

FASSAROE INERT WASTE RECOVERY FACILITY

Fassaroe, Bray, Co. Wicklow

Application to EPA for Technical Amendment to
Remove Backfilled Lands from Licensed Area

CLOSURE AUDIT REPORT

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1.0 INTRODUCTION

1.1 Background

This Closure Audit Report is prepared in support of an application by Roadstone Limited (herein after 'Roadstone') to the Environmental Protection Agency (hereinafter 'the EPA' or 'the Agency') for a technical amendment of its waste licence at Fassaroe, Bray, Co. Wicklow (Ref No. W0269-01) to remove an area of backfilled land from the existing licensed site area.

The existing licensed waste site is located entirely within the townland of Fassaroe, Co. Wicklow, approximately 1.5km west of Bray town and 2km east of Enniskerry village. The licensed site area and the extent of the lands owned by Roadstone are indicated on a 1:20,000 scale map of the area, in Figure 1.

The lands to be removed are located on the eastern and north-eastern side of the existing licensed site and comprise the lands within and around the footprint of the former sand and gravel pit at Fassaroe. These lands were backfilled under licence using imported surplus soil and stone from construction and development projects between mid-2011 and the early months of 2015.

The lands to be removed from the licensed area extend to 11.7 hectares (28.2 acres) of the overall existing licensed area of 25.8 hectares (62.2 acres). Should the application lands ultimately be removed from the licenced site area by way of technical amendment, the residual licensed site, extending to 14.1 hectares (34.0 acres), will principally comprise

- (i) the existing construction and demolition (C&D) waste recovery area,
- (ii) the central site infrastructure area and
- (iii) the surface water holding pond.

It is envisaged that C&D waste recovery activities will continue across the remaining licenced area until such time as all C&D waste imported to, and stockpiled at, the site is processed into recycled aggregate and submitted to end uses which accord with a future End of Waste decision by the Agency.

The extent of the lands to be removed from the licenced area and the residual licensed area are indicated in Figure 1 and on a recently updated topographical survey drawing in Figure 2.

1.2 Scope and Contents of this Closure Audit Report

This report address the final site restoration and closure activities associated with the backfilling of the former pit area at the licenced inert C&D waste recovery at Fassaroe and the works which have been undertaken to ensure / confirm that the restored site presents no long term risks to human health or the local environment.

Section 2 presents background details on the existing site layout, development history, planning / waste licencing consents and an overview of site activities.

Thereafter, in Section 3, the report provides details of the post-closure works which have been undertaken by Roadstone at the backfilled pit since it ceased waste soil intake and soil waste recovery activities in January 2015. These works are benchmarked against undertakings previously provided in the most recent closure plan furnished by Roadstone to the EPA.

Section 4 presents details of site inspections undertaken by staff from SLR Consulting Ireland to confirm that the works undertaken are substantially in accordance with undertakings provided previously and that they present no long-term risk to human health or the local environment. Where relevant, details are provided of any additional works recommended to Roadstone and the subsequent follow up audit and close-of these works by SLR personnel.

Section 4 also presents an brief overview of the findings of an environmental risk assessment which has been completed based on information in respect of soil waste intake, independent site investigations and groundwater monitoring undertaken by SLR personnel.

Section 5 presents the final audit conclusion and recommendation.

1.3 Existing Site Context and Layout

The existing waste licence area covers an area of approximately 25.8 hectares. The licensed facility is located within a long-established construction materials production facility operated by Roadstone Ltd. The former pit void, which has now been backfilled to its original ground level using imported inert soil and stone waste, is located in the eastern part of the licensed facility. It originally extended across 9.3ha and constitutes the bulk of the area to be removed from the licensed site area by way of a technical amendment.

Throughout the site's history, a number of commercial activities have taken place, some of which have ceased. By way of background and to provide some context, a brief overview of these activities is set out below. The existing site layout is shown on a recent (2017) aerial photograph of the site in Figure 3, with the following key areas identified and delineated.

Concrete Production Area

Intermittent production of ready-mixed concrete has been undertaken at the shared infrastructure area at the western end of the licensed facility for many years.

Retail Shop

There is currently an on-site retail outlet for concrete paving products located immediately adjacent to the site office, close to the site entrance.

Aggregate Processing

Processing of natural aggregates, (principally washing of sand and gravel) was previously undertaken within the licenced site area at Fassaroe, but has now ceased.

Inert Soil Waste Recovery Area

Ground levels across the licensed site follow that of the (original) surrounding ground, falling south-eastwards from approximately 95mOD to 74mOD (Malin), toward the Cookstown and Dargle Rivers. The pit void previously had depths from existing ground level varying from 15m at its northern end to a minimum of 5m at its southern end. These levels have since been raised and restored to surrounding ground level by backfilling with imported inert soil and stone.

C&D Waste Recovery Area

C&D waste recycling activities are concentrated in the north central part of the licensed facility and are concentrated with an area of approximately 3.0 ha. The remainder of the licenced area holds various site infrastructure (offices, workshops, fuel storage areas, inspections shed etc.) and a settlement / surface water pond which is shared with the co-located concrete production facility.

C&D waste is currently stockpiled in this area and awaiting crushing / processing prior to eventual dispatch off-site as a recycled product.

2.0 EXISTING LICENSED FACILITY

2.1 Regulatory Consents

2.1.1 Planning Permission

As extraction activities commenced at the licensed site at Fassaroe prior to the introduction of planning controls under the Local Government (Planning and Development) Act of 1963, planning permission was never required in respect of historical extraction activities at the facility.

Planning permission for the existing C&D waste recovery facility was granted by Bord Pleanála on appeal in July 2004 (Wicklow County Council Planning Ref. No. 03/9501 / ABP Ref. PL27.206464). The original permission was renewed for a further 5 years in 2009 (Planning Reference 09/844) and subsequently again in 2014 (Planning Ref. 14/1440) and 2019 (Planning Ref. 19/620). The existing 5 year planning permission expires on 2 September 2024.

A planning application to provide for the backfilling and restoration of the existing void at Fassaroe was submitted to Wicklow County Council in July 2008 (Planning Register Reference No. 08/1258). A final decision to grant planning permission for this activity for a 10 year period was issued by Wicklow County Council on 21st January 2009.

The life of this permission was extended by way of an application (Planning Ref. 19/68) in early 2019 to extend the life of the planning permission by 5 years up to March 2024 to provide additional time to complete the sit restoration works and close out the removal / surrender of the restored lands from the licensed site area.

2.1.2 Waste Permits

Roadstone has operated a C&D waste recovery facility at Fassaroe since 2004. The facility was operated in accordance with the conditions attaching to a waste permit (Reference Number ESS/15/8/12) issued by Wicklow County Council for an initial three year period from 2004. The waste permit was subsequently renewed for a further three year period by Wicklow County Council in July 2008 (Ref. No. ESS/15/8/12-339).

A separate waste permit application was submitted to Wicklow County Council in May 2008 to provide for partial backfilling of the existing pit. This waste permit was issued, with conditions, in April 2009.

The C&D waste recovery facility and the soil recovery facility both operated under the Local Authority waste permit regime up to April 2011, at which time they were superseded by the grant of an EPA waste licence in respect of all site based recovery activities at Fassaroe.

2.2 Current Waste Licence

The EPA issued a waste licence to Roadstone in respect of an inert waste recovery facility at Fassaroe, Bray, Co. Wicklow on 6th April 2011 (Ref. W0269-01). The principal waste activity at the licensed facility was the backfilling of the existing (at that time) pit void using imported inert soil and stone from local construction and development sites. The second waste activity was construction and demolition waste recovery / recycling.

The waste licence, as issued, has not been amended to date and in summary provides (provided) for

- Recovery of up to 750,000 tonnes of naturally occurring waste materials, principally excess inert soil, stones and/or broken rock excavated on construction and development sites, though its placement on land and its re-use in backfilling and restoring a pit void created by the prior extraction of sand and gravel;
- Recycling of up to 20,00 tonnes of construction and demolition waste per annum, to produce secondary (recycled) aggregates, principally for use and further use off-site;
- Separation of any non-inert construction and demolition waste (principally metal, timber, PVC pipes and plastic) unintentionally imported to site (and its temporary storage at an inspection

and quarantine facility) prior to its removal off-site to an appropriately licensed waste disposal or recovery facility;

- Final levelling and restoration of the lands around the backfilled void and C&D recycling facility area (including placement of cover soils and seeding) and their return to natural grassland habitat; and
- Environmental monitoring of noise, dust, surface water and groundwater for the duration of the proposed waste recovery activities and for a short aftercare period thereafter.

