Corrib
natural gas

Corrib Gas Field Development

Environmental Impact Statement

Prepared in respect of the proposed Bellanaboy Bridge Gas Terminal and associated Srahmore Peat Deposition Site.

Volume 1:
Technical appendix 3
Proposed Bellanaboy Bridge Gas Terminal
Bellanaboy Bridge
Bellagelly South
Co. Mayo

Site Drainage

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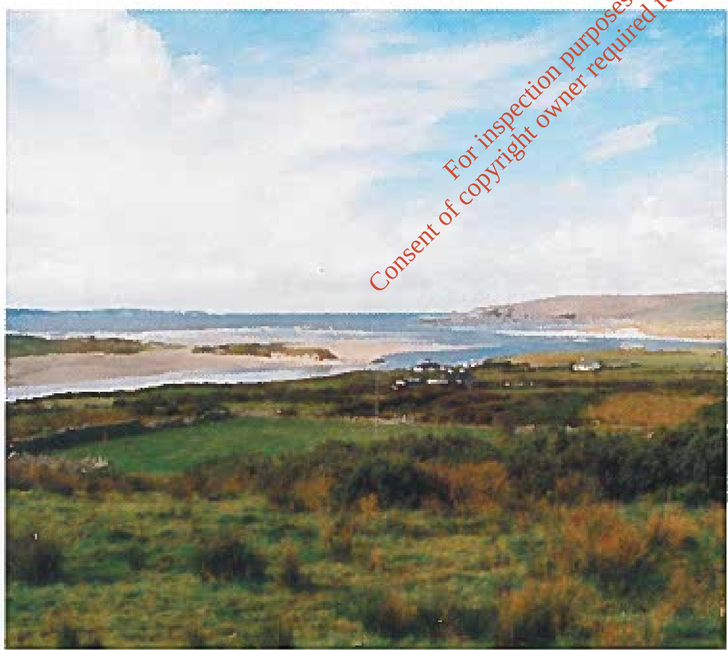

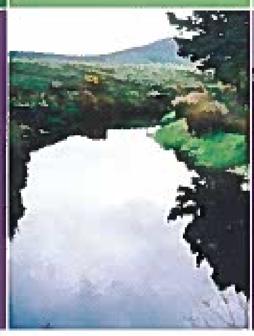

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Corrib Terminal: Bellanaboy Bridge

Site Drainage Report

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1. OVERVIEW

The drainage of the perimeter of the proposed terminal platform provides for separate surface water runoff and ground water collection networks. Each network has 2 branches each beginning at the northeast corner of the terminal. The first branch runs along the northern and western boundaries to the southwest corner of the terminal. The second branch runs along the eastern and southern boundaries also to the southwest corner. At the southwest corner of the terminal, the two branches of both the surface water and ground water collection networks are combined into a single carrier drain that conveys the water to the settlement ponds located to the southwest of the terminal. After the water passes through the settlement ponds, it is discharged to the open land north of road R314. After flowing overland, the runoff will enter an open channel on the northern side of road R314. The open channel crosses under road R314 in an existing culvert that outfalls to ditch D16.

A conservative approach has been taken towards the drainage design and associated calculations. This approach ensures that the drainage network will perform satisfactorily beyond the limits of "normal" rainfall events and will have no negative impacts on the existing watercourses. The following points reflect the level of conservative design:

- The surface water network is designed for the 1-in-100 year storm.
- The construction phase peak storm water runoff values are calculated for a 1 hour Time of Concentration to the settlement ponds, where field data suggests that the Time of Concentration for the site is in the order of 2 hours. This results in storm water flows, and in turn the size of the settlement ponds, that are larger than would normally be calculated for the 1-in-100 year storm.
- The peat suspended solids outflow values from the settlement ponds (i.e. pond efficiency) are based upon inflow from milled peat production areas, where a large amount of exposed peat would be in contact with the rainwater producing a large amount of suspended solids in the rainwater runoff. The inflow to the settlement ponds for the terminal will contain a much lower concentration of suspended solids because: (a) during the construction phase, the exposed peat will be limited to the excavation face and the windrowed peat, resulting in the vast majority of the drainage area having no disturbed peat to contribute suspended solids to the storm water runoff; (b) during the permanent phase, there will be no exposed peat surfaces to contribute suspended solids to the storm water runoff.

With the conservative design philosophy, the drainage network is designed to be robust and able to cater to storms more extreme than the 1-in-100 year storm without flooding. The settlement ponds are sized for the construction phase 1-in-100 year, 1-hour storm, whereas the actual time of concentration of 2 hours would likely reduce the 1-in-100 year flow to the settlement ponds by approximately 40 percent, thus allowing more settlement than calculated.

2. SURFACE WATER DRAINAGE

The perimeter surface water drainage network of the proposed terminal will collect the storm water runoff from the cutting and embankment slopes. The internal drainage system of the terminal also connects into the perimeter surface water network at eight locations as shown on Drawing COR-AR-SD-001.

2.1 Design Parameters

The design of the perimeter drainage system for the proposed terminal is based upon Met Eireann rainfall statistics for Bellmullet, County Mayo. The perimeter drainage network is designed for a 31mm of rainfall in one hour (1-in-100 year return period) storm, with no flooding in the 45mm of rainfall in one hour (approximately a 1-in-700 year return period) storm. Therefore, the storm water runoff flows freely within the drainage network when a 1-in-100 year storm (or less severe) is experienced. When a storm of severity greater than the 1-in-100 year is experienced, the drainage network is surcharged, but will not flood up to and including the 1-in-700 year return period storm. The perimeter drainage areas are calculated using an imperviousness of 100%, to be conservative. The perimeter surface water drainage system was designed using the Storm module of the software package MicroDrainage. The Simulation module was used to determine flowrates and flooding susceptibility for various return periods.

2.2 Construction Phase

During the construction of the terminal, the existing peat and portions of the underlying mineral soils and rock will be excavated from the site. Storm water runoff during the construction will be collected in sumps within the proposed terminal area and pumped to existing field drains to the west of the excavation face and the fire break ditch to the south of the proposed terminal. During construction the ditches that contain construction runoff will be diverted through the proposed settlement ponds (refer to Section 4.0) to remove the suspended solids from the runoff. The suspended solids in the runoff during the construction phase will include peat and silts as a result of excavating through the peat, mineral soils and rock layers.

As a part of the construction phase, the roads to the north, east and west of the proposed terminal will be upgraded by means of soil stabilization. The roads vary in width from 6 to 15 metres with sheet piling along the edge of the stabilized peat for the primary access roads as shown on Drawing COR-AR-SD-006. A 0.5 metre thick layer of stone will be placed on top of the stabilized peat, with geotextile fabric between the stone and stablized peat. The roads will be drained by open channels located outside of the sheet piling and will follow the topography of the existing ground. During the construction phase, the road drainage will be diverted through the settlement ponds. Where the road drainage cannot hydraulically reach the main settlement ponds, smaller settlement ponds, similar to the settlement ponds located along the field drains, will be constructed near the end of the stabilized road. Drawing COR-AR-SD-006 shows the location and details of the open channels and settlement ponds during the construction phase.

Since the existing open channels are used in the conveyance system of the storm water runoff to the settlement ponds during the construction phase, the drainage area to the settlement ponds includes the entire area that drains to the open channels, not just the terminal and embankment footprint. In total, during the construction phase the drainage area to the settlement ponds is 35.4 hectares. The peak runoff from the 100-year, 60-minute storm (31 mm/hr intensity) is 3.05 m^3/s, see Calculation 1. Although the peak flow will be distributed between the D12 to the west and the D99 to the south, as shown on Drawing COR-AR-SD-

006, each ditch alone has capacity for the entire construction phase 1-in-100 year runoff. Calculation 2 shows that the capacity of D12 is 4.4 m^3/s and D99 is 3.25 m^3/s.

The flow in the open channels D12 and D99 will be collected into the surface water drain by constructing a headwall in the channel to divert the flow into the drain. A surface water manhole will be constructed to combine the two diverted ditches from which the 900 mm diameter polyethylene drain will convey the flow to the settlement ponds. After the construction phase is completed, the open channels D12 and D99 will be reinstated to operate as they did prior to construction. The manhole and pipework flowing to the settlement ponds will be incorporated into the permanent drainage network for the terminal.

The surface water drain, to convey the diverted open drains to the settling ponds, was designed using MicroDrainage and the results are presented as Calculation 3.

2.3 Permanent Phase

The terminal is to be constructed at a level of 33.4m AOD Malin Head. The area in which the terminal is currently located has elevations ranging from 43mAOD to 31mAOD; therefore the majority of the terminal footprint will be excavated to a level of 33.4mAOD. The cutting slopes are primarily on the northern and eastern terminal boundaries, where up to 10.5 metres depth are to be excavated. Minor cutting and embankment slopes can be found on the western and southern boundaries.

The cutting slopes generally have gradients of 1:1 through rock, 1:3 through mineral soils and the peat faces are retained by stone gabions. Since the existing elevations are falling generally to the south, the existing field drains north of the top of the northern cutting slope will be maintained, to minimise the amount of surface water runoff from the adjacent land draining to the perimeter drainage system.

The southern portion of the proposed terminal will be constructed in fill. In this portion of the terminal, the platform will be at an elevation higher than the existing ground; therefore an embankment will be required from the terminal level to the existing ground level.

As mentioned in the above section, cut or embankment slopes surround the majority of the terminal footprint. Therefore a drainage system will be required along the perimeter of the terminal, primarily at the bottom of the cut or embankment slopes and at the base of the gabion retaining walls to collect the surface water. It is proposed to utilise an ACO channel to collect the surface water runoff which discharges to an underground surface water drain via silt/grit traps. The areas draining to the ACO channel are shown on Drawing COR-AR-SD-001.

In addition to surface water runoff from the cuttings and embankments, the perimeter drainage system also collects the surface water runoff from the terminal footprint. The terminal has eight connection points into the perimeter surface water drain, as shown on Drawing COR-AR-SD-001. The internal terminal drainage network was designed by AMEC Capital Projects Ltd. and is shown on drawing COR-AM-TD-001. The drainage areas and time of concentrations for each connection, as provided by AMEC, are shown as Calculation 4.

The perimeter drainage network is designed for a 1-in-100 year return period storm, with no flooding in the 1-in-700 year return period storm. Therefore, the storm water runoff flows freely within the drainage network when a 1-in-100 year (or less severe) is experienced. When a storm of severity greater than the 1-in-100 year is experienced, the drainage network is surcharged, but will not flood up to and including the 1-in-700 year return period storm. The results of the terminal perimeter drain 1-in-100 year Storm model and the 1-in-700 year Simulation model are presented as Calculation 5.

As described in the overview, the proposed perimeter drainage system has 2 branches. The first branch starting near the northeast corner and running along the northern and western boundaries is represented by pipe numbers (PN) 1.000 through 1.011. The second branch, with pipe numbers 6.000 through 6.012, also starts near the northeast corner and runs along the eastern and southern boundaries of the proposed terminal. Pipe numbers 1.012 through 1.016 represent the carrier drain that conveys the perimeter drainage to the proposed settlement ponds. This portion of the surface water network does not pick up any additional drainage areas. As shown in Calculation 5, the peak 1-in-100 year flow rate from the terminal perimeter drainage system is 0.973 m^3/s.

The AMEC report "Civils Drainage Philosophy and Calculations" presents the design of the drainage network within the terminal footprint and is included as an appendix to this report.

3. GROUND WATER DRAINAGE

Setting the platform level at +33.4mAOD Malin Head minimises the impact on the principal (bedrock) groundwater body on the site. Nevertheless, because of the expected variation in bedrock groundwater level within the terminal footprint area, bedrock groundwater level will be intersected in places, particularly towards the northeastern corner of the site where water levels are judged to be highest. In addition, the two shallower groundwater bodies – that are associated with the shallow mineral soils below the peat (so-called 'A' horizon water body) and that associated with the upper part of the peat, will also be intersected. Although the volume of water contained in these latter two groundwater units is very small, by comparison with the bedrock groundwater unit, they will nevertheless provide a source of free water during the earthworks phase of construction and a potential source of seepage (from cuttings) in the longer term. In addition, the peat, which is expected to be near to full saturation, may contain pockets of water, which may issue when these soils are excavated.

In order to minimise:

- the impact of groundwater, generally, on construction and on operation of the terminal;
- the potential for the construction to create negative environmental impacts on the groundwater and those environmental features dependent on the groundwater;

a two-stage approach is being adopted. Temporary construction dewatering will be installed, initially, to be replaced by a system of permanent groundwater control drainage.

3.1 Construction Groundwater Control

A series of dewatering wells will be installed in advance of the main earthworks phase in order to remove as much water as possible from those materials that have to be excavated, before excavation commences. This dewatering is very important in terms of bringing the materials to a condition whereby they can be excavated, handled, transported and trafficked upon with the minimum of difficulty.

Two lines of dewatering wells are proposed, one extending into the northeastern corner of the site, the other along the southwestern half of the site. The former line of wells will cut off the water that drains onto the site through the bedrock from north of the site; this is seen as being the principal source of groundwater entering the site. By removing this source of groundwater recharge and lowering the groundwater level beneath those parts of the site where it is highest, these wells will serve two very useful functions. The second line of wells will be installed along a zone of the site where bedrock groundwater levels have been observed above the rock level. In this area, bedrock groundwater levels are at or very close to the present ground surface. The principal aim of these wells is to lower this high groundwater table

Collectively however, the two lines of dewatering wells also serve another function, which is made possible, firstly, by the way in which the wells are designed to be operated and, secondly, by the particular geology of the site. The wells are designed as vacuum wells, which means that they will physically suck water from the ground, rather than allow the water to drain under gravity, as with a conventional well. This vacuum effect is necessary because of the relatively low permeability of the materials that are to be dewatered. It also means that each well will command a larger catchment area than would otherwise be the case. Conventional pumps will be used to lift the water to the surface. The particular geological features of the site that makes vacuum wells particularly appropriate are:

- A higher permeability layer within the bedrock, extending at depth beneath the site, which means that a strong downward gradient of water flow (underdrainage) can be induced in those materials that have to be excavated.

- A capping layer of very low permeability peat, which will prevent premature air penetration to the well and bypassing of water flow.

The vacuum dewatering will give rise to an effect similar to a temporary consolidation pressure of up to 90kPa (the maximum that can be achieved without cavitation of the water). This effect will be similar to squeezing water out of the compressible soils so that during the excavation phase, when the ground is effectively unloaded, these soils will not only be at a lower moisture content but remnant suction will help to hold the soil together. Clearly, without the continuous capping layer of peat, air would have the opportunity of entering the ground and rapidly bypass the water flow to the wells.

It is evident that air entry will occur once the peat is excavated and so the dewatering wells are expected to become less effective with time. However, the earthworks will be phased to maximise the usefulness and operational time of the dewatering wells. Stripping of peat will commence in the northeastern corner of terminal where the peat is driest and thinnest, and where rock is closest to the surface. Once the peat is stripped in this area, the dewatering wells will continue to operate as conventional (non-vacuum) pumping wells to maintain bedrock water levels at suitably depressed levels. Peat stripping will progress south-westwards across the site, followed by excavation of the underlying mineral soils and rock in the stripped areas, in this way the lower line of dewatering wells will be kept fully operational for as long as possible.

Pumping of the dewatering wells will cease following completion of the earthworks. However, consideration may be given to using some of the wells for long term monitoring of groundwater within the terminal area.

3.2 Handling of Surface Water During Construction

Surface precipitation water and the anticipated small amount of water that emerges from the ground during construction will be dealt with by temporary surface drainage measures. To promote run-off and reduce percolation of surface water into the ground, excavated surfaces will be cut to falls and any surfaces that are to be left exposed on a temporary basis, will be sealed by light rolling and soil modification, as required. This is good engineering practice since it minimises the risk of wetting up of soil materials that can become softened by excess moisture. Not to do so would be to defeat the object of dewatering. Surface water will be channelled into sumps along a series of grips cut or formed in the surface. From the sumps, the water will be pumped using conventional suction-pumps and hoses into the settling pond.

Water raised to the surface in the dewatering wells will be collected in a common header pipe and also pumped to the settlement pond.

3.3 Permanent Groundwater Control Drainage

As the Terminal Platform is nearing completion the permanent surface water and groundwater drainage system will be established around the perimeter of the platform.

The drain will be excavated as a continuous trench with falls away in both directions from the northeast corner. A porous pipe will be installed in the base of the trench with free-draining crushed stone backfill up to approximately 0.5m below formation level. Drawing COR-AR-SD-002 shows the location and typical cross section of the ground water drain. Through intact rock the trench will not be lined, but in weathered rock and in mineral soil a geotextile filter fabric liner will be used to prevent penetration of soil and fines into the crushed stone backfill. The upper part of the trench will contain an ACO channel to collect the surface water runoff from the cutting slopes, as described in Section 2.3.

The main purpose of this groundwater drain is to take over the function of the upper line of dewatering wells in controlling the (bedrock) groundwater levels. The drain will set an upper limit on the level to which groundwater can rise around the edge of the site defined by cutting slopes. By creating a conduit for groundwater (essentially the porous pipe), whose flow capacity is orders of magnitude higher than the permeability of the ground, groundwater will flow preferentially towards the drain. Groundwater levels will be drawn down to the level of the drain, so that cutting slopes will remain essentially dry (i.e. free from seepage) and thus stable. The maximum flow in this groundwater drain is expected to be 25 l/s. Any localised significant seepage that might occur in cutting faces during excavation, which does not rapidly dry up, will be dealt with by a face drainage system installed in the face of the cutting. This will apply particularly to mineral soil cuttings in which seepage may occur from the 'A' horizon. The face drains (essentially trenches filled with free-draining crushed stone) will be connected to the main groundwater toe drain.

At intervals along the groundwater toe drain, silt traps will be installed in the form of deeper concrete-lined sumps. These sumps will define the length of completed drain during the progress of its construction, as the earthworks gradually extend across the site. The invert of the inlet to each silt trap will be slightly higher than that of the outlet so that a cascade effect is developed. This is to promote aeration (oxygenation) of the water and thus the precipitation of iron and manganese (as oxides). By removing these metals (which tend to occur at quite high concentrations dissolved in the bedrock groundwater) along the length of the drain run, the settlement pond will be relieved of this burden.

Completion of the surface drain part of this combined surface and groundwater platform-perimeter drain is discussed in the Permanent Surface Drainage section.

A separate groundwater drain will also be installed at the base of the fill along the southern edge of the terminal site, see Drawing COR-AR-SD-002. The purpose of this drain is to set a limit on the potential rise of groundwater within the fill. It is planned to define the line of this drain by means of sheet piling installed through the peat into the underlying mineral soil. This line of sheet piles is required, temporarily, to support the peat to the south that will not be excavated. By creating a vertical (rather than sloping) edge to the excavation, the volume of peat to be taken off-site can thus be minimised. A vertical bank of fill will be created (by reinforced earth construction) on the excavation side of the sheet piling, but set back from the sheet piling in order to form a trench between the sheet piling and the fill. A porous pipe drain, embedded in free-draining crushed stone, will be installed in the base of this trench, in similar fashion to the previously described cutting toe drain. The sectional area of free-draining backfill will be approximately 1m^2 (1m wide x 1m deep) and the backfill will be completely wrapped in geotextile filter fabric. Above the level of the drain, fill will be placed directly against the sheet piling, so this will be a buried drain. It will also be isolated from the peat to the south by virtue of the sheet piling and so there will be no adverse effect on the hydrology of the peat. The maximum flow in this groundwater drain is expected to be 72 l/s.

Since far less iron and manganese is present in the mineral soil groundwater at this elevation on the site, there is no requirement for silt traps along this drain, as with the cutting toe drain.

4. SETTLEMENT PONDS

In order to reduce the concentration of suspended solids in the surface water run-off from the site, both during the construction and permanent phases of the works, settlement ponds for the collection of suspended solids have been included in the drainage network.

The main settlement ponds are provided as two identical ponds working in parallel, as shown on Drawing COR-AR-SD-003. The ponds have been located to fit into the local topography and have a width of 20 metres and a total depth of 2 metres with a rectangular cross section. From this arrangement, the minimum cross-sectional flow area of each pond is $20m^2$ when the maximum 1m allowable depth of sludge is present.

4.1 Design Parameters

In order to facilitate the settlement of the suspended solids within the settlement ponds during construction, it will be necessary to limit the velocity of the water through the settlement pond for two reasons. First, to allow the peat particles sufficient time to settle, the maximum slowest fall velocity of the suspended peat within the pond flow should be 0.045 mm/sec in order to achieve 30 mg/l of suspended solids discharged from the outflow weir and 0.25 mm/sec to achieve 60 mg/l of suspended solids from the weir. The suspended peat fall velocity is a function of the water flow velocity, depth of water over the outfall weir and length of the settlement pond. The determination of the fall velocity is presented in Calculation 6. Secondly, in order to keep settled peat from re-entraining into the water, the maximum velocity of the water within the settlement ponds can be no greater than 0.1 m/s.

The settling pond design is based on the peak runoff during the construction phase, which is greater than the peak runoff during the permanent phase due to the larger drainage area. The settlement ponds have been sized so that the water velocity within the pond will reduce the suspended solids concentration to <30 mg/l for 80% of the peak annual storms and to <100 mg/l for 99% of the peak annual storms.

The above design assumptions also correlate with the Bord na Móna IPC Licence 505 for Owininny Work Bellacorick (1) and Bord na Mona practice as described by Harkins (2) and Irz (3). These criteria have been derived from many years of observation of settling pond performance (see summaries in Harkins and Irz).

Ponds designed in accordance with these criteria are reported to reduce the level of suspended solids to <30 mg/l for 80% of the peak annual storms and to <100 mg/l for 99% of the peak annual storms. The periods of poor performance are typically from dry peat debris washing into the drain system during excavation and maintenance of drains and peat production. These conditions will not exist at the terminal site because the peat will be removed before it can dry out.

The settled solids will be removed from the pond as required during the construction phase of the works along with the permanent phase of operations. The ponds have a total of 2 metres of depth, with the lower 1 metre used for settled solids storage, at which point the pond is considered full and in need of desludging. During the desludging activities, the pond to be cleaned will be taken offline using stoplogs to prevent the inflow water to the pond and divert any flow to the online pond. As either pond approaches it's capacity of settled solids, the desludging activities will be coordinated with the weather forecast to ensure that both ponds are in operation during a storm.

4.2 Construction Phase

Since the area draining to the settlement ponds in the construction phase is significantly larger than in the permanent phase, the allowable suspended solids requirements, and therefore the length of the pond will be dictated by the construction phase activities. In order to meet the criteria of limiting suspended solids to <30 mg/l for 80% of the peak annual storms, the 1-in-5 year return period storm, with a 15 mm/hr intensity, was used as the design storm, as this storm has a 20% chance of occurrence in any given year. The peak 1-in-5 year flowrate to the pond from the construction phase activities, roads and surrounding areas is 1.48 m^3/s. The maximum velocity through the settlement ponds is 0.037 m/s and to achieve the slowest fall velocity of 0.045 mm/s, the required length of the pond is 70 metres. Calculation 6 shows the calculations used to derive the required pond length.

In order to limit the suspended solids to <100 mg/l for 99% of the peak annual storms, the 1-in-100 year return period storm, with a 31 mm/hr intensity, was used as this storm has a 1% chance of occurrence in any given year. The peak 1-in-100 year flowrate to the pond during the construction phase is 3.05 m^3/s. The maximum velocity through the settlement ponds is 0.076 m/s through the 70 metre long pond, as sized to limit suspended solids in the outflow to <30 mg/l. Given these design parameters, the slowest fall velocity is 0.14 mm/sec, which relates to approximately 45 mg/l of suspended solids in the outflow. Since this value of 45 mg/l occurring in 1% of the peak annual storms (meaning <45 mg/l for 99% of the peak annual storms) provides cleaner outflow than the target of <100 mg/l occurring 99% of the peak annual storms, the pond length (70 metres) as determined by the 30 mg/l target is sufficient to meet the design criteria. Calculation 6 also shows the calculations used to check the suspended solids settlement of the 1-in-100 year flow within the settlement ponds

4.3 Permanent Phase

Since the settlement ponds were sized for the larger peak flowrate during the construction activities, the size of the ponds will be sufficient to meet the design criteria for the permanent phase. During the permanent phase the peak 1-in-5 year runoff is 0.507 m^3/s, yielding a maximum velocity of 0.013 m/s in the settlement ponds. This velocity, along with the pond configuration, yields a slowest fall velocity of 0.007 mm/s, which will produce <20 mg/l of suspended solids in the pond outflow for 80% of the peak annual storms.

For the 1-in-100 year storm, the runoff is 0.973 m^3/s with a maximum velocity in the settlement ponds of 0.024 m^3/s. This velocity, along with the pond configuration, yields a slowest fall velocity of 0.021 mm/s, which will produce <25 mg/l of suspended solids in the pond outflow for 99% of the peak annual storms.

Calculation 7 shows the performance check for the settlement ponds in the permanent phase.

4.4 Pond Outflow

The outflow from the settlement ponds will discharge, via a riprap outfall, to the open land for final polishing approximately 80 metres north of road R314. Open drains to collect the water after flowing overland and to also provide a conveyance network for the more intense storm bound the open land. After polishing, the outflow from the pond is routed through a water quality sampling point, before discharging to the open channel on the northern side of road R314. The open channel crosses under road R314 in an existing culvert that outfalls to ditch D16.

5. EARLY CONSTRUCTION PHASE DRAINAGE

During the early stages of the construction phase, a portion of the terminal area will be excavated before the settlement ponds are constructed. This is because a suitable area needs to be established for the excavated peat from the settlement pond area to be windrowed before removal from the site. During these early stages, storm water runoff along with water released from the windrowed peat will be collected in local sumps and pumped to the existing field drains to the west of the excavated area. The field drains will be 1.4 metres deep with 0.5-metre bottom widths and 1.2-metre top widths and flow to the perimeter open drain D12. In order to reduce the volume of flow into any single field drain, the pumped water will be distributed between 7 drains, by means of a flow manifold. Drawing COR-AR-SD-005 shows the configuration of the excavated area in relation to the existing field drains in the early stages of the construction phase.

An area of approximately 2 hectares will be excavated before the main settlement ponds will be constructed. As Calculation 8 shows, the peak storm water runoff from the excavated area is 0.172 m^3/s and the windrowed peat will release an additional 0.009 m^3/s, combining for a peak runoff in the early stages excavated area of 0.181 m^3/s. Assuming a pumping rate of 0.2 m^3/s, each drain will receive 0.029 m^3/s from the excavated area.

A small settlement pond will be constructed on each of the field drains, near the outfall of the drain into D12; location and details of the ponds are shown on Drawing COR-AR-SD-005. These smaller ponds are sized to achieve the same design standards, reduction of the suspended solids concentration to <30 mg/l for 80%, and to <100 mg/l for 99%, of the peak annual storms.

For the 1-in-5 year return period storm, each field drain will receive 0.029 m^3/s from the pumped excavation area runoff, which combines with 0.038 m^3/s from the drainage area of the field drain, for a flow of 0.066 m^3/s into each of the local settlement ponds. Based on a 4 metre wide pond, the velocity in the pond will be 0.0165 m/s and to achieve the desired slowest fall velocity of 0.045 mm/s, the required length of the pond is 16.5 metres. Calculation 9 shows the calculations used to derive the required length of the small settlement ponds, along with the suspended solids discharged vs. fall velocity relationship.

The peak 1-in-100 year flowrate to the pond during the early construction phase is 0.106 m^3/s. The maximum velocity through the settlement ponds is 0.026 m/s through the 16.5 metre long pond, as sized to limit suspended solids in the outflow to <30 mg/l. Given these design parameters, the slowest fall velocity is 0.095 mm/sec, which relates to approximately 40 mg/l of suspended solids in the outflow. Since this value of 40 mg/l occurring in 1% of the peak annual storms (meaning <40 mg/l for 99% of the peak annual storms) provides cleaner outflow than the target of <100 mg/l occurring in 99% of the peak annual storms, the pond length (16.5 metres) as determined by the 30 mg/l target is sufficient to meet the design criteria. Calculation 9 shows the calculations used to check the suspended solids settlement of the 1-in-100 year flow within the settlement ponds.

Runoff from the temporary construction facilities will be collected in the existing drains D01, D34 and D99 and diverted through an additional field silt pond located along D99, as shown on Drawing COR-AR-SD-005. This silt pond has a required width of 10m and length of 20m to meet the design parameters, see Calculation 10.

The southernmost 150 metres of the main access road cannot drain to the D99, therefore, small silt ponds will be constructed on either side of the road before the outfall to the R314 roadside open channel, as shown on Drawing COR-AR-SD-005. Due to the low peak runoff rate, the ponds will be 2 metres wide and 1 metre long to meet the design parameters, see Calculation 11.

6. REFERENCES

IPC Licence 505 for Oweninny Works Bellacorrick, Environmental Protection Agency (2000)

J. Harkins, Silt Control Report, Bord na Mona (1991)

P. Irz, A Study of Peat Silt Runoff from Commercial Milled Peat Workings, Department of the Marine (1991)

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Equations

ARUP

G 10
Rev 0

ARUP Calculation Sheet

Job No.	Sheet No.	Rev.
C1157.100	1/2	P1

Member / Location N/A

Drg. Ref. N/A

Made by SCC Date 7-12-03 Chd. pp JM

Job Title Enterprise Corrib Terminal Drainage

Reference	Calculation	Result

Equations used in Calculations.

(1) Modified Rational Formula

$$Q = 2.78\, i\, A$$

Q = peak flow (l/s)
i = rainfall intensity (mm/hr)
A = drainage area (ha)

(2) Manning's Equation

$$Q = \frac{1}{n} A R^{2/3} S^{1/2}$$

Q = flow capacity (m^3/s)
A = flow area (m^2)
R = Hydraulic Radius = A/P (m)
P = Wetted Perimeter (m)
S = slope (m/m)

(3) Flow Velocity in Pond

$$V = Q/A$$

V = flow velocity (m/s)
Q = rate of flow (m^3/s)
A = flow area (m^2)

G 10
Rev 0

ARUP Calculation Sheet

Job No.	Sheet No.	Rev.
C1157.100	3/2	P1

Member / Location N/A
Drg. Ref. N/A
Made by SCC Date 7-12-03 Chd. JM PP

Job Title Enterprise Corrib Terminal Drainage

Reference	Calculation	Result

Equations (cont)

(4) Weir Equation

$$Q_w = C_d\left(\tfrac{2}{3}\right)\sqrt{2g}\,L_w h^{3/2}$$

Q_w = flow over weir (m^3/s)
C_d = weir coefficient (0.6)
g = gravity (9.81 m/s^2)
L_w = length of weir (m)
h = water depth over weir (m)

(5) Slowest Fall Velocity

Used to find slowest fall velocity of a suspended solid that will settle under given conditions.

