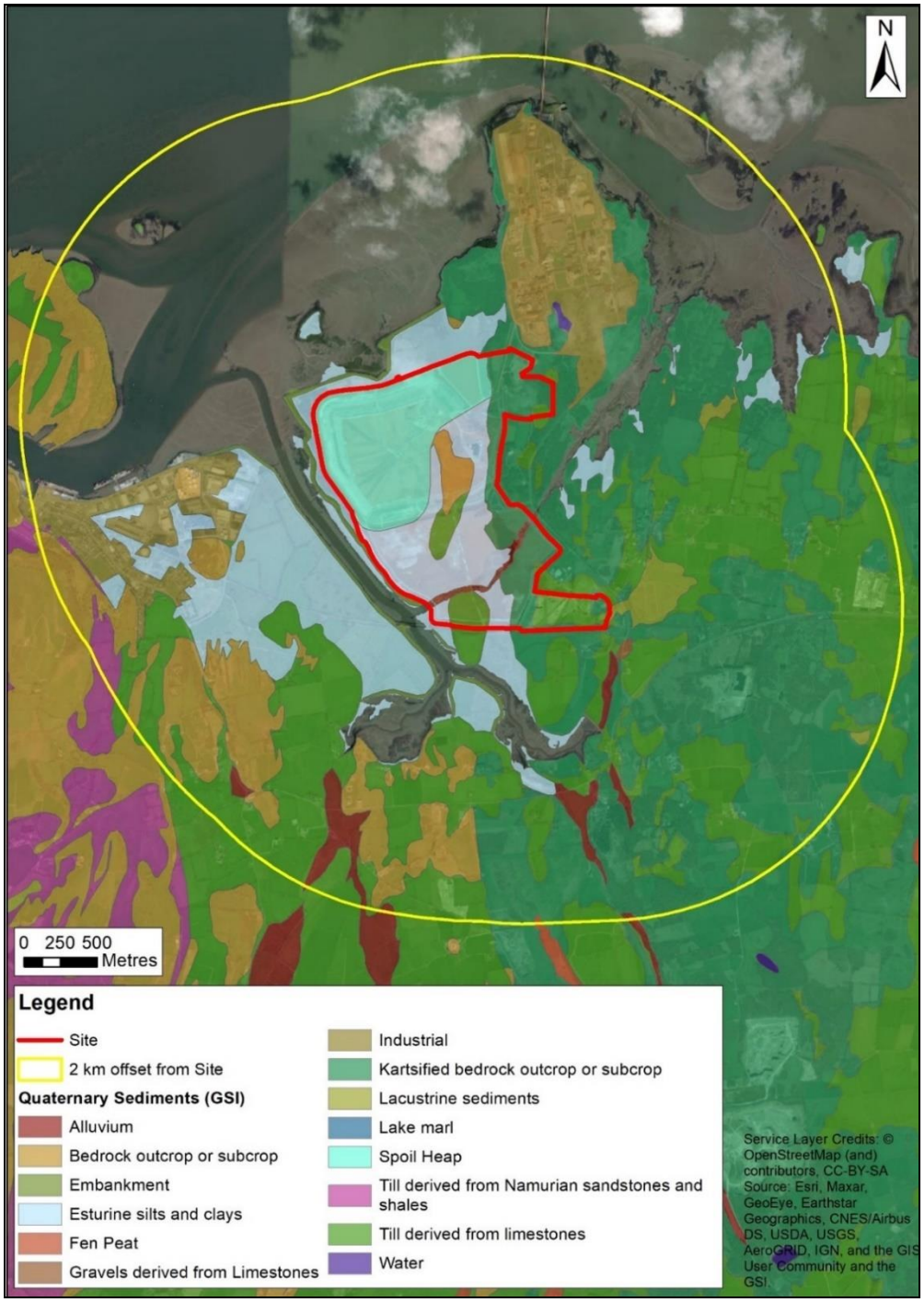

Figure 8.2: Quaternary Soils mapping (GSI, 2021)

Made Ground

The BRDA is comprised of made ground, which are derived from the waste streams generated from the Bayer process. Four (4) waste streams derived from the extraction process are deposited in the BRDA and comprise the made ground when deposited.

Bauxite residue and process sand are the primary waste streams that comprise the bulk of the material deposited:

- Hydraulic deposition (pumped) discharge of bauxite residue paste (≈ 90.6% bauxite residue, AAL AER 2020) is from 'Mud Points' located centrally within the BRDA into purpose-built cells and grades at 2% to 4% towards the perimeter.
- Process sand (≈ 6.9% process sand, AAL AER 2020) is poorly graded, medium sand by-product, primarily resulting from the addition of limestone in the early stages of the Bayer process. It is hauled from the AAL Plant by dumper and used in the construction of internal haul roads, ramps and berms in the BRDA.

The secondary waste streams are:

- Scales and sludges (≈ 1.5%, AAL AER 2020) arise from maintenance of plant infrastructure and are removed periodically, and subsequently hauled and tipped at internal designated areas within the BRDA.
- Salt cake (≈ 1.0%, AAL AER 2020) is a by-product of the process of purification of the caustic soda liquor used in the alumina extraction process from the bauxite ore.

The bauxite residue, process sand, scales and sludges deposited in the BRDA are classified as non-hazardous (99% of waste stream) according to the European Waste Catalogue. Salt cake is classified as hazardous (1% of waste stream) and is deposited in the SCDC, an independently lined engineered cell located within the BRDA.

The BRDA falls within the scope of Directive 2006/21/EC on the management of waste from the extractive industries. The BRDA is a Category A waste facility.

The overall BRDA site is composed of the Phase 1 BRDA and Phase 2 BRDA, both of which are still discernible within the current footprint, as is the SCDC located in the eastern sector of the Phase 1 BRDA.

- The north-eastern BRDA site is composed of the Liquid Waste Pond (LWP) and Storm Water Pond (SWP), both are artificial lined ponds
- The Phase 1 and Phase 2 of the BRDA are surrounded by a Perimeter Interceptor Channel (PIC) which is formed by constructing outer and inner perimeter embankment walls. The Phase 1 and Phase 2 PICs connect at the west sector of the facility where the Phase 1 and Phase 2 BRDAs' adjoin.
- The Phase 1 BRDA was formed from two facilities, (Original BRDA and the Phase 1 BRDA Extension) which merged over time.
- The Phase 2 BRDA area is a southern extension of the Phase 1 BRDA and is merged into the Phase 1 BRDA.
- The maximum permitted elevation of the perimeter of the BRDA is 24 mOD (Stage 10) and the maximum permitted dome crown elevation is 32 mOD. The current elevation of the BRDA dome surface is variable across the site, from ca. 23 mOD to ca. 33 mOD in Phase 1 BRDA and from ca. 11 mOD to ca. 20 mOD in Phase 2 BRDA.
- The Proposed Development comprises raising the BRDA by 12m comprising six no. 2m high stage raises, to Stage 16. The maximum permitted elevation of the perimeter will be 36 mOD and the maximum permitted dome crown elevation will be 44 mOD.
- The Proposed Development includes raising the SCDC to provide the equivalent of an additional three (3) years of operational capacity. This is to provide storage capacity in the short term prior to the plant coming online to remove salt cake from the waste stream and to provide back-up in the longer term when this plant is under maintenance.

Unlike other tailings facilities or water retaining dams, the BRDA retains little to no surface water on the bauxite residue surface. The bauxite residue is discharged as a paste from several near central discharge points to form a dome which typically has the apex some 6m to 8m above the perimeter elevation. The BRDA is built upwards in a series of upstream raised 2m high berms known as 'stage raises'. The stage raises are constructed of processed limestone rock fill which is separated from the underlying bauxite residue by a layer of separation geotextile.

Prior to 2009, bauxite residue deposited in the Phase 1 BRDA did not undergo a process known as 'mud-farming' and is referred to as 'unfarmed'. Since 2009, the deposited bauxite residue has been 'farmed' and includes the bauxite residue in the Phase 1 BRDA from above Stage 6 (16 mOD) and all of the Phase 2 BRDA. The farming process consists of ploughing and aerating bauxite residue for a prolonged period (the process typically takes 5 to 6 months) to reduce the pH < 11.5, prior to placing the next layer. This process also reduces the moisture content, increases the density and the strength parameters for the material. The bauxite residue for the Proposed Development will be farmed.

Bedrock Geology

The mapped bedrock geology (GSI, 2021) comprises Waulsortian Formation limestones beneath the eastern sector of the BRDA and Borrow Pit areas and the Plant. The Rathkeale Formation limestones and mudstones underlie the central and western sectors of the BRDA (see Figure 8.3 below).

The Waulsortian Formation is characterised as a medium bedded to massive, fine to coarsely crystalline, blue grey limestone. The Rathkeale Formation is characterised as impure muddy limestones and shaley mudstones. Structurally no major faults have been identified by the GSI at the Application Site. The Rathkeale Formation is present under the bulk of the BRDA and is not susceptible to karstification. The Waulsortian Formation is susceptible to karstification.

Ground investigation work in the Plant area identified a number of minor palaeokarst features, i.e., infilled ('choked') cavities and fissures, in the Waulsortian Limestone. Similar features were encountered in boreholes drilled as part of investigations related to the Borrow Pit Areas and the eastern sector of the BRDA footprint. As is the case with the Plant Site, the palaeokarst features intersected under the Borrow Pit Areas and BRDA were found to be 'choked' with sediment, usually consisting of sand sized grains of dolomite, indicating in-situ alteration of the host rock rather than transported material associated with collapse, sink holes or extensive cave systems. No karstification features are identified by the GSI in the footprint of the BRDA (GSI, 2021) or were identified during the construction of the basins for the Phase 1 BRDA Extension and the Phase 2 BRDA.

Aggregate potential mapping (GSI, 2021) classifies the BRDA site area as having 'low' or 'very low' potential as a source for extracting rock to crush, while the Borrow Pit sites are classified as having 'very high' potential.

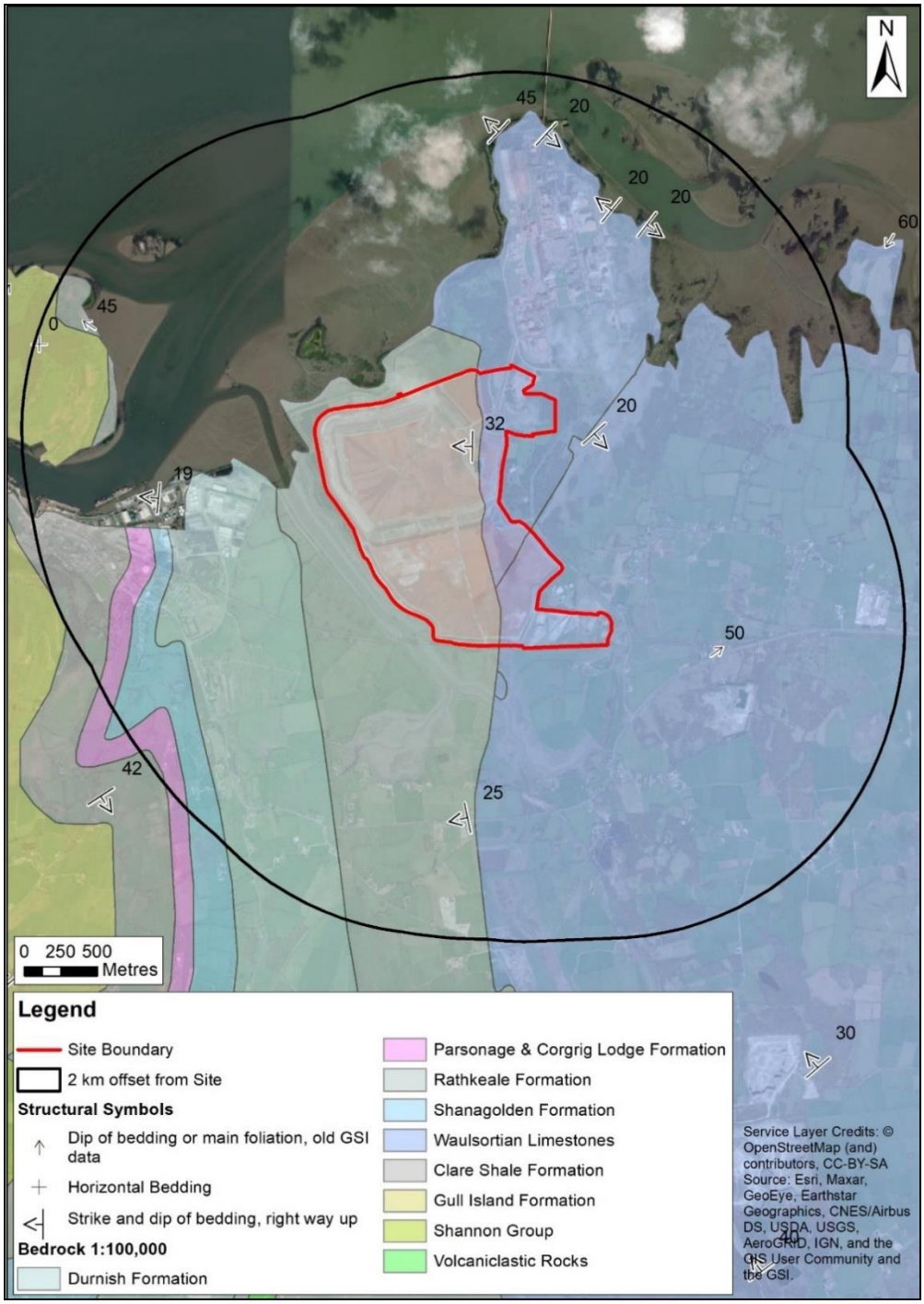

Figure 8.3: Bedrock Geology 1:100,000 map (GSI, 2021)

Naturally Occurring Radioactive Material

Surveys have been undertaken of two potential sources of Naturally Occurring Radioactive Material (NORM); radon and bauxite residue. These have concluded that the BRDA does not present a radiation hazard to either site operatives, visitors or the surrounding environment.

Land Use

Land within the Application Site is already in industrial usage or forms part of a vegetated area within the larger industrial site area. As there would be no loss of productive land or further land take required to enable the Proposed Development.

8.3 Construction Soil Materials

The construction of the BRDA raise and the SCDC raise requires rock fill material which is proposed to be sourced solely from the Borrow Pit areas (permitted and proposed). Similarly, the civil elements of the BRDA closure and restoration works require rock fill material which is proposed to be sourced solely from the Borrow Pit areas (permitted and proposed).

Superficial deposits are required to be removed from the footprint of the Borrow Pit Extension. The superficial deposits are very thin (circa < 0.5m to 1m depth) and of value locally. The removed soils will remain in the immediate area and will be utilized in the construction of screening berms. Any surplus soil materials shall be hauled to the stockpile yard to the south of the BRDA and shall be available for future landscaping and/or restoration works. There are current stockpiles of topsoil and subsoil available on Site that allow AAL to conduct interim landscaping and progressive closure and restoration works.

An assessment of the remaining stockpile volumes has been conducted and additional soil materials will be required to complete the proposed closure and restoration works for the BRDA, the SCDC and the Borrow Pit Extension area. The soil materials required include commercial soil materials that will be sourced from approved and licenced providers and brought to Site as needed during the closure and restoration works, and soil by-products that are proposed to be sourced from local developments as they become available. These soil by-products are proposed to be imported to Site in accordance with the EPA objective for excess uncontaminated soils to be beneficially used (EPA 2019) and stockpiled for future use.

