

SECTION 2 : PROPOSED REMEDIATION SCHEME

2.1 PRINCIPAL ELEMENTS

The proposed remediation scheme for the unauthorised landfill sites on the Roadstone Dublin lands at Blessington, Co. Wicklow involves:

- (i) Prior removal of leachate from boreholes in domestic commercial and industrial (DCI) waste at the unauthorised landfill sites and transport off-site to an approved wastewater treatment facility.
- (ii) Construction of sumps at each unauthorised landfill site in advance of the excavation works to facilitate collection and extraction of any residual leachate;
- (iii) Excavation and removal of all DCI waste from the unauthorised landfill sites at Areas 1, 4 and 6. This will include excavation and removal of 0.5m thickness of soil above, below and around the waste. Soil remaining in-situ will be subject to validation testing.
- (iv) Segregation, temporary storage and classification testing of potentially hazardous waste (identified by visual inspection, in-situ monitoring and testing of the excavated DCI waste) at a designated waste inspection and quarantine facility.
- (v) Transfer of any hazardous material which is not acceptable at the proposed engineered landfill off-site to licensed hazardous waste recycling / disposal facilities.
- (vi) Segregation of any significant volumes of construction and demolition (C&D) waste, encountered during excavation of the DCI waste for recycling either on-site or off-site or deposition in the engineered landfill, as appropriate (only applies if significant quantities of such material are encountered);
- (vii) Transfer of residual non-hazardous DCI waste to an engineered landfill facility within Roadstone Dublin's landholding, south of the unauthorised landfill site at Area 1;
- (viii) Restoration of Areas 1, 4 and 6 using appropriate excavated soils overlying the waste bodies and excess overburden materials from the engineered landfill construction;
- (ix) Capping of the engineered landfill and restoration to grassland;
- (x) Environmental monitoring (of surface water, groundwater and landfill gas) using the existing groundwater monitoring infrastructure around Areas 1, 4 and 6 and additional monitoring infrastructure to be installed at, around and down hydraulic gradient of the engineered landfill.

The proposed engineered landfill will only be used for disposal of residual non-hazardous waste excavated from unauthorised landfills on the site. No importation of waste will be permitted to this facility under any circumstances. The relative locations of Areas 1, 4 and 6 and the engineered landfill, together with the proposed internal haul routes are shown on Figure 2.1.

2.2 SITE INFRASTRUCTURE

2.2.1 Site Security

Access to the engineered landfill facility on Roadstone Dublin's lands at Blessington can be gained via one of two gate entrances, one off the western, northbound carriageway of the N81 National Secondary Route, the other via a minor county road ('Darkers Lane') to the north.

In general, the only traffic which currently passes these gates is that generated by sand and gravel extraction activities at the site. The gates are opened at 07.00 hours each weekday and Saturday morning and are locked again each evening at 18.30 hours (16.30 hours Saturday). During the site remediation works, all materials and plant required to construct and progress the works will access and egress the site via the entrance fronting onto the N81.

A paved access road / right of way from Darker's Lane to Roadstone Dublin's landholding which runs through a neighbouring sand and gravel pit (operated by J.W. Carnegie and Co. Ltd.) has recently been blocked off. Sections of the unpaved track on Roadstone Dublin's land leading to and from this right of way are currently being restored to agricultural grassland (see Figure 2.1).

For the duration of landfill construction, filling and capping operations, it is proposed to provide manned security at both gates on a 24 hour / 7 day basis. It is also proposed to fix site

security cameras (operational 24 hours/day) and lighting to the roof of a temporary site office adjacent to the landfill facility. Access to the waste licence application area will be restricted by fencing along the application boundary or beyond it, at the boundary of Roadstone Dublin's landholding.

2.2.2 Site Roads and Parking Areas

The dump trucks transferring waste from excavation areas to the landfill facility will be confined within Roadstone Dublin's landholding for the duration of the site remediation works and will travel over the existing network of unpaved internal roads and tracks. The extent of paved and unpaved internal roads across the site is indicated on Figure 2.1.

A temporary unpaved access road will be constructed from the existing internal haul road to the engineered landfill facility as indicated on Figure 2.1. This temporary road will be 8m wide and shall comprise 300mm of Class 6F1/6F2 granular material (as per the National Roads Authority Specification for Roadworks) overlaid by approximately 150mm of Clause 804 sub-base (as per same specification). A cross-section through the proposed temporary haul road is shown on Figure 2.1. Temporary access roads required to access or egress each unauthorised landfill area shall be of a similar construction and specification to that outlined above.

Provision for additional employee car-parking will be provided near established offices and staff accommodation facilities in the centre of Roadstone Dublin's landholding (beside the rising conveyor). This parking area will be unpaved and will be of similar construction to the proposed temporary access roads (ie. 150mm of sub-base over 300mm of capping).

2.2.3 Hardstanding Areas

A temporary compound for storage of plant, equipment and materials, covering an area of approximately 200m by 75m, will be provided west of the unauthorised landfill at Area 1 and the proposed landfill facility. In order to form a hardstanding area, approximately 300mm of Class 6F1 granular fill (as per the National Roads Authority Specification for Roadworks) will be placed and compacted over the existing ground surface and laid to a fall.

A temporary hardstanding area of similar construction will also be provided east of Area 4 for recovery of C&D waste encountered above the DCI waste at each unauthorised landfill site.

A temporary hardstanding area will also be established near the existing offices and staff accommodation facilities in the centre of Roadstone Dublin's landholding (beside the rising conveyor) to provide car parking and accommodation for additional employees and contractor staff. This area will be unpaved and will comprise 150mm of sub-base over 300mm of capping).

2.2.4 Wheelwash and Weighbridge

Dump trucks transferring waste from excavation areas to the landfill facility or the proposed waste inspection / quarantine area will be entirely confined within Roadstone Dublin's landholding and will travel over internal roads and tracks.

In order to prevent transport of mud and potential contaminants on internal and public roads, it is proposed to install a temporary self-contained wheelwash facility at the egress from each unauthorised landfill site and the proposed engineered landfill facility, as shown on the site infrastructure layout in Figure 2.2.

During the initial construction of the landfill liner and site infrastructure and later landfill capping activities, a temporary self-contained wheelwash facility will also be provided at the end of the existing paved internal access road as shown on Figure 2.2, in order to prevent the transport of fines onto the public road network by HGV's delivering construction materials to the site. Details of the temporary wheelwashes are provided in Appendix 2A.

A weighbridge will be provided along the access track to the proposed landfill facility to record the waste tonnages placed therein. Details of the proposed weighbridge are also provided in Appendix 2A.

2.2.5 Laboratory Testing

Laboratory testing of soil, surface water, groundwater and leachate will be undertaken off-site at a UKAS accredited geo-environmental laboratory (AlControl Laboratories, Ballycoolin, Co. Dublin). Any validation testing and laboratory testing required to assist classification of waste as either hazardous or non-hazardous will also be undertaken by AlControl. All samples taken on-site will be forwarded to the laboratory on the same day and test results will be forwarded to site within five working days.

Portable monitoring equipment such as pH and temperature meters, conductivity meters, flow meters and dissolved oxygen meters will be stored at the site office for the duration of the landfill construction and waste removal, segregation and transfer activities. On-site landfill gas monitoring will be undertaken at regular intervals over this period by an external environmental monitoring contractor.

2.2.6 Fuel and Oil Storage

Fuel and oil for plant and equipment undertaking the site remediation works will be stored at an existing bunded tank facility in Doran's Pit, on the eastern side of the N81 National Secondary Route. This plant will principally comprise mechanical excavators, bulldozers, dump trucks, sheepsfoot rollers, earthworks compaction plant and HGV delivery trucks.

It is understood that the capacity of the existing bunded area in Doran's Pit is 110% of the tank volume. Insofar as possible, re-fuelling of all wheeled plant and vehicles will take place at Doran's Pit. Tracked plant and equipment will however be re-fuelled from a mobile bunded fuel bowser at either of the proposed hardstanding areas located on Figure 2.2 (at car-parking area or temporary site compound). Details of the bowser are provided in Appendix 2B.

All wheeled plant and vehicles will be serviced as necessary using existing facilities at the maintenance yard in Doran's Pit. Tracked plant will be serviced off site. Oil and lubricant changes for tracked plant will be undertaken at either of the proposed hardstanding areas.

2.2.7 Waste Inspection and Quarantine Area

A temporary waste inspection and quarantine area (partially enclosed to minimise leachate volumes) will be constructed north-east of Area 4 and west of the proposed landfill facility at the location shown on Figure 2.2. The waste inspection and quarantine area will be sealed by a 150mm thick reinforced concrete slab over 150mm of Clause 804 sub-base (as per NRA Specification for Road Works) and bunded to a design storm volume. Surface water falling on the roof of the enclosed structure will be discharged directly to the existing groundwater pond at the centre of Roadstone Dublin's landholding. Any other surface water running over the top surface of the concrete slab will be directed toward buried storage tanks with double skin protection. Surface water collected in the buried tanks will be transferred to a collection tanker for disposal off-site at an approved treatment facility.

Visual inspection, in-situ monitoring and testing of waste materials will be undertaken by Roadstone Dublin staff / agents on a continuous full-time basis as waste materials are excavated. Should there be any concern about the nature of the waste being excavated (ie. hazardous), it will be loaded onto a truck and directed to the waste inspection and quarantine area for closer examination and inspection. Detailed records of all such inspections will be kept.

Should inspections or testing at the waste inspection area identify any hazardous waste which is not acceptable at the proposed engineered landfill facility, it will be segregated and temporarily stockpiled (at the quarantine area) or transferred to skips pending removal off-site to a suitably licensed hazardous waste disposal or recovery facility.

2.2.8 Traffic Control

Traffic carrying construction materials to the landfill facility will access the site via the main entrance fronting onto the N81 National Secondary Route. Warning notices, speed restriction signs and construction traffic signposting will all be established along the paved and unpaved roads leading to the temporary site compound and the landfill facility.

All construction traffic egressing Roadstone Dublin's lands will be required to pass through a temporary wheelwash facility at the end of the paved internal road, shown on Figure 2.2.

At the present time, it is envisaged that waste will be excavated at the unauthorised landfills (Areas 1,4 and 6) using conventional tracked excavation plant. On-site inspection and testing will determine whether the excavated waste is transferred directly to the engineered landfill or to the waste inspection and quarantine area. All waste will be transferred by sealed (i.e. watertight) and covered dump trucks working on a turnaround basis. Details of the proposed trucks are provided in Appendix 2C.

At each area, the dump trucks will access and egress the waste body via a temporary down ramp. Once filled, the trucks will travel to either the waste inspection and quarantine area or the engineered landfill over the existing internal roads within Roadstone Dublin's landholding. At the landfill facility, trucks will access and egress the tipping face via a temporary down ramp. The proposed haul routes are shown on Figure 2.1.

2.2.9 Sewerage and Surface Water Drainage Infrastructure

Existing toilet and hand washing facilities are provided for Roadstone Dublin staff currently employed in quarrying activities at the site. Additional facilities will be temporarily required to accommodate personnel employed in the construction and site remediation works. It is currently proposed to provide washrooms (with showers) in a portacabin behind (east of) the existing offices at the centre of the site (see Figure 2.2). A number of temporary self-contained toilet units ('portaloos') will also be provided at the hardstanding area. Details and dimensions of the portacabins are provided in Appendix 2D.

During the landfill construction and filling, surface water run-off will arise from the construction site, lined (but unfilled) parts of the landfill facility, the working landfill face, temporary and permanently capped areas, temporary hardstanding areas and access roads.

In order to reduce the amount of precipitation falling on exposed waste during excavation works at the unauthorised landfill sites (and potential for leachate generation), it is envisaged that

- (i) waste will be excavated in small areas ('strip mining') so that the rest remains covered;
- (ii) exposed waste in sides of excavation will be temporarily covered with inert fill (or alternatively with hessian, plastic sheeting) at the end of each day;
- (iii) any surface water falling within an open excavation will be directed to a temporary sump and will be transferred via a collection tanker for disposal off-site at an approved treatment facility;
- (iv) temporary diversionary drains will be constructed around open excavations at the unauthorised landfill sites to prevent surface water run-off from surrounding ground, including perimeter screening berms, spilling into the excavations;
- (v) these drains will be directed to temporary sumps and soakaways

The engineered landfill, including leachate drainage and collection systems, will be constructed prior to the removal, transfer and placement of non-hazardous waste at the engineered landfill, thereby providing significant storage for precipitation which will be collected from the drainage system during the landfilling operation. This surface water run-off will be taken off-site to an approved wastewater treatment facility.

At the landfill facility, a surface water management scheme will be implemented to minimise the volume of surface water entering the waste body. The proposed surface water management system comprises a series of lined ditches which allow run off around the landfill to drain to an intermediate surface water pond, from which discharge to the existing lagoon to the west (which forms at the lowest point on Roadstone Dublin's landholding and corresponds to the groundwater table) can be controlled.

The proposed surface water management system will be put in place prior to the transfer of waste to the engineered landfill. Outline details of the surface water management system are shown on Figure 2.3. Details of the surface water management system to be established at the site are provided in Appendix 2E.

The temporary hazardous waste inspection and quarantine area, including delivery and collection areas, will be constructed on a 150mm thick reinforced concrete slab over sub base, with a surface water collection system in place to ensure no run-off will infiltrate into the aquifer. The storage and sorting areas will be bunded to a design storm volume. If waste is stored outside of an enclosed area, it will be covered with plastic sheeting outside of working hours and in times of heavy rainfall to minimise leachate production.

2.2.10 Site Services

Electric power, lighting and heating will be provided to the temporary site office at the site of the engineered landfill facility by a temporary generator or a connection to nearby overhead power lines.

Submersible pumps will be provided at the large existing groundwater pond at the centre of Roadstone Dublin's landholding and connected to flexible pipework leading to the edge of the proposed engineering landfill. These pumps will remain on standby at all times to deliver fire-fighting water, should it be required in the event of an outbreak of fire in the DCI waste. Additional fire-fighting capacity will be provided capacity using water stored in mobile fuel bowzers at the proposed hardstanding areas.

Key personnel directing or overseeing the site remediation works will be contactable by mobile phone. A telephone landline and fax facilities, if required, can be established at the proposed accommodations facilities in the middle of Roadstone Dublin's landholding.

2.2.11 Plant Sheds, Garages and Equipment Compounds

Plant and equipment will be stored at a temporary site compound adjacent to the waste inspection and quarantine area west of the unauthorised landfill at Area 1 and west of the proposed engineered landfill facility. If necessary, plant and equipment may also be stored at existing sheds and garages in Doran's Pit on the opposite side of the N81 National Secondary Road. Given the limited access onto Roadstone Dublin's lands and the 24 hour security presence, it is not currently considered necessary to provide a palisade fence around the compound area.

Workshops may also be provided by the construction Works Contractor and/or Roadstone Dublin at the temporary site compound. If necessary, the existing workshops at Doran's Pit will also be made available for servicing of plant employed on the site remediation works.

Small items of mobile or hand-held plant and equipment will be stored in storage containers at the temporary site compound.

2.2.12 Site Accommodation

It is currently envisaged that temporary site offices (portacabins) for administrative and site management staff will be located on high ground behind, and north of, the proposed landfill facility, adjacent to the proposed access road. In positioning site offices at this location, it is intended that staff employed by the construction Works Contractor and/or Roadstone Dublin will be able to monitor all construction activity, traffic movements and operational activities at the landfill.

Landfill gas detection sensors will be fitted as a precaution in site office accommodation and storage containers at the compound area. Fire extinguishers will also be provided for use in fighting small-scale fires should any occur either in the site offices or immediately outside at the landfill site.

Temporary accommodation facilities will be provided for personnel employed by the construction Works Contractor and/or Roadstone Dublin at the hardstanding area adjacent to existing facilities in the centre of the site (see Figure 2.2) for the duration of the landfill construction and remediation works. These facilities will include changing (drying) rooms, a canteen and washrooms (with showers) and will generally be housed in portacabins. Temporary self-contained toilet units ('portaloos') will also be provided in the same area.

2.2.13 Waste Recovery Infrastructure

If a significant volume of C&D waste is mixed through the soils overlying the main body of DCI waste at each unauthorised landfill site, it will be transferred to the hardstanding area immediately east of Area 4 in Deerpark or west of Area 1 in Dillonsdown (see Figure 2.2).

The C&D waste will be processed at that location by passing it through a mobile trommel screen fitted with a series of large screening grids and magnets to draw off any recyclable concrete or metal waste. Large boulders, concrete blocks, metal panels, large tyres and other waste which may be too large to pass through the trommel, will be removed by excavation plant and stockpiled separately.

Metal wastes and tyres will be transferred by public road to suitably licensed recovery facilities. Where practicable, oversize stone and concrete waste will be stockpiled on-site with oversize cobbles and boulders for future crushing. Alternatively, such wastes will be transferred to a construction and demolition recycling facility operated by Roadstone Dublin at Fortunestown in south County Dublin. The relatively small volume of residual non-recoverable waste (timber, rope, plastics etc) originally intermixed through the overburden soils will be stockpiled separately and ultimately transferred to the engineered landfill.

2.3 ENGINEERED LANDFILL : CONSTRUCTION WORKS

The design of the proposed engineered landfill has been carried out in accordance with the Environmental Protection Agency's (EPA) Guidance on Landfill Site Design on the basis that the waste to be placed within the repository is classified as non-hazardous, biodegradable.

The dimensions of the engineered landfill are dictated by the requirement to create a void sufficient to accommodate the volume of waste identified by the environmental investigations undertaken in 2003 plus an allowance for intermixed and contaminated soils and some C&D waste that may be intermixed with, or encountered during the excavation of, DCI waste. The landfill has been designed for a maximum capacity of 175,000m³.

