5.0 SITE DESCRIPTION

INTRODUCTION

5.1 This chapter provides a brief description of the history of the current site and proposed extension. More detailed descriptions of various aspects of the site are included in the respective technical assessment reports.

Existing Site

5.2 The site is located in the townland of Ballynacarrick, near Ballintra, Co. Donegal and the existing landfill occupies an area of approximately 5.5 hectares. Donegal County Council owns the major portion of the site, however, the Council lease a small area on the northeast corner of the site from a local landowner (See Figure 5.1). The existing landfill site was opened in 1980 and has a remaining lifespan of approximately 2 years with the majority of the void space available in the recently constructed lined cell at the southwest of the site. A Waste Licence (Reference 24-1) was granted to the existing site for 24,000 tonnes per annum of non hazardous waste in December 2000 by the Environmental Protection Agency (EPA) under Section 40(1) of the Waste Management Act, 1996. The site has been operated since opening in 1980 by a Contractor on behalf of Donegal County Council.

Proposed Extension

5.3 The proposed extension covers an area of approximately 3.5 hectare which will provide an additional capacity of approximately 225,000m^3 of landfill void space over an estimated lifespan of 8½ years. It is envisaged the landfill operations, i.e. the deposition of waste at the facility, will commence during 2005 and cease by the end of 2013. An additional strip of land varying between two to eight metres wide to the north of the site is also proposed to be incorporated to facilitate the restoration of the existing site.

Site Topography

5.4 The current landfill site lies to the east of the proposed extension (See Figure 5.1). To the north, south and west of the proposed extension the land is utilised as agricultural land that encompasses pasture, improved rough grazing and wetland. On the northern boundary of the extension area is a derelict farm dwelling and associated outbuildings.

5.5 The current landfill site is located in a low lying position in an area of marginal hill land and is bounded on its northern and southern aspects by natural hedgerows and post and wire fencing. The southern and eastern boundaries of the site are secured with a 2.0 m high security fence.

5.6 The existing landfill is confined to a 180m wide hollow, which falls under a slight gradient in a westerly direction away from an area of blanket bog at the site access. The proposed extension to the landfill will extend from the western site margin and follow a continuation of the broad hollow, which is centrally divided by a rocky spur of slightly elevated ground. The hollow extends some 200m beyond the current landfill bank and closes at a minor road that separates the low lying area from slightly more elevated terrain beyond.

5.7 To the north, the existing landfill and its proposed extension is bounded by a prominent ridge that rises to a maximum elevation of 103m OD some 20 m beyond the site boundary. Beyond the ridge the ground falls steeply through an elevation of 10m into a low-lying blanket bog area whose surface is inclined under a shallow gradient to the west. To the south the landfill is flanked by the slopes of a low hill that rises to an elevation of 120m OD within 250m of the site.

OUTLINE OF THE PROPOSAL

5.8 The site will accept a maximum annual tonnage of 24,000 tonnes of non hazardous waste.

5.9 The landfill site will be developed on a containment basis to meet the requirements of the EU Landfill Directive (1999/31/EC). The site will be lined with a composite lining system to prevent the migration of leachate and landfill gas off-site. It is planned to construct the landfill in two phases, each encompassing two cells. The site will be operated to standards set out by the Environmental Protection Agency. The cells will be capped, after being filled to the final permitted levels, with a low permeability capping layer thereby minimising the generation of leachate in the existing waste body.

5.10 It is planned to install a leachate collection system in the two phases and subsequently to transport the collected leachate to the Donegal Town Waste Water Treatment Works.

5.11 Landfill gas is generated as the putrescible fractions within the landfill degrade and can cause odour and as well as being a fire risk and contributor to greenhouse gas. It is therefore planned to install a landfill gas collection and flaring system, which will collect gas from the waste body. Landfill gas will be collected and safely vented and/or flared during operation as well as after the cessation of landfilling as gas production can continue for some years post closure.

5.12 Potential nuisances such as odours, dust, noise, litter, vermin etc. will be addressed with the implementation of the Environmental Management Plan whereby landfilling will be carried out in a controlled manner thereby minimising the possibility of these nuisances.

5.13 Detailed descriptions of the site development, operation and restoration of the site are contained in Chapters 6, 7 and 8 of the Environmental Impact Statement (EIS).

FIGURES

KEY

- LAND OWNED BY DONEGAL COUNTY COUNCIL
- LAND LEASED BY DONEGAL COUNTY COUNCIL
- PROPOSED EXTENSION AREA (LAND TO BE TRANSFERRED TO DONEGAL COUNTY COUNCIL)

SCALE: 1:2500

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Comhairle Chontae Dhún na nGall
Donegal County Council

PROJECT

BALLYNACARRICK LANDFILL PROJECT

TITLE

MAP SHOWING LAND OWNERSHIP

FIGURE

5.1

6.0 SITE DEVELOPMENT

INTRODUCTION

6.1 Design of historical landfill sites was directed by the 'dilute and disperse' principal, where emissions were accepted provided sufficient dilution occurred. Operational practices were generally poor, and no attempt was made to control leachate generation or build up of landfill gas.

6.2 It is now accepted practice for a modern landfill to be developed and operated on an engineered "containment" basis, to isolate the wastes and to prevent any adverse impact on the surrounding environment. The key feature of such a facility is the containment of any leachate generated within the site, and as necessary, to abstract any excess leachate from the site for safe treatment, recirculation and/or final disposal. The containment measures also serve to prevent landfill gas migrating from the site and presenting an unacceptable risk.

6.3 The containment system is achieved by engineering the sides and base of the site and by lining these with low permeability materials such as naturally occurring clays and/or synthetic geomembranes. Upon completion of infilling, leachate generation is further reduced by the installation of a low-permeability cap. In addition, leachate generation must be controlled during the operational phase by filling in cells sized on the water balance principle as described in the Environmental Protection Agency (EPA) Guidance on Landfill Site Design (EPA, 2000). This involves infilling in discrete cells which will be brought up to final level in succession and capped and restored as quickly as possible.

6.4 The EU Directive on the Landfilling of Wastes (1999/31/EC) is also based on the concept of containment, specifying equivalent maximum allowable permeabilities and minimum thickness for the mineral component of containment systems. These depend on the nature of the wastes to be deposited and are summarised in Table 6.1 below.

Table 6.1 Maximum allowable permeabilities and minimum thickness for mineral component of containment systems

Waste Type	Thickness (t)	Permeability (K)
Inert Waste	t > 1.0 m	$K < 10^{-7}$
Non Hazardous Waste	t > 1.0 m	$K < 10^{-9}$
Hazardous Waste	t > 5.0 m	$K < 10^{-9}$

Note: Thickness to be a minimum of 0.5m if artificial layers are used

6.5 The development of the site will also necessitate the construction of monitoring systems for landfill gas and leachate outside the containment system to ensure the continuing adequacy of the installation.

CAPACITY AND LIFESPAN

6.6 The capacity of the proposed extension is approximately 225,000m^3 which will accommodate 8½ years of landfilling at the estimated rates of waste input and includes for the requirements of cover materials and settlements within the waste mass. It is envisaged that the site will be constructed and infilled in a phased manner as discussed in section 7.0.

SITE CONSTRUCTION WORKS

6.7 Much of the site infrastructure has already been installed as part of the current site operations. The remainder of the proposed infrastructure will be completed prior to the infilling at the proposed extension. During the development of the extension all peat will be stripped from the surface to the in situ rock level. A material deficit occurs on site, therefore additional suitable material for construction of the earthworks will have to be imported from external sources. The extension disposal area will be bounded by a minimum 10m wide buffer zone from the public roads to the south and west. The excavated peat will be placed over the cap of the existing site and the remainder stored on areas of the existing site for use in the restoration of the proposed extension.

6.8 All existing monitoring boreholes within the disposal area shall be removed and sealed prior to installation of the lining system.

Engineered Containment System

6.9 The site will be designed and operated on a containment basis in accordance with the EU Landfill Directive (1999/31/EC). This is based on engineering the base and side slopes of the site, installation of a groundwater drainage system, low permeability containment system incorporating a geomembrane liner, provision of a leachate and landfill gas collection and management system and ultimately a low permeability capping layer (Figure 6.1).

Groundwater Drainage

6.10 The base and sides of each cell will be prepared by cutting or filling as necessary to achieve the desired profile. These will then be covered by a 300 mm deep layer of fines free crushed rock aggregate with a minimum permeability of 1 x 10^{-3} m/s with a network of collection drains. The base of each cell will have a minimum 1:50 gradient towards the collection sump and 1:100 in a transverse direction in accordance with the EPA Landfill Design Manual (Figure 6.2).

6.11 The drainage blanket will intercept any groundwater seepage below the landfill, deliver it under gravity to the existing watercourse to the north west of the site.

Surface Water Drainage

6.12 An existing watercourse runs along the southern boundary and cuts through the southwest quadrant of the proposed extension. In order to engineer the site it will be necessary to divert the watercourse into a pipeline along the southern and western boundaries of the proposed extension. The pipeline will be designed to allow the surface water to gravitate to a discharge point to the north west of the site. In addition to this a surface water collection pipeline will be installed along the northern boundary of the proposed landfill to collect surface water from the north of the site. The two surface water pipelines will join at the north west of the site and discharge into the existing watercourse (Figure 6.2).

Lining System

6.13 The proposed containment will be a composite lining system which is illustrated in Figure 6.3. The lining system on the base will comprise a 500 mm thick layer of Bentonite Enhanced Soil (BES) installed on top of the groundwater drainage blanket over a separation geotextile. The BES will have a maximum permeability of 1×10^{-10} m/s and will be rolled and compacted to the desired falls (1:50 longitudinally and 1:100 cross-falls) to form a smooth surface suitable for covering by the geomembrane liner. The BES will extend over the base and up the side slopes to a vertical height of 2 m.

6.14 The liner will be a 2 mm thick High Density Polyethylene (HDPE) geomembrane in accordance with the EPA Landfill Design Guidance (EPA, 2000). The liner, which is available in rolls of width varying from 5.0 m to 9.3 m, will be site welded to form a continuous membrane across the lined area. This operation, including the installation of the BES, will be subject to full Construction Quality Assurance (CQA) procedures. The installation will then be covered by a protective geotextile prior to receiving a 500 mm deep blanket of 16/32 mm sized crushed rock aggregate. This will provide a drainage blanket for efficient removal of any excess quantities of leachate which may be generated.

6.15 The sides of the cells will be engineered to form slopes suitable to receive lining. These will be of the order of 1:3 (Vertical : Horizontal) for the first 2m (vertical) and there after 1:2 (Vertical : Horizontal). It is proposed to achieve this slope using a combination of suitable imported crushed rock and rock excavated from the floor of the site. The liner will be brought up the entire length of the side slopes and secured at the top in an anchor trench.

6.16 The composite lining system beyond the 2 m vertical height (extent of BES layer) above the base will take the form of geomembrane overlying a proprietary Geosynthetic Clay Layer (GCL). The 500mm leachate drainage layer will be replaced by a geonet for the leachate drainage on the side slopes.

CONSTRUCTION QUALITY ASSURANCE

6.17 The installation of the lining system will be supervised in accordance with normal Civil Engineering procedures and, in addition, full Construction Quality Assurance (CQA) will be applied to ensure that the materials and workmanship meet the design specification. The installation of the containment layers will be under the supervision of an experienced Engineer and ancillary staff as may be required, to be appointed by Donegal County Council. This will involve the conformance testing of the lining materials and the in-situ welding of the geomembrane. The integrity of fusion welds will be checked by air pressure testing and extrusion welds by spark testing. In addition welds will be subject to destructive testing in shear and peel.

6.18 A detailed CQA Plan for each phase will be submitted to the EPA before development commences.

6.19 At the end of each phase of lining installation, all CQA data will be presented in a report which will be submitted to the EPA before waste infilling commences in that particular phase.

6.20 In addition to CQA, a leak detection survey will be carried out in each lined cell to check the integrity of the lining system, prior to the placement of waste in that cell. There are several such systems which have been used for this purpose. The geoelectric potential method is a standard geophysical technique using the insulating properties of the geomembranes with respect to electrical current to highlight any anomalies in the lining system.

6.21 Leak detection surveys are a recognised procedure within landfill development and provide a useful quality check for the installed lining system.

LEACHATE GENERATION

6.22 Leachate would be produced by rainfall percolating through the waste and it is current standard practice, recommended in the EPA Guidance, to minimise the quantities generated by operating to "water-balance" principles, and limiting cell sizes, by phased disposal and progressive restoration, use of a low permeability cap and by shaping of the final landform to encourage surface water run-off.

6.23 Water balance equations, which model the hydrological balance of a landfill, are available for both the operational and post-closure phases. A simple equation relating to the operational phase can be given by:

$Q = I - E - aW$

where

Q = free leachate generated (m^3 per annum);

I = total liquid input (m^3 per annum);

E = actual evaporative losses (m^3 per annum);

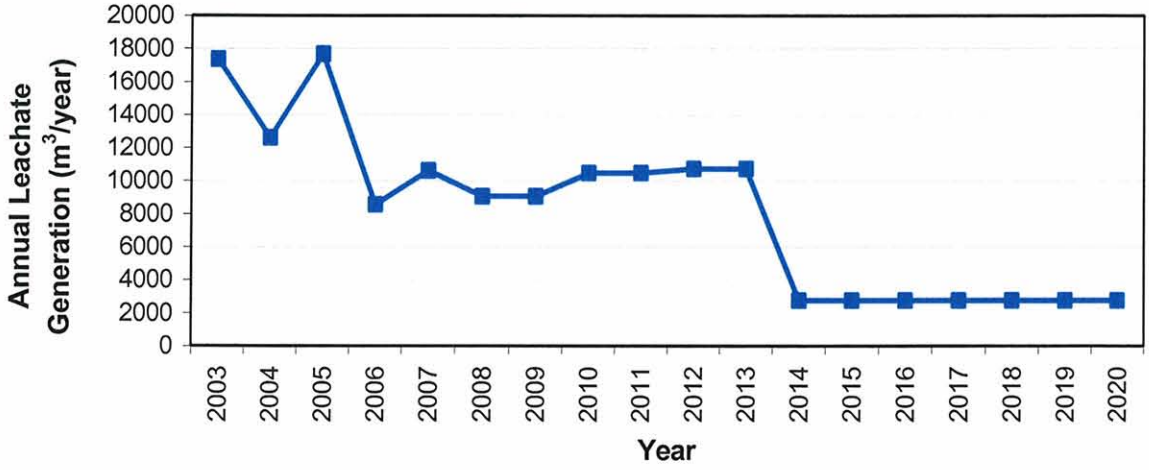
a = absorptive capacity of waste (m^3 per tonne);

W = weight of waste disposal (tpa).

6.24 This equation is typically used to calculate cell sizes on the basis of zero or "negative" quantities of free leachate although seasonal variations and storm events tend to result in excess leachate being produced. This requires a knowledge of the rate of waste input, so that the area exposed to precipitation is limited, and the rainfall is taken up by the absorptive capacity of the waste, typically assumed to be 10%, but which is a function of the waste density and composition.