Any particles with fall velocities greater than the "slowest fall velocity" will settle in the pond. Particles with a lower fall velocity will not settle in the pond.

$$\text{Slowest Fall Vel.} = \frac{\text{Pond Flow Vel.} \times \text{Height over Weir}}{\text{Pond Length}}$$

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Calculation 1

Peak Stormwater Runoff during Construction

ARUP

ARUP Calculation Sheet

Job No.	Sheet No.	Rev.
C1157.100	1/34	P1

Member / Location

Drg. Ref.

Job Title: Enterprise Corrib Terminal - Drainage

Made by SCC Date 26-11-03 Chd. PPJM

Reference	Calculation	Result

Calculation No 1

Peak Stormwater Runoff During Construction

Design Storm: 1-in-100yr Return Period
60-minute Duration

Intensity: 31.0 mm/hr

Drainage Area: 35.4 ha

Eqn (1) Peak Runoff ⇒ 2.78 (i) (A)
⇒ 3050 l/s

$\boxed{= 3.05\ m^3/s}$

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Calculation 2

Capacity of Open Drains Located East and West of Proposed Terminal

ARUP

ARUP Calculation Sheet

Job No.	Sheet No.	Rev.
C1157.100	2/34	P1

Member / Location N/A

Drg. Ref. N/A

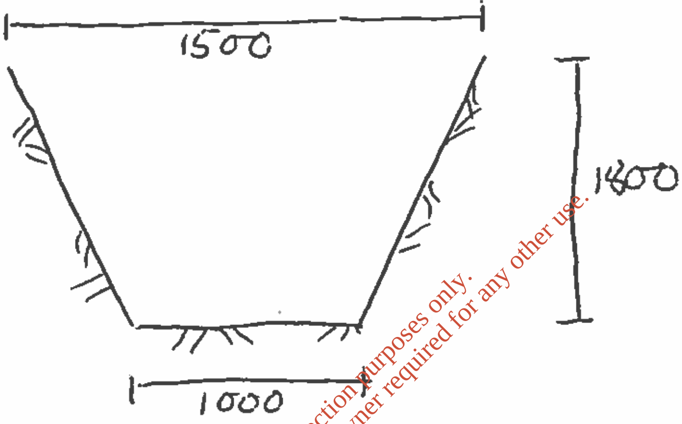
Job Title Enterprise Corrib Terminal - Drainage

Made by SCC Date 26-11-03 Chd JM

Reference	Calculation	Result

Calculation No. 2

Capacity of Open Drains D12 & D99



Both Drains have similar dimensions but the slopes are different.

Manning's Eqn.

Eqn (2) $Q = \frac{1}{n} A R^{2/3} S^{1/2}$

$n = 0.04$ (Gravel + Boulder Stream)

$R = A/P$

$A = \text{Area} = 2.25\ m^2$

$P = 2.06 + 1.0 + 2.06 = 5.12\ m$

D12 $S = 7m / 380m = 0.0184\ m/m$

$Q = \frac{1}{0.04}(2.25)(2.25/5.12)^{2/3}(0.0184)^{1/2}$

$\boxed{Q_{D12} = 4.41\ m^3/sec}$

D99 $S = 3.5m / 350m = 0.01\ m/m$

$Q = \frac{1}{0.04}(2.25)(2.25/5.12)^{2/3}(0.01)^{1/2}$

$\boxed{Q_{D99} = 3.25\ m^3/sec}$

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Calculation 3

Construction Phase Surface Water Drain Storm Model Results

ARUP

ARUP Calculation Sheet

Job No.	Sheet No.	Rev.
C1157.100	3/34	P1

Member / Location N/A

Drg. Ref. N/A

Made by SCC Date 26-11-03 Chd. pp JM

Job Title Enterprise Comb Terminal Drainage

Reference	Calculation	Result
	Calculation No. 3 Construction Phase Surface Water Drain Storm Model Results	

Arup Consulting Engineers		Page 1
Oliver Plunkett St Cork Ireland	Corrib Terminal Perimeter DrainageReport Calculation 3	Micro Drainage
Date 25-Nov-03 File CONSTRUCTIONDRAIN....	Designed By SCC Checked By	
ENCAD	Storm W.7.6 (c)1982-2001 Micro Drainage	

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Location - Scotland & Ireland

Return Period (years)	100
M5-60 (mm)	15
Ratio R	0.29
Maximum Rainfall (mm/hr)	31
Foul Sewage (l/s/ha)	0.00
O'flow Setting (*Foul only)	0
Volumetric Runoff Coeff.	0.75
Infiltration %	0
Minimum Backdrop Height (m)	0.200
Depth from Soffit to G.L. (m)	1.200
Min Vel. (m/s - Auto Design Only)	0.75
Min Slope (1:X - Optimisation)	500

Designed with Level Soffits

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	335.00	5.746	58.3	35.400	30.00	78	0.040	o	900
1.001	15.00	0.259	57.9	0.000	0.00	0	0.040	o	900
1.002	30.00	1.000	30.0	0.000	0.00	0	0.040	o	900

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.000	31.0	31.1	24.420	35.400	78	0	0	5.25	3338	3050
1.001	31.0	31.1	18.674	35.400	78	0	0	5.27	3350	3050
1.002	31.0	31.2	18.415	35.400	78	0	0	7.37	4691	3050

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Calculation 4

Terminal Drainage Areas

ARUP

G 10
Rev 0

ARUP Calculation Sheet

Job No.	Sheet No.	Rev.
C1157.100	5/34	P1

Member / Location N/A

Drg. Ref. N/A

Made by SCC Date Chd. pp JM

Job Title Enterprise Corrib Terminal Drainage

Reference | Calculation | Result

Calculation No. 4

Terminal Drainage Areas

Basis of Design

- Paved + Roof Areas = 100% Impermiable
- Gravel Areas = 60% "

Areas to Oily Water Sewer will have no flow due to treatment and discharge to sea

Connection Point areas and Time of Concentration were calculated by AMEC and are summarised below:

Connection Point No.	Area (ha)	TOC (min)
1	0.615	14
2	0.449	21
3	0.732	15
4	1.558	23
5	N/A	N/A
6	N/A	N/A
7	1.342	25
8	0.687	16

Emergency drain not included in storm water runoff.

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Calculation 5

Permanent Phase Perimeter Drain Storm Model Results

ARUP

ARUP Calculation Sheet

Job No.	Sheet No.	Rev.
C1157.100	6/34	P1

Member / Location N/A

Drg. Ref. N/A

Made by SC Date 26-11-03 Chd. pp JM

Job Title Enterprise Corrib Terminal Drainage

Reference	Calculation	Result

Calculation No. 5

Storm Output For 1-in-100 yr.
Terminal Perimeter Drain

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Location - Scotland & Ireland

Return Period (years)	100
M5-60 (mm)	15
Ratio R	0.29
Maximum Rainfall (mm/hr)	200
Foul Sewage (l/s/ha)	0.00
O'flow Setting (*Foul only)	0
Volumetric Runoff Coeff.	0.75
Infiltration %	0
Minimum Backdrop Height (m)	0.000
Depth from Soffit to G.L. (m)	1.200
Min Vel. (m/s - Auto Design Only)	0.75
Min Slope (1:X - Optimisation)	500

Designed with Level Inverts

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	54.00	0.216	250.0	0.248	5.00	0	0.600	o	300
2.000	8.00	0.080	100.0	0.615	14.00	0	0.600	o	375
1.001	85.00	0.283	300.4	0.285	0.00	0	0.600	o	600
1.002	85.00	0.283	300.4	0.235	0.00	0	0.600	o	600
1.003	90.00	0.300	300.0	0.185	0.00	0	0.600	o	600
3.000	8.00	0.080	100.0	0.449	21.00	0	0.600	o	300
1.004	85.00	0.283	300.4	0.135	0.00	0	0.600	o	600
1.005	60.00	0.200	300.0	0.160	0.00	0	0.600	o	600

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.000	98.8	5.9	32.100	0.248	0	0	0	0.99	70	66
2.000	68.1	14.1	32.100	0.615	0	0	0	1.81	200	114
1.001	65.9	15.1	31.884	1.148	0	0	0	1.40	396	205
1.002	63.8	16.1	31.601	1.383	0	0	0	1.40	396	239
1.003	61.8	17.2	31.318	1.568	0	0	0	1.40	396	262
3.000	55.6	21.1	32.100	0.449	0	0	0	1.57	111	68
1.004	54.2	22.1	31.018	2.152	0	0	0	1.40	396	316
1.005	53.2	22.8	30.735	2.312	0	0	0	1.40	396	333

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.006	120.00	0.480	250.0	0.100	0.00	0	0.600	o	600
1.007	62.00	0.248	250.0	0.020	0.00	0	0.600	o	600
4.000	8.00	1.770	4.5	0.732	15.00	0	0.600	o	225
1.008	27.00	0.108	250.0	0.011	0.00	0	0.600	o	600
1.009	88.00	0.352	250.0	0.020	0.00	0	0.600	o	600
1.010	77.00	0.308	250.0	0.023	0.00	0	0.600	o	600
5.000	8.00	2.750	2.9	1.558	23.00	0	0.600	o	225
1.011	43.00	0.172	250.0	0.030	0.00	0	0.600	o	750
6.000	53.00	0.353	150.1	0.280	5.00	0	0.600	o	300
6.001	84.00	0.305	275.4	0.250	0.00	0	0.600	o	450
6.002	26.00	0.095	273.7	0.026	0.00	0	0.600	o	450
7.000	8.00	0.080	100.0	0.576	16.00	0	0.600	o	300
6.003	110.00	0.402	273.6	0.111	0.00	0	0.600	o	600
6.004	54.00	0.202	267.3	0.040	0.00	0	0.600	o	600
6.005	33.00	0.165	200.0	0.010	0.00	0	0.600	o	600
6.006	66.00	0.330	200.0	0.030	0.00	0	0.600	o	600

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.006	51.6	24.1	30.535	2.412	0	0	0	1.54	434	337
1.007	50.8	24.8	30.055	2.432	0	0	0	1.54	434	337
4.000	66.0	15.0	32.100	0.732	0	0	0	6.20	246	131
1.008	50.4	25.1	29.807	3.175	0	0	0	1.54	434	433
1.009	49.3	26.0	29.699	3.195	0	0	0	1.54	434	433
1.010	48.4	26.9	29.347	3.218	0	0	0	1.54	434	433
5.000	53.0	23.0	32.100	1.558	0	0	0	7.73	307	223
1.011	48.0	27.3	29.039	4.806	0	0	0	1.77	780	625
6.000	100.1	5.7	32.100	0.280	0	0	0	1.28	91	76
6.001	93.5	6.8	31.747	0.530	0	0	0	1.22	194	134
6.002	91.6	7.2	31.442	0.556	0	0	0	1.22	195	138
7.000	63.8	16.1	32.100	0.576	0	0	0	1.57	111	100
6.003	61.5	17.3	31.347	1.243	0	0	0	1.47	415	207
6.004	60.4	17.9	30.945	1.283	0	0	0	1.48	420	210
6.005	59.9	18.3	30.743	1.293	0	0	0	1.72	486	210
6.006	58.9	18.9	30.578	1.323	0	0	0	1.72	486	211

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
8.000	8.00	0.080	100.0	1.342	25.00	0	0.600	o	375
6.007	45.00	0.225	200.0	0.045	0.00	0	0.600	o	600
6.008	56.00	0.280	200.0	0.017	0.00	0	0.600	o	600
6.009	15.00	0.075	200.0	0.003	0.00	0	0.600	o	600
6.010	16.00	0.080	200.0	0.001	0.00	0	0.600	o	600
6.011	77.00	0.385	200.0	0.040	0.00	0	0.600	o	600
6.012	71.00	0.355	200.0	0.050	0.00	0	0.600	o	600
1.012	59.50	0.535	111.2	0.000	0.00	0	0.600	o	750
1.013	128.00	1.280	100.0	0.000	0.00	0	0.600	o	750
1.014	26.50	0.265	100.0	0.000	0.00	0	0.600	o	750
1.015	235.00	4.031	58.3	0.000	0.00	0	0.600	o	900
1.016	100.00	1.715	58.3	0.000	0.00	0	0.600	o	900
1.017	15.00	0.259	57.9	0.000	0.00	0	0.600	o	900
1.018	30.00	1.000	30.0	0.000	0.00	0	0.600	o	900

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
8.000	50.4	25.1	32.100	1.342	0	0	0	1.81	200	183
6.007	49.9	25.5	30.248	2.710	0	0	0	1.72	486	366
6.008	49.3	26.1	30.023	2.727	0	0	0	1.72	486	366
6.009	49.1	26.2	29.743	2.730	0	0	0	1.72	486	366
6.010	49.0	26.4	29.668	2.731	0	0	0	1.72	486	366
6.011	48.2	27.1	29.588	2.771	0	0	0	1.72	486	366
6.012	47.5	27.8	29.203	2.821	0	0	0	1.72	486	366
1.012	47.1	28.2	26.500	7.627	0	0	0	2.65	1172	973
1.013	46.4	28.9	25.965	7.627	0	0	0	2.80	1236	973
1.014	46.2	29.1	24.685	7.627	0	0	0	2.80	1236	973
1.015	45.4	30.0	24.420	7.627	0	0	0	4.11	2613	973
1.016	45.0	30.4	20.389	7.627	0	0	0	4.11	2613	973
1.017	44.9	30.5	18.674	7.627	0	0	0	4.12	2622	973
1.018	44.9	30.6	18.415	7.627	0	0	0	5.73	3647	973

Time Area Diagram

Time From (mins)	Time To (mins)	Area (ha)
0	4	0.065
4	8	0.782
8	12	1.796
12	16	2.142
16	20	1.191
20	24	0.906
24	28	0.561
28	32	0.183

Total Area Contributing (ha) = 7.627

Total Pipe Volume (m3) = 757.664

Arup Consulting Engineers		Page 1
Oliver Plunkett St Cork Ireland	Corrib Terminal Drainage Permanent Phase Network 45 mm/hour Check	Micro Drainage®
Date 4-Dec-03 File PERMANENT.SIM	Designed By SCC Checked By	
ENCAD	Simulation W.7.6 (c)1982-2001 Micro Drainage	

Summary of Results

Return Period (years)	700
Storm Duration (mins)	30
Margin for Flood Risk warning (mm)	300
Analysis Time Step (seconds)	15
DVD Status	OFF
Inertia Status	OFF

PN	Water Lev. (m)	Surcharged Depth (m)	Flooded Vol (m3)	Flow/ Capacity	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	32.870	0.470	0.000	1.43	0	98	SURCH'ED
2.000	32.796	0.321	0.000	1.36	0	150	SURCH'ED
1.001	32.742	0.258	0.000	0.88	0	338	SURCH'ED
1.002	32.659	0.458	0.000	0.98	0	378	SURCH'ED
1.003	32.543	0.625	0.000	0.98	0	377	SURCH'ED
3.000	32.497	0.097	0.000	1.21	0	85	SURCH'ED
1.004	32.399	0.781	0.000	1.19	0	461	SURCH'ED
1.005	32.179	0.844	0.000	1.18	0	451	SURCH'ED
1.006	31.958	0.823	0.000	1.04	0	445	SURCH'ED
1.007	31.590	0.935	0.000	1.04	0	438	SURCH'ED
4.000	32.386	0.061	0.000	0.90	0	170	SURCH'ED
1.008	31.354	0.947	0.000	1.74	0	574	SURCH'ED
1.009	31.050	0.751	0.000	1.37	0	579	SURCH'ED
1.010	30.420	0.473	0.000	1.35	0	569	SURCH'ED
5.000	33.136	0.811	0.000	1.10	0	257	FLD RISK
1.011	29.865	0.076	0.000	1.26	0	821	SURCH'ED
6.000	32.873	0.473	0.000	1.26	0	112	SURCH'ED
6.001	32.307	0.110	0.000	1.09	0	208	SURCH'ED
6.002	31.955	0.063	0.000	1.19	0	206	SURCH'ED
7.000	32.571	0.171	0.000	1.82	0	129	SURCH'ED
6.003	31.817	-0.130	0.000	0.88	0	358	O K
6.004	31.547	0.002	0.000	0.87	0	349	SURCH'ED
6.005	31.432	0.089	0.000	0.80	0	325	SURCH'ED
6.006	31.343	0.165	0.000	0.64	0	303	SURCH'ED
8.000	32.699	0.224	0.000	2.00	0	221	SURCH'ED
6.007	31.202	0.354	0.000	1.04	0	482	SURCH'ED
6.008	30.968	0.345	0.000	1.04	0	484	SURCH'ED
6.009	30.674	0.331	0.000	1.75	0	479	SURCH'ED
6.010	30.450	0.182	0.000	1.71	0	484	SURCH'ED
6.011	30.209	0.021	0.000	1.02	0	483	SURCH'ED
6.012	29.758	-0.045	0.000	1.01	0	477	O K
1.012	27.885	0.635	0.000	1.15	0	1284	SURCH'ED
1.013	27.196	0.481	0.000	1.05	0	1270	SURCH'ED
1.014	25.790	0.355	0.000	1.57	0	1264	SURCH'ED
1.015	24.865	-0.455	0.000	0.49	0	1265	O K
1.016	20.840	-0.449	0.000	0.50	0	1263	O K
1.017	19.562	-0.012	0.000	1.10	0	1263	O K
1.018	18.898	-0.417	0.000	0.56	0	1261	O K

Global Variables

Region	FSR - Scotland & Ireland
Return Period (yrs)	700
M5-60 (mm)	15.000
Ratio R	0.290
Volumetric Runoff Coef	0.750
Profile Type	Summer
PIMP (%)	100
Areal Reduction Factor	1.000
Storm Duration (mins)	30
Hot Start (mins)	0
Manhole Headloss Coefficient	0.150
MADD Factor * 10m3/ha Storage	1.000
Foul Sewage/Hectare (l/s)	0.00
Additional Flow - % of Total Flow	0
Number of Input Hydrographs	0
Number of Time/Area Diagrams	0
Number of Bifurcations	0
Number of Overflows	0
Number of Off-Line Controls	0
Number of Tank Sewers	29

Freely Discharging Outfalls

Outfall Pipe Number	Outfall MH/No	C.Level (m)	I.Level (m)	D,L (mm)	B (mm)
1.018	32	18.500	17.415	1200	0

Tank Sewers (No Control)

PN	Volume (m3)	Ctrl MH Name	PN	Volume (m3)	Ctrl MH Name	PN	Volume (m3)	Ctrl MH Name
1.001	24.034	3	1.011	18.997	26	6.010	4.524	24
1.002	24.034	4	6.001	13.360	15	6.011	21.772	25
1.003	25.448	5	6.002	4.135	16	6.012	20.075	26
1.004	24.034	6	6.003	31.103	17	1.012	26.287	26
1.005	16.965	7	6.004	15.269	18	1.013	56.551	27
1.006	33.930	8	6.005	9.331	19	1.014	11.708	28
1.007	17.531	9	6.006	18.662	20	1.015	149.506	29
1.008	7.634	10	6.007	12.724	21	1.016	63.619	30
1.009	24.882	11	6.008	15.834	22	1.017	9.543	31
1.010	21.772	12	6.009	4.241	23			

Rainfall Hyetograph

Region	FSR - Scotland & Ireland
Return Period (yrs)	700
M5-60 (mm)	15.000
Ratio R	0.290
Profile Type	Summer
Storm Duration (mins)	30

Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)
1	22.96	9	42.42	17	183.97	25	30.66
2	24.15	10	51.66	18	134.83	26	28.35
3	25.34	11	67.06	19	94.01	27	26.46
4	26.46	12	94.01	20	67.06	28	25.34
5	28.35	13	134.83	21	51.66	29	24.15
6	30.66	14	183.97	22	42.42	30	22.96
7	33.60	15	247.39	23	37.17		
8	37.17	16	247.39	24	33.60		

Network Details

PN	Length (m)	Fall (m)	Slope (1:x)	Area (ha)	T.E. (mins)	Rain Pro	k (mm)	Hyd Sect	Dia (mm)
1.000	54.00	0.216	250	0.248	5.00	1	0.600	o	300
2.000	8.00	0.080	100	0.615	14.00	1	0.600	o	375
1.001	85.00	0.283	300	0.285	0.00	1	0.600	o	600
1.002	85.00	0.283	300	0.235	0.00	1	0.600	o	600
1.003	90.00	0.300	300	0.185	0.00	1	0.600	o	600
3.000	8.00	0.080	100	0.449	21.00	1	0.600	o	300
1.004	85.00	0.283	300	0.135	0.00	1	0.600	o	600
1.005	60.00	0.200	300	0.160	0.00	1	0.600	o	600
1.006	120.00	0.480	250	0.100	0.00	1	0.600	o	600
1.007	62.00	0.248	250	0.020	0.00	1	0.600	o	600
4.000	8.00	1.770	5	0.732	15.00	1	0.600	o	225
1.008	27.00	0.108	250	0.011	0.00	1	0.600	o	600
1.009	88.00	0.352	250	0.020	0.00	1	0.600	o	600
1.010	77.00	0.308	250	0.023	0.00	1	0.600	o	600
5.000	8.00	2.750	3	1.558	23.00	1	0.600	o	225
1.011	43.00	0.172	250	0.030	0.00	1	0.600	o	750

PN	USMH No.	US/CL (m)	US/IL (m)	US/Dep (m)	DS/CL (m)	DS/IL (m)	DS/Dep (m)	Ctrl No.	US/MH (mm)
1.000	1	33.400	32.100	1.000	33.400	31.884	1.216		1050
2.000	2	33.400	32.100	0.925	33.400	32.020	1.005		1350
1.001	2	33.400	31.884	0.916	33.400	31.601	1.199		1500
1.002	3	33.400	31.601	1.199	33.400	31.318	1.482	4	1500
1.003	4	33.400	31.318	1.482	33.400	31.018	1.782	4	1500
3.000	5	33.400	32.100	1.000	33.400	32.020	1.080		1050
1.004	5	33.400	31.018	1.782	33.400	30.735	2.065	4	1500
1.005	6	33.400	30.735	2.065	33.400	30.535	2.265	4	1500
1.006	7	33.400	30.535	2.265	33.400	30.055	2.745	4	1500
1.007	8	33.400	30.055	2.745	31.700	29.807	1.293	4	1500
4.000	9	33.400	32.100	1.075	31.700	30.330	1.145		1050
1.008	9	31.700	29.807	1.293	31.400	29.699	1.101	4	1500
1.009	10	31.400	29.699	1.101	32.500	29.347	2.553	4	1500
1.010	11	32.500	29.347	2.553	30.800	29.039	1.161	4	1500
5.000	12	33.400	32.100	1.075	30.800	29.350	1.225		1050
1.011	12	30.800	29.039	1.011	30.400	28.867	0.783	4	1800

Network Details

PN	Length (m)	Fall (m)	Slope (1:x)	Area (ha)	T.E. (mins)	Rain Pro	k (mm)	Hyd Sect	Dia (mm)
6.000	53.00	0.353	150	0.280	5.00	1	0.600	o	300
6.001	84.00	0.305	275	0.250	0.00	1	0.600	o	450
6.002	26.00	0.095	274	0.026	0.00	1	0.600	o	450
7.000	8.00	0.080	100	0.576	16.00	1	0.600	o	300
6.003	110.00	0.402	274	0.111	0.00	1	0.600	o	600
6.004	54.00	0.202	267	0.040	0.00	1	0.600	o	600
6.005	33.00	0.165	200	0.010	0.00	1	0.600	o	600
6.006	66.00	0.330	200	0.030	0.00	1	0.600	o	600
8.000	8.00	0.080	100	1.342	25.00	1	0.600	o	375
6.007	45.00	0.225	200	0.045	0.00	1	0.600	o	600
6.008	56.00	0.280	200	0.017	0.00	1	0.600	o	600
6.009	15.00	0.075	200	0.003	0.00	1	0.600	o	600
6.010	16.00	0.080	200	0.001	0.00	1	0.600	o	600
6.011	77.00	0.385	200	0.040	0.00	1	0.600	o	600
6.012	71.00	0.355	200	0.050	0.00	1	0.600	o	600
1.012	59.50	0.535	111	0.000	0.00	1	0.600	o	750
1.013	128.00	1.280	100	0.000	0.00	1	0.600	o	750
1.014	26.50	0.265	100	0.000	0.00	1	0.600	o	750
1.015	235.00	4.031	58	0.000	0.00	1	0.600	o	900
1.016	100.00	1.715	58	0.000	0.00	1	0.600	o	900

PN	USMH No.	US/CL (m)	US/IL (m)	US/Dep (m)	DS/CL (m)	DS/IL (m)	DS/Dep (m)	Ctrl No.	US/MH (mm)
6.000	13	33.400	32.100	1.000	33.400	31.747	1.353		1050
6.001	14	33.400	31.747	1.203	33.400	31.442	1.508		1350
6.002	15	33.400	31.442	1.508	33.400	31.347	1.603	4	1350
7.000	16	33.400	32.100	1.000	33.400	32.020	1.080		1050
6.003	16	33.400	31.347	1.453	33.400	30.945	1.855	4	1500
6.004	17	33.400	30.945	1.855	33.400	30.743	2.057	4	1500
6.005	18	33.400	30.743	2.057	33.400	30.578	2.222	4	1500
6.006	19	33.400	30.578	2.222	33.400	30.248	2.552	4	1500
8.000	20	33.400	32.100	0.925	33.400	32.020	1.005		1350
6.007	20	33.400	30.248	2.552	33.400	30.023	2.777	4	1500
6.008	21	33.400	30.023	2.777	32.200	29.743	1.857	4	1500
6.009	22	32.200	29.743	1.857	32.000	29.668	1.732	4	1500
6.010	23	32.000	29.668	1.732	32.100	29.588	1.912	4	1500
6.011	24	32.100	29.588	1.912	31.200	29.203	1.397	4	1500
6.012	25	31.200	29.203	1.397	30.400	28.848	0.952	4	1500
1.012	26	30.400	26.500	3.150	30.400	25.965	3.685	4	1800
1.013	26	30.400	25.965	3.685	28.500	24.685	3.065	4	1800
1.014	27	28.500	24.685	3.065	27.300	24.420	2.130	4	1800
1.015	28	27.300	24.420	1.980	22.200	20.389	0.911	4	1800
1.016	29	22.200	20.389	0.911	20.000	18.674	0.426	4	1800

Network Details

PN	Length (m)	Fall (m)	Slope (1:x)	Area (ha)	T.E. (mins)	Rain Pro	k (mm)	Hyd Sect	Dia (mm)
1.017	15.00	0.259	58	0.000	0.00	1	0.600	o	900
1.018	30.00	1.000	30	0.000	0.00	1	0.600	o	900

PN	USMH No.	US/CL (m)	US/IL (m)	US/Dep (m)	DS/CL (m)	DS/IL (m)	DS/Dep (m)	Ctrl No.	US/MH (mm)
1.017	30	20.000	18.674	0.426	19.500	18.415	0.185	4	1800
1.018	31	19.500	18.415	0.185	18.500	17.415	0.185	4	1800

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Calculation 6

Construction Phase Settlement Pond Calculations

ARUP

ARUP Calculation Sheet

Job No. C1157.100 | Sheet No. 18/34 | Rev. P1

Member / Location N/A

Drg. Ref. N/A

Job Title Enterprise Corrib Terminal - Drainage

Made by SCC | Date 26-11-03 | Chd. pp JM

Reference	Calculation	Result

Calculation No. 6

1-in-5 year Settlement Pond Calculations - Construction Phase

Design Storm: 1-in-5 year Return Period
60 minute duration

Intensity: 15 mm/hr

Drainage Area: 35.4 ha

Eqn (i)

$Q = 2.78\,(15)(35.4) = 1476$ l/s

$\boxed{Q = 1.48 \text{ m}^3/\text{s}}$

Flow is divided into 2 ponds

$Q = 1.48/2$

$\boxed{Q = 0.74 \text{ m}^3/\text{s}}$

Flow velocity

Eqn (3)

$V = Q/A = 0.74 \text{ m}^3/\text{s} \,/\, 20 \text{ m}^2$

$\boxed{V = 0.037 \text{ m/s}}$

Depth over Weir

Eqn (4)

$Q_w = C_d \left(\tfrac{2}{3}\right)\sqrt{2g}\, L_w h^{3/2} = 0.6\left(\tfrac{2}{3}\right)(2 \times 9.81)^{1/2}(18)\, h^{3/2}$

$0.74 = 31.892\, h^{3/2}$

$\boxed{h = 0.082 \text{ m}}$

ARUP Calculation Sheet

Job No. C1157.100 | Sheet No. 19/34 | Rev. P1

Member / Location

Drg. Ref.

Job Title Enterprise Corrib Terminal - Drainage

Made by SCC | Date 26-11-03 | Chd. pp JM

Reference	Calculation	Result

Calculation No 6 (cont.)