2.3.1 Construction Schedule

It is currently envisaged that the basal and formation works for the engineered landfill facility and the associated long-term infrastructure (such as the surface water management system) will be constructed in one phase by an externally appointed Works Contractor. Any temporary infrastructure required to facilitate the proposed remediation scheme will also be constructed at this stage. The estimated construction period for these works is between three and four months.

Thereafter, the buried waste will be excavated in sequence at Areas 4, 6 and 1, in one continuous operation, using plant and equipment owned or leased by Roadstone Dublin and operated by its employees / Contractors.

C&D waste intermixed with overburden soils overlying the buried DCI waste will be recycled and recovered insofar as it is possible to do so. Any potentially hazardous waste identified within the buried waste will be segregated and transferred to the waste inspection and quarantine area for detailed classification testing. Any hazardous material which is unacceptable for disposal to the proposed engineered landfill facility will be transferred off-site to a suitably licensed hazardous waste disposal or recovery facility. The residual non-hazardous DCI waste will be transferred to the engineered landfill facility. It is currently estimated that these works will take a further four to six months.

The final phase of the works, final landfill capping and restoration will be undertaken by an external Works Contractor. This work is expected to take no more than one to two months.

2.3.2 Method and Safety Statements for Construction Works

The design of the engineered landfill facility has been developed in line with the Environmental Protection Agency's (EPA) Guidance on Landfill Site Design on the basis that the waste to be transferred to it is classified as non-hazardous, biodegradable. It will be a condition of the

construction Works Contract that a detailed construction method statement and health and safety statement shall be prepared in respect of each element of the works. Detailed QA/QC plans will also be prepared and submitted to regulatory authorities for approval in advance of commencement of the site remediation works.

Roadstone Dublin shall also prepare a detailed method statement in respect of waste excavation and transfer procedures (waste inspection, testing, classification, removal, transfer, storage, placement, etc). It shall also prepare a detailed health and safety plan and ensure that all employees employed on site remediation work are given a thorough safety induction at the outset, and that appropriate safety measures are implemented during the works. An outline health and safety plan for this scheme is provided in Appendix 2F.

2.3.3 Material Requirements

Roadstone Dublin will source natural drainage stone from its own sand and gravel processing facility at Doran's Pit, on the opposite side of the N81 to the proposed engineered landfill facility. Topsoil and subsoil will be sourced from ongoing restoration works on sand and gravel pits on its lands at Blessington.

A suitable source of clay liner material has been identified off-site (glacial till) at Roadstone Dublin's Huntstown Quarry in North Dublin.

An estimate of the principal material quantities required to construct the proposed engineered landfill facility is provided below: -

MATERIAL	QUANTITY	SOURCE
Excavation	125,000m ³	On-site
General Filling	32,000m ³	On-site
Clay Liner (1000mm)	26,000m ³	Import from Huntstown Quarry
Clay Bunds	1,000m ³	Import from Huntstown Quarry
HDPE Geomembrane	27,000m ²	Import
Geotextile Protector	27,000m ²	Import
Geosynthetic Clay Liner (Base)	27,000m ²	Import
Leachate Drainage Blanket (500mm)	25,000m ²	On-site (Doran's Pit)
Leachate Collection Pipework	1380m	Import
Leachate Extraction Well	2 No.	Import
Leachate Monitoring Well	2 No.	Import
Gas Drainage Layer (300mm)	27,000m ²	On-site (Doran's Pit)
Geosynthetic Clay Liner (Cap)	27,000m ²	Import
LLDPE Geomembrane	27,000m ²	Import
Drainage Layer (500mm)	27,000m ²	On-site (Doran's Pit)
Subsoils (850mm)	27,000m ²	On-site
Topsoil (150mm)	27,000m ²	On-site
Leachate Recirculation Pipework	400m	Import
Deep Gas Extraction Well Heads	7No.	Import
Extraction Well Pipework	100m	Import
Gas Drainage Layer Well Heads	6No.	Import
Extraction Well Pipework	400m	Import

Table 2.1 Material Requirements

2.3.4 Materials Balance

While the original design of the engineered landfill facility endeavoured to achieve a cut / fill balance, whilst minimising the total earthworks volumes, it had to be re-located to avoid conflict with the rare flower species (Blue Fleabane), and as such it has not been possible to achieve a cut / fill balance, with excavation substantially in excess of filling requirements.

Any excess inert soil / topsoil arising from the construction of the landfill will be recovered and used in restoration of the area around the engineered landfill or in ongoing restoration works at worked-out sand and gravel pits elsewhere across Roadstone Dublin's landholding.

2.3.5 Stability Analyses

The available site investigation data indicates that the proposed engineered landfill is underlain by relatively competent sand and gravel strata. Given that the soil at basal formation level will experience no increase in loading (and most likely a net unloading) following the excavation of natural in-situ soils and backfilling with intermixed soil and DCI waste, no risk of foundation instability will occur at the base of the landfill.

The proposed slopes at the contact between the in-situ soil and the basal side slope liner and between the soil capping and underlying liner, at 1(v) : 3(h), are relatively shallow and will ensure there is no risk of slope failure. Details of preliminary geotechnical stability analyses for the side slopes are provided in Appendix 2G.

2.3.6 Importation of Construction Materials

Although some construction materials, principally drainage stone and topsoil / subsoil, can be sourced by the Roadstone Dublin on its lands at Blessington, other materials will have to be imported. The principal materials to be imported to site are identified in Table 2.1 above.

2.3.7 Removal of Materials Off-Site

The only materials to be removed off site are hazardous waste, if any, contained within the excavated DCI waste bodies and recoverable or segregated waste recovered within the overburden soil, and possibly some concrete and oversize cobbles and boulders.

Segregated hazardous waste will be transferred to a licensed waste recovery or disposal facility. Recoverable waste (principally scrap metal and tyres) will be removed off-site and transferred to an appropriately licensed recovery or disposal facility.

The C&D waste generated by the landfill construction works or encountered above the buried waste will either be

- (i) transferred and disposed of at the engineered landfill facility (timber, plastic etc.)
- (ii) re-used for site restoration works within Roadstone Dublin's landholding (clean soil) or
- (iii) re-used in construction of internal haul roads within Roadstone Dublin's landholding and possibly transferred to a C&D recycling facility operated by Roadstone Dublin at Fortunestown in south County Dublin (cobbles, boulders or concrete)

Any leachate collecting in sump excavations within Areas 1, 4 or 6 or by the leachate management system at the engineered landfill will be pumped to a mobile tanker and transferred off-site to an approved treatment facility.

2.3.8 Formation Levels and Gradients

The topography of the preferred location for the landfill currently provides a relatively flat area bounded on the eastern and western sides by existing slopes formed in sand and gravel. To create the required formation for the landfill, excavation and filling, it will be required to generate the basal falls and side slopes. Figure 2.4 presents the formation model at the underside of the proposed landfill lining system.

The base of the landfill has been split into two cells, with a sump located at the western end of each cell. In line with Environmental Protection Agency guidelines, the base of the landfill has

been designed to fall at a gradient of 1 in 50 to the sump. In order to aid the lining of the side slopes, a maximum gradient of 1 in 3 has been used. Access ramps into the landfill will be constructed at a maximum gradient of 1:10.

In order to minimise the volume of water entering the waste mass and to prevent high concentrations of suspended solids entering the existing groundwater pond to the west of the proposed engineered landfill, a surface water management scheme will be installed. The system comprises a series of lined ditches which allow run off from the landfill to drain to an intermediate pond, in order to encourage settling out of suspended solids and control discharge of the water to the lagoon. Construction details and the location of the ditches and pond are shown on Figure 2.3.

2.3.9 Bund Design

Around the western boundary of the engineered landfill, containment is provided by a bund constructed as part of the lining system. A bund has also been used to split the basal area of the landfill into two cells. It is envisaged that containment bunds will be formed from clay liner material to a height of 2m and overlain with the geomembrane, geotextiles and the leachate drainage layer. Cross-sections through the containment / internal bunds are provided on Figure 2.5.

2.3.10 Landfill Capacity and Lifespan

Given the degree of uncertainty as to:-

- (i) the exact volume of buried DCI waste at the unauthorised landfill sites;
- (ii) the degree of contamination of in-situ soil (if any) intermixed with the waste;
- (iii) the degree of contamination of soil immediately overlying and underlying the waste;
- (iv) the proportion of non-recoverable material within the C&D waste,

it is considered prudent to assume an upper bound volume for the unauthorised waste buried at the site and to provide sufficient capacity within the engineered landfill to accommodate it.

For this reason, the engineered landfill has been designed to provide up to a landfill storage capacity of up to 175,000m³. Ultimately however, it is expected that the total volume of waste placed at the landfill will be less than that provided for in design. Any deficit in the volume of waste placed in the constructed landfill will be made up by excess soil generated by excavation of the landfill void.

In order to provide a degree of flexibility in respect of timing of the excavation of each of the waste bodies and mixing of soils with the waste during excavation, the landfill design has been developed to provide flexibility to accommodate variations in the volumes and timing of the excavation, whilst minimising leachate generation (by minimising infiltration).

It is currently envisaged that the basal and formation works for the engineered landfill facility and the associated long-term infrastructure will be constructed prior to excavation and removal of buried waste at the unauthorised landfill sites. Any temporary infrastructure required to facilitate the proposed remediation scheme will also be constructed at this stage. The estimated construction period for these works is between three and four months.

Thereafter, the buried waste will be excavated at the unauthorised landfill sites, inspected, tested and segregated. Construction and demolition waste will be recycled where possible. All residual non-hazardous DCI waste will be transferred to the engineered landfill facility. Hazardous material will be transferred off-site. It is currently estimated that these works will take a further four to six months.

2.3.11 Basal and Side Slope Liner Design

The design of the lining system exceeds the requirements for a residual non-hazardous biodegradable landfill set out by the Environmental Protection Agency in its landfill design manual which interprets the European Landfill Directive (Council Directive 1999/31/EC). The proposed lining system shall comprise the following elements: geotextile separator, leachate

drainage, geotextile protection layer, 2mm thick HDPE geomembrane, geosynthetic clay liner and 1m thick clay liner of maximum permeability (k) 1×10^{-9} m/s.

Prior to commencing on site, the Works Contractor will be required to prepare a detailed method statement covering all aspects of the construction works. He shall also be required to prepare a detailed health and safety statement in advance of the Works.

The construction of the landfill will be subject to a process of construction quality assurance (CQA) by an external independent consultant appointed by Roadstone Dublin. Details of CQA procedures to be implemented on site will be set out in a CQA Plan to be approved by the Environmental Protection Agency. The construction Works Contractor will be required to prepare and submit a detailed method statement and health and safety plan addressing all aspects of the Works prior to commencement of construction.

In addition to presenting the specification for the works, the CQA Plan would also present details of monitoring procedures, compliance (pre-commissioning) testing (including leak detection surveys) and records to be maintained by a CQA Engineer based on site for the duration of the landfill construction works. An outline CQA plan is presented in Appendix 2H.

The following sections describe each of the materials that would be used within the lining system and highlights the principal performance criteria to be considered for each.

2.3.11.1 Geotextile Separator

Due to the likelihood of a high percentage of the waste mass comprising fine graded soils, there is a greater risk of fine particles being washed from the waste into the underlying leachate drainage blanket. To prevent this from occurring a geotextile separator has been included above the leachate drainage blanket. This material would be a non-woven thermally bonded geotextile, this type of geotextile is ideally suited as a separator as it has good hydraulic properties and a small apparent pore size. Details of the material to be specified and CQA procedures to be implemented will be set out in the CQA Plan.

2.3.11.2 Leachate Drainage Blanket Material

A 500mm thick leachate drainage blanket would extend over the base of the landfill and extend up the perimeter slopes. The blanket would initially be installed to a height of 2m vertically above the base of the engineered landfill to minimise the possibility of strains in the liner, prior to the placement of the waste. Subsequent lifts in the leachate drainage blanket would be undertaken in line with the input of waste. The drainage media would comprise of a clean graded aggregate produced by Roadstone Dublin from their works on site.

This material, whilst having a calcareous content in excess of 10%, has been used elsewhere in Ireland as a leachate drainage media. In order to gain approval for this material, samples have previously been subjected to testing within a column of flowing leachate. This demonstrated that the material did not break down in leachate nor clog, and it was therefore deemed suitable for leachate drainage purposes (Timoney, O'Sullivan and Quigley, 1999).

The leachate drainage blanket will be selected to achieve a minimum permeability 1×10^{-3} m/s, in line with the guidance. It is envisaged that the stone would have a grading of nominally 10-20mm, however, the actual grading will need to be selected in conjunction with cylinder testing of the geotextile protector. A detailed specification and CQA procedures for the supply and installation of the leachate drainage blanket will be set out in the CQA Plan.

2.3.11.3 Geotextile Protector

The geotextile protector lies between the leachate drainage blanket and the geomembrane. This material will be a non-woven needle punched geotextile, which will act as a cushion to the drainage stone reducing the strains on the underlying geomembrane as the waste load is applied. The selection of the specific product to be used will be based upon a successful cylinder test, which will demonstrate that the strains induced on the geomembrane element of the lining system will not exceed a tolerable limit of 0.25%. Details of the cylinder test and CQA procedures for the supply and installation of the geotextile protector will be set out in the CQA Plan.

2.3.11.4 Geomembrane

A 2mm thick high density polyethylene (HDPE) geomembrane will be installed directly above and in intimate contact with the underlying geosynthetic clay liner. It will extend over the whole of the lined area and will be anchored around the perimeter of the site. The geomembrane will be fully welded and subjected to a rigorous CQA procedure. A detailed specification and CQA procedures for the supply and installation of the geomembrane will be set out in the CQA Plan.

2.3.11.5 Geosynthetic Clay Liner

The proposed geosynthetic clay liner consists of a factory manufactured composite matting comprising a bentonite layer, approximately 6mm thick between two layers of geotextile. It will be installed directly above and in intimate contact with the underlying natural clay liner.

2.3.11.6 Clay Liner

A suitable source of clay liner material (glacial till) has been identified off-site at Roadstone Dublin's Huntstown Quarry in North County Dublin. This material will be imported to site via road for the basal liner construction. Permeability tests undertaken on reconstituted samples of this material indicate that it will be possible, assuming controlled compaction in-situ, to achieve a permeability of less than 1×10^{-9} m/s. Soil classification, strength and permeability test data are provided in Appendix 2J.

On site the clay would be placed in a series of discrete lifts 250mm thick, using a sheepfoot roller to prevent forming laminations and therefore ensure the clay forms a homogenous mass. A detailed specification and CQA procedures for the supply and installation of the clay liner will be set out in the CQA Plan. It is proposed on the basis of previous successful experience (Timoney, O'Sullivan and Quigley, 1999), that the top 250mm of the clay liner would comprise processed soil (glacial till) with a maximum particle size of 50-75mm.

2.3.12 Leachate Management System

The leachate management system has been designed to collect the leachate from the base of the waste mass and to allow it flow to two extraction sumps, one in each cell. In addition to the leachate drainage blanket, a herringbone system of pipework has been included in the base of each cell to aid the flow of the leachate to the sump at the lowest point of the collection system, as detailed on Figure 2.6. A maximum head of 1m of leachate will be maintained above the top of the basal liner.

The leachate drainage pipework will be manufactured from HDPE and will be required to withstand the loadings anticipated from the overlying waste. Spacing of the pipework has been designed to provide a degree of redundancy against blockage or malfunction of the drainage systems and exceeds the requirements outlined in Environmental Protection Agency guidelines.

At the sump a vertical extraction system will be constructed, and given the shallow waste depths (<15m) it is considered that a relatively simple riser comprising concrete rings is appropriate. Two monitoring wells have also been included, one in each of the proposed cells.

Due to the presence of fine soils within the waste mass, there is an increased likelihood of clogging of the leachate drainage pipework. In order to minimise the risk of clogging the main leachate collection pipework will extend from the eastern boundary to the west, making it accessible from either end to enable inspection and cleaning.

No provision is made for an on-site leachate storage or treatment facility. It is envisaged that leachate produced and collected within the lined landfill will be transferred via submersible pumps at the leachate extraction wells directly to road tankers and taken off-site to an approved treatment facility, most likely an existing local wastewater treatment plant. It is proposed to install a telemetry system to monitor leachate levels within the landfill at leachate monitoring and extraction wells. This will allow site management to monitor leachate build up on a daily basis and to ensure timely removal and transfer of leachate off-site to an approved wastewater treatment facility.

Notwithstanding this, provision has been made in design for re-circulation of the leachate within the waste body, should it be required. The re-circulation system comprises a number of trenches excavated in the final waste levels within which a 150mm diameter perforated HDPE pipe is installed and then backfilled with granular material, as detailed on Figure 2.7. Leachate is pumped from the extraction wells into the perforated pipe which then seeps out into the waste through the granular fill.

During construction uncontaminated rainwater run-off collecting in the empty landfill cells will be discharged via the surface water collector channel to the intermediate surface water pond. Thereafter, as waste is placed within the landfill, leachate will be transferred to road tankers and taken off-site to an approved treatment facility.

2.3.13 Landfill Gas Management System

Given the volume of biodegradable waste and the degraded condition of the waste, it is not possible to accurately estimate the volume of landfill gas that will be produced at this facility. Notwithstanding this, the volume of gas produced by such a volume of biodegradable waste will be insufficient to support a generation unit and it is also questionable whether the gas volumes will be sufficient to allow flaring.

In line with EPA guidance, the landfill design has incorporated details for the passive venting of gas from beneath the capping system. The volume of gas released to the atmosphere is likely to be relatively low and will be significantly diluted. However, it is intended that the proposed passive venting system will have the capability to connect the vents to a small flare should monitoring ever indicate that landfill gas production rates are sufficiently high.