The waste licence issued to Roadstone by the Environmental Protection Agency (EPA) provides for the following licensed activities (Fourth Schedule of the Waste Management Acts 1996-2019).

- Class R5 (Principal Activity) : Recycling/reclamation of other inorganic materials, which includes soil cleaning resulting in recovery of the soil and recycling of inorganic construction materials.
- Class R3 : Recycling/reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes), which includes gasification and pyrolysis using the components as chemicals.
- Class R4 : Recycling/reclamation of metals and metal compounds.
- Class R13 : Storage of waste pending any of the operations numbered R 1 to R 12 (excluding temporary storage (being preliminary storage according to the definition of 'collection' in section 5(1)), pending collection, on the site where the waste is produced).

2.3 Current Status

Backfilling of the former pit void using imported inert soil and stone was substantially completed in January 2015. The final levelling and contouring works, in accordance with planning approvals, were undertaken across the backfilled pit in late summer of 2019. A low rise earth mound was also constructed to demarcate the boundary between the backfilled area and the C&D waste recycling area at that time.

The onset of prolonged heavy rainfall in September of 2019 and the early saturation of the levelled ground surface mitigated against final ploughing, harrowing and preparation of soils to receive grass seed at that time. Ultimately it was not possible to sow grass as originally intended in autumn 2019 and seeding had to be deferred. The backfilled area was eventually seeded in April 2020 and grass cover has gradually become established over recent months.

Recovery of C&D waste on the lands west of and adjoining the backfilled / restored pit will continue for the foreseeable future. At the time of writing, the off-site dispatch and sale of processed C&D was suspended at the waste recovery facility, pending an EPA decision on End-of-Waste criteria for recycled aggregates produced from such waste.

In light of recent End of Waste decisions by the EPA and its recent publication of draft guidance on the preparation of End of Waste applications, it is anticipated that Roadstone will shortly submit an application to the EPA to establish End of Waste criteria for re-use of recycled concrete in concrete production. Following any EPA decision setting such criteria, it is expected further processing of the existing stockpiled C&D waste at Fassaroe and the off-site export, sale and re-use of recycled aggregate product will proceed shortly thereafter.

The closure and restoration of the construction and demolition waste recovery area will be undertaken at an unknown date in the future. It is envisaged that after that time, a waste licence surrender application will be prepared and submitted to the EPA in respect of any and all remaining lands within the (amended) licenced site area.

Current site activities at Fassaroe, which are unrelated to the waste licence activities, include the production of concrete products, as well as the operation of a retail facility for Roadstone paving products, which is open to the general public

2.4 Operator Performance

2.4.1 Environmental Management Systems

Roadstone implements an Environmental Management System (EMS) at all its facilities in respect of its core extraction and construction material production activities and has extended it to encompass inert soil / C&D waste recovery activities. A part of its EMS, Roadstone has developed standard procedures to address waste acceptance and handling activities, as well as an emergency response plan.

2.4.2 Compliance History

As previously noted, extraction activities have been undertaken at Fassaroe since before 1963.

Neither Roadstone Ltd. nor any of its predecessor companies (which includes Roadstone Dublin, Roadstone Provinces and Roadstone Wood), has ever been convicted of any offence under the Waste Management Acts and Regulations 1996-2020, the Environmental Protection Agency Act 2003 or the Air Pollution Act 1987.

Extraction, aggregate and concrete production and waste recovery activities at Fassaroe have operated in compliance with all planning and waste consents and Roadstone has not been subject to enforcement action by the Local Authority or the EPA.

2.4.3 Incident History

Insofar as is known or can be recalled by site based staff, no significant environmental incidents have arisen in the course of on-site waste operations at the licensed facility at Fassaroe, either prior to, or since, the waste licence was issued in March 2011. Specifically, no significant fuel leak or spill has occurred.

2.4.4 Environmental Monitoring

There is an established programme of environmental monitoring in connection with waste recovery activities at the licenced facility at Fassaroe. This environmental monitoring programme complies with the requirements of the existing waste licence and the associated planning permissions.

Groundwater

There are currently 7 No. groundwater monitoring wells installed across the licensed facility at Fassaroe. Of these, 3 No. (BH02A, BH03 and BH04) have been long established since the facility commenced operations, while 4 No additional wells (BH05, BH06, BH07 and BH08) were installed in early summer 2017.

Of the 7 No. monitoring wells, 3 No are located upgradient of the recovery facility (BH03, BH05 and BH08) while the remainder (BH02A, BH03, BH06 and BH07A) are located downgradient.

Groundwater is sampled and tested for a wide range of quality parameters at frequencies prescribed by the waste licence. Groundwater levels are also recorded at the time of sampling. The available groundwater quality data for Fassaroe indicates that it is generally of good status, with virtually all parameters analysed having ion concentrations lower than the Interim Guideline Values (IGV) set out in the EPA Publication *'Towards setting Guideline Values for the Protection of Groundwater in Ireland'*. The guideline value for arsenic has been exceeded on occasion, but this is considered to be reflective of arsenic which occurs naturally in soils around the monitoring well or in locally occurring soils imported and placed close to it.

A septic tank located to the south of the existing site offices, close to the site entrance, currently services toilets, wash hand basins and sink units at the recovery facility. The treated effluent from the septic tanks discharges to groundwater via a percolation area. The potable water demand at Fassaroe is met by a Local Authority mains supply.

Dust

Planning permissions for waste recovery activities at Fassaroe specify an emission limit value for dust deposition (at the site boundary) of 350 mg/m²/day (30 day composite sample) when measured using the conventional 'Bergerhoff' method.

Dust emissions are monitored using Bergerhoff dust gauges at three locations (D1, D2 and D3) around, or immediately beyond the boundary of the licensed facility, between it and potentially sensitive receptors beyond.

Ongoing dust deposition monitoring indicates that dust deposition levels around the Fassaroe facility are comfortably within the prescribed emission limit value of 350mg/m²/day.

Noise

Planning permissions for associated established activities within Roadstone's landholding specify noise emission limit values of 55 dB(A) L_{Aeq} at the property boundary during day-time hours, with a reduced limit of 45 dB(A) L_{Aeq} during night-time hours.

Noise emissions are monitored on a quarterly (i.e. three monthly) basis at 5 No. locations across the Fassaroe facility (designated N1 to N5), all of which are located at, or close to, the licensed site boundary.

Ongoing noise monitoring indicates that noise levels around the Fassaroe facility are comfortably within the prescribed daytime emission limit value of 55 dB(A) L_{Aeq}.

2.5 Site Inventory / Infrastructure

Existing site facilities and key site infrastructure are listed below and identified on Figure 3. Much, if not all, of this infrastructure is shared with the concrete production facility and will therefore remain in place and continue in service following cessation of all licenced waste recovery activities:

- **Buildings:** site office; maintenance garage / workshop; waste quarantine shed.
- **Infrastructure:** paved and unpaved internal road system; employee and visitor parking.
- **Hardstanding and paved areas:** retail area; storage yard; block yard; concrete yard and C&D waste recycling area.
- **Plant and Machinery:** wheel wash; weighbridge; bunded fuel tanks; mobile crushing and screening plant; mechanical excavators; bulldozers.
- **Services:** 3 septic tanks; Dublin City Council Watermain; internal buried water supply and wastewater pipework, short section of buried electrical cable (west of the block yard); several overhead electricity transmission cables.

2.6 Raw Materials, Products and Waste

An inventory of the raw materials, products and waste currently stored at the licenced recovery facility is provided in Table 2-1 below. Most of the materials stored are oils, fuels and lubricants required for ongoing maintenance and repair of any plant and equipment used in concrete production, C&D waste recovery and/or transport activities.

Table 2-1
Inventory of Raw Materials, Products and Waste

Type	Storage Area	Storage Type
Road Diesel	External Tanks	Bunded Tank
Marked Diesel (Gasoil)	Internal Tank	Bunded Tank
Diesel Engine Lubricant	Maintenance Shed	Barrel on spill trap
Hydraulic Oil	Maintenance Shed	Barrel on spill trap
Waste Oil	Maintenance Shed	Bunded Area or Bunded Tanks
Hydrocarbon Fluids and Gels	Maintenance Shed	Bunded Area or Bunded Tanks

All the raw materials identified above are stored at the workshop at the site infrastructure area which remains within the residual licence area. None of these materials are stored across the restored pit footprint to be removed from the existing licence area by way of technical amendment.