To find the slowest settlement fall velocity use

Eqn (5) $\text{Slowest Fall velocity} = \dfrac{\text{Flow Velocity} \times \text{Height of water over weir}}{\text{Pond Length}}$

$\therefore \text{Pond Length} = \dfrac{V_{Flow} \times h_w}{\text{Fall velocity}}$

From graph on next sheet, In order to achieve 30mg/l over the outfall weir the fall velocity must be 0.045 mm/s (0.000045 m/s)

$$\text{Pond Length} = \frac{0.037 \times 0.082}{0.000045}$$

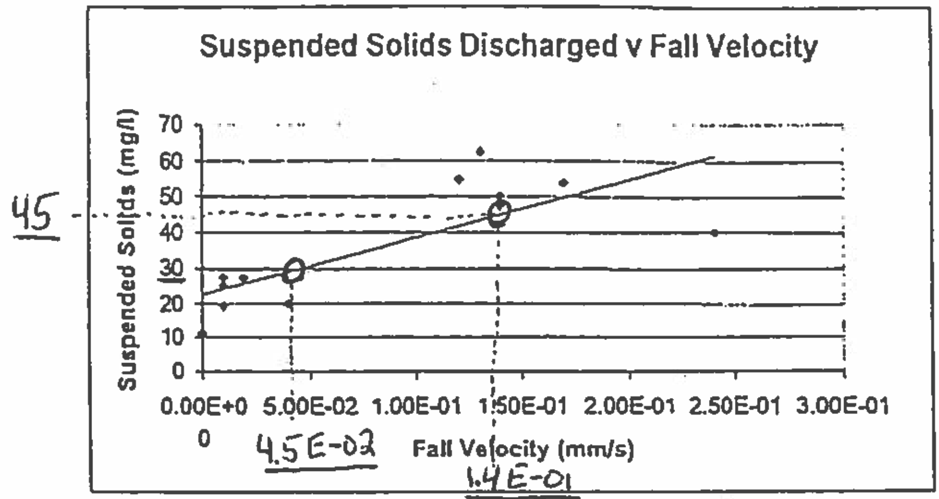
$$= 67.4\text{ m}$$

$$\boxed{\text{Pond Length} = 70\text{ m}}$$

ARUP Calculation Sheet

Job No.	C1157.100
Sheet No.	20/34
Rev.	P1
Member / Location	N/A
Drg. Ref	N/A
Made by	SCC
Date	26-11-03
Chd.	pp JM
Job Title	Enterprise Corrib Terminal Drainage

Reference | Calculation | Result



Graph created from solids concentration / fall velocity data contained in Irz, 1991

Calculation No. 6 (cont)

1-in-5 yr

⇒ To achieve 30 mg/l,

Fall velocity must ≤ 0.045 mm/s

1-in-100 yr

Fall velocity = 0.14 mm/s

⇒ Suspended Solids = 45 mg/l

ARUP Calculation Sheet

Job No.	Sheet No.	Rev.
C1157.100	21/34	P1

Member / Location: N/A
Drg. Ref.: N/A
Job Title: Enterprise Corrib Terminal - Drainage
Made by: SCC Date: 26-11-03 Chd. pp JM

Reference	Calculation	Result

Calculation No. 6 (cont)

1-in-100 year Settlement Pond Calculations - Construction Phase

Design Storm: 1-in-100 year Return Period
60 minute duration

Intensity : 31 mm/hr
Drainage Area : 35.4 ha

Eqn (1) $Q = 2.78\,(31)\,(35.4)$

$\underline{Q = 3.05\ m^3/s}$

For 2 ponds, each has

$Q = 1.525\ m^3/s$

Eqn (3) $\underline{V} = 1.525/20 = \underline{0.076\ m/s}$

Depth over weir

Eqn (4) $1.525 = 31.892\ h^{3/2}$

$\underline{h = 0.13\ m}$

Eqn (5) Slowest Fall velocity $= V \cdot h/L = \dfrac{0.076 \times 0.13}{70}$

Fall velocity $= 0.00014\ m/s$
$= 0.14\ mm/s$

This velocity Represents 45 mg/e over the weir (see graph)

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Calculation 7

Permanent Phase Settlement Pond Calculations

ARUP

ARUP Calculation Sheet

Job No. C1157.100 | Sheet No. 22/34 | Rev. P1

Member / Location N/A

Drg. Ref. N/A

Job Title Enterprise Corrib Terminal Drainage

Made by SCC | Date | Chd. PP JM

Reference	Calculation	Result
	Calculation No. 7 Permanent Phase Settlement Pond Check	
	1-in-5 year	
	$Q = 507\ l/s = 0.507\ m^3/s$	
	Divide by 2 Ponds	
	$Q = 0.254\ m^3/s$	
Eqn (3)	Velocity $V = 0.254/20 = 0.0127\ m/s$	
	Depth over weir	
Eqn (4)	$0.254 = 31.892\ h^{3/2}$	
	$h = 0.04m$	
	Slowest fall velocity	
Eqn (5)	$= \frac{0.0127 \times 0.04}{70}$	
	$= 0.000007257\ m/s$ $= 0.007\ mm/s$	
	This fall velocity represents $\sim$ 20 mg/l over the weir (see graph)	

ARUP

Calculation Sheet

Job No. C1157.100 | Sheet No. 23/34 | Rev. P1

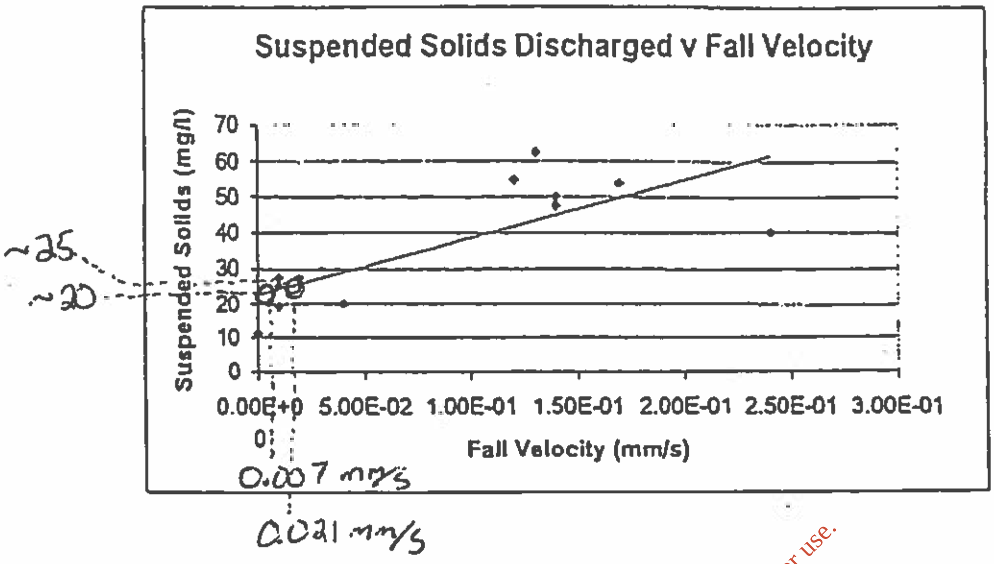
Member Location N/A

Drg. Ref N/A

Job Title Enterprise Corrib Terminal Drainage

Made by SCC | Date 26-11-03 | Chd. pp JM

Reference | Calculation | Result



Graph created from solids concentration / fall velocity data contained in Irz, 1991

Calculation 7 (cont.)

1-in-5 yr

Fall Velocity = 0.007 mm/s

⇒ Suspended Solids = ~20mg/l

1-in-100 yr

Fall velocity = 0.021 mm/s

⇒ Suspended Solids = 25mg/l

G 10
Rev 0

ARUP Calculation Sheet

Job No. C1157.100 | Sheet No. 24/34 | Rev. P1

Member / Location N/A

Drg. Ref. N/A

Job Title Enterprise Corrib Terminal - Drainage

Made by SCC | Date | Chd. pp JM

Reference	Calculation	Result
	Calculation 7 (cont.)	
	1-in-100 year	
	$Q = 0.973\ m^3/s$	
	Divide by 2 Ponds	
	$Q = 0.487\ m^3/s$	
Eqn (3)	$V = 0.487/20 = 0.024\ m/s$	
	Depth over weir	
Eqn (4)	$0.487 = 31.892\ h^{3/2}$	
	$h = 0.062$	
	Slowest Fall velocity	
Eqn (5)	$= \frac{0.024 \times 0.062}{70}$	
	$= 0.000021\ m/s$	
	$= 0.021\ mm/s$	
	This fall velocity relates to ~25mg/l over the weir (see graph)	

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Calculation 8

Early Excavation Peak Runoff Calculations

ARUP

ARUP Calculation Sheet

Job No.	Sheet No.	Rev.
C1157.100	25/34	P1

Member / Location

Drg. Ref.

Made by SCC Date 26-11-03 Chd. pp JM

Job Title: Corrib Terminal - Drainage

Reference	Calculation	Result

Calculation 8
Early Excavation
Peak Runoff to Field
Settlement Ponds

Excavated Area: 2 ha

Design Storm: 1-in-100 year Return
60 minute duration

Intensity : 31 mm/hr

Eqn (i)

$Q = 2.78 (31)(2) = 172$ l/s

$= 0.172$ m³/s

Windrowed Peat Runoff

Target Rate for Excavation: 4000 m³/day peat
= 333 m³/hr peat

Assume 10% volume of water is released

$333\ m^3 \times 10\% = 33.3\ m^3/hr$ water

$= 0.009\ m^3/s$ water

Max Flowrate to Sump

$0.172 + 0.009 = 0.181\ m^3/s$

Assume pumps will pump at rate of

$\boxed{0.200\ m^3/s}$

Pump over 7 drains

$\boxed{Q = 28.5\ l/s}$

Arup Consulting Engineers

Calculation 9

Field Settlement Pond Calculations

ARUP

Reference	Calculation	Result

Calculation 9

Field Drain Settlement Ponds

- Excavated Area = 2 ha

Runoff

Design Storm : 1-in-100yr, 60min.

Intensity : 31 mm/hr

Imperviosness : 100%

Eqn(1) $Q = 2.78(31)(2) = 172$ l/s

$\underline{Q = 0.172 \text{ m}^3/\text{s}}$

- Windrowed Peat Runoff

Excavation Rate = 4000 m³/day

= 333 m³/hr

= 0.09 m³/s peat

10% volume of water released

= 0.009 m³/s water

Flowrate to internal sumps

$Q = 0.172 + 0.009 = 0.181$ m³/s

$\boxed{Q = 181 \text{ l/s}}$

Assume pumps will pump at a rate of $\underline{200 \text{ l/s}}$.

ARUP Calculation Sheet

Job No. C1157.100	Sheet No. 27/34		Rev. P1
Member / Location	N/A		
Drg. Ref.	N/A		
Made by SCC	Date 26-11-03	Chd PP JM	

Job Title Enterprise Corrib Terminal Drainage

Reference	Calculation	Result

Calculation 9 (cont.)

Pumps will pump over 7 drains via manifold

$$Q_{Drain.} = 200/7 = 28.6 \ l/s$$

plus Drainage Area of Field Drain

Eqn (i) $Q = 2.78 (i)(A)$

$A = 0.90$ ha (maximum)

1-in-5 year

$i = 15$ mm/hr

$Q = 2.78(15)(0.90) + 28.6$

$= 66 \ l/s$

Eqn (3) $V = .066/4 \ m^2 = 0.0165 \ m/s$

Depth over weir

Eqn (4) $Q_w = 0.6 (2/3) \sqrt{2(9.81)} \ 4 \ h^{3/2}$

$0.066 = 7.087 \ h^{3/2}$

$h = 0.045 \ m$

Eqn (5) $\text{Pond Length} = \dfrac{\text{Water Vel} \times \text{Weir Depth}}{\text{Fall Velocity}}$ (0.045) mm/sec

Length = 16.5 m → 17 m

ARUP Calculation Sheet

Job No.	Sheet No.	Rev.
C1157.100	28/34	P1
Member / Location	N/A	
Drg. Ref.	N/A	
Made by SCC	Date 28-11-03	Chd. JM

Job Title: Enterprise Corrib Terminal Drainage

Reference	Calculation	Result

Calculation 9 (cont)

1-in-100 year

$i = 31$ mm/hr

$Q = 2.78(31)(0.90) + 28.6$

$Q = 106$ l/s

Eqn (3) $V = 0.106 / 4m^2 = 0.026$ m/s

Depth over Weir

Eqn (4) $h = 0.06$ m

Slowest fall velocity

Eqn (5) $= \dfrac{\text{Water Vel.} \times \text{Weir Depth}}{\text{Pond Length}}$

$= 0.000092$ m/s

$= 0.092$ mm/s

which represents ~ 40 mg/l suspended solids in outflow (see graph)

ARUP Calculation Sheet

Job No. C1157.100 | Sheet No. 29/34 | Rev. P1

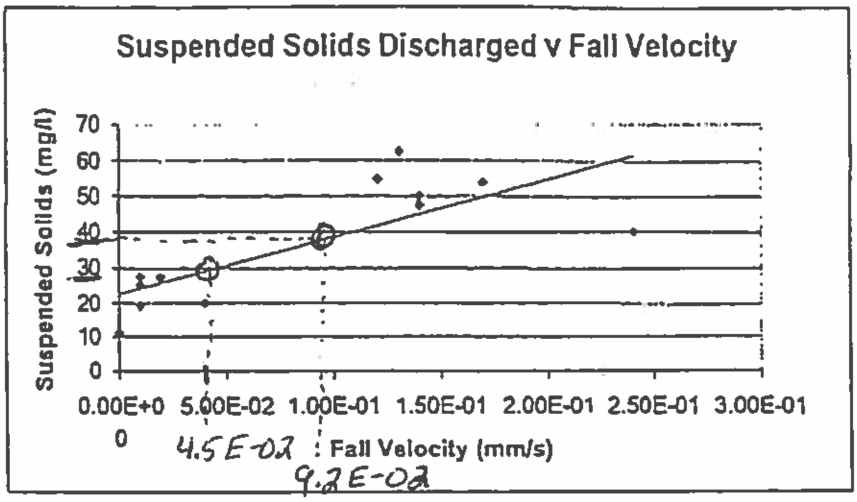
Member / Location N/A

Drg. Ref N/A

Job Title Enterprise Corrib Terminal Drainage

Made by SCC | Date 26-11-03 | Chd. pp JM

Reference | Calculation | Result



Graph created from solids concentration / fall velocity data contained in Irz, 1991

Calculation 9 (cont)

1-in-5 year

SS = 30 mg/l

⇒ Fall velocity = 0.045 mm/s

1-in-100 yr

Fall velocity = 0.092 mm/s

SS = ~40 mg/l

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Calculation 10

D99 Settlement Pond Calculations

ARUP

ARUP Calculation Sheet

Job No.	Sheet No.	Rev.
C1157.100	30/34	P1

Member / Location N/A

Drg. Ref. N/A

Job Title Enterprise Corrib Terminal Drainage

Made by SCC Date 26-11-03 Chd. pp JM

Reference	Calculation	Result
	Calculation 10	
	D99 Settlement Pond	
	Drainage Area = 5.4 ha	
	1-in-5 yr	
Eqn (1)	$Q = 2.78 (15)(5.4)$	
	$Q = 225$ l/s	
	Pond is 1.5m deep & 10m wide	
Eqn (3)	$V = \frac{0.225}{15} = 0.015$ m/s	
	Depth over weir	
Eqn (4)	$0.225 = 17.718\, h^{3/2}$	
	$h = 0.055$	
Eqn (5)	Pond Length $= \frac{0.015 \times 0.055}{.000045}$	
	$= 18.3$m $\rightarrow$ 20m	

ARUP Calculation Sheet

Job No.	Sheet No.	Rev.
C1157.100	31/34	P1

Member / Location N/A

Drg. Ref. N/A

Job Title Enterprise Corrib Terminal Drainage

Made by SCC Date 28-11-03 Chd pp JM

Reference	Calculation	Result
	Calculation 10 (cont)	
	1-in-100 yr	
Eqn (i)	$Q = 2.78(31)(5.4)$ $= 465$ l/s	
Eqn (3)	$V = 0.465/15 = 0.031$	
	Depth over weir	
Eqn (4)	$0.465 = 17.718\ h^{3/2}$ $h = 0.09$ m	
Eqn (5)	Fall velocity $= \dfrac{0.031 \times 0.09}{20}$ $= 0.00014$ m/s $= 0.14$ mm/s	
	Represents 45 mg/l suspended solids	

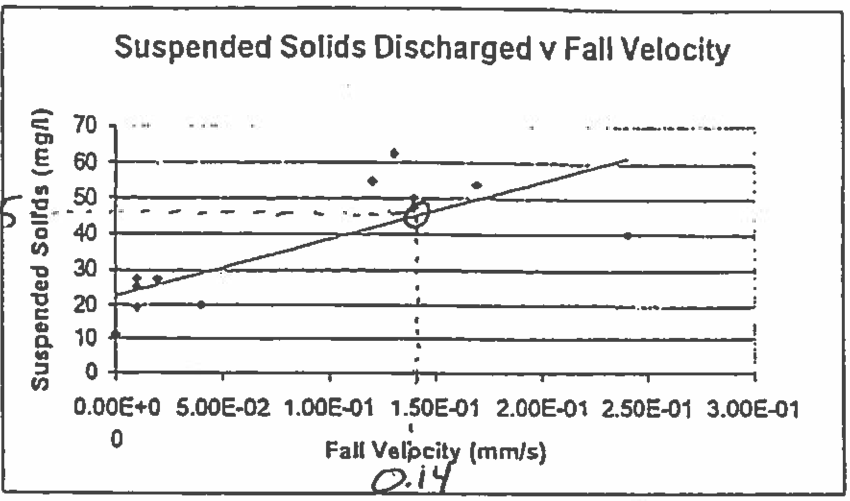
ARUP Calculation Sheet

Job No.	Sheet No.	Rev.
C1157.100	32/34	P1

Member Location N/A
Drg. Ref N/A
Made by SCC Date 26-11-03 Chd. pp JM

Job Title Enterprise Corrib Terminal Drainage

Reference	Calculation	Result



Graph created from solids concentration / fall velocity data contained in Irz, 1991

Calculation 10 (cont).

1-in-5 year

SS = 30 mg/l

$\Rightarrow$ Fall Velocity = 0.045 mm/s

1-in-100 year

Fall Velocity = 0.14 mm/s

SS = 45 mg/l

Arup Consulting Engineers

Calculation 11

Main Access Road Settlement Pond Calculations

ARUP

ARUP Calculation Sheet

Job No.	Sheet No.	Rev.
C1157.100	33/34	P1

Member / Location N/A

Drg. Ref. N/A

Enterprise

Job Title Corrib Terminal Drainage

Made by SCC Date 26-11-03 Chd. pp JM

Reference	Calculation	Result
	Calculation 11	
	Main Access Roads Settlement Ponds	
	Drainage Area = 0.1 ha	
Eqn (1)	1-in-5 yr = 2.78(15)(0.1)	
	$Q = 4.2\ l/s$	
	$= 0.004\ m^3/s$	
	Pond is 2m wide x 1m deep	
Eqn (3)	$V = 0.004/2 = 0.002\ m/s$	
	Depth over weir	
Eqn (4)	$0.004 = 3.54\ h^{3/2}$	
	$h = 0.01\ m$	
Eqn (5)	Pond Length $= \dfrac{\cancel{0.004}\ 0.01 \times 0.002}{\cancel{0.07}\ 0.000045}$	
	$= 0.4\ m \Rightarrow \underline{1\ m}$	
	1-in-100 yr	
Eqn (1)	$Q = 2.78(31)(0.1) = 8.6\ l/s$	
Eqn (3)	$V = 0.0045\ m/s$	
Eqn (4)	$h = 0.02$	
Eqn (5)	Fall Velocity = 0.09 mm/s $\Rightarrow \sim 40$ mg/l	

ARUP Calculation Sheet

Job No. C1157.100 | Sheet No. 34/34 | Rev. P1

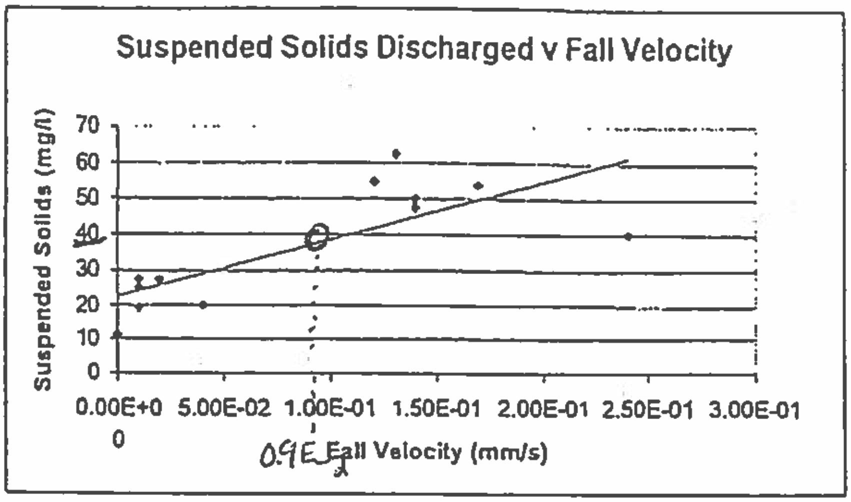
Member Location N/A

Drg. Ref N/A

Job Title Enterprise Corrib Terminal Drainage

Made by SCC Date 26-11-03 Chd. pp JM

Reference	Calculation	Result



Graph created from solids concentration / fall velocity data contained in Irz, 1991

Calculation 11 (cont)

1-in-5 year

SS = 30 mg/l

⇒ Fall Vel. = 0.045 m/s

1-in-100 year

Fall Vel = 0.09 m/s

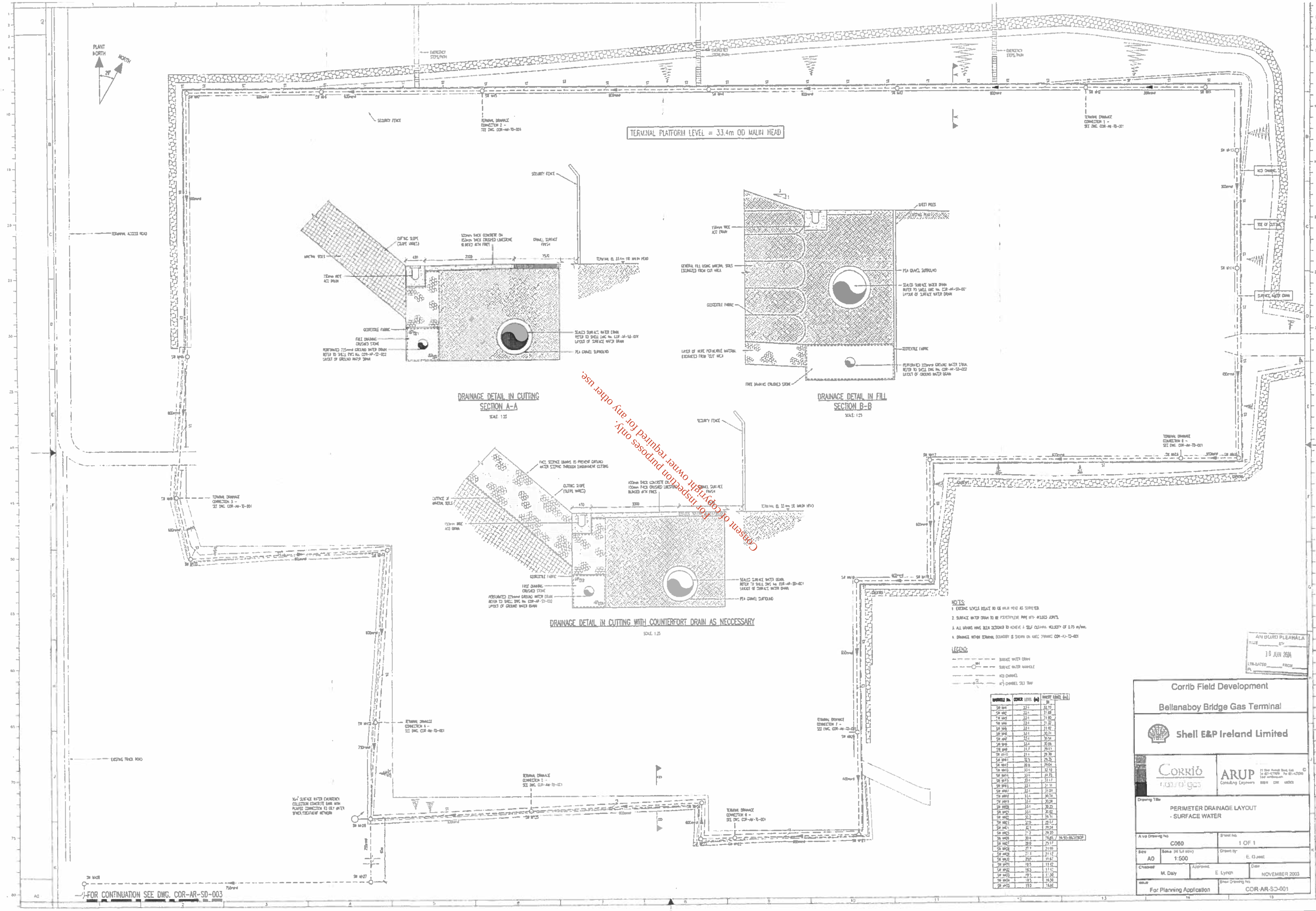
SS = ~ 40 mg/l

Arup Consulting Engineers

Perimeter Drainage Layout – Surface Water

Drawing
COR-AR-SD-001

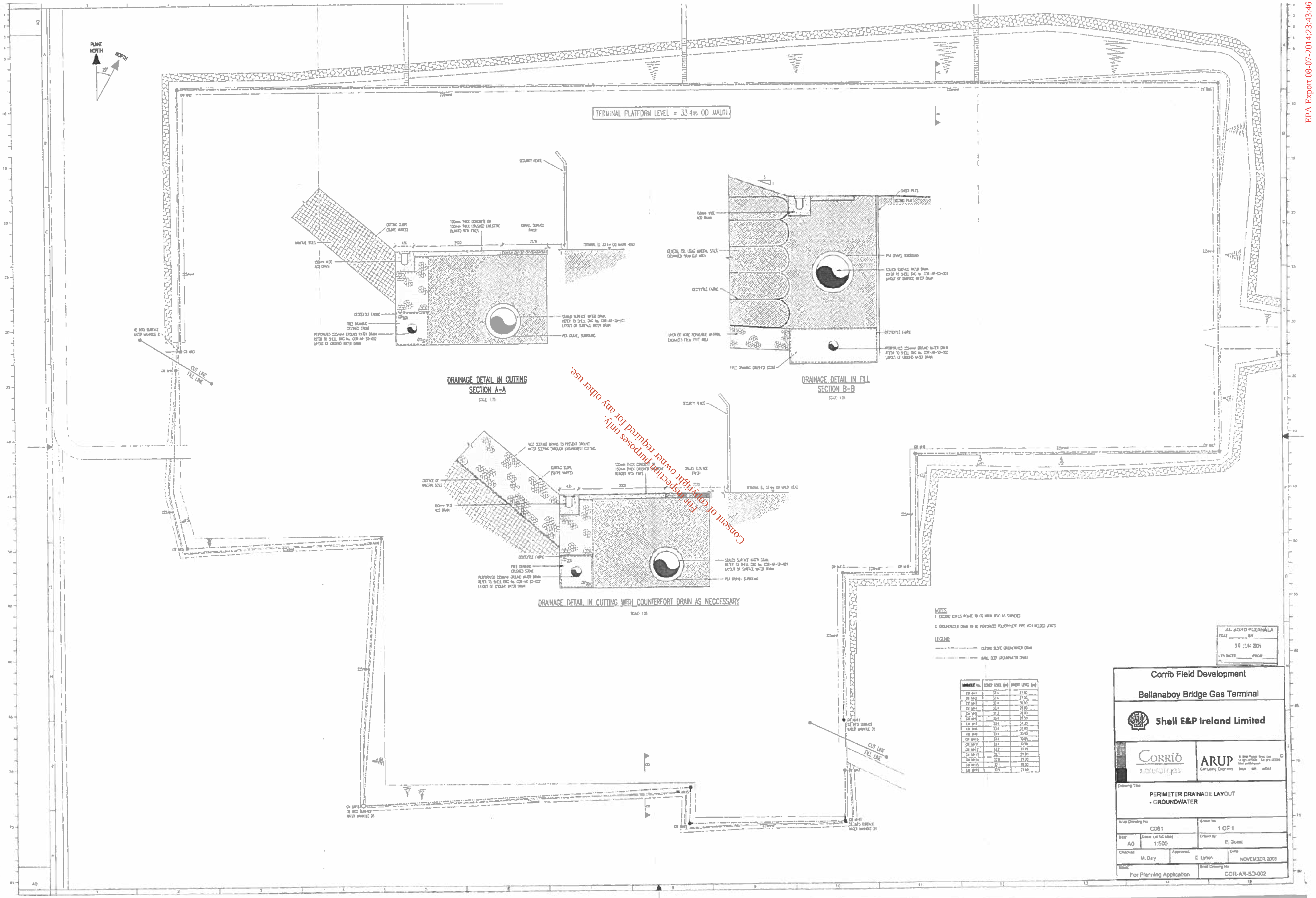
ARUP


PLANT NORTH
NORTH
TERMINAL PLATFORM LEVEL = 33.4m OD MALIN HEAD
SECURITY FENCE
TERMINAL ACCESS ROAD
EXISTING TRACK ROAD
DRAINAGE DETAIL IN CUTTING
SECTION A-A
SCALE 1:25
DRAINAGE DETAIL IN FILL
SECTION B-B
SCALE 1:25
DRAINAGE DETAIL IN CUTTING WITH COUNTERFORT DRAIN AS NECCESSARY
SCALE 1:25
NOTES:
LEGEND:
—FOR CONTINUATION SEE DWG. COR-AR-SD-003
AN BORD PLEANÁLA
16 JUN 2004
Corrib Field Development
Bellanaboy Bridge Gas Terminal
Shell E&P Ireland Limited
Corrib natural gas
ARUP Consulting Engineers
Drawing Title
PERIMETER DRAINAGE LAYOUT
- SURFACE WATER
Arup Drawing No
C060
Sheet No
1 OF 1
Size
A0
Scale (at full size)
1:500
Drawn by
E. Ó Jewell
Checked
M. Daly
Approved
E. Lynch
Date
NOVEMBER 2003
Issue
For Planning Application
Shell Drawing No
COR-AR-SD-001

Arup Consulting Engineers

Perimeter Drainage Layout - Groundwater Drawing COR-AR-SD-002

ARUP



NOTES.
1. EXISTING LEVELS RELATE TO OS MALIN HEAD AS SURVEYED
2. GROUNDWATER DRAIN TO BE PERFORATED POLYETHYLENE PIPE WITH WELDED JOINTS

LEGEND:
CUTTING SLOPE GROUNDWATER DRAIN
WALL DEEP GROUNDWATER DRAIN

MANHOLE No.	COVER LEVEL (m)	INVERT LEVEL (m)
CB MH1	33.4	31.80
CB MH2	33.4	31.05
CB MH3	33.4	30.50
CB MH4	33.4	29.00
CB MH5	31.3	28.80
CB MH6	33.4	28.50
CB MH7	33.4	31.30
CB MH8	33.4	31.00
CB MH9	33.4	30.90
CB MH10	33.4	30.85
CB MH11	33.4	30.50
CB MH12	33.2	30.49
CB MH13	32.1	29.80
CB MH14	32.0	29.20
CB MH15	32.1	28.50
CB MH16	30.9	28.60

AN BORD PLEANÁLA
TIME ______ BY ______
30 JUN 2004
LTR DATED ______ FROM ______
PL ______

Corrib Field Development
Bellanaboy Bridge Gas Terminal
Shell E&P Ireland Limited
Corrib natural gas
ARUP Consulting Engineers