6.25 It is difficult to make precise predictions at this stage since the exact composition of the waste cannot be defined accurately. The graph 6.1 below illustrates the water balance calculation for the existing and proposed landfill up to 2020. In addition water balance calculations will be carried out twice a year, as recommended in the EU Landfill Directive, and cell sizes adjusted as necessary to control leachate production. From graph 6.1, it can be seen that leachate quantities vary over the operational period of the site between 17,300m^3 and 8,500m^3 per annum depending on the area of the site which is operational. Post closure leachate generation continues at an estimated 2,700 m^3/annum.

Graph 6.1 Water Balance Calculation For The Existing And Proposed Landfill Up To 2020



Leachate Collection & Treatment

6.26 Control systems are needed at contained landfill sites to enable the safe management of excess leachate and to ensure that the integrity of the lining system is not prejudiced.

6.27 The proposals for the leachate collection system are illustrated in Figure 6.4. The leachate collection system will comprise a 500 mm deep drainage blanket, as previously described, with 225 mm diameter perforated High Density Polyethylene (HDPE) collection pipes at approximately 50 m centres. These pipes are laid to a minimum 2% falls along their length and the floor will incorporate a 1% crossfall. The pipes will discharge into a collection sump at the low points of each of the phases.

6.28 Leachate will then be pumped to a treatment tank where it will be subject to pre-treatment prior to disposal to a Sewage Treatment Works or recirculated through the waste to promote more rapid degradation. The leachate from the Ballynacarrick site will be transported to the Donegal Town Waste Water Treatment Works when constructed or to an alternative facility agreed with the EPA prior to these works being completed.

6.29 The treatment tank will be constructed from a steel or glass reinforced plastic tank. The tank which in first instance will have capacity of 1,500m^3 will be developed on a modular basis to accommodate future leachate generation. The proposed treatment process will involve the use of a surface or diffused air aeration system followed by a quiescent period to allow settlement.

6.30 The proposed leachate collection and treatment system complies with the accepted and specified standards and practices and should ensure that there is no uncontrolled build up of excess leachate within the landfill.

Recirculation of Leachates

6.31 Recirculation of collected leachate will be required where accelerated stability is to be achieved. A comprehensive leachate recirculation system will also be provided under the proposed capping system in order to facilitate the process.

Phasing

6.32 It is now accepted practice, particularly with the advent of containment sites, for landfills to be designed and operated in a series of discrete phases. Each phase will consist of a number of cells which will be designed to water balance principles to control leachate generation. The area of each cell will be sized on water balance principles and time for completion will depend on input rates. The phases of this development are shown in Figure 6.5.

6.33 Consistent with good landfill practice, new infill areas will be progressively prepared in advance of tipping activities. Following completion of infilling, groups of cells will be capped and progressively restored.

6.34 The layout and phasing of the site has been designed to minimise visual intrusion, as far as practicable, by infilling cells along the south of the site first, thereby providing further screening of tipping operations behind.

LANDFILL GAS COLLECTION SYSTEM

6.35 Landfill gas, the principle constituents of which are Methane and Carbon Dioxide, is generated as the putrescible fractions within the landfill degrade. Carbon Dioxide levels predominate during the early aerobic stage of degradation. The anaerobic stage, in a mature landfill, produces a ratio of Methane to Carbon Dioxide of 2:1. The potential risks associated with these relate primarily to the flammability of Methane and the asphyxiant properties of Carbon Dioxide. Consequently, a landfill gas collection system will be incorporated into the development to provide the necessary control. Further details of the Landfill Gas Collection system are provided in Section 9.

6.36 The engineered composite lining system proposed for the landfill base and sides, together with the capping system when infilling is completed should provide an adequate barrier to the uncontrolled migration of landfill gas to the atmosphere or surrounding strata. As a result provision must be made for an active gas extraction system to ensure that gas generated within

the landfill mass can be disposed off in a controlled manner. There have already been 12 gas vents installed in the existing site as detailed in Figure 6.6. For this purpose the proposed site and existing engineered cell a series of gas wells will be installed after waste infilling. The wells will then be connected to the permanent enclosed gas flaring unit via a HDPE collection pipe (Figure 6.6).

SITE INFRASTRUCTURE

6.37 Modern landfills require a substantial amount of associated infrastructure in order to operate to current guidelines and licence requirements. The following paragraphs describe the various elements of the site infrastructure currently on site and any additional infrastructure that will be installed as part of the proposed extension to the facility. These facilities will allow for good operational practices to be applied in respect to waste acceptance, recording, control and emplacement as well as leachate and landfill gas management.

6.38 Significant site infrastructure has already been installed as part of the existing landfill operations and this includes:

- Site identification board
- Site Office
- Weighbridge
- Wheelwash
- Haul Road
- Security Fencing
- Leachate holding tank
- Waste Inspection/Quarantine area
- Surface water drainage
- Site services
- Car parking

6.39 Additional Infrastructure to be installed for the proposed extension includes:

- Enclosed Landfill Gas Flare
- Leachate treatment facility
- Recycling Area
- Relocating the Waste Inspection/Quarantine area.
- Fuel Storage Area

6.40 The site identification and information board erected at the site entrance includes details of the operator, licence details, opening hours and contact and emergency telephone numbers.

6.41 The site accommodation includes an administration office, weighbridge management system kitchen and separate canteen area. A portable toilet is also provided on the site.

6.42 A surface mounted weighbridge has been installed adjacent to the site office and is sufficiently far from the public road to avoid queuing. It is 15m long and has a load weighing capacity of up to 60 tonnes. It is linked to a weighbridge management system which records all relevant information on waste and cover materials entering the site.

6.43 A wheelwash has been constructed on the exit route from the waste disposal area sufficiently far from the public road to allow removal of excess dirt from vehicle wheels. All contaminated water from the wheelwash is discharged to the leachate holding tank.

6.44 The site will be accessed through the existing entrance to the east of the site. The layout of the internal road network is shown in Figure 6.7. A 9m wide concrete haul road, narrowing to 6m beyond the wheelwash, has been constructed from the site entrance to a point approximately 90m from the site entrance. Beyond the end of the concrete haul road a 200mm deep layer of crusher run stone, 6m wide, provides access through the site and this road will be continued into the proposed extension. Further details of the location and layout of the proposed site entrance are given in Section 18: Transportation.

6.45 Lighting has already been provided for the existing site to areas which operate after darkness. This includes access from the public road to site reception area, weighbridge, wheelwash, leachate treatment system and gas flare.

6.46 A 2.4m high security fence currently encloses the eastern and southern boundaries of the existing facility. The proposed extension to the site will include securing the remaining perimeter of the site with a 2.4m high bent arm chainlink fence. The security fence along the remainder of the southern boundary and on the western boundary will be set back 3m from the existing road verge. The fenceline on northern boundary will be erected along the line of the site boundary. Gates will be provided in the fence to allow access to adjacent land for maintenance. The site will be secured outside operating hours. Details of site fencing are provided in Figure 6.8 while a layout of the fence location is provided in Figure 6.9.

6.47 The existing site currently has limited leachate storage capacity on site. For the proposed extension a leachate treatment facility will be installed and will provide increased storage capacity and a treatment system using diffused air or surface aerated oxygenation method to biologically and chemically treat leachate. The tanks will be constructed above ground level, rising to a maximum height of 5.0m.

6.48 A waste inspection and quarantine area for the site is currently located adjacent to the site office. This will have to be relocated to allow for the positioning of the gas flare. The new location for the waste inspection area is adjacent to the car park (Figure 6.7) and will be a concrete area with a concrete wall constructed around 3 sides. Drainage from this area will be independent of the rest of the reception area and can be diverted to the leachate treatment system.

6.49 The layout of the existing surface water management is shown in Figure 6.7. The surface water from the site roads is directed to gulleys and passes through an oil interceptor prior to discharging to an area to the east of the existing site. A portable toilet is provided on site and the sewerage from the site is collected on a weekly basis by a private contractor.

6.50 Other services on the site include:

- telephone line
- mains water supply
- three phase power supply
- landfill gas detection monitor in buildings

In addition to this a metrological station will be erected on site.

6.51 Car parking facilities have been provided adjacent to the site office for site staff and visitors.

6.52 A landfill gas flare will be provided adjacent to the leachate holding tank and will be introduced prior to infilling in the extension to allow for the extraction of landfill gas from the existing facility. This will be an enclosed landfill gas flare with no visible flame.

6.53 A fuel storage area, located adjacent to the northern boundary of the proposed extension, will provide a fuelling point for all site vehicles. The storage area will comprise a 10,000 litre tank within a bunded area with a capacity of 110% of the storage tank.

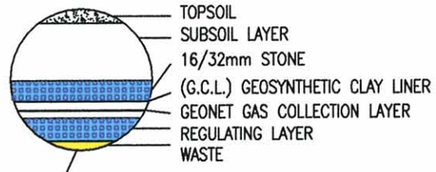
BIBLIOGRAPHY

The Environmental Protection Agency Landfill Manual – Landfill Site Design 2000

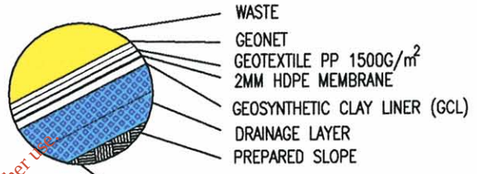
FIGURES

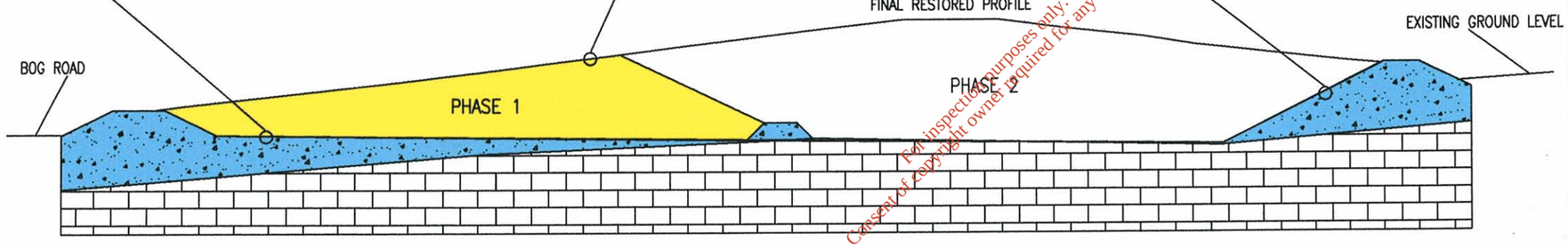
ENGINEERED BASE OF LANDFILL

ENGINEERED SURFACE OF LANDFILL



ENGINEERED SIDE SLOPE OF LANDFILL





KEY:

LANDFILL WASTE

BALLYSHANNON LIMESTONE

QUARRY BACKFILL MATERIALS

SCALE: NTS

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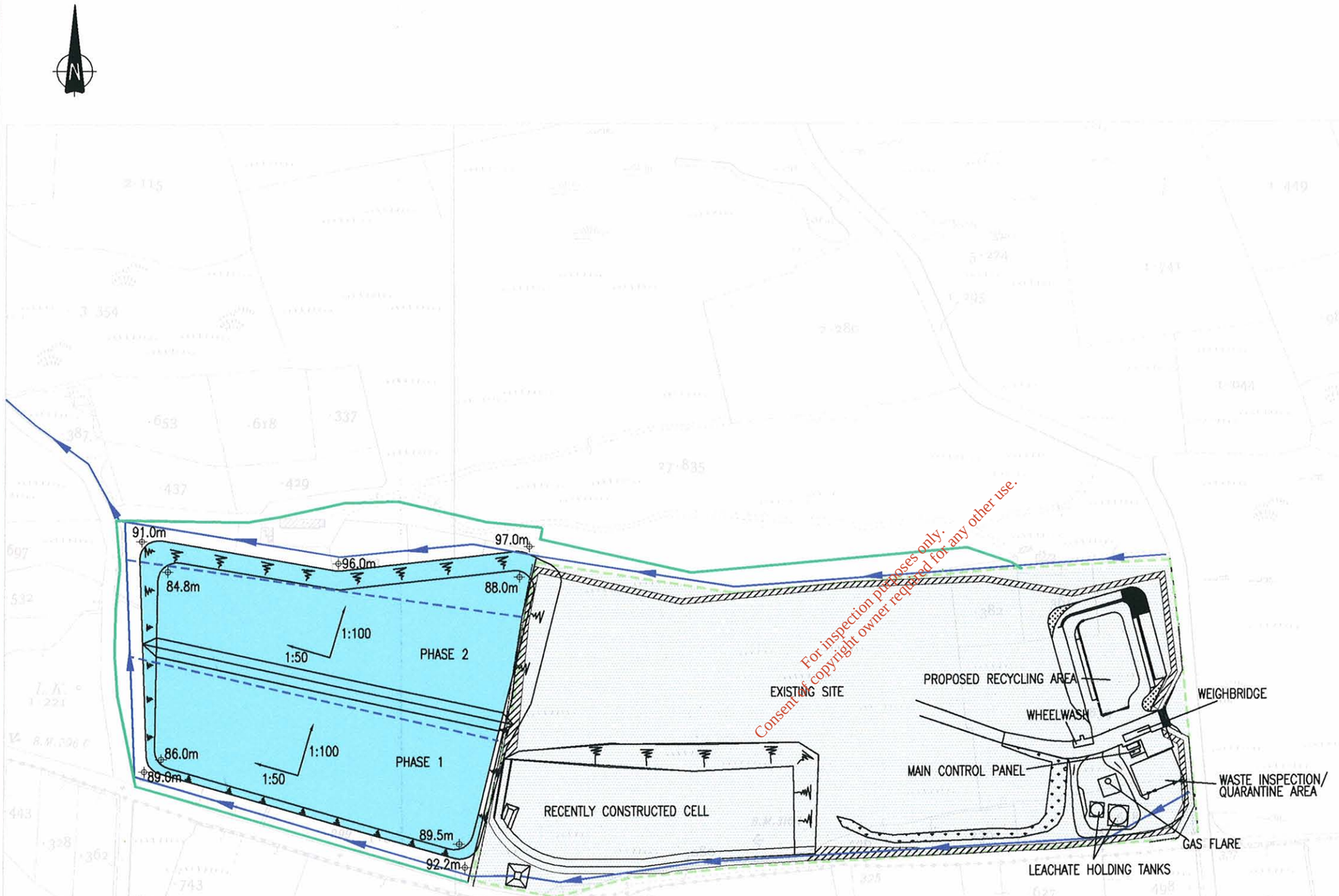
PROJECT
BALLYNACARRICK LANDFILL PROJECT

TITLE
TYPICAL SECTION THROUGH THE SITE

FIGURE
6.1



KEY

- BOUNDARY OF EXISTING LANDFILL
- BOUNDARY OF PROPOSED EXTENSION
- LIMIT OF PROPOSED LANDFILL EXTENSION
- SURFACE WATER DRAINAGE PIPELINE
- GROUNDWATER DRAINAGE PIPELINE
- LIMIT OF EXISTING SITE
- 84.8m FORMATION LEVELS