2.7 Pre-Existing Closure Plan

The most recent closure plan prepared by Roadstone Ltd. in respect of its licenced facility at Fassaro clearly indicates that the various licenced recovery activities would be completed or would cease at different times and that the respective areas of the facility at which they were located would be closed and restored in stages.

The most recent closure plan submitted to the Agency (in 2018) envisaged that the licenced site would be closed and restored in two phases as follows:

- **Phase 1** provides for the closure and restoration of the area around the backfilled pit void;
- **Phase 2** provides for the closure and restoration of the remainder of the waste licence area which includes the C&D waste recovery area, the central infrastructure area and the surface water pond.

This application for a technical amendment of the existing waste licence is made following the recent completion of works to backfill and restore the lands around the former pit at Fassaro to grassland habitat and provides for the removal of the recently restored lands from the overall licenced site area.

3.0 CLOSURE AND RESTORATION OF FORMER PIT AREA

3.1 Post-Closure Landform

The former pit at Fassaroe was effectively backfilled by way of recovery of inert soil and stone waste (through deposition on land) from mid-year 2011, following the award of the EPA waste licence, up to early 2015. Although the former pit was effectively backfilled to the former ground surface at that time, the ground surface was uneven and undulating, and a closed depression several meters deep remained in the south-eastern corner.

Surface water run-off which arose across the backfilled area collected in this closed depression and percolated to ground through permeable sands and gravels in the former pit faces. Following cessation of soil recovery activities, this depression effectively acted as an attenuation pond and soakaway for any surface water run-off arising.

The backfilled ground was left undisturbed up to late summer of 2019. Over this period, it is likely that the weak compressible silts and clay at the base of the former pit generated by past sand and gravel processing (washing) activities consolidated and settled under the weight of the backfilled materials. It is likely that some internal settlement and consolidation of the backfilled materials also took place over this time.

3.2 Site Infrastructure

As noted previously, much of the storage and maintenance infrastructure within the recovery facility at Fassaroe is shared with the adjoining concrete production facilities, retail facility and construction and demolition waste recovery facility.

All of the site infrastructure which services the waste recovery facility is located outside of, and beyond, the former pit footprint and will be retained within the residual waste licence site area, following the removal of the backfilled lands by way of technical amendment of the waste licence (should this be approved by the Agency).

No permanent structures or services ever existed or were ever installed across the plan footprint of the backfilled pit, nor was there ever any paved or hardstand areas or storage facilities for hazardous materials (fuels, oils and related wastes). There was therefore no requirement for any post closure work to demolish, decommission, remove or relocate any pre-existing structures, fixed plant or storage facilities across this area or to break up, excavate and/or remove any paved surfaces.

Following cessation of backfilling activities, all mobile plant and equipment associated with the backfilling, placement and compaction of backfilled materials was removed and reassigned to other site activities or to other Roadstone facilities.

3.3 Post Closure Investigations / Monitoring

3.3.1 Trial Pit Excavations

Following the completion of pit backfilling and cessation of soil waste intake and recovery activities in early 2015, post-closure investigations of the backfilled soil waste mass was undertaken in two separate exercises.

In February, personnel from Roadstone excavated a total of 6 trial pits across the former pit footprint and took 21 soil samples at 1m depth intervals between ground level and 4m depth. These samples were subsequently forwarded to a test laboratory for inert waste acceptance criteria testing (specifically the soil contaminants identified in *Council Decision 2003/33/EC establishing criteria and procedures for the acceptance of waste at landfills*).

This was followed by a later independent investigation comprising 12 trial pits across the backfilled pit which was directed and overseen by representatives of SLR Consulting Ireland in July 2017. Representative soil test samples were taken by SLR staff for independent testing at an accredited testing laboratory for a broad range of potential contaminants using both dry weight and leachate analysis.

The trial pits excavated in July 2017 were also inspected at that time by an Inspector from the Environmental Protection Agency. A record of trial pit excavations overseen and logged by SLR personnel are presented together with a plan showing trial pit locations in Appendix 02 of the Quantitative Risk Assessment which accompanies this Closure Audit Report. Laboratory test reports presenting results of soil testing are presented Appendix 03 of the same report.

The post closure investigations and testing undertaken in 2017 did not identify any suspect (discoloured or odorous) wastes in the trial pits or excavated stockpiles, nor did they reveal any evidence of hazardous waste materials amongst the backfilled soil and stone. All the observed waste complied with the permitted list of waste intake codes indicated in Schedule A1 of the waste licence for the facility at Fassaroe. No waste was identified which required removal off-site to an appropriately authorised waste disposal or recovery facility.

Although some occasional, generally isolated, inclusions of construction and demolition waste (including concrete, brick, wire strands, timber, PVC piping etc.) were identified amongst the backfilled waste, given that it was largely inert and that the overall proportion was very low (<<1% by weight), it was concluded that it does not present a risk to human health or the natural environment.

The results of these post-closure soil waste testing, together with the database of soil characterisation and compliance test results obtained over the operational life of the soil recovery facility, were used to define the geochemical characteristics of the backfilled soil waste at Fassaroe (or 'source term') for the purposes of the risk assessment which accompanies this Closure Audit Report. The findings of the risk assessment, informed by the findings of the investigations referenced above are briefly outlined in later sections of this report

3.3.2 Groundwater Monitoring

Seven groundwater monitoring boreholes have been installed across the licensed site since 2008. Three wells (designated BH1, BH2 and BH3) were initially installed across the site in December 2008 to depths of 21m (BH1), 24m (BH2) and 30m (BH3). Of three wells, BH1 and BH2 were downgradient of the then open pit while BH3 lay upgradient. In general, over the installation depths, the monitoring wells encountered sand and gravel overlying gravelly sand with localised clayey horizons.

Shortly after the waste licence was awarded, BH1 was replaced by a deeper well (BH4) in November 2011. The drillers logs for this replacement well indicates that it intersects notably more clayey horizons within the soil profile than had previously been recorded in the original three wells.

Periodic monitoring of these groundwater wells continued following the substantial completion of the pit backfilling works in early 2015 and the cessation of soil and stone waste intake to the recovery facility. An additional four boreholes were installed in the Spring of 2017 to obtain additional groundwater quality and additional insight about what, if any, long-term impact the backfilled soils might have on the groundwater resource.

Three of the additional wells, down gradient of the backfilled pit designated BH05, BH06 and BH07 were installed to depths of 30m, while the fourth, up-gradient of the pit and designated BH08, was installed to 40m depth. These wells generally encountered intermixed sandy gravel, gravelly sand and poorly sorted sand over their full depth.

Groundwater monitoring was undertaken for an extensive range of potential contaminants at monthly intervals over the second half of 2017 in order to track possible seasonal fluctuations in groundwater quality around the backfilled pit. As no groundwater samples were recovered in wells BH02 and BH07 in mid-2017, two deeper replacement wells, identified as BH02A and BH07A, were installed in September of that year to depths of 43m and 49m respectively. These wells generally encountered similar ground conditions to those in the wells they replaced.

Extensive groundwater monitoring of the wells has continued periodically (quarterly) since mid-2019, with the most recent round of groundwater monitoring having been completed in August 2020.

The well installation details, based on drillers / site records are presented separately in Appendix 01 of the Quantitative Risk Assessment which accompanies this Closure Audit Report, together with a plan showing the well location and construction (level) details. The findings of the risk assessment (informed in part by the groundwater monitoring data referenced above) are briefly outlined in later sections of this report.

3.4 Post Closure Works 2019-2020

3.4.1 Site Levelling and Contouring

In late summer 2019, the final site levelling and contouring works were progressed across the backfilled pit footprint. This essentially entailed levelling up and re-grading the ground surface, backfilling the closed depression in the south-eastern corner and creating a final landform (consistent with that required by planning permission and waste licence) using previously stripped topsoil and mineral subsoils which had, up to that point, been stockpiled along the eastern side of the former pit, immediately inside the eastern boundary of the waste licence area.

The available topsoil was spread over the restored surface to provide a growing medium to support establishment of a grass sward. A new low rise earth mound was also constructed at that time on the western side of the backfilled area to delineate the boundary between it and the C&D waste recycling area.

The onset of prolonged heavy rainfall and a succession of autumn storms in September of 2019 made ground conditions too wet and difficult for plant and machinery to traverse and mitigated against the final ploughing, harrowing and preparation of soils to receive grass seed as was originally intended at that time.

It was ultimately not possible to prepare the ground and sow grass as originally intended in autumn 2019, and further works had to be deferred. The backfilled area was eventually prepared and seeded in April 2020 and grass cover has gradually become established over the intervening months.