Passive vents will be installed as landfilling operations progress and will comprise 180mm diameter perforated HDPE pipe installed either

- (i) through the waste body in a 300mm diameter bore, backfilled with pea gravel or
- (ii) along the gas drainage layer beneath the capping,

and connected to 180mm diameter solid HDPE pipes protruding through the capping layer and extending approximately 1.5m to 3m above ground level. Details of the gas management system are presented on Figure 2.8.

2.3.14 Capping and Restoration

As waste is transferred and placed in the lined landfill, there will be a requirement for daily cover of exposed waste at the end of each working day or before a weekend or extended holiday period. Exposed waste in the landfill will be covered by 100mm to 150mm of available soil cover or alternatively with hessian, degradable plastic sheeting or recovered construction and demolition waste.

The landfill may be developed in a number of phases and may require the installation of a temporary cap. If so, it is envisaged that this will comprise 1mm thick LLDPE geomembrane and the gas collection layer, such that if the remainder of the waste is never placed within the landfill then the overlying layers of the permanent system can be installed.

In accordance with EPA Guidance, the permanent capping system will comprise the following elements: 150mm thick topsoil layer, 850mm thick subsoil layer, 500mm thick drainage layer of minimum permeability 1×10^{-4} m/s, and 1mm thick linear low density polyethylene (LLDPE) geomembrane over a geosynthetic clay liner (GCL) and a 300mm thick gas collection layer of minimum permeability 1×10^{-4} m/s.

Suitable restoration soils and materials for each of the drainage layers will be sourced elsewhere within the Doran's Pit site. Construction details for the capping and restoration, including final restoration contours, are presented on Figure No. 2.7.

The capping installation works will be addressed by the method statement and health and safety statement prepared by the construction Works Contractor. A detailed specification and construction quality assurance (CQA) procedure covering the supply and installation of materials used in the capping and restoration will be set out in a CQA Plan similar to that developed in respect of the basal and side slope liner.

Following completion of capping and restoration works, provision will be made for long-term monitoring of the quality of environmental media in the immediate vicinity of the engineered landfill – soil, air, surface water and groundwater. Details of environmental monitoring are presented in Section 2.7 of this report.

2.4 REMEDIATION OF UNAUTHORISED LANDFILL SITES

2.4.1 Proposed Remediation Works

The proposed remediation works at each of the three unauthorised landfill areas on the Roadstone Dublin lands at Blessington essentially comprises

- (i) excavation and removal of all buried domestic, commercial and domestic waste from unauthorised landfills at Areas 1, 4 and 6;
- (ii) segregation and transfer of unacceptable waste off-site
- (iii) recycling and temporary stockpiling of construction and demolition waste
- (iv) transfer of residual non-hazardous waste and acceptable hazardous waste to the proposed engineered landfill facility.

At each of the three unauthorised landfill areas, site preparatory works will include construction of approximately 3m to 5m high earth mounds around the boundary using the inert soils overlying the main body of waste. The earth mounds are principally intended to screen on-site activities from external view, but will also provide an extra degree of security and safety.

The overburden soils will be excavated in a safe and systematic manner using conventional tracked excavation plant.

If significant volumes of construction and demolition waste are mixed through the overburden soil, it will be transferred to the recycling areas east of the unauthorised landfill at Area 4 or west of Area 1 and separated out by passing it through a mobile trommel screen. The trommel will be fitted with a series of large screening grids and magnets to draw off any recyclable concrete or metal waste. Large concrete blocks, metal panels, oversize tyres and other wastes which may be too large to pass through the trommel will be removed by excavation plant and stockpiled separately to the overburden soil.

Metal wastes and tyres will be transferred by public road to suitably licensed recovery facilities. Where practicable, oversize stone and concrete waste will be stockpiled on-site with oversize cobbles and boulders for future crushing and/or re-use in construction of temporary haul routes within Roadstone Dublin's landholding. Alternatively, such wastes will be transferred to a construction and demolition recycling facility operated by Roadstone Dublin at Fortunestown in South County Dublin. The relatively small volume of residual non-recoverable waste (timber, rope, plastics etc) originally intermixed through the overburden soils will be stockpiled separately and ultimately transferred to the engineered landfill.

A programme of soil sampling and validation testing will be established on-site to confirm that separated overburden soils are inert and free of contamination before they are re-used for site restoration and reclamation works.

A minimum of 150mm of soil will be left in place over the main body of domestic, commercial and industrial waste prior to its excavation and removal, in order to prevent windblown litter, odours etc. Where necessary, any existing leachate within the waste bodies will be removed by active pumping from existing boreholes to a mobile tanker prior to excavation and transferred to an approved / agreed treatment plant. Where required, sumps will be constructed in advance of excavation works to facilitate collection and extraction of any residual leachate within the waste bodies.

The DCI waste in each area will be excavated in a systematic and controlled manner ('strip mining') using conventional tracked excavation plant.

If the excavated DCI waste is considered on the basis of visual inspection, in-situ monitoring and testing to be non-hazardous, it shall be placed directly onto sealed (watertight) dump

trucks, covered and immediately transferred to the proposed engineered landfill facility. It is currently envisaged that the truck transferring waste will be provided by Roadstone Dublin and operated by its personnel. The waste acceptance criteria (including those for acceptance of hazardous waste at non-hazardous landfill facilities) will be based on the European Council decision of 19 December 2002 (made pursuant to Article 16 of and Annex II to Directive 1999/31/EC) and will be agreed with the EPA Agency as part of the waste licensing process.

Where visual inspection, in-situ monitoring and testing indicates the presence of potentially hazardous or unacceptable material within the excavated DCI waste, it shall be segregated, placed onto sealed trucks and transferred to the enclosed waste inspection and temporary quarantine area, refer to Figure 2.2, whereon the waste will be subject to more detailed classification testing. Hazardous or potentially hazardous waste will be placed in skips and covered. Any hazardous material which is not acceptable at the proposed engineered landfill will be transferred off-site to an appropriately licensed hazardous waste disposal or recycling facility. Waste segregation and classification procedures to be implemented on site will be agreed with the regulatory authorities in advance.

During excavation operations, efforts will be made to ensure that the area of waste exposed to the atmosphere is minimised insofar as possible in order to limit odour emissions. Exposed waste will be covered at the end of each working day with any available soil cover or alternatively, with hessian, impermeable PVC sheeting or recovered construction and demolition waste.

Excavation side slopes will be benched and graded as necessary to prevent instability. The width and gradient of temporary access roads into each excavation will be sufficient to ensure safe access and egress of plant and personnel. A programme of gas monitoring will be established around and within each excavation to monitor ambient concentrations of landfill gas and to safeguard the health and safety of site staff and operatives. In order to minimise dust emissions at each excavation area, water from a tractor drawn bowser will be sprayed on dry exposed soil and waste as and when required.

Waste excavation, removal, processing and temporary storage activities will only be undertaken between 07.30 hours and 17.30 hours Monday to Friday and 08.00 hours to 13.00 hours on Saturdays. No landfilling will be undertaken on Sundays or public holidays.

Details of the restoration work to be undertaken at each unauthorised landfill sites is provided in Section 2.8.

2.4.2 Area 1 : Dillonsdown

At Area 1 in Dillonsdown, the recent environmental investigations indicated that the depth of generally inert and uncontaminated overburden cover above the main body of waste varies from approximately 9m in the centre of the site to approximately 2m or less around the perimeter. The maximum depth of excavation at this site is expected, on the basis of investigations to date, to be of the order of 15m below existing ground level.

While the waste body is generally dry, confined pockets of leachate were observed within the waste during the environmental investigations. The volume of domestic, commercial and industrial waste imported to Area 1 is estimated to be 48,000m³ (36,000 tonnes). The overburden material mainly comprises glacial till and dried out fine sandy silt intermixed with occasional construction and demolition waste. (The sandy silt is a by-product of sand washing activity elsewhere at the Doran's Pit complex)

2.4.3 Area 4 : Deerpark

At Area 4 in Deerpark, the recent environmental investigations indicated that the depth of generally inert and uncontaminated overburden cover above the main body of waste varies randomly from 2.5m to 6m depth. The maximum depth of excavation at this site is expected, on the basis of investigations to date, to be of the order of 7m below existing ground level.

The waste body is generally dry, although confined pockets of leachate were observed within the waste during the recent environmental investigations. The volume of domestic, commercial and industrial waste imported to Area 4 is estimated to be 3,750m³ (2,800

tonnes). The overburden material mainly comprises glacial till and dried out fine sandy silt intermixed with occasional construction and demolition waste.

2.4.4 Area 6 : Newpaddocks

At Area 6 in Newpaddocks, the initial environmental investigations indicated that the depth of generally inert and uncontaminated overburden cover above the main body of waste is between 2m and 3m deep. The maximum depth of excavation at this site is expected, on the basis of investigations to date, to be of the order of 8m to 9m below existing ground level.

The waste body was generally found to be dry above 5m or 6m depth, but below this depth it became increasingly wet to approximately 8m depth. It appeared from initial investigations that leachate generated by waste decomposition was ponding over an underlying, relatively impermeable layer of silt.

Three sumps extending to underside of waste level will be constructed close to the site boundary prior to commencement of the bulk excavation in order to collect any leachate held within the buried waste. Leachate flowing into these sumps will be pumped to a mobile tanker and transferred to a local wastewater treatment plant (or similar facility licensed to accept such liquid waste).

The volume of domestic, commercial and industrial waste imported to Area 6 is estimated to be 18,000m³ (13,500 tonnes) The overburden material mainly comprises glacial till and dried out fine sandy silt, intermixed with occasional construction and demolition waste.

The residential housing immediately beyond the site boundary is likely to be sensitive to dust and odour emissions generated by the excavation, stockpiling and processing activities at this site. A gas venting trench was installed beyond the eastern and southern boundary of the waste body at Area 6 in November / December 2003. The vent trench extends from ground level to approximately 1m to 2m below the waste body and was installed to inhibit lateral migration of landfill gas through the ground toward the adjacent residential development. The gas venting trench will remain in place following removal of the domestic, commercial and industrial waste to inhibit lateral migration of any residual landfill gas. A number of passive landfill gas vents were also installed in December 2003/ January 2004 to reduce the potential odour impact of the excavation works. Details of the passive venting systems currently in place are provided in Figures 2.9 and 2.10

Given its proximity to recently constructed residential housing, it is currently envisaged that a mist scrubbing system may need to be established to reduce potential odour nuisance caused by waste excavation activities in Area 6. This system operates by spraying mist droplets of odour suppression solution through nozzles on a boom located in close proximity to uncovered waste and will be automated to ensure that it is operational only when winds blow from a critical pre-set direction and below a certain speed.

2.5 WASTE TRANSFER TO ENGINEERED LANDFILL

Only the residual non-hazardous DCI waste excavated within Roadstone's landholding at Doran's Pit will be accepted at the proposed engineering landfill facility. No waste from external sources will be accepted or placed at the landfill.

Roadstone Dublin will be responsible for overall operational control of the landfill. Site management and direction of landfilling activities will be undertaken by Roadstone Dublin personnel, assisted as necessary by appropriately qualified and experienced technical advisors.

Landfilling operations will be undertaken between 07.30 hours and 17.30hours Monday to Friday and 08.00hours to 13.00 hours on Saturdays. No landfilling will be undertaken on Sundays or public holidays. The haul routes to the proposed engineering landfill from each of the three unauthorised landfill areas are indicated on Figure 2.1.

All waste unloaded from trucks at the engineered landfill facility will be visually inspected by appropriately qualified staff to ensure that no hazardous waste or other unacceptable waste is placed within it. Any potentially hazardous or unacceptable waste identified amongst the

existing buried waste will be segregated and brought to the waste quarantine area for detailed classification. Any material which is not acceptable at the non-hazardous engineered landfill will be removed off site to a suitably licensed hazardous waste disposal or waste recycling facility.

2.6 ENVIRONMENTAL NUISANCE CONTROL

2.6.1 General

The proposed environmental remediation works on Roadstone Dublin's lands includes a number of environmental controls to eliminate or minimise the nuisance to the public arising from the excavation of buried waste and its subsequent transfer and placement in the engineered landfill. The proposed control measures are outlined in detail in the following sections.

The remediation works at the site will ultimately be regulated by conditions attaching to any waste licence issued by the Environmental Protection Agency (EPA). Any additional control measures required by the Waste Licence, over and above those outlined herein, will also be implemented.

2.6.2 Bird Control

The excavation and placement of putrescible (food / kitchen) waste may attract scavenging birds such as gulls and crows during the site remediation works. In order to minimise the number of birds attracted to the exposed waste areas, the following measures will be implemented:-

- (i) the area of exposed waste (active area) will be minimised, both during excavation and subsequent placement in the engineered landfill;
- (ii) exposed waste will be covered at the end of each working day with any available soil cover or, alternatively, with hessian, plastic sheeting or recovered construction and demolition waste and
- (iii) netting will be provided as and when required around the active excavation and landfilling areas to restrict access to the exposed wastes.

Should these measures be insufficient to control the number of scavenging birds, consideration will also be given to employing external contractors to provide trained birds of prey such as falcons or hawks to disperse them.

2.6.3 Dust Control

In dry, windy weather conditions, the remediation activities may give rise to dust blows across, and possibly beyond the site. In order to control dust emissions, the following measures will be implemented:-

- (i) water from a tractor drawn bowser will be sprayed on dry exposed soil / waste surfaces (including unpaved road surfaces) as and when required;
- (ii) the area of exposed waste (active area) will be minimised, both during excavation and subsequent placement in the engineered landfill;
- (iii) open excavations will be backfilled and grassed as soon as practicable after waste excavation and removal has been completed;
- (iv) the engineered landfill will be temporarily or permanently capped as soon as practicable after the waste emplacement is complete. Capping layers will be grassed to minimise soil erosion and potential dust emissions;
- (v) a temporary wheelwash facility will be installed at the end of the paved internal access road (refer to Figure 2.2). This measure will prevent transport of fines on both the paved access road and the public road network by HGVs delivering construction materials to the site.
- (vi) temporary wheelwash facilities will be installed at the access and egress to each unauthorised landfill and the proposed landfill facility.

The amount of dust or fines carried onto the public road network will be further reduced by ongoing, regular sweeping of the paved internal access road and the existing N81 National Secondary Road immediately in front of Roadstone Dublin's landholding.

2.6.4 Litter Control

In order to reduce the amount of windblown litter arising from the excavation and placement of the waste at this site, the following measures will be implemented:-

- (i) the area of exposed waste (active area) will be minimised, both during excavation and subsequent placement in the engineered landfill;
- (ii) exposed waste will be covered at the end of each working day with any available soil cover or, alternatively, with hessian, plastic sheeting or recovered construction and demolition waste;
- (iii) all trucks transferring waste between the unauthorised disposal sites and the engineered landfill will be required to use netting or a tarpaulin cover;
- (iv) netting will be provided around the active excavation and landfilling areas in order to catch any windblown litter. Litter caught in the netting will be collected on a regular basis and placed in the active landfilling area and
- (v) loose litter falling around the excavation areas, the proposed haul routes, the engineered landfill and surrounding areas will be manually collected on a regular basis and placed in the active landfilling area.

If, despite these measures, windblown litter manages to escape beyond the boundary of Roadstone's landholding, site staff will seek the permission of adjacent property owners to enter their land / gardens to recover any litter. It is considered that the only area where this problem could arise is at Area 6.

2.6.5 Odour Control

In order to reduce the odour emissions from the biodegrading waste at this site, the following measures will be implemented:-

- (i) the area of exposed waste (active area) will be minimised, both during excavation and subsequent placement in the engineered landfill;
- (ii) exposed waste will be covered at the end of each working day with any available soil cover or, alternatively, with hessian, plastic sheeting or recovered construction and demolition waste;
- (iii) passive venting wells were installed at the most critical unauthorised landfill site (Area 6) in December 2003 and January 2004. The installation of these wells prior to the excavation and transfer of waste to the engineered landfill will encourage prior vertical dispersion of potentially odourous landfill gas;
- (iv) site staff will walk over the landfill on a regular basis (at least once per week) to identify any leakage areas as part of the landfill gas management plan;
- (v) sufficient cover will be provided when placing temporary or permanent capping at the engineered landfill to limit formation of leakage areas;
- (vi) a soil binding agent (i.e. grass) will be placed over capping layers to minimise soil erosion and potential fugitive gas emissions and
- (vii) when removing leachate from wells or sumps for off-site treatment, the tanker pipe will be lowered beneath the free surface of the leachate in order to minimise agitation and the potential volatilisation of odourous compounds.

Should odour emissions cause a nuisance during the excavation and removal of waste, close to residential housing at Area 6, a mist-scrubbing system will be established and used to absorb odourous gases emitted by biodegrading waste

2.6.6 Vermin Control

The excavation and placement of putrescible (food / kitchen) waste may also attract vermin (rats) and flies during the site remediation works. In order to control the population of vermin in the vicinity of the site remediation works, the following measures will be implemented by external vermin / pest control contractors appointed by Roadstone Dublin:-

- (i) application of rodenticides and insecticides, as and when required, around the engineered landfill and remediation sites and
- (ii) laying of bait at regular intervals around the engineered landfill and remediation sites.

Dead or dying rats will be collected and removed by an appointed vermin / pest control company in order to avoid attracting interest from scavenging animals / birds and minimise the spread of disease.