SCALE: 1:2500

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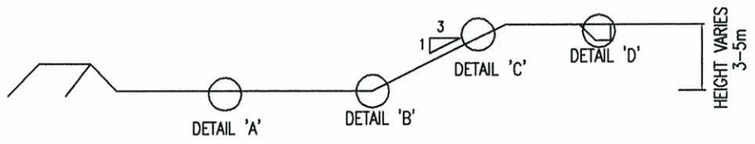
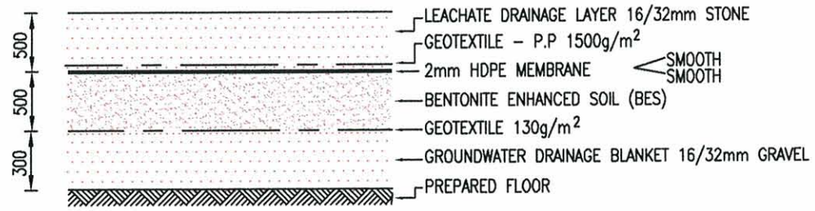
PROJECT
BALLYNACARRICK LANDFILL PROJECT

TITLE
SURFACEWATER AND GROUNDWATER MANAGEMENT

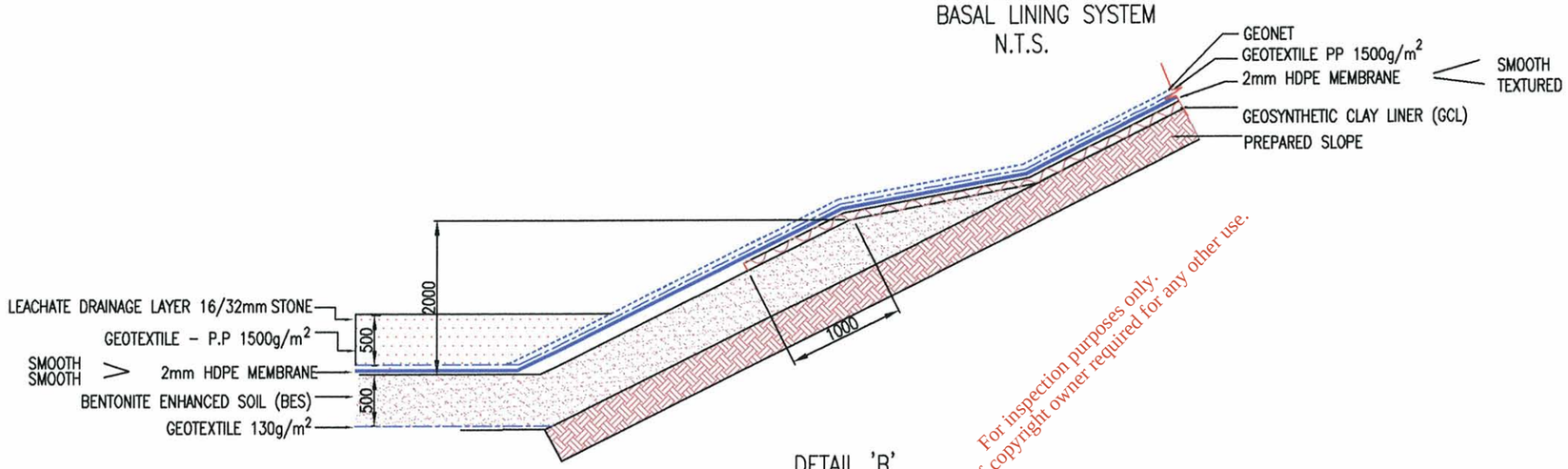
FIGURE
6.2



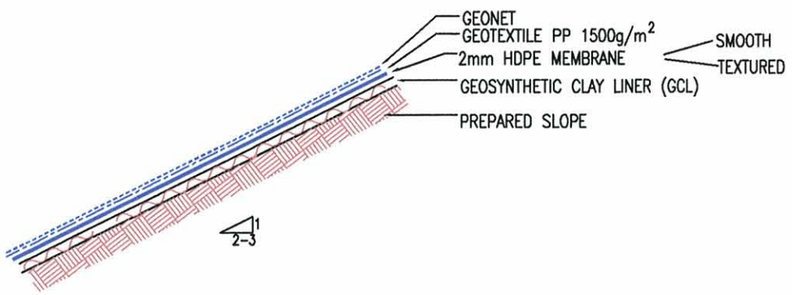
SCHEMATIC SECTION
N.T.S.



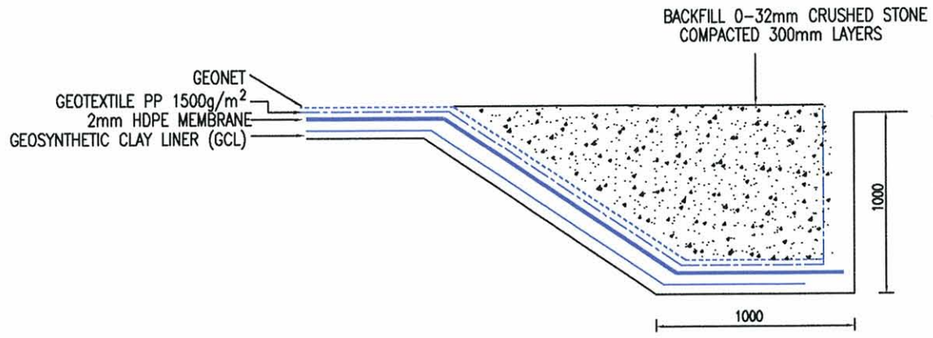
DETAIL 'A'
BASAL LINING SYSTEM
N.T.S.



DETAIL 'B'
BES/GCL INTERFACE
N.T.S.



DETAIL 'C'
SIDE SLOPE LINING SYSTEM
N.T.S.



DETAIL 'D'
ANCHOR TRENCH LINING SYSTEM
N.T.S.

SCALE: NTS

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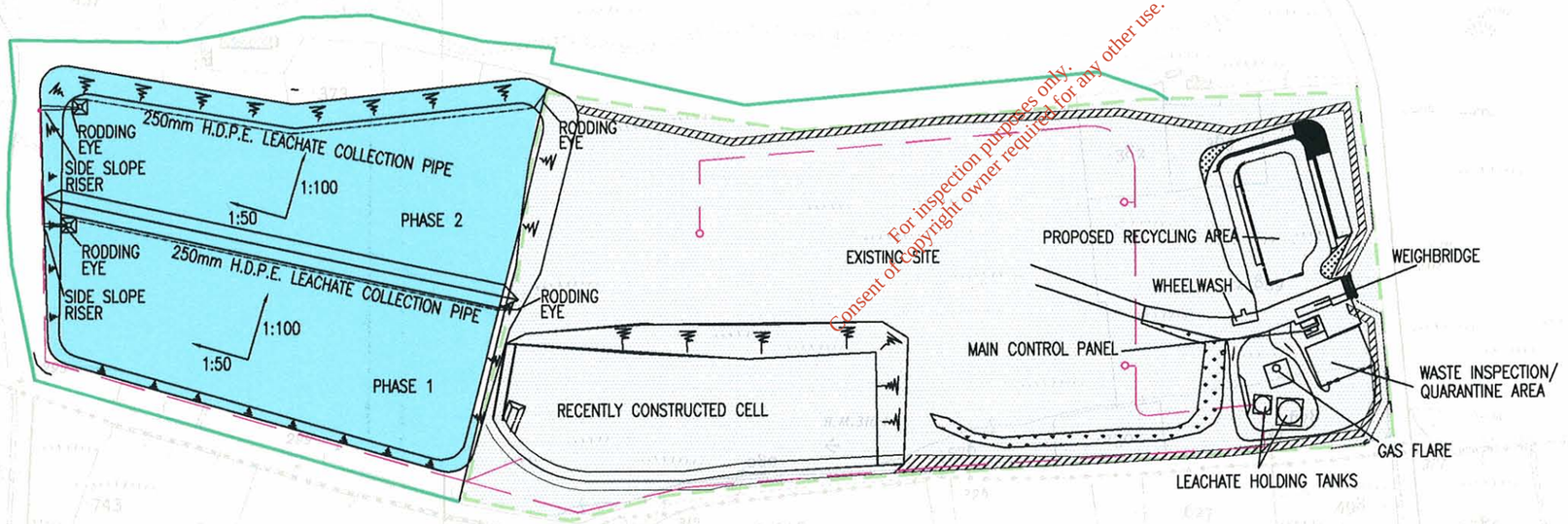
PROJECT
BALLYNACARRICK LANDFILL PROJECT

TITLE
LINING DETAILS

FIGURE
6.3



KEY

- BOUNDARY OF EXISTING LANDFILL
- BOUNDARY OF PROPOSED EXTENSION
- LIMIT OF PROPOSED LANDFILL EXTENSION
- LEACHATE PUMPING MAIN
- LIMIT OF EXISITNG SITE

SCALE: 1:2500

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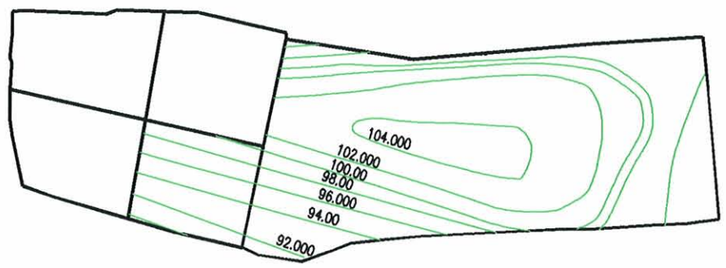
PROJECT
BALLYNACARRICK LANDFILL PROJECT

TITLE
LEACHATE MANAGEMENT SYSTEM

FIGURE
6.4

FIRST PHASE



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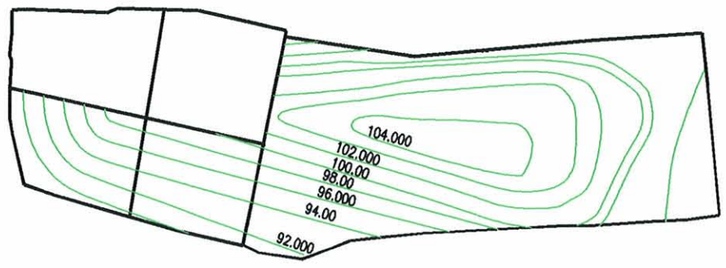

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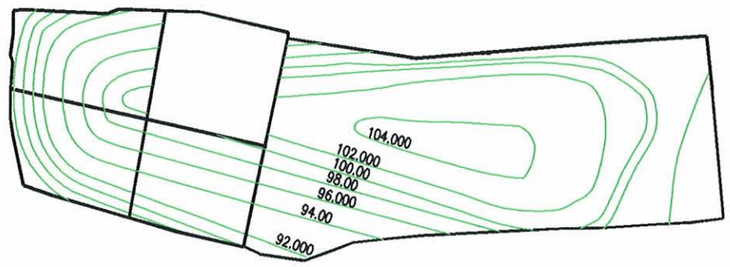

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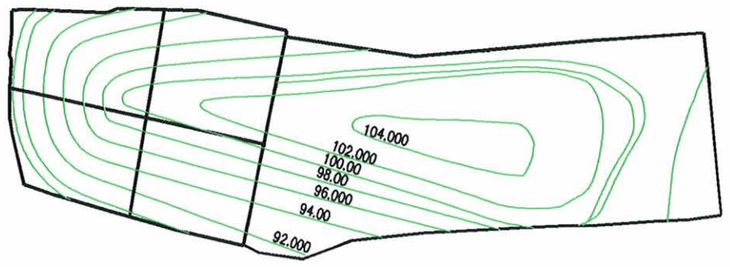


KEY

PROPOSED RESTORATION CONTOURS

KIRK McCLURE MORTON
CONSULTING ENGINEERS

Comhairle Chontae Dhún na nGall
Donegal County Council

PROJECT

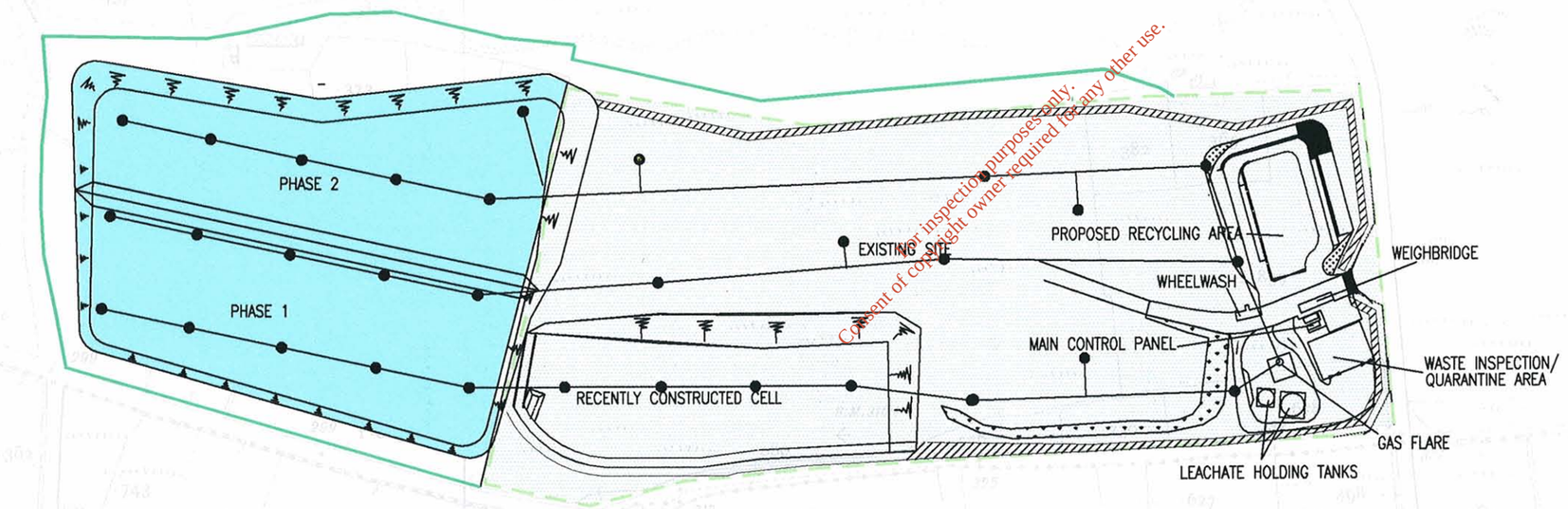
BALLYNACARRICK LANDFILL PROJECT

TITLE

PHASING PLAN

FIGURE

6.5



KEY

- BOUNDARY OF EXISTING LANDFILL
- BOUNDARY OF PROPOSED EXTENSION
- LIMIT OF PROPOSED LANDFILL EXTENSION
- GAS VENT
- GAS COLLECTION PIPELINE
- LIMIT OF EXISTING SITE