3.4.2 Surface Water Drainage

During the early winter months of 2019 / 2020, with the restoration soils across the former pit footprint levelled and compacted, but not yet seeded, prolonged heavy rainfall led to saturation of the ground surface, the development of rills and gullies and the erosion of restoration soils across the backfilled pit footprint.

Following a number of intense rainfall events in October and November, Roadstone decided to construct a network of open channels / land drains across the eastern (downslope) side of the backfilled area in order to manage, direct and control surface water run-off, minimise potential for soil erosion and encourage infiltration to ground through the underlying (undisturbed) sandy soils. The line of these land drains followed those of the larger rills and the natural drainage paths which had been established by them.

The constructed land drains were then connected to two minor ponds within the licensed site boundary which were intended to provide some limited attenuation capacity and facilitate additional discharge to ground. Outflows from these ponds were channelled to a pre-existing drainage channel which is partially vegetated and runs from the licenced site boundary to a manhole on the northern side of Fassaroe Avenue.

This manhole stands at the head of a 300mm diameter pipe drain which extends beneath Fassaroe Avenue, connects to a smaller 225mm diameter pipe and carries surface water run-off downslope to a discharge point along the Cookstown River.

While these drainage measure were initially sufficient, as winter progressed, continued prolonged heavy rainfall resulted in ponding / accumulation of run-off around the manhole and at one point, some minor flooding occurred along Fassaroe Avenue.

In response, Roadstone decided to excavate a lagoon on its lands along the northern side of Fassaroe Avenue (but outside of the licensed site boundary) to hold back excess surface water run-off which does not immediately discharge off-site via the existing piped drain. These drainage works have remained in place since last winter and have been effective in avoiding / preventing any further flooding since that time. The layout of the surface water drainage network put in place by Roadstone over the winter of 2019 / 2020 is shown on the site survey in Figure 2.

4.0 CLOSURE AUDIT

4.1 Criteria for Successful Closure

The latest version of the closure plan for the Fassaroe facility identified that the principal objective to be achieved for each stage of closure was to achieve a clean closure, leaving no residual risk of environmental pollution, particularly to soil or groundwater.

The principal criteria identified in the plan against which successful closure were to be assessed were set out as follows :

- the landform over the backfilled pit will be uniformly graded and stable;
- all mobile plant and equipment associated with the backfilling, placement and compaction of soil or processing and handling of C&D wastes will have been decontaminated and/or removed off site;
- post-closure environmental monitoring of surface water and groundwater will establish that there is no significant evidence of surface water and/or groundwater contamination at, or attributable to, the licensed site.

In order to assess the compliance with the objectives set out above, an independent closure audit has been undertaken by SLR Consulting Ireland on behalf of the Licensee, Roadstone Limited. This closure audit comprised the following elements which will be elaborated upon in the following sections of this audit report;

- (i) a review of EPA audit reports, to establish what, if any, outstanding actions or measures may need to be closed out in respect of the backfilled sand and gravel pit and the area to be removed from the waste licence area;
- (ii) a review of available soil waste testing data to establish the nature and composition of the soil and stone materials imported to the facility over its operational life;
- (iii) a quantitative risk assessment informed by the soil waste quality test data reviewed above and the results of the water quality testing of groundwater samples from up-gradient and down-gradient monitoring wells discussed previously;
- (iv) the findings and observations arising from an inspection of the backfilled and restored pit area, and details of recommended final works to be undertaken prior to making an application to have it removed from the licensed site area by way of a technical amendment;
- (v) the findings and conclusions arising from a subsequent site inspection to confirm that any final works have been completed; and
- (vi) recommendations in respect of further works which may need to be executed in the future, following removal of the backfilled area from the licensed site area.

4.2 Review of EPA Audit Reports

As part of this Close Out Audit, a review was undertaken of recent EPA Site Visit Reports which form part of its regulatory (licensing) compliance and environmental oversight role. These reports are published on the EPA and publicly accessible via its website (www.epa.ie).

The EPA site visit reports, dating from 2016, after the closure of the soil recovery facility, identify a number of non-compliance with licence conditions, the bulk of which are related to shortcomings around reporting, nuisance (dust) emissions and management of hazardous substances at the maintenance shed. One of the audit report records the fact of the EPA Inspector's visit at the time of the post-closure investigations in July 2017. No non-compliances were raised in any of the audit reports in respect of the management of the backfilled pit area.

The audit inspection report on the visit undertaken in February 2016 made observations in respect of consistent elevated arsenic levels (above IGV levels) recorded in monitoring well BH04 and elevated phenol and 3&4-Methyphenal in monitoring well BH02 in September 2015.

The elevated arsenic levels recorded in borehole BH04 have been addressed in the risk assessment report which accompanies this audit report. The assessment concluded that the elevated arsenic recorded within BH04 is likely to be naturally occurring and related to arsenic from the naturally occurring clay deposits present at this well and absent at all other monitoring wells (including borehole BH06, located in very close proximity). Follow-up groundwater sampling at monitoring well BH02 / BH02A failed to identify any repeat evidence of 3&4-Methyphenal in excess of the detection limit in 3 subsequent rounds of groundwater monitoring in 2017 or in any more recent quarterly monitoring rounds and the recorded finding is considered to be an isolated one-off incident or error.

4.3 Review of Waste Testing Records

The total estimated amount of soil and stone imported and used to backfill the former pit at Fassaroe under in accordance with the conditions set out in the existing waste licence is approximately 750,000 tonnes. Ground levels around the backfilled area vary from 90mOD to 80mOD, and the former floor level (prior to backfilling) was approximately 75mOD. The depth of backfilled soil is therefore estimated at between 5m and 15m.

The soil and stone material imported and recovered in backfilling of the former pit could conceivably (albeit unlikely) contain materials which present a long-term risk to the environment or to human health. Of the likely potential risks, that which is likely to be of principal interest or concern is the potential for groundwater flowing through the backfilled soil to generate potentially contaminated groundwater (identified as “leachate”) which might adversely impact water quality in any surrounding receiving groundwater or surface water body.

In order to mitigate against this, regular testing of incoming soil waste intake was carried out when the waste facility was operational between 2012 and 2014 to ensure that it could be classified as inert according to the criteria set out in *Council Decision 2003/33/EC establishing criteria and procedures for the acceptance of waste at landfills*). In all, a total of 190 soil intake samples were tested. The results of these tests which were provided to SLR by the Licensee indicate that the material accepted and used to backfill the former pit typically recorded concentrations well below the inert waste acceptance criteria (IWAC) limits, with the average of most determinands more than an order of magnitude lower than IWAC. A few isolated samples recorded concentrations marginally above IWAC limits, with cadmium, fluoride, sulphate, phenol, TDS and TOC having been recorded above their respective limits.

Most of the exceedances can be considered one-off readings, and not representative of the typical content of the restoration soil material, for example:

- the maximum sulphate of 2,987mg/kg is significantly higher than all other results, with the next highest reading of 887mg/kg (below IWAC) and an average of just 170mg/kg; and
- the fluoride maximum of 12mg/kg, marginally above its IWAC is also the only result recorded above IWAC with the next highest of 9.30mg/kg and an average of just 1.91mg/kg.

More details on the waste intake data is provided in Section 3.1 and Appendix 2 of the Risk Assessment Report which accompanies this audit report.

The above waste intake data were supplemented by the post-closure testing of samples recovered from trial pits excavated into the inert waste backfill by Roadstone on 17 February 2017 and subsequently by SLR Consulting Ireland on 20th and 21st July 2017, referenced in Section 3.3.1 of this report (above). The trial pits excavated in July 2017 were also inspected at that time by an Inspector from the Environmental Protection Agency.

The results of tests of contaminant testing on soil samples recovered from post-closure investigations were typically found to be comparable to the IWAC testing data for the soil waste intake, with concentrations consistently below respective inert waste limits, the only exception being a single exceedance of antimony.

A record of trial pit excavations overseen and logged by SLR personnel are presented together with a plan showing trial pit locations in Appendix 02 of the Risk Assessment Report which accompanies this audit report.

The quantitative risk assessment was undertaken on the basis of the waste intake data and post-closure soil test data described. Details of the assessment and the conclusions derived therefrom are presented in the section below.

4.4 Quantitative Risk Assessment

A quantitative risk assessment has been undertaken in respect of the backfilled materials in the former pit at Fassaroe based on all available soil waste quality data and the results of water quality testing of groundwater samples taken from monitoring wells up-gradient and down-gradient of the buried waste mass.