Soil materials and quantities proposed to be imported to Site are listed below:

- Subsoil and Topsoil ≈ 365,000 tonnes, for use in BRDA Side-Slope Restoration.
- Organic Soil Improver ≈ 61,000 tonnes for use in BRDA Side-Slope and Dome Restoration.
- Gypsum ≈ 15,300 tonnes for use in the BRDA Perimeter Stage 5 & Stage 10 Benches, the SCDC Dome and BRDA Dome Restoration at Stage 16.

8.4 Potential Effects

The main potential impacts and associated effects considered in the assessment during the construction, operation and closure of the Proposed Development relate to the following:

- Removal of superficial and bedrock deposits at the proposed Borrow Pit Extension site during the stripping and extraction process;
- Activities or events that might impact bedrock or soil during operations e.g., leaks and spills from machinery or stored substances (including from stored imported soil, which is proposed to be imported during the operational and closure phases of the development as soil materials become available locally and to progressively restore the side-slopes of the BRDA), or discharges; and

- A trigger event e.g., seismic event or blasting in the proposed or permitted Borrow Pit areas causing instability or failure within the BRDA and/or the SCDC (both existing and proposed facilities).

8.4 Summary and Conclusions

Removal of materials during the stripping and excavation process will be managed by prevailing legislation and best practice methodology, and in accordance with established activities already undertaken onsite.

Similarly, the potential for fuel and other substance leaks or spills from stored substances or from machinery/equipment will be negligible given the lack of underground tanks or other onsite requirements and the proposed use of uncontaminated imported commercial soils sourced from approved and licenced providers in accordance with EPA guidance.

A risk assessment has been undertaken to assess the probability of slope failure for the BRDA, which has concluded that the risk is negligible. The stability analyses for the Phase 1 BRDA and the Phase 2 BRDA have returned FoS in compliance with the target FoS criteria for the permitted BRDA constructed to Stage 10 and for the proposed BRDA Raise to Stage 16. These target FoS criteria are consistent with the current international guidelines for tailings dam safety management and best practice.

A capping containment design has been provided for the side-slopes and dome of the BRDA and includes primary and secondary water management infrastructure to transfers flows securely to the PIC. A wetlands treatment and discharge to environment system design is provided for the aftercare phase. A specific capping containment design, appropriate for the capping of a hazardous waste material, is proposed for the SCDC Raise which is accordance with the EPA approved design for the current SCDC.

Active monitoring of the BRDA will be continued for a minimum of 5 years after closure and will include stability checks and assessments and monitoring of water levels and water quality. The monitoring in the passive after-care phase is expected to continue for a minimum of an additional 30 years.

Known design, construction management and operation measures were accounted for in the assessment of initial impacts and effects. Where additional mitigation measures could be incorporated to reduce the initial impacts and effects, these were identified and included in an assessment of residual impacts and effects. These additional mitigation measures can be considered standard operational and construction good practice.

The assessment has concluded that the Proposed Development would not lead to significant effects on soils, land and geology during its operational and closure phases.

9.0 LANDSCAPE & VISUAL

9.1 Introduction

The site of the proposed development is set within the existing Aughinish Alumina Ltd (AAL) landholding at Aughinish Island on the southern side of the Shannon Estuary. In broad terms, the AAL landholding includes three distinct parts including:

1. The AAL buildings and structures located on low-lying flat ground adjacent to the estuary shoreline and including the jetty that extends almost 1.0km into the estuary;
2. The Bauxite Residue Disposal Area (BRDA) that is set further inland and extends to c.1.8km x 1.0km and is characteristic for its terraced or stepped side slopes and its red-brown colouring; and,
3. Additional low-lying lands along both sides of Poulaweala Creek.

The operational parts of the AAL facility primarily include the buildings, structures, jetty and the BRDA. These are bound by the River Shannon to the north, the Poulaweala Creek to the east, the disused Limerick-Foynes railway line to the south and the Robertstown River to the west.

The existing permitted BRDA includes Phase 1 and Phase 2. They are similar in area however Phase 1 is presently reaching its maximum height of 10 Stages which are 20.0m high overall, while Phase 2 is only at Stage 4, or 8.0m. Both would ultimately reach Stage 10, or 20.0m in height, and would include a shallow sloped dome on top rising a further 8.0m towards the centre.

9.2 Proposed Development

The proposed development is to increase the capacity of the overall BRDA by adding 6 additional stages equivalent to an additional 12.0m in height. The shallow sloped dome would be raised up by a corresponding amount. The proposed development includes two additional elements associated with the BRDA raise including:

1. Extension of the permitted Borrow Pit along the eastern side of the BRDA to provide the additional rock fill material required for the BRDA raise;
2. Increasing the capacity of the existing Salt Cake Disposal Cell (SCDC) that is set within the Phase 1 BRDA by increasing the height of its rock bund wall by c. 2.25m.

In addition, as the proposed development is established over its lifetime, a progressive restoration landscaping scheme will be implemented comprising two aspects:

- Greening of individual rock stages on the side slopes by hydroseeding as they are filled with bauxite residue;
- Introduction of landscape mounds that will locally span two or more stepped terraces and will be planted with a combination of ground cover, shrubs and copses of trees. These will disrupt the geometric stepped and liner appearance of the BRDA and establish a more natural character that is consistent with the wider landscape setting.

9.3 Landscape Context

The Shannon Estuary is the defining landscape characteristic of the region and is set in the context of the rural landscapes of County Limerick and County Clare. Rural and low-lying landscapes extend south from the estuary; east towards Askeaton; and north of the estuary in County Clare. To the west and

southwest of Aughinish Island, the landscape rises prominently to Knockpatrick Hill (172m OD) from where expansive views are offered over the low-lying landscape and of the estuary.

While the Shannon Estuary is characterised by the natural estuary leading through a range of coastal, estuarine and rural landscape typologies, it is also the setting for many large-scale industrial and infrastructural developments. Within the visual context of AAL, these include AAL itself, Foynes Port, Tarbert and Moneypoint power stations located along the estuary with direct access to shipping and typically more prominent than those set inland.

The local landscape context of AAL is the rural, low-lying area dominated by the estuary, its associated wetlands, mudflats and large areas of open water. The broader landscape is generally that of an enclosed farm type, essentially that of a hedgerow dominant landscape. Closer to the estuary, there are agricultural lowlands with less regular field patterns to other agricultural landscapes of the County.

These agricultural lowlands comprise a large area of northern part of County Limerick and is bounded on one side by the Shannon Estuary while its southern boundary is defined by the gradually rising ground, which leads onto the agricultural zone and the western hills zoned to the south. The immediate and wider landscape includes clusters of private dwellings, individual dwellings and farmhouses.

AAL is one of the more significant built features on the southern estuary of the River Shannon. The built structures of the AAL plant remain the primary built visual feature in the wider landscape setting whereas the red-brown colouring of the bauxite residue is locally prominent.

9.4 Landscape Planning Context

The AAL facility is now within the administrative area of Limerick City and County Council (LCCC), however, the *Limerick County Development Plan 2010-2016 (As Extended)* remains the relevant policy document until the *Draft Limerick Development Plan 2022 – 2028* is adopted. The Clare County Development Plan 2017-2023 is also relevant given the adjacency of County Clare on the opposite side of River Shannon.

All of these have been considered in preparing Chapter 9 Landscape and Visual Impact of the EIAR, as has the Strategic Integrated Framework Plan (SIFP) for the Shannon Estuary. In summary, the lands of the proposed development are suitably zoned for the proposed development, however, there are also a range of policies and objectives to ensure the protection of the landscape including its character, biodiversity, seascape and special views and prospects. With regard to the latter, the closest scenic route and views are along the N69 leading west from Foynes and along the Coast Road R473 in County Clare.

9.5 Landscape and Visual Impacts

The proposed BRDA raise development will occupy the same area as the existing permitted and continually evolving BRDA and will result in a higher BRDA being established in the longer term than is currently permitted. The proposed SCDC and Borrow Pit extensions will extend existing/permitted facilities on and adjacent to the BRDA.

Progressive restoration is such that the BRDA, including unestablished stages of the permitted BRDA, will be progressively greened by hydroseeding as each stage is filled and the nest stage established. Additionally, as each group of five or six stages are completed, landscape mounds spanning two or more terraces will be established and planted with grasses, ground cover, shrubs and copses of trees.

These landscape mounds will break down the overall scale of the BRDA and establish a more natural landscape character of the slopes. The final dome will also be landscaped with grasses and wildflower mixes and will include hedgerows that subdivide the overall dome surface to present as field patterns that are consistent with the wider landscape context.

The primary effects of the Operational Phase will result from the increase in duration of the phase from that currently permitted, in that the proposals will comprise a continuation of the operation of the BRDA into the long-term.

The proposed development will not have a significant impact on landscape character. Impacts on landscape fabric of the site during the Operational Phase will be not significant, negative, long-term.

Impacts on landscape context will depend on the sensitivity and relative proximity of different parts of the landscape such as the Shannon Estuary, the Agricultural Lowlands and the Western Uplands and will vary from imperceptible to moderate, negative and long term.

While the sensitivity of residential dwellings is considered high, impacts will vary depending on relative proximity and the nature and extent of intervening landscape or buildings. Impacts on the majority of residential dwellings considered will range from not significant to slight / moderate, while a smaller number of dwellings principally south of and closer to the BRDA will experience moderate or significant effects.

Photomontage views are included in the EIAR that are representative of the range of views from public roads and proximity to clusters of dwellings and individual dwellings. These illustrate the progressive establishment of the BRDA of its operational lifetime and at final closure and restoration. Typically, they illustrate the character of the proposed development being similar in appearance to the existing BRDA but rising to a greater overall height in the longer term. The also illustrate that the progressive restoration proposals will be effective in visually integrating the BRDA with the surrounding landscape context.

9.6 Summary

The proposed development will be a continuation and intensification of an existing and permitted development occupying the substantially the same site area as the existing but rising to a greater overall height than is currently permitted. The extended operational duration of the BRDA will of itself increase landscape and visual impacts and the proposed increase in height will result in increased impacts in the longer term.

Nonetheless, the progressive restoration proposals will ensure that landscape mitigation is implemented throughout the operation of the facility and the proposals are considered to provide a better landscape and visual solution to those that have been implemented to date. Restoration proposals will result in the longer term BRDA having a substantially greener and more natural appearance and character that is more consistent with the surrounding landscape context.

10.0 HYDROLOGY & HYDROGEOLOGY

Golder Associates Ireland Limited (Golder) has been commissioned by AAL to prepare an Environmental Impact Assessment Report (EIAR) Hydrology and Hydrogeology Chapter in support of the Proposed Development at Aughinish Alumina Limited (AAL), Aughinish Island, Askeaton, Co. Limerick.

10.1 Introduction

The assessment considers the potential direct and indirect significant effects, and the significance of these effects, of the Proposed Development on surface water and the groundwater receptors located in the vicinity of the Application Site. The Study Area extends 2 km from the Application Site boundary.

Figure 10.1: Study Area (Red Line is the Application Boundary and Yellow Line is a 2 km offset) Aerial Photo Source – Bing Maps (2013)

The Proposed Development involves construction activities as an intrinsic part of the preparatory, construction, operational and closure phases, as the facility is progressively raised in elevation as it is filled with bauxite residue and is progressively restored on the side-slopes. Therefore, this assessment considers an overall construction phase encompassing the preparatory construction activities, construction activities during general operations and the closure construction activities.

The assessment of potential effects has been undertaken using the qualitative assessment method outlined below and is supported by the baseline condition information, the preliminary Construction Environmental Management Plan (CEMP) and the Proposed Development design.

The Proposed Development design is understood to comprise the project design principles and standards adopted to avoid or prevent adverse safety and environmental effects, construction and operation to appropriate codes of practice and guidelines, and including fixed procedural commitments such as instrumentation and monitoring. This measure provides the baseline for the assessment of impacts.

The assessment follows a staged approach.

1) Confirm baseline conditions.
2) Confirm the key receptors and their value/importance.
3) Qualitatively characterise the magnitude of impacts on the receptors.
4) Determine the initial effect significance of each potential impact on each sensitive receptor.
5) Consider the need for additional mitigation.
6) Assess the residual impact magnitude and residual effect significance.

10.2 Existing Conditions

Soils

Prior to the construction of the BRDA site, the area was a green field site, and the natural topography of the area was low lying. Planning permission for the original BRDA was granted by Limerick County Council (LCC) in February 1979 and the BRDA commenced operations following commissioning of the plant in 1983.

Historical mapping by Ordnance Survey Ireland (OSI) indicates that the bulk of the Phase 1 BRDA and the western sector of the Phase 2 BRDA is constructed over relatively flat, low-lying and poorly drained farmland (elevations between 0 mOD and 2 mOD), with the underlying soils comprising estuarine silts and clays with intermittent overlying thin till layers (sandy gravelly CLAY to silty sandy gravelly CLAY of low plasticity, typically 8% to 10%). The estuarine silts and clays vary in depth from ca. 10m to 30m along the northern perimeter of the Phase 1 BRDA (greatest depth at the north-east and north-west sectors), from ca. 4m to 10m along the western perimeter of the Phase 1 BRDA, from ca. < 1m to 8m along the north-western perimeter of the Phase 2 BRDA and are largely absent under the centre of the Phase 1 BRDA, under the Phase 1 BRDA Extension and under the bulk of the Phase 2 BRDA.

The eastern sector of the BRDA (Phase 1 BRDA Extension and the eastern sector of the Phase 2 BRDA) is constructed over a ridge of outcropping crop, sloping upwards from west to east, which had intermittent cover of till material in minor depths. Mechanical grading was undertaken for the Phase 1 BRDA Extension and blasting and mechanical grading was carried out for the eastern sector of the Phase 2 BRDA, prior to the placement of a compacted layer of till (minimum 1m depth) to provide a subgrade for the installation of the composite lining system (geomembrane underlain by GCL) during construction (1996 - 1998 for the Phase 1 BRDA Extension, and 2010 - 2011 for the Phase 2 BRDA). The original Phase 1 BRDA, underlain by the in-situ low hydraulic conductivity estuarine deposits, is unlined.

Soil mapping from An Foras Taluntais (1979) indicates that the soils at the permitted Borrow Pit and proposed Borrow Pit Extension site are composed of shallow, drained till derived from limestones and

karstified bedrock outcrop. The soil cover for the permitted Borrow Pit has been removed due to previous construction and operational activities. The soil cover for the proposed Borrow Pit Extension is undisturbed and is described as shallow, pale or pale to medium grey, silty gravelly overburden.

Made Ground

The BRDA is comprised of made ground, which are derived from the waste streams generated from the Bayer process. Four (4) waste streams derived from the extraction process are deposited in the BRDA and comprise the made ground when deposited.