Drawing Title:
PERIMETER DRAINAGE LAYOUT
- GROUNDWATER

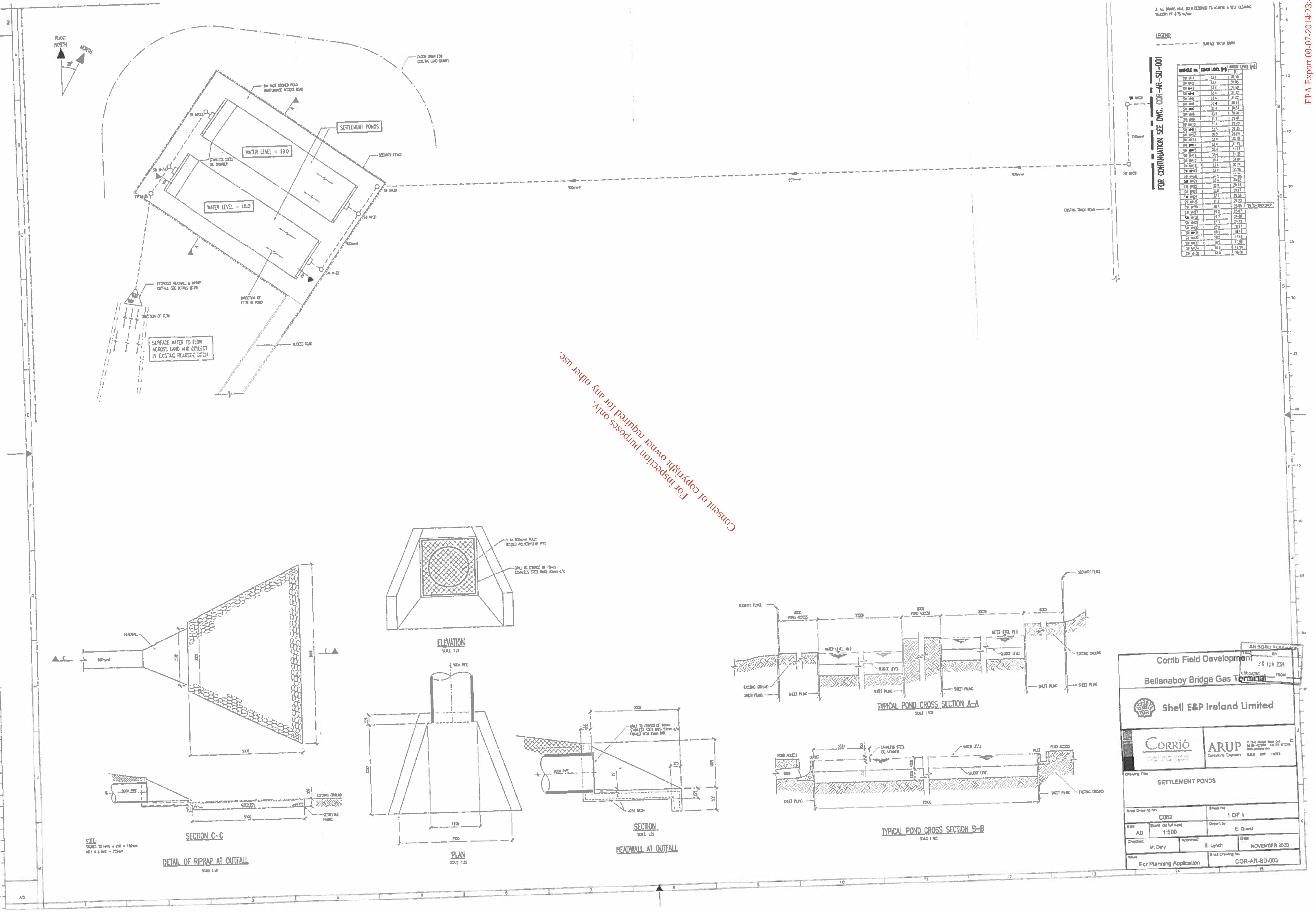
Arup Drawing No. C061		Sheet No. 1 OF 1	
Size A0	Scale (at full size) 1:500	Drawn by F. Guest	
Checked M. Daly	Approved E. Lynch	Date NOVEMBER 2003	
Status For Planning Application		Shell Drawing No. COR-AR-SD-002	

Arup Consulting Engineers

Settlement Ponds

Drawing
COR-AR-SD-003

ARUP



MANHOLE No.	COVER LEVEL (m)	INVERT LEVEL (m)
SW MH1	33.4	32.10
SW MH2	33.4	31.85
SW MH3	33.4	31.62
SW MH4	33.4	31.32
SW MH5	33.4	31.07
SW MH6	33.4	30.76
SW MH7	33.4	30.54
SW MH8	33.4	30.06
SW MH9	31.7	29.81
SW MH10	31.4	29.70
SW MH11	32.5	29.35
SW MH12	30.8	29.04
SW MH13	33.4	32.19
SW MH14	33.4	31.75
SW MH15	33.4	31.63
SW MH16	33.4	31.38
SW MH17	33.4	31.09
SW MH18	33.4	30.74
SW MH19	33.4	30.38
SW MH20	[illegible]	[illegible]
SW MH21	33.4	30.02
SW MH22	32.2	29.74
SW MH23	32.0	29.47
SW MH24	32.1	29.39
SW MH25	31.2	29.20
SW MH26	30.8	28.95 (28.50 - BACKDROP)
SW MH27	29.2	23.07
SW MH28	27.7	24.48
SW MH29	27.5	24.42
SW MH30	25.2	18.07
SW MH31	19.5	18.47
SW MH32	18.5	17.02
SW MH33	18.5	17.90
SW MH34	18.5	16.50
SW MH35	18.0	16.00

Corrib Field Development

Bellanaboy Bridge Gas Terminal

Shell E&P Ireland Limited

CORRIÓ

ARUP
Consulting Engineers

AN BORD PLEANÁLA
2 6 JUN 2004

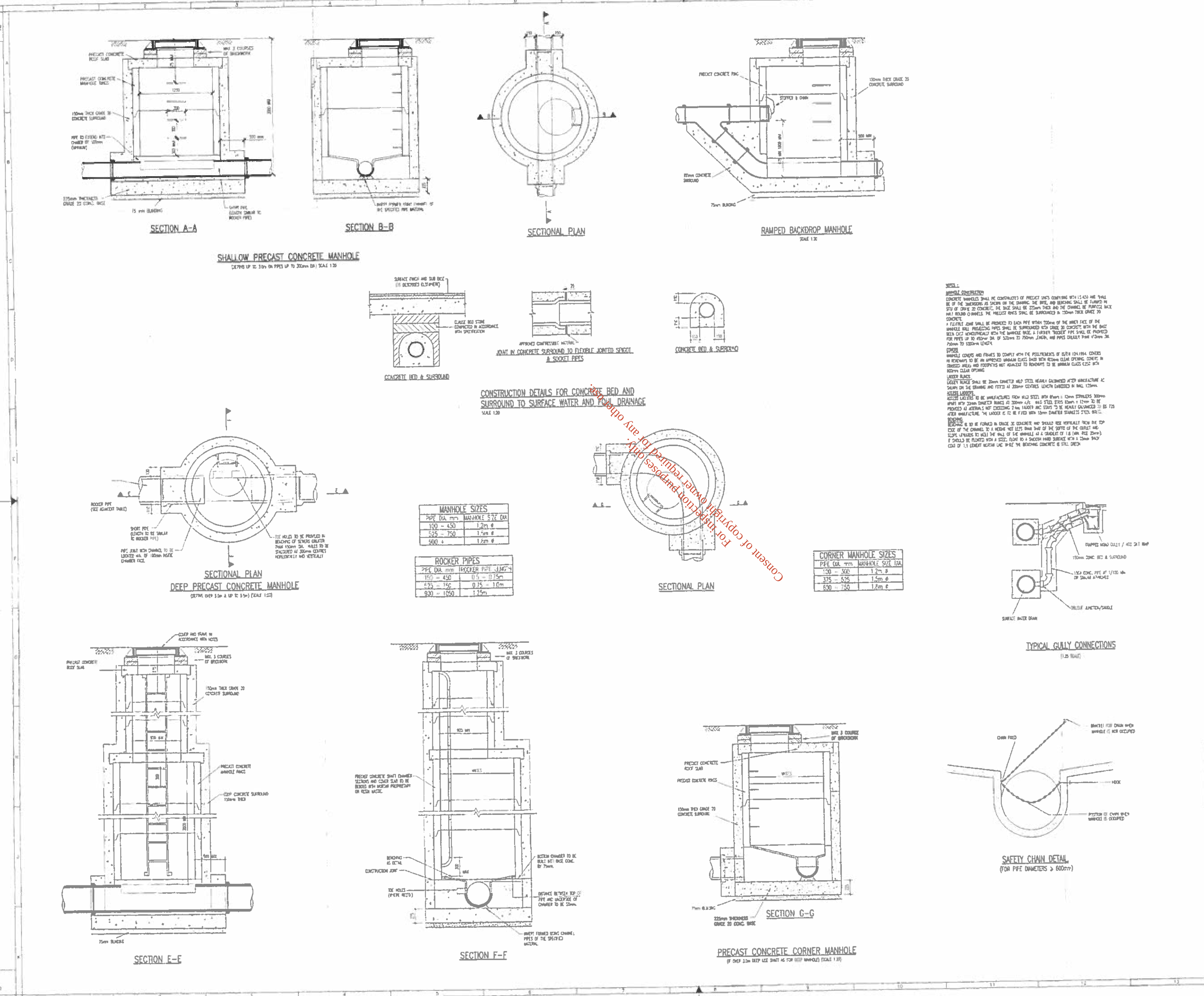
Drawing Title: SETTLEMENT PONDS

Arup Drawing No.: C062	Sheet No.: 1 OF 1
Size: A0	Scale (at full size): 1:500
Drawn by: E. Quest	
Checked: M. Daly	Approved: E. Lynch
Date: NOVEMBER 2003	
Issue: For Planning Application	Shell Drawing No.: COR-AR-SD-003

Arup Consulting Engineers

Typical Drainage Details

Drawing
COR-AR-SD-004



MANHOLE SIZES	
PIPE DIA. mm	MANHOLE SIZE DIA.
100 - 450	1.2m ø
525 - 750	1.5m ø
900 +	1.8m ø

ROCKER PIPES	
PIPE DIA. mm	ROCKER PIPE LENGTH
150 - 450	0.5 - 0.75m
525 - 750	0.75 - 1.0m
900 - 1050	1.25m

CORNER MANHOLE SIZES	
PIPE DIA. mm	MANHOLE SIZE DIA.
100 - 300	1.2m ø
375 - 525	1.5m ø
600 - 750	1.8m ø

Corrib Field Development

Bellanaboy Bridge Gas Terminal

Shell E&P Ireland Limited

Corrib natural gas — ARUP Consulting Engineers

Drawing Title: TYPICAL DRAINAGE DETAILS

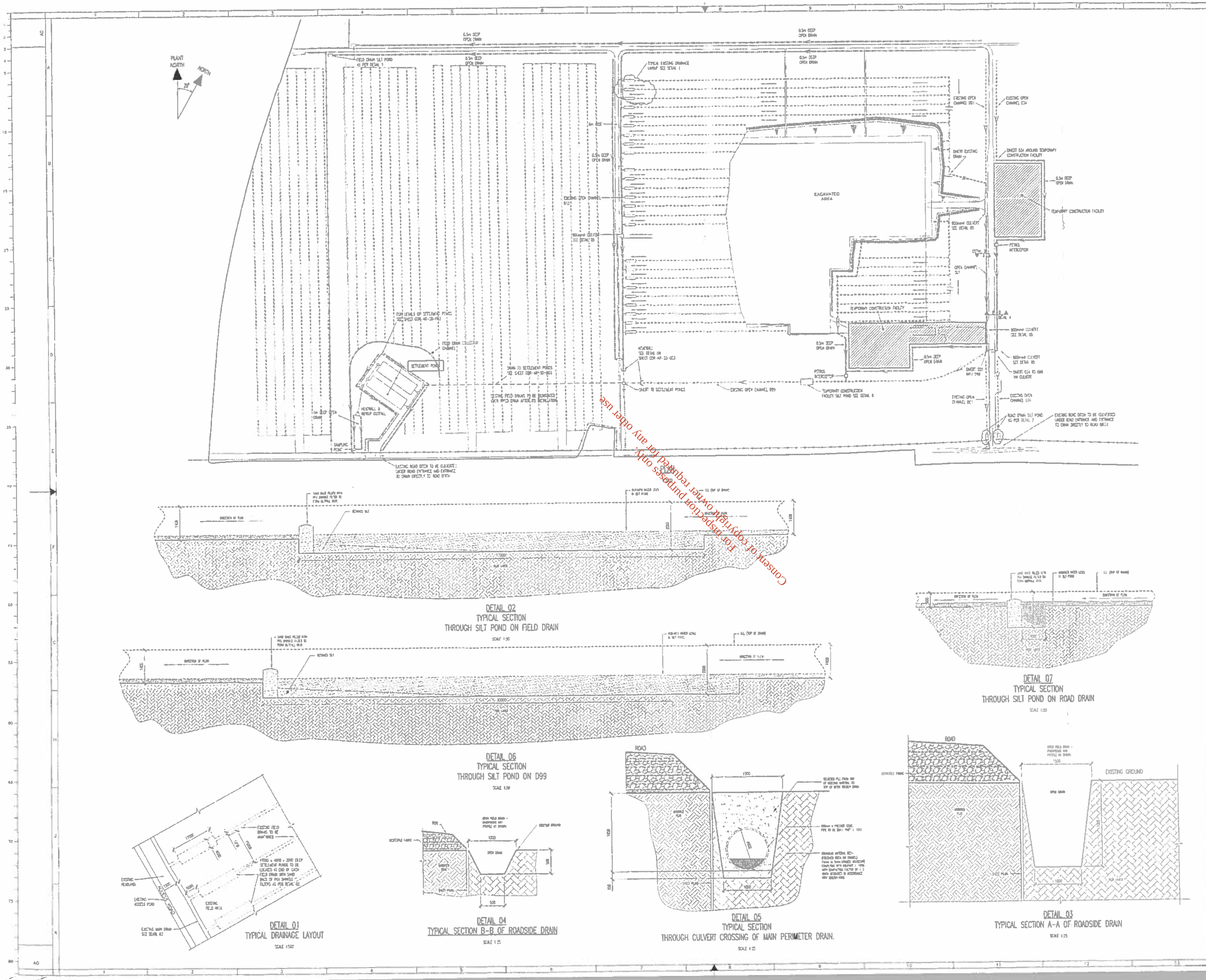
Arup Drawing No. C063		Sheet No. 1 OF 1
Size A0	Scale VARIOUS	Drawn by E. Guest
Checked M. Daly	Approved E. Lynch	Date NOVEMBER 2003
Issue: For Planning Application		Shell Drawing No. COR-AR-SD-004

Arup Consulting Engineers

Construction Phase Drainage Layout – Before Settlement Pond is Constructed

Drawing
COR-AR-SD-005

ARUP



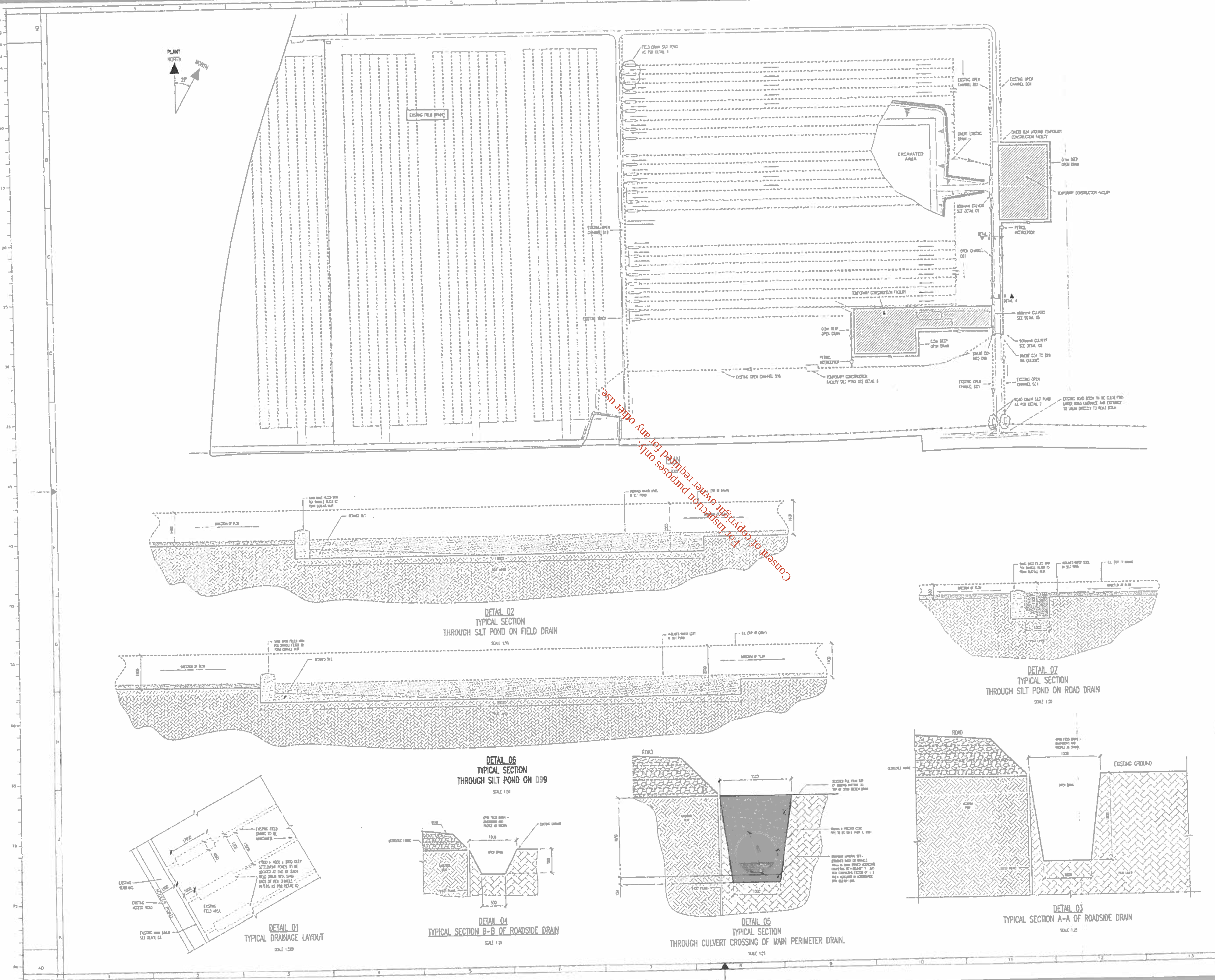
Corrib Field Development	
Bellanaboy Bridge Gas Terminal	
Shell E&P Ireland Limited	
CORRIB	ARUP Consulting Engineers
Drawing Title	CONSTRUCTION PHASE DRAINAGE LAYOUT - AFTER SETTLEMENT POND IS CONSTRUCTED
Arup Drawing No. C085	Sheet No. 1 OF 1
Size A0	Scale VARIOUS
Drawn by D Kabel	Checked B Cullen
Approved E Lynch	Date NOVEMBER 2003
Issue For Planning Application	Shell Drawing No. COR-AR-SD-006

Arup Consulting Engineers

Construction Phase
Drainage Layout –
After Settlement Pond is
Constructed

Drawing
COR-AR-SD-006

ARUP



NOTES:

DURING CONSTRUCTION OF THE TERMINAL, SURFACE WATER WITHIN THE TERMINAL WILL BE SUMPED AND PUMPED TO THE EXISTING FIELD DRAINS.

LEGEND:

= OPEN CHANNEL

= EXISTING OPEN CHANNEL

= CULVERT

Corrib Field Development

Bellanaboy Bridge Gas Terminal

Shell E&P Ireland Limited

Corrib

ARUP Consulting Engineers

Drawing Title: CONSTRUCTION PHASE DRAINAGE LAYOUT - BEFORE SETTLEMENT POND IS CONSTRUCTED

Arup Drawing No.	C004	Sheet No.	1 OF 1
Size	A0	Scale (at full size) VARIOUS	Drawn by D Karal
Checked	S Cullen	Approved E Lynch	Date NOVEMBER 2003
Issue	For Planning Application	Shell Drawing No.	COR-AR-SD-005

Arup Consulting Engineers

Report 12

AMEC Civils Drainage Philosophy and Calculations

	amec	Corrib natural gas

Corrib Project L3882	Shell E+P Contract No. 101.24.15
CORRIB FIELD DEVELOPMENT: BELLANABOY BRIDGE GAS TERMINAL	

DOCUMENT TITLE: CIVILS DRAINAGE PHILOSOPHY DOCUMENT

DOCUMENT NUMBER: L3882-030-110-0390

SHEET NO.: 1 of 10

P1	NOV '03	FOR PLANNING APPLICATION	DSR	MC	SC
REV	DATE	DESCRIPTION	BY	CHK	APP
REVISIONS			APPROVALS		

CONTENTS

1. INTRODUCTION

Shell E+P Ireland Limited (SEPIL) are submitting a new Planning Application for the Corrib Natural Gas Terminal at Bellanaboy Bridge.

This report describes the terminal site drainage system, the drainage system is critically important for the following reasons:

- To control run-off and prevent pollution and damage to land, water bodies and watercourses in the local area around the site.
- For foundation, earthwork integrity and global stability.
- For operational reasons during the life of the facilities.

2. PREAMBLE

AMEC (Oil and Gas) has assessed the drainage design within the terminal security fence area. The purpose of this document is to set out the drainage design philosophy.

Arup Consulting Engineers have carried out the engineering of the drainage for the overall area of the development, AMEC have prepared the drainage design for the terminal site, which interfaces with the Arup designed drainage system.

This report assesses the 'final' terminal site drainage condition. Arup has also assessed the existing drainage arrangement and the drainage during the construction phase.

3. TERMINAL DRAINAGE SYSTEMS – SUMMARY

The terminal drainage is controlled using four separate drainage systems, summarised below, which are covered in more detail within this report. Refer to drawing number COR-AM-TD-001 for the terminal drainage schematic.

- Open ditch system (surface water)
- Surface water system (roof drainage).
- Oily water system, including access road and car park.
- Foul Sewer.

The terminal open ditch system captures uncontaminated rainfall and discharges into the external drainage system, at six locations. Refer to Appendix A for a schematic indicating the interface locations. Refer to drawing Number COR-AR-SD-001 for the external drainage drawing.

The surface water system collects rainfall from building roofs and discharges into the external drainage system, at two locations. There is an additional discharge from the administration building surface water system, which is routed to an existing ditch, which is also shown on the external drainage drawing.

The oily water system is a piped, self-contained system, routed to the open drains sump for treatment and discharging offshore via an out-fall. This system captures any water run-off that might be contaminated with oil or other chemicals.

The foul water sewer is routed to a "Puraflo" system for treatment and discharge.

4. DESIGN PARAMETERS

The design calculations were based on the following parameters.

- The 100-year return event rainfall is assumed to be 31mm in one hour. However, the drainage systems were also reviewed for the extreme design rainfall event of 45mm in one hour.
- A run-off co-efficient of 0.6 was applied for unpaved (gravel areas)
- A run-off co-efficient of 1.0 was applied for paved areas and roads.
- Catchment areas were assessed from the drainage drawing.
- Drainage run lengths were assessed from the drainage drawing.
- Localised flooding of ditch systems is not permissible.

The capacity analyses have been determined from the Micro-drainage program. Refer to appendix A for the drainage system calculations.

5. OPEN DITCH SYSTEM

5.1 INTRODUCTION

The ditch arrangement, and sizes are indicated on the terminal drainage plan drawing, drawing number COR-AM-TD-001. The on plot ditches will be constructed along the edges of the roads, and will be concrete lined. The ditch design is based on trapezoidal and rectangular cross section.

The purpose of the concrete lining is to avoid ground contamination from surface water run-off from the terminal site.

Although the 100-year return rainfall event is 31mm in one hour the drainage system was checked for the extreme design rainfall of 45mm in one hour.

The rate of rainfall was assessed using the relationships given in 'The Wallingford Procedure', based on the reference design rate rainfall of 45mm in one hour.

The design was carried out on the basis that localised flooding of the ditch system is not permissible. This analysis was performed using the Micro-Drainage 'simulation' program, this considers the backwater curve through the system and therefore provides a realistic and robust result.

5.2 OUTFLOWS FROM ON-PLOT DITCHES.

The on-plot ditch drainage system interfaces with the Arup external ditch system at six locations, as shown in appendix A.

The summary of ditch outflows is as below:

Ditch System	Tie in point number	Outflow Invert Level (m)	Time of Concentration (min)	Max Flow (l/s)
NW Ditch outfall	1	31.800	13-21	120
NE Ditch outfall	2	32.216	8-14	190
E Ditch outfall	3	32.135	9-16	151
SE Ditch outfall	4	31.300	15-25	261
Firewater pond ditches	5	31.650	13-23	329
W Ditch outfall	6	32.400	9-15	205

6. SURFACE WATER SYSTEM.

6.1 INTRODUCTION

The surface water system collects the water run-off from the building roofs as well as water at ground level where required for de-watering. The surface water is split into three systems to reflect the location of the various buildings, and as such there are three discharge locations.

- Generator building, firewater pump house, wastewater treatment building and firewater building discharge into the external drainage system.
- The control building discharge into the external drainage system.
- The Maintenance building and administration building complex drains into the existing ditch in the tree firebreak.

Although the 100-year return rainfall event is 31mm in one hour the drainage system was checked for the extreme design rainfall of 45mm in one hour.

The rate of rainfall was assessed using the relationships given in 'The Wallingford Procedure', based on the reference design rate rainfall of 45mm in one hour.

The design of the system was carried out using the Micro-drainage 'storm' program without consideration of storage within the system. The system is capable of accommodating short term peaks in rainfall under even more extreme conditions than the 45mm in one hour, if the effect of storage is considered.

6.2 OUTFLOWS FROM ON-PLOT SURFACE WATER SYSTEM – INTERFACE WITH EXTERNAL DRAINAGE SYSTEM

Surface water System	Tie in point number	Outflow Invert Level (m)	Time of Concentration (min)	Max Flow (l/s)
Control Building	7	31.425m (At N 32820m)	5.1	38
LER, Drains Sump, Generator Building, Firewater Pump House	8	29.900m (At N 32820m)	10.0	147

6.3 OUTFLOWS FROM ON-PLOT SURFACE WATER SYSTEM – DRAINING TO EXISTING DITCH IN FIRE BREAK BETWEEN TREES

Surface water System	Tie in point number	Outflow Invert Level (m)	Time of Concentration (min)	Max Flow (l/s)
Admin Area Buildings (roofs only)	9	31.000m (At N 32816m)	5.6	74

7. OILY WATER SYSTEM

7.1 INTRODUCTION

In the paved areas the paving is laid to falls, draining to catch basins at the low point of the paving. The discharge from the oily water system is collected in the open drain sump (T-8301) for treatment.

The oily water system design was assessed for the following paved areas.

- Slug catcher area and Storage tanks bunds (Raw methanol, product methanol and condensate) system.
- Process area.
- Waste storage area.
- Flare Facilities Area (where paved).

The oily water system was checked for two design conditions, firewater event and heavy rain event.

7.2 FIREWATER FLOW RATES

The firewater flow rate for the tanks is based on the maximum deluge flow rate on the condensate tank. The firewater in the bund discharges through an overflow at the top of the bund into the oily water system, where it drains into the oily water sump.

The firewater rate for the process area is based on 4 monitors and 4 hydrants working simultaneously. The flow rate from the waste storage area is based on 2 hydrants working.

The fire water rate for the flare facilities area is based on 1 monitor working, the fire water flow enters the drainage system at the HP / LP knock out vessels paved area.

7.3 RAINWATER RUN-OFF

Although the 100-year return rainfall event is 31mm in one hour the drainage system was checked for the extreme design rainfall of 45mm in one hour.

The rate of rainfall was assessed using the relationships given in 'The Wallingford Procedure', based on the reference design rate rainfall of 45mm in one hour.

The design of the system was carried out using the Micro-drainage program without consideration of storage within the system. The system is capable of accommodating short term peaks in rainfall under even more extreme conditions than the 45mm in one hour, if the effect of storage is considered.

The paved catchment areas were calculated for each part of the oily water system, and are detailed in Appendix A.

The discharge from the paved areas, for the average hourly rainfall, is given in the table below. The total paved area represents all of the paving on the terminal site.

Event	Rainwater Run-off Rate	
	TOTAL PAVED AREA M^2	13,000
20 Year Return, Daily Maximum Rainfall	2.825 mm / hr	36.7 m^3/h
1 hour, 100 Year Return Rainfall	31mm / hr	402 m^3/h
1 hour, Extreme Rainfall	45mm / hr	584 m^3/h

7.4 OILY WATER SYSTEM DESIGN SUMMARY.

The table below provides details of the drainage flow rates for each of the drainage systems. The governing case for drainage design purposes is highlighted.

System Description	Rain Water 45mm / hr(l/s)	Firewater (l/s)	Design Case
Slug Catcher And Storage Tanks	73	320	Fire Water
Main Header To Open Drains Sump	362	320	Rain Water
Process Area	261	160	Rain Water
Waste Storage Area	130	218	Fire Water
Flare Area	17	50	Fire Water

Note the rain water flow rates in the table above are the instantaneous maximums and are not the average rain water rates.

8. ACCESS ROAD AND CAR PARK

The terminal access road includes a separate, piped drain system to contain possible tanker spillage and rainwater run-off. This system extends from the entrance gate to the waste storage area, and up to the tanker loading / unloading area.

The car park drainage is also connected to this piped drain system, to contain rainwater run-off.

The piped drain system is gravity drained into a sump, located alongside the entrance road inside the main entrance gate, from where it is pumped back to the terminal oily-water system (ref section 7.0 above).

The rate of rainfall was assessed using the relationships given in 'The Wallingford Procedure', based on the reference design rate rainfall of 45mm in one hour.

The system design was checked for a 45mm per hour extreme rainfall event, on the basis that no localised flooding of the ditch system would be permitted. This analysis was performed using the Micro-Drainage 'simulation' program, this considers the backwater curve through the system and therefore provides a realistic and robust result.

9. FOUL WATER SYSTEM

The foul water system from the administration building and control building drains to a septic tank, where it is pumped via a pumping chamber through a "Puraflo" system for treatment and discharge. The "Puraflo" system size is based on an occupany of 30 personnel at the terminal. The discharge is through a percolation area of 300m^2, which is provided outside the security fence south of the car park.