SCALE: 1:2500

KIRK McCLURE MORTON
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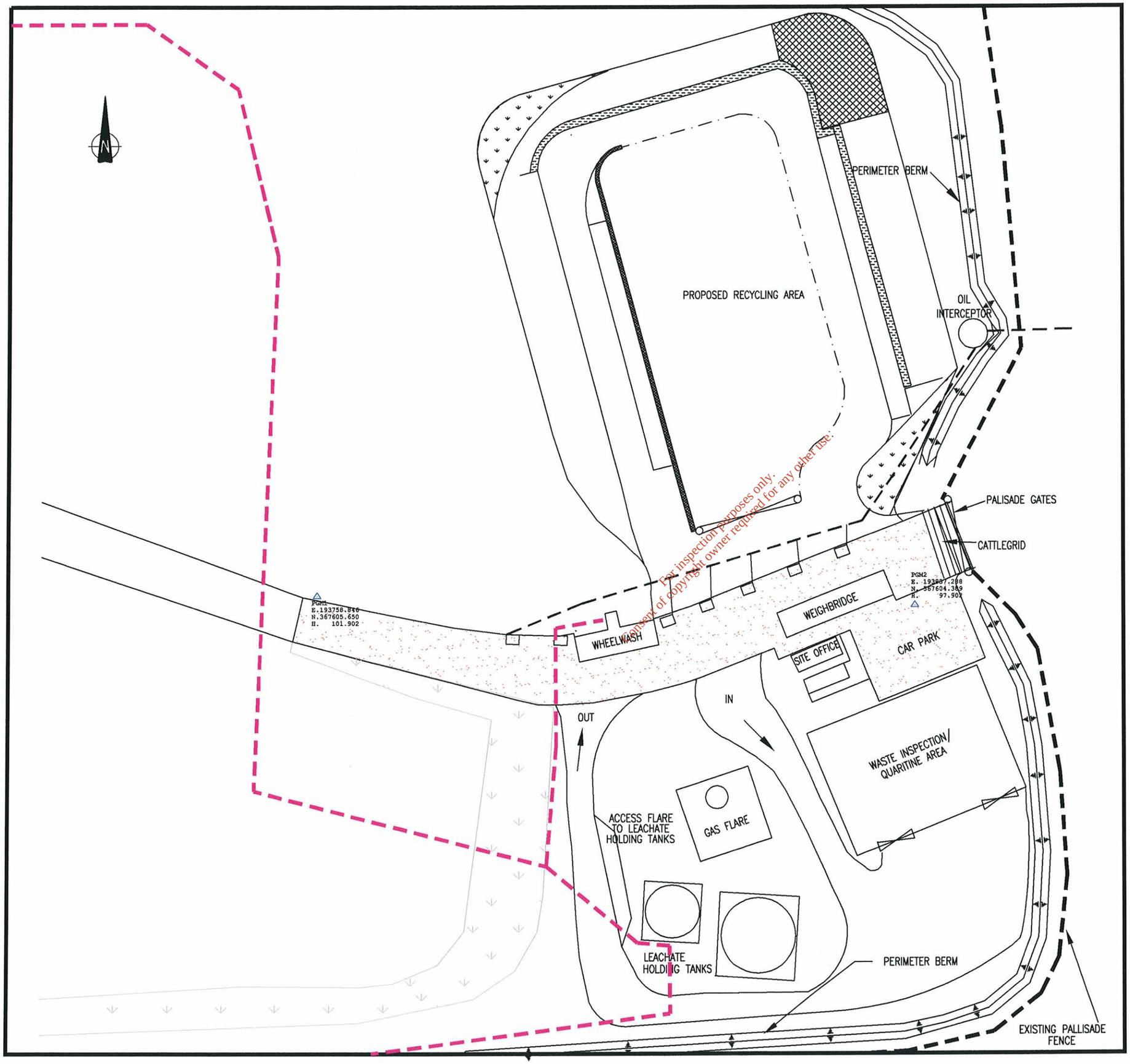
Comhairle Chontae Dhún na nGall
Donegal County Council

PROJECT
BALLYNACARRICK LANDFILL PROJECT

TITLE
LANDFILL GAS MANAGEMENT SYSTEM

FIGURE
6.6



KEY

- CONCRETE SURFACE
- LANDSCAPE SLOPE
- LEACHATE PUMPING MAIN
- EXISTING ROAD DRAINAGE
- EXISTING ROAD GULLY
- PERMANENT ORDNANCE DATUM CONTROL POINT

SCALE: 1:500

KIRK McCLURE MORTON
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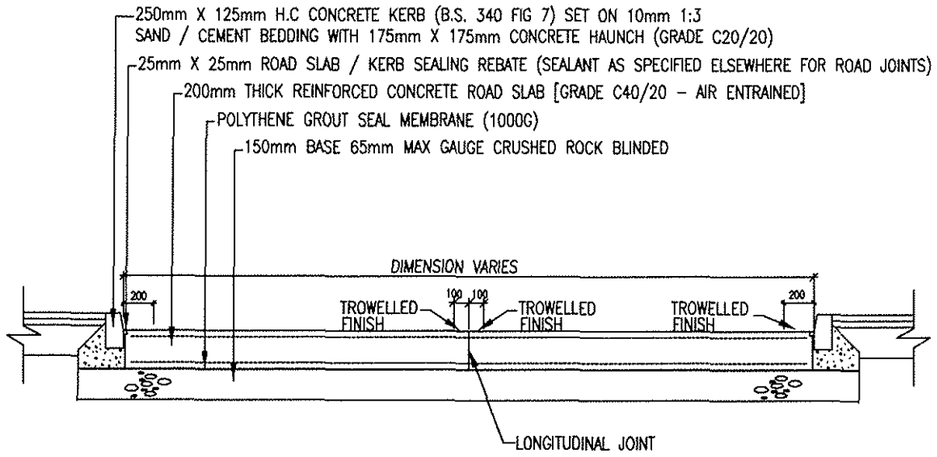
Donegal County Council

PROJECT
BALLYNACARRICK LANDFILL PROJECT

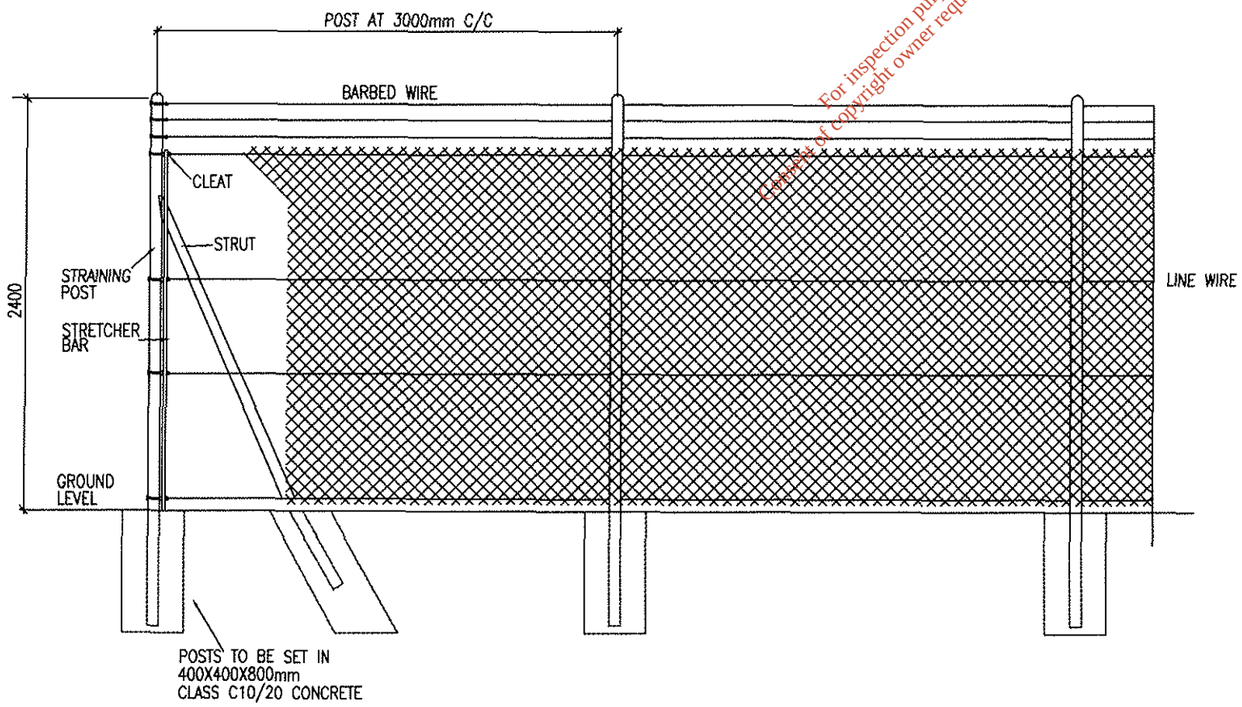
TITLE
SITE INFRASTRUCTURE

FIGURE
6.7



TYPICAL SECTION THROUGH CONCRETE ROAD

SCALE N.T.S.



CHAIN LINK FENCE WITH EXTENSION ARMS FOR BARBED WIRE (SECURITY FENCE)

SCALE: NTS

KIRK McCLURE MORTON
CONSULTING ENGINEERS

Comhairle Chontae Dhún na nGall
Donegal County Council

PROJECT

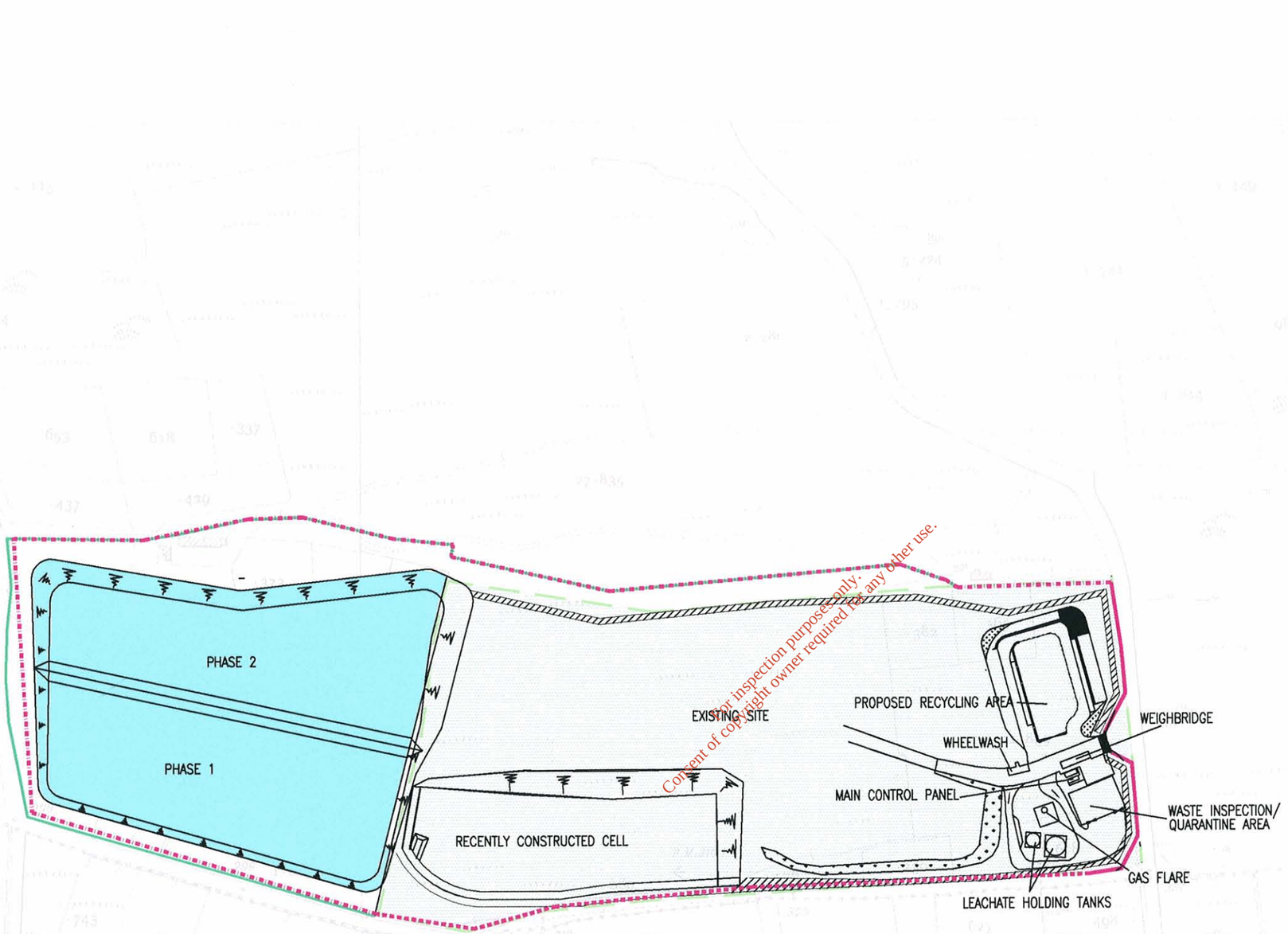
BALLYNACARRICK LANDFILL PROJECT

TITLE

ENGINEERING DETAILS

FIGURE

6.8



KEY

- BOUNDARY OF EXISTING LANDFILL
- BOUNDARY OF PROPOSED EXTENSION
- LIMIT OF PROPOSED LANDFILL EXTENSION
- LIMIT OF EXISTING SITE
- EXISTING PALISADE FENCE
- EXISTING CHAINLINK FENCE
- PROPOSED CHAINLINK FENCE

SCALE: 1:2500

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Donegal County Council

PROJECT
BALLYNACARRICK LANDFILL PROJECT

TITLE
FENCELINE LAYOUT

FIGURE
6.9

7.0 SITE OPERATIONS

INTRODUCTION

7.1 The Ballynacarrick extension is to be developed to meet the requirements of the Donegal County Council Waste Management Plan, which was adopted by the Council in 2000. The site at Ballynacarrick will be operated by Donegal County Council to serve the waste disposal requirements for the south of the county.

7.2 It is envisaged that the site will receive a maximum of 24,000 tonnes of non hazardous waste per annum.

7.3 The waste will be delivered to the site by road in refuse freighters operated by private waste collection companies.

SITE LICENCE

7.4 All operational activities will be carried out in accordance with the Waste Disposal Licence, which would be issued by the Environmental Protection Agency in accordance with the Waste Management (Licensing) Regulations, 2000.

ENVIRONMENTAL MANAGEMENT SYSTEM

7.5 All operations on the landfill site will be carried out in accordance with the Environmental Management System, a document which defines responsibilities and site procedures, this will be required as a condition of the Site Waste Licence. In addition to this an Annual Environmental Report will be prepared and will include an assessment of the environmental monitoring for the site as well as the waste inputs, location of cells used in the period and the phasing system.

OPENING HOURS

7.6 Proposed landfill site opening hours for waste reception will be 8.30 am to 5.00 pm Monday to Friday and 9.00 am to 1.00 pm on Saturday. The facility will not open on Sundays. Operations may be undertaken outside these hours to facilitate emergency situations.