The assessment, a copy of which accompanies this Closure Audit Report, concluded that the materials deposited in backfilling and restoring the former pit will pose no risk to long-term groundwater or surface water quality at any receptor down-gradient of the licensed site. Sensitivity analysis undertaken as part of the overall risk assessment indicated that even where allowance was made for some uncertainties in the parameters adopted in developing the conceptual site model in the risk assessment, there was still no adverse impact on downgradient receptors, even when highly conservative assumptions are incorporated into the model.

At the present time, the backfilled pit lands have been restored to open grassland and there is currently no planning permission in place for any future development or other long-term use of the lands. A generic quantitative human health risk assessment has indicated that on the basis of the available soil waste quality data, the risk to human health from a range of potential future development and/or land-uses including open parkland or commercial / industrial development is low.

The risk assessment did however note that some further assessment of in-situ soil quality should be undertaken, if there were any prospective change in existing land use which could provide for the growth of food for human consumption in the future.

On this basis, the risk assessment concluded that no additional measures are required in respect of the site closure to address any risks to the environment or human health and that no long-term monitoring of either groundwater or surface water is considered to be necessary.

4.5 Initial Site Inspection 25 September 2020

4.5.1 Observations

An inspection of the restored pit area which is to be removed from the waste licence area was undertaken by SLR Consulting Ireland on 25th September 2020. The principal observations arising out of the site inspection are presented below

- The final restored landform, had been levelled and re-graded to integrate with surrounding sloping ground beyond the licensed site area;
- The final site contours, shown in Figure 2, were broadly in line with those originally proposed in the site restoration plan submitted for planning approval and waste licencing purposes;
- A low rise mound provided a clear demarcation between the restored lands and the construction and demolition waste recovery facility which will remain within the licensed site area;
- The boundary between the restored lands and the site infrastructure area to the west is largely delineated by a low rise earth bank / slope running north-south. There is largely open and unimpeded access to the restored site area across this boundary;
- Groundwater monitoring wells across the restored lands remained accessible, operational and in use and had not been damaged in the course of the restoration works;

- Grass growth was well established across the bulk of the inspected area, although there were local pockets, most notably at the eastern limit of the restored area which were underlain by predominantly natural, in-situ sandy soils, where grass cover was less well established;
- There was some isolated, loose fragments of litter, waste plastic, cable, timber, concrete, stone, roots across the restored surface;
- Some isolated low rise mounds and ridges of soil arising from the excavation and installation of land drains in the winter of 2019 remained in place on the eastern side of the restored area and did not integrate well into the surrounding landform;
- Larger mounds of excavated soil were also in place locally around the two excavated holding ponds within the licensed site area (shown in Figure 2);
- The depth of water held in these ponds was relatively low at the time of the inspection, and wetting horizons around the pond walls indicated that they did facilitate soakage of run-off to the underlying unsaturated ground;
- The pre-existing drainage channel leading from the existing licence boundary to the manhole on the northern side of Fassaroe Avenue appears stable, with vegetation cover established along the floor and sides for much of its run length;
- The invert levels at the end of the pre-existing channel and around its tie-in to the large holding (attenuation) pond constructed along the northern side of Fassaroe Avenue, were over steep and developed in bare soil, with no measures in place to minimise soil erosion or potential side wall instability in the channel or around the pond intake area;
- The diameter of the inlet pipe at the base of the manhole (150mm) which had recently been installed was less than that of the outlet / downstream pipe and is likely to overly restrict the off-site discharge of any surface water run-off collecting in the pond immediately behind it;
- To optimise off-site discharge of surface water run-off, it was also considered that the invert level of the inlet pipe should be lowered to that of the outlet pipe (subsequent post-inspection survey of levels indicated that it was 400mm higher).

4.5.2 Minor Works Recommendations

Arising from the observations presented above, a number of recommendations were made to Roadstone for further minor works to achieve successful phased closure and facilitate removal of the backfilled pit from the licenced site area. These recommendations were as follows

- Any litter or loose fragments of waste across the restored surface should be removed and appropriately disposed of;
- The low rise mounds and ridges of soil arising from the excavation and installation of land drains should be spread and/or levelled and better integrated into the surrounding landform. Where this is not possible, they should be removed off-site;
- The larger mounds in place around the holding ponds excavated within the licenced site area should remain in place pending future backfilling of the ponds;
- Further efforts should be made to establish some grass cover across any bare or exposed soils which occur across the backfilled / restored lands;
- Efforts should also be made to establish grass cover where mounds or ridges of soil have been spread or levelled and across any of larger earth mounds around the holding ponds;
- Additional drainage stone should be placed within any open drainage channels / land drains exhibiting signs of erosion or instability in their side banks or a build-up of sediment and eroded soil along their base. The drainage stone will slow run-off flow, prevent bank erosion and reduce amount of eroded sediment carried by the drains;

- Drainage stone should also be placed on any bare or exposed soils around the tie-in of the pre-existing channel to the large holding pond along the northern side of Fassaroe Avenue. This will minimise soil erosion and potential side wall instability in the channel or pond intake area.

4.5.3 Post Inspection Assessment of Off-Site Drain Capacity

Following on from the site inspection SLR Consulting Ireland undertook a review of the in-situ land drainage network established over the winter of 2019 and a survey of the piped drain which leads from the manhole at Fassaroe Avenue down to the Cookstown River to determine if the drainage measures in place were adequate to prevent future off-site flooding.

A simple hydraulic model of the drainage arrangements across the restored area, the large holding pond behind the manhole and what was known of the existing piped drain was developed using MicroDrainage software. The catchments upslope (or up-gradient) of the manhole sized and modelled in the drainage analysis comprise the backfilled pit and the intervening agricultural lands between it and Fassaroe Avenue.

A 'baseline' model was run assuming that there was no holding pond in place and no flow restriction on the inlet to the existing 300mm diameter outlet pipe at the manhole. This model established that in the absence of the upstream holding pond, the recorded rainfall around November 2019 would have given rise to flooding upstream of the 300mm pipe, consistent with what was observed at that time.

The drainage analysis indicated that with the holding pond in place, the existing inlet pipe to the manhole increased to at least 225mm diameter and lowered to a similar invert level to the outlet pipe (at 58.5mOD) there will be a significant reduction in the flood risk to the any property downslope / downstream of manhole and that the storage capacity of the holding pond is only likely to be exceeded by a 1 in 20 year rainfall event.

The analysis also indicated that a 225mm diameter orifice plate (flow restrictor) should be placed upstream of the 300mm outlet pipe which crosses Fassaroe Avenue, to control flow and prevent pressure build-up in the pipe drain which runs at a relatively steep gradient downslope to the Cookstown River. In the absence of this control, the drainage analysis indicated that pressure build up could cause a manhole to lift and give rise to potential downslope / downgradient flooding.

Separately the drainage analysis identified that surface water run-off from the undeveloped, tilled land to the north-east of the backfilled pit should be divert away from the attenuation pond and the off-site discharge manhole as it could overwhelm them during an intense rainfall event. These flows should largely be left to follow the existing natural eastward fall of the ground, toward the drain / gully which is understood to be located at the entrance to Fassaroe Avenue.

4.6 Follow Up Visit 30 October 2020

Further minor works were undertaken by Roadstone across the backfilled pit area on foot of the recommendations made following the initial site inspection undertaken on 25th September 2020.

A follow up inspection of the pit area was undertaken by SLR Consulting on the 30th October 2020 to confirm these works had been completed to an acceptable standard and that the phased closure objectives had been achieved. In the course of the inspection, it was noted that

- Litter and loose fragments of waste across the restored surface had been removed as advised;
- The low rise mounds and ridges of soil which had been present previously had been spread and levelled and merged into the surrounding landform. These soils have yet to be seeded with grass.
- Although it was not possible to re-seed bare soils across the levelled or backfilled areas, the earth mounds around the holding ponds or any ground disturbed by recent works, every effort should be made to re-seed these areas and establish grass growth at the earliest opportunity at the outset of the next growing season (in Spring 2021);

- Additional drainage stone had been placed within the land drain as advised helping to slow run-off flows, prevent bank erosion and reduce amount of eroded sediment carried by the drains;
- Drainage stone had been placed on the bare soils around the tie-in of the pre-existing channel to the large holding pond along the northern side of Fassaroe Avenue, helping to minimise soil erosion and potential instability;
- The diameter of the intake piper to the manhole on the northern side of Fassaroe Avenue was increased and lowered to a similar invert level to the outlet pipe as advised. A 225mm diameter orifice plate had also been placed across the 300mm outlet pipe from the same manhole to control flow and prevent pressure build-up in the drainage pipe further downstream.