Bauxite residue and process sand are the primary waste streams that comprise the bulk of the material deposited:

- Hydraulic deposition (pumped) discharge of bauxite residue paste (≈ 90.6% bauxite residue, AAL AER 2020) is from 'Mud Points' located centrally within the BRDA into purpose-built cells and grades at 2% to 4% towards the perimeter.
- Process sand (≈ 6.9% process sand, AAL AER 2020) is poorly graded, medium sand by-product, primarily resulting from the addition of limestone in the early stages of the Bayer process. It is hauled from the AAL Plant by dumper and used in the construction of internal haul roads, ramps and berms in the BRDA.

The secondary waste streams are:

- Scales and sludges (≈ 1.5%, AAL AER 2020) arise from maintenance of plant infrastructure and are removed periodically, and subsequently hauled and tipped at internal designated areas within the BRDA.
- Salt cake (≈ 1.0%, AAL AER 2020) is a by-product of the process of purification of the caustic soda liquor used in the alumina extraction process from the bauxite ore.

The bauxite residue, process sand, scales and sludges deposited in the BRDA are classified as non-hazardous (99% of waste stream) according to the European Waste Catalogue. Salt cake is classified as hazardous (1% of waste stream) and is deposited in the SCDC, an independently lined engineered cell located within the BRDA.

The BRDA falls within the scope of Directive 2006/21/EC on the management of waste from the extractive industries. The BRDA is a Category A waste facility.

The overall BRDA site is composed of the Phase 1 BRDA and Phase 2 BRDA, both of which are still discernible within the current footprint, as is the SCDC located in the eastern sector of the Phase 1 BRDA.

- The north-eastern BRDA site is composed of the Liquid Waste Pond (LWP) and Storm Water Pond (SWP), both are artificial lined ponds
- The Phase 1 and Phase 2 of the BRDA are surrounded by a Perimeter Interceptor Channel (PIC) which is formed by constructing outer and inner perimeter embankment walls. The Phase 1 and Phase 2 PICs connect at the west sector of the facility where the Phase 1 and Phase 2 BRDAs' adjoin.
- The Phase 1 BRDA was formed from two facilities, (Original BRDA and the Phase 1 BRDA Extension) which merged over time.
- The Phase 2 BRDA area is a southern extension of the Phase 1 BRDA and is merged into the Phase 1 BRDA.

- The maximum permitted elevation of the perimeter of the BRDA is 24 mOD (Stage 10) and the maximum permitted dome crown elevation is 32 mOD. The current elevation of the BRDA dome surface is variable across the site, from ca. 23 mOD to ca. 33 mOD in Phase 1 BRDA and from ca. 11 mOD to ca. 20 mOD in Phase 2 BRDA.
- The Proposed Development comprises raising the BRDA by 12m comprising six no. 2m high stage raises, to Stage 16. The maximum permitted elevation of the perimeter will be 36 mOD and the maximum permitted dome crown elevation will be 44 mOD.
- The Proposed Development includes raising the SCDC to provide the equivalent of an additional three (3) years of operational capacity. This is to provide storage capacity in the short term prior to the plant coming online to remove salt cake from the waste stream and to provide back-up in the longer term when this plant is under maintenance.

Unlike conventional tailings facilities or water retaining dams, the BRDA retains little to no surface water on the bauxite residue surface. The bauxite residue is discharged as a paste from several near central discharge points to form a dome which typically has the apex some 6m to 8m above the perimeter elevation. The BRDA is built upwards in a series of upstream raised 2m high berms known as 'stage raises'. The stage raises are constructed of processed limestone rock fill which is separated from the underlying bauxite residue by a layer of separation geotextile.

Prior to 2009, bauxite residue deposited in the Phase 1 BRDA did not undergo a process known as 'mud-farming' and is referred to as 'unfarmed'. Since 2009, the deposited bauxite residue has been 'farmed' and includes the bauxite residue in the Phase 1 BRDA from above Stage 6 (16 mOD) and all of the Phase 2 BRDA. The farming process consists of ploughing and aerating bauxite residue for a prolonged period (the process typically takes 5 to 6 months) to reduce the pH < 11.5, prior to placing the next layer. This process also reduces the moisture content, increases the density and the strength parameters for the material. The bauxite residue for the Proposed Development will be farmed.

Bedrock Geology

The mapped bedrock geology (GSI, 2021) comprises Waulsortian Formation limestones beneath the eastern sector of the BRDA and Borrow Pit areas and the Plant. The Rathkeale Formation limestones and mudstones underlie the central and western sectors of the BRDA (see Figure 8.1).

The Waulsortian Formation is characterised as a medium bedded to massive, fine to coarsely crystalline, blue grey limestone. The Rathkeale Formation is characterised as impure muddy limestones and shaley mudstones. Structurally no major faults have been identified by the GSI at the Application Site. The Rathkeale Formation is present under the bulk of the BRDA and is not susceptible to karstification. The Waulsortian Formation is susceptible to karstification.

Ground investigation work in the Plant area identified a number of minor palaeokarst features, i.e., infilled ('choked') cavities and fissures, in the Waulsortian Limestone. Similar features were encountered in boreholes drilled as part of investigations related to the Borrow Pit Areas and the eastern sector of the BRDA footprint. As is the case with the Plant Site, the palaeokarst features intersected under the Borrow Pit Areas and BRDA were found to be 'choked' with sediment, usually consisting of sand sized grains of dolomite, indicating in-situ alteration of the host rock rather than transported material associated with collapse, sink holes or extensive cave systems. No karstification features are identified by the GSI in the footprint of the BRDA (GSI, 2021) or were identified during the construction of the basins for the Phase 1 BRDA Extension and the Phase 2 BRDA.

Land Use

Land within the Application Site is already in industrial usage or forms part of a vegetated area within the larger industrial site area. The wider Study Area identifies several different land types (Corine 2018) within Aughinish Island and surrounding townlands (Island MacTeige, Glenbane West and Fawnamore).

- The predominant land use to the south of the Site is pastoral farming / agricultural, within which some areas may contain naturally vegetated areas;
- To the north of the Site is a small stretch of salt marsh;
- To the east of the Site is a noted mixed use of land with 'industrial or commercial units' denoting the main AAL facility to the north-east which transitions into agricultural land with areas of natural vegetation and pastureland further east. One-off housing or ribbon development is common in the area along the road network approaching the Study Area from the south-east and east (along the L1234 and L6064), in areas previously noted as pasture or agricultural with natural vegetation;
- To the south of the Site is noted intertidal flats which transitions into mixed pastureland. An area of transitional woodland scrub is noted to the southeast of the Site. However, the central area in this zone is occupied by the Roadstone owned Barrigone Quarry which is an operational limestone quarry and may be considered a 'mineral extraction site' (Corine 2018); and
- To the west of the Site, mapping notes an area of mixed pastureland and industrial or commercial units around Foynes.

In addition to land areas in the Study Area, there are notable regions, which are occupied by water-bodies, and these surround the Site to the west and north and also occur further to the east.

The Shannon estuary is noted as 'estuaries', with 'intertidal flats' noted as occurring in the intertidal zones north, west and east of the Site (Corine 2018).

Hydrology

Figure 10.2 shows the main water features associated with the Study Area.

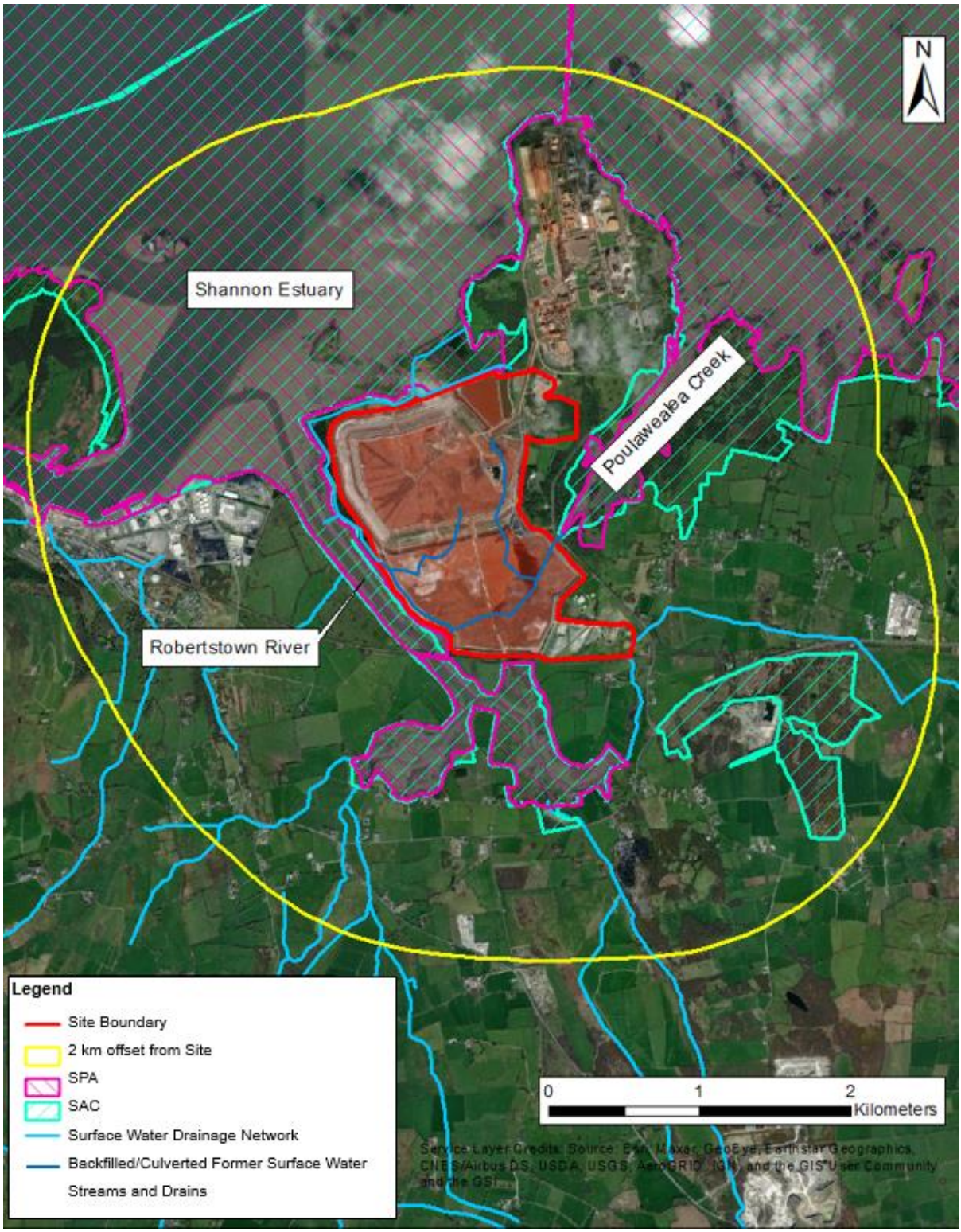

Figure 10.2: Water Features at the Site and in the Study Area (NPWS and EPA 2021) Aerial Photo Source – Bing Maps (2013)

The regional area drains to the Shannon Estuary which is designated as a Special Area of Conservation (SAC). Along a stretch of coast adjacent to the overall Aughinish Site, and within the wider Study Area,

mudflats are exposed at low tide which are listed in the conservation objectives of the SAC with the objective of maintaining a stable or increasing area of habitat, subject to natural processes. Rivers within the Study Area drain predominantly to the Robertstown River before entering the Shannon Estuary further north. Rivers within the Study Area which flow in Foynes, drain directly into the Shannon Estuary. The River Shannon and River Fergus Estuaries Special Protection Area (SPA) also cover the area of the Shannon Estuary adjacent to the Site and within the wider Study Area.

The local area (Aughinish facility) is within the Lower Shannon Estuary Transitional Water Body. The EPA data indicates that water quality in this transitional estuarine reach of the River Shannon is of "good" status. This is based on the EPA's assessment cycle 2013-2018. The area is bounded to the north and west by the Shannon Estuary, to the east by Poulaweala Creek and to the southwest by the Robertstown River, to form Aughinish Island. The Poulaweala Creek, a former estuarine channel, which originally divided Aughinish Island from the 'mainland' to the south at Island MacTeige and Glenbane West, was partially culverted and infilled with coarse rock fill during the development of the Phase 2 BRDA.

Figure 10.3 presents the surface water drainage pattern associated with the Application Site overlain on a recent aerial. No streams are present in the vicinity of the proposed Borrow Pit Extension site or the permitted Borrow Pit site. All surface water runoff from the BRDA is collected in the encompassing perimeter interceptor channel (PIC) and returned to the Plant for treatment. There are no discharge points to the local environment from the BRDA.

Figure 10.3: Surface Water Drainage associated with the BRDA Aerial Photo Source – Bing Maps (2013)

A Toe Drain is present offset from the downstream toe of the outer perimeter wall (OPW) for the north and west sectors of the Phase 1 BRDA leakages from the PIC or seepages passing beneath the PIC are captured by this Toe Drain and pumped back to the PIC.

A Perimeter Drain is present as the primary surface water drainage network for the low-lying area between the Toe Drain and the Flood Tidal Defence Berm (FTDB) and is offset from the north and west sectors of the BRDA (see Figure 10.3 and shown in schematic cross-section in Figure 10.4). Surface water in the Perimeter Drain is allowed to discharge into the Robertstown River only through a Penstock, located to the west of the Phase 1 BRDA (at Section A-A' on Figure 10.3), and via a Flap Valve during periods of low tide. This Penstock can be closed via a manual valve should contamination be identified in the Perimeter Drain or should a significant event occur, that may potentially impact on the water quality in the Perimeter Drain; neither of which have occurred.

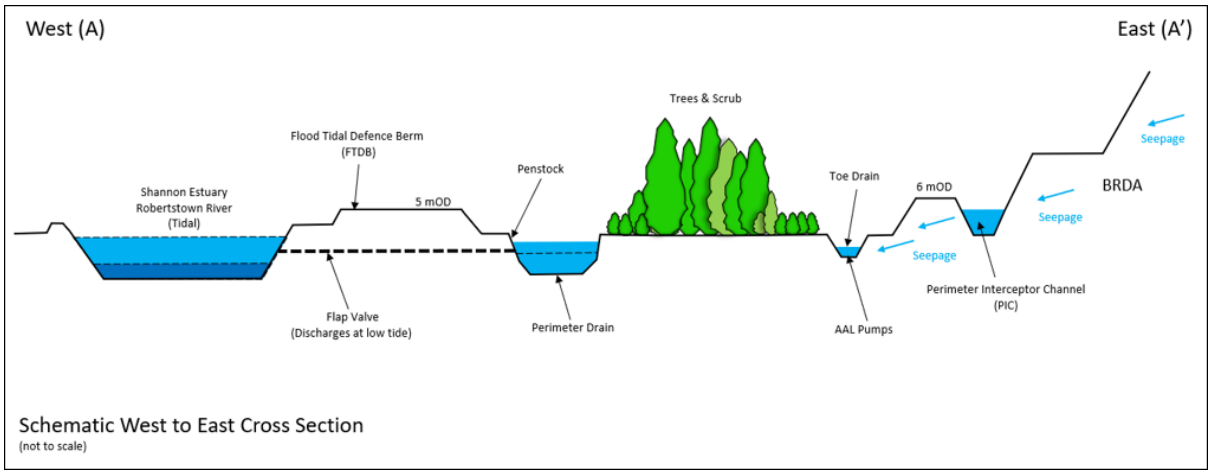

Figure 10.4: Schematic Cross-Section A-A' showing surface water drainage to Robertstown River

Flooding

Historically, flooding events have occurred to the east and west outside of Aughinish Island (and are reoccurring flood events) but no flood events have been recorded at the AAL Plant or around the BRDA footprint.