PLANT

7.7 The following sets out a schedule of plant currently used on site. If an item of plant is replaced permanently, due to circumstance, it will be by a machine of similar capability.

- 1 No. Landfill Compactor
- 1 No. Crawler Excavator
- 1 No. Tractor and trailer

7.8 In addition to this, other plant will be employed as and when required such as an extra tractor and trailer for temporary capping and road construction and a water bowser for dust suppression.

PERSONNEL

7.9 The site will generally be manned by a minimum of 4 personnel, consisting of a Site Manager, Weighbridge Operator and 2 Site Operatives. Further personnel will be employed on an as required basis to deal with general maintenance of the site. All personnel employed on the site will be adequately trained in their own personal discipline and will be familiar with the operating conditions relating to the site. A named engineer based at head office, at Senior Executive Engineer level or above will be appointed to have overall responsibility for the operation of the site at Ballynacarrick.

7.10 Donegal County Council Environment Section will continually assess training needs of all involved in the operation of Ballynacarrick Landfill and carry out such training as required by regulation. Records of staff training will be updated and stored on site.

PHASING

7.11 The site will be progressively infilled and restored in phases as shown in Figure 7.1. Each phase will be filled from the base to final levels sequentially. It will be necessary to commence filling in the subsequent cell before final levels may be reached in the preceding cell. However it is envisaged that no more than two cells will be open at any one time.

7.12 This is in accordance with the recommendations of the EPA Guidance on Landfill Operational Practices. The actual timescale for infilling will be dependent upon the rates of waste input. The detailed operation of each phase will be outlined in the site's phasing plan.

7.13 Each phase will be bounded by bund walls, lined face or previously tipped airspace. Bund walls will be constructed to a maximum height of 2.5 m and the depth of the working face will not exceed 2.5 m.

7.14 The site will be filled in each phase to the proposed final profile as detailed in Figures 7.1 making appropriate allowances for settlement of the waste mass to ensure that the predetermined profiles can be achieved.

SITE MANAGEMENT PROCEDURES

7.15 The site management procedures for the current landfill site are set out in the Environmental Management System. The current Environmental Management system will be revised to include operations at the proposed extension. The key sections within the Environmental Management System mirror the requirements of the site licence.

7.16 Waste Acceptance:

- All waste vehicles (suitably covered) entering the site will be booked in at the weighbridge. The current site weighbridge is fully computerised and is located close to the site control office from where it is operated and will be regularly to be maintained and calibrated to ensure that reliable data is being collected. The weighbridge will record the weight and description of the waste including the European Waste Catalogue (EWC) codes.
- If the waste is scheduled for compliance testing then the vehicle will be directed to the waste inspection area.
- Once wastes have been accepted at the reception area, vehicles will be directed to their respective discharge area.
- Any loads not meeting the criteria will be held on site in the refuse freighters and the Waste Rejection procedure followed as briefly discussed in section 7.26.

7.17 Waste Disposal:

- Wastes will be landfilled in prepared cells, which will typically be 60m in width. The layers will be compacted in layers of approximately 300mm thickness and in face depth of approximately 2.5m. The slope of the advancing face and on the edges of the cell will be maintained at a slope of less than 1:3.
- In addition to the waste inspection procedures at the Weighbridge, the compactor operator, during the waste spreading and compaction process, will visually inspect all waste deliveries for compliance with acceptable Waste Management Licence categories.
- If the operator sees a suspected non-compliant waste, he shall follow procedures as set out in the site's Waste Rejection Procedure briefly discussed in paragraph 7.26.

- The waste will be covered at the end of each working day with sufficient inert material so as to ensure satisfactory control of potential problems associated with exposed wastes (e.g. litter blow, odour, vermin, insects and scavenging birds).

7.18 Traffic Control:

- The site is served by a minor road and the impact of traffic movements on the road is discussed in section 18 of this document.
- To mitigate against these impacts, passing bays will be constructed along the minor road.
- All traffic movements to the site will be along the designated route from the N15 to the site and measures to ensure the implementation of this are included in Section 18 in this document e.g. physical barrier at entrance to prevent access from the Bog Road, regulation through the waste permits.
- Donegal County Council will ensure that all operators using the site are aware of the designated route by the use of signage at the site and on the access routes to the site.

7.19 Pest and Vermin Control:

- In order to prevent the presence of vermin, a specialist contractor will be employed to inspect the site.
- The contractor will take the necessary action to eliminate the cause of any evidence of vermin activity discovered or reported.
- If rodents or evidence of rodents is seen at any time on site, it will be immediately reported to the contractor who will visit the site as soon as is practicable and take the necessary action to eliminate the rodents.
- Insect control will be maintained by controlled spraying of the landfill areas when necessary, with an approved insecticide, in accordance with manufacturers guidelines and relevant regulations.

7.20 Bird Control:

- Rapid and effective covering of waste and the consequent decrease in potential food supply is recognised as the most effective means of bird control. This will be supplemented by other control measures.
- If required this will include gas cannons, visual deterrents, distress calls, physical barriers, birds of prey and the flying of kites over the landfill.
- These methods will be varied to prevent birds becoming accustomed to a single method and will be reviewed to ensure that effective bird control is being achieved.

7.21 Litter Control:

- The proposed landfilling operations will minimise the possible impact of litter by tipping in locations appropriate to the wind strength and direction and by ensuring that suitable litter netting is established around the active landfill area.
- Litter netting will primarily be achieved by the provision of semi-permanent, temporary and mobile screen systems to agreed specifications and locations, which will be detailed and recorded in the Environmental Management System. Such screens will be inspected daily and regularly cleared of litter.
- Any litter blown outside the boundaries of the site will be collected if possible during the same day. Any remaining litter at the end of the day will be collected as soon as possible, with notes made in site records of special actions taken to remedy the situation.
- Under normal conditions, all wind blown litter on site will be collected and deposited at the working face by the end of the day. However, if waste has blown outside the site, this will take priority over that contained within. This will not detract from the importance of standards within site and notes will be made in site records of actions taken to resolve problems.

7.22 Odour Control:

- Odours associated with ongoing operation of the site will be mitigated by effective compaction and the provision of adequate cover, rapid deposition of malodours waste, effective landfill gas management and prevention of stored leachate becoming anaerobic.

7.23 Noise Control:

- Noise impacts on the site will be minimised by ensuring that vehicles and equipment visiting the site conform to appropriate standards in relation to noise performance.
- Donegal County Council will ensure that all plant supplied to the site meets the necessary standards.

7.24 Fires:

- Site management practice do not permit material to be burnt within the boundary of the facility.
- Further to this, staff will be trained in fire prevention and control. Burning waste which are delivered to the tipping face will not be accepted.
- Any fire discovered on site will be dealt with by the fire service in accordance with the emergency response procedure for the site.

7.25 Waste Assessment:

- The Weighbridge Operator will randomly select vehicles for recorded waste assessment.
- The vehicle will be directed to the waste inspection area.
- Where there is doubt about whether the contents of a waste consignment complied with the Site Licence, the following action will be taken:
  - (i) Irrespective of whether the load has been discharged, site staff will endeavour to prevent the vehicle delivering the waste from leaving the site, they shall note details of the registration number of the vehicle, if possible, the trading name, address, name of driver, origin of waste and any other available details will also be recorded.
  - (ii) If material has been deposited at the tip face, such material will be removed and stored in the waste quarantine area.
  - (iii) If considered appropriate, a sample of waste will be sent for analysis.
  - (iv) As soon as is practicable, the Environmental Protection Agency will be notified and action taken to ensure safe disposal with the agreement of the EPA.

7.26 Waste Rejection:

- Any rejected waste loads will be recorded and will include details of the occurrence, type of waste and reason for rejection, name of producer and facility to which the waste was removed.

7.27 Site Traffic:

- Traffic on site will be controlled by a series of signs, marshalling by operatives and use of weighbridge traffic lights. Signs on site will indicate maximum permissible speeds, directional information and queuing positions.
- The weighbridge operator will provide the primary means of marshalling traffic. Normally he will restrict the number of vehicles on site to a level, which is easily controlled in the tipping area.
- In the event that lorries arrive at the weighbridge at a greater rate than can be allowed onto site, the weighbridge operator will allow vehicles to park within the site boundary until such times as they can be weighed.
- Site access will be maintained by the construction of suitable roadways to ensure the safe passage of all vehicles using the site. Site roads will be swept by a tractor and brush on a regular basis. Dust control on site roads will be provided by spraying with water when necessary.
- All vehicles that have travelled off the concrete road surfaces will be required to use wheel wash facilities before leaving the site unless otherwise directed by site staff due to wheel wash failure or planned maintenance. All directives will be clearly sign posted and advised to vehicle drivers to ensure its effective use. Site personnel will supervise its use

if conditions dictate.

- The wheelwash will be cleaned down by site staff when required. This will take place outside of opening hours, or when it is deemed that the wheelwash can be stood down, usually in dry weather conditions.
- If required site management will arrange to have a suction road sweeper used on the public highway.

SECURITY

7.28 The existing site is bounded along the eastern boundary by a 2.4m high palisade fence and by a 2.4m high bent arm post with galvanised chainlink fence topped with barbed wire along the southern boundary. The main access to the site is along the eastern boundary. A pedestrian access gate is also provided in the fence on the southern boundary adjacent to the surface water lagoon to allow access to adjacent land for maintenance. For the extension to the site the security fencing will be extended around the remaining boundary of the site with a 2.4m high bent arm post with galvanised chainlink fence, as illustrated in Figure 7.2. The site gates will be locked and secured outside operating hours.

COVER MATERIALS

7.29 Daily covering of the waste reduces the odour from the deposited waste and also minimises any potential nuisances caused by pests and birds. Inert material or alternative cover will be placed over the working area at the end of each day. Given the significant volumes of traditional cover material which is needed and its requirement in respect of permeability and free drainage, the use of alternative cover materials (e.g. geosynthetic materials) will be considered, if a practical effectiveness can be demonstrated. This would include the ability to prevent vermin, odours and blowing litter.

7.30 The amount of available material which would be suitable for covering is limited and the majority of material will have to be imported onto the site. Some imported materials for cover will be stockpiled on site to ensure continuity of supply for covering and to allow the amount of traffic movements for vehicles delivering cover materials to spread out to avoid periods of increased traffic densities. It is proposed that cover material (e.g. quarry dust) would be imported as required from a nearby quarry. Typically the quantities required are estimated to be approximately 15-20% of the waste input.

ENVIRONMENTAL MONITORING

7.31 All monitoring on site will be in accordance with the requirements of the site licence and the Environmental Protection Agency's manual on Landfill Monitoring. The proposed frequency and location of sampling is detailed in Appendix D and the proposed sampling points are shown on Figure 7.3. In addition to the existing landfill gas monitoring points, external monitoring points at the boundary of the existing site and proposed extension will be installed at locations detailed in Figure 7.3.

LEACHATE MANAGEMENT

7.32 Leachate management at the site will follow the procedures laid down in the Environmental Protection Agency's manual on Landfill Operational Practices. The leachate management system is shown in Figure 7.4.

7.33 When water enters a landfill, principally in the form of rainfall, it infiltrates the surface and percolates through the landfill and in doing so it comes into contact with the disposed material or waste. Water may also enter a landfill site in the form of surface or groundwater inflows. Leachate is the name given to describe any liquid percolating through or contained within a landfill and its composition and characteristics will typically depend on the type and compaction of waste, the age of waste, rainfall and surface water ingress and the extent of cover, capping and restoration.

7.34 The proposals for the extension of the Ballynacarrick site allow for containment of all leachate generated at the site. This will require appropriate management throughout the life and aftercare period of the site to maintain leachate control and treatment.

7.35 Management of leachate will relate to generation, composition, control, treatment, disposal and monitoring. The generation of leachate will be dependant on the effective rainfall at the site and the size of landfill cells and extent of capping, coupled with the quantity of liquids deposited in the waste.

7.36 It is acknowledged, given the relatively high effective rainfall typical of the western coastal area of Ireland that the management of leachate will be of particular importance to the successful operation of the site.

7.37 Leachate management within the waste mass will be effected by a leachate drainage collection layer below the waste which is transferred by pipeline to the leachate sump at the low point of each cell. From this point the leachate will be pumped by a submersible pump and flexible rising main in a side slope riser or leachate extraction tower to the leachate main and to the treatment tanks.

7.38 Effective leachate management at the site will require the use of optimum cell sizes and the phasing of capping to quickly follow infilling to ensure that the areas contributing to leachate generation are restricted.

7.39 Cell sizes will initially be based on the water balance calculations detailed in the site development section and will be continually reviewed against site operational requirements and the results of ongoing monitoring.

7.40 The main phases have been sub divided to give a total of 4 cells. This will allow efficient and effective management of leachate and will optimize the "open" area producing leachate in terms of minimizing area while allowing practical daily operations. It will further allow the segregation of rainwater falling in lined but unfilled cells which can be discharged as surface water.

7.41 To assist with leachate management temporary capping will be introduced to areas of filling which have reached elevated levels to allow incident surface water to be diverted away hence minimising leachate production. To allow drainage of the cap (temporary or permanent) a perimeter cut off and surface water drain will be established. This will also act as a barrier to surface water and groundwater flows at the perimeter of the landfill area thus reducing any possibility of groundwater or surface water intrusion.

7.42 All leachate collected by this system will receive treatment on site in leachate tanks prior to disposal to the sewage treatment works. The on site treatment will be an aeration and settlement process operated on a batch system.

7.43 The treatment process will allow the quality of leachate to be improved to domestic sewage standards prior to discharge to the sewage treatment works for further treatment and ultimate disposal to the stipulated acceptance criteria. There is no proposal to discharge treated leachate directly to any watercourse. The sizing of the tanks allow for the batching and storage of leachate required by the operation of the process throughout the lifetime and aftercare of the site.

7.44 Leachate recirculation will be used as part of the leachate management system at the site to take advantage of the anaerobic treatment within the landfill and to introduce flushing of the waste mass.

7.45 Recirculation of site treated leachate will be by way of pumped irrigation system located within the gas collection layer, which forms part of the final capping proposals. The details of the extent of recirculation will be site specific and will be based on ongoing monitored and assessment of the process.

LANDFILL GAS MANAGEMENT

7.46 Landfill gas will be produced by the biodegration process in the landfill. It is primarily composed of methane, carbon dioxide and water vapour.

7.47 The rate of gas generation is typically a function of the dimensions of the site; the type, age and rate of infilling of waste; moisture content, pH, temperature and density of wastes deposited and the extent of cover and capping.

7.48 Management procedures at Ballynacarrick will ensure appropriate management of landfill gas during the life and aftercare of the site. This will accommodate the changes in quantity and composition of landfill gas which occur with time. The management procedures will ensure that uncontrolled off-site migration will not occur. This will be monitored at the boundary of the existing site and proposed extension at points along the boundary of the facility as illustrated in Figure 7.3.