2.6.7 Fire Control

Site operational practices will focus on prevention of fires at the three unauthorised waste disposal sites and at the engineered landfill facility. In order to reduce the risk of fire at the site, the following measures will be implemented:-

- (i) smoking in the vicinity of the unauthorised waste disposal sites and the engineered landfill facility will be prohibited
- (ii) exposed waste will be covered daily using any available soil cover;
- (iii) plant and equipment will be fitted with spark arrestors and will be removed if they exhibit signs of overheating etc.

In the unlikely event that a fire does occur, the local fire station in Blessington will be contacted and emergency response procedures will be implemented.

If necessary, water in the surface water lagoon at the western end of the site and the clear water pond in the centre of the site will be used to augment any tankered supply. Fire extinguishers (water and foam) will be provided in the existing site office and at the temporary site office to deal with any small outbreaks which may occur.

2.7 ENVIRONMENTAL MONITORING

2.7.1 General

Immediately after evidence of unauthorised waste disposal had been uncovered at the Roadstone Dublin lands at Blessington, the company began to extend its established environmental monitoring programme to measure what, if any, impacts the buried waste had on surrounding environmental receptors. The scope of the existing environmental monitoring programme was agreed with officials from Wicklow County Council and the Environmental Protection Agency (EPA) and is outlined below.

Limit values for all environmental emissions arising during the site remediation works and the subsequent aftercare period will be set by any waste licence issued by the EPA in respect of the proposed remediation works. It is envisaged that the existing environmental monitoring regime will be extended to monitor compliance with these limits.

Where possible, environmental sampling, monitoring and testing will be undertaken by Roadstone Dublin's staff, with external consultants used only as required. Records of environmental monitoring and testing will be maintained on-site and will be forwarded to Wicklow County Council and the EPA as required under the terms of the waste licence.

2.7.2 Dust Monitoring

Dust emissions from established quarrying activities at Roadstone Dublin's site are measured using Bergerhoff dust gauges at 2 No. locations across the site, shown on Figure 2.11. These gauges are currently monitored by in-house environmental technicians on a quarterly (i.e. three monthly) basis.

It is currently proposed to establish 4 No. additional dust monitoring stations, 1 No. at each of Area 4, the site of the proposed engineered landfill, the eastern boundary of Area 6 and the rear of the residences along Darker's Lane (closest to Area 1) at least three months prior to commencement of the site remediation works. The proposed location of these additional monitoring stations are also indicated on Figure 2.12.

All dust monitoring stations will be monitored at monthly intervals for the duration of the site remediation works and for agreed aftercare period thereafter.

2.7.3 Ecological Monitoring

During the site remediation phase, the bird and vermin populations will be closely monitored by site staff. As and when necessary, measures will be implemented to reduce the environmental nuisance posed by these species.

A freshwater macroinvertebrate survey and biological pollution assessment was undertaken in February 2003 by White Young Green Ireland along the Burgess Stream to the south of the application site. Sampling locations along the stream are indicated in Figure 2.11. It is currently envisaged that such a survey will be undertaken on an annual basis until the site remediation works have been completed and for an agreed aftercare period thereafter.

The local population of *Erigeron Acer* to the west of the proposed landfill will be examined one and five years after completion of the remediation works and the results of the mitigation measures assessed.

2.7.4 Groundwater Monitoring

At the present time, groundwater sampling and testing is undertaken by external consultants on a quarterly basis at 18No. monitoring wells on, or immediately beyond, Roadstone Dublin's landholding. Groundwater levels are also recorded on a quarterly basis.

Of the 18No. wells, 4No. are positioned around the buried waste at Area 1, 4No. are positioned around the buried waste at Area 4, 6No. are positioned around the buried waste at Area 6 and a further 4No. are positioned at random points some distance down-gradient of the buried waste. The locations of the existing groundwater monitoring wells are indicated in Figure 2.11.

Any of the existing groundwater monitoring wells which have to be destroyed to facilitate the proposed remediation works (specifically well GW1/3) will be replaced. Any wells inadvertently damaged during the works will also be replaced. It is envisaged that an additional 5No. groundwater monitoring wells will be installed within Roadstone Dublin's landholding prior to the commencement of the remediation works, one (designated GWR4) immediately up-gradient of the engineered landfill, two (GWR5 and GWR6) immediately down-gradient and two others (GWR7 and GWR8) approximately 300m down-gradient of the landfill. The location of these additional wells are indicated on Figure 2.12.

Groundwater samples are currently tested for a wide range of physical and chemical parameters in order to assess water quality and detect contamination which may be attributable to the presence of buried waste. Details of the existing test parameters are provided in Section 6 of this report.

It is currently envisaged that the existing groundwater monitoring regime will remain in place up to and for an agreed period after completion of the site remediation works.

The results of groundwater quality testing will be forwarded for review by external consultants and Wicklow County Council and/or the Environmental Protection Agency on a quarterly basis. Should any party advise that additional groundwater monitoring wells are required to better fully assess the impact of the proposed remediation scheme on the local groundwater aquifer, Roadstone Dublin will install, develop and monitor such wells and incorporate them into its environmental management and monitoring systems.

2.7.5 Landfill Gas Monitoring

Given the volume of biodegradable waste to be placed at the proposed engineering landfill, and its already degraded condition of the waste, it is expected that the volume of landfill gas produced will be insufficient to support a power generation unit and it is also questionable whether the gas volumes will be sufficient to allow flaring.

In line with EPA guidance, the landfill design has incorporated details for the passive venting of gas from beneath the capping system. However, it is intended that this system will have the capability to connect the vents to a small flare should monitoring demonstrate that the gas production rates are sufficiently high. It is currently envisaged that landfill gas emissions at each of the passive vents will be monitored monthly initially (during placement) and at quarterly intervals thereafter (following placement of capping). Landfill gas will be monitored using a portable landfill gas analyser (GA2000) and parameters measured will include volumetric flow rate, atmospheric pressure, temperature and landfill gas composition. The proposed locations of the passive vents are indicated in Figure 2.12.

Landfill gas detection sensors will be fitted as a precaution in site office accommodation and storage containers at the compound area.

2.7.6 Leachate Monitoring

At the present time, 'perched' groundwater / leachate within the buried waste at Areas 1, 4 and 6 is sampled and tested by external consultants at 11No. monitoring wells on a quarterly basis. 'Perched' groundwater / leachate levels are also recorded on a quarterly basis.

Of the 11No. monitoring boreholes installed into buried waste, 5No. are at Area 1, 3No. are at Area 4 and a further 3No. are at Area 6. The locations of the existing monitoring boreholes are indicated in Figure 2.11. It is currently envisaged that these monitoring boreholes will remain in place until such time as they are destroyed by excavation works.

Perched groundwater / leachate samples are currently tested for a wide range of physical and chemical parameters in order to assess the nature and degree of contamination resulting from the degradation of the buried waste. Details of the leachate management system are presented on Figure 2.6.

It is currently envisaged that leachate sampling and testing will initially be undertaken at each of the extraction and monitoring wells at quarterly intervals during waste placement and following completion of final capping. The proposed leachate monitoring locations are indicated in Figure 2.12. Details of the proposed leachate test parameters are provided in Section 6 of this report.

At the engineered landfill, the leachate management system has been designed to collect leachate from the base of the waste mass and to allow it flow to two extraction sumps at the front (west) of the facility. Leachate levels within the landfill facility will be recorded at the extraction sumps and at two leachate monitoring wells, initially on a weekly basis. When this monitoring indicates that the head of leachate above the basal drainage layer is in excess of 1m, leachate will be tankered off-site to a local wastewater treatment plant (or similar facility licensed to accept such liquid waste) or re-circulated within the landfill.

2.7.7 Meteorological Monitoring

In preparing this report, measured rainfall and evapotranspiration data at the nearby weather station in Pollaphuca has been used in water balance calculations. Other climatic data (including temperature, wind speed and direction) has been obtained from the weather station at Casement Aerodrome, approximately 15km north-northeast of the application site.

It is proposed, as part of this remediation scheme to purchase and install a small weather station to record all relevant meteorological parameters, including rainfall evapotranspiration, temperature, wind speed and direction, barometric pressure and humidity close to the proposed site offices, immediately north of the engineered landfill.

2.7.8 Noise Monitoring

Noise emissions from established quarrying activities at Roadstone Dublin's site are currently monitored by in-house environmental technicians on a quarterly (i.e. three monthly) basis at two noise sensitive sites along the site boundary. These noise sensitive locations are the newly constructed residential housing immediately east of Area 6 and the detached residences along Darker's Lane, north of Area 1.

It is currently envisaged that noise monitoring during the site remediation works will be undertaken at the 4 No. monitoring locations indicated on Figure 2.12. Noise monitoring will be undertaken using a Larson Davis Model 824 Sound Level Meter, calibrated using a Larson Davies Acoustic Calibrator CAL 200 (or equivalent).

All noise monitoring stations will be monitored at monthly intervals for the duration of the site remediation works and at quarterly intervals thereafter, for an agreed aftercare period.

2.7.9 Odour Monitoring

Roadstone Dublin's site staff will report and record any odour emissions at remediation sites, at the engineered landfill and close to adjacent residences as they arise. Records will also be kept of any complaints about odour emissions from nearby residents. Efforts will be made to identify what weather conditions give rise to noticeable odour emissions and, at such times, additional effort will be made to suppress or minimise odour emissions.

2.7.10 Surface Water Monitoring

At the present time, surface water sampling and testing is undertaken by external consultants on a quarterly basis at six locations, three within Roadstone's landholding and three immediately beyond it, along the Burgess Stream, upstream, adjacent to and downstream of Area 6. The locations of the existing surface water monitoring stations are indicated on Figure 2.11.

Surface water samples are currently tested for a wide range of physical and chemical parameters in order to assess water quality and detect contamination which may be attributable to the presence of buried waste at the site. Details of the test parameters are provided in Section 6 of this report.

In addition to the existing surface water quality monitoring at three locations along the Burgess Stream, it is also proposed to extend this to include monitoring of surface water quality at the head of the Burgess Stream (BSW4) and at the intermediate surface water settlement pond, to the west of the proposed engineered landfill site (BSW5), also on a quarterly basis. It is also proposed to undertake biological monitoring at the three monitoring points along the Burgess Stream on an annual basis.

It is currently envisaged that this environmental monitoring regime will remain in place up to, during and for an agreed period after completion of the site remediation works.

2.7.11 Stability and Settlement Monitoring

On completion of the capping layer, a number of fixed stations will be set into the ground surface above the landfill and will be surveyed annually in order to assess the magnitude of landfill settlement and instability (lateral movement).

The landfill will be visually inspected for indications of potential instability once a month by Roadstone Dublin's site staff, and once a year by a suitably qualified geotechnical engineer. Should these inspections give cause for concern, an immediate survey of the landfill site will be undertaken to quantify the extent, if any of any instability arising.

2.8 RESTORATION AND AFTERCARE

Following excavation and removal of buried waste at each unauthorised landfill area, the resultant void will be partially backfilled using the inert overburden soils used in the construction of the 3m to 5m high boundary earth mounds.

As soon as practicable thereafter, Roadstone Dublin will complete backfilling of the remaining void space either using fine sandy silt (dried) generated by washing activity elsewhere on the landholding or excess soils arising from excavation of the landfill void.

In the longer term, Roadstone Dublin will continue to place dried out silt at and around each site in order to better merge them back into the surrounding undulating pastoral landscape. The ground surface will be profiled to give a domed shape in order to facilitate surface water

run-off to existing ponds and lagoons within Roadstone Dublin's landholding. Due regard will be had in profiling to possible settlement and consolidation of the inert backfill materials. At no time will surface water run-off be directed to watercourses or ponds beyond Roadstone Dublin's landholding. When restoration in each area is finally complete, the soils will be grassed.

Permanent capping of the engineered landfill and subsequent site restoration will be undertaken in accordance with the detail provided in Figure 2.7. A detailed specification and construction quality assurance (CQA) procedures covering the supply and installation of materials used in the capping and restoration will be set out in a CQA Plan.

The restoration of the area around the engineered landfill will also make provision for the restoration of disturbed ground in the vicinity of the rare plant *Erigeon Acer* using gravel of a similar size so as to create conditions for natural colonisation.

Any temporary site accommodation, infrastructure and services established for the duration of the site remediation and landfill construction works will be decommissioned and/or removed off-site.

Wherever possible, hardstanding surfaces will be broken up using a hydraulic breaker and subjected to validation testing to confirm the materials are acceptable for re-use in ongoing land restoration works. Any of these materials which are found to contain unacceptable levels of contamination will be transferred to a suitably licensed waste disposal facility.

The final phase of the works, final landfill capping and site restoration will be undertaken by an external Works Contractor. This work is expected to take no more than one to two months.

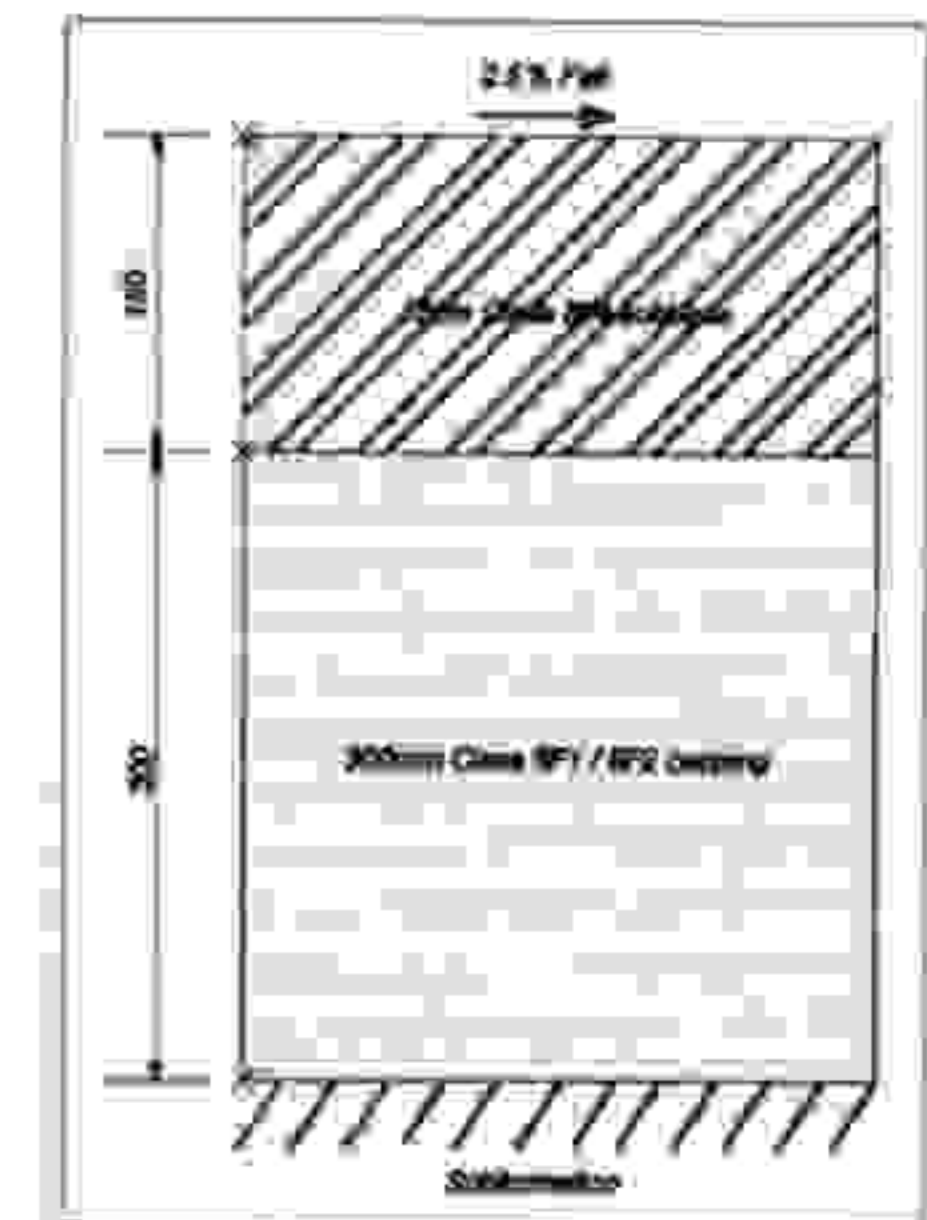
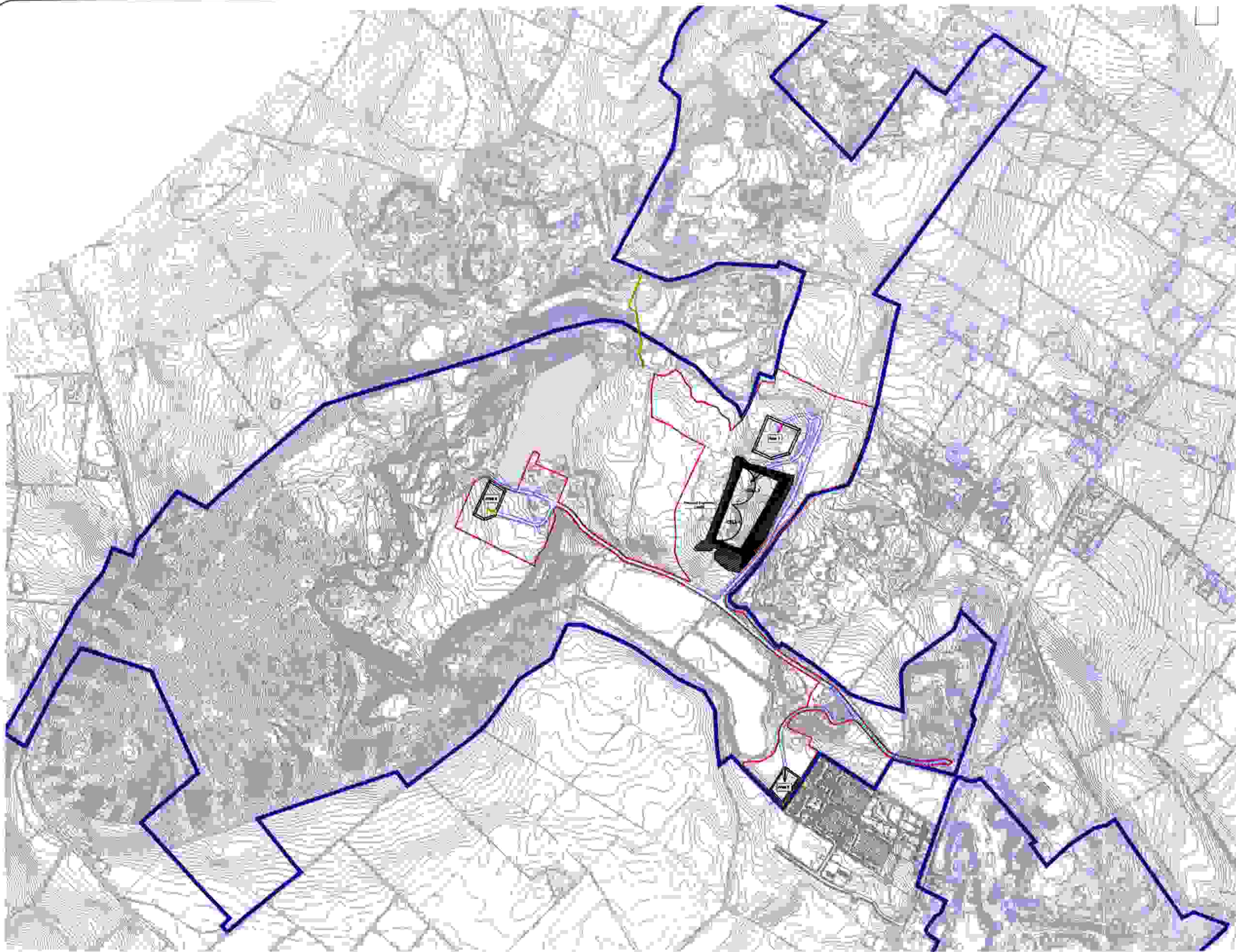
Following completion of capping and restoration works, provision will be made for the long-term monitoring of the quality of environmental media in the immediate vicinity of the landfill – soil, air, surface water and groundwater. Details of the proposed environmental monitoring regime are outlined in Section 2.7 above.