The BRDA is located on lands which are defended by flood protection works. The BRDA footprint and surrounding catchment is defended by the OPW constructed flood protection works on the north bank (Shannon Estuary) and west bank (Robertstown River) of the Island, where a flood tidal defence berm (FTDB) is present. The original FTDB is understood to have been constructed in the early 1900s and was subsequently raised and broadened by the OPW in the early 1960's. The crest elevation was increased to c. 5 mOD and a rock fill revetment was constructed at the toe of the upstream slope at this time. The OPW have maintained the FTDB over the years and various repairs and improvement works have been conducted. AAL currently monitor and maintain the FTDB structure and improvement works to the upstream slope on the north bank have recently been undertaken by AAL.

BRDA Water Management System

Surface water runoff, bleed water, sprinkler water and seepage from the bauxite residue percolates through the rock fill stage raises and discharge into the encompassing PIC. The PIC is composite lined and conveys the free water by gravity and pumping to either to the Effluent Clarifier System (ECS) or to the Storm Water Pond (SWP). The SWP is where leachate and storm wate is stored prior to treatment. The ECS discharges treated water to Liquid Waste Pond (LWP) where it is conditioned (for cooling and settlement) prior to its discharge in accordance with the IE Licence or reused on site (in the Plant process or in the sprinkler system). The current BRDA water management system is presented conceptually by the block flow diagram in Figure 10.5 below.

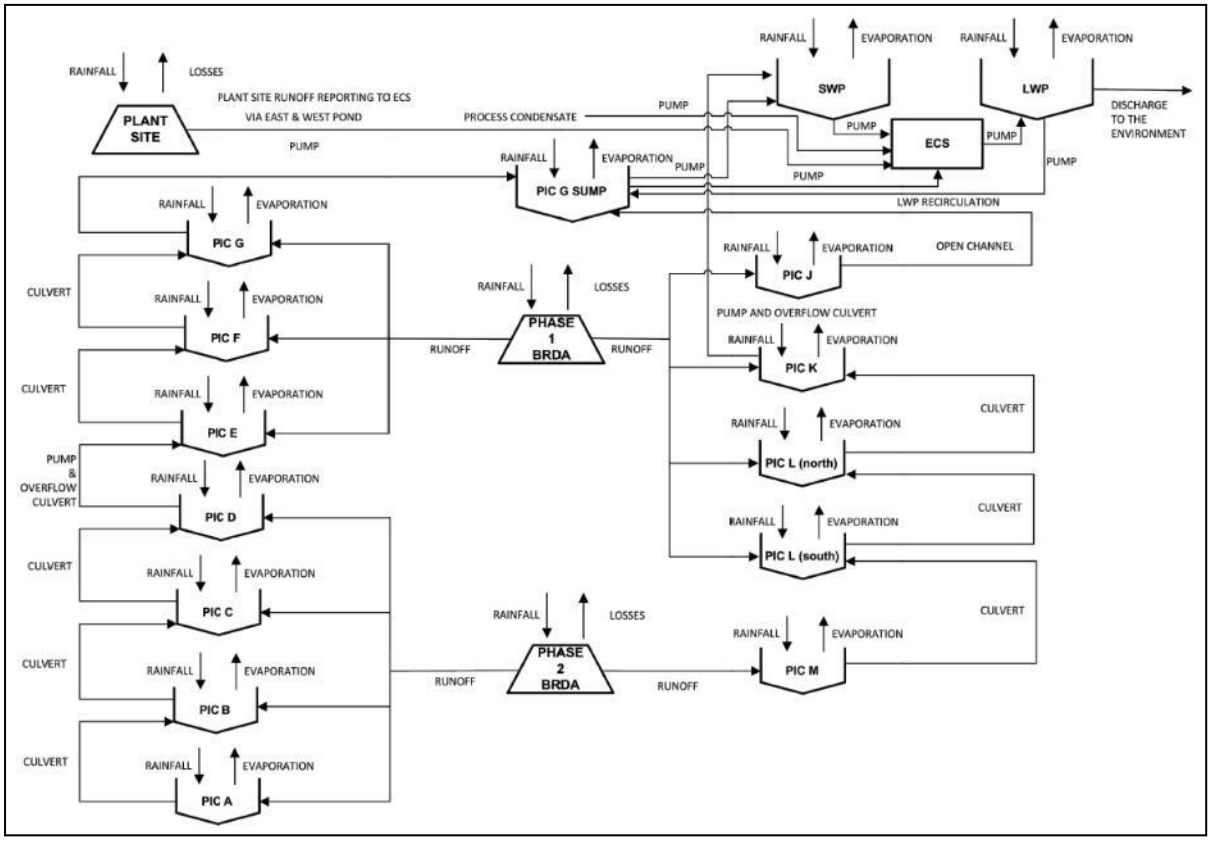

Figure 10.5: BRDA Water Management System - Block Flow Diagram

Notes:

1) *Catchment "Losses" presented in the flow diagram represent all hydrological losses from rainfall including evaporation, transpiration, infiltration, and losses due to surface depressions and ponding.*

Surface water monitoring is carried out routinely for surface water bodies in the vicinity of the BRDA site in accordance with Schedule C.2.3 of the Industrial Emissions Licence (IEL) P0035-07.

There are no decant structures associated with the operational BRDA i.e., spillways, decant towers etc., other than the caustic recovery system constructed within the Salt Cake Disposal Cell (SCDC).

The waters inside the SCDC comprise dissolved salt cake (caustic liquor leachate) which are diluted by the rainfall catchment of the cell. The drainage of its internal catchment i.e., inside the lined crest, is via the perforated decant tower located in the north-east corner of the existing SCDC. A decant pipe is located at the base of the decant tower, where the waters flow by gravity to the storage tank installation located to the north and at a lower elevation than the SCDC (to the south-west of the SWP). The waters are then pumped to the Plant for caustic recovery.

The closure design for the BRDA will include spillways to channel flows from the dome directly to the PIC and spillways at the two breach locations for the perimeter interceptor channel (PIC).

Hydrogeology

Figure 10.6 shows the bedrock aquifers beneath the Application Site and the wider Study Area.

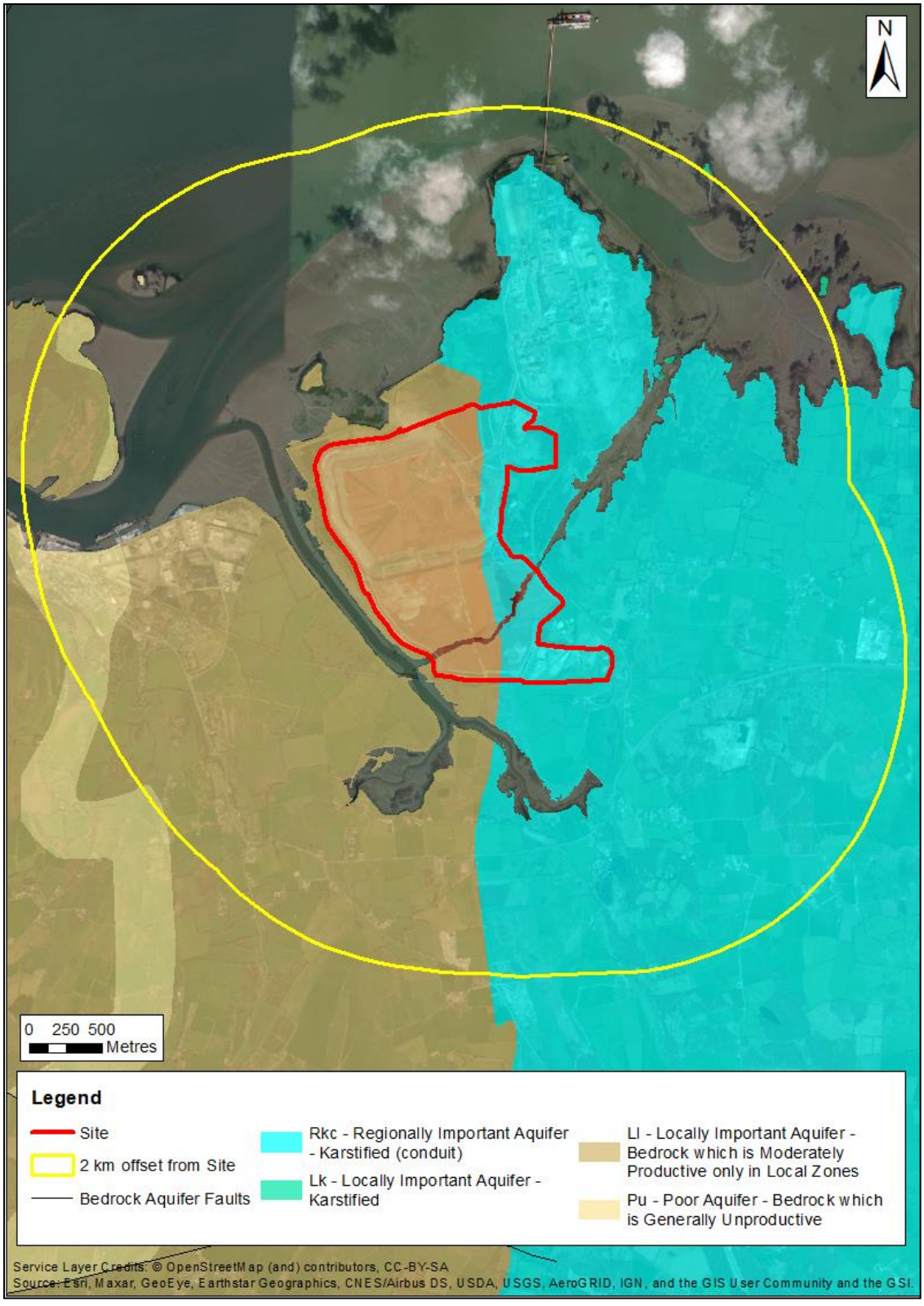

Figure 10.6 : Bedrock Aquifer details beneath the Application Site and wider Study Area

The Application Site is underlain by two separate aquifer units, one is a Locally Important Bedrock Aquifer (Rathkeale Formation) and the other is a Regionally Important Karstified Bedrock Aquifer (Waulsortian Formation). The interpretation of the hydrogeological conceptual model presented by Golder 2015 identified that the groundwater present beneath the Application Site generally comprises a freshwater lens that is both downgradient and isolated laterally from the mainland by being laterally

hydraulically isolated by Poulaweala Creek and the Roberstown River and the underlying saline groundwater. Figures 10.7 and 10.8 below show the interpreted local groundwater contours for January and July 2021

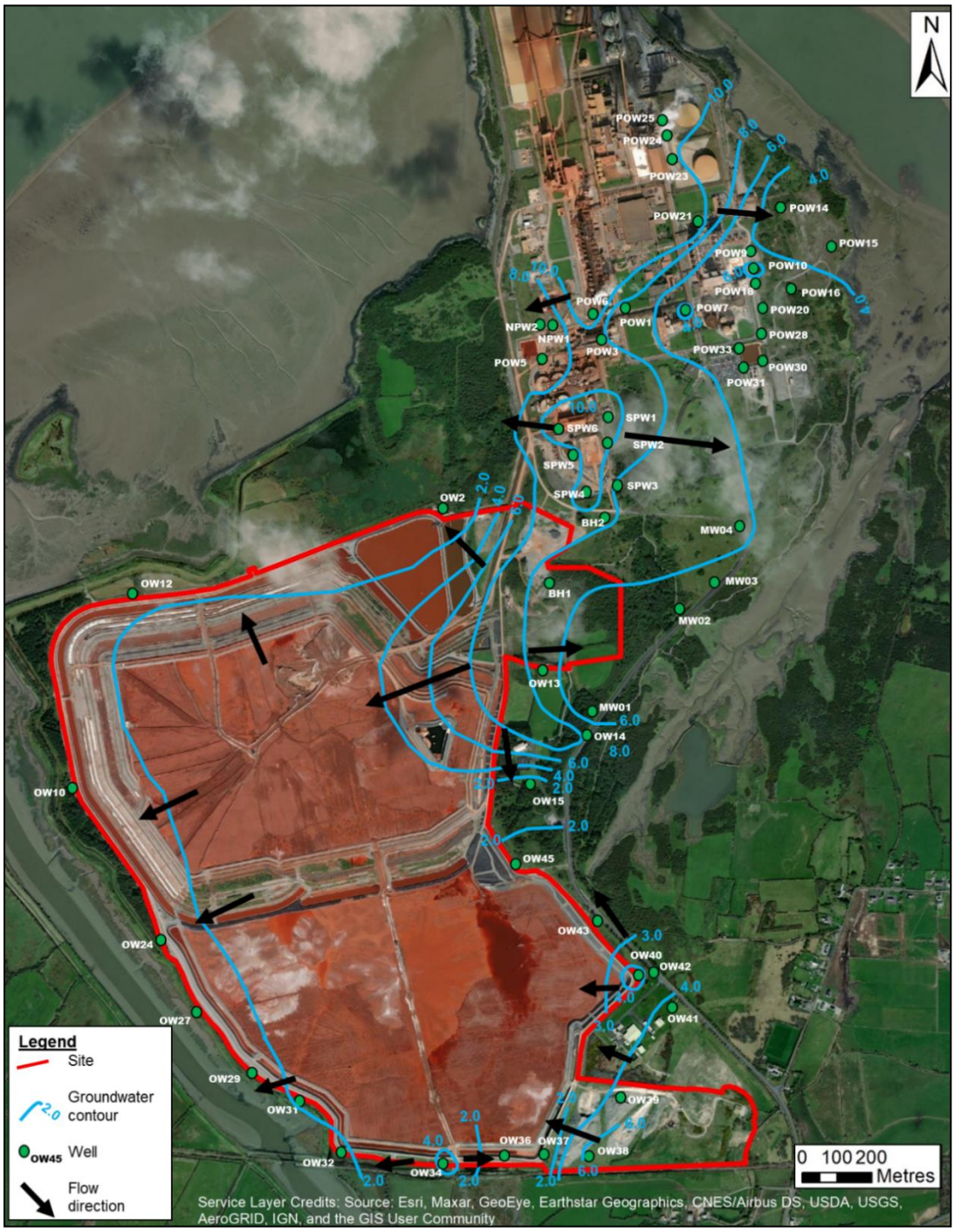

Figure 10.7: Groundwater Contours (mOD) for the Site (January 2021) Aerial Photo Source – Bing Maps (2013)