A number of photographs of the final restored landform across the backfilled pit area to be removed from the licenced site area are presented in Appendix 1 of this report.

4.7 Site Arrangements Following Licence Amendment

In detailing findings of the audit inspections above and making recommendations for further minor works, it has been assumed that the waste facility operator Roadstone Ltd., will have continued control and/or right of access to the lands to be removed from the licenced site area.

4.7.1 Continuation of On-Site Monitoring

The recent audit inspections at the licenced recovery facility at Fassaroe confirmed that groundwater monitoring infrastructure remains in place across the backfilled / restored pit area, is easily accessible, continues to function reliably and to be sampled at quarterly intervals.

If the licenced site area is amended, there will be continued access across the landholding at Fassaroe to the existing groundwater monitoring wells and they will remain in service, providing groundwater quality data down-gradient of the construction and demolition waste recovery facility (which will continue to operate under the amended waste licence).

4.7.2 Licensed Site Boundary

As was noted in the course of the recent audit inspections, there is currently no restriction on movement within the licenced site between the backfilled lands and the site infrastructure area.

If the licenced site area is amended, there will be no immediate requirement to erect a fence between these two areas once all lands remain in existing ownership and access to all areas can be controlled by way of the existing site entrance at the end of Fassaroe Avenue.

4.7.3 Flood Contingency Measures

As part of the long term land management of the backfilled land, and in recognition of the potential risk for off-site flooding to arise following a 1 in 20 year rainfall event, contingency measures should be developed by the Licensee to mitigate the effects on private property of any potential flooding which might occur in future along Fassaroe Avenue.

This will principally entail implementation of temporary measures to prevent floodwaters spilling down sloping driveways to properties along the southern side of Fassaroe Avenue (e.g. placement of sand bags / erection of flood barriers etc. if required) and diverting them to other surface water drains / gullies along the road.

5.0 CLOSING STATEMENT

5.1 Closure Audit Findings

On the basis of our recent closure audit of the backfilled lands at the licenced waste recovery facility at Fassaroe and the information presented herein and accompanying risk assessment report, we have concluded that

- (i) the materials deposited in backfilling and restoring the former pit will pose no risk to long-term groundwater or surface water quality at any receptor down-gradient of the licenced site;
- (ii) the risk to human health from a range of potential future development and/or land-uses including open parkland or commercial / industrial development is low;
- (iii) the backfilled lands at the former pit have been restored and reinstated to a landform consistent with the site restoration plan previously submitted for planning approval and waste licencing purposes;
- (iv) the boundary between the backfilled lands (which it is intended to remove from the licenced site area) and the residual licence area comprising the C&D waste recovery facility and site infrastructure area is clearly demarcated by physical features on the ground;
- (v) grass growth is well established across the bulk of the backfilled area, although there are patches where grass cover is less well established, notably in areas on the eastern side which are underlain by in-situ sandy soils, at earth mounds and around recent works areas. These areas will require re-seeding at the outset of the next growing season (in Spring 2021);
- (vi) the network of channels and land drains and holding ponds which was installed to manage surface water run-off in the early winter of 2019 has been backfilled with drainage stone which should minimise instability, soil erosion, sediment transport by any surface water run-off across the backfilled area;
- (vii) the existing holding ponds and recent works to the inlet pipe at the manhole on the northern side of Fassaroe Avenue have significantly reduced flood risk from surface water run-off, with flooding along Fassaroe Avenue only likely to arise following a 1 in 20 year rainfall event. As part of the long term land management of the backfilled land, contingency measures should be developed by the Licensee to mitigate the effects of any future flooding along Fassaroe Avenue on private property;
- (viii) existing groundwater monitoring wells across the backfilled area should remain in service and can continue to be monitored following removal of the backfilled lands from the licenced waste area.
- (ix) although there is currently no restriction on movement between the backfilled lands and the site infrastructure area, there is no requirement to erect a boundary wall or fence between the two areas for as long as the lands all remain in existing ownership.

5.2 Conclusion

In light of the above, we consider that there is no impediment to the removal of the backfilled / restored pit lands from the existing waste licence area at Fassaroe and that, in the absence of any demonstrable long-term risk to the natural environment or to human health, the lands can be safely removed from the existing licenced site area by way of a technical amendment of the waste licence.

FIGURES

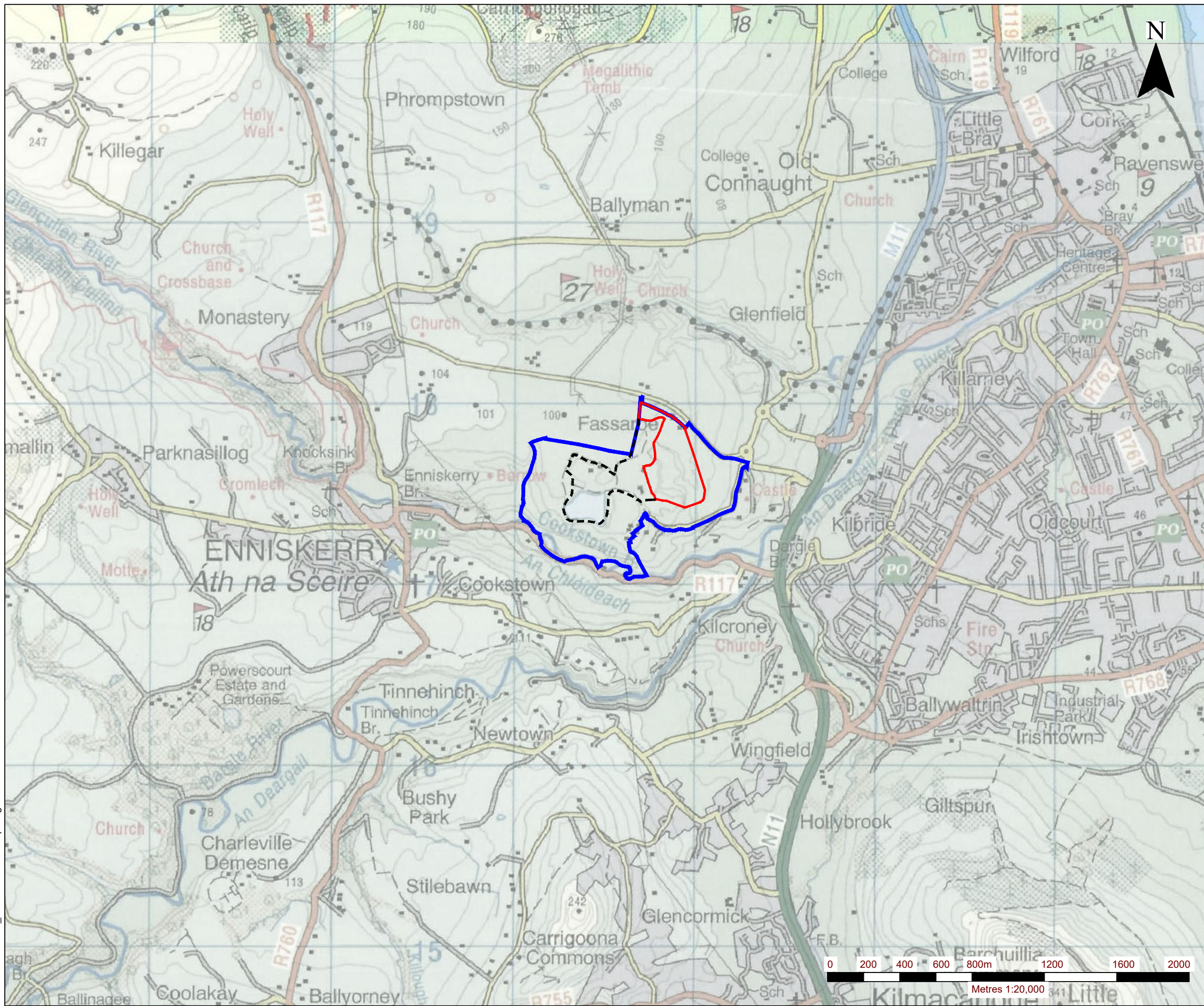
Figure 1
Existing Site Location

Figure 2
Lands to be Removed from Licenced Site Area

Figure 3
Site Layout Plan

Figure 4
Groundwater Monitoring Well Locations


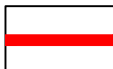
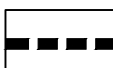
00180.00186.FIG_1.Site Location Map.dwg