The discharge units were calculated in accordance with BS 8301

Number Of Units	Discharge Tie In Point Number (Ref. Appendix 8)	Flow Rate (l/s)
259	10	5

APPENDIX A CONTENTS

APPENDIX A - CALCULATIONS

SECTION A1 INTRODUCTION

Shell E & P require the drainage systems on the Terminal Site to be designed for rainfall of 31mm in one hour (100 year return period). Shell have also indicated that the effect of an alternative, more extreme, rainfall of 45mm in one hour (100 year return period) should be considered. The calculations which follow have been based on the 45mm in one hour rainfall case for simplicity. The designed system will, therefore, be robust for the 31mm rainfall condition.

For the purpose of these calculations, the extreme design rainfall of 45mm in one hour is used and is described as the reference design condition.

The rainfall profiles in storms of different durations and return period to the base design condition have been assessed using the relationships given in the Wallingford Procedure. An example of these calculations is included in Section A2 - Design Storm Intensity and Return Period. In practice, these calculations have been carried out using the Micro Drainage Win Des software.

It is common practice to design drainage systems for a storm of 5 or 10 year return period using the 'Modified Rational Method', as described in the Wallingford Procedure. This designs drainage on a simple basis, which does not take account of the beneficial effects of storage within the system and surcharge. Where required, the drainage system can be re-checked for its resistance to flooding in a longer return period storm, allowing for the effects of storage and surcharge.

BS EN 752-2 - 'Drain and Sewer Systems Outside Buildings - Performance Rquirements' suggests that sewer systems in industrial areas should be designed for a 1 in 5 year return period storm. Where it is required to check the resistance to flooding in a longer period storm, the Standard recommends that a 1 in 30 year return period storm is considered.

The piped drainage systems have been designed for a 1 in 10 year storm, without any consideration of the effects of storage within the system or surcharge. This is a more severe design condition than the 1 in 5 year storm suggested in BS EN 752-2. As the reference design condition of 45mm rainfall in one hour is also conservative, it can be seen that a highly robust system results.

Sizing of the open rainwater ditches has been carried out initially based on the 1 in 10 year storm, as for the piped drain systems. In view of the fact that surcharge of these drains would immediately result in flooding, these ditches have been individually checked for a 1 in 100 year storm, taking account of storage within the system. The rainfall profile during this design storm event varies according to the time taken for water to travel down each system. For each system, the actual rainfall profile has been derived from the reference design condition, as described above. As the reference design condition of 45mm rainfall in one hour is conservative, it can be seen that a highly robust system results.

Client:	Shell E & P Ireland Ltd.	Job Ref. L3882
Plant:	Gas Reception Terminal	
Location:	Corrib On-Plot Storm Drainage	Sheet no./rev.

Calc. by	Date	Chck'd by	Date	App'd by	Date
IM	Nov '03				

To summarise:

- Piped drain systems are designed for a 1 in 10 year storm, taking no account of the beneficial effects of storage and surcharge.
- Open drain systems are designed for a 1 in 100 year storm, with the beneficial effects of storage within the system taken into account.
- The rainfall profile for each system is derived from the reference design condition, according to the design storm return period and the time taken for water to travel down the system.

The calculations have been carried out initially using the Micro Drainage Win Des 'Storm' program, which ignores the effects of storage and surcharge. Design of open ditches is checked using the more complex Win Des 'Simulation' programme, which allows for the beneficial effects of storage within the ditches.

The interface between the on-plot Terminal drainage system and the external drainage system designed by Arup is shown on Drawing COR-AP-SD-001. The Terminal drainage layout is shown on Drawing COR-AM-TD-001/002 - Terminal Drainage Plan.

The results of initial calculations were made available to Arup for design of the external drainage system. The final calculations included here show some variation to these figures, but the latest figures are generally less severe. For simplicity, the figures given in the summary report have been left unchanged. Full consistency checks will be made during the detailed design of the drainage systems.

The on-plot drainage generally takes runoff within the boundary road. A small amount of runoff from the area outside the boundary road is also allowed for. Other runoff, including runoff from the flare area and the ground drainage from the admin buildings and car park areas is taken by the external drainage system, designed by Arup.

Calculations have been carried out on the basis of a common plant level of 100m (equal to 33.400m OD).

SECTION A2 Design Storm Intensity and Return Period

The rate of rainfall has been assessed using the relationships given in 'The Wallingford Procedure', based on the reference design condition of 45mm in one hour (100-year return period). The Appendix in 'Volume 4 – The Modified Rational Method' is used.

Calculations are carried out using the WinDes software and manual estimations are included here as a cross-check on the values computed by the software. These manual calculations also enable us to find a value of M5-60 which correlates with the design case of "M100-60 = 45mm".

The calculations below start with the value of M5-60 = 20mm. Rainfall intensities are assessed and the resulting value of M100-60 is found. The value of M5-60 is then adjusted pro-rata to a value appropriate for M100-60 = 45mm. The detailed figures below are provided to show the derivation only and are not representative of the 45mm rainfall case. They are, however close and provide confidence in the output from the Win Des software. It is not considered necessary to re-run the figures for the correct M5-60 value.

(Seed value); "M5-60min = 20 mm"

From Fig A.2, the figure of R in the previous calculations appears to cover all circumstances. Therefore accept the earlier figure; r = 0.4

From Fig A.3b, obtain values of Z1 and insert in the spreadsheet below:

Storm Duration (Mins)	Storm Duration (Hours)	Z1	M5-60	5-Year Depth for Duration D (M5-D) (mm)
5	0.083	0.4	20	8.00
10	0.166	0.56	20	11.20
15	0.25	0.65	20	13.00
30	0.5	0.78	20	15.60
	1	1	20	20.00
	2	1.3	20	26.00
	4	1.59	20	31.80
	6	1.79	20	35.80
	10	2.21	20	44.20
	24	2.8	20	56.00
	48	3.5	20	70.00

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Use values in Table A-1 (of the Wallingford Procedure Vol 4) to give values of MT-D and intensity, for comparison with Micro Drainage output.

Storm Duration (Hours)	5-Year Depth for Duration D (M5-D) (mm)	M50-D (mm)	50-Year Intensity (mm/hr)	M100-D (mm)	100-Year Intensity (mm/hr)
0.083	8.00	12.96	156.14	14.96	180.24
0.166	11.20	18.59	112.00	21.62	130.22
0.25	13.00	21.84	87.36	25.48	101.92
0.5	15.60	26.52	53.04	31.20	62.40
1	20.00	34.60	34.60	40.60	40.60
2	26.00	44.46	22.23	52.00	26.00
4	31.80	50.56	12.64	62.01	15.50
6	35.80	59.79	9.96	69.09	11.52
10	44.20	71.16	7.12	81.77	8.18
24	56.00	87.36	3.64	99.68	4.15
48	70.00	104.30	2.17	116.90	2.44

From the above, it can be seen that the 100-year 1-hour rainfall corresponding with the M5-60 value of 20mm used in the original calculations is 40.6mm. This is fairly close to the required value of 45mm.

It can be seen from the above table that the M5-60 figure used in the Micro Drainage computer runs should be increased by a factor of 45/40.6 to suit the 100-year 1-hour rainfall design value of 45mm. Therefore, the Micro Drainage analyses have been carried out using the M5-60 value of 22.2mm.

SECTION A3 RUNOFF COEFFICIENTS

A run off coefficient of 1.0 is used for paved areas and a runoff coefficient of 0.6 for unpaved areas.

The Modified Rational Method would be used in the United Kingdom for the design of urban drainage systems. This is described in 'Design and Analysis of Urban Drainage, Volume 4, The Modified Rational Method'. From Section 4 it can be seen that the Volumetric Runoff Coefficient, Cv, would normally be taken as 0.75. A Routing Coefficient, Cr, would be taken as 1.3. The overall runoff coefficient for impervious areas would, therefore, be 0.75 x 1.3 = 0.975.

The documentation provided with the Micro Drainage Win Des program shows that a Routing Coefficient of 1.3 is included in the program design. The default value of Cv is 0.75. However, if it is required to adopt an overall runoff coefficient of 1.0, as is the case here, a Cv of 0.77 can be entered. The overall runoff coefficient is then 0.77 x 1.3 = 1.001.

When using the Modified Rational Method for design of urban drainage, it is common to ignore runoff from pervious areas. The Cv of 0.75, combined with Cr of 1.3, applied to impervious areas, is considered sufficient to allow for the runoff from both pervious and impervious areas.

At the Corrib Terminal site, conditions cannot be described as urban. For non-standard conditions, 'The Wallingford Procedure, Volume 1, offers Equation 7.3. As a check, the overall catchment permeability has been calculated in accordance with this equation, as shown below:

"PIMP is the percentage of catchment area covered by impervious surfaces intended to drain to the storm sewer: From the assessments of road areas within the original calculations it can be seen, by eye, that the impervious areas represent less than 25% of the total areas (total area = pervious + impervious area). For this comparison calculation, the impervious areas are, conservatively, taken to be 30% of the total areas".

Percentage of catchment area covered by impervious surfaces; PIMP = 30

SOIL is, conservatively, taken as the upper limit value of 0.5, from Section 7.4 of 'The Wallingford Procedure' (equivalent to a rock or peat surface); SOIL = 0.5

From Section 9.4 and Fig 9.7 (Annual rainfall taken as 1450mm from Section 2.2.5 of document L3847-010-110-0001 Rev A2); UCWI = 145

From Eqn 7.3;

PR = (0.829×PIMP) + (25.0×SOIL) + (0.078×UCWI) – 20.7; PR =**27.980**

This shows that an overall runoff coefficient of 0.3 would be adequate when applied to the overall catchment, including the impervious areas. Allowing for an overall runoff coefficient of 1.0 applied to the impervious areas, a conservative value of runoff coefficient for the pervious areas alone would be;

Cperv = ((0.3×1)-(0.25×1))/1; Cperv = **0.050**

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As indicated above an overall runoff coefficient of 0.6 has been applied to the pervious areas. It is considered that a highly conservative design results, in line with the design requirement to avoid pollution caused by flooding.

As noted above for the impervious areas, a Cv value 0.77 has been used in the program input In combination with the Cr value of 1.3, a total runoff coefficient of 1.0 is applied to 0.6 x Pervious Area. This is equivalent to applying a total runoff coefficient of 0.6 to all of the pervious area.

It can be seen that the calculations are conservative. Ditches on the Terminal Site should be well able to cope with storm flows and minor local variations in rainfall, ditch profile, etc.

SECTION A4 DESIGN OF ON-PLOT OPEN DITCHES (RAINWATER)

Open ditches are laid flat where possible. This does not generate enough flow velocity to be self cleansing. It is a requirement that the on-plot ditches will be regularly maintained and that this should not present undue difficulty. It should be noted that it may be necessary to provide handrail or grating to some ditches.

Open ditches are to be provided with a concrete lining, to minimise the possibility of ground pollution in the event of a spill. In order to contain any spillage, the open ditches are designed to work without overtopping.

Open ditches have been sized initially using the 'Storm' program. In order to confirm that the on-plot ditch system will operate without flooding, calculations were transferred to the Micro-Drainage 'Simulation' program. This considers the backwater curve through the system and is expected to provide a more realistic result.
The on-plot open ditches have a sprayed concrete lining. The purpose of the lining is to avoid ground contamination by oil spillage.

The areas draining to each ditch have been marked on the Catchment Areas drawing included at Appendix A10.

There are six ditch systems making up the total on-plot rainwater ditch system. These are:

- North-West outfall ditches.
- North-East outfall ditches.
- East outfall ditches.
- South-East outfall ditches.
- Firewater pond area ditches.
- West outfall ditches.

Drawings showing the run numbers used in computer calculations for each ditch length are included at Appendix A11.

Following the summary of calculated outflows, below, are:

- Detailed summation of areas draining to each ditch.
- Win Des calculations output.

A4.1 Summary of Outflows from On-Plot Ditches:

Given below are the summaries of the outflows from the Terminal Site ditches. These outflows are given for a 1 in 100-year storm, based the reference design condition, using the 'Simulation' design software. As indicated in the Introduction, above, these are values resulting from initial runs and it is not considered necessary to revise the figures to reflect changes of small effect in the final calculation runs which follow.

Ditch System	Outflow Invert Level (m)	Time of Concentration (min)	Max Flow (l/s)
NW Ditch outfall	98.400	13-21	120
NE Ditch outfall	98.816	8-14	190
E Ditch outfall	98.735	9-16	151
SE Ditch outfall	97.900	15-25	261
Firewater pond ditches	98.250	13-23	329
W Ditch outfall	99.000	9-15	205

The range of times of concentration is given as it was noted that the times of concentration calculated in 'Simulation' were much longer than output from the original 'Storm' calculations. It has been recommended to Arup that the effect on the perimeter drain system of the range of times of concentration should be considered.

A4.2 'Simulation' Runs for On-Plot Ditches

As noted in the Introduction, above, it was decided to analyse the ditch systems using the Micro Drainage 'Simulation' package. The package analyses the backwater curve in individual pipe lengths and links the water levels of adjacent pipe lengths to calculate the overall flow in the system.

The network data have been brought in to the 'Simulation' package, on the following basis:

- Trapezoidal ditch invert levels include a nominal fall of up to 10mm, to allow the program to function, the program expects channels laid falls. (Rectangular channels will be constructed to falls).
- A standard head loss coefficient of 1.0 has been applied at all the manholes called up in the network data. This is intended to make some allowance for the losses at bends which are not included in the current network model.

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A4.3 DRAINED AREA SUMMATIONS FOR INDIVIDUAL DRAIN RUNS (TIE IN POINT 1)

A4.3.1 NORTH WEST OUTFALL DITCH SYSTEM – AREAS DRAINING TO DITCHES

Description	Contributing to Pipe Length	Drain Length (m)	Area Length (m)	Area Breadth (m)	Cv, Runoff Coefficient (If Partially Pervious)	Area (m2)	Sum of Areas (m2)	Comment
NW Outfall Ditches								
Road	1.000	140	75	3	1	225		
Road			55	3	1	165		
Road			20	3	1	60		
Road			8	3	1	24		
Pervious Area			50	15	0.6	450		
Pervious Area			25	15	0.6	225		
Pervious Area			45	13	0.6	351		
Road			3	70	1	210	1710 m2	
	1.001	10	0	0	0	0		Carrier
Road	1.002	30	35	3	1	105		
Road			3	25	1	75		
Road			30	11	0.6	198	378 m2	
Road	2.000	15	20	3	1	60		
Road			3	15	1	45		
Road			15	15	0.6	135	240 m2	
	1.003	10	0	0	0	0		Carrier
Road	3.000	57	3	20	1	60		
Road			60	3	1	180		
Road			3	18	1	54		
Pervious Area			55	11	0.6	363	657 m2	
	3.001	10	0	0	0	0		Carrier
Road	3.002	30	28	3	1	84		
Road			3	18	1	54		
Pervious Area			25	12	0.6	180	318 m2	
Road	4.000	18	25	3	1	75		
Road			3	15	1	45		
Pervious Area			7	12	0.6	50	170 m2	
	3.003	10	0	0	0	0		Carrier
	5.000	95	95	3	1	285		
			95	3	0.6	171	456 m2	
	3.004	45	45	3	1	135		
			45	3	0.6	81	216 m2	
	6.000	120	110	3	1	330		
			115	3	0.6	207	537 m2	
Total							$\boxed{4682}$ m2	

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A4.3.2 NORTH EAST OUTFALL DITCH SYSTEM – AREAS DRAINING TO DITCHES (TIE IN POINT 2)

Description	Contributing to Pipe Length	Drain Length (m)	Area Length (m)	Area Breadth (m)	Cv, Runoff Coefficient (If Partially Pervious)	Area (m2)	Sum of Areas (m2)	Comment
NE Outfall Ditches								
Pervious Area	1.000	40	34	10	0.6	204		
Pervious Area			30	5	0.6	90		
Road			35	3	1	105		
Road			15	3	1	45		
Road			15	3	1	45		
Road		13	15	3	1	45	534	m2
	1.001	6	0	0	0	0		Carrier
Road	2.000	35	50	3	1	150		
Road			15	3	1	45		
Road			11	8	1	88		
Pervious Area			35	5	0.6	105	388	m2
Road	1.002	29	25	3	1	75		
Pervious Area			22	6	0.6	79	154	m2
Road	3.000	13	18	3	1	54	54	m2
	1.003	10	0	0	0	0		Carrier
Road	4.000	13	18	3	1	54	54	m2
Road	1.004	75	75	3	1	225		
Pervious Area			15	20	0.6	180		
Pervious Area			58	40	0.6	1392	1797	m2
Road	5.000	78	32	3	1	96		
Road			60	3	1	180		
Pervious/Paving			35	52	0.9	1638	1914	75% future paving allowed
Road	6.000	150	142	3	1	426		
Pervious Area			142	3	0.6	256	682	m2
Road	7.000	140	40	3	1	120		
Road			90	3	1	270		
Pervious Area			40	3	0.6	72		
Pervious Area			95	3	0.6	171	633	m2
	1.005	10	0	0	0	0		Carrier
	1.006	14	0	0	0	0		Carrier
Total							$\boxed{6210}$	m2

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A4.3.3 EAST OUTFALL DITCH SYSTEM – AREAS DRAINING TO DITCHES (TIE IN POINT 3)

Description	Contributing to Pipe Length	Drain Length (m)	Area Length (m)	Area Breadth (m)	Cv, Runoff Coefficient (If Partially Pervious)	Area (m2)	Sum of Areas (m2)	Comment
E Outfall Ditches								
Road	1.000	120	140	6	1	840		
Road			3	28	1	84		
Pervious Area			40	10	0.6	240		
Pervious Area			85	6	0.6	306	**1470** m2	
	1.001	9	0	0	0	0		Carrier
Road	1.002	24	30	3	1	90		
Pervious Area			25	15	0.6	225	**315** m2	
Road	2.000	32	30	3	1	90		
Pervious Area			32	20	0.6	384	**474** m2	
Road	3.000	22	3	28	1	84		
Road			23	3	1	69		
Pervious Area			8	20	0.6	96	**249** m2	
	2.001	10	0	0	0	0		Carrier
Road	1.003	53	25	3	1	75		
Pervious Area			18	53	0.6	572		
Pervious Area			12	40	0.6	288		
Pervious Area			12	30	0.6	216	**1151** m2	
	1.004	10	0	0	0	0		Carrier
	1.005	14	0	0	0	0		Carrier
Total							$\boxed{3659}$ m2	

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A4.3.4 SOUTH - EAST OUTFALL DITCH SYSTEM – AREAS DRAINING TO DITCHES (TIE IN POINT 4)

Description	Contributing to Pipe Length	Drain Length (m)	Area Length (m)	Area Breadth (m)	Cv, Runoff Coefficient (If Partially Pervious)	Area (m2)	Sum of Areas (m2)	Comment
SE Outfall Ditches								
Road	1.000	24	3	26	1	78		
Pervious Area			28	24	0.6	403	481 m2	
Road	2.000	24	3	24	1	72		
Pervious Area			4	24	0.6	58	130 m2	
	2.001	10	0	0	0		Carrier	
Road	1.001	31	3	33	1	99		
Pervious Area			28	33	0.6	554	653 m2	
Road	3.000	13	3	13	1	39		
Pervious Area			4	13	0.6	31	70 m2	
	3.001	10	0	0	0		Carrier	
Road	1.002	11	3	10	1	30		
Pervious Area			20	10	0.6	120	150 m2	
	1.003	10	0	0	0		Carrier	
Road	1.004	100	3	100	1	300		
Pervious Area			20	45	0.6	540		
Pervious Area			10	17	0.6	102	942 m2	
	1.005	10	0	0	0		Carrier	
Road	4.000	44	50	3	1	150		
Pervious Area			12	10	0.6	72	222 m2	
Road	1.006	69	3	70	1	210		
Pervious Area			12	55	0.6	396		
Pervious Area			20	12	0.6	144	750 m2	
Road	5.000	37	3	30	1	90		
Pervious Area			16	25	0.6	240	330 m2	
	5.001	12	0	0	0		Carrier	
Road	5.002	86	3	48	1	144		
Road			3	20	1	60		
Road			3	10	1	30		
Pervious Area			15	10	0.6	90		
Pervious Area			23	12	0.6	166		
Pervious Area			52	8	0.6	250	739 m2	
	1.007	10	0	0	0		Carrier	
Road	6.000	38	3	50	1	150		
Pervious Area			14	46	0.6	386	536 m2	
	6.001	10	0	0	0		Carrier	
Road	6.002	115	3	115	1	345		
Pervious Area			55	115	0.6	3795	4140 m2	
Road	1.008	70	3	10	1	30		
Pervious Area			55	12	0.6	396		
Pervious Area			21	10	0.6	126	552 m2	
	1.009	18	0	0	0		Carrier	
	1.010	80	0	0	0		Carrier	
Total							$\boxed{9696}$ m2	

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A4.3.5 FIRE WATER POND SYSTEM DITCHES – AREAS DRAINING TO DITCHES (TE IN POINT 5)

Description	Contributing to Pipe Length	Drain Length (m)	Area Length (m)	Area Breadth (m)	Cv, Runoff Coefficient (If Partially Pervious)	Area (m2)	Sum of Areas (m2)	Comment
FW Ditches								
Pervious Area	1.000	59	65	10	0.6	390	390 m2	
	1.001	8	0	0	1	0		Carrier
Pervious Area	2.000	59	65	27.5	0.6	1073	1073 m2	
Pervious Area	1.002	105	85	20	0.6	1020	1020 m2	
Pervious Area	3.000	65	43	20	0.6	516		
Road			45	3	1	135	651 m2	
	1.003	10	0	0	1	0		Carrier
Pervious Area	4.000	112	100	15	0.6	900	900 m2	
	1.004	10	0	0	0	0		(Negligible)
Pervious Area	5.000	165	145	14	0.6	1218		
Pervious Area			20	14	0.6	168		
Road			145	3	1	435		
Road			20	3	1	60	1881 m2	
Pervious Area	6.000	52	25	17	0.6	255	255 m2	
	5.001	10	0	0	0	0		Carrier
Pervious Area	1.005	82	90	15	0.6	810		
Road			85	3	1	255	1065 m2	
Pervious Area	7.000	162	70	13	0.6	546		
Pervious Area			60	22	0.6	792		
Pervious Area			10	22	0.6	132		
Pervious Area			10	22	0.6	132		
Road			145	3	1	435		
Road			20	3	1	60	2097 m2	
Pervious Area	8.000	133	75	8	0.6	360		
Pervious Area			33	22	0.6	436		
Pervious Area			22	12	0.6	158		
Pervious Area			22	10	0.6	132		
Road			135	3	1	405	1491 m2	
	7.001	10	0	0	0	0		Carrier
Total carried to next sheet							10822.5 m2	

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A4.3.5 FIRE WATER POND SYSTEM DITCHES – AREAS DRAINING TO DITCHES (Cont'd)

Description	Contributing to Pipe Length	Drain Length (m)	Area Length (m)	Area Breadth (m)	Cv, Runoff Coefficient (If Partially Pervious)	Area (m2)	Sum of Areas (m2)	Comment
Carried forward from previous sheet							10823	(Input manually)
Pervious Area	1.006	100	65	15	0.6	585		
Pervious Area			35	30	0.6	630		
Road			100	3	1	300	1515	m2
Pervious Area	9.000	55	27	35	0.6	567		
Road			55	3	1	165	732	m2
	1.007	14	0	0	0	0		Carrier
Pervious Area	10.000	35	90	3	0.6	162		
Road			90	3	1	270	432	m2
Pervious Area	11.000	35	15	15	0.6	135		
Road			20	3	1	60		
Road			15	3	1	45	240	m2
	10.001	8	0	0	0	0		Carrier
	1.008	85	35	8	0.6	168	168	m2
Total area							13910	m2

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A4.3.6 WEST OUTFALL DITCH SYSTEM – AREAS DRAINING TO DITCHES (TIE IN POINT 6)

Description	Contributing to Pipe Length	Drain Length (m)	Area Length (m)	Area Breadth (m)	Cv, Runoff Coefficient (If Partially Pervious)	Area (m2)	Sum of Areas (m2)	Comment
W Outfall Ditches								
Road	1.000	125	3	15	1	45		
Road			22	2	1	44		
Road			3	90	1	270		
Road			15	3	1	45		
Pervious Area			38	87	0.6	1984		
Road			35	30	1	630		
Pervious Area			20	30	0.6	360		
Pervious Area			23	3	0.6	41	3419 m2	
	1.001	10	0	0	0			Carrier
Road	1.002	17	18	3	1	54		
Road			3	6	1	18		
Pervious Area			15	6	0.6	54		
Pervious Area			25	9	0.6	135	261 m2	
Road	2.000	143	95	3	1	285		
Road			80	3	1	240		
Road			3	7	1	21		
Pervious Area			17	92	0.6	938		
Road			20	30	1	360		
Pervious Area			30	5	0.6	90	1934 m2	
	1.003	10	0	0	0			Carrier
	3.000	95	82	3	1	246		
			3	6	1	18		
			80	3	0.6	144		
			3	10	0.6	18	426 m2	
	4.000	140	3	140	1	420		
			15	3	1	45		
			3	140	0.6	252		
			12	3	0.6	22	739 m2	
	4.001	13	0	0	0			Carrier
	4.002	18	15	3	1	45		
			20	3	1	60		
			15	3	0.6	27		
			3	15	0.6	27	159 m2	
	1.004	13	0	0	0			Carrier
Total							6938 m2	

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Location - Scotland & Ireland

Return Period (years)	100	Volumetric Runoff Coeff.	0.77
M5-60 (mm)	22	Infiltration %	0
Ratio R	0.40	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Depth from Soffit to G.L. (m)	0.001
Foul Sewage (l/s/ha)	0.00	Min Vel. (m/s - Auto Design Only)	0.25
O'flow Setting (*Foul only)	0	Min Slope (1:X - Optimisation)	1000

Designed with Level Soffits

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	140.00	0.010	14000.0	0.171	2.00	0	15.000	\/	-3
1.001	10.00	0.002	5000.0	0.000	0.00	0	6.000	\/	-3
1.002	30.00	0.002	15000.0	0.038	0.00	0	15.000	\/	-3
2.000	15.00	0.120	125.0	0.024	2.00	0	0.600	o	150
1.003	10.00	0.020	500.0	0.000	0.00	0	6.000	\/	-3
3.000	57.00	0.002	28500.0	0.066	2.00	0	15.000	\/	-2
3.001	10.00	0.002	5000.0	0.003	0.00	0	6.000	\/	-2
3.002	30.00	0.050	600.0	0.032	0.00	0	6.000	|_|	-102
4.000	18.00	0.100	180.0	0.017	2.00	0	0.600	o	150
3.003	10.00	0.020	500.0	0.000	0.00	0	6.000	|_|	-102
5.000	95.00	0.006	15833.3	0.046	2.00	0	15.000	\/	-2

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.000	0.0	16.5	99.474	0.171	0	0	0	0.16	54	0
1.001	0.0	17.0	99.464	0.171	0	0	0	0.32	107	0
1.002	0.0	20.2	99.462	0.209	0	0	0	0.16	53	0
2.000	0.0	2.3	99.400	0.024	0	0	0	0.90	16	0
1.003	0.0	20.4	98.980	0.233	0	0	0	1.00	338	0
3.000	0.0	12.5	99.624	0.066	0	0	0	0.09	16	0
3.001	0.0	13.2	99.622	0.069	0	0	0	0.26	46	0
3.002	0.0	13.8	99.620	0.101	0	0	0	0.81	219	0
4.000	0.0	2.4	99.400	0.017	0	0	0	0.75	13	0
3.003	0.0	14.0	99.300	0.118	0	0	0	0.89	240	0
5.000	0.0	15.0	99.624	0.046	0	0	0	0.12	22	0

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
3.004	45.00	0.050	900.0	0.022	0.00	0	6.000	|_|	-102
6.000	120.00	0.010	12000.0	0.054	2.00	0	15.000	\/	-2
1.004	13.00	0.250	52.0	0.000	0.00	0	0.600	o	750

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
3.004	0.0	16.2	99.280	0.186	0	0	0	0.66	179	0
6.000	0.0	16.3	99.624	0.054	0	0	0	0.14	25	0
1.004	0.0	20.5	98.660	0.473	0	0	0	3.89	1717	0

The following hydraulic sections have been used in this network

NOTE: 'Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from the file DITCH.SEC

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m2)
-2	\/	300	300	45		0.627	0.180
-3	\/	300	450	45		0.860	0.338
-102	|_|	900	300			0.720	0.270

Summary of Results

Return Period (years)	100	Analysis Time Step (seconds)	5
Storm Duration (mins)	15	DVD Status	OFF
Margin for Flood Risk Warning (mm)	300	Inertia Status	OFF

PN	Water Lev. (m)	Surcharged Depth (m)	Flooded Vol (m3)	Flow/ Capacity	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	99.925	0.001	0.000	0.49	0	94	FLD RISK
1.001	99.815	-0.099	0.000	0.15	0	27	O K
1.002	99.802	-0.110	0.000	0.18	0	29	O K
2.000	99.517	-0.033	0.000	0.96	0	13	O K
1.003	99.112	-0.318	0.000	0.17	0	31	O K
3.000	99.924	0.000	0.000	0.46	0	36	O K
3.001	99.844	-0.078	0.000	0.29	0	25	O K
3.002	99.709	-0.211	0.000	0.20	0	34	O K
4.000	99.502	-0.048	0.000	0.80	0	9	O K
3.003	99.451	-0.149	0.000	0.29	0	40	O K
5.000	99.924	0.000	0.000	0.31	0	25	O K
3.004	99.444	-0.136	0.000	0.49	0	72	O K
6.000	99.924	0.000	0.000	0.36	0	30	O K
1.004	99.019	-0.391	0.000	0.16	0	122	O K

Global Variables

Region	FSR - Scotland & Ireland
Return Period (yrs)	100
M5-60 (mm)	22.200
Ratio R	0.400
Volumetric Runoff Coef	0.770
Profile Type	Summer
PIMP (%)	100
Areal Reduction Factor	1.000
Storm Duration (mins)	15
Hot Start (mins)	0
Manhole Headloss Coefficient	1.000
MADD Factor * 10m3/ha Storage	1.000
Foul Sewage/Hectare (l/s)	0.00
Additional Flow - % of Total Flow	0
Number of Input Hydrographs	0
Number of Time/Area Diagrams	0
Number of Bifurcations	0
Number of Overflows	0
Number of Off-Line Controls	0
Number of Tank Sewers	11

Freely Discharging Outfalls

Outfall Pipe Number	Outfall MH/No	C.Level (m)	I.Level (m)	D,L (mm)	B (mm)
1.004	13	100.000	98.410	1200	0