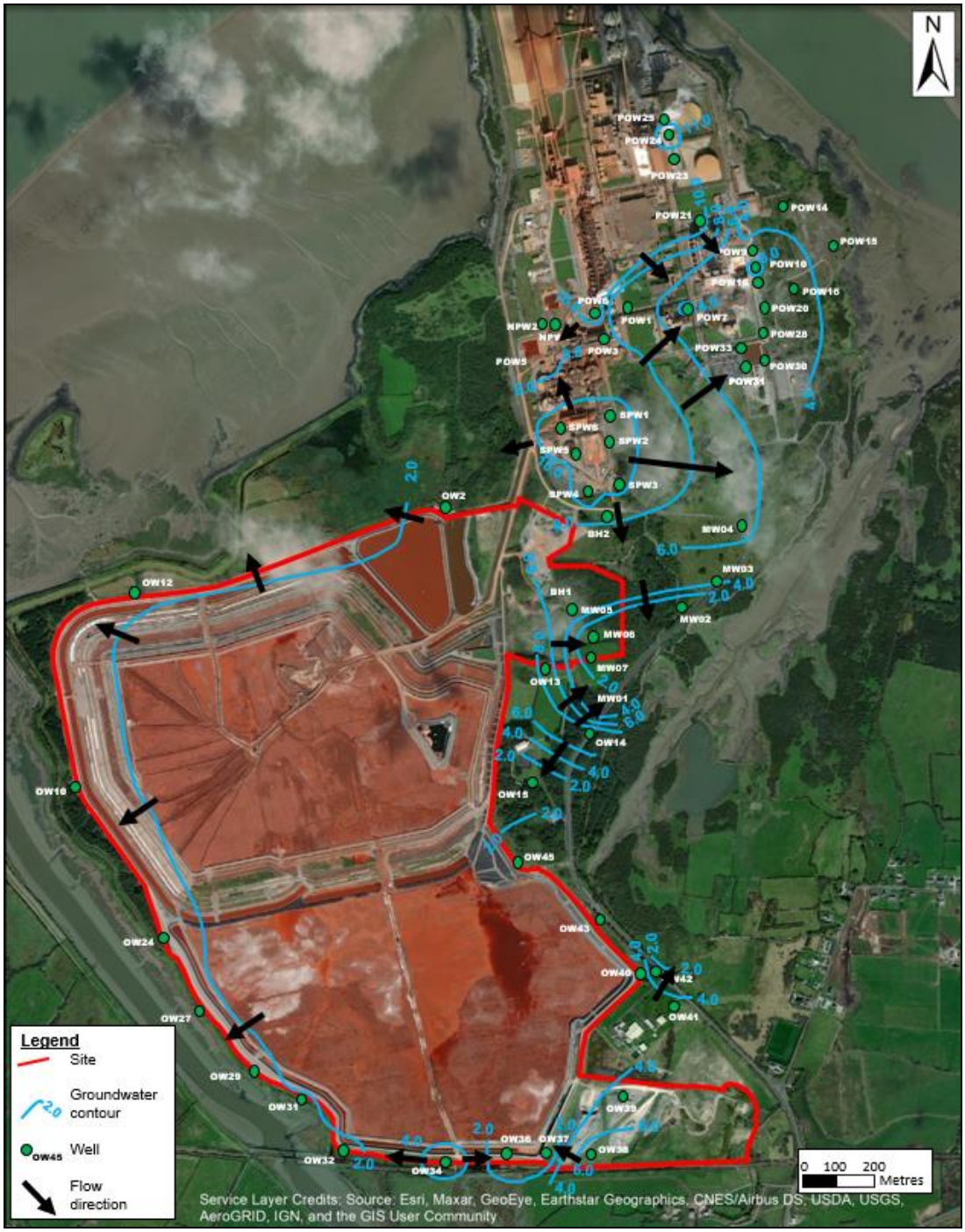

Figure 10.8: Groundwater Contours (mOD) for the Site (July 2021) Aerial Photo Source – Bing Maps (2013)

Groundwater levels measured in groundwater monitoring boreholes across the overall Aughinish site indicates that groundwater flow is outwards from the central part of the 'Island' towards the coastline via springs (the Estuarine Streams) to the Shannon Estuary, Robertstown River and the Poulaweala Creek.

A portion of the Application Site in the southeast is within the mainland area of Glenbane West, however, groundwater flow in this area is west and north-westwards towards the Poulaweala Creek and the Robertstown River.

Figures 10.9 below show the interpreted groundwater contours for the Borrow Pit areas in July 2021. The data suggests that a groundwater divide exists within or in close proximity to the Borrow Pit areas. The maximum proposed excavation of the Borrow Pit areas is to 8.5 mOD.

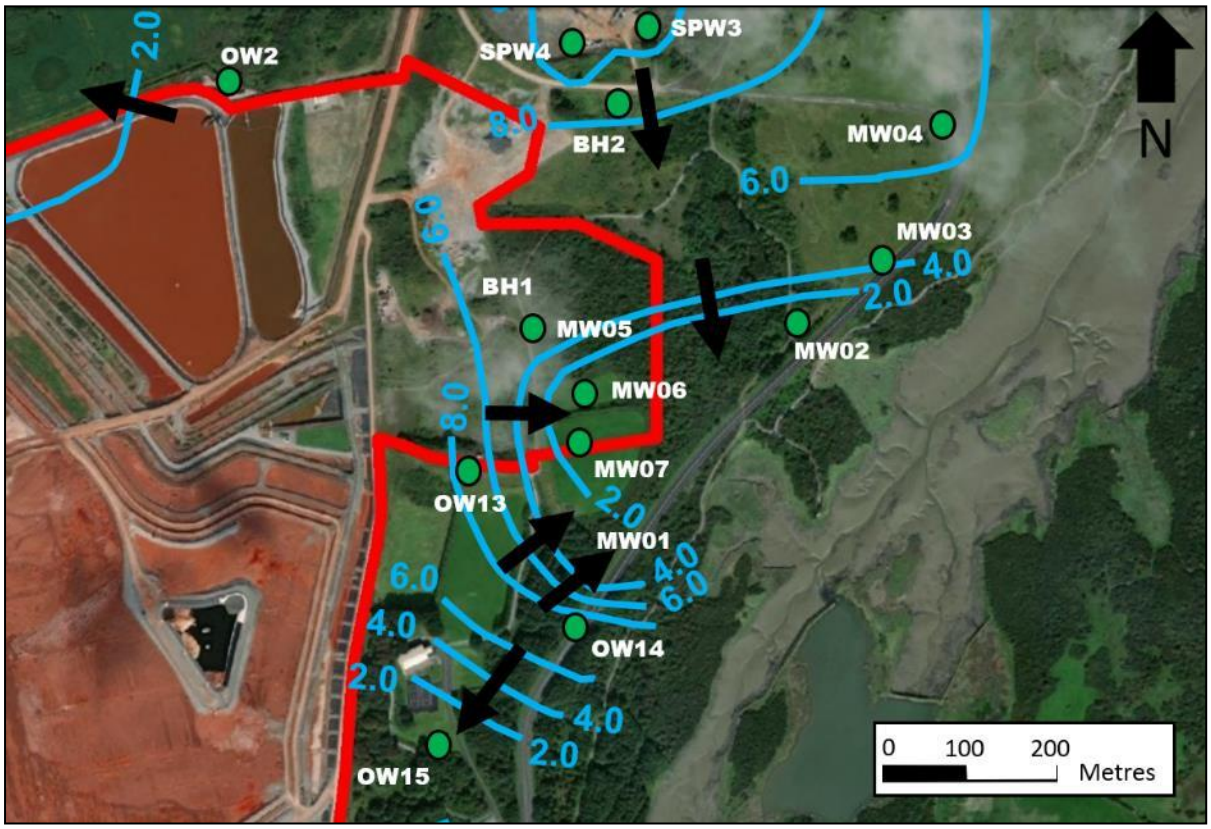

Figure 10.9: Groundwater Contours (mOD) for the Site (July 2021) Aerial Photo Source – Bing Maps (2013)

The overall Aughinish site operates under an Industrial Emissions Licence (Reg. No. P0035-07) and carries out routine groundwater monitoring.

The principal contaminant of concern arising from the alumina production process is dilute sodium aluminate, which is characterised by elevated pH, elevated alkalinity and elevated aluminium relative to groundwater. Fluoride, a common element in bauxite ore, is also present in the sodium aluminate solution and so is a potential contaminant of concern.

The groundwater monitoring system for the Borrow Pit areas comprises monitoring wells (SPWs and MWs) and are shown in Figure 10.9 above.

The groundwater monitoring system installed around the perimeter of the BRDA is shown in Figure 10.10 below. Observation wells (OWs) are generally paired, with one well drilled into the overburden and its partner driller drilled into the limestone bedrock.

Monitoring results are generally below the relevant groundwater regulation threshold values. Where exceedance have been recorded, they typical occur in isolation to other parameters i.e., just a single metal exceeding a threshold value in a round of readings and then are not present for future rounds and hence are considered to be natural or the result of saline intrusion.

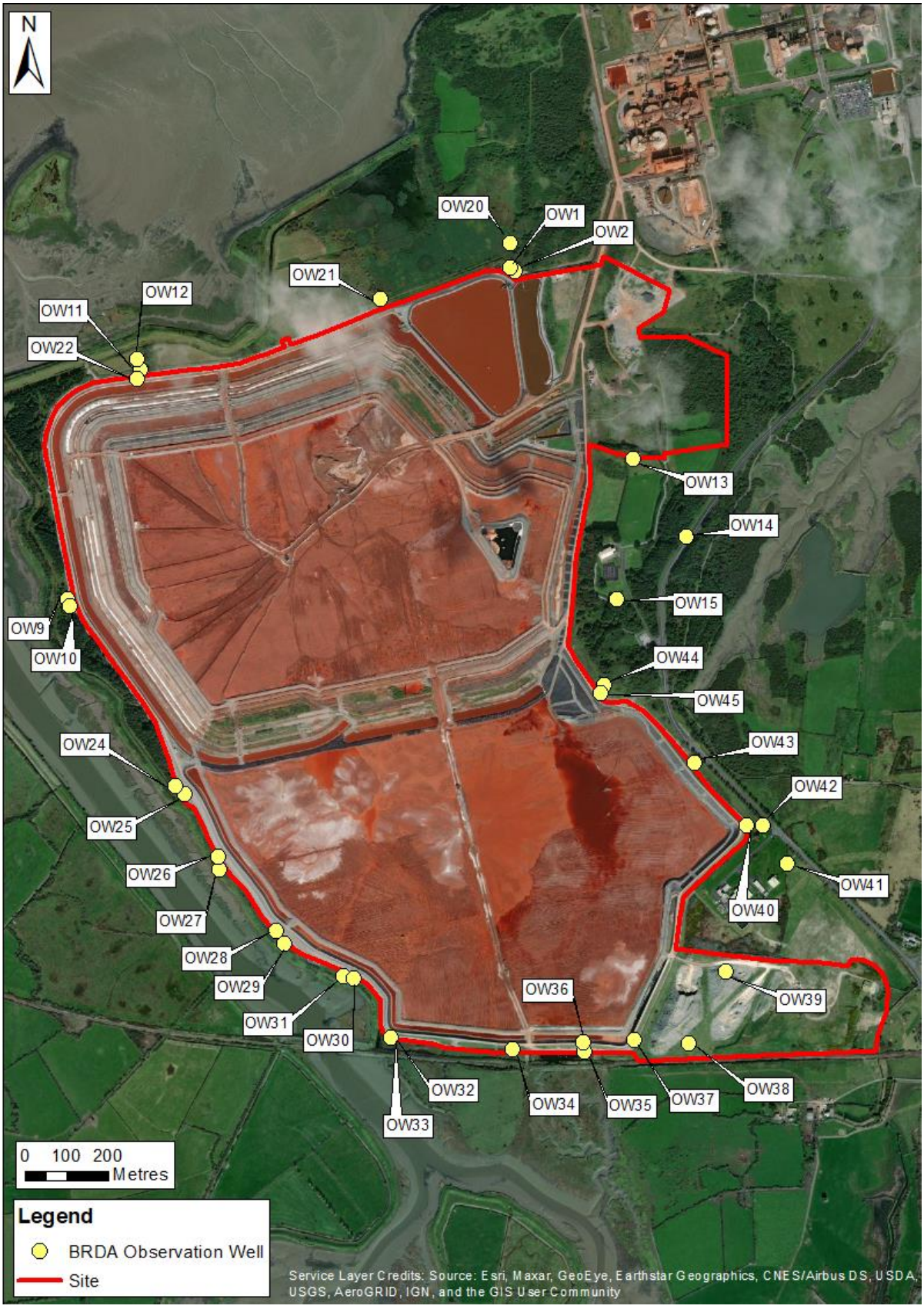

Figure 10.10: Location of Observation Wells (OWs) around the perimeter of the BRDA Aerial Photo Source – Bing Maps (2013)

Regulated Discharges and Emissions

There are no licensed discharges to surface water or groundwater from the BRDA. However, there are two licensed discharges of treated effluent to the Shannon Estuary from the Plant. These are W1-1 and Sanitary Effluent discharge points. The former is treated industrial process effluent and the latter is treated sanitary effluent. Both discharge at the same outfall point W1-1, which is located close to the AAL Marine Terminal, c. 1.7 km from the Site boundary.

The Proposed Development does not comprise any change to the two current licenced discharges.

Local Water Users and Wastewater Systems

No groundwater is abstracted for domestic purposes within the Application Site or at the Plant Area. There are no source protection zones or preliminary source protection zones within the Application Site or the Study Area.

The nearest source protection area to the Proposed Development is located c. 11 km away, just north of Kilcolman. Two other source protection zones are located at Glin, located c. 22 km to the west and at Ardagh, located c. 19 km to the south of the Application Site.

A Group Water Scheme is located approx. 2 km to the south-east of the Study Area, but is upgradient of the Application Site groundwater.

Fourteen (14) wells have been identified within the Study Area; only two (2) have a listed use, one as only domestic and the other is both agricultural and domestic use. The majority of these wells are from the 1960s and are predominantly drilled boreholes rather than dug by hand. However, as the groundwater present beneath Application Site comprises a freshwater lens that is both downgradient and isolated laterally from the mainland by being laterally hydraulically isolated by Poulaweala Creek and the Robertstown River and the underlying saline groundwater, these fourteen (14) wells are not identified to be part of the same regional hydrogeological system.

10.3 Potential Impacts

The main potential impacts and associated effects considered in the assessment during the construction, operation and closure of the Proposed Development relate to the following:

- Mobilisation of leachate by operational works, e.g., earth movements, that could impact water quality and use;
- Changes in groundwater levels and flow regimes, and, therefore, water availability; and
- Activities that might impact water quality and use, e.g., increased suspended solids, leaks and spills from machinery or stored substances, or discharges – including drainage and waste-water discharges, leakages and seeps from the BRDA/SCDC and their potential impacts, and effects on water quality at the SACs/SPAs.

10.4 Summary and Conclusions

There is a combination of regionally and locally important aquifers underlying the Application Site but there is a limited future resource potential as a drinking water source at the Application Site, due to salinity issues. There are groundwaters users in the area, but they are upgradient and not identified to be part of the same hydrogeological system as the Application Site. Routine groundwater monitoring is carried out in the vicinity of the BRDA site in accordance with the IE Licence.

The Site is hydrologically connected to internationally designated areas i.e., Special Areas of Conservation (SAC) and Special Protection Areas (SPA), which have regulatory requirements to maintain water availability and quality status. In addition, there are protected surface water bodies in the vicinity of the Site. Surface water monitoring is carried out routinely for surface water bodies in the vicinity of the BRDA site in accordance with the IE Licence.

The status of the nearby transitional waterbody (Lower Shannon Estuary) during the 2013 – 2018 monitoring period is given as 'good' by the EPA (2021). Water quality results for surface water features around the Site show parameters are within threshold values between 2008 and 2021.