7.49 Monitoring will form an important part of this process and will follow the guidance laid down in the Environmental Protection Agency's manual on "Landfill Monitoring".

7.50 Gas control at the site will initially be through the use of passive gas venting system in the form of vents installed retrospectively to landfilling as detailed in Figure 7.5. The lining system will form an effective gas barrier around the perimeter of the landfill area. The leachate collection layer will continue up the side slopes and will effectively act as a gas venting trench adjacent to the lining system around the perimeter of the landfill area.

7.51 The active system will abstract gas under negative pressure by a system of pipework interlinking gas vents. The negative pressure will be applied by extractor pumps and the system will include moisture traps, flame arrestor and an alarm to indicate instances when combustion is not occurring. The enclosed flare will operate on a 24 hour basis and further details of the active gas system are provided in Section 9.

7.52 The system will be supported by other gases as required by the combustion process. The collected gas will be used for flaring and may ultimately be used for energy generation.

COMMUNITY LIAISON GROUP

7.53 It is proposed to establish a Community Liaison Group. Representatives of the local community will be invited to meet periodically with Members and Officers of Donegal County Council and site management to discuss progress with the infilling, restoration and landscaping and to resolve any difficulties that may arise from time to time. Specific details of the composition of the group will be agreed following issue of the waste licence.

HEALTH AND SAFETY

7.54 Health and Safety will be a priority on site at all time. Site personnel have been appropriately trained in health safety matters generally and particularly on those areas which specifically pertain to operation of a landfill facility. Training already undertaken with existing site staff includes first aid and Safe Pass as well as the site emergency procedures.

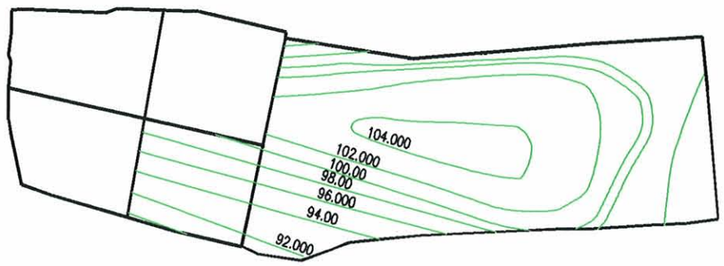
BIBLIOGRAPHY

The Environmental Protection Agency Landfill Manual – Landfill Monitoring 1995

The Environmental Protection Agency Landfill Manual – Landfill Operational Practices 1997

FIGURES

FIRST PHASE



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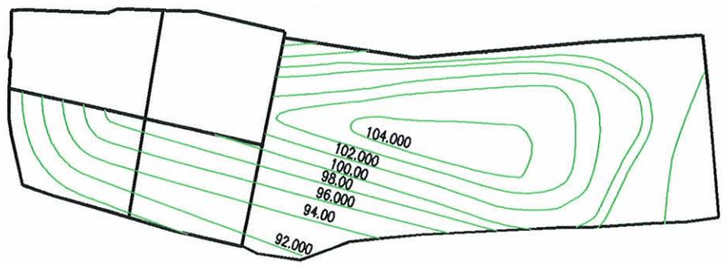

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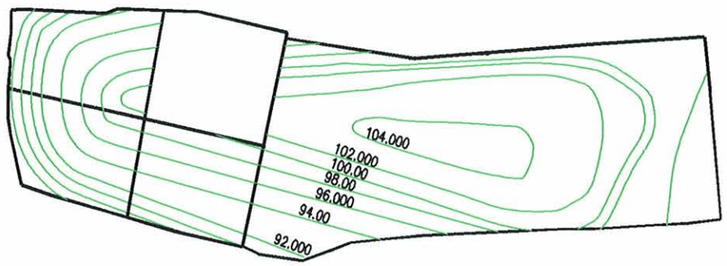

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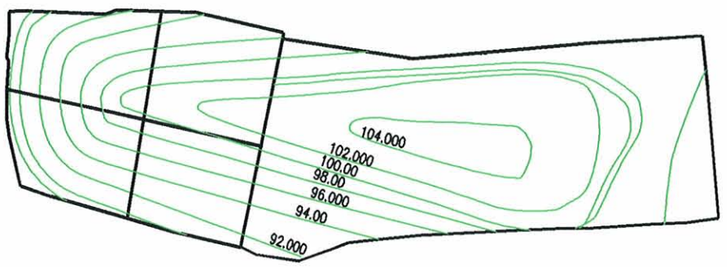

KEY

PROPOSED RESTORATION CONTOURS

SCALE: 1:5,000

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Comhairle Chontae Dhún na nGall
Donegal County Council

PROJECT

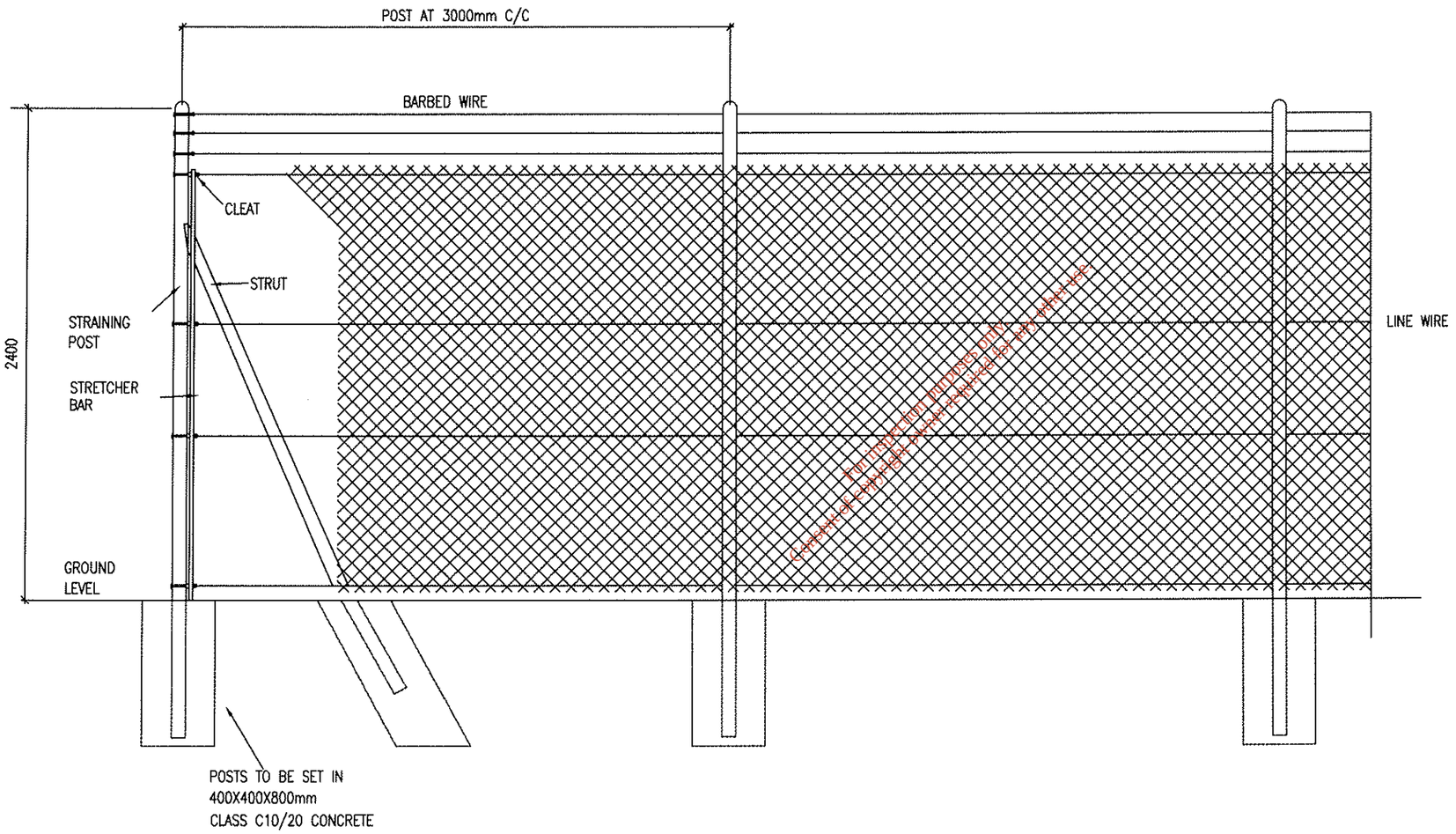
BALLYNACARRICK LANDFILL PROJECT

TITLE

PHASING PLAN

FIGURE

7.1



CHAIN LINK FENCE WITH EXTENSION ARMS FOR BARBED WIRE (SECURITY FENCE)

SCALE: NTS

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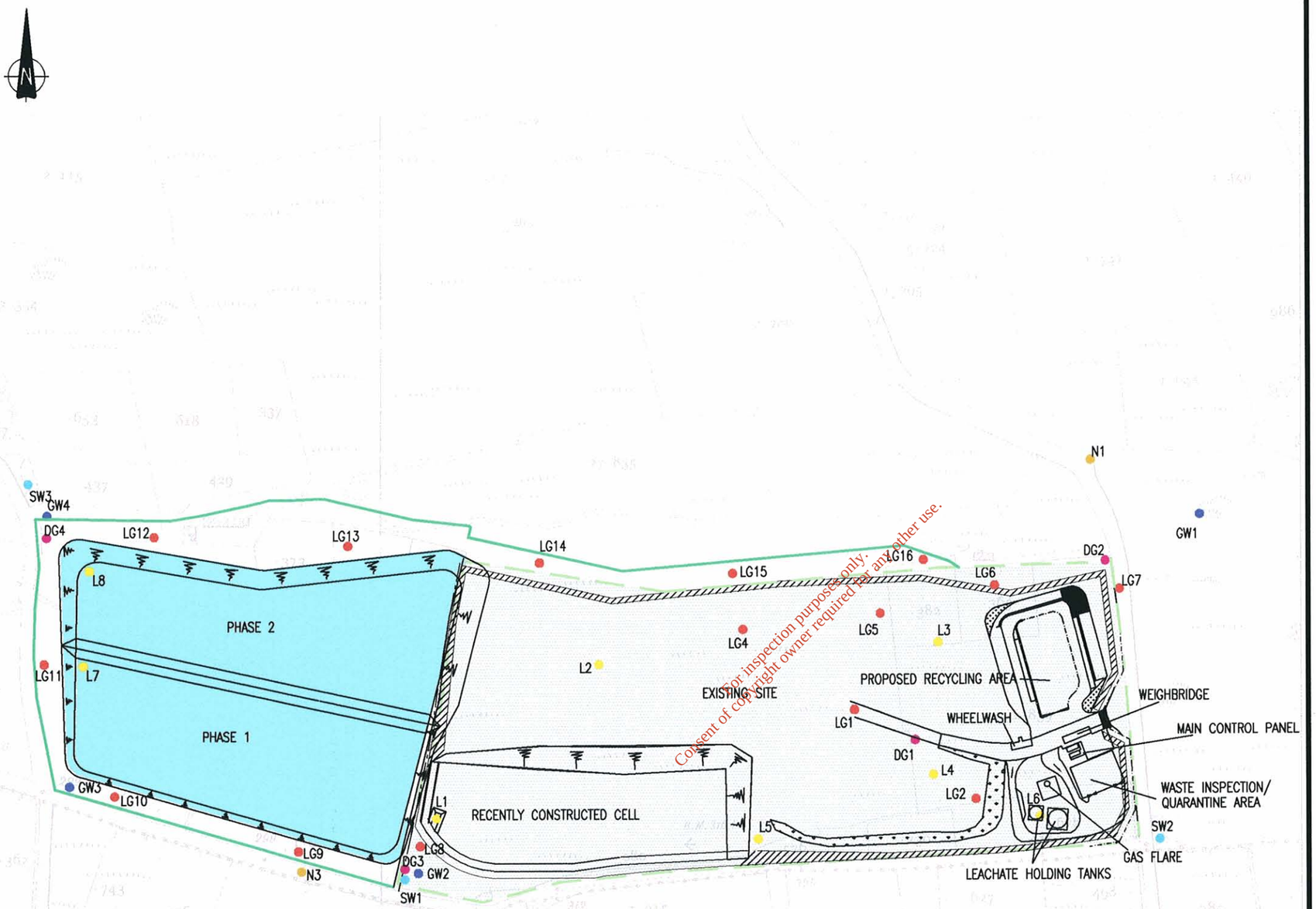
Donegal County Council

PROJECT
BALLYNACARRICK LANDFILL PROJECT

TITLE
ENGINEERING DETAILS

FIGURE
7.2



KEY

- BOUNDARY OF EXISTING LANDFILL
- BOUNDARY OF PROPOSED EXTENSION
- LIMIT OF PROPOSED EXTENSION
- DG — DUST MONITORING POINTS
- GW — GROUNDWATER MONITORING POINTS
- LG — LANDFILL GAS MONITORING POINTS
- L — LEACHATE SAMPLING POINTS
- N — NOISE MONITORING POINTS
- SW — SURFACE WATER MONITORING POINTS
- LIMIT OF EXISTING SITE

SCALE: 1:2500

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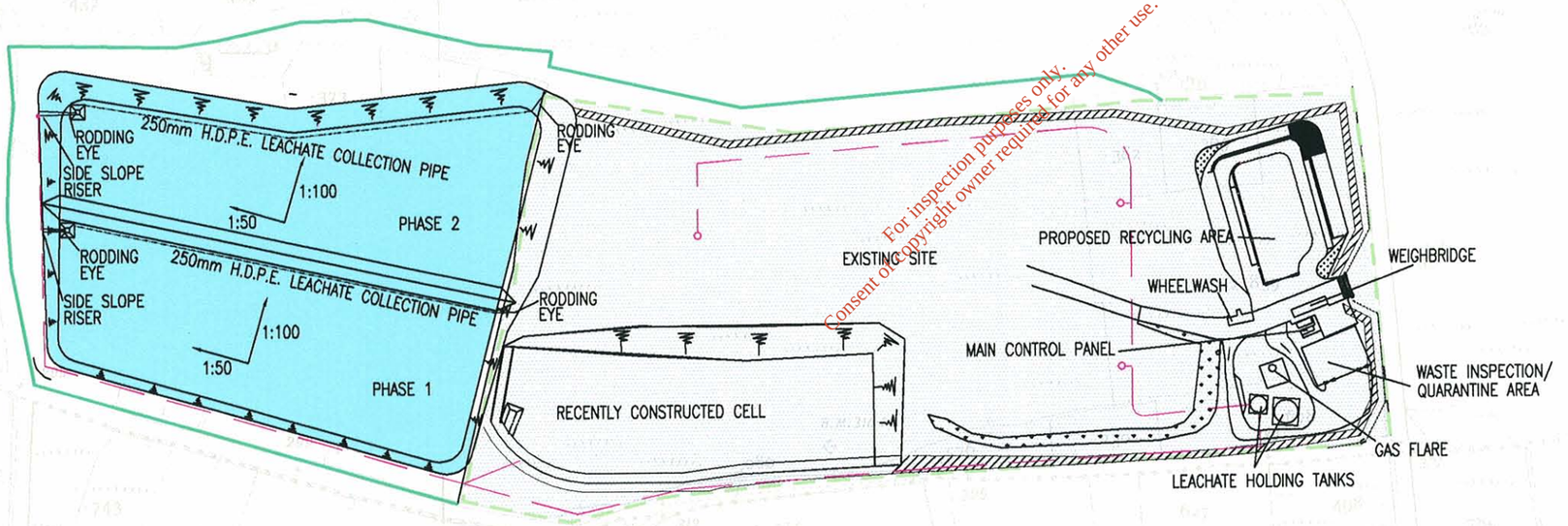
Donegal County Council