Network Details

PN	Length (m)	Fall (m)	Slope (1:x)	Area (ha)	T.E. (mins)	Rain Pro	k (mm)	Hyd Sect	Dia (mm)
1.000	140.00	0.010	14000	0.171	2.00	1	15.000	\/	-3
1.001	10.00	0.002	5000	0.000	0.00	1	6.000	\/	-3
1.002	30.00	0.002	15000	0.038	0.00	1	15.000	\/	-3
2.000	15.00	0.120	125	0.024	2.00	1	0.600	o	150
1.003	10.00	0.020	500	0.000	0.00	1	6.000	\/	-3
3.000	57.00	0.002	28500	0.066	2.00	1	15.000	\/	-2
3.001	10.00	0.002	5000	0.003	0.00	1	6.000	\/	-2
3.002	30.00	0.050	600	0.032	0.00	1	6.000	|_|	-102
4.000	18.00	0.100	180	0.017	2.00	1	0.600	o	150
3.003	10.00	0.020	500	0.000	0.00	1	6.000	|_|	-102
5.000	95.00	0.006	15833	0.046	2.00	1	15.000	\/	-2
3.004	45.00	0.050	900	0.022	0.00	1	6.000	|_|	-102
6.000	120.00	0.010	12000	0.054	2.00	1	15.000	\/	-2
1.004	13.00	0.250	52	0.000	0.00	1	0.600	o	750

PN	USMH No.	US/CL (m)	US/IL (m)	US/Dep (m)	DS/CL (m)	DS/IL (m)	DS/Dep (m)	Ctrl No.	US/MH (mm)
1.000	1	99.925	99.474	0.001	101.000	99.464	1.086		1200
1.001	2	101.000	99.464	1.086	101.000	99.462	1.088	4	1200
1.002	3	101.000	99.462	1.088	99.925	99.460	0.015	4	1200
2.000	4	99.925	99.400	0.375	99.925	99.280	0.495		1200
1.003	5	99.925	98.980	0.495	99.925	98.960	0.515	4	1200
3.000	6	99.925	99.624	0.001	101.000	99.622	1.078		1200
3.001	7	101.000	99.622	1.078	101.000	99.620	1.080	4	1200
3.002	8	101.000	99.620	1.080	99.925	99.570	0.055	4	1200
4.000	9	99.925	99.400	0.375	99.925	99.300	0.475		1200
3.003	10	99.925	99.300	0.325	99.925	99.280	0.345	4	1200
5.000	11	99.925	99.624	0.001	99.925	99.618	0.007		1200
3.004	11	99.925	99.280	0.345	99.925	99.230	0.395	4	1200
6.000	12	99.925	99.624	0.001	99.925	99.614	0.011		1200
1.004	12	99.925	98.660	0.515	100.000	98.410	0.840	4	1200

Peak flow
13 mins
pipe [illegible]

Time (Min)	US Level (m)	DS Level (m)	Surcharged Depth (m)	F O'flow (m3/s)	Pipeflow (m3/s)
1	98.668	99.160	-0.742	0.000	0.000
2	98.717	99.160	-0.693	0.000	0.000
3	98.843	99.160	-0.567	0.000	0.000
4	99.007	99.160	-0.403	0.000	0.000
5	99.010	99.160	-0.400	0.000	0.007
6	99.010	99.160	-0.400	0.000	0.012
7	99.010	99.160	-0.400	0.000	0.019
8	99.011	99.160	-0.399	0.000	0.031
9	99.012	99.160	-0.398	0.000	0.051
10	99.015	99.160	-0.395	0.000	0.076
11	99.018	99.160	-0.392	0.000	0.104
12	99.019	99.160	-0.391	0.000	0.121
13	99.018	99.160	-0.392	0.000	0.122
14	99.016	99.160	-0.394	0.000	0.112
15	99.015	99.160	-0.395	0.000	0.099
16	99.014	99.160	-0.396	0.000	0.086
17	99.013	99.160	-0.397	0.000	0.074
18	99.012	99.160	-0.398	0.000	0.065
19	99.012	99.160	-0.398	0.000	0.057
20	99.012	99.160	-0.398	0.000	0.049
21	99.011	99.160	-0.399	0.000	0.043
22	99.011	99.160	-0.399	0.000	0.038
23	99.011	99.160	-0.399	0.000	0.034
24	99.011	99.160	-0.399	0.000	0.031
25	99.011	99.160	-0.399	0.000	0.027
26	99.010	99.160	-0.400	0.000	0.025
27	99.010	99.160	-0.400	0.000	0.022
28	99.010	99.160	-0.400	0.000	0.021
29	99.010	99.160	-0.400	0.000	0.019
30	99.010	99.160	-0.400	0.000	0.017
31	99.010	99.160	-0.400	0.000	0.016
32	99.010	99.160	-0.400	0.000	0.015
33	99.010	99.160	-0.400	0.000	0.014
34	99.010	99.160	-0.400	0.000	0.013
35	99.010	99.160	-0.400	0.000	0.012
36	99.010	99.160	-0.400	0.000	0.012
37	99.010	99.160	-0.400	0.000	0.011
38	99.010	99.160	-0.400	0.000	0.011
39	99.010	99.160	-0.400	0.000	0.010
40	99.010	99.160	-0.400	0.000	0.009
41	99.010	99.160	-0.400	0.000	0.009
42	99.010	99.160	-0.400	0.000	0.008
43	99.010	99.160	-0.400	0.000	0.008
44	99.010	99.160	-0.400	0.000	0.007
45	99.010	99.160	-0.400	0.000	0.007
46	99.010	99.160	-0.400	0.000	0.007
47	99.010	99.160	-0.400	0.000	0.006
48	99.010	99.160	-0.400	0.000	0.006

Total V [illegible] (p [illegible])

cf. Tc = 20.5 mins in 'Storm [illegible]
use more critical 13 mins fr [illegible]

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Location - Scotland & Ireland

Return Period (years)	100	Volumetric Runoff Coeff.	0.77
M5-60 (mm)	22	Infiltration %	0
Ratio R	0.40	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Depth from Soffit to G.L. (m)	1.200
Foul Sewage (l/s/ha)	0.00	Min Vel. (m/s - Auto Design only)	0.25
O'flow Setting (*Foul only)	0	Min Slope (1:X - Optimisation)	1000

Designed with Level Soffits

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	40.00	0.005	8000.0	0.053	2.00	0	15.000	\/	-2
1.001	6.00	0.002	3000.0	0.000	0.00	0	6.000	\/	-2
2.000	13.00	0.002	6500.0	0.039	2.00	0	15.000	\/	-2
1.002	29.00	0.004	7250.0	0.016	0.00	0	15.000	\/	-3
3.000	13.00	0.001	13000.0	0.005	2.00	0	15.000	\/	-1
1.003	10.00	0.075	133.3	0.000	0.00	0	6.000	\/	-3
4.000	13.00	0.001	13000.0	0.005	2.00	0	15.000	\/	-1
1.004	75.00	0.170	441.2	0.180	0.00	0	15.000	|_|	-103
5.000	78.00	0.010	7800.0	0.191	2.00	0	15.000	\/	-3
1.005	10.00	0.100	100.0	0.000	0.00	0	6.000	\/	-3

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.000	0.0	5.9	99.624	0.053	0	0	0	0.17	31	0
1.001	0.0	6.2	99.619	0.053	0	0	0	0.33	59	0
2.000	0.0	3.1	99.624	0.039	0	0	0	0.19	34	0
1.002	0.0	8.4	99.467	0.108	0	0	0	0.22	76	0
3.000	0.0	4.0	99.724	0.005	0	0	0	0.11	11	0
1.003	0.0	8.4	99.463	0.113	0	0	0	1.94	655	0
4.000	0.0	4.0	99.724	0.005	0	0	0	0.11	11	0
1.004	0.0	9.7	99.388	0.298	0	0	0	1.03	555	0
5.000	0.0	8.0	99.474	0.191	0	0	0	0.22	73	0
1.005	0.0	9.7	99.218	0.489	0	0	0	2.24	756	0

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
6.000	150.00	0.010	15000.0	0.068	2.00	0	15.000	\/	-3
7.000	140.00	0.010	14000.0	0.063	2.00	0	15.000	\/	-3
1.006	14.00	0.150	93.3	0.000	0.00	0	15.000	o	450

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
6.000	0.0	18.1	99.474	0.068	0	0	0	0.16	53	0
7.000	0.0	16.5	99.474	0.063	0	0	0	0.16	54	0
1.006	0.0	18.3	99.118	0.620	0	0	0	1.26	200	0

The following hydraulic sections have been used in this network

NOTE: 'Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from the file Ditch.sec

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m2)
-1	\/	300	200	45		0.462	0.100
-2	\/	300	300	45		0.627	0.180
-3	\/	300	450	45		0.860	0.338
-103	|_|	1200	450			1.029	0.540

Summary of Results

Return Period (years)	100	Analysis Time Step (seconds)	5
Storm Duration (mins)	15	DVD Status	OFF
Margin for Flood Risk Warning (mm)	300	Inertia Status	OFF

PN	Water Lev. (m)	Surcharged Depth (m)	Flooded Vol (m3)	Flow/ Capacity	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	99.915	-0.009	0.000	0.38	0	29	O K
1.001	99.840	-0.079	0.000	0.27	0	26	O K
2.000	99.860	-0.064	0.000	0.27	0	21	O K
1.002	99.819	-0.098	0.000	0.28	0	45	O K
3.000	99.819	-0.105	0.000	0.07	0	3	O K
1.003	99.619	-0.294	0.000	0.14	0	45	O K
4.000	99.819	-0.105	0.000	0.07	0	3	O K
1.004	99.612	-0.226	0.000	0.26	0	125	O K
5.000	99.924	0.000	0.000	0.57	0	105	O K
1.005	99.586	-0.082	0.000	0.39	0	146	O K
6.000	99.895	-0.029	0.000	0.19	0	37	O K
7.000	99.867	-0.057	0.000	0.18	0	35	O K
1.006	99.577	0.009	0.000	1.09	0	177	SURCH'ED

Global Variables

Region	FSR - Scotland & Ireland
Return Period (yrs)	100
M5-60 (mm)	22.200
Ratio R	0.400
Volumetric Runoff Coef	0.770
Profile Type	Summer
PIMP (%)	100
Areal Reduction Factor	1.000
Storm Duration (mins)	15
Hot Start (mins)	0
Manhole Headloss Coefficient	1.000
MADD Factor * 10m3/ha Storage	1.000
Foul Sewage/Hectare (l/s)	0.00
Additional Flow - % of Total Flow	0
Number of Input Hydrographs	0
Number of Time/Area Diagrams	0
Number of Bifurcations	0
Number of Overflows	0
Number of Off-Line Controls	0
Number of Tank Sewers	9

Freely Discharging Outfalls

Outfall Pipe Number	Outfall MH/No	C.Level (m)	I.Level (m)	D,L (mm)	B (mm)
1.006	14	99.925	98.968	1200	0

Network Details

PN	Length (m)	Fall (m)	Slope (1:x)	Area (ha)	T.E. (mins)	Rain Pro	k (mm)	Hyd Sect	Dia (mm)
1.000	40.00	0.005	8000	0.053	2.00	1	15.000	\/	-2
1.001	6.00	0.002	3000	0.000	0.00	1	6.000	\/	-2
2.000	13.00	0.002	6500	0.039	2.00	1	15.000	\/	-2
1.002	29.00	0.004	7250	0.016	0.00	1	15.000	\/	-3
3.000	13.00	0.001	13000	0.005	2.00	1	15.000	\/	-1
1.003	10.00	0.075	133	0.000	0.00	1	6.000	\/	-3
4.000	13.00	0.001	13000	0.005	2.00	1	15.000	\/	-1
1.004	75.00	0.170	441	0.180	0.00	1	15.000	|_|	-103
5.000	78.00	0.010	7800	0.191	2.00	1	15.000	\/	-3
1.005	10.00	0.100	100	0.000	0.00	1	6.000	\/	-3
6.000	150.00	0.010	15000	0.068	2.00	1	15.000	\/	-3
7.000	140.00	0.010	14000	0.063	2.00	1	15.000	\/	-3
1.006	14.00	0.150	93	0.000	0.00	1	15.000	o	450

PN	USMH No.	US/CL (m)	US/IL (m)	US/Dep (m)	DS/CL (m)	DS/IL (m)	DS/Dep (m)	Ctrl No.	US/MH (mm)
1.000	1	99.925	99.624	0.001	99.925	99.619	0.006		1200
1.001	3	99.925	99.619	0.006	99.925	99.617	0.008	4	1200
2.000	4	99.925	99.624	0.001	99.925	99.622	0.003		1200
1.002	4	99.925	99.467	0.008	100.000	99.463	0.087	4	1200
3.000	5	99.925	99.724	0.001	100.000	99.723	0.077		1200
1.003	6	100.000	99.463	0.087	99.925	99.388	0.087	4	1200
4.000	7	99.925	99.724	0.001	99.925	99.723	0.002		1200
1.004	8	99.925	99.388	0.087	99.925	99.218	0.257	4	1200
5.000	9	99.925	99.474	0.001	99.925	99.464	0.011		1200
1.005	10	99.925	99.218	0.257	99.925	99.118	0.357	4	1200
6.000	11	99.925	99.474	0.001	99.925	99.464	0.011		1200
7.000	12	99.925	99.474	0.001	99.925	99.464	0.011		1200
1.006	13	99.925	99.118	0.357	99.925	98.968	0.507	4	1200

Return Period 100 years
Average Rainfall Intensity 110.98 mm/hr

Time (Min)	US Level (m)	DS Level (m)	Surcharged Depth (m)	E O'flow (m3/s)	Pipeflow (m3/s)
1	99.118	99.418	-0.450	0.000	0.000
2	99.135	99.418	-0.433	0.000	0.000
3	99.176	99.418	-0.392	0.000	0.000
4	99.241	99.418	-0.327	0.000	0.000
5	99.280	99.418	-0.288	0.000	0.000
6	99.328	99.418	-0.240	0.000	0.001
7	99.340	99.418	-0.228	0.000	0.023
8	99.356	99.418	-0.212	0.000	0.048
9	99.387	99.418	-0.181	0.000	0.078
10	99.440	99.418	-0.128	0.000	0.117
11	99.510	99.418	-0.058	0.000	0.152
12	99.543	99.418	-0.025	0.000	0.161
13	99.570	99.418	0.002	0.000	0.162
14	99.577	99.418	0.009	0.000	0.175
15	99.566	99.418	-0.002	0.000	0.177
16	99.547	99.418	-0.021	0.000	0.162
17	99.527	99.418	-0.041	0.000	0.161
18	99.479	99.418	-0.089	0.000	0.161
19	99.450	99.418	-0.118	0.000	0.156
20	99.410	99.418	-0.158	0.000	0.137
21	99.368	99.418	-0.200	0.000	0.107
22	99.344	99.418	-0.224	0.000	0.067
23	99.334	99.418	-0.234	0.000	0.038
24	99.329	99.418	-0.239	0.000	0.020
25	99.328	99.418	-0.240	0.000	0.009
26	99.328	99.418	-0.240	0.000	0.005
27	99.328	99.418	-0.240	0.000	0.003
28	99.328	99.418	-0.240	0.000	0.003
29	99.328	99.418	-0.240	0.000	0.002
30	99.328	99.418	-0.240	0.000	0.002
31	99.328	99.418	-0.240	0.000	0.001
32	99.328	99.418	-0.240	0.000	0.001
33	99.328	99.418	-0.240	0.000	0.001
34	99.328	99.418	-0.240	0.000	0.001
35	99.328	99.418	-0.240	0.000	0.001
36	99.328	99.418	-0.240	0.000	0.001
37	99.328	99.418	-0.240	0.000	0.001
38	99.328	99.418	-0.240	0.000	0.001
39	99.328	99.418	-0.240	0.000	0.001
40	99.328	99.418	-0.240	0.000	0.000
41	99.328	99.418	-0.240	0.000	0.000
42	99.328	99.418	-0.240	0.000	0.000
43	99.327	99.418	-0.241	0.000	0.001
44	99.328	99.418	-0.240	0.000	0.001
45	99.327	99.418	-0.241	0.000	0.000
46	99.328	99.418	-0.240	0.000	0.000
47	99.327	99.418	-0.241	0.000	0.000
48	99.328	99.418	-0.240	0.000	0.000

PEAK FLOW
15 MINS
PIPE [illegible]

Total Volume over Overflow (Spill Flow) 0.000m3

Cf. TC 18.3mins in 'STORM' RUN
USE MORE CRITICAL VALUE ABOVE.

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Location - Scotland & Ireland

Return Period (years)	100	Volumetric Runoff Coeff.	0.77
M5-60 (mm)	22	Infiltration %	0
Ratio R	0.40	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Depth from Soffit to G.L. (m)	1.200
Foul Sewage (l/s/ha)	0.00	Min Vel. (m/s - Auto Design Only)	0.25
O'flow Setting (*Foul only)	0	Min Slope (1:X - Optimisation)	1000

Designed with Level Soffits

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	120.00	0.008	15000.0	0.150	2.00	0	15.000	\/	-3
1.001	9.00	0.003	3000.0	0.000	0.00	0	6.000	\/	-3
1.002	24.00	0.050	480.0	0.032	0.00	0	15.000	|_|	-103
2.000	32.00	0.002	16000.0	0.048	2.00	0	15.000	\/	-2
3.000	22.00	0.002	11000.0	0.025	2.00	0	15.000	\/	-2
2.001	10.00	0.002	5000.0	0.000	0.00	0	6.000	\/	-2
1.003	53.00	0.100	530.0	0.115	0.00	0	15.000	|_|	-104

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.000	0.0	14.9	99.474	0.150	0	0	0	0.16	53	0
1.001	0.0	15.2	99.466	0.150	0	0	0	0.41	138	0
1.002	0.0	15.6	99.463	0.182	0	0	0	0.99	532	0
2.000	0.0	6.4	99.624	0.048	0	0	0	0.12	22	0
3.000	0.0	4.5	99.624	0.025	0	0	0	0.15	26	0
2.001	0.0	7.1	99.622	0.073	0	0	0	0.26	46	0
1.003	0.0	16.4	99.263	0.370	0	0	0	1.12	1006	0

The following hydraulic sections have been used in this network

NOTE: 'Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from the file Ditch.sec

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m2)
-2	\/	300	300	45		0.627	0.180
-3	\/	300	450	45		0.860	0.338
-103	|_|	1200	450			1.029	0.540
-104	|_|	1500	600			1.333	0.900

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Amec Capital Projects Ltd		
11 The Boulevard Crawley West Sussex RH10 1UX	Shell E & P Ireland Ltd Corrib Project East Ditch Outfall	Micro Drainage
Date 14-November-2003 File East Ditch Outfall.SIM	Designed By IM Checked By	
Micro Drainage	Simulation W.7.6 (c)1982-2001 Micro Drainage	

Summary of Results

Return Period (years)	100	Analysis Time Step (seconds)	5
Storm Duration (mins)	15	DVD Status	OFF
Margin for Flood Risk warning (mm)	300	Inertia Status	OFF

PN	Water Lev. (m)	Surcharged Depth (m)	Flooded Vol (m3)	Flow/ Capacity	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	99.924	0.000	0.000	0.43	0	82	O K
1.001	99.763	-0.153	0.000	0.33	0	60	O K
1.002	99.693	-0.220	0.000	0.17	0	63	O K
2.000	99.924	0.000	0.000	0.35	0	26	O K
3.000	99.892	-0.032	0.000	0.18	0	12	O K
2.001	99.873	-0.049	0.000	0.36	0	32	O K
1.003	99.685	-0.178	0.000	0.14	0	107	O K

Global Variables

Region	FSR - Scotland & Ireland
Return Period (yrs)	100
M5-60 (mm)	22.200
Ratio R	0.400
Volumetric Runoff Coef	0.770
Profile Type	Summer
PIMP (%)	100
Areal Reduction Factor	1.000
Storm Duration (mins)	15
Hot Start (mins)	0
Manhole Headloss Coefficient	1.000
MADD Factor * 10m3/ha Storage	1.000
Foul Sewage/Hectare (l/s)	0.00
Additional Flow - % of Total Flow	0
Number of Input Hydrographs	0
Number of Time/Area Diagrams	0
Number of Bifurcations	0
Number of Overflows	0
Number of Off-Line Controls	0
Number of Tank Sewers	5

Freely Discharging Outfalls

Outfall Pipe Number	Outfall MH/No	C.Level (m)	I.Level (m)	D,L (mm)	B (mm)
1.003	8	99.925	99.163	1200	0

Network Details

PN	Length (m)	Fall (m)	Slope (1:x)	Area (ha)	T.E. (mins)	Rain Pro	k (mm)	Hyd Sect	Dia (mm)
1.000	120.00	0.008	15000	0.150	2.00	1	15.000	\/	-3
1.001	9.00	0.003	3000	0.000	0.00	1	6.000	\/	-3
1.002	24.00	0.050	480	0.032	0.00	1	15.000	|_|	-103
2.000	32.00	0.002	16000	0.048	2.00	1	15.000	\/	-2
3.000	22.00	0.002	11000	0.025	2.00	1	15.000	\/	-2
2.001	10.00	0.002	5000	0.000	0.00	1	6.000	\/	-2
1.003	53.00	0.100	530	0.115	0.00	1	15.000	|_|	-104

PN	USMH No.	US/CL (m)	US/IL (m)	US/Dep (m)	DS/CL (m)	DS/IL (m)	DS/Dep (m)	Ctrl No.	US/MH (mm)
1.000	1	99.925	99.474	0.001	100.000	99.466	0.084		1200
1.001	2	100.000	99.466	0.084	99.925	99.463	0.012	4	1200
1.002	3	99.925	99.463	0.012	99.925	99.413	0.062	4	1200
2.000	4	99.925	99.624	0.001	100.000	99.622	0.078		1200
3.000	5	99.925	99.624	0.001	100.000	99.622	0.078		1200
2.001	6	100.000	99.622	0.078	99.925	99.620	0.005	4	1200
1.003	7	99.925	99.263	0.062	99.925	99.163	0.162	4	1200

Return Period 100 years
Average Rainfall Intensity 110.98 mm/hr

Time (Min)	US Level (m)	DS Level (m)	Surcharged Depth (m)	E'O'flow (m3/s)	Pipeflow (m3/s)
1	99.307	99.763	-0.556	0.000	0.000
2	99.382	99.763	-0.481	0.000	0.000
3	99.455	99.763	-0.408	0.000	0.000
4	99.492	99.763	-0.371	0.000	0.000
5	99.524	99.763	-0.339	0.000	0.000
6	99.568	99.763	-0.295	0.000	0.000
7	99.628	99.763	-0.235	0.000	0.000
8	99.660	99.763	-0.203	0.000	0.000
9	99.675	99.763	-0.188	0.000	0.036
10	99.682	99.763	-0.181	0.000	0.060
11	99.685	99.763	-0.178	0.000	0.079
12	99.682	99.763	-0.181	0.000	0.096
13	99.680	99.763	-0.183	0.000	0.107
14	99.680	99.763	-0.183	0.000	0.105
15	99.679	99.763	-0.184	0.000	0.100
16	99.679	99.763	-0.184	0.000	0.093
17	99.673	99.763	-0.190	0.000	0.080
18	99.662	99.763	-0.201	0.000	0.069
19	99.655	99.763	-0.208	0.000	0.058
20	99.651	99.763	-0.212	0.000	0.047
21	99.648	99.763	-0.215	0.000	0.037
22	99.646	99.763	-0.217	0.000	0.030
23	99.644	99.763	-0.219	0.000	0.023
24	99.643	99.763	-0.220	0.000	0.016
25	99.643	99.763	-0.220	0.000	0.009
26	99.643	99.763	-0.220	0.000	0.005
27	99.643	99.763	-0.220	0.000	0.003
28	99.643	99.763	-0.220	0.000	0.002
29	99.643	99.763	-0.220	0.000	0.001
30	99.643	99.763	-0.220	0.000	0.001
31	99.643	99.763	-0.220	0.000	0.001
32	99.643	99.763	-0.220	0.000	0.000
33	99.643	99.763	-0.220	0.000	0.001
34	99.643	99.763	-0.220	0.000	0.000
35	99.643	99.763	-0.220	0.000	0.000
36	99.643	99.763	-0.220	0.000	0.000
37	99.642	99.763	-0.221	0.000	0.000
38	99.643	99.763	-0.220	0.000	0.000
39	99.643	99.763	-0.220	0.000	0.000
40	99.642	99.763	-0.221	0.000	0.000
41	99.642	99.763	-0.221	0.000	0.000
42	99.643	99.763	-0.220	0.000	0.000
43	99.642	99.763	-0.221	0.000	0.000
44	99.642	99.763	-0.221	0.000	0.000
45	99.643	99.763	-0.220	0.000	0.000
46	99.641	99.763	-0.222	0.000	0.000
47	99.642	99.763	-0.221	0.000	0.000
48	99.642	99.763	-0.221	0.000	0.000

PEAK FLOW 107L/S →
PIPE 1.003

Total Volume over Overflow (Spill Flow) 0.000m3

Cf TC 16.4 MINS FROM 'STORM' AN,
USE MORE CRITICAL VALUE SHOWN ABOVE

Amec Capital Projects Ltd		Page 1
11 The Boulevard Crawley West Sussex RH10 1UX	Shell E & P Ireland Ltd Corrib Project S E Ditch Outfall	Micro Drainage
Date 14-November-2003 File S E Outfall Ditches.SWS	Designed By IM Checked By	
Micro Drainage	Storm W.7.6 (c)1982-2001 Micro Drainage	

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Location - Scotland & Ireland

Return Period (years)	100	Volumetric Runoff Coeff.	0.77
M5-60 (mm)	22	Infiltration %	0
Ratio R	0.40	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Depth from Soffit to G.L. (m)	1.200
Foul Sewage (l/s/ha)	0.00	Min Vel. (m/s - Auto Design Only)	0.25
O'flow Setting (*Foul only)	0	Min Slope (1:X - Optimisation)	1000

Designed with Level Soffits

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	24.00	0.009	2666.7	0.048	2.00	0	15.000	\/	-2
2.000	24.00	0.006	4000.0	0.013	2.00	0	15.000	\/	-2
2.001	10.00	0.002	5000.0	0.000	0.00	0	6.000	\/	-2
1.001	31.00	0.003	10333.3	0.065	0.00	0	15.000	\/	-3
3.000	13.00	0.001	13000.0	0.007	2.00	0	15.000	\/	-2
3.001	10.00	0.001	10000.0	0.000	0.00	0	6.000	\/	-2
1.002	11.00	0.001	11000.0	0.015	0.00	0	15.000	\/	-3
1.003	10.00	0.001	10000.0	0.000	0.00	0	6.000	\/	-3
1.004	100.00	0.100	1000.0	0.095	0.00	0	15.000	|_|	-103
1.005	10.00	0.030	333.3	0.000	0.00	0	6.000	|_|	-103
4.000	44.00	0.001	44000.0	0.023	2.00	0	15.000	\/	-2
1.006	69.00	0.075	920.0	0.075	0.00	0	15.000	|_|	-104

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.000	0.0	3.3	99.624	0.048	0	0	0	0.30	53	0
2.000	0.0	3.7	99.624	0.013	0	0	0	0.24	44	0
2.001	0.0	4.3	99.618	0.013	0	0	0	0.26	46	0
1.001	0.0	7.1	99.465	0.126	0	0	0	0.19	63	0
3.000	0.0	3.6	99.624	0.007	0	0	0	0.13	24	0
3.001	0.0	4.5	99.623	0.007	0	0	0	0.18	32	0
1.002	0.0	8.1	99.462	0.148	0	0	0	0.18	61	0
1.003	0.0	8.8	99.461	0.148	0	0	0	0.22	75	0
1.004	0.0	11.3	99.460	0.243	0	0	0	0.68	369	0
1.005	0.0	11.4	99.360	0.243	0	0	0	1.38	744	0
4.000	0.0	12.1	99.624	0.023	0	0	0	0.07	13	0
1.006	0.0	13.4	99.180	0.341	0	0	0	0.85	763	0

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11 The Boulevard Crawley West Sussex RH10 1UX	Shell E & P Ireland Ltd Corrib Project S E Ditch Outfall	Micro Drainage
Date 14-November-2003 File S E Outfall Ditches.SWS	Designed By IM Checked By	
Micro Drainage	Storm W.7.6 (c)1982-2001 Micro Drainage	

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
5.000	37.00	0.001	37000.0	0.033	2.00	0	15.000	\/	-2
5.001	12.00	0.001	12000.0	0.000	0.00	0	6.000	\/	-2
5.002	86.00	0.001	86000.0	0.075	0.00	0	15.000	\/	-3
1.007	10.00	0.030	333.3	0.000	0.00	0	6.000	|_|	-104
6.000	38.00	0.001	38000.0	0.054	2.00	0	15.000	\/	-2
6.001	10.00	0.030	333.3	0.000	0.00	0	6.000	|_|	-102
6.002	115.00	0.120	958.3	0.414	0.00	0	15.000	|_|	-103
1.008	70.00	0.050	1400.0	0.055	0.00	0	15.000	|_|	-105
1.009	18.00	0.030	600.0	0.000	0.00	0	0.600	|_|	-105
1.010	80.00	0.030	2666.7	0.000	0.00	0	0.600	|_|	-13

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
5.000	0.0	9.8	99.624	0.033	0	0	0	0.08	14	0
5.001	0.0	11.0	99.623	0.033	0	0	0	0.16	30	0
5.002	0.0	33.2	99.472	0.108	0	0	0	0.06	22	0
1.007	0.0	33.3	99.105	0.449	0	0	0	1.63	1468	0
6.000	0.0	10.1	99.624	0.054	0	0	0	0.08	14	0
6.001	0.0	10.2	99.623	0.054	0	0	0	1.09	294	0
6.002	0.0	13.0	99.443	0.468	0	0	0	0.70	377	0
1.008	0.0	34.9	99.075	0.972	0	0	0	0.73	837	0
1.009	0.0	35.0	99.025	0.972	0	0	0	1.72	1964	0
1.010	0.0	36.8	98.595	0.972	0	0	0	0.76	763	0

The following hydraulic sections have been used in this network

NOTE: 'Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, 0 egg.