Activities, systems and monitoring installations are already in place to manage and limit the potential impact from refuelling, seepage from the BRDA, and leaks and spills from stored and used substances. The proposed activities at the Site are all extensions to existing activities, systems and monitoring of groundwater and surface water quality in the vicinity of the Site are in compliance with the IEL re-quirements.

The BRDA and SCDC are existing structures which are compositely lined (or demonstrable equivalent), as would be the proposed raises to both. Seepage modelling has been undertaken by Golder for the BRDA at closure following the construction to Stage 16 and the construction of the dome and the capping and restoration works. The modelling has concluded that there is negligible seepage through the base of the facility, either in the unlined or lined phases, due to the low hydraulic conductivity properties of the bauxite residue itself, the underling estuarine deposits in the unlined phases and the low hydraulic conductivity properties of the geosynthetic lining systems in the lined phases.

A capping containment design has been provided for the side-slopes and dome of the BRDA and includes primary and secondary water management infrastructure to transfers flows securely to the PIC. A wetlands treatment and discharge to environment system design is provided for the aftercare phase.

Active monitoring of the BRDA will be continued for a minimum of 5 years after closure and will include stability checks and assessments and monitoring of water levels and water quality. The monitoring in the passive after-care phase is expected to continue for a minimum of an additional 30 years.

Known design, construction management and operation measures were accounted for in the assessment of initial impacts and effects. Where additional mitigation measures could be incorporated to reduce the initial impacts and effects, these were identified and included in an assessment of residual impacts and effects. These additional mitigation measures can be considered standard operational and construction good practice.

The assessment has concluded that the Proposed Development would not lead to significant effects on water (and on human health from water) during its operational and closure phases.

11.0 AIR QUALITY

11.1 Introduction

The likely air quality impacts associated with the proposed BRDA raise and Borrow Pit extension at Aughinish Alumina has been assessed by AWN Consulting Ltd.

11.2 Receiving Environment

The existing ambient air quality levels based on site specific and EPA measurements has been reviewed. Ambient levels of PM_{10}, $PM_{2.5}$ and dust deposition are all below the ambient air quality standards and guidelines for the protection of human health.

11.3 Likely Significant Impacts

The air quality impact assessment has focused on the potential PM_{10}, $PM_{2.5}$ and dust deposition impacts associated with the construction and operational phases of the proposed development on its surrounding environment. For a development of this nature the construction and operational phases are considered together. Traditional separation of construction and operational phases is not considered appropriate given that the operation of the BRDA, also including the construction and operation of the Salt Cake Disposal Cell, itself involves construction of each stage elevation, which in turn will require the extraction of material from the Borrow Pit. Therefore, the assessment presented in Chapter 11 assesses the potential air quality impacts of the proposed development against the appropriate ambient air quality standards and guidelines.

During the operational phase, the potential sources of PM_{10}, $PM_{2.5}$ and dust deposition are those associated with the Borrow Pit extraction and internal site vehicle movements to the BRDA area where the phasing will see the height of the existing BRDA increase from Stage 10 to Stage 16. Activity within the Borrow Pit will include occasional blasting to remove rock, on site breaking and crushing of the rock and excavator, loading shovel and dump truck movements to stockpile the materials. There is also the potential to generate wind-blown dust from the surface of the BRDA. Note that the proposed development will not generate additional vehicle movements on site and the development is continued operation of the BRDA up to Stage 16, construction and operation of the Salt Cake Cell and extending the borrow pit footprint. The same activity currently permitted within the borrow pit and BRDA will continue to be used within the proposed development.

11.4 Mitigation Measures

A range of dust mitigation measures have been proposed in order to ensure that the ambient air quality standards and guidelines are not exceeded. Such measures in the BRDA include an extensive network of automatic water sprinklers, placement of residue berms on the residue surface, residue farming which roughens the surface and managing residue placement. Measures in the Borrow Pit include the use of a wheel wash prior to exiting the site, the watering of road surfaces using a bowser tank and the restriction of internal road speeds to 30 km/hr.

11.5 Conclusion

In summary, once consideration is given to the range of mitigation measures outlined in the air quality impact assessment, the associated air quality impact of the proposed development is not significant.

12.0 NOISE & VIBRATION

12.1 Introduction

The likely noise and vibration impacts associated with the proposed BRDA raise and Borrow Pit extension at Aughinish Alumina has been assessed by AWN Consulting Ltd.

12.2 Receiving Environment

The existing noise climate has been surveyed during day, evening and night-time periods at five noise sensitive locations. Noise sources that contribute to the measured noise levels include distant activity from the existing Aughinish Alumina facility as well as other noise sources such as traffic on the existing Local and National road network, noise from the nearby port, birdsong, pedestrian voices, dog barking, occasional aircraft movements and some slight wind generated noise on nearby foliage.

12.3 Likely Significant Impacts

The noise impact assessment has focused on the potential outward noise and vibration impacts associated with the construction and operational phases of the proposed development on its surrounding environment. For a development of this nature the construction and operational phases are considered together. Traditional separation of construction and operational phases is not considered appropriate given that the operation of the BRDA, also including the construction and operation of the Salt Cake Disposal Cell, itself involves construction of each stage elevation, which in turn will require the extraction of material from the Borrow Pit. Therefore, the assessment presented in Chapter 12 assesses the potential noise and vibration impacts of the proposed development against the operational phase noise and vibration limits specified.

During the operational phase, the potential sources of noise and vibration are those associated with the Borrow Pit extraction and internal site vehicle movements to the BRDA area where the phasing will see the height of the existing BRDA increase from Stage 10 to Stage 16. Activity within the Borrow Pit will include occasional blasting to remove rock, on site breaking and crushing of the rock and excavator, loading shovel and dump truck movements to stockpile the materials. On the BRDA there will be many excavators in operation in addition to a low ground pressure bulldozer, amphirol equipment and compactors for mud farming. Note that the proposed development will not generate additional vehicle movements on site and the development is continued operation of the BRDA up to Stage 16, construction and operation of the Salt Cake Cell and extending the borrow pit footprint. The same activity currently permitted within the borrow pit and BRDA will continue to be used within the proposed development.

12.4 Mitigation Measures

A range of noise and vibration mitigation measures have been proposed in order to ensure appropriate noise and vibration limits are not exceeded. Such measures include limitations of blast frequency, noise control at source, recommendations for good practice blast design including trial blasting, public information circulars, regular timing of blasts where possible and ongoing noise, vibration and air overpressure monitoring during blasting by an independent body.

12.5 Conclusion

In summary, once consideration is given to the range of mitigation measures outlined in the noise and vibration impact assessment, the associated noise and vibration impact of the proposed development is not significant.

13.0 MATERIAL ASSETS – WASTE MANAGEMENT

Golder Associates Ireland Limited (Golder) has been commissioned by AAL to prepare an Environmental Impact Assessment Report (EIAR) Material Assets – Waste Chapter in support of the Proposed Development at Aughinish Alumina Limited (AAL), Aughinish Island, Askeaton, Co. Limerick.

13.1 Introduction

The assessment considered the likely direct and indirect significant impacts and effects the preparatory, construction, operational and closure phases of the Proposed Development may have on external waste management infrastructure capacity. The objective is to ensure that these external waste management infrastructure assets (landfills, municipal incinerators, etc.) are used in a sustainable manner, so that they will be available for future generations, after the delivery of the Proposed Development. There is decreasing landfill capacity available nationwide, therefore the assessment considers the impact of waste requiring offsite disposal in the national context.

An assessment is made of the likely impact of the waste produced, and mitigation measures are identified which minimise the levels of waste generated in the first place and also reduce the impact of the waste generated by the Proposed Development.

AAL is a producer of a bauxite residue (also known as 'red mud') and salt cake waste streams. The waste streams arise from the processing of bauxite to form alumina and are discharged to the facility's own waste management infrastructure, namely the BRDA. These wastes are managed in accordance with European and national legislation. The BRDA does not import and accept waste from external sources and the AAL facility does not export bauxite residue wastes to other sites. The BRDA waste infrastructure is itself excluded from the assessment as the Proposed Development seeks to increase the capacity of the BRDA, to which this is (in part) the focus of this planning application and EIAR.

13.2 Potential Effects

Soils to be removed at the proposed Borrow Extension Pit site, prior to extraction of rock, are not categorised as waste but are considered to be a material asset. The overburden consisting of the topsoil and subsoil at shallow depths (> 1m) and will be used for the creation of screening berms for the Borrow Pit Extension. These materials will be stockpiled temporarily at appropriate locations nearby or hauled directly for use in the construction of the screening berms. Any surplus soil materials will be hauled to the stockpile yard to the south-east of the BRDA and will be available for future landscaping and/or restoration works.

Potential hazardous and non-hazardous waste streams expected to be generated from the proposed development and needing to be disposed of offsite have been identified. The volumes are expected to be very low, due to the nature and design of the Proposed Development, and it is anticipated that the majority of the waste material generated will be suitable for reuse, recovery or recycling. Annual tonnages of the construction and demolition (C&D) waste streams that are anticipated to be exported from the Site have been estimated. These materials will be appropriately recycled and recovered as is the current practice at the AAL facility.

In order to establish a worst-case scenario, the estimated waste tonnages determined were based on professional experience of similar projects, a review of the wastes generated by the overall AAL facility and identification of waste streams that can be considered applicable to the ongoing construction of BRDA raises and the worst-case waste estimates assuming that the wastes will be removed from site for disposal and not recovered or reused.

13.2 Summary and Conclusions

The estimated waste tonnages have been compared to the quantity of construction and demolition waste collected in Ireland in 2018. Taking these conservative assumptions of anticipated quantities, it is estimated that the annual amounts generated are approximately 0.0002% of the total national construction and demolition waste arisings (EPA 2018).

Due to the nature and minor quantities of the waste generated and the use of the AAL existing waste management procedures, the potential impacts associated with the waste management of the Proposed Development are expected to be imperceptible, therefore no additional mitigation measures above those systems already in place at the facility are required.

14.0 TRAFFIC & TRANSPORTATION

14.1 Introduction

Transport Insights has been commissioned by AAL to prepare an Environmental Impact Assessment Report (EIAR) Traffic and Transport Chapter in support of a proposed development at Aughinish Alumina, Aughinish Island, Askeaton, Co. Limerick.

14.2 Overview of the Proposed Development

The proposed development consists of works to the Bauxite Residue Disposal Area (BRDA) comprising of an expansion to increase its disposal capacity to accommodate additional bauxite residue arising from the continued operation of the permitted alumina refinery plant located on the wider AAL facility. The proposed increase in disposal capacity to the BRDA will result in a proposed increase in height of c.12m above the currently permitted stage 10 level (c. 32m OD) to a final stage 16 level (c. 44m OD). No increase to the existing footprint of the BRDA is proposed.

The operation of the existing road network and the potential traffic impacts of the proposed development were examined as part of the study.

14.3 Construction Phase Traffic Impact

No significant traffic related construction phase impacts are anticipated.

A small number of seasonal workers (required for 16 to 20 weeks per year when blasting occurs) will be needed to operate equipment at the expanded Borrow Pit and these would include 2 no. drill rig operators intermittently, 2 no. crusher and excavator drivers, a maintenance/breakdown fitter intermittently and a quarry manager (who would already work at the plant). Commuting trips associated with the 5-6 no. additional workers during the BRDA construction phases will have negligible impact on the local road network.

It should also be noted that these works will take place while the existing facility is fully operational, as the construction of the BRDA and extraction of rock from the Borrow Pit form part of the AAL facility's ongoing operations.

14.4 Operational Phase Traffic Impact

In the 'Do Nothing' scenario AAL will continue to operate until such a point as the existing storage capacity within the BRDA is exhausted (assumed to be during 2030). At that point, alumina will no longer be produced on-site and the plant will cease to function with a resultant decrease in staff car and HGV traffic on the local road network.

In the 'Do Minimum' scenario, it is assumed that the refinery shall continue operate as it currently does, however the permitted borrow pit application shall also be in operation. This shall result in the removal of HGV trips on the local road network associated with the movement of rock.

In the 'Do Something' scenario, HGV traffic associated with the importation of rock shall be eliminated (as per the 'Do Minimum' scenario), with the abovementioned very small increase in light vehicle trips (4 no. one-way trips per day associated with operation of the Borrow Pit). However, compared with the 'Do Minimum' scenario there will be additional HGV trips anticipated on the external road network associated with the importation of soil and soil improver required for the proposed raising of the BRDA. Any other additional vehicle movements generated by site activities will be wholly internal to the site itself.

Traffic associated with the closure of the refinery has also been considered and includes HGV trips required to bring in soil, soil improver and gypsum to close the refinery and create a dome over the BRDA.

The operational phase traffic impact analysis undertaken in support of the application indicates the proposed development shall not have a material impact on the road network, with the critical road link (N69 national road) anticipated to operate well below its theoretical carrying capacity in all scenarios.

14.5 Mitigation Measures

As the proposed development will have no material impact upon the operation of the local road network, no mitigation measures are proposed. Furthermore, it is noted that historic improvement works carried out at the L1234/ N69 junction appear to have mitigated previous safety issues and no further mitigation measures in this regard are deemed necessary.

It should be noted that sourcing of rock material on-site can be considered to mitigate potential impacts of the development on the local road network, with HGV movements concentrated on-site. Furthermore, the proposed Foynes to Limerick (including Adare Bypass) scheme will provide an alternative high-quality route to the N69 between Foynes and Askeaton to the west and east of the proposed development site respectively. This scheme, which is anticipated to proceed to construction in the near future, has been forecast to produce a ca. 78% reduction in AADT on the N69 at Ballyculhane between Foynes and Askeaton (in the vicinity of the L1234/ N69 junction) in both its year of opening (2023) and year of opening + 15 years (2038).

14.6

14.7 Residual Impacts

Based on the level of traffic generated and taking into account the capacity of the local road network, no construction or operational phase residual impacts are predicted as a result of the proposed development.

15.0 MATERIAL ASSETS – SITE SERVICES

Golder Associates Ireland Limited (Golder) has been commissioned by AAL to prepare an Environmental Impact Assessment Report (EIAR) Material Assets – Site Services Chapter in support of the Proposed Development at Aughinish Alumina Limited (AAL), Aughinish Island, Askeaton, Co. Limerick.

15.1 Introduction

The assessment considered the likely direct and indirect significant impacts and effects the preparatory, construction, operational and closure phases of the Proposed Development may have on Material Assets – Site Services located in the vicinity of the Application Site. Material Assets – Site Services in the vicinity of the Application Site comprise of built services and infrastructure such as electricity, gas, telecommunications, water supply infrastructure, surface water drainage and sewerage.

15.2 Potential Impacts

Mapping obtained from ESB Dial-Before-You-Dig shows underground ESB (10 kV/ 20 kV/ 400V/ 230V) located outside of the south-east sector of the Application Site boundary; with the nearest ESB cabling being approx. 150m away. Overhead ESB (10 kV and 38 kV) lines are present within the south-eastern corner of the Application Site, where the stockpile area is located, and protection measures are in place. There is an ESB substation located at the south-east boundary of the AAL Plant Site which has local areas of 110 kV/ 20 kV/ 400V/ 230V underground cabling. Two (2) 110 kV overhead cables and one (1) 110kV underground cable runs north from the substation into the Plant Site. Two (2) 110 kV overhead cables run south-east from the substation and continue to the south-east and then east.