PROJECT
BALLYNACARRICK LANDFILL PROJECT

TITLE
PROPOSED ENVIRONMENTAL MONITORING POINTS

FIGURE
7.3



KEY

- BOUNDARY OF EXISTING LANDFILL
- BOUNDARY OF PROPOSED EXTENSION
- LIMIT OF PROPOSED LANDFILL EXTENSION
- LEACHATE PUMPING MAIN
- LIMIT OF EXISITNG SITE

SCALE: 1:2500

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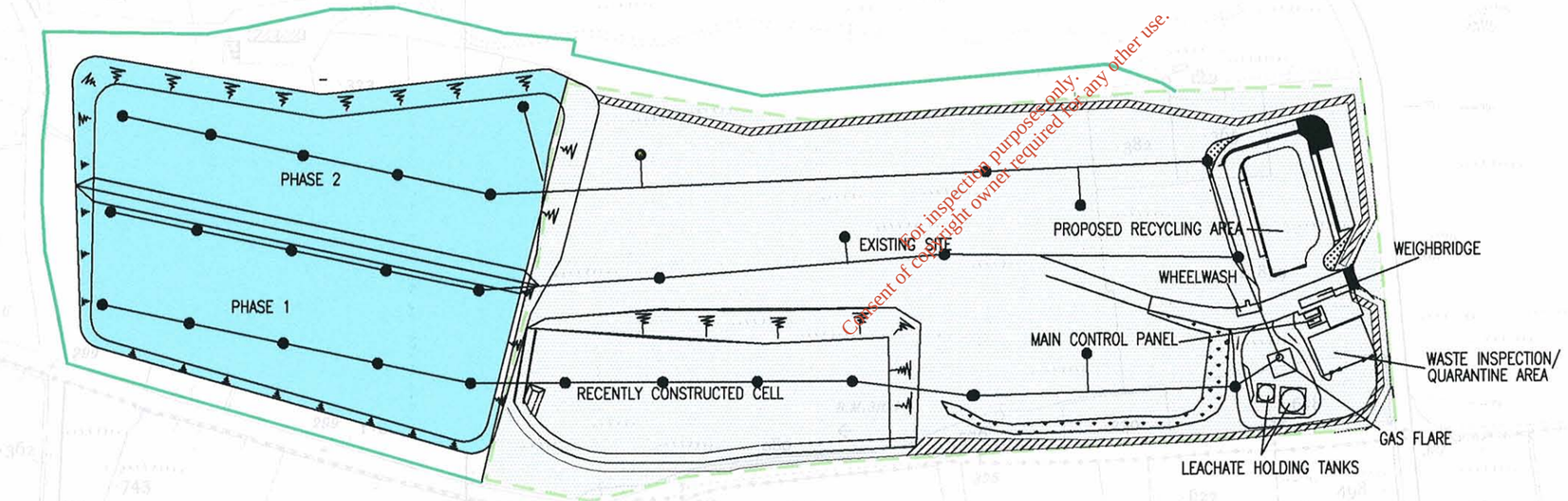
Donegal County Council

PROJECT
BALLYNACARRICK LANDFILL PROJECT

TITLE
LEACHATE MANAGEMENT SYSTEM

FIGURE
7.4



KEY

- BOUNDARY OF EXISTING LANDFILL
- BOUNDARY OF PROPOSED EXTENSION
- LIMIT OF PROPOSED LANDFILL EXTENSION
- GAS VENT
- GAS COLLECTION PIPELINE
- LIMIT OF EXISTING SITE

SCALE: 1:2500

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PROJECT
BALLYNACARRICK LANDFILL PROJECT

TITLE
LANDFILL GAS MANAGEMENT SYSTEM

FIGURE
7.5

8.0 RESTORATION AND AFTERCARE

INTRODUCTION

8.1 A key component of landfill design is the restoration and aftercare of the landfill after it has ceased receiving wastes. The purpose of the process is to cap the site to reduce leachate generation and to facilitate environmental management and to return the landscape to beneficial use. The site will be progressively capped and restored at regular intervals during its life as detailed in Figure 8.1.

8.2 The capping and restoration layers are designed to contain the wastes, to control the ingress of rainfall and surface water thereby managing leachate production and to provide a suitable growing medium for restoration planting. The final contours will be designed to enable the implementation of the intended afteruse and to blend into the surrounding landscape.

8.3 Therefore, following completion of infilling and allowing time for settlement, groups of cells will be capped and progressively restored. Once any one phase has been capped, it will be restored in the first available soil moving season. The overall profile consists of two essential elements, a low permeability capping to minimise water infiltration of the wastes, and a layer of soils to meet the restoration objectives.

CAPPING DESIGN

8.4 Details of the proposed restoration and cap profile are shown on Figure 8.1. Following completion of infilling, a regulating layer will be laid over the final layer of waste. A geonet layer, will be placed to act as a gas collection layer with a Geosynthetic Clay Liner (GCL) placed as the containment layer. The GCL sheets will be overlapped in accordance with the manufacturers instructions. As with the basal lining system, CQA procedures will be adopted.

8.5 Above the GCL a 500 mm drainage layer will be installed, to drain any water which infiltrates through the restoration sub-soils above. Finally the restoration soils will be placed. It is envisaged that a 150 mm restoration top soil layer (settled depth) will be placed above a 850 mm sub-soil layer. Appropriate additional depths of soils will be provided in the areas where tree planting is proposed over the landfill cap.

8.6 Placement of restoration soils on each cell will take place in the first available soil moving season following completion of capping of that cell. Soils will be placed using machinery of low load bearing weight whilst soils are dry and friable. Care will be taken to avoid unnecessary trafficking over previously placed soil.

8.7 Following topsoiling the surface will be prepared for seeding. The preparation carried out will depend upon the time of seeding and the circumstances of the soils (ie need for weed removal, stone picking etc).

SURFACE WATER DRAINAGE

8.8 The site has been designed to provide good surface water run-off from the site (Figure 8.2) in order to reduce the likelihood of surface water ponding.

8.9 Surface water run-off form the capped and profiled landfill will be collected in a peripheral drain, which will comprise a 300mm diameter perforated concrete pipe, bedded into a trench and backfilled using a 20mm clean stone. The pipe will discharge the surface water run-off into the existing watercourse to the North West of the proposed extension (Figure 8.2).

Settlement

8.10 Landfilled wastes will continue to settle over a protracted period due to physical compaction and biological degradation. It is, therefore necessary to estimate the amount of settlement that will occur if proposed final levels are to be achieved. Experience has shown that a settlement allowance of 15% of the overall depth should be allowed. Slopes on the restoration profile vary between 1 in 5 and 1 in 8 and as such can accommodate differential settlement within the cap without compromising the ability of the cap to shed surface water.

Post Closure Monitoring

8.11 All post closure monitoring will be in accordance with the requirements of the Environmental Protection Agency's Manual on Landfill Monitoring. The minimum requirements for aftercare monitoring are shown in Table 8.1. The location of the aftercare monitoring points are shown in Figure 8.3.

Table 8.1 Proposed Aftercare Monitoring Programme

Parameter	Frequency	Determinand
Surface water	Six Monthly will depend on water body and flow rate. Annually	NH_4-N, BOD, COD, Cl, DO, EC, pH, TSS, Temp Cd, Ca, Cr, Cu, Fe, Pb, Mg, Mn, Hg, K, SO_4, Na, Alk, PO_4, TON, Zn
Groundwater	Quarterly (may be reduced to 6-monthly if there is evidence of stable conditions). Annually (may be reduced to bi annually if there is evidence of stable conditions).	Groundwater level, NH_4-N , EC, pH, Temp, K, Visual, Cl, DO, Na, TON, TOC, Phenols B, Ca, Cd, Cr, Cu, Cn, F, Fe, Pb, Mg, Mn, Hg, SO_4, Alk, PO_4, Residual on evap, Zn, Faecal coliforms, Total Coliforms, List I & II substances.
Landfill gases	Six Monthly	CH_4, CO_2, O_2, AP
Leachate levels	Monthly (reduce to quarterly if stable conditions prevail)	Leachate level
Leachate Volume and Composition	Six Monthly Annually (may be reduced to bi annually if there is evidence of stable conditions).	Visual, NH_4-N , BOD, COD, Cl, EC, pH, Temp, Fe, K Na, TON B, Cd, Ca, Cr, Cu, Cn, F, , Pb, Mg, Mn, Hg, SO_4 Alk, Tot.Phos, Zn, Faecal coliforms, Total Coliforms, List I & II substances
Meteorological Data	Monthly	Precipitation, Temp, Wind, Evaporation, Humidity, Atmospheric Pressure
Other parameters	Annually	Settlement

LANDSCAPING

8.12 Landscaping proposals are described in full in Section 15.0, but are summarised below as they form a key element of the site restoration proposals.

8.13 It is not proposed to carry out major areas of landscaping on the landfill site itself. This is consistent with good landfill practice, as root systems from trees and shrubs, etc, may compromise the integrity of the capping system (ie the GCL). However, it is recognised that the restoration of the site would benefit from the planting of hedgerows and trees both in terms of creating a visually acceptable landscape in the long term and help where possible to screen operations by advance works.

8.14 It is therefore proposed to carry out the landscaping works as shown on Figure 8.4. Perimeter planting will be initiated prior to the commencement of landfilling operations. The screening and restoration proposal will be implemented as part of the phased infilling of the site.

8.15 The species mix, plant sizes and spacing will be agreed with the EPA following the granting of a site licence but, as a matter of principle, will be predominantly native species.

Site Aftercare

8.16 Donegal County Council will assume responsibility for the aftercare management of the site. The Council will ensure that a suitable level of staffing is maintained to allow this process to continue as required.

8.17 It is envisaged that an aftercare programme will be drawn up prior to the completion of each phase of the landfill. Each restored cell will be subject to an initial aftercare period. During this period an annual inspection will take place.

8.18 The following aftercare issues are likely to be considered depending upon site conditions:

- The need for a programme of soil analysis to determine requirements for liming and fertilising during the year;
- Need for ripping or other treatment of the soils to improve drainage;
- Areas where reseeding is necessary and any changes to the rate of seed application or seed mix;
- Modifications to the mowing or grazing regime.

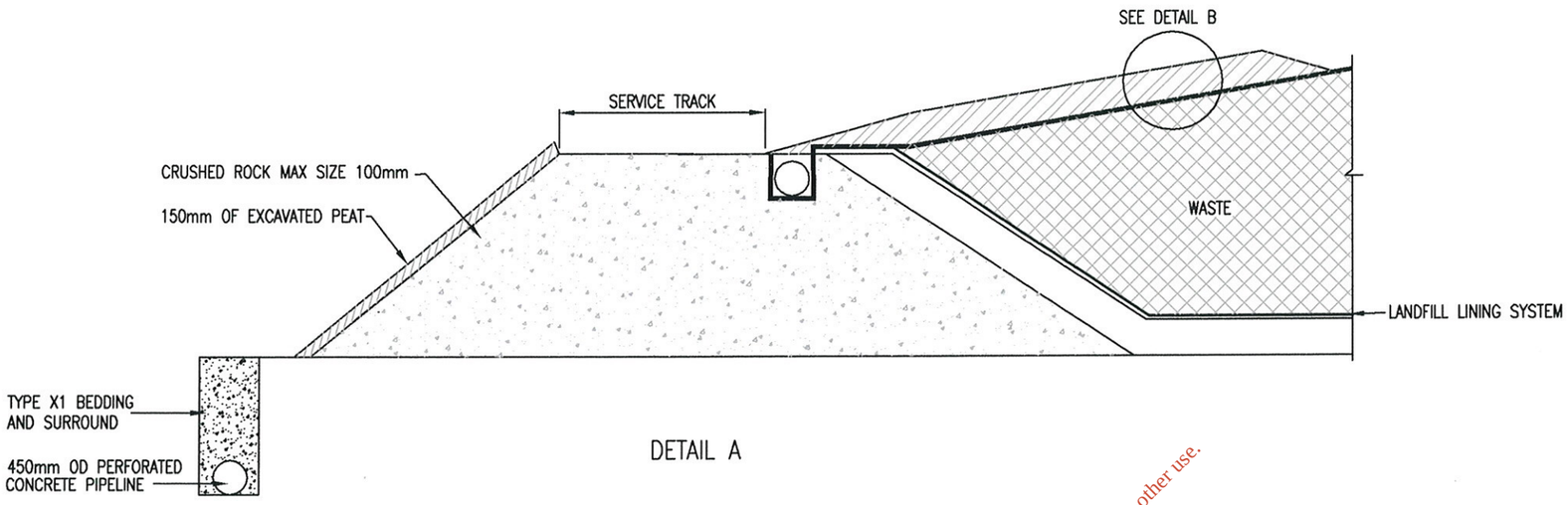
8.19 This will be carried out in addition to the environmental monitoring, which will continue whilst the site licence is maintained.

8.20 Leachate treatment will be ongoing during site operation, restoration and closure. It is proposed that leachate recirculation should be included in this system to use the flushing effect on the waste mass. Leachate monitoring with regard to level, volume and composition will continue on the site to allow an assessment to be made on the duration of treatment post closure. The cessation of treatment will be by agreement with the EPA on the basis of the results of ongoing monitoring.

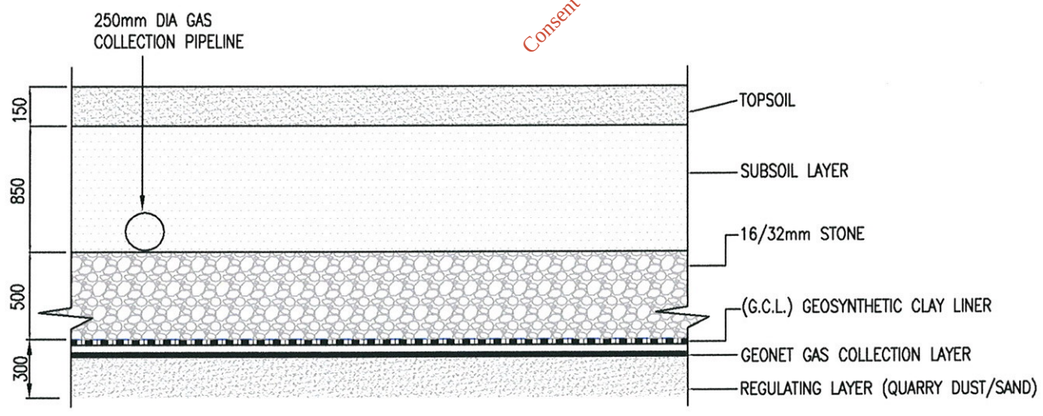
8.21 Landfill gas management will also continue on the site, be it active or passive. When management of the system ceases by agreement with the EPA the passive system will be left in place.