2.9 CONTINGENCY ARRANGEMENTS

Details of contingency arrangements to be established on site during and subsequent to the proposed remedial works are provided in the contingency plan, a copy of which is provided in Appendix 2J of this report.

FIGURES

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Cross Section : Unpaved Internal Road
(Scale 1:10)

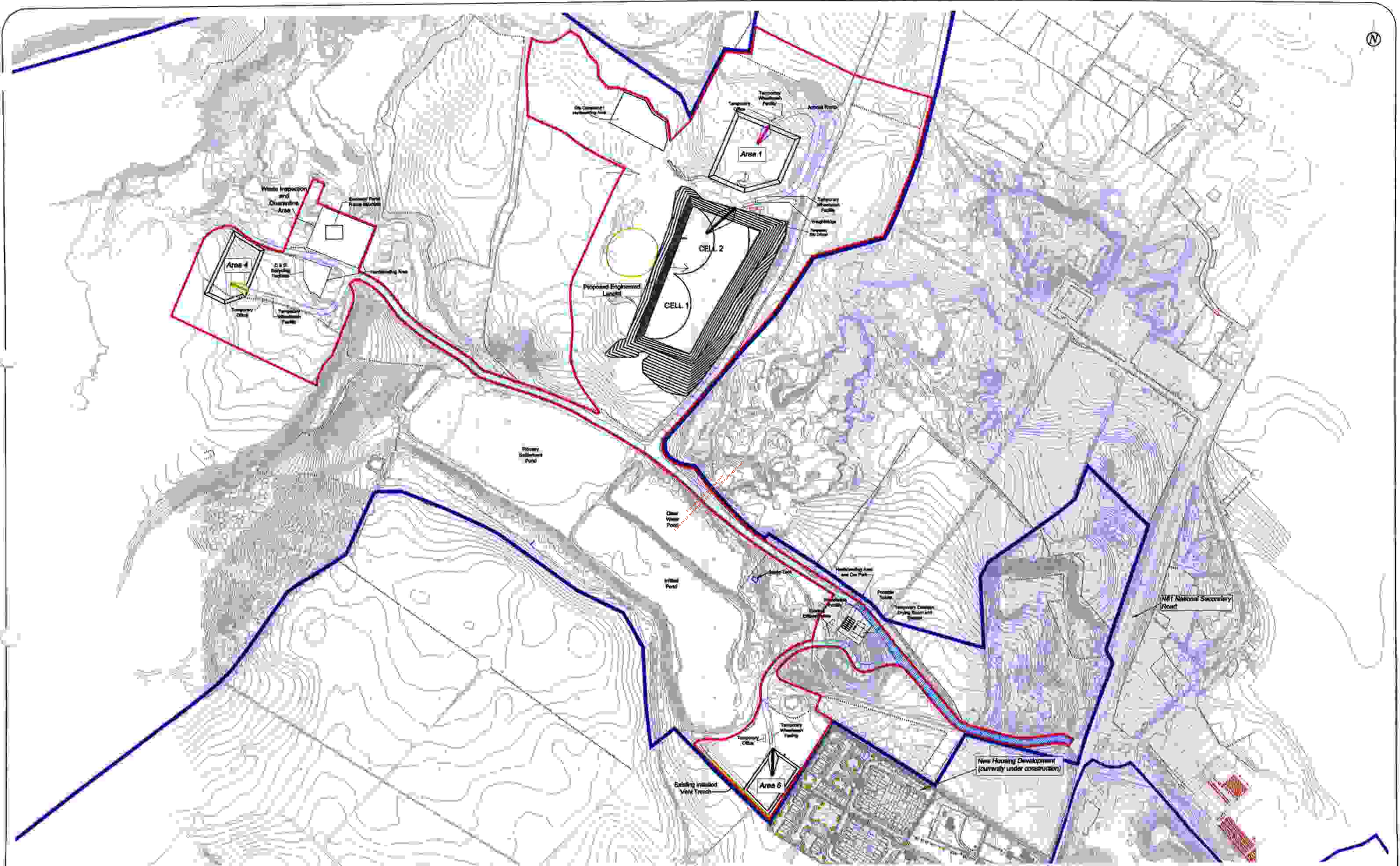
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SLR
Roadstone Landholding Boundary
Waste Licence Application Area
Internal Roads (Unpaved)
Internal Roads (Paved)
Existing Right of Way from Darkers Lane

Rev.	Date	By	Description
1	Dec 03	PM	Cell Layout Revised
0	Jul 03	SMD	Cell Layout Revised

Site:	Lands at Blessington, Co. Wicklow		
Project:	Remediation of Unauthorised Landfill Sites		
Title:	Existing / Proposed Internal Roads		
Drawn: PM	Scale: 1:10,000	FIGURE 2.1	
Job. No: 2901/10	Date: Dec 2004		



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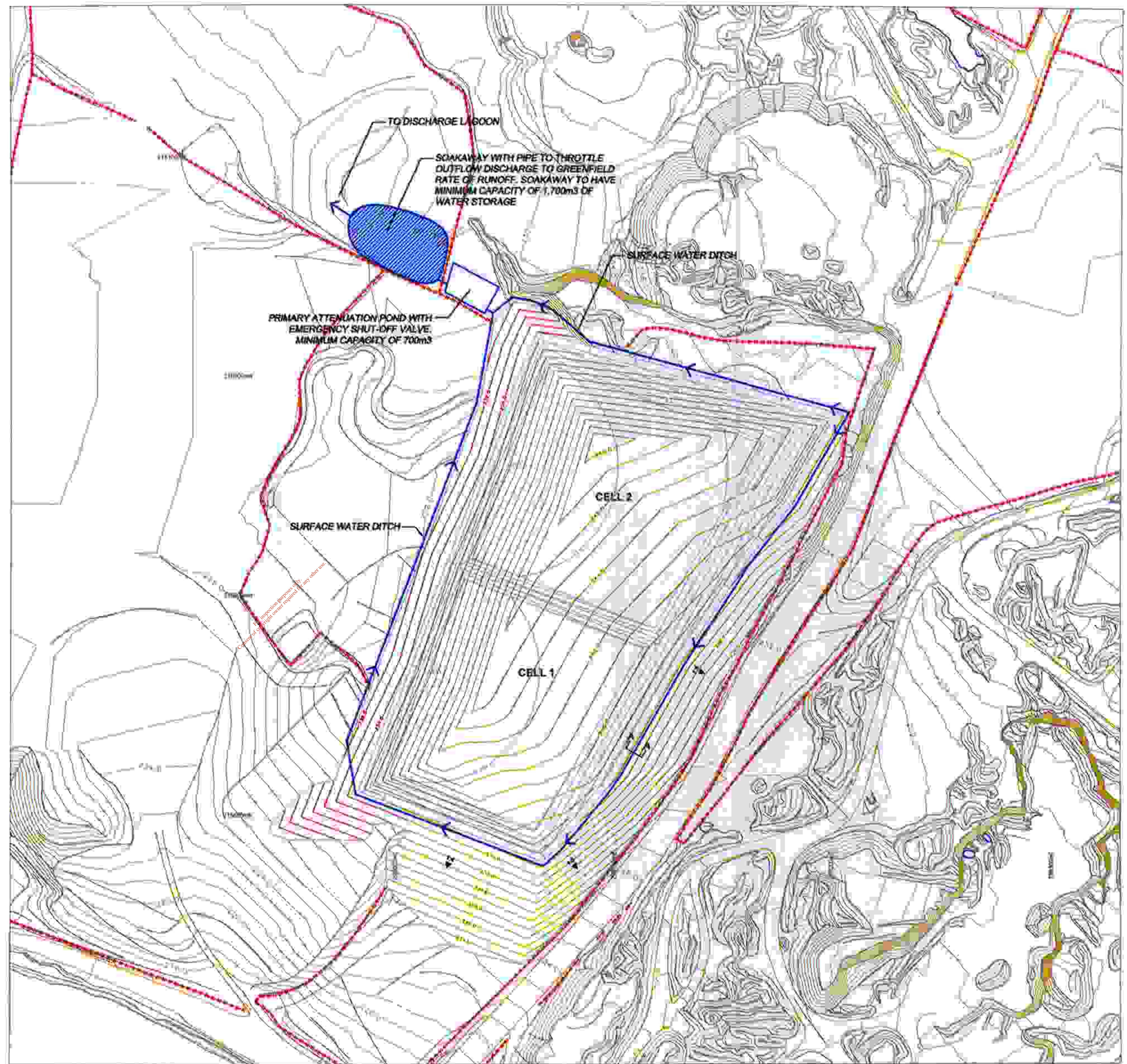
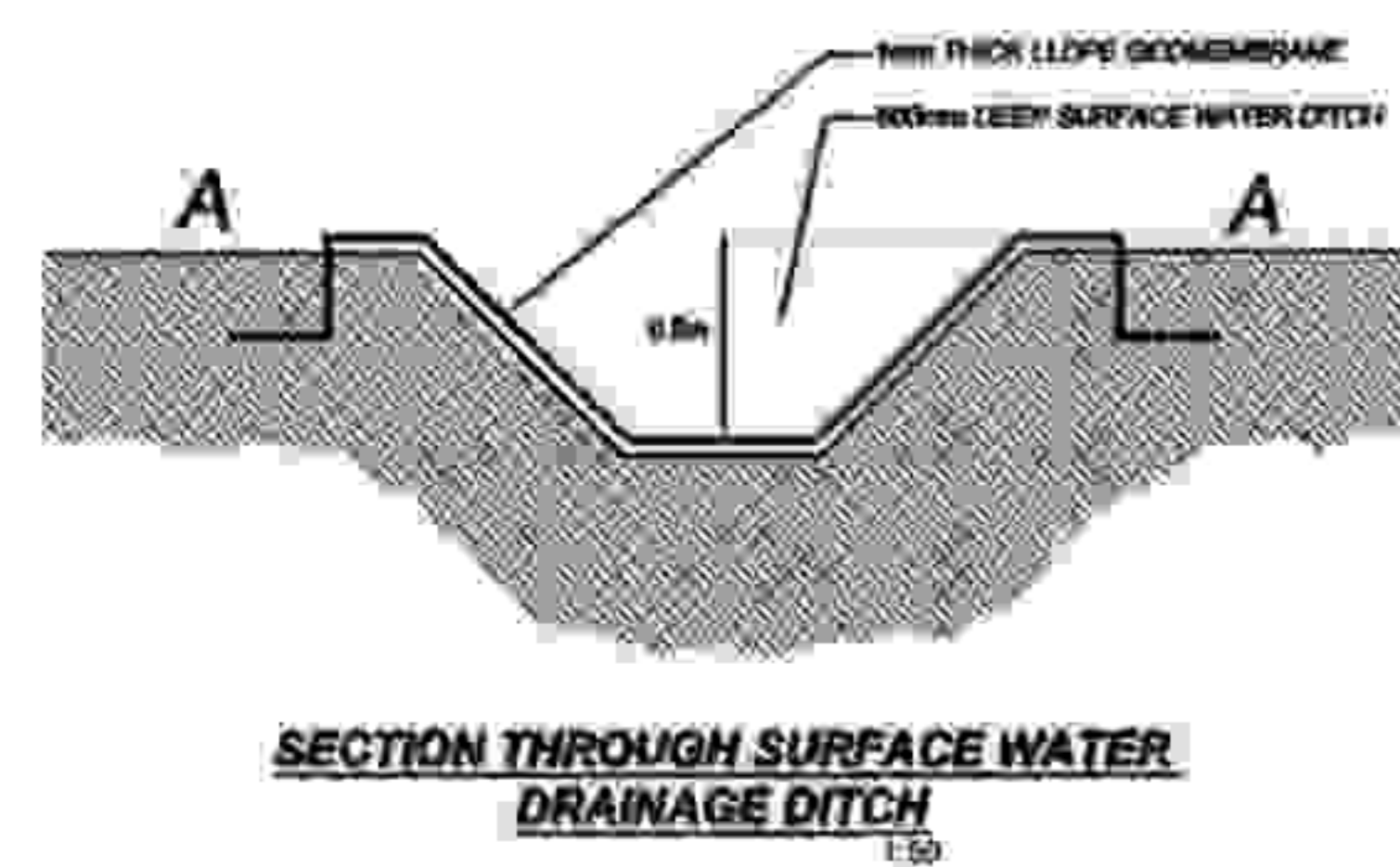
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 JOHN BARNETT & ASSOCIATES
 7 DUNDUM BUSINESS PARK
 WINDY ARBOUR
 DUBLIN 14

SLR
 Roadstone Landholding Boundary
 Waste Licence Application Area
 Exclusion Area for Blue Fleabane

Rev.	Date	By	Description
0	Dec 03	PM	

Site: Lands at Blessington, Co. Wicklow
 Project: Remediation of Unauthorised Landfill Sites
 Title: Site Infrastructure Layout
 Drawn: JC/PM Scale: 1:5000
 Job No: 2901/09 Date: Dec 2004

FIGURE 2.2



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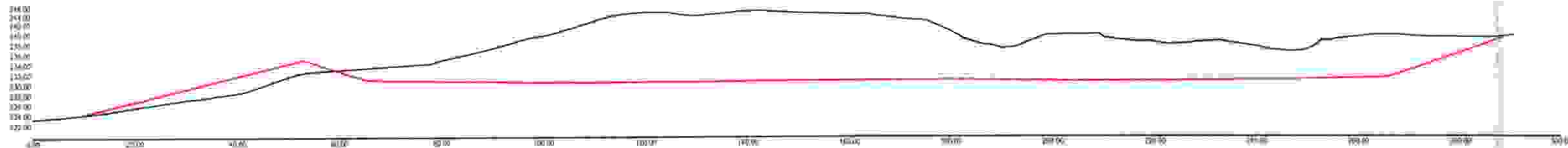
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- EXISTING GROUND CONTOURS
- FORMATION CONTOURS
- TOP OF CLAY LINER CONTOURS
- 25% TEMPORARY WASTE FACE CONTOURS
- FINAL RESTORATION CONTOURS
- SURFACE WATER DITCH

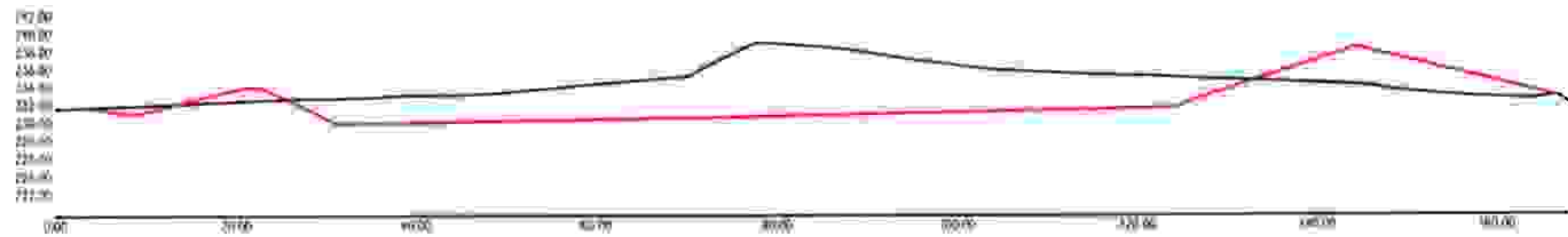
Rev.	Date	By	Description
2	April 04	PM	Contour Correction
1	Dec 03	PM	Cell Layout Revised
0	Jul 03	SMD	Cell Layout Revised