Section numbers < 0 are taken from the file Ditch.sec

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m2)
-2	\/	300	300	45		0.627	0.180
-3	\/	300	450	45		0.860	0.338
-13	|_|	1000	1000	90		1.333	1.000
-102	|_|	900	300			0.720	0.270
-103	|_|	1200	450			1.029	0.540
-104	|_|	1500	600			1.333	0.900
-105	|_|	1900	600			1.471	1.140

Summary of Results

Return Period (years)	100	Analysis Time Step (seconds)	5
Storm Duration (mins)	30	DVD Status	OFF
Margin for Flood Risk warning (mm)	300	Inertia Status	OFF

PN	Water Lev. (m)	Surcharged Depth (m)	Flooded Vol (m3)	Flow/ Capacity	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	99.924	0.000	0.000	0.28	0	20	O K
2.000	99.919	-0.005	0.000	0.07	0	5	O K
2.001	99.915	-0.003	0.000	0.05	0	5	O K
1.001	99.913	-0.002	0.000	0.31	0	49	O K
3.000	99.871	-0.053	0.000	0.03	0	2	O K
3.001	99.870	-0.053	0.000	0.02	0	2	O K
1.002	99.869	-0.043	0.000	0.26	0	44	O K
1.003	99.804	-0.107	0.000	0.24	0	43	O K
1.004	99.630	-0.280	0.000	0.21	0	70	O K
1.005	99.527	-0.283	0.000	0.15	0	55	O K
4.000	99.844	-0.080	0.000	0.13	0	10	O K
1.006	99.541	-0.239	0.000	0.13	0	79	O K
5.000	99.917	-0.007	0.000	0.19	0	14	O K
5.001	99.877	-0.046	0.000	0.16	0	14	O K
5.002	99.867	-0.055	0.000	0.18	0	34	O K
1.007	99.506	-0.199	0.000	0.13	0	79	O K
6.000	99.924	0.000	0.000	0.32	0	25	O K
6.001	99.743	-0.180	0.000	0.17	0	28	O K
6.002	99.741	-0.152	0.000	0.60	0	206	O K
1.008	99.489	-0.186	0.000	0.27	0	216	O K
1.009	99.442	-0.183	0.000	0.25	0	201	O K
1.010	99.384	-0.211	0.000	0.22	0	199	O K

Global Variables

Region	FSR - Scotland & Ireland
Return Period (yrs)	100
M5-60 (mm)	22.200
Ratio R	0.400
Volumetric Runoff Coef	0.770
Profile Type	Summer
PIMP (%)	100
Areal Reduction Factor	1.000
Storm Duration (mins)	30
Hot Start (mins)	0
Manhole Headloss Coefficient	1.000
MADD Factor * 10m3/ha Storage	1.000
Foul Sewage/Hectare (l/s)	0.00
Additional Flow - % of Total Flow	0
Number of Input Hydrographs	0
Number of Time/Area Diagrams	0
Number of Bifurcations	0
Number of Overflows	0
Number of Off-Line Controls	0
Number of Tank Sewers	18

Freely Discharging Outfalls

Outfall Pipe Number	Outfall MH/No	C.Level (m)	I.Level (m)	D,L (mm)	B (mm)
1.010	23	99.925	98.565	1200	0

Amec Capital Projects Ltd		Page 3
11 The Boulevard Crawley West Sussex RH10 1UX	Shell E & P Ireland Ltd Corrib Project S E Ditch Outfall	Micro Drainage
Date 14-November-2003 File S E Outfall Ditches.SIM	Designed By IM Checked By	
Micro Drainage	Simulation W.7.6 (c)1982-2001 Micro Drainage	

Network Details

PN	Length (m)	Fall (m)	Slope (1:x)	Area (ha)	T.E. (mins)	Rain Pro	k (mm)	Hyd Sect	Dia (mm)
1.000	24.00	0.009	2667	0.048	2.00	1	15.000	\/	-2
2.000	24.00	0.006	4000	0.013	2.00	1	15.000	\/	-2
2.001	10.00	0.002	5000	0.000	0.00	1	6.000	\/	-2
1.001	31.00	0.003	10333	0.065	0.00	1	15.000	\/	-3
3.000	13.00	0.001	13000	0.007	2.00	1	15.000	\/	-2
3.001	10.00	0.001	10000	0.000	0.00	1	6.000	\/	-2
1.002	11.00	0.001	11000	0.015	0.00	1	15.000	\/	-3
1.003	10.00	0.001	10000	0.000	0.00	1	6.000	\/	-3
1.004	100.00	0.100	1000	0.095	0.00	1	15.000	|_|	-103
1.005	10.00	0.030	333	0.000	0.00	1	6.000	|_|	-103
4.000	44.00	0.001	32000	0.023	2.00	1	15.000	\/	-2
1.006	69.00	0.075	920	0.075	0.00	1	15.000	|_|	-104
5.000	37.00	0.001	32000	0.033	2.00	1	15.000	\/	-2
5.001	12.00	0.001	12000	0.000	0.00	1	6.000	\/	-2
5.002	86.00	0.003	32000	0.075	0.00	1	15.000	\/	-3
1.007	10.00	0.030	333	0.000	0.00	1	6.000	|_|	-104
6.000	38.00	0.001	32000	0.054	2.00	1	15.000	\/	-2
6.001	10.00	0.030	333	0.000	0.00	1	6.000	|_|	-102
6.002	115.00	0.120	958	0.414	0.00	1	15.000	|_|	-103

PN	USMH No.	US/CL (m)	US/IL (m)	US/Dep (m)	DS/CL (m)	DS/IL (m)	DS/Dep (m)	Ctrl No.	US/MH (mm)
1.000	1	99.925	99.624	0.001	99.925	99.615	0.010		1200
2.000	2	99.925	99.624	0.001	100.000	99.618	0.082		1200
2.001	3	100.000	99.618	0.082	99.925	99.616	0.009		1200
1.001	4	99.925	99.465	0.010	99.925	99.462	0.013	4	1200
3.000	5	99.925	99.624	0.001	100.000	99.623	0.077		1200
3.001	6	100.000	99.623	0.077	99.925	99.622	0.003		1200
1.002	7	99.925	99.462	0.013	100.000	99.461	0.089	4	1200
1.003	8	100.000	99.461	0.089	99.925	99.460	0.015	4	1200
1.004	9	99.925	99.460	0.015	100.000	99.360	0.190	4	1200
1.005	10	100.000	99.360	0.190	99.925	99.330	0.145	4	1200
4.000	11	99.925	99.624	0.001	99.925	99.623	0.002		1200
1.006	12	99.925	99.180	0.145	100.000	99.105	0.295	4	1200
5.000	13	99.925	99.624	0.001	100.000	99.623	0.077		1200
5.001	14	100.000	99.623	0.077	99.925	99.622	0.003	4	1200
5.002	15	99.925	99.472	0.003	100.000	99.471	0.079	4	1200
1.007	16	100.000	99.105	0.295	99.925	99.075	0.250	4	1200
6.000	17	99.925	99.624	0.001	100.000	99.623	0.077		1200
6.001	18	100.000	99.623	0.077	99.925	99.593	0.032	4	1200
6.002	19	99.925	99.443	0.032	99.925	99.323	0.152	4	1200

Network Details

PN	Length (m)	Fall (m)	Slope (1:x)	Area (ha)	T.E. (mins)	Rain Pro	k (mm)	Hyd Sect	Dia (mm)
1.008	70.00	0.050	1400	0.055	0.00	1	15.000	|_|	-105
1.009	18.00	0.030	600	0.000	0.00	1	0.600	|_|	-105
1.010	80.00	0.030	2667	0.000	0.00	1	0.600	|_|	-13

PN	USMH No.	US/CL (m)	US/IL (m)	US/Dep (m)	DS/CL (m)	DS/IL (m)	DS/Dep (m)	Ctrl No.	US/MH (mm)
1.008	20	99.925	99.075	0.250	100.000	99.025	0.375	4	1200
1.009	21	100.000	99.025	0.375	99.925	98.995	0.330	4	1200
1.010	22	99.925	98.595	0.330	99.925	98.565	0.360	4	1200

Return Period 100 years
Average Rainfall Intensity 70.13 mm/hr

Time (Min)	US Level (m)	DS Level (m)	Surcharged Depth (m)	E O'flow (m3/s)	Pipeflow (m3/s)
1	98.595	99.565	-1.000	0.000	0.000
2	98.601	99.565	-0.994	0.000	0.000
3	98.637	99.565	-0.958	0.000	0.000
4	98.711	99.565	-0.884	0.000	0.000
5	98.862	99.565	-0.733	0.000	0.000
6	99.012	99.565	-0.583	0.000	0.000
7	99.044	99.565	-0.551	0.000	0.000
8	99.054	99.565	-0.541	0.000	0.000
9	99.064	99.565	-0.531	0.000	0.000
10	99.095	99.565	-0.500	0.000	0.000
11	99.131	99.565	-0.464	0.000	0.000
12	99.172	99.565	-0.423	0.000	0.000
13	99.187	99.565	-0.408	0.000	0.000
14	99.134	99.565	-0.461	0.000	0.000
15	99.282	99.565	-0.313	0.000	0.000
16	99.216	99.565	-0.379	0.000	0.000
17	99.249	99.565	-0.346	0.000	0.000
18	99.377	99.565	-0.218	0.000	0.000
19	99.298	99.565	-0.297	0.000	0.000
20	99.344	99.565	-0.251	0.000	0.030
21	99.364	99.565	-0.231	0.000	0.047
22	99.373	99.565	-0.222	0.000	0.062
23	99.378	99.565	-0.217	0.000	0.144
24	99.377	99.565	-0.218	0.000	0.178
25	99.382	99.565	-0.213	0.000	0.199
26	99.383	99.565	-0.212	0.000	0.189
27	99.383	99.565	-0.212	0.000	0.172
28	99.384	99.565	-0.211	0.000	0.154
29	99.382	99.565	-0.213	0.000	0.149
30	99.383	99.565	-0.212	0.000	0.142
31	99.381	99.565	-0.214	0.000	0.136
32	99.379	99.565	-0.216	0.000	0.133
33	99.378	99.565	-0.217	0.000	0.127
34	99.376	99.565	-0.219	0.000	0.123
35	99.377	99.565	-0.218	0.000	0.112
36	99.377	99.565	-0.218	0.000	0.102
37	99.377	99.565	-0.218	0.000	0.087
38	99.377	99.565	-0.218	0.000	0.076
39	99.377	99.565	-0.218	0.000	0.074
40	99.377	99.565	-0.218	0.000	0.072
41	99.377	99.565	-0.218	0.000	0.069
42	99.377	99.565	-0.218	0.000	0.065
43	99.377	99.565	-0.218	0.000	0.061
44	99.377	99.565	-0.218	0.000	0.056
45	99.377	99.565	-0.218	0.000	0.052
46	99.377	99.565	-0.218	0.000	0.047
47	99.376	99.565	-0.219	0.000	0.042
48	99.376	99.565	-0.219	0.000	0.037

MAX flow
pipe [illegible]

Total Volume over Overflow (Spill Flow) 0.000m3

Cf Tc 36.8 mins in 'storm' file.
Use more critical value given above.

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Location - Scotland & Ireland

Return Period (years)	100	Volumetric Runoff Coeff.	0.77
M5-60 (mm)	22	Infiltration %	0
Ratio R	0.40	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Depth from Soffit to G.L. (m)	1.200
Foul Sewage (l/s/ha)	0.00	Min Vel. (m/s - Auto Design Only)	0.25
O'flow Setting (*Foul only)	0	Min Slope (1:X - Optimisation)	1000

Designed with Level Soffits

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	59.00	0.004	14750.0	0.039	2.00	0	15.000	\/	-2
1.001	8.00	0.015	533.3	0.000	0.00	0	6.000	\/	-2
2.000	59.00	0.003	19666.7	0.108	2.00	0	15.000	\/	-3
1.002	105.00	0.030	3500.0	0.102	0.00	0	15.000	|_|	-103
3.000	65.00	0.002	32500.0	0.066	2.00	0	15.000	\/	-2
1.003	10.00	0.015	666.7	0.000	0.00	0	6.000	|_|	-103
4.000	112.00	0.005	22400.0	0.090	2.00	0	15.000	\/	-3
1.004	10.00	0.015	666.7	0.000	0.00	0	15.000	|_|	-103
5.000	165.00	0.050	3300.0	0.188	2.00	0	15.000	|_|	-102
6.000	52.00	0.001	52000.0	0.026	2.00	0	15.000	\/	-2

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.000	0.0	9.8	99.624	0.039	0	0	0	0.13	23	0
1.001	0.0	10.0	99.620	0.039	0	0	0	0.78	141	0
2.000	0.0	9.2	99.475	0.108	0	0	0	0.14	46	0
1.002	0.0	14.8	99.455	0.249	0	0	0	0.36	197	0
3.000	0.0	14.8	99.624	0.066	0	0	0	0.08	15	0
1.003	0.0	15.0	99.425	0.315	0	0	0	0.97	526	0
4.000	0.0	16.7	99.475	0.090	0	0	0	0.13	43	0
1.004	0.0	16.9	99.410	0.405	0	0	0	0.84	452	0
5.000	0.0	11.4	99.624	0.188	0	0	0	0.29	79	0
6.000	0.0	15.0	99.624	0.026	0	0	0	0.07	12	0

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
5.001	10.00	0.020	500.0	0.000	0.00	0	6.000	|_|	-102
1.005	82.00	0.020	4100.0	0.107	0.00	0	15.000	|_|	-104
7.000	162.00	0.150	1080.0	0.210	2.00	0	15.000	|_|	-102
8.000	133.00	0.195	682.1	0.149	2.00	0	15.000	|_|	-101
7.001	10.00	0.030	333.3	0.000	0.00	0	6.000	|_|	-102
1.006	100.00	0.075	1333.3	0.151	0.00	0	15.000	|_|	-105
9.000	55.00	0.005	11000.0	0.073	2.00	0	15.000	\/	-2
1.007	14.00	0.020	700.0	0.000	0.00	0	6.000	|_|	-105
10.000	90.00	0.008	11250.0	0.043	2.00	0	15.000	\/	-2
11.000	35.00	0.002	17500.0	0.024	2.00	0	15.000	\/	-2
1.008	85.00	0.200	425.0	0.017	0.00	0	15.000	|_|	-13

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
5.001	0.0	15.2	99.574	0.214	0	0	0	0.89	240	0
1.005	0.0	20.3	99.245	0.726	0	0	0	0.40	361	0
7.000	0.0	7.3	99.624	0.210	0	0	0	0.51	139	0
8.000	0.0	6.4	99.624	0.149	0	0	0	0.51	71	0
7.001	0.0	7.4	99.329	0.359	0	0	0	1.09	294	0
1.006	0.0	22.5	98.999	1.236	0	0	0	0.75	858	0
9.000	0.0	8.3	99.624	0.073	0	0	0	0.15	26	0
1.007	0.0	22.7	98.924	1.309	0	0	0	1.20	1368	0
10.000	0.0	12.4	99.624	0.043	0	0	0	0.14	26	0
11.000	0.0	7.0	99.624	0.024	0	0	0	0.12	21	0
1.008	0.0	23.8	98.504	1.393	0	0	0	1.25	1248	0

The following hydraulic sections have been used in this network

NOTE: 'Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from the file Ditch.sec

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m2)
-2	\/	300	300	45		0.627	0.180
-3	\/	300	450	45		0.860	0.338
-13	|_|	1000	1000	90		1.333	1.000
-101	|_|	700	200			0.509	0.140
-102	|_|	900	300			0.720	0.270
-103	|_|	1200	450			1.029	0.540
-104	|_|	1500	600			1.333	0.900
-105	|_|	1900	600			1.471	1.140

Summary of Results

Return Period (years)	100	Analysis Time Step (seconds)	5
Storm Duration (mins)	30	DVD Status	OFF
Margin for Flood Risk warning (mm)	300	Inertia Status	OFF

PN	Water Lev. (m)	Surcharged Depth (m)	Flooded Vol (m3)	Flow/ Capacity	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	99.891	-0.033	0.000	0.22	0	18	O K
1.001	99.769	-0.151	0.000	0.17	0	16	O K
2.000	99.925	0.000	0.000	0.28	0	49	O K
1.002	99.764	-0.141	0.000	0.25	0	84	O K
3.000	99.924	0.000	0.000	0.37	0	30	O K
1.003	99.637	-0.238	0.000	0.27	0	81	O K
4.000	99.910	-0.015	0.000	0.21	0	41	O K
1.004	99.628	-0.232	0.000	0.35	0	100	O K
5.000	99.924	0.000	0.000	0.62	0	85	O K
6.000	99.858	-0.066	0.000	0.15	0	12	O K
5.001	99.707	-0.167	0.000	0.52	0	72	O K
1.005	99.611	-0.234	0.000	0.29	0	178	O K
7.000	99.903	-0.021	0.000	0.69	0	96	O K
8.000	99.824	0.000	0.000	1.00	0	69	O K
7.001	99.525	-0.104	0.000	0.94	0	158	O K
1.006	99.364	-0.235	0.000	0.37	0	315	O K
9.000	99.924	0.000	0.000	0.42	0	33	O K
1.007	99.195	-0.329	0.000	0.50	0	315	O K
10.000	99.885	-0.039	0.000	0.24	0	19	O K
11.000	99.842	-0.082	0.000	0.14	0	11	O K
1.008	99.163	-0.341	0.000	0.30	0	322	O K

Global Variables

Region	FSR - Scotland & Ireland
Return Period (yrs)	100
M5-60 (mm)	22.200
Ratio R	0.400
Volumetric Runoff Coef	0.770
Profile Type	Summer
PIMP (%)	100
Areal Reduction Factor	1.000
Storm Duration (mins)	30
Hot Start (mins)	0
Manhole Headloss Coefficient	1.000
MADD Factor * 10m3/ha Storage	1.000
Foul Sewage/Hectare (l/s)	0.00
Additional Flow - % of Total Flow	0
Number of Input Hydrographs	0
Number of Time/Area Diagrams	0
Number of Bifurcations	0
Number of Overflows	0
Number of Off-Line Controls	0
Number of Tank Sewers	20

Freely Discharging Outfalls

Outfall Pipe Number	Outfall MH/No	C.Level (m)	I.Level (m)	D,L (mm)	B (mm)
1.008	20	99.925	98.304	1200	0

Network Details

PN	Length (m)	Fall (m)	Slope (1:x)	Area (ha)	T.E. (mins)	Rain Pro	k (mm)	Hyd Sect	Dia (mm)
1.000	59.00	0.004	14750	0.039	2.00	1	15.000	\/	-2
1.001	8.00	0.015	533	0.000	0.00	1	6.000	\/	-2
2.000	59.00	0.003	19667	0.108	2.00	1	15.000	\/	-3
1.002	105.00	0.030	3500	0.102	0.00	1	15.000	|_|	-103
3.000	65.00	0.002	32000	0.066	2.00	1	15.000	\/	-2
1.003	10.00	0.015	667	0.000	0.00	1	6.000	|_|	-103
4.000	112.00	0.005	22400	0.090	2.00	1	15.000	\/	-3
1.004	10.00	0.015	667	0.000	0.00	1	15.000	|_|	-103
5.000	165.00	0.050	3300	0.188	2.00	1	15.000	|_|	-102
6.000	52.00	0.002	32000	0.026	2.00	1	15.000	\/	-2
5.001	10.00	0.020	500	0.000	0.00	1	6.000	|_|	-102
1.005	82.00	0.020	4100	0.107	0.00	1	15.000	|_|	-104
7.000	162.00	0.150	1080	0.210	2.00	1	15.000	|_|	-102
8.000	133.00	0.195	682	0.149	2.00	1	15.000	|_|	-101
7.001	10.00	0.030	333	0.000	0.00	1	6.000	|_|	-102

PN	USMH No.	US/CL (m)	US/IL (m)	US/Dep (m)	DS/CL (m)	DS/IL (m)	DS/Dep (m)	Ctrl No.	US/MH (mm)
1.000	1	99.925	99.624	0.001	100.000	99.620	0.080		1200
1.001	2	100.000	99.620	0.080	99.925	99.605	0.020	4	1200
2.000	3	99.925	99.475	0.000	99.925	99.472	0.003		1200
1.002	4	99.925	99.455	0.020	100.000	99.425	0.125	4	1200
3.000	5	99.925	99.624	0.001	100.000	99.622	0.078		1200
1.003	6	100.000	99.425	0.125	99.925	99.410	0.065	4	1200
4.000	7	99.925	99.475	0.000	99.925	99.470	0.005		1200
1.004	8	99.925	99.410	0.065	99.925	99.395	0.080	4	1200
5.000	9	99.925	99.624	0.001	100.000	99.574	0.126		1200
6.000	10	99.925	99.624	0.001	100.000	99.623	0.077		1200
5.001	11	100.000	99.574	0.126	99.925	99.554	0.071	4	1200
1.005	12	99.925	99.245	0.080	99.925	99.225	0.100	4	1200
7.000	13	99.925	99.624	0.001	100.000	99.474	0.226		1200
8.000	14	99.925	99.624	0.101	100.000	99.429	0.371		1200
7.001	15	100.000	99.329	0.371	99.925	99.299	0.326	4	1200

Network Details

PN	Length (m)	Fall (m)	Slope (1:x)	Area (ha)	T.E. (mins)	Rain Pro	k (mm)	Hyd Sect	Dia (mm)
1.006	100.00	0.075	1333	0.151	0.00	1	15.000	|_|	-105
9.000	55.00	0.005	11000	0.073	2.00	1	15.000	\/	-2
1.007	14.00	0.020	700	0.000	0.00	1	6.000	|_|	-105
10.000	90.00	0.008	11250	0.043	2.00	1	15.000	\/	-2
11.000	35.00	0.002	17500	0.024	2.00	1	15.000	\/	-2
1.008	85.00	0.200	425	0.017	0.00	1	15.000	|_|	-13

PN	USMH No.	US/CL (m)	US/IL (m)	US/Dep (m)	DS/CL (m)	DS/IL (m)	DS/Dep (m)	Ctrl No.	US/MH (mm)
1.006	16	99.925	98.999	0.326	100.000	98.924	0.476	4	1200
9.000	17	99.925	99.624	0.001	100.000	99.619	0.081		1200
1.007	18	100.000	98.924	0.476	99.925	98.904	0.421	4	1200
10.000	19	99.925	99.624	0.001	99.925	99.616	0.009		1200
11.000	19	99.925	99.624	0.001	99.925	99.622	0.003		1200
1.008	19	99.925	98.504	0.421	99.925	98.304	0.621	4	1200

Return Period 100 years
Average Rainfall Intensity 70.13 mm/hr

Time (Min)	US Level (m)	DS Level (m)	Surcharged Depth (m)	E D'flow (m3/s)	Pipeflow (m3/s)
1	98.518	99.304	-0.986	0.000	0.000
2	98.541	99.304	-0.963	0.000	0.000
3	98.619	99.304	-0.885	0.000	0.000
4	98.800	99.304	-0.704	0.000	0.000
5	98.927	99.304	-0.577	0.000	0.000
6	98.946	99.304	-0.558	0.000	0.000
7	98.956	99.304	-0.548	0.000	0.000
8	98.971	99.304	-0.533	0.000	0.000
9	98.994	99.304	-0.510	0.000	0.000
10	99.018	99.304	-0.486	0.000	0.000
11	99.040	99.304	-0.464	0.000	0.000
12	99.071	99.304	-0.433	0.000	0.000
13	99.103	99.304	-0.401	0.000	0.000
14	99.116	99.304	-0.388	0.000	0.000
15	99.111	99.304	-0.393	0.000	0.000
16	99.116	99.304	-0.388	0.000	0.026
17	99.122	99.304	-0.382	0.000	0.085
18	99.128	99.304	-0.376	0.000	0.143
19	99.136	99.304	-0.368	0.000	0.166
20	99.143	99.304	-0.361	0.000	0.197
21	99.147	99.304	-0.357	0.000	0.230
22	99.151	99.304	-0.353	0.000	0.254
23	99.155	99.304	-0.349	0.000	0.270
24	99.160	99.304	-0.344	0.000	0.283
25	99.163	99.304	-0.341	0.000	0.298
26	99.163	99.304	-0.341	0.000	0.313
27	99.161	99.304	-0.343	0.000	0.322
28	99.156	99.304	-0.348	0.000	0.320
29	99.151	99.304	-0.353	0.000	0.311
30	99.146	99.304	-0.358	0.000	0.297
31	99.141	99.304	-0.363	0.000	0.278
32	99.136	99.304	-0.368	0.000	0.260
33	99.130	99.304	-0.374	0.000	0.243
34	99.125	99.304	-0.379	0.000	0.224
35	99.121	99.304	-0.383	0.000	0.199
36	99.117	99.304	-0.387	0.000	0.177
37	99.114	99.304	-0.390	0.000	0.158
38	99.111	99.304	-0.393	0.000	0.139
39	99.111	99.304	-0.393	0.000	0.120
40	99.111	99.304	-0.393	0.000	0.095
41	99.111	99.304	-0.393	0.000	0.064
42	99.112	99.304	-0.392	0.000	0.052
43	99.111	99.304	-0.393	0.000	0.045
44	99.110	99.304	-0.394	0.000	0.036
45	99.108	99.304	-0.396	0.000	0.032
46	99.108	99.304	-0.396	0.000	0.029
47	99.109	99.304	-0.395	0.000	0.026
48	99.105	99.304	-0.399	0.000	0.021

Peak flow
[illegible]

Total Volume over Overflow (Spill Flow) 0.000m3

cf TC 23 MINS IN STORM RUN.
ADOPT 23 MIN FIGURE

Amec Capital Projects Ltd		Page 1
11 The Boulevard Crawley West Sussex RH10 1UX	Shell E & P Ireland Ltd Corrib Project West Outfall Ditch.	Micro Drainage
Date 14-November-2003 File West Outfall Ditches.S...	Designed By IM Checked By	
Micro Drainage	Storm W.7.6 (c)1982-2001 Micro Drainage	

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Location - Scotland & Ireland

Return Period (years)	100	Volumetric Runoff Coeff.	0.77
M5-60 (mm)	22	Infiltration %	0
Ratio R	0.40	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Depth from Soffit to G.L. (m)	0.010
Foul Sewage (l/s/ha)	0.00	Min Vel. (m/s - Auto Design only)	0.25
O'flow Setting (*Foul only)	0	Min Slope (1:X - Optimisation)	1000

Designed with Level Soffits

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	125.00	0.020	6250.0	0.342	2.00	0	15.000	|_|	-103
1.001	10.00	0.020	500.0	0.000	0.00	0	6.000	|_|	-103
1.002	17.00	0.020	850.0	0.026	0.00	0	15.000	|_|	-103
2.000	143.00	0.005	28600.0	0.194	2.00	0	15.000	\/	-4
1.003	10.00	0.020	500.0	0.000	0.00	0	6.000	|_|	-104
3.000	95.00	0.003	31666.7	0.043	2.00	0	15.000	\/	-2
4.000	140.00	0.020	7000.0	0.074	2.00	0	15.000	|_|	-102
4.001	13.00	0.010	1300.0	0.000	0.00	0	15.000	|_|	-102
4.002	18.00	0.010	1800.0	0.016	0.00	0	15.000	|_|	-102
1.004	13.00	0.100	130.0	0.000	0.00	0	6.000	o	525

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.000	0.0	9.6	99.324	0.342	0	0	0	0.27	147	0
1.001	0.0	9.8	99.304	0.342	0	0	0	1.12	607	0
1.002	0.0	10.2	99.284	0.368	0	0	0	0.74	400	0
2.000	0.0	20.1	99.324	0.194	0	0	0	0.13	71	0
1.003	0.0	20.2	99.114	0.562	0	0	0	1.33	1199	0
3.000	0.0	20.5	99.624	0.043	0	0	0	0.09	15	0
4.000	0.0	13.6	99.624	0.074	0	0	0	0.20	54	0
4.001	0.0	14.0	99.604	0.074	0	0	0	0.47	126	0
4.002	0.0	14.8	99.594	0.090	0	0	0	0.40	107	0
1.004	0.0	20.6	99.094	0.695	0	0	0	1.41	306	0

The following hydraulic sections have been used in this network

NOTE: 'Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from the file Ditch.sec

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m2)
-2	\/	300	300	45		0.627	0.180
-4	\/	300	600	45		1.082	0.540
-102	|_|	900	300			0.720	0.270
-103	|_|	1200	450			1.029	0.540
-104	|_|	1500	600			1.333	0.900

Summary of Results

Return Period (years)	100		Analysis Time Step (seconds)	5
Storm Duration (mins)	15		DVD Status	OFF
Margin for Flood Risk Warning (mm)	300		Inertia Status	OFF

PN	Water Lev. (m)	Surcharged Depth (m)	Flooded Vol (m3)	Flow/ Capacity	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	99.774	0.000	0.000	0.55	0	188	O K
1.001	99.561	-0.193	0.000	0.40	0	119	O K
1.002	99.558	-0.176	0.000	0.45	0	116	O K
2.000	99.924	0.000	0.000	0.30	0	106	O K
1.003	99.530	-0.184	0.000	0.35	0	179	O K
3.000	99.924	0.000	0.000	0.29	0	24	O K
4.000	99.924	0.000	0.000	0.30	0	41	O K
4.001	99.709	-0.195	0.000	0.16	0	19	O K
4.002	99.696	-0.198	0.000	0.18	0	21	O K
1.004	99.510	-0.109	0.000	0.96	0	206	O K

Global Variables

Region	FSR - Scotland & Ireland
Return Period (yrs)	100
M5-60 (mm)	22.200
Ratio R	0.400
Volumetric Runoff Coef	0.770
Profile Type	Summer
PIMP (%)	100
Areal Reduction Factor	1.000
Storm Duration (mins)	15
Hot Start (mins)	0
Manhole Headloss Coefficient	1.000
MADD Factor * 10m3/ha Storage	1.000
Foul Sewage/Hectare (l/s)	0.00
Additional Flow - % of Total Flow	0
Number of Input Hydrographs	0
Number of Time/Area Diagrams	0
Number of Bifurcations	0
Number of Overflows	0
Number of Off-Line Controls	0
Number of Tank Sewers	9

Freely Discharging Outfalls

Outfall Pipe Number	Outfall MH/No	C.Level (m)	I.Level (m)	D,L (mm)	B (mm)
1.004	11	99.925	98.994	1200	0

Network Details

PN	Length (m)	Fall (m)	Slope (1:x)	Area (ha)	T.E. (mins)	Rain Pro	k (mm)	Hyd Sect	Dia (mm)
1.000	125.00	0.020	6250	0.342	2.00	1	15.000	|_|	-103
1.001	10.00	0.020	500	0.000	0.00	1	6.000	|_|	-103
1.002	17.00	0.020	850	0.026	0.00	1	15.000	|_|	-103
2.000	143.00	0.005	28600	0.194	2.00	1	15.000	\/	-4
1.003	10.00	0.020	500	0.000	0.00	1	6.000	|_|	-104
3.000	95.00	0.003	31667	0.043	2.00	1	15.000	\/	-2
4.000	140.00	0.020	7000	0.074	2.00	1	15.000	|_|	-102
4.001	13.00	0.010	1300	0.000	0.00	1	15.000	|_|	-102
4.002	18.00	0.010	1800	0.016	0.00	1	15.000	|_|	-102
1.004	13.00	0.100	130	0.000	0.00	1	6.000	o	525

PN	USMH No.	US/CL (m)	US/IL (m)	US/Dep (m)	DS/CL (m)	DS/IL (m)	DS/Dep (m)	Ctrl No.	US/MH (mm)
1.000	1	99.925	99.324	0.151	100.000	99.304	0.246		1200
1.001	2	100.000	99.304	0.246	99.925	99.284	0.191	4	1200
1.002	3	99.925	99.284	0.191	100.000	99.264	0.286	4	1200
2.000	4	99.925	99.324	0.001	100.000	99.319	0.081		1200
1.003	5	100.000	99.114	0.286	99.925	99.094	0.231	4	1200
3.000	6	99.925	99.624	0.001	99.925	99.621	0.004		1200
4.000	7	99.925	99.624	0.001	99.925	99.604	0.021		1200
4.001	8	99.925	99.604	0.021	99.925	99.594	0.031	4	1200
4.002	9	99.925	99.594	0.031	99.925	99.584	0.041	4	1200
1.004	10	99.925	99.094	0.306	99.925	98.994	0.406	4	1200

Return Period 100 years
Average Rainfall Intensity 110.98 mm/hr

PEAK FLOW
PIPE 1.009

Time (Min)	US Level (m)	DS Level (m)	Surcharged Depth (m)	E D'flow (m3/s)	Pipeflow (m3/s)
1	99.103	99.519	-0.516	0.000	0.000
2	99.113	99.519	-0.506	0.000	0.000
3	99.128	99.519	-0.491	0.000	0.000
4	99.149	99.519	-0.470	0.000	0.000
5	99.192	99.519	-0.427	0.000	0.000
6	99.236	99.519	-0.383	0.000	0.000
7	99.307	99.519	-0.312	0.000	0.000
8	99.361	99.519	-0.258	0.000	0.000
9	99.414	99.519	-0.205	0.000	0.000
10	99.423	99.519	-0.196	0.000	0.028
11	99.450	99.519	-0.169	0.000	0.075
12	99.479	99.519	-0.140	0.000	0.133
13	99.510	99.519	-0.109	0.000	0.182
14	99.485	99.519	-0.134	0.000	0.206
15	99.507	99.519	-0.112	0.000	0.202
16	99.476	99.519	-0.143	0.000	0.201
17	99.474	99.519	-0.145	0.000	0.177
18	99.464	99.519	-0.155	0.000	0.158
19	99.455	99.519	-0.164	0.000	0.141
20	99.445	99.519	-0.174	0.000	0.123
21	99.437	99.519	-0.182	0.000	0.104
22	99.428	99.519	-0.191	0.000	0.085
23	99.424	99.519	-0.195	0.000	0.068
24	99.421	99.519	-0.198	0.000	0.055
25	99.417	99.519	-0.202	0.000	0.043
26	99.416	99.519	-0.203	0.000	0.032
27	99.415	99.519	-0.204	0.000	0.023
28	99.414	99.519	-0.205	0.000	0.016
29	99.414	99.519	-0.205	0.000	0.012
30	99.414	99.519	-0.205	0.000	0.008
31	99.414	99.519	-0.205	0.000	0.006
32	99.414	99.519	-0.205	0.000	0.005
33	99.414	99.519	-0.205	0.000	0.004
34	99.414	99.519	-0.205	0.000	0.004
35	99.414	99.519	-0.205	0.000	0.003
36	99.414	99.519	-0.205	0.000	0.003
37	99.414	99.519	-0.205	0.000	0.003
38	99.414	99.519	-0.205	0.000	0.003
39	99.414	99.519	-0.205	0.000	0.002
40	99.414	99.519	-0.205	0.000	0.002
41	99.414	99.519	-0.205	0.000	0.002
42	99.414	99.519	-0.205	0.000	0.002
43	99.414	99.519	-0.205	0.000	0.002
44	99.414	99.519	-0.205	0.000	0.002
45	99.414	99.519	-0.205	0.000	0.002
46	99.414	99.519	-0.205	0.000	0.002
47	99.414	99.519	-0.205	0.000	0.002
48	99.414	99.519	-0.205	0.000	0.001

Total Volume over Overflow (Spill Flow) 0.000m3

cf 13 MINS TC IN 'STORM' RUN
ADOPT MORE CRITICAL 13 MINS.