8.22 It is envisaged that the site building, leachate treatment plant and gas flare stack will all be retained on site post closure. Ultimately it will be possible to remove the building, leachate treatment plant and gas flare stack. The weighbridge, wheelwash and waste inspection area will be removed after completion of the final phase of restoration on the infilled area. The perimeter security fencing will be removed and replaced with post and wire fencing except for areas involved in the ongoing aftercare management of the site.

FIGURES



DETAIL A



CAPPING DETAIL (N.T.S.)
DETAIL B

SCALE: NTS

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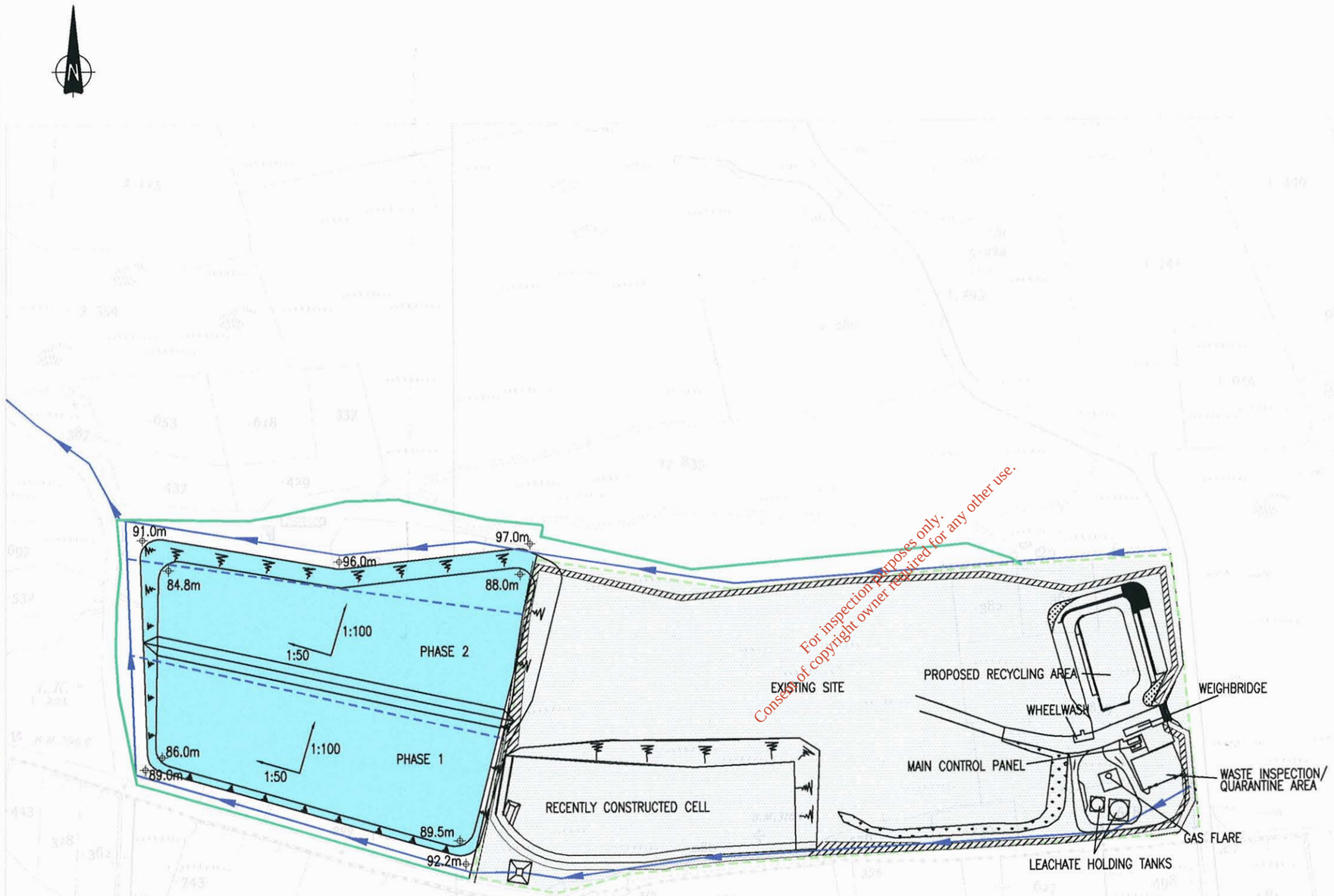
PROJECT
BALLYNACARRICK LANDFILL PROJECT

TITLE
CAPPING DETAILS

FIGURE
8.1



KEY

- BOUNDARY OF EXISTING LANDFILL
- BOUNDARY OF PROPOSED EXTENSION
- LIMIT OF PROPOSED LANDFILL EXTENSION
- SURFACE WATER DRAINAGE PIPELINE
- GROUNDWATER DRAINAGE PIPELINE
- LIMIT OF EXISTING SITE
- 84.8m FORMATION LEVELS

SCALE: 1:2500

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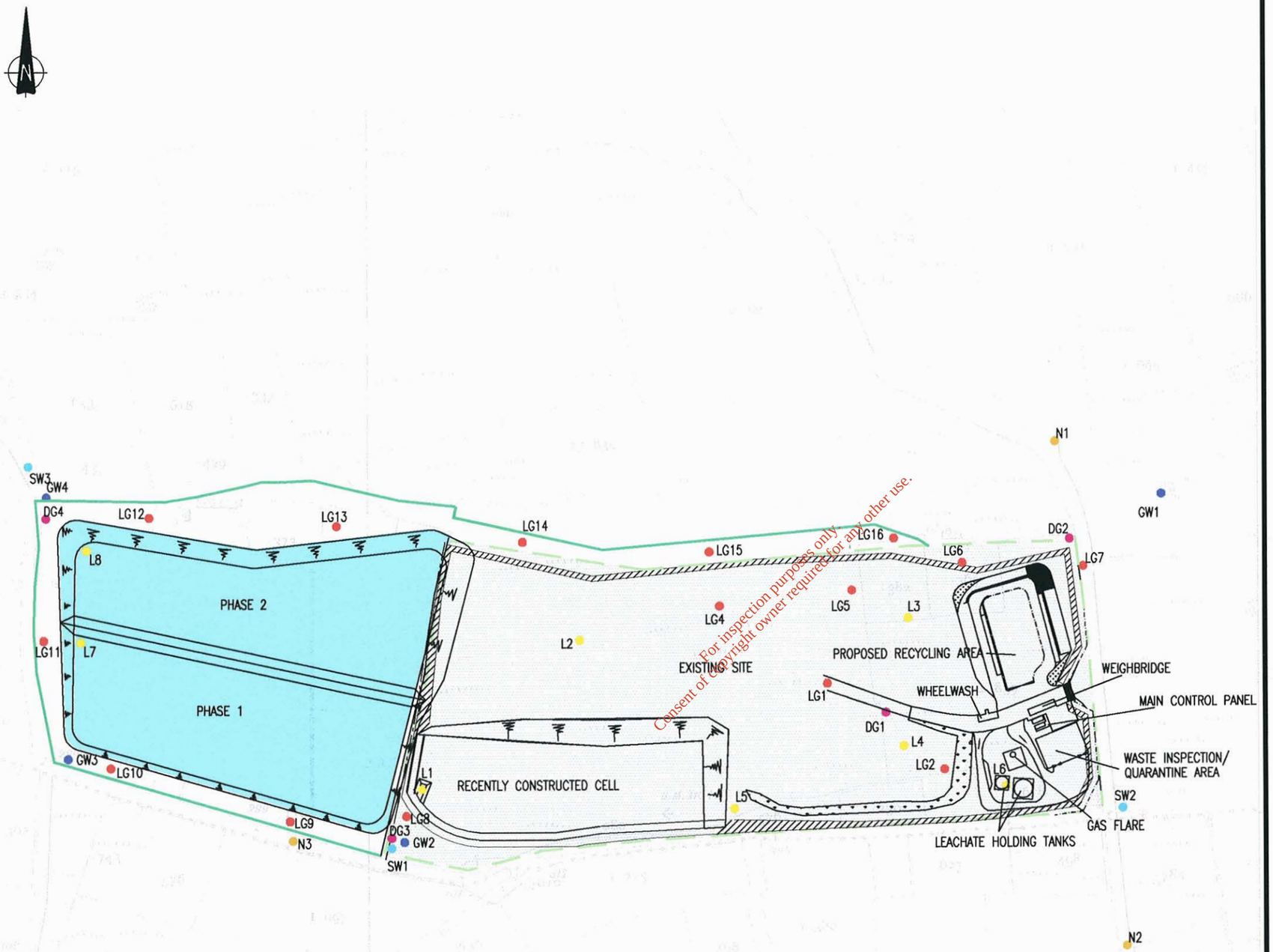
Donegal County Council

PROJECT
BALLYNACARRICK LANDFILL PROJECT

TITLE
SURFACEWATER AND GROUNDWATER MANAGEMENT

FIGURE
8.2



KEY

- BOUNDARY OF EXISTING LANDFILL
- BOUNDARY OF PROPOSED EXTENSION
- LIMIT OF PROPOSED EXTENSION
- DG — DUST MONITORING POINTS
- GW — GROUNDWATER MONITORING POINTS
- LG — LANDFILL GAS MONITORING POINTS
- L — LEACHATE SAMPLING POINTS
- N — NOISE MONITORING POINTS
- SW — SURFACE WATER MONITORING POINTS
- LIMIT OF EXISTING SITE

SCALE: 1:2500

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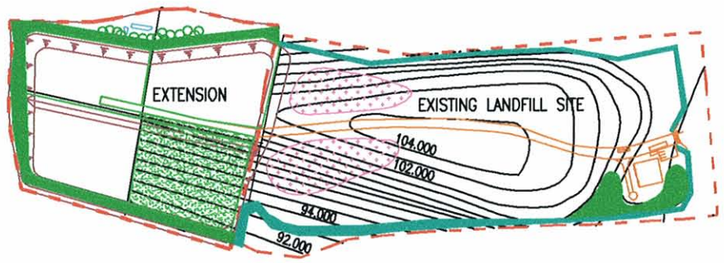
PROJECT
BALLYNACARRICK LANDFILL PROJECT

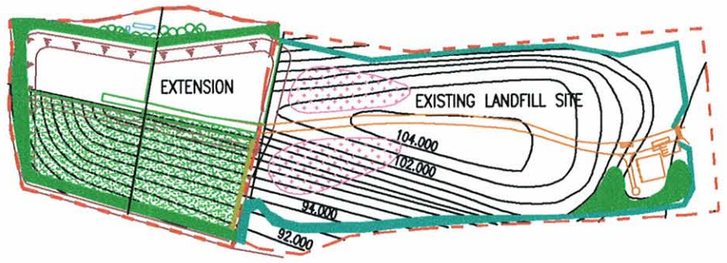
TITLE
PROPOSED ENVIRONMENTAL MONITORING POINTS

FIGURE
8.3

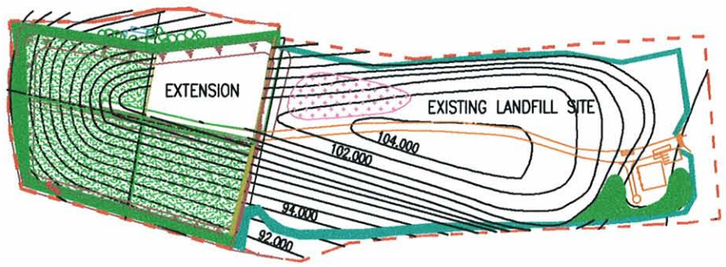
FIRST PHASE



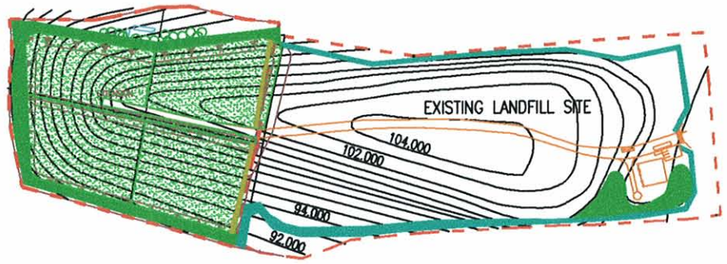
SECOND PHASE



THIRD PHASE



FINAL PHASE



KEY

- PROPOSED PLANTING IN EXISTING LANDFILL SITE
- PROPOSED WOODLAND SCREEN PLANTING
- PROPOSED NEW HEDGE
- PROPOSED NATIVE GRASS SEEDING
- INTERNAL SERVICE ROAD
- SITE BOUNDARY
- TEMPORARY SPOIL HEAPS
- EXISTING BUILDING
- PROPOSED CONTOURS

PHASE 1
CONSTRUCTION OF CELLS 1–4, PERIMITER BUNDS CREATED AND COMPLETION OF PERIMETER SCREEN PLANTING WORKS.
PROGRESSIVE FILLING OF CELL1, CAPPING, TOPSOILING AND GRASS SEEDING.
CONSTRUCTION OF 3M HIGH BUND AROUND THE GAS FLARE STACK IN THE EXISTING LANDFILL SITE AND THE BUND PLANTED WITH WOODLAND SCREEN PLANTING.

PHASE 2
PROGRESSIVE FILLING OF CELL 2, CAPPING, TOPSOILING AND GRASS SEEEDING.
CONTINUED GROWTH AND MAINTENANCE OF PERIMETER SCREEN PLANTING.
PLANTING OF HEDGE ON EASTERN BOUNDARY OF RESTORED CELL 1 ALONG WITH GRASS MAINTENANCE.

PHASE 3
PROGRESSIVE FILLING OF CELL 3, CAPPING, TOPSOILING AND GRASS SEEDING.
CONTINUED GROWTH AND MAINTENANCE OF PERIMETER SCREEN PLANTING.
MAINTENANCE OF HEDGE ON RESTORED CELL 2 ALONG WITH GRASS MAINTENANCE.

PHASE 4
PROGRESSIVE FILLING OF CELL 4, CAPPING, TOPSOILING AND GRASS SEEDING.
CONTINUED GROWTH AND MAINTENANCE OF PERIMETER SCREEN PLANTING AND HEDGE.
PLANTING NEW HEDGE ON EASTERN BOUNDARY OF RESTORED CELL 4 ALONG WITH GRASS MAINTENANCE.

CONTINUED MAINTENANCE OF PLANTING. HEDGES AND GRASS TO ENSURE PLANTING OBJECTIVES ARE REALIZED AND THE SITE IS ASSIMILATED BACK INTO THE LANDSCAPE SETTING.

SCALE: 1:5000

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PROJECT
BALLYNACARRICK LANDFILL PROJECT

TITLE
LANDSCAPING DETAILS

FIGURE
8.4