Site:	Lands at Blessington, Co. Wicklow
Project:	Remediation of Unauthorised Landfill Sites
Title:	Engineered Landfill - Surface Water Management Scheme
Drawn:	JC/PM
Scale:	1:2000
Job. No:	2901/09
Date:	Dec 2004

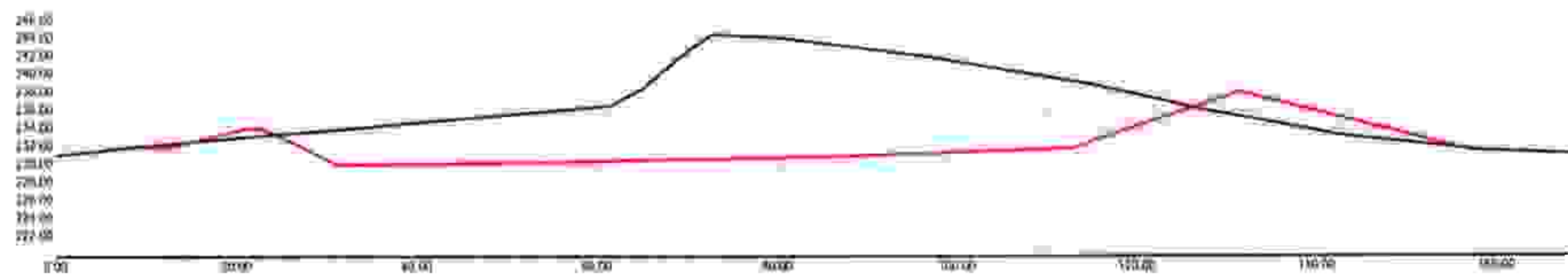
FIGURE 2.3



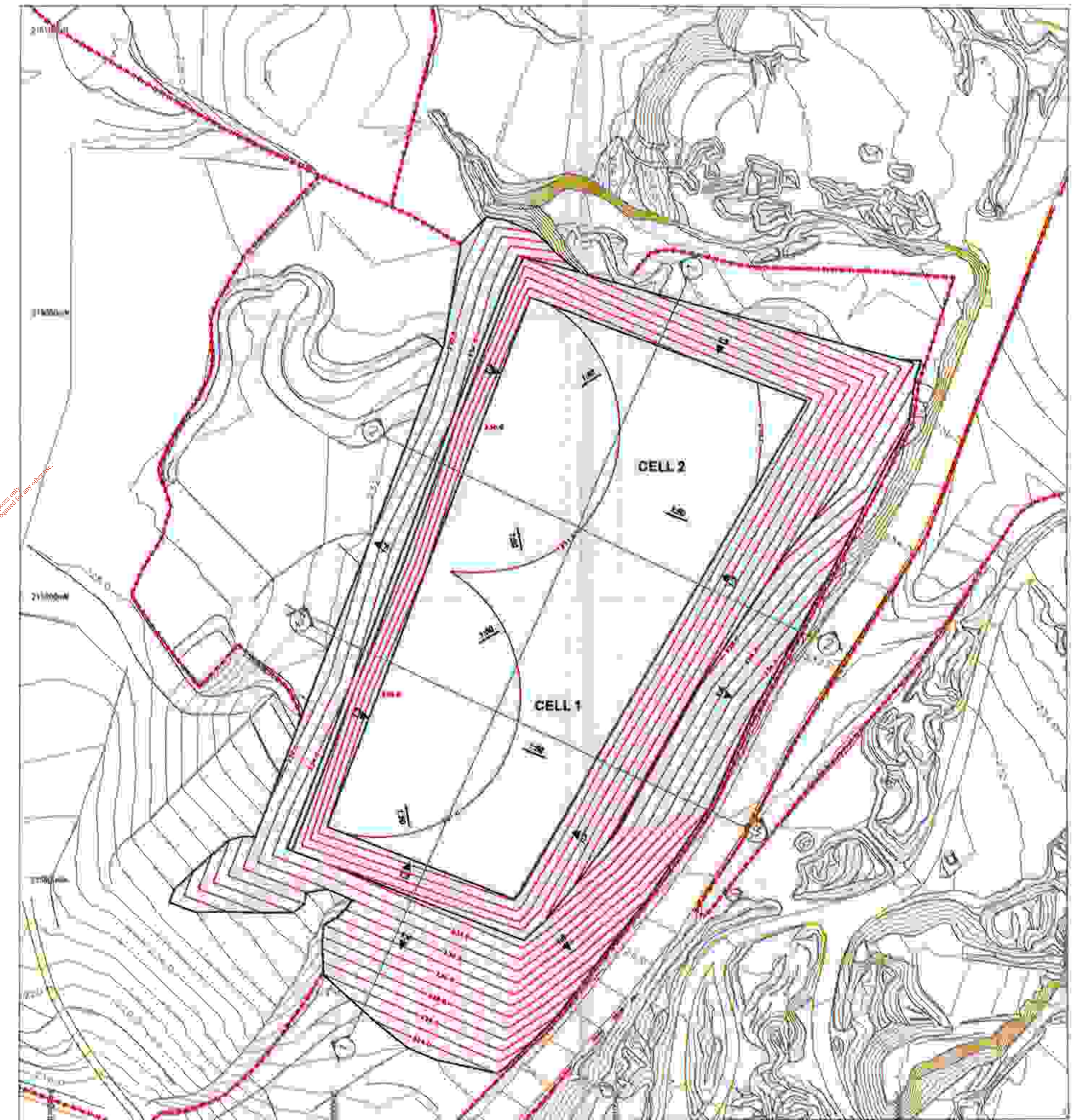
SECTION 1-1
1:500



SECTION 2-2
1:500



SECTION 3-3
1:500



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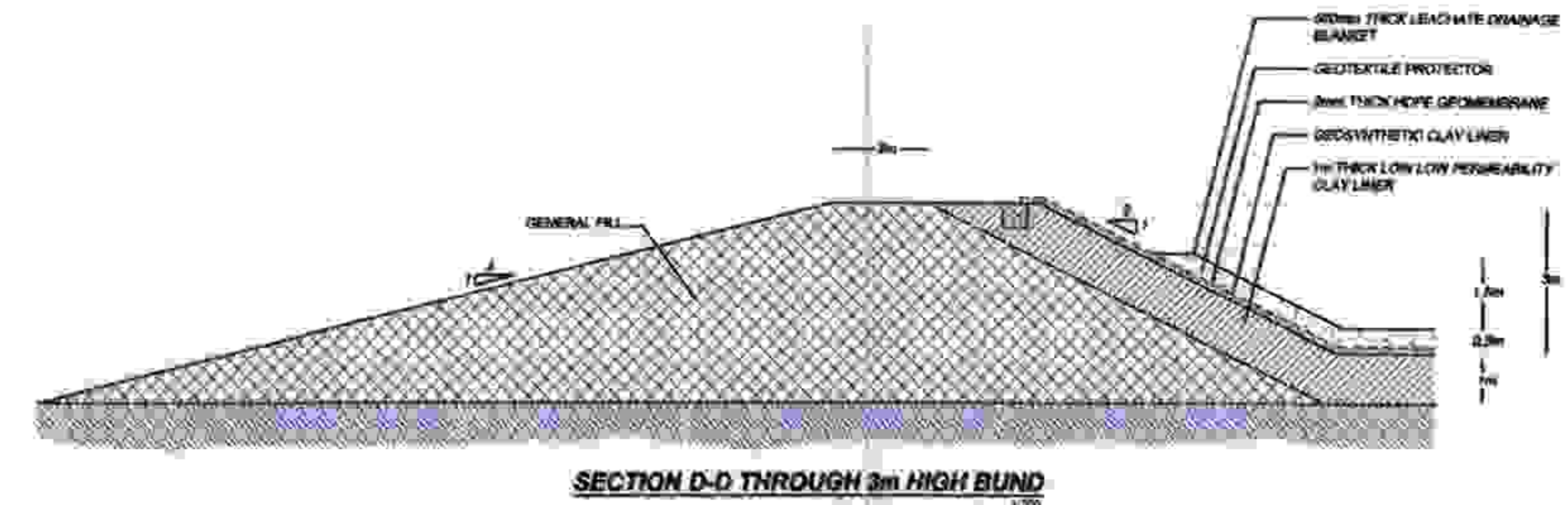
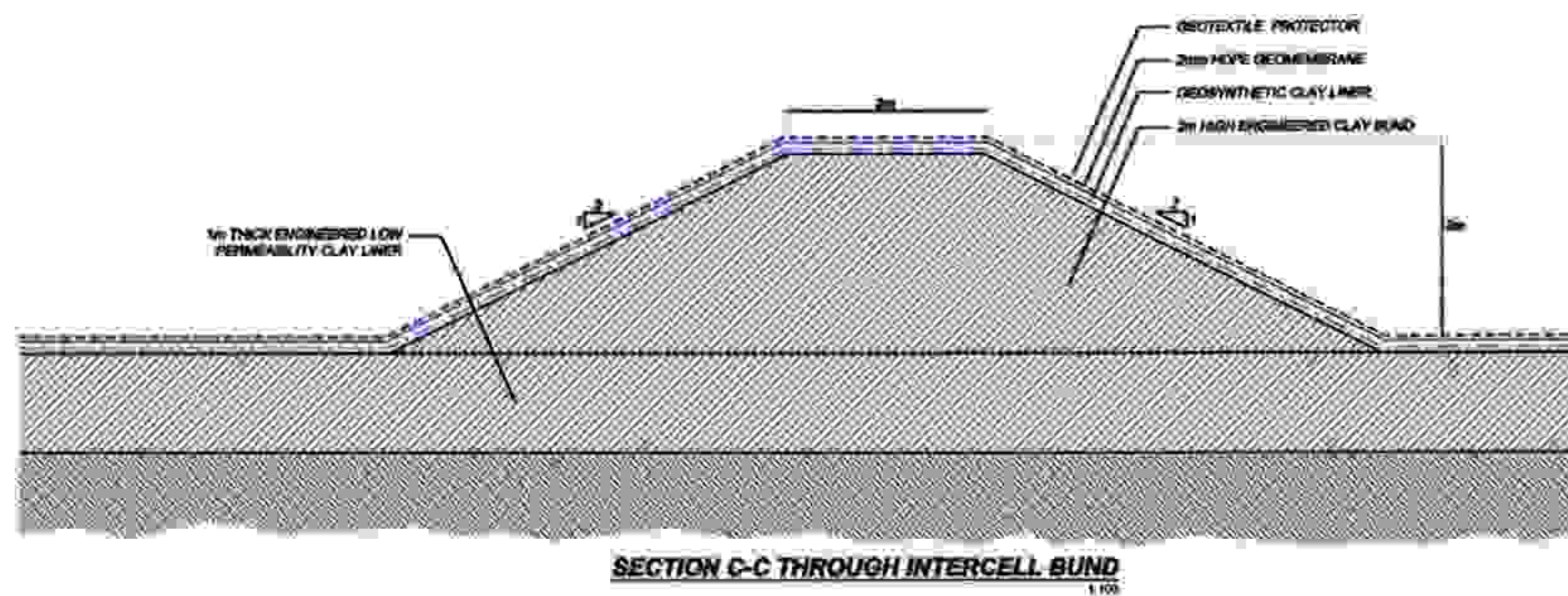
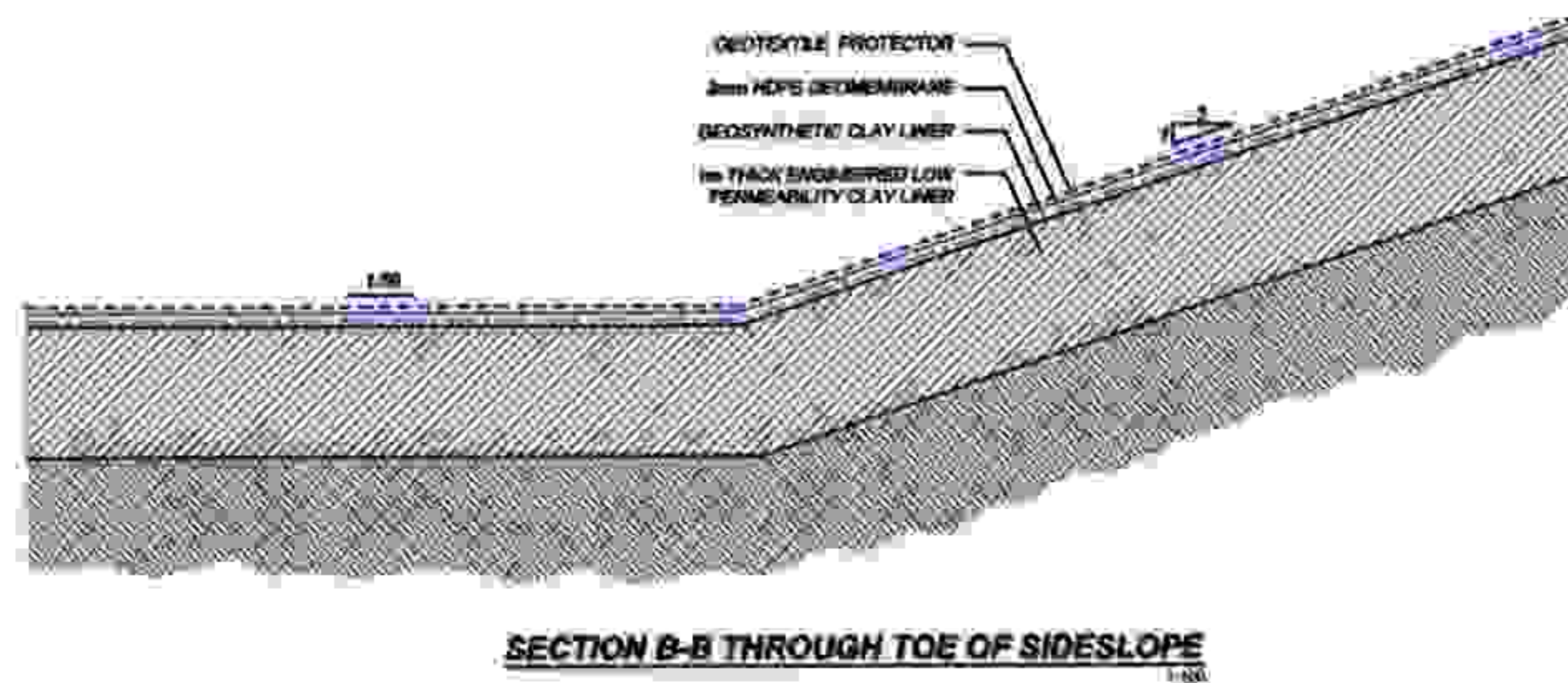
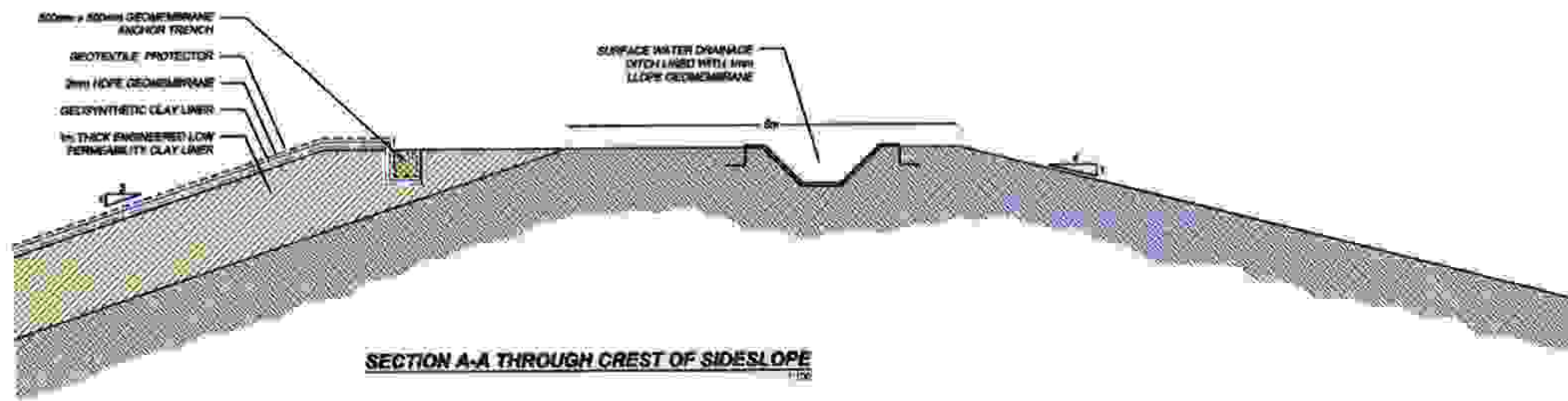
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— 244.00 —	EXISTING GROUND CONTOURS
— 235.00 —	FORMATION CONTOURS
— 225.00 —	TOP OF CLAY LINER CONTOURS
— 215.00 —	TEMPORARY WASTE CONTOURS
— 205.00 —	FINAL RESTORATION CONTOURS
—	ACCESS POINT TO LEACHATE RECIRCULATION SYSTEM
—	LEACHATE RECIRCULATION TRENCH

Rev.	Date	By	Description
2	April 04	PM	Contour Correction
1	Dec 03	PM	Cell Layout Revised
0	Jul 03	SMD	Cell Layout Revised

Site:	Lands at Blessington, Co. Wicklow
Project:	Remediation of Unauthorised Landfill Sites
Title:	Engineered Landfill : Basal Liner Formation Levels
Drawn:	JC/PM
Scale:	1:2,000
Job. No.:	2901/09
Date:	Dec. 2004