NOTES

1. Extract from Ordnance Survey Map No.50
2. Ordnance Survey Ireland Licence No. SU 0000720 (c) Ordnance Survey Ireland and Government of Ireland

LEGEND

	LAND INTEREST (c. 66.2 HECTARES)
	LANDS TO BE REMOVED FROM LICENSED SITE AREA (c.11.7 HECTARES)
	REMAINING LICENSED SITE AREA (c.14.1 HECTARES)

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CLOSURE AUDIT REPORT**

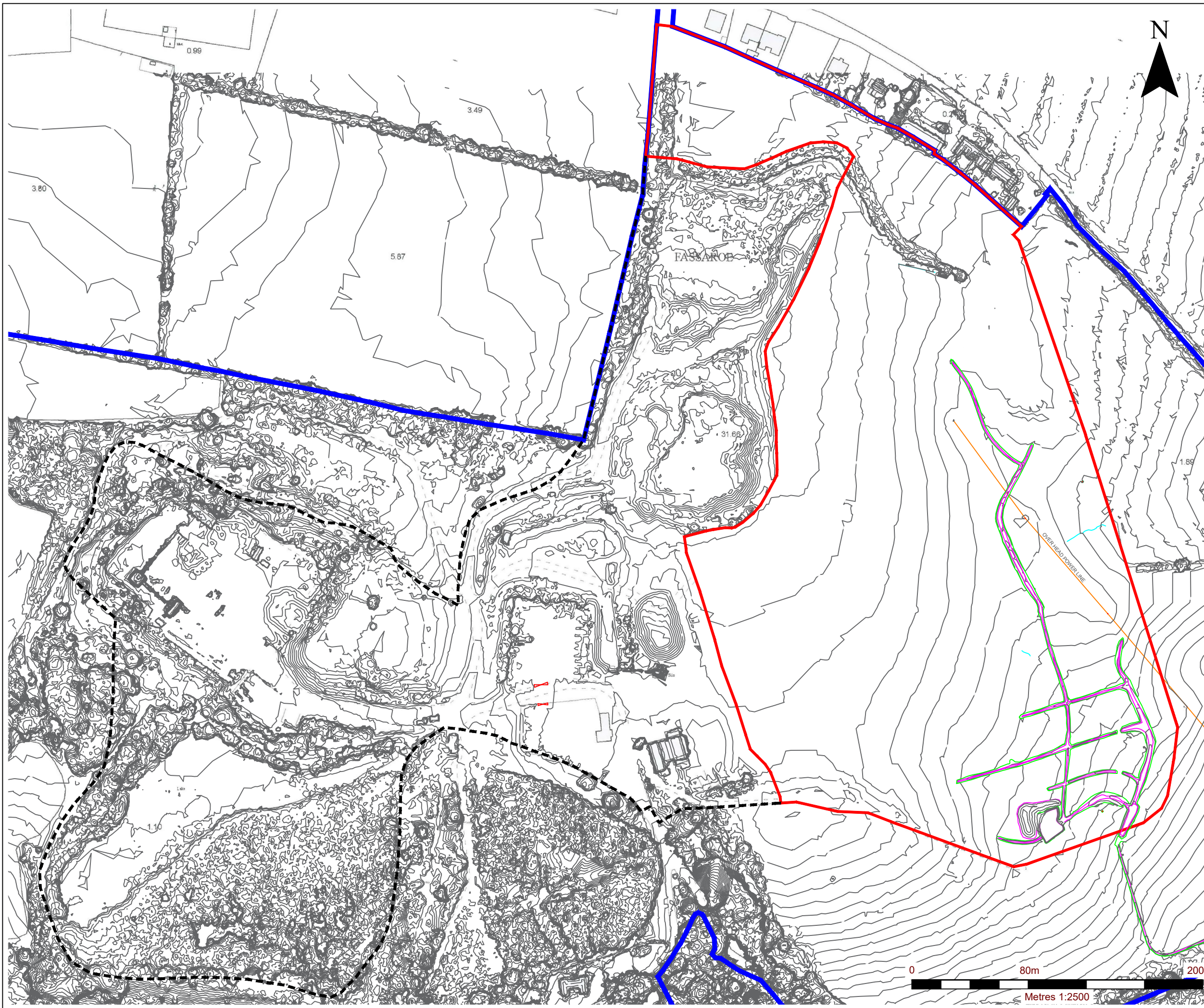
**INERT SOIL WASTE RECOVERY FACILITY
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SITE LOCATION MAP

FIGURE 1

Scale 1:20,000 @ A3 Date NOVEMBER 2020


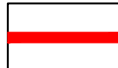

00180.00186.FIG_2.Lands to be Removed from Licensed Site Area.dwg



NOTES

1. EXTRACT FROM ORDNANCE SURVEY 6 INCH MAP NO'S. **WW003 & WW007**
2. ORDNANCE SURVEY IRELAND LICENCE NO. **SU 0000720 (C)** ORDNANCE SURVEY & GOVERNMENT OF IRELAND

LEGEND

	LAND INTEREST (c.66.2 HECTARES)
	LANDS TO BE REMOVED FROM LICENSED SITE AREA (c.11.7 HECTARES)
	REMAINING LICENSED SITE AREA (c.14.1 HECTARES)

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CLOSURE AUDIT REPORT**

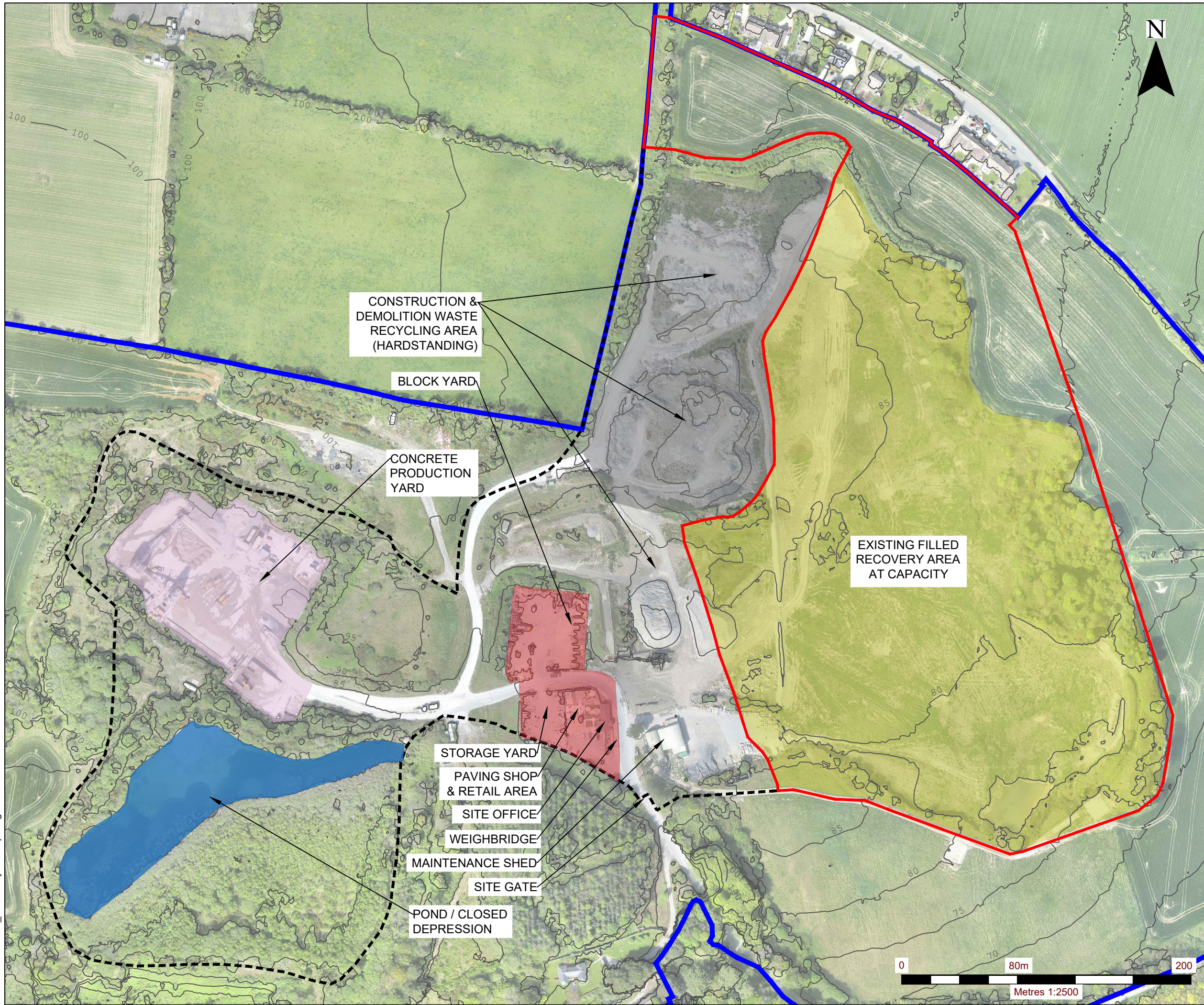
**INERT SOIL WASTE RECOVERY FACILITY
FASSAROE, BRAY, CO. WICKLOW**

**LANDS TO BE REMOVED FROM
LICENSED SITE AREA**

FIGURE 2

Scale 1:2,500 @ A3 Date NOVEMBER 2020

00180.00186.FIG_3.Site Layout Map.dwg



NOTES

*Orthomosaic produced from Aerial Photography flown in May 2017 by SLR Consulting Ireland (IAA Permit No. 150052) www.slrconsulting.com Tel. +353-1-2964667.