Mapping obtained from Gas Networks Ireland (GNI) shows a 300mm diameter gas transmission steel pipeline running to the east of the Application Site boundary. The closest distance from the proposed Borrow Pit Extension to the transmission pipe is at the south-east corner, where the 50m minimum distance agreed with GNI is maintained. Marker posts are positioned at regular intervals above the pipe. The gas line feeds the Combined Heat and Power (CHP) plant at the main Plant Site, where its two gas powered turbines provide power and steam for plant processes.

Mapping obtained from Eir Call-Before-You-Dig shows underground Eir cabling located outside of the south-east sector of the Application Site boundary; with the nearest Eir cabling being approx. 65m away. The Eir cabling extends along the access road, passing to the east of the proposed Borrow Pit Extension, and to the AAL facility. There is an overhead supply crossing the south-eastern portion of the Application Site.

Independent Site Management Limited (ISM) were commissioned to review and assess the Proposed Development in order to establish the potential effects on important telecommunication channels, (such as microwave links) in the vicinity of the Site. No microwave links were identified in the vicinity of the Application Site that might have potential to be impacted by the Proposed Development.

Mapping obtained from Irish Water indicates an Irish Water owned mains supply passing through the south-eastern extent and along the eastern edge of the Application Site. The mapping shows a 750mm diameter asbestos pipe passing to the south-east of the BRDA and through the stockpile area in the south-east sector of the Application Site. This 750mm diameter asbestos pipe enters the footprint of the Limerick City and County Council Water Treatment Plant (LCCC WTP) and two (2) 600mm diameter ductile iron pipe branches emerge; one going north towards the AAL facility and the other going east.

The 600mm diameter ductile iron pipe to the AAL facility is installed along the west verge of the access road and is offset 20m from the constructed Phase 2 BRDA at its closed point. It continues further north and passes to the south-east and east of the proposed Borrow Pit Extension and has a minimum offset of 50m at its closest point to south-east corner of the Borrow Pit Extension footprint.

Irish Water mapping does not contain details of any sewer network within the region of the Application Site. AAL operates a dedicated Wastewater Treatment Management System for both the BRDA and the Plant Site, which incorporates a surface water and storm runoff system.

15.2 Summary and Conclusions

The Proposed Development does not require any connection to the site services identified or any increase in the current connections. The underground service pipes that have been identified are considered to be of sufficient distance from the Application Site that they are not at risk of disruption from earthworks. Appropriate offset distances from the proposed Borrow Pit Extension have been agreed with the service stakeholders, as part of the Proposed Development design.

The magnitude of impact on site services in the vicinity of the Application Site has assessed to have imperceptible implications. No additional mitigation measures outside of standard construction good practice are required.

16.0 MAJOR ACCIDENTS & DISASTERS

Golder Associates Ireland Limited (Golder) has been commissioned by AAL to prepare an Environmental Impact Assessment Report (EIAR) Major Accidents and Disasters Chapter in support of the Proposed Development at Aughinish Alumina Limited (AAL), Aughinish Island, Askeaton, Co. Limerick.

16.1 Introduction

The Chapter presents the assessment of the vulnerability of the Proposed Development to major accidents and / or disasters, and the potential for the Proposed Development, if any, to cause major accidents and/or disasters as a result of unplanned events or extreme natural events exceeding the design criteria. In addition, the Chapter identifies control and/or emergency preparedness measures which are in place, or that may need to be implemented, to prevent or mitigate the likely significant adverse effects of such events on the environment.

The Proposed Development design is understood to comprise the project design principles and standards adopted to avoid or prevent adverse safety and environmental effects, construction and operation to appropriate codes of practice and guidelines, and including fixed procedural commitments such as instrumentation and monitoring. This measure provides the baseline for the assessment of impacts.

The discussion is supported by a risk assessment which considers the likelihood of major accidents or disasters occurring combined with the severity of their associated impacts. The general risk assessment methods are based on the DoEHLG, (2010), Guide to Risk Assessment in Major Emergency Management, which have been supplemented to include the highly improbable scenarios to which tailings facilities and the AAL BRDA has been designed.

Major accidents and disasters have the potential to give rise to effects outside the Proposed Development on the human health, economy, transport, tourism, etc, as such the DoEHLG classifies impacts under categories such as 'Life, Health, Welfare', 'Environment', 'Infrastructure' and 'Social'.

16.2 Potential Impacts

For the purposes of the assessment, potential major accident or disaster hazards are categorised as either 'natural hazards' or 'industrial hazards'.

Natural hazards assessed included the potential for a: seismic event; storm event; tidal surge or wave event, including the climate change effects on such events; and, significant karst features i.e., sinkholes or caves, resulting in structural failure of the BRDA, the SCDC or both, breach of the BRDA and liquefaction of the bauxite residue leading to discharge externally or structural failure of the pit face of the borrow pit, leading to pit wall collapse.

Industrial Hazards assessed included the potential of: incidents at proximal industrial sites resulting in structural failure of the BRDA, breach of the BRDA and liquefaction of the bauxite residue leading to discharge externally, fire or explosion; failure of bauxite residue pipeline transfer; contamination of underlying soils and groundwater from fuelling activities; collapse of the borrow pit faces; and, damage or rupture of proximal gas transmission pipeline.

16.3 Summary and Conclusions

The AAL facility has been in operation since 1983. There have been no major events at the facility from 1983 to the present day.

The permitted BRDA is design and operated in accordance with the Best Available Techniques (BAT) Reference Document for the Management of Waste from Extractive Industries in accordance with Directive 2006/21/EC (MWEI BREF 2018). In accordance with MWEI BREF 2018 and in the absence of a national or EN standard, AAL have selected to classify the BRDA and ancillary infrastructure in accordance with the Canadian Dam Association (CDA) Guidelines (CDA 2013, CDA 2014) and to adopt the target level criteria for design parameters (inflow design flood, seismic event and factors of safety for static, pseudo-static and post-seismic stability) which are dependent on the consequence of failure and hence the dam classification. The Proposed Development will be similarly designed and operated in accordance with the relevant best international current practice and, as such, has a low vulnerability to the hazards of major accidents and disasters.

Monitoring instrumentation has been installed on the side slopes of the BRDA. These measure settlement, lateral and downslope movement and piezometric elevation. These instruments are read, interpreted and audited at frequencies in accordance with the conditions of IE Licence P0035-07 and with the Physical Stability Monitoring Plan for the AAL BRDA (Golder 2021). Existing geotechnical monitoring and design preventative measures are assessed to be sufficient for the control of major accidents and disasters related to the BRDA and SCDC.

The stability analyses for the Phase 1 BRDA and the Phase 2 BRDA have returned FoS in compliance with the target FoS criteria for the permitted BRDA constructed to Stage 10 and for the proposed BRDA Raise to Stage 16. These target FoS criteria are consistent with the current international guidelines for tailings dam safety management and best practice.

To manage and to mitigate the effects associated with major accidents on Site, AAL maintain existing environmental and health and safety management protocols, best practice measures, relevant preventative measures, emergency preparedness provision which include response procedures in place to manage emergency scenarios within the AAL facility. Emergency scenarios which entail a breach in the BRDA have been identified and planned for in Limerick City and County Council External Emergency Plan for the Bauxite Residue Disposal Area (2019), and it is concluded that further mitigation is not required for such scenarios.

Risks associated with the failure of a face in the Borrow Pit Extension have been reduced by the Proposed Development design and the existing and proposed comprehensive management practices that will govern works in the area. Similarly, risks associated with blasting activities in the Borrow Pit Extension have been reduced with the implementation of the strict management protocols surrounding each of the blasts. It is considered that no further mitigation and additional 'planning and preparedness' is required for these scenarios.

From the assessment it is considered that the prevention and Proposed Development design measures already included are sufficient and that the risk of a major accident and/or disaster during the construction, operation, closure and aftercare of the Proposed Development is considered 'low' in accordance with the risk assessment methodology. As such, no additional mitigation measures are considered to be required.

17.0 CLIMATIC FACTORS

17.1 Introduction

The likely climatic impacts associated with the proposed BRDA raise and Borrow Pit extension at Aughinish Alumina has been assessed by AWN Consulting Ltd.

17.2 Receiving Environment

The existing emissions of Greenhouse Gases (GHGs) based on EPA data has been reviewed. National GHG emissions for 2019 are estimated to be 4.5% lower than those recorded in 2018. National Emission reductions have been recorded in 6 of the last 10 years. However, compliance with the annual EU targets has not been met for four years in a row. National Emissions from 2016 – 2019 exceeded the annual EU targets by 0.29 $MtCO_2eq$, 2.94 $MtCO_2eq$, 5.57 $MtCO_2eq$ and 6.98 $MtCO_2eq$ respectively.

17.3 Likely Significant Impacts

Appropriate flood risk measures and extreme weather events have been considered as part of the construction planning. However, the potential for changes to long-term seasonal averages as a result of climate change are not considered to be as significant. Thus, the likelihood of extreme weather and flooding is assessed to be of either very low or low likelihood and with a moderate adverse effect leading to a finding of low risk and thus a non-significant impact.

In the operational phase, the likelihood of flooding was investigated. The study found that the likelihood of extreme weather and flooding leading to a containment breach or red mud release was assessed to be of very low likelihood and with a moderate to high adverse effect leading to a finding of low risk and thus a non-significant impact.

The climate impact assessment has focused on the potential GHG emissions associated with the construction and operational phases of the proposed development on its surrounding environment. The overall combined operational phase GHG emissions, prior to mitigation, due to the combined Construction and Operational Phase of the Proposed Development will be negative, long-term and not significant. The annual GHG emissions due to the combined Construction and Operational Phase are equivalent to the construction of 23 3-bedroom houses or four transatlantic return flights. Similarly, the combined Construction and Operational Phase GHG emissions are equivalent to the annual carbon footprint of 93 individuals.

In order to add context to this approach to significance, it is clear that there are many activities and sectors which are contributing to net GHG emissions in Ireland. Large industrial and power GHG emissions, including AAL, are captured in the context of the EU-wide ETS which has set defined targets which are being met due to the structure of the Cap-and-Trade mechanism which places a price on carbon to ensure that GHG emissions are reduced at least cost. Most other activities such as agriculture, transport, built environment, waste and smaller industry however are included in the Effort Sharing Regulations which has set a specific target for Ireland of a 30% reduction in GHG emissions by 2030. Any activities in these sectors are now considered relevant if they lead to a quantifiable increase in greenhouse gas emissions.

17.4 Mitigation Measures

Vehicle traffic is expected to be the dominant source of greenhouse gas emissions as a result of the combined construction and operational phases of the Proposed Development. Vehicles, generators etc., may give rise to some CO_2 and N_2O emissions. A series of mitigation measures will be implemented which will mitigate GHG emissions including requiring all vehicles to switch off engines when stationary (no idling), all vehicles will be serviced and maintained to ensure emissions are minimised and limestone will be sourced from the onsite borrow pit thus minimising transportation distances for the construction phase of project.

In relation to indirect emissions, AAL operates a long-established alumina extraction plant. AAL operates under the ETS based on Permit Register Number IE-GHG038-10361-3 with verified emissions of 1,224,809 tonnes CO_{2eq} in 2020. If the BRDA raise does proceed the facility will continue to operate beyond 2030.

The do-something scenario will lead to indirect GHG emissions from the Alumina Plant continuing beyond 2030. However, the ETS market will have to meet a target of a 61% reduction by 2030 based on annual reductions of 4.2% compared to the previous annual reduction level of 2.2% per year and thus it is likely that there will be a gradual reduction in GHG emissions from the facility under the facility's ETS Permit. Under the EU ETS, AAL will continue to be regulated and will continue to pay gradually increasing carbon cost as there are no free allocations for power generators.

In relation to the impact of climate on the Proposed Development, if appropriate, additional measures, such as an increase in berms in the BRDA, to ensure the resilience of the Proposed Development to impacts during extreme weather events will be implemented for the construction phase.

17.5 Conclusion

In summary, the overall combined construction and operational phase GHG emissions, after mitigation, due to the direct and indirect operational phase of the Proposed Development will be negative, long-term and not significant.

18.0 INTERACTIONS AND CUMULATIVE IMPACTS

18.1 Introduction

This Chapter of the EIAR has been prepared by Tom Phillips + Associates and deals with likely interactions between effects predicted as a result of the proposed development.

In addition to the requirement under the *Planning and Development Regulations 2001 (as amended)* to describe the likely significant effects of the proposed development on particular aspects of the environment, it is also required to consider the interaction between impacts on different environmental factors. As such, these are assessed below.

The interaction of effects within the Proposed Development in respect of each of the environmental factors, listed in Article 3(1) of the EIA Directive, has been identified and addressed in the respective chapters in this EIAR. This chapter presents an overview of these interactions of impacts, from the Proposed Development, between the various environmental factors.

This Chapter outlines the areas where potential interactions may arise as a result of the proposed development.

The potential cumulative impact of the proposed development with other existing and/or approved projects within close proximity of the subject site has also been assessed and is discussed further below.

As noted in Chapter 1 of the EIAR, air and GHG emissions associated with the Plant will continue regardless of the Proposed Development until c. 2030. The ongoing operation of the Plant, post 2030, is addressed as an indirect effect in the context of the assessment of the Proposed Development.

18.2 Inter-Relationships/ Interactions

All aspects of the environment are likely to interact to some extent and to various degrees of complexity. The likely significant interactions between factors arising from the proposed development are set out in the matrix provided as Table 18.1 below.

Table 18.1: Matrix of Interactions Between Environmental Factors

	Archaeology, Architectural & Cultural Heritage	Biodiversity	Population + Human Health	Soils, Land and Geology	Landscape & Visual	Hydrology & Hydrogeology	Air Quality	Noise & Vibration	Material Assets - Waste	Material Assets - Site Services	Traffic + Transportation	Climatic Factors
Archaeology, Architectural & Cultural Heritage				✓								
Biodiversity				✓	✓	✓	✓	✓	✓			
Population + Human Health					✓	✓	✓	✓	✓		✓	
Soils, Land & Geology					✓	✓					✓	
Landscape & Visual												
Hydrology & Hydrogeology											✓	
Air Quality											✓	
Noise & Vibration											✓	
Material Assets - Waste											✓	
Material Assets - Site Services												✓
Traffic & Transportation												
Climatic Factors												

18.2.1 Interactions between Archaeology, Architecture & Cultural Heritage and impacts associated with Soils, Land & Geology

Chapter 8 of the EIAR relates to Soils, Land & Geology and outlines the proposed works associated with the extension of the borrow pit at the north east of the subject site. There is potential for the proposed extraction of rock in this area to impact on previously unrecorded archaeological assets, and to alter the special interests or qualities of the asset.

Targeted archaeological test-trenching will be carried out within the proposed borrow pit area of the subject site and any features will be appropriately preserved / recorded in accordance with National Monuments Service guidelines, thereby enriching the known archaeological heritage of the County. No significant adverse effects arising from interactions between Archaeology, Architecture & Cultural Heritage and Land & Soils are anticipated.