FIGURE 2.4



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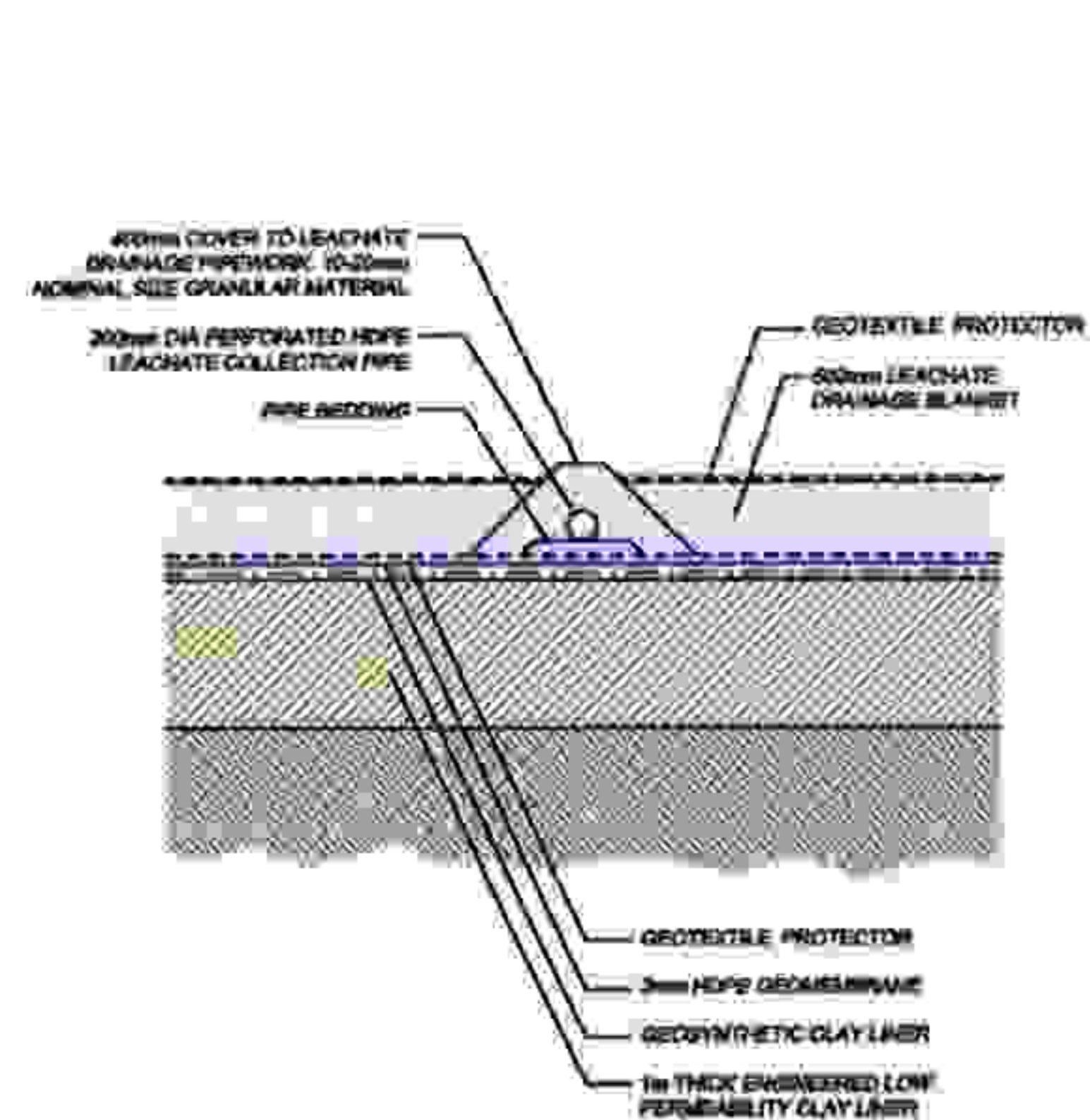
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- 231.10 — EXISTING GROUND CONTOURS
- 235.0 — FORMATION CONTOURS
- 230.0 — TOP OF CLAY LINER CONTOURS
- — GEOMEMBRANE ANCHOR TRENCH

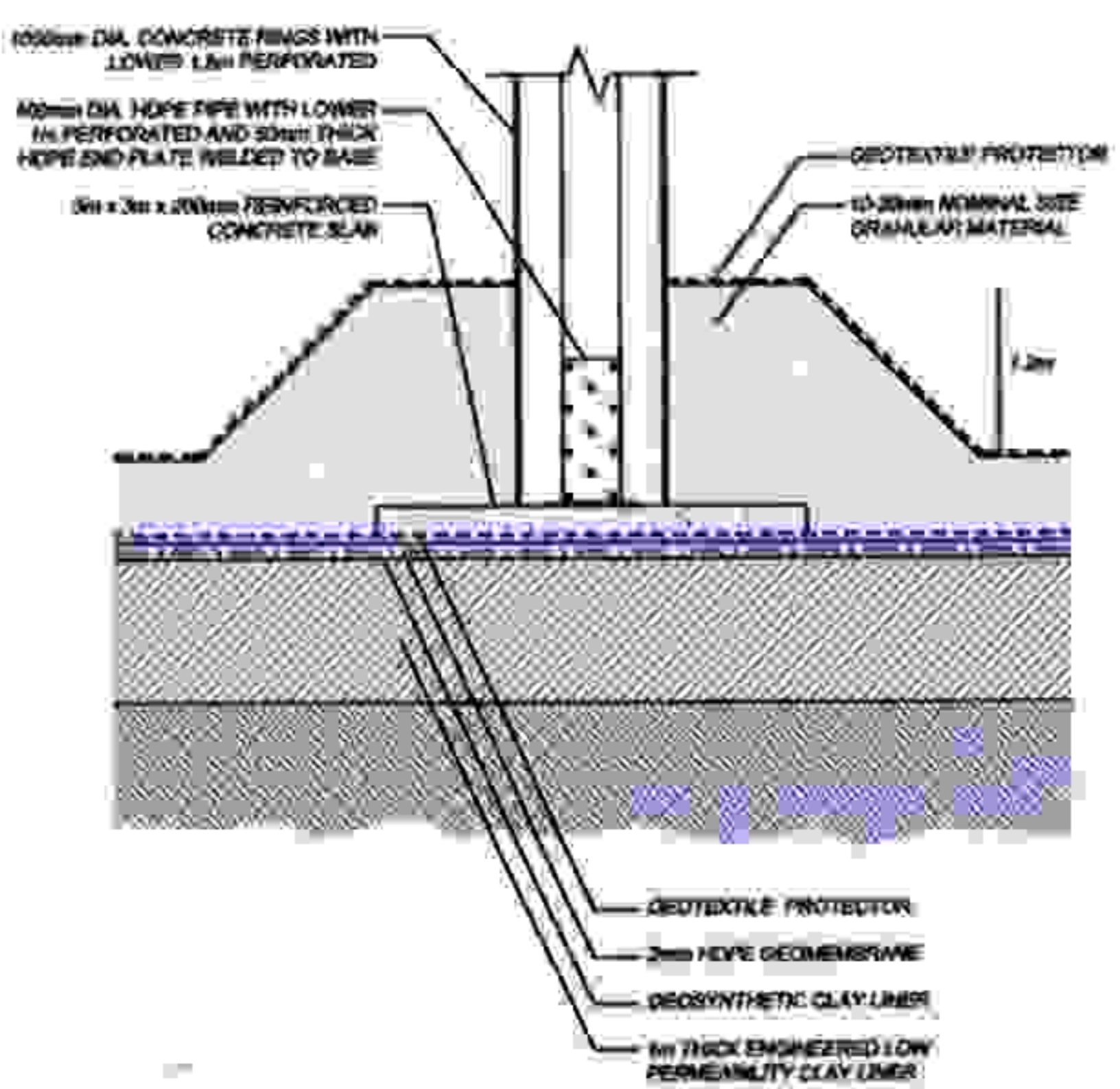
Rev.	Date	By	Description
2	April 04	PM	Contour Correction
1	Dec 03	PM	Cell Layout Revised
0	Jul 03	SMD	Cell Layout Revised

Site:	Lands at Blessington, Co. Wicklow
Project:	Remediation of Unauthorised Landfill Sites
Title:	Engineered Landfill : Bund Construction Details / Top of Liner Level
Drawn: JC/PM	Scale: 1:2,000
Job No: 2901/09	Date: Dec 2004