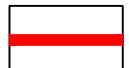






Orthomosaic produced using Ground Control Points; Related to Irish Transverse Mercator Coordinate System and OS Malin Head Level Datum.

The accuracy of the orthomosaics and the digital elevation models (DEM) strongly depends on the flight height, lighting conditions, availability of textures, image quality, overlap, and type of terrain. Contours / 3D data relates to the surface model and not terrain levels. Typical accuracies: E: 0.05 m; N:0.05 m; Levels: 0.30 m.

All Dimensions and Levels are to be checked on site.

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LEGEND

	LAND INTEREST (c.66.2 HECTARES)
	LANDS TO BE REMOVED FROM LICENSED SITE AREA (c.11.7 HECTARES)
	REMAINING LICENSED SITE AREA (c.14.1 HECTARES)
	CONCRETE PRODUCTION AREA
	POND
	RETAIL AREA
	C&D PRODUCTION AREA
	INERT SOIL WASTE RECOVERY AREA

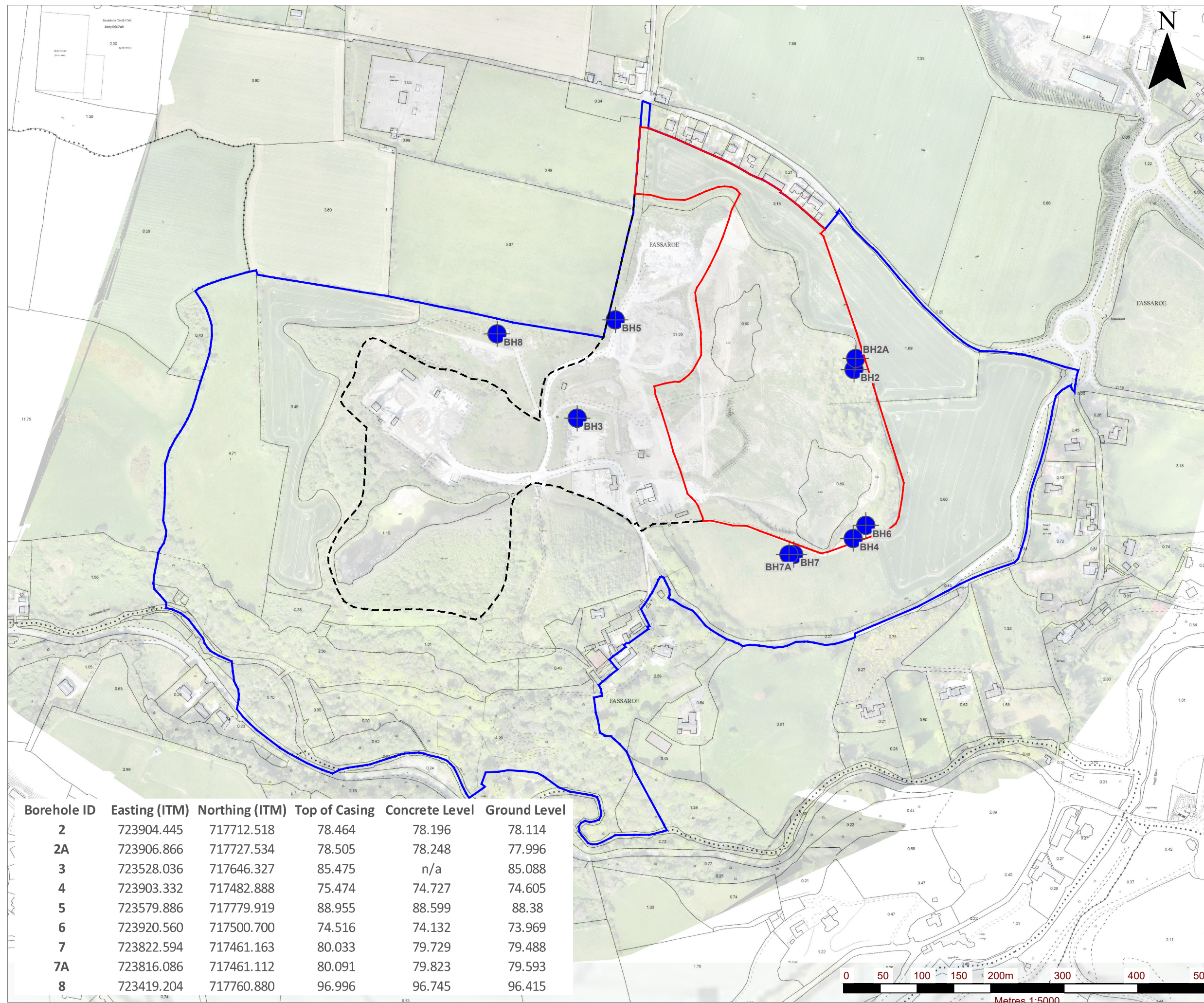
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CLOSURE AUDIT REPORT
INERT SOIL WASTE RECOVERY FACILITY
FASSAROE, BRAY, CO. WICKLOW
SITE LAYOUT MAP**

FIGURE 3





Scale: 1:2,500 @ A3 Date: NOVEMBER 2020



NOTES

1. EXTRACT FROM ORDNANCE SURVEY 6 INCH MAP NO'S. **WW003 & WW007**
2. ORDNANCE SURVEY IRELAND LICENCE NO. **SU 0000720 (C)** ORDNANCE SURVEY & GOVERNMENT OF IRELAND

LEGEND

-  **LAND INTEREST**
(c. 66.2 HECTARES)
-  **LANDS TO BE REMOVED FROM LICENSED SITE AREA**
(c.11.7 HECTARES)
-  **REMAINING LICENSED SITE AREA**
(c.14.1 HECTARES)
-  **BOREHOLE LOCATION**

Borehole ID	Easting (ITM)	Northing (ITM)	Top of Casing	Concrete Level	Ground Level
2	723904.445	717712.518	78.464	78.196	78.114
2A	723906.866	717727.534	78.505	78.248	77.996
3	723528.036	717646.327	85.475	n/a	85.088
4	723903.332	717482.888	75.474	74.727	74.605
5	723579.886	717779.919	88.955	88.599	88.38
6	723920.560	717500.700	74.516	74.132	73.969
7	723822.594	717461.163	80.033	79.729	79.488
7A	723816.086	717461.112	80.091	79.823	79.593
8	723419.204	717760.880	96.996	96.745	96.415



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**ROADSTONE LIMITED
CLOSURE AUDIT REPORT**

**INERT SOIL WASTE RECOVERY FACILITY
FASSAROE, BRAY, CO. WICKLOW**

GROUNDWATER WELL LOCATIONS

FIGURE 4

Scale 1:5,000 @ A3 Date NOVEMBER 2020

APPENDIX 1

Photographs of Restored Area (to be Removed from Licenced Site Area)



Plate 1 – General View North Across Backfilled / Restored Pit Area toward C&D Area



Plate 2 – General View North-East and East Across Backfilled / Restored Area



**Plate 3 - General View East across Backfilled / Restored Pit Area
with Land Drains in Centre Ground**



Plate 4 – View Looking North along Recently Completed Land Drain



Plate 5 – View Along Existing Channel Leading from Backfilled Area to Manhole



Plate 6 – View from Existing Channel to Holding Pond Upstream of Manhole / Pipe Drain

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