18.2.2 Interactions between *Biodiversity* and impacts associated with *Soils, Land & Geology*

Arising from the proposed expansion of the borrow pit into a current greenfield area and the importation of soils to be used for the progressive restoration of the BRDA, there may be potential interactions between biodiversity and Soils, Land & Geology. Mitigation measures included within Chapter 6 of the EIAR include ensuring that stockpiles of soil will be appropriately managed, that areas will be surveyed by a suitably qualified ecologist prior to vegetation clearance, and that escape ramps will be provided for fauna in areas where deep excavations have taken place. No significant adverse effects arising from interactions between Biodiversity and impacts associated with Soil, Land & Geology are anticipated.

18.2.3 Interactions between *Biodiversity* and impacts on *Landscape & Visual*

Potential interactions between Biodiversity and impacts on Landscape & Visual are discussed in Chapters 6 and 9 of the EIAR, respectively. The existing BRDA is of little ecological value, however landscaping measures including the progressive restoration and seeding of the BRDA will establish a hedgerow pattern consistent with the surrounding landscape which will be considerably more attractive for local fauna. No significant adverse effects arising from interactions between Biodiversity and impacts associated with Landscape & Visual are anticipated.

18.2.4 Interactions between *Biodiversity* and impacts associated with *Waste*

Potential interactions between Biodiversity and impacts associated with Waste Management are addressed in chapters 6 and 13 of the EIAR, respectively. Improper management of wastes has the potential to negatively impact upon local biodiversity. Mitigation measures such as ensuring that all wastes will be stored and managed in an appropriate manner will minimise potential impacts associated with the interaction between waste and ecology in the area. No significant adverse effects arising from interactions between Biodiversity and impacts associated with Waste are anticipated.

18.2.5 Interactions between Biodiversity and impacts on Hydrology & Hydrogeology

The potential for interactions between Biodiversity and Hydrology & Hydrogeology is discussed in Chapters 6 and noted in Chapter 10 of the EIAR.

The proposed development activities within the BRDA and SCDC, the extended borrow pit and the stockpile area have potential to cause increased sediment load in local water courses which can result

in impacts on aquatic ecology. Inadequate design of drainage systems can result in failures, which could lead to the release of sediment laden water and hence have potential for impact on habitats and species.

The mitigation measures proposed in relation to water management will ensure that leakages and spills will be avoided and thus negative impacts on habitats of biodiversity value including the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA will not arise. Therefore, no significant adverse effects arising from interactions between biodiversity and hydrology & hydrogeology are anticipated.

18.2.6 Interactions between Biodiversity and Air Quality Impacts

The proposed project activities have potential to impact air quality, through e.g. dust emissions. Dust emissions have potential to affect habitat and species within and in the vicinity of the subject site. The potential for interactions between Biodiversity and Air Quality impacts are discussed in Chapters 6 and 11 of the EIAR, respectively. The mitigation measures proposed to minimise impact on air quality (including dust monitoring and dust suppression measures) will further minimise the likelihood of potential impacts on the flora, habitats and fauna on or in the vicinity of the site. No significant adverse effects arising from interactions between biodiversity and air quality impacts are anticipated.

18.2.7 Interactions between *Biodiversity* and *Noise & Vibration* Impacts

Noise & vibration impacts associated with the proposed development have potential for interactions with impacts on species that are on or in the vicinity of the site. This is discussed in Chapters 6 and 12 of the EIAR, respectively. It is considered within the biodiversity chapter that the mitigation measures proposed in the noise chapter (such as the reduced time window within which blasting is to take place) will be effective in addressing the potential impacts of noise & vibration on the species that occur in the receiving environment. Therefore, no significant adverse effects arising from interactions between biodiversity and noise & vibration factors are anticipated.

18.2.8 Interactions between Population & Human Health and Landscape and Visual Impact

Chapter 9 of the EIAR assesses the landscape and visual impacts of the proposed development. The effect of the proposed development on surrounding views including on residential receptors, amenity areas and scenic routes have been assessed. With regard to residential receptors (i.e. nearby populations), whose sensitivity is classed as high, it is anticipated that the progressive landscaping as the stages are raised plus the overall effect on completion and restoration of the development, mean that effects will be not significant, slight or moderate neutral in the long term. Therefore, no significant adverse effects arising from interactions between population and landscape and visual impact factors are anticipated.

18.2.9 Interactions between Population & Human Health and Waste Management

There is potential for improper waste management arising from the proposed development to result in negative effects on population and human health. However, as a result of the mitigation measures outlined within Chapter 13 (Waste Management) of the EIAR and the commitment to adhere to relevant waste disposal guidelines, no significant adverse effects arising from interactions between population and waste factors are anticipated.

18.2.10 Interactions between *Population & Human Health* and *Traffic* Impacts

Chapter 7 and Chapter 14 of the EIAR address population & human health and traffic, respectively. The traffic assessment finds that the proposed development will result in a minor increase in traffic levels in the surrounding area. It is noted that the forecasted traffic levels for the N69 (the main road in the surrounding area) will still be well below the theoretical capacity for this road. It is concluded that the proposed development will have no material impact upon the operation of the local road network and as such no significant effects are anticipated to occur in terms of traffic disturbances on the local population.

Increases in traffic movements within and outside of the site give rise to impacts on air quality which have potential to negatively affect human health. This is discussed below in Section 18.2.11.

18.2.11 Interactions between Population & Human Health and Air Quality

Chapter 7 and Chapter 11 of the EIAR address population & human health and air quality, respectively. The impact on air quality of the proposed development has been assessed and taking into account that the overall majority of traffic movements will be internal with the closest residential dwellings to the site located at a distance greater than 900m from the boundary, there is no potential for significant impact on Human Health from air quality impacts arising from vehicle movements on the site.

The mitigation measures outlined in Chapter 11 of the EIAR including dust monitoring and dust suppression efforts will ensure that dust generation is minimised and that good air quality standards are maintained at all times. As a result, no significant adverse effects arising from interactions between population and air quality factors are anticipated.

18.2.12 Interactions between Population & Human Health and Noise & Vibration Impacts

Chapter 7 and Chapter 12 of the EIAR address population & human health and noise & vibration, respectively. There is potential for noise & vibration impacts from internal vehicle movements and machinery, and the proposed extended borrow pit activities to negatively impact upon the surrounding population. However, as a result of the mitigation measures (such as the very limited number of blasts per year) outlined within Chapter 12 of the EIAR, no significant adverse effects on the local population as a result of noise & vibration impacts are anticipated.

18.2.13 Interactions between Population & Human Health and Hydrology & Hydrogeology Impacts

Chapter 7 and Chapter 10 of the EIAR address population & human health and noise & vibration, respectively. There is potential for hydrological and hydrogeological impacts resulting from emissions water and groundwater from the BRDA, Salt Cake Disposal Cell and the borrow pit to negatively impact upon the surrounding population. However, as a result of the mitigation measures outlined within Chapter 10 of the EIAR, no significant adverse effects on the local population as a result of hydrological and hydrogeological impacts are anticipated.

18.2.14 Interactions between Soils, Land & Geology and Hydrology & Hydrogeology impacts

The interaction between Soils, Land & Geology and Hydrology & Hydrogeology impacts is detailed in Chapters 8 and 10 of the EIAR. Operational activities such as excavations and earth movement represent potential sources of suspended solids and may result in impacts on water quality. The

ongoing management of these activities are expected to minimise the potential for impact on water quality, and no significant effects are anticipated.

The lining of the BRDA and the ongoing ground water monitoring scheme ensure that there are no significant impact on groundwater arising from the proposed development. There is no extraction proposed below the groundwater table within the proposed borrow pit extension. No significant effects are anticipated.

18.2.15 Interactions between Soils, Land & Geology and Landscape and Visual Impacts

The use of rock in the construction stage raises within the BRDA facilitates the increased height and provides the additional disposal capacity of the BRDA. This ongoing raising of the BRDA structure although somewhat mitigated through the gradual revegetation of the lower side slopes will have impact on the landscape i.e. visual impact. Likewise, the use of soils and the additional planting mitigation to be applied in the closure stages enables the revegetation of the surface of the BRDA, which again will have a direct impact on the landscape, as well as indirect positive impacts on biodiversity, in terms of landscape and visual impact.

18.2.16 Interactions between Soils, Land & Geology and Traffic & Transportation Impacts

As outlined in Chapter 8 – Soils, Land & Geology of the EIAR, the proposed construction of the BRDA and SCDC stage raises will use rock sourced solely from the Borrow Pit areas (permitted and proposed). As this Borrow Pit is located on the subject site and directly adjacent to the BRDA, the transit of this material will not impact on the surrounding traffic network.

Imported soil materials required to facilitate the progressive restoration and closure of the proposed development are considered in Chapter 14 – Traffic & Transportation of the EIAR, which takes account of the soil quantities required in its traffic assessment. The traffic assessment concludes that the proposed development will have no material impact on traffic or the surrounding road network and there will as such be a neutral effect. Therefore, no significant adverse effects arising from interactions between Soils, Land & Geology and Traffic & Transportation impacts are anticipated.

18.2.17 Interactions Hydrology & Hydrogeology and Traffic & Transportation Impacts

There is potential for leakages and spills associated with traffic movements to have interaction impacts with hydrology & hydrogeology factors. Mitigation measures including vehicle loading controls and frequent maintenance of vehicles will ensure that such potential impacts are minimised. No significant adverse effects arising from interactions between hydrology & hydrogeology and Traffic & Transportation impacts are anticipate.

18.2.18 Interactions between Air Quality and Traffic & Transportation Impacts

Increases in traffic movements within and outside of the site give rise to potential impacts on air quality. The interaction between air and traffic is outlined in Chapter 11 of the EIAR. It is noted that the proposed development will utilise rock fill from the permitted/proposed borrow pit area and will thus minimise required traffic movement distances. Additional mitigation measures including watering of access roads and the provision of wheel washes will minimise windblown dust arising from traffic movements. No significant adverse effects arising from interactions between Air Quality and Traffic & Transportation factors are anticipated.

18.2.19 Interactions between Air Quality Impacts and Climatic Factors

Chapter 17 of the EIAR addresses climatic factors and acknowledges that there is potential for interactions between climatic factors and air quality. Emissions associated with vehicle traffic during the construction and operation of the proposed development have the potential to result in impacts on climate. The environmental assessment of climatic factors included within Chapter 17 of the EIAR has taken account of such air quality emissions. No significant adverse effects arising from interactions between air quality and climatic factors are anticipated.

18.2.20 Interactions between Waste and Traffic & Transportation Impacts

There is potential for waste and traffic impact interactions to arise as a result of the proposed development. Were efforts not to be made to minimise waste on site, this would result in increased traffic movements associated with its disposal. However, and as noted in Chapter 13 of the EIAR, residual waste generation associated with the proposed development will be minimised where possible and where it is not will be dealt with through permitted waste collectors and via licensed waste facilities. No significant adverse effects arising from interactions between waste and traffic & transportation factors are anticipated

18.2.21 Interactions between Traffic & Transportation impacts and Climatic Factors

It is noted that the operational traffic i.e. the operation of vehicles has been identified as the dominating source of greenhouse gas emissions associated with the proposed development. The environmental assessment of climatic factors included within Chapter 17 of the EIAR has taken account of potential interactions with traffic.

Mitigation measures include arrangements to ensure that vehicles are well maintained and do not idle. With the implementation of these measures, negative effects arising from traffic on climatic factors will be minimised. No significant adverse effects arising from interactions between air quality and climatic factors are anticipated.

18.2.22 Interactions between Traffic & Transportation impacts and Noise & Vibration

The movement of vehicles associated with the proposed development has the potential to result in noise and vibration impacts. The noise & vibration chapter of the EIAR has been prepared in consideration of an in conjunction with the information contained within the traffic & transportation chapter. No significant adverse effects arising from interactions between traffic & transportation and noise & vibration factors are anticipated

18.3 Cumulative Impact

The potential cumulative impact of the Proposed Development with other existing and/or approved projects has also been assessed in the EIAR. A survey of existing and/or approved projects in the area was undertaken to determine whether the nature and scale of each of these projects could be sufficient to generate cumulative impacts of significance on the environment. The projects identified as part of this survey are listed and shown in Appendix 18.1 of the EIAR.

For the purposes of this survey, all planning applications which were recorded on the National Planning Applications Database (DoHPLG) with extant permissions or were otherwise under consideration as of August 2021 within a c. 15km radius of the Subject Development were included.

A record of relevant planning applications within c. 15km of the planning boundary was established in August 2021. These applications were determined to constitute new or recent development of a commercial, industrial, agricultural or residential nature, which may be of significance to the cumulative assessment given their size or proximity to the subject site. The following types of applications were excluded from the final listing:

- Minor change of use applications;
- Residential applications of less than 10 no. units located greater than c. 1.5km of the subject site;
- Minor amendments to permitted applications;
- Retention applications;
- Minor signage applications;
- ESB infrastructure (i.e. substations, switch rooms and towers);
- Minor utilities works including lighting and junction upgrades;
- Developments of a scale that would not exacerbate significant environmental effects (e.g. internal reorganisation, car parking of less than 20 spaces, continuance of use, etc.);
- Developments that have become operational by the time of writing (as they have been considered in the baseline); and
- Applications that were granted prior to February 2016 as it is assumed that these permissions will have lapsed, unless otherwise stated in the Grant of Permission.

The list of projects identified in Appendix 18.1 of the EIAR were distributed to the expert consultants undertaking each of the assessments of environmental factors. As outlined in Table 18.1, no significant cumulative impacts were identified by any of the expert consultants.

18.3.2 Mitigation And Monitoring Measures

No significant cumulative impacts will arise. Therefore, no mitigation measures are required to address cumulative impacts.

19.0 MITIGATION & MONITORING

The chapters contained within this EIAR have been ordered in a grouped format by their relevant topic. Chapter 19 in the EIAR summarises all mitigation measures proposed in order to provide a comprehensive overview of the full range of mitigation measures discussed within each chapter.

20.0 DIFFICULTIES ENCOUNTERED

Difficulties encountered are noted within three of the EIAR chapters. These difficulties are outlined below.

Archaeology
A small area of the planning application site was unavailable during field inspection due to the dense vegetation occupying the north-eastern portion of the planning application site.

Waste

As noted previously, quantities of construction waste materials may vary depending on construction methodologies. Therefore, there was difficulty in estimating waste quantities which will be dependent on the approach of the appointed Main Contractor. To resolve this, the quantities determined were based on professional experience of similar projects, a review of the wastes generated by the overall AAL facility and identification of waste streams that can be considered applicable to the ongoing construction of BRDA raises and the worst-case waste estimates assuming that the wastes will be removed from site for disposal and not recovered or reused.

Traffic

As outlined in Section 14.3.5, due to ongoing COVID-19 restrictions, traffic levels on the N69 national secondary road were understood to be lower than those that would have been present under pre-COVID circumstances. As a result, publicly available traffic data for the year 2019 (i.e. pre-COVID) from a local TII counter located on the N69 was used in determining typical traffic volumes and factored up to future year levels using TII growth factors. This factored traffic data provided the baseline from which the proposed development was assessed.

Notwithstanding the above, no significant difficulties, in terms of technical deficiencies or lack of sources of information, were encountered in compiling the specified information contained in the Statement.