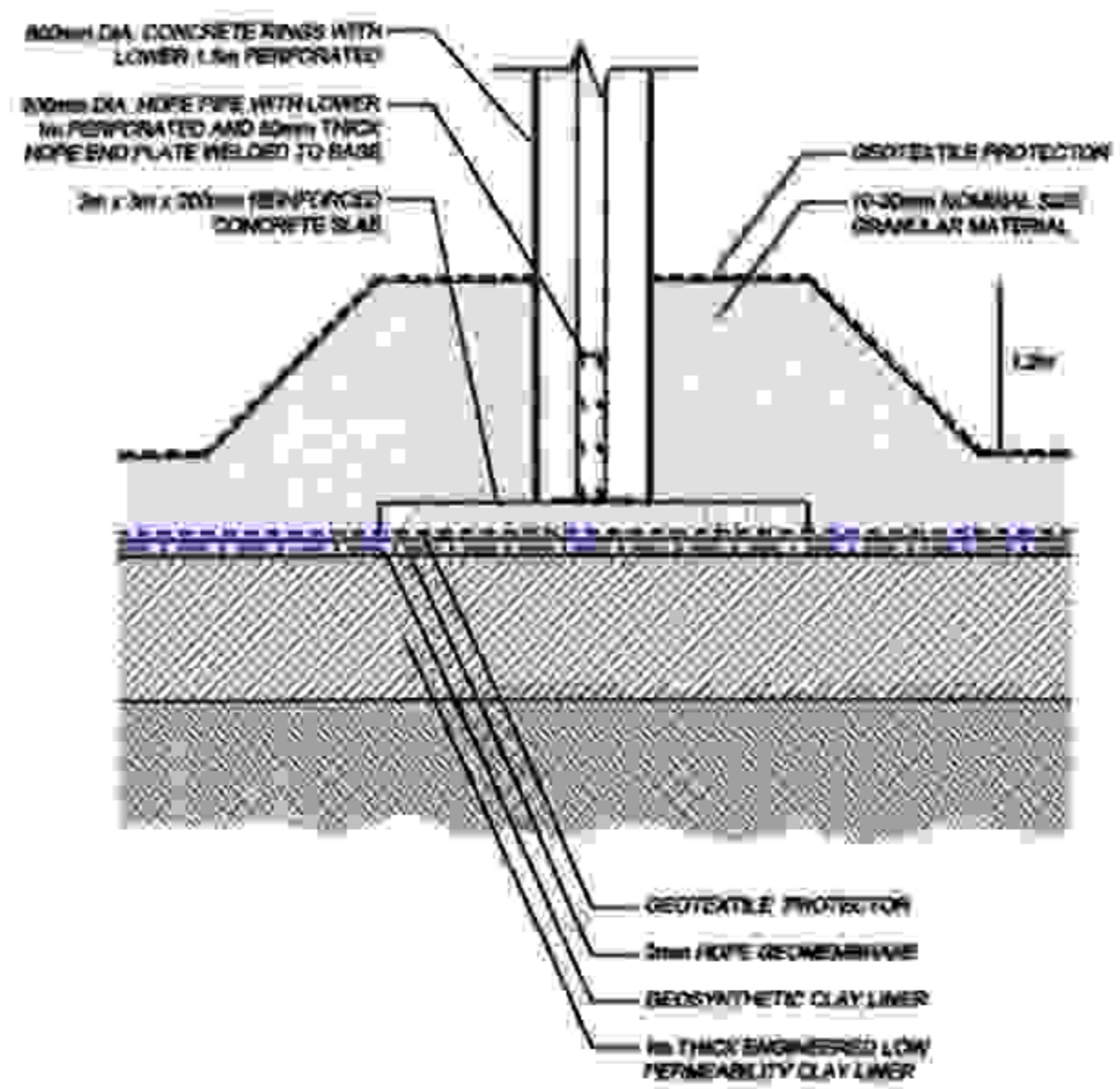
FIGURE 2.5



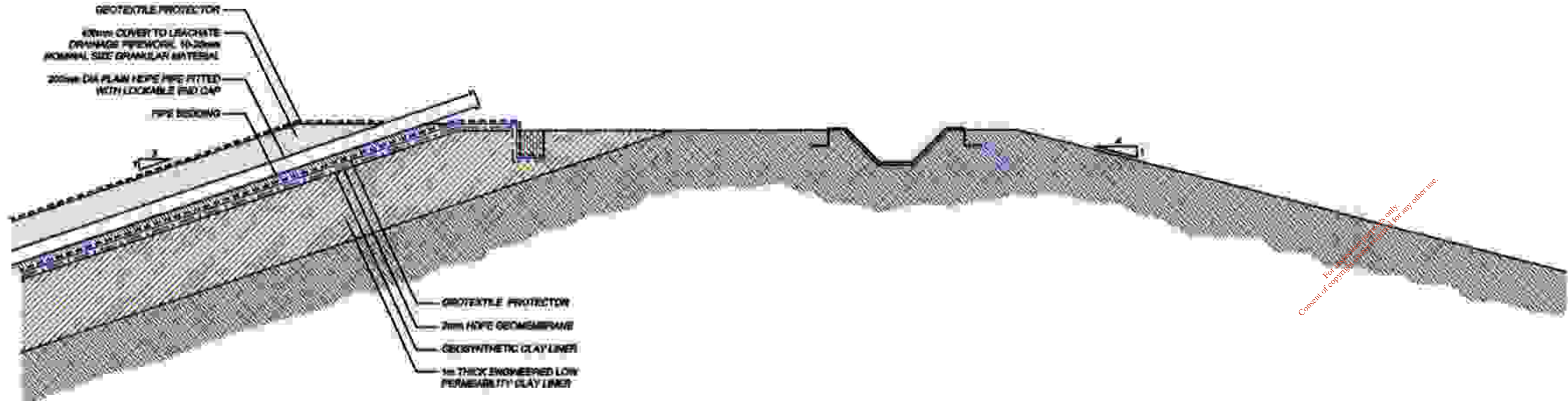
SECTION A-A THROUGH LEACHATE COLLECTION PIPEWORK
1:10



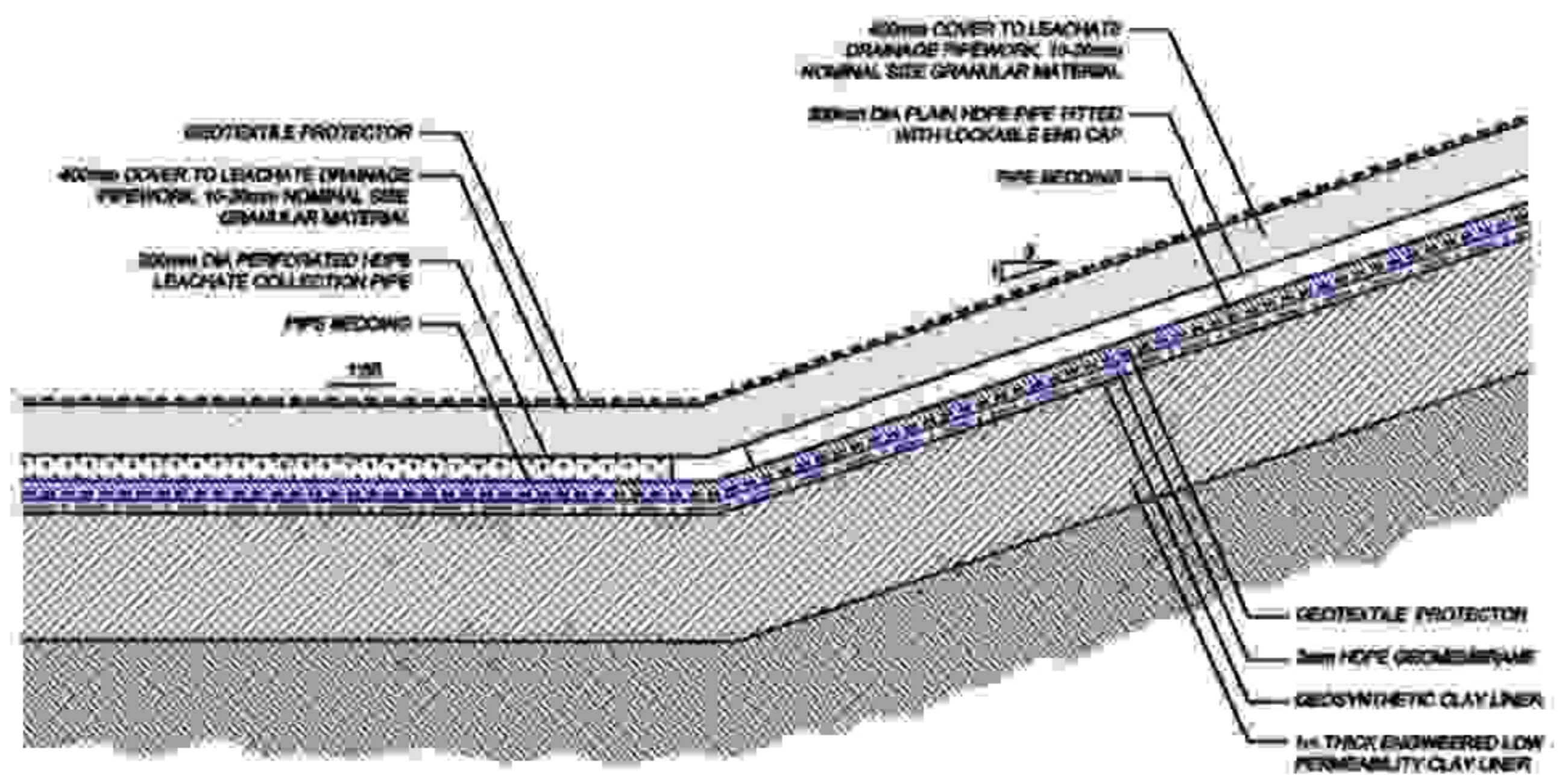
SECTION B-B THROUGH LEACHATE EXTRACTION WELL
1:10



SECTION C-C THROUGH LEACHATE MONITORING WELL
1:10



SECTION D-D THROUGH LEACHATE COLLECTION DRAIN AT CREST OF SIDESLOPE
1:10



SECTION E-E THROUGH LEACHATE COLLECTION DRAIN AT BASE OF SIDESLOPE
1:10



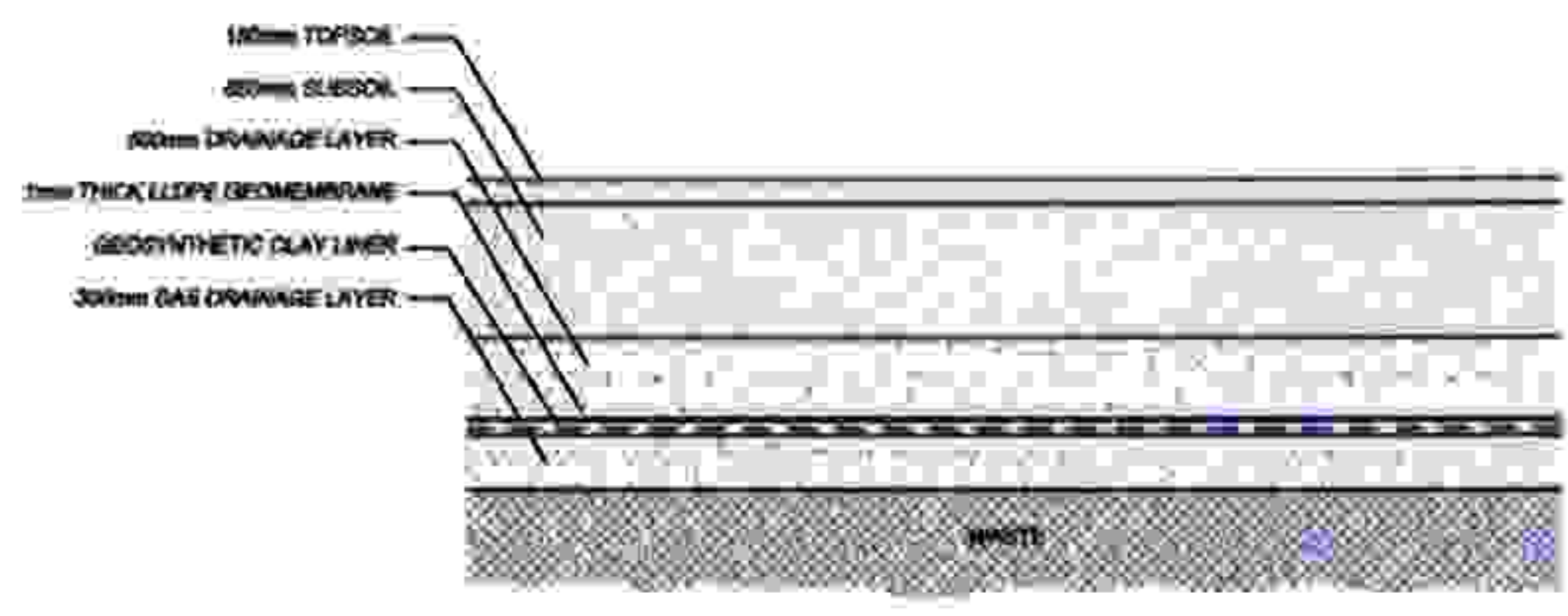
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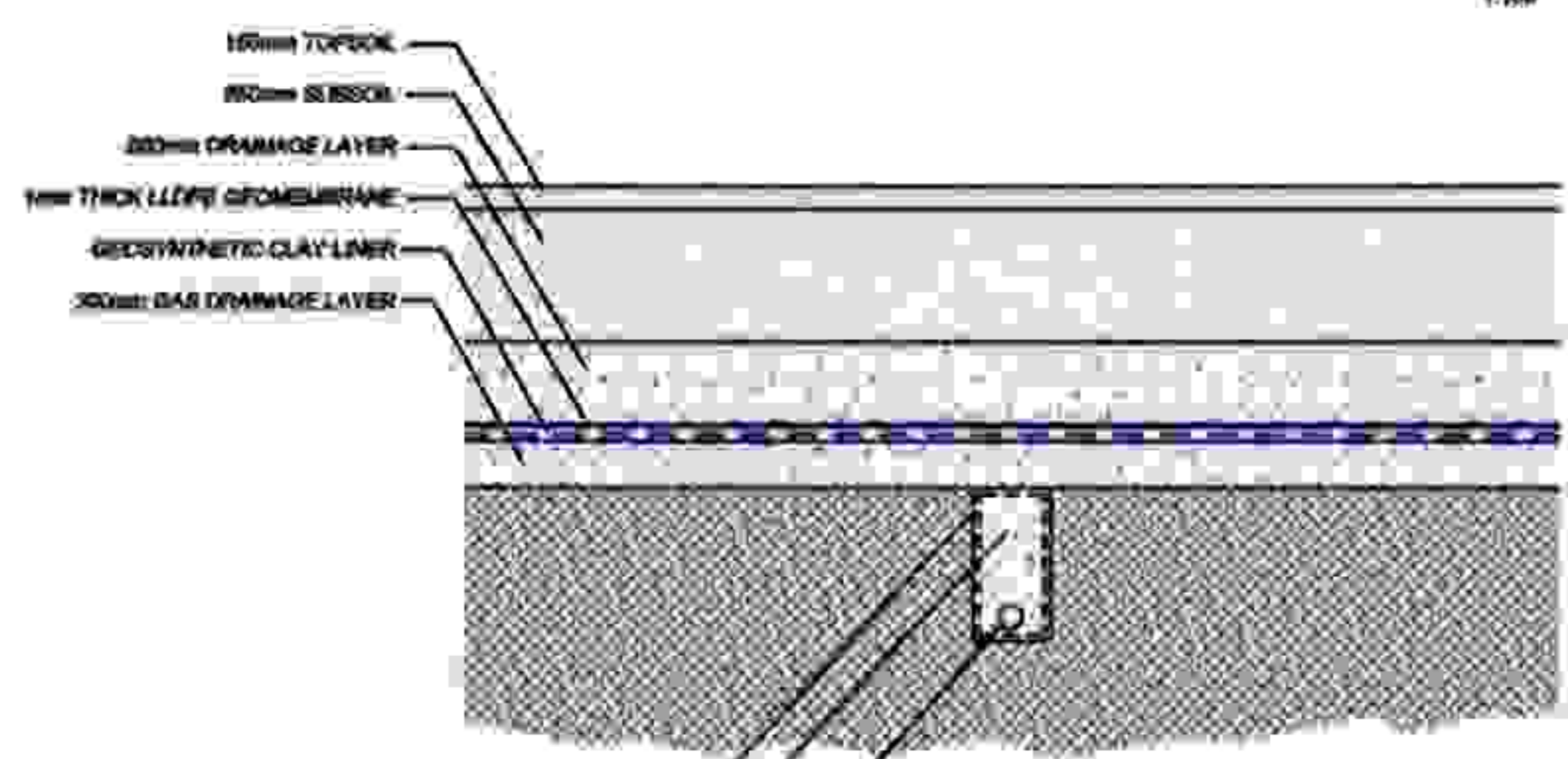
- - - - - EXISTING GROUND CONTOURS
 - - - - - FORMATION CONTOURS
 - - - - - TOP OF CLAY LINER CONTOURS
 - - - - - GEOMEMBRANE ANCHOR TRENCH
 - - - - - EXTENT OF LEACHATE DRAINAGE BLANKET
 - - - - - 200mm DIAMETER PERFORATED HDPE LEACHATE COLLECTION PIPEWORK
 - - - - - 200mm DIAMETER PLAN HDPE LEACHATE EXTRACTION PIPEWORK
 - - - - - LEACHATE EXTRACTION WELL LOCATION
 - - - - - LEACHATE MONITORING WELL LOCATION

Rev.	Date	By	Description
2	April 04	PM	Contour Correction
1	Dec 03	PM	Cell Layout Revised
0	Jul 03	SMD	Cell Layout Revised

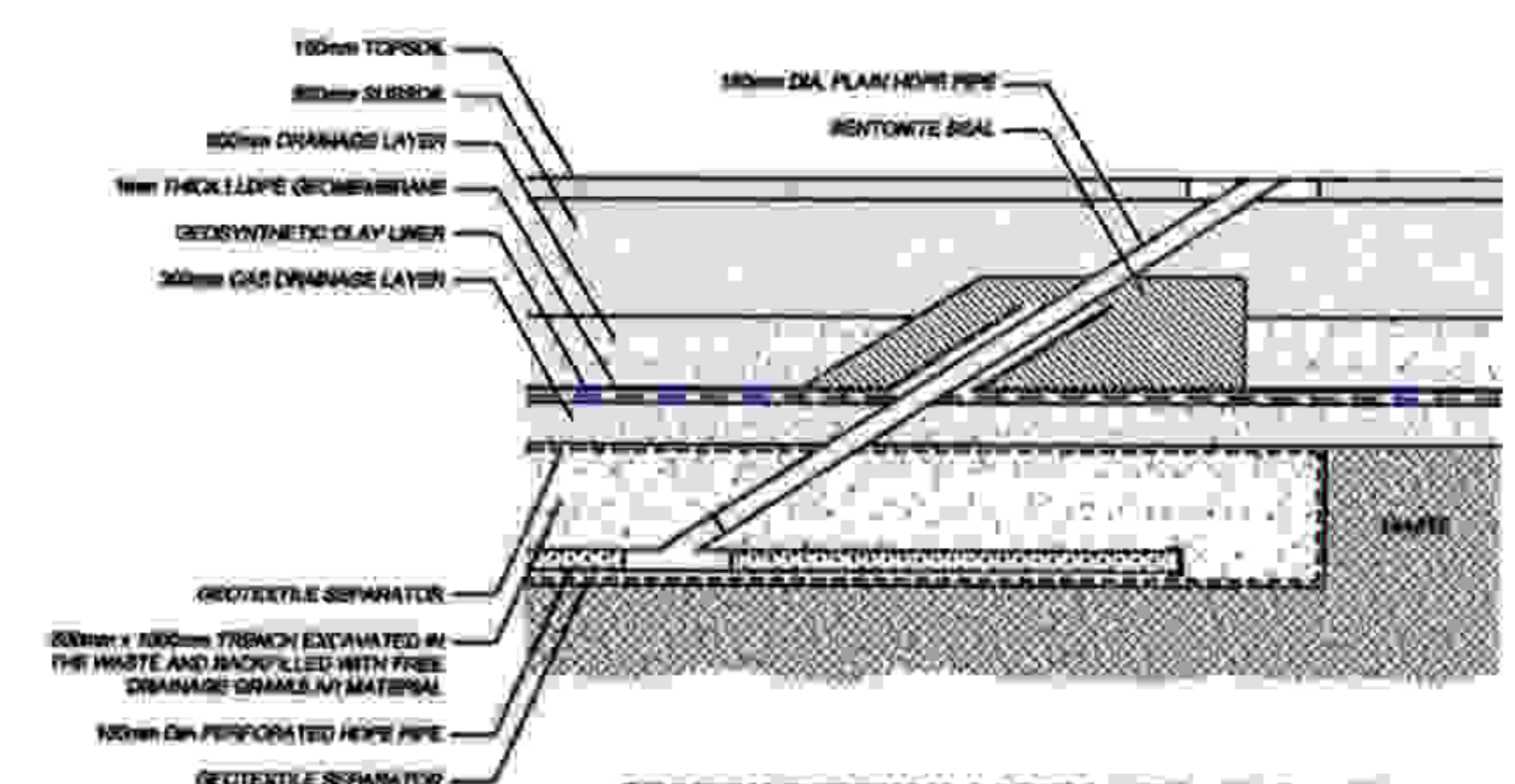
Site: Lands at Blessington, Co. Wicklow
 Project: Remediation of Unauthorised Landfill Sites
 Title: Engineered Landfill : Leachate Management System
 Drawn: JC/PM
 Scale: 1:2000
 Job. No: 2901/10
 Date: Dec 2004
FIGURE 2.6



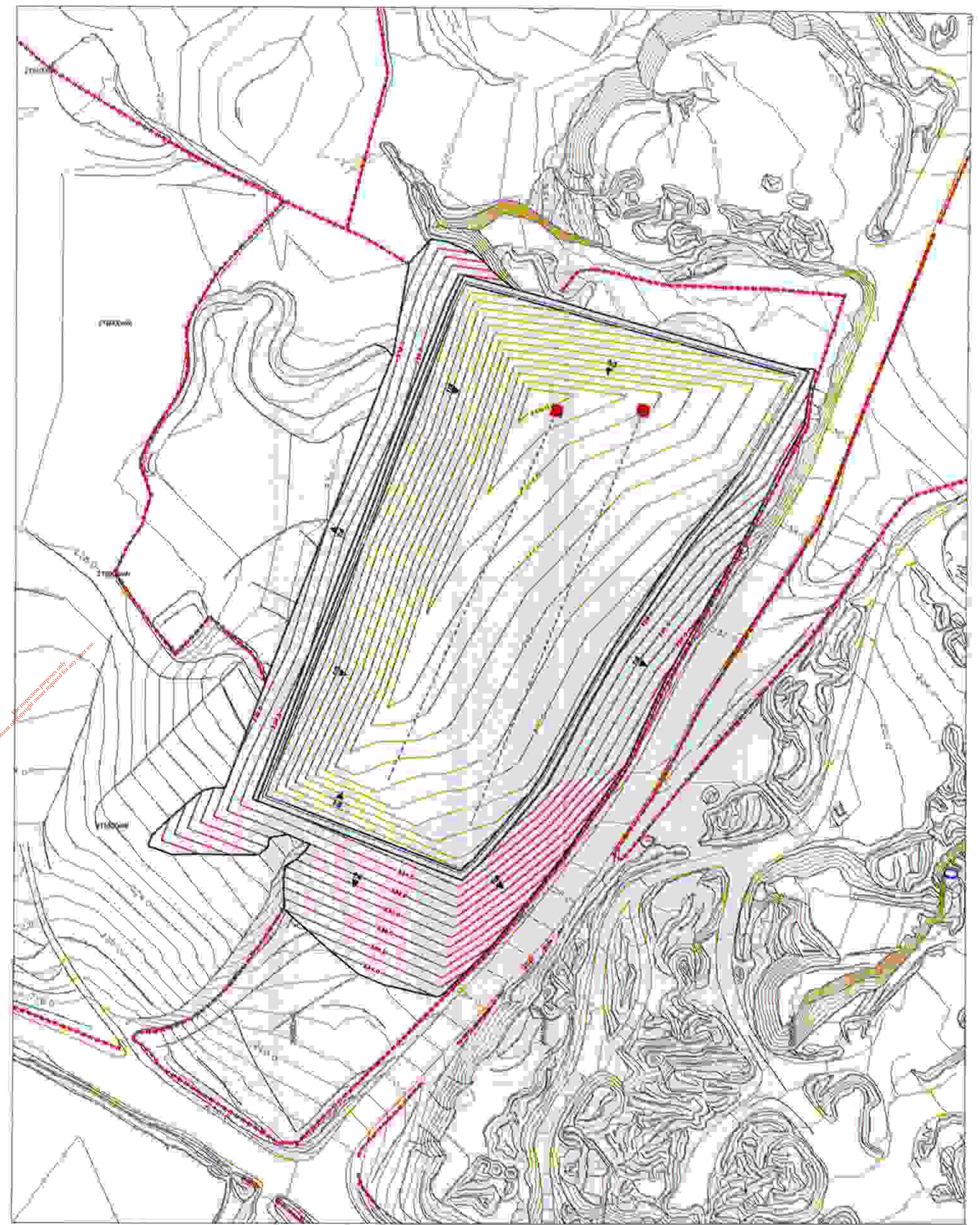
SECTION THROUGH GEOSYNTHETIC CAPPING SYSTEM
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SECTION THROUGH LEACHATE RECIRCULATION TRENCH (GEOSYNTHETIC CAP OPTION)
1:100



SECTION THROUGH ACCESS INTO LEACHATE RECIRCULATION SYSTEM (GEOSYNTHETIC CAP OPTION)
1:100



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— 242.0 — EXISTING GROUND CONTOURS
— 238.0 — FORMATION CONTOURS
— 235.0 — TOP OF CLAY LINER CONTOURS
— 234.0 — TEMPORARY WASTE CONTOURS
— 230.0 — FINAL RESTORATION CONTOURS
■ ACCESS POINT TO LEACHATE RECIRCULATION SYSTEM
--- LEACHATE RECIRCULATION TRENCH

Rev.	Date	By	Description
2	April 04	PM	Contour Correction
1	Dec 03	PM	Cell Layout Revised
0	Jul 03	SMD	Cell Layout Revised

Site: Lands at Blessington, Co. Wicklow
Project: Remediation of Unauthorised Landfill Sites
Title: Engineered Landfill Capping & Restoration Scheme
Drawn: JC/PM
Scale: 1:2,000
Job No: 2901/09
Date: Dec 2004

FIGURE 2.7