SECTION A5 OILY WATER DRAIN SYSTEM

A5.1 INTRODUCTION

The oily water drain system is a piped self-contained system, routed to the open drains sump for treatment and discharging offshore via an out-fall. This system captures any water run-off that might be contaminated with oil or other chemicals.

The oily water system was divided into four systems for the purpose of design, as follows:-

1) Slug catcher area; including the storage tank bunds (Methanol storage tank, Raw methanol storage tank and condensate storage tank). This system includes the main header draining into the open drains sump. Flows from the adjacent oily water systems are added to this system to check the capacity of the header.

2) Process area; this system includes the rainwater run-off from the compressor building roof and the process area paving.

3) Flare area; this system includes the condensate run-off from the flare as part of the closed drain system.

4) Waste storage area; this system includes the run-off from the bunded waste storage area, local paved areas and the pumped return from the access road drain system. The discharge from the oily surface water interceptor is a controlled discharge into the terminal oily drain system via a pump, and is not taken as coincident with peak fire water or rainwater run-off.

The system was checked for two design cases, the firewater discharge scenario and rainwater runoff.

A5.2 RAINWATER SCENARIO

The drainage system was designed using the Micro Drainage WinDes storm software for a 1 in 10 year return period storm. The storm intensity is derived from the reference design condition of design 45mm rainfall in one hour (100 year return period), as noted in section A1. It is considered that this will provide a robust system for the 1 in 100 year storm when storage and surcharging effects are considered.

A5.3 FIREWATER SCENARIO

The four oily water systems were checked for the maximum fire water discharge for each of the areas, based on the fire hydrant and fire monitor maximum flows. The bunded areas for the storage tanks are designed to over flow into the oily water drainage system during firewater deluge. The drainage system between the storage tanks and the open drain sump was checked for the maximum tank firewater deluge. Individual overflow branches were checked for the applicable tank firewater deluge.

	Client: Shell E & P Ireland Ltd. Plant: Gas Reception Terminal				Job Ref. L3882	
	Location: Corrib On-Plot Storm Drainage				Sheet no./rev.	
	Calc. by IM	Date Nov '03	Chck'd by	Date	App'd by	Date

A5.4 OILY WATER SYSTEM DESIGN SUMMARY

The governing design case for each system is as follows:

SYSTEM DESCRIPTION	RAIN WATER (l/s)	FIREWATER (l/s)	DESIGN CASE
SLUG CATCHER AND STORAGE TANKS	73	320	FIRE WATER
MAIN HEADER TO OPEN DRAINS SUMP	362	320	RAIN WATER
PROCESS AREA	261	160	RAIN WATER
WASTE STORAGE AREA	130	218	FIRE WATER
FLARE AREA	17	50	FIRE WATER

amec

Client: Shell E & P Ireland Ltd.
Plant: Gas Reception Terminal
Location: Corrib
On-Plot Storm Drainage

Job Ref. L3882
Sheet no./rev.

Calc. by IM | Date Nov '03 | Chck'd by | Date | App'd by | Date

A5.5 SLUG CATCHER AND STORAGE TANK DRAINAGE SYSTEM RAINWATER CASE

Slug catcher and storage tank drainage System – Rain water run-off areas Draining to system

Description	Contributing to Pipe Length	Drain Length (m)	Area Length (m)	Area Breadth (m)	Cv, Runoff Coefficient (If Partially Pervious)	Area (m2)	Sum of Areas (m2)	Comment
SLUG CATCHER								
Paving	1.000	37	44.00	8.50	1	374		
no catchment	1.001	20				0		
Paving	1.002	56	44.00	8.50	1	374		
from pipe 2.000					1	135	760 m2	
Paving	1.003	39	6.50	11.00	1	72	72 m2	
Paving	1.004	35	6.50	34.00	1	221	221 m2	
from pipe 5.000	1.005	38				280		
from pipe 8.000						60	340 m2	
from pipe 3.000	1.006	16				96		
from pipe 4.000	1.007					236	332 m2	
from pipe 7.000	1.008					540	540 m2	
tanker loading	1.009		25.00	50.00	1	1250	1250 m2	
flow from process area 261 l/s - refer to process area storm run								
no catchment	1.010					0		
Paving	2.000	13	6.00	22.50	1	135	135 m2	
Paving	3.000	12	4.00	9.00	1	36		
Paving			12.00	5.00	1	60	96 m2	
Paving	4.000	50	5.50	9.00	1	50		
Paving			3.50	10.00	1	35		
Paving			6.70	22.60	1	151	236 m2	
Paving	5.000	33	20.00	14.00	1	280	280 m2	
road	7.000		6.00	90.00	1	540	540 m2	
Paving	8.000		3.00	10.00	1	60	60 m2	

amec	Client: Shell E & P Ireland Ltd.			Job Ref. L3882	
	Plant: Gas Reception Terminal				
	Location: Corrib On-Plot Storm Drainage			Sheet no./rev.	
	Calc. by IM	Date Nov '03	Chck'd by	Date	App'd by	Date

A5.6 PROCESS AREA DRAINAGE SYSTEM RAINWATER CASE

Process area drainage System – Rain water run-off areas draining to system

Description	Contributing to Pipe Length	Drain Length (m)	Area Length (m)	Area Breadth (m)	Cv, Runoff Coefficient (If Partially Pervious)	Area (m2)	Sum of Areas (m2)	Comment
PROCESS AREA								
frompipe 7.000	1.000	30			1	388		
Paving			17.25	21.50	1	371		
Paving			30.00	18.33	1	550	1309 m2	
frompipe 2.000	1.001	19			1	760	760 m2	
frompipe 4.000	1.002	17			1	760	m2	
Paving			15.00	18.33	1	275	1035 m2	
Paving	1.003	50	14.00	9.40	1	132		
Paving			30.00	9.17	1	275		
Paving			30.00	18.33	1	550		
Paving			17.25	21.50	1	371	1327 m2	
Paving	1.004	41	17.25	21.50	1	371		
Paving			22.00	10.00	1	220		
Paving			18.00	19.50	1	351	942 m2	
Paving								
frompipe 5.000	1.005	59			1	280		
frompipe 8.000					1	521		
frompipe 3.000					1	288		
frompipe 6.000					1	1467		
frompipe 6.001					1	568	3124 m2	
Paving	2.000	49	24.00	18.00	1	432		
Paving			41.00	8.00	1	328	760 m2	
Paving	3.000	10	18.00	16.00	1	288	288 m2	
Paving	4.000	53	24.00	18.00	1	432		
Paving			41.00	8.00	1	328	760 m2	
Paving	5.000	12	20.00	14.00	1	280	280 m2	
frompipe 8.000	6.000	33			1	521		
Paving			17.25	21.50	1	371		
Paving			10.00	22.00	1	220		
Paving			18.00	19.75	1	356	1467 m2	
frompipe 5.000	6.001	32			1	280		
frompipe 3.000		32			1	288	568 m2	
building roof	7.000	26	22.50	17.25	1	388		
building roof	8.000	46	7.00	16.00	1	112		
building roof			3.00	7.00	1	21		
building roof			22.50	17.25	1	388	521 m2	

Client: Shell E & P Ireland Ltd.				Job Ref. L3882
Plant: Gas Reception Terminal				
Location: Corrib				Sheet no./rev.
On-Plot Storm Drainage				
Calc. by IM	Date Nov '03	Chck'd by	Date	App'd by	Date

A5.7 WASTE STORAGE AREA DRAINAGE SYSTEM RAINWATER CASE

Waste storage area drainage System – Rain water run-off Areas Draining to system

	1.000	33.0					
	1.001	54.0					
	1.002	58.0					

Note pipe lengths 1.000, 1.001 and 1.002 reserved for pipe from external oily surface water interceptor controlled discharge - no included with stormwater calculation

storage area	1.003	85	26.00	35.00	1	910	
storage area			15.00	15.00	1	225	
Paving			32.50	9.20	1	299	
road			6.00	90.00	1	540	1974 m2
from pipe 2.000	1.004	37	9.00	9.00	1	581	
from pipe 3.000			19.50	7.70	1	150	
road			6.00	40.00	1	240	971 m2

also allow for 27 l/s pumped from access road system

Paving	1.005	48	27.00	15.00	1	405	
Road			6.00	40.00	1	240	645 m2
no catchment	1.006		16.30	7.20	1	117	117 m2
tanker loading	1.007	35	20.00	20.00	1	400	400 m2

Include 17l/s from flare area, refer to flare storm run

Paving	2.000	36	9.00	9.00	1	81	
			27.00	18.50	1	500	581 m2
Paving	3.000	13	19.50	7.70	1	150	150 m2

Client: Shell E & P Ireland Ltd. Plant: Gas Reception Terminal		Job Ref. L3882
Location: Corrib On-Plot Storm Drainage		Sheet no./rev.
Calc. by IM	Date Nov '03	Chck'd by / Date / App'd by / Date

A5.8 FLARE AREA DRAINAGE SYSTEM RAINWATER CASE

Flare area drainage System – Rain water areas Draining to system

Description	Contributing to Pipe Length	Drain Length (m)	Area Length (m)	Area Breadth (m)	Cv, Runoff Coefficient (If Partially Pervious)	Area (m2)	Sum of Areas (m2)	Comment
FLARE AREA								
	1.000	35						
Allow for 5 l/s flare condensation from flare								
no catchment	1.001	80						
	2.000	27						
Allow for 5 l/s from LER number 1 transformer sumps (Controlled discharge)								
Paving	2.001	15		20.00	12.00	1	240 m2	
no catchment	1.002	68						

amec	Client: Shell E & P Ireland Ltd. Plant: Gas Reception Terminal	Job Ref. L3882
	Location: Corrib On-Plot Storm Drainage	Sheet no./rev
	Calc. by IM | Date Nov '03 | Chck'd by | Date	App'd by | Date

A5.9 SLUG CATCHER AND STORAGE TANK DRAINAGE SYSTEM FIREWATER CASE

Slug catcher and storage tank drainage System – Firewater deluge scenario

The firewater discharge will be 4 monitors and 4 hydrants discharging at once to the head of the oily water system.

Monitors =32 l/s * 4 = 127 l/s

Hydrants=7.5 l/s * 4= 30 l/s

Max fire water flow = 157 l/s.

Fire water will enter system through 4 number gullies at 40 l/s per gully

The three storage tank bunded areas will have a bund overflow pipe, allowing the excess firewater deluge to drain into the oily water system, this overflow will not incorporate a valve. Drainage sytem designed for the following deluge rates.

Raw methanol tank bund – 319 l/s (note this is applied as 160 l/s, in combination with the 160l/s applied at the head of the sytem)

Product methanol tank bund 120 l/s

Condensate tank bund 228 l/s

Note that each component of the system is designed for the maximum firewater flow for that component. These are not combined as this would result in the firewater flow in the whole system exceeding 320 l/s (Raw methanol

Description	Contributing to Pipe Length	Drain Length (m)	number of hydrants (32 l/s)	number of monitors (7.5 l/s)	deluge system (l/s)	total	Comment
			40.00	7.50			
SLUG CATCHER							
2 gullies	1.000	37	2.00	0.00	0	80	
	1.001	20	0.00	0.00	0	0	
2 gullies	1.002	56	2.00	0.00	0	80	
from pipe 2.000							not coincident max already 160 l/s
no additional fw	1.003	39	0.00	0.00	0		
	1.004	35	0.00	0.00	160	160	Raw methanol tank deluge - max case
from pipe 5.000	1.005	38	0.00	0.00		0	max case 320 l/s from tank deluge
from pipe 8.000						0	max case 320 l/s from tank deluge
	1.006	16	0.00	0.00	0	0	max case 320 l/s from tank deluge
from pipe 4.000	1.007	50	0.00	0.00	0	0	max case 320 l/s from tank deluge
from pipe 7.000	1.008	30	0.00	0.00	0	0	max case 320 l/s from tank deluge
no additional fw	1.009	55	0.00	0.00	0	0	max case 320 l/s from tank deluge
	1.010	4	0.00	0.00	0	0	max case 320 l/s from tank deluge
From equipment	2.000	13	0.00	0.00	2	2	
1 gully	3.000	12	1.00	0.00	0	40	
residual run-off	4.000	50	0.00	0.00	35	35	
2 gullies	5.000	33	2.00	0.00	0	80	
methanol tank	6.000	20				120	
condensate tank c	7.000	25				228	
2 gullies	8.000	29	0.00	2.00	0	15	

storage tank deluge).

Client:	Shell E & P Ireland Ltd.	Job Ref. L3882	
Plant:	Gas Reception Terminal		
Location:	Corrib On-Plot Storm Drainage	Sheet no./rev.	
Calc. by IM	Date Nov '03	Chck'd by	Date
App'd by	Date		

A5.10 PROCESS AREA DRAINAGE SYSTEM FIRE WATER CASE

Process area drainage System – Firewater deluge scenario

The firewater discharge will be 4 monitors and 4 hydrants discharging at once to the head of the oily water system.

Monitors =32 l/s * 4 = 127 l/s

Hydrants=7.5 l/s * 4= 30 l/s

Max fire water flow = 157 l/s.

Fire water will enter system through 4 number gullies at 40 l/s per gully

Note that each component of the system is designed for the maximum firewater flow for that component. These are not combined as this would result in the firewater flow in the whole system exceeding 157 l/s

Description	Contributing to Pipe Length	Drain Length (m)	number of hydrants (32 l/s)	number of monitors (7.5 l/s)	deluge system(l/s)	total	Comment
			40.00	7.50			
PROCESS AREA							
2 gullies	1.000	30	2.00	0.00	0	80	
2 gullies	1.001	19	2.00	0.00	0	80	max case 160 l/s
	1.002	17	0.00	0.00	0	0	max case 160 l/s
	1.003	50	0.00	0.00	0	0	max case 160 l/s
	1.004	41	0.00	0.00	0	0	max case 160 l/s
	1.005	59	0.00	0.00	0	0	max case 160 l/s
	2.000	49	3.00	0.00	0	120	
2 gullies	3.000	10	2.00	0.00	0	80	
3 gullies	4.000	53	3.00	0.00	0	120	
1 gully	5.000	12	1.00	0.00	0	40	
2 gullies	6.000	33	2.00	0.00	0	80	
2 gullies	6.001	32	2.00	0.00	0	80	
no fw	7.000	26	0.00	0.00	0	0	
no fw	8.000	46	0.00	0.00	0	0	

Client:	Shell E & P Ireland Ltd.				Job Ref. L3882
Plant:	Gas Reception Terminal				
Location:	Corrib On-Plot Storm Drainage				Sheet no./rev.
Calc. by IM	Date Nov '03	Chck'd by	Date	App'd by	Date

A5.11 WASTE STORAGE AREA DRAINAGE SYSTEM FIRE WATER CASE

Waste storage area drainage System - Firewater Draining to system

The firewater discharge will be 2 hydrants discharging at once to the head of the oily water system.
Hydrants=7.5 l/s * 2= 15 l/s

Firewater will enter system from 2 hydrants adjacent to power generator building. Note this has been modelled as one 40 l/s.

Note that each component of the system is designed for the maximum firewater flow for that component. These are not combined as this would result in the firewater flow in the whole system exceeding 30 l/s

Description	Contributing to Pipe Length	Drain Length (m)	number of hydrants (32 l/s)	number of monitors (7.5 l/s)	deluge system (l/s)	total	Comment
			40.00	7.50			
WASTE STOARGE AREA							
	1.000	33.0	0.00	0.00	0	0	
	1.001	54.0	0.00	0.00	0	0	
	1.002	58.0	0.00	0.00	0	0	
Note pipe lengths 1.000, 1.001 and 1.002 reserved for pipe from external oily surface water interceptor controlled discharge - no included with fire water calculation							
2 hydrants	1.003	85	0.00	2.00	0	15	
from pipe 2.000	1.004	37				40	
from pipe 2.001						27	
Paving	1.005	48	0.00	0.00	0	0	
no catchment	1.006		0.00	0.00	0	0	
tanker loading	1.007	35	0.00	0.00	0	0	
1 monitor	2.000	36	1.00	0.00	0	40	
	2.001	65				27	
also allow for 27 l/s pumped from access road system							
from flare	3.000	13				50	

amec	Client: Shell E & P Ireland Ltd. Plant: Gas Reception Terminal				Job Ref. L3882	
	Location: Corrib On-Plot Storm Drainage				Sheet no./rev.	
	Calc. by IM	Date Nov '03	Chck'd by	Date	App'd by	Date

A5.12 FLARE AREA DRAINAGE SYSTEM

Description	Contributing to Pipe Length	Drain Length (m)	number of hydrants (32 l/s)	number of monitors (7.5 l/s)	deluge system (l/s)	total	Comment
			40.00	7.50			
FLARE AREA							
	1.000	35					
Allow for 5 l/s flare condensation from flare							
no catchment	1.001	80					
	2.000	27					
Allow for 5 l/s from LER number 1 transformer sumps (Controlled discharge)							
1 Gully	2.001	15	1	0.00	0.00	40	
no catchment	1.002	68					

Amec Capital Projects Ltd		Page 1
11 The Boulevard Crawley West Sussex RH10 1UX	SHELL E&P LTD CORRIB PROJECT SLUG CATCHER-STORM	Micro Drainage
Date Dec-03 File SlugCatcherStorm2.SWS	Designed By DR Checked By	
Micro Drainage	Storm W.7.6 (c)1982-2001 Micro Drainage	

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Location - Scotland & Ireland

Return Period (years)	10	Volumetric Runoff Coeff.	0.77
M5-60 (mm)	22	Infiltration %	0
Ratio R	0.40	Minimum Backdrop Height (m)	0.010
Maximum Rainfall (mm/hr)	200	Depth from Soffit to G.L. (m)	0.500
Foul Sewage (l/s/ha)	0.00	Min Vel. (m/s - Auto Design only)	0.75
O'flow Setting (*Foul only)	0	Min Slope (1:X - Optimisation)	750

Designed with Level Soffits

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	37.00	0.074	500.0	0.037	2.00	0	0.600	o	375
1.001	20.00	0.040	500.0	0.000	0.00	0	0.600	o	375
1.002	55.50	0.080	693.8	0.076	0.00	0	0.600	o	525
1.003	39.00	0.053	735.8	0.007	0.00	0	0.600	o	525
1.004	34.50	0.043	802.3	0.022	0.00	0	0.600	o	675
1.005	37.50	0.048	781.3	0.034	0.00	0	0.600	o	675
1.006	16.00	0.020	800.0	0.010	0.00	0	0.600	o	675
1.007	50.00	0.063	793.7	0.033	0.00	0	0.600	o	675
1.008	30.00	0.038	789.5	0.054	0.00	0	0.600	o	675
1.009	55.00	0.069	797.1	0.125	0.00	261	0.600	o	750
1.010	4.00	0.013	307.7	0.000	0.00	0	0.600	o	675
2.000	12.50	0.083	150.6	0.014	2.00	0	0.600	o	150
3.000	12.00	0.040	300.0	0.010	2.00	0	0.600	o	150
4.000	50.00	0.550	90.9	0.024	2.00	0	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.000	143.8	2.8	99.160	0.037	0	0	0	0.80	89	15
1.001	137.7	3.2	98.910	0.037	0	0	0	0.80	89	15
1.002	124.1	4.3	98.815	0.113	0	0	0	0.84	182	39
1.003	116.1	5.1	98.660	0.120	0	0	0	0.82	177	39
1.004	110.5	5.7	98.460	0.142	0	0	0	0.92	328	44
1.005	105.2	6.4	98.331	0.176	0	0	0	0.93	333	51
1.006	103.1	6.7	98.197	0.186	0	0	0	0.92	329	53
1.007	97.1	7.6	98.091	0.219	0	0	0	0.92	330	59
1.008	93.8	8.1	97.942	0.273	0	0	0	0.92	331	71
1.009	88.8	9.0	97.818	0.398	261	0	0	0.98	434	359
1.010	88.6	9.1	97.674	0.398	261	0	0	1.49	533	359
2.000	152.3	2.3	99.125	0.014	0	0	0	0.82	14	6
3.000	150.6	2.3	98.875	0.010	0	0	0	0.58	10	4
4.000	148.0	2.5	99.200	0.024	0	0	0	1.65	117	10

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
5.000	33.00	0.200	165.0	0.024	2.00	0	0.600	o	250
6.000	20.00	0.036	555.6	0.028	2.00	0	0.600	o	450
7.000	25.00	0.033	757.6	0.054	2.00	0	0.600	o	600
8.000	29.00	0.193	150.3	0.010	2.00	0	0.600	o	200
8.001	15.00	0.100	150.0	0.000	0.00	0	0.600	o	200

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
5.000	148.0	2.5	98.700	0.024	0	0	0	1.09	53	10
6.000	149.9	2.4	98.500	0.028	0	0	0	0.86	136	12
7.000	148.5	2.5	98.500	0.054	0	0	0	0.88	248	22
8.000	148.2	2.5	99.260	0.010	0	0	0	0.99	31	4
8.001	144.2	2.7	98.990	0.010	0	0	0	0.99	31	4

Amec Capital Projects Ltd		Page 1
11 The Boulevard Crawley West Sussex RH10 1UX	SHELL E&P IRELAND LTD CORRIB PROJECT PROCESS STORM	Micro Drainage
Date Dec-03 File PROCESSTORM.sws	Designed By DR Checked By	
Micro Drainage	Storm W.7.6 (c)1982-2001 Micro Drainage	

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Location - Scotland & Ireland

Return Period (years)	10	Volumetric Runoff Coeff.	0.77
M5-60 (mm)	22	Infiltration %	0
Ratio R	0.40	Minimum Backdrop Height (m)	0.010
Maximum Rainfall (mm/hr)	200	Depth from Soffit to G.L. (m)	0.500
Foul Sewage (l/s/ha)	0.00	Min Vel. (m/s - Auto Design Only)	0.75
O'flow Setting (*Foul only)	0	Min Slope (1:X - Optimisation)	750

Designed with Level Soffits

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	30.00	0.100	300.0	0.131	2.00	0	0.600	o	375
1.001	19.00	0.026	730.8	0.076	0.00	0	0.600	o	525
1.002	17.00	0.023	739.1	0.104	0.00	0	0.600	o	525
1.003	50.00	0.069	724.6	0.133	0.00	0	0.600	o	525
1.004	41.00	0.057	719.3	0.095	0.00	0	0.600	o	525
1.005	59.00	0.081	728.4	0.312	0.00	0	0.600	o	675
2.000	49.00	0.098	500.0	0.076	2.00	0	0.600	o	450
3.000	35.00	0.078	448.7	0.029	2.00	0	0.600	o	225
4.000	53.00	0.106	500.0	0.076	2.00	0	0.600	o	450
5.000	12.00	0.046	260.9	0.028	2.00	0	0.600	o	200
6.000	33.00	0.066	500.0	0.147	2.00	0	0.600	o	375
6.001	32.00	0.043	744.2	0.057	0.00	0	0.600	o	525

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.000	148.4	2.5	98.775	0.131	0	0	0	1.04	115	54
1.001	142.3	2.9	98.525	0.207	0	0	0	0.82	178	82
1.002	137.3	3.2	98.499	0.311	0	0	0	0.82	177	119
1.003	124.7	4.2	98.476	0.444	0	0	0	0.82	178	154
1.004	116.3	5.1	98.407	0.539	0	0	0	0.83	179	174
1.005	107.5	6.1	98.200	0.851	0	0	0	0.96	345	254
2.000	141.7	2.9	98.948	0.076	0	0	0	0.90	144	30
3.000	141.0	3.0	98.912	0.029	0	0	0	0.61	24	11
4.000	140.6	3.0	98.991	0.076	0	0	0	0.90	144	30
5.000	152.1	2.3	99.105	0.028	0	0	0	0.75	23	12
6.000	145.1	2.7	98.900	0.147	0	0	0	0.80	89	59
6.001	135.5	3.3	98.684	0.204	0	0	0	0.81	176	77

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
7.000	26.00	0.217	119.8	0.039	2.00	0	0.600	o	300
8.000	46.00	0.053	867.9	0.052	2.00	0	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
7.000	151.5	2.3	99.525	0.039	0	0	0	1.44	101	16
8.000	134.0	3.5	99.442	0.052	0	0	0	0.53	37	19

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Location - Scotland & Ireland

Return Period (years)	10	Volumetric Runoff Coeff.	0.77
M5-60 (mm)	22	Infiltration %	0
Ratio R	0.40	Minimum Backdrop Height (m)	0.010
Maximum Rainfall (mm/hr)	200	Depth from Soffit to G.L. (m)	0.500
Foul Sewage (l/s/ha)	0.00	Min Vel. (m/s - Auto Design Only)	0.75
O'flow Setting (*Foul only)	0	Min Slope (1:X - Optimisation)	250

Designed with Level Soffits

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	35.00	0.200	175.0	0.000	2.00	5	0.600	o	150
1.001	80.00	0.457	175.1	0.000	0.00	0	0.600	o	150
2.000	27.00	0.154	175.3	0.000	2.00	5	0.600	o	150
2.001	15.00	0.146	102.7	0.024	0.00	0	0.600	o	300
1.002	68.00	0.168	404.8	0.000	0.00	0	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.000	143.7	2.8	99.200	0.000	5	0	0	0.76	13	5
1.001	121.4	4.5	99.000	0.000	5	0	0	0.76	13	5
2.000	146.5	2.6	99.150	0.000	5	0	0	0.76	13	5
2.001	144.0	2.8	98.846	0.024	5	0	0	1.55	110	15
1.002	108.1	6.0	0.000	0.024	10	0	0	0.78	55	17

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Location - Scotland & Ireland

Return Period (years)	10	Volumetric Runoff Coeff.	0.77
M5-60 (mm)	22	Infiltration %	0
Ratio R	0.40	Minimum Backdrop Height (m)	0.010
Maximum Rainfall (mm/hr)	200	Depth from Soffit to G.L. (m)	0.500
Foul Sewage (l/s/ha)	0.00	Min Vel. (m/s - Auto Design Only)	0.75
O'flow Setting (*Foul only)	0	Min Slope (1:X - Optimisation)	250

Designed with Level Soffits

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	33.00	0.078	423.1	0.000	2.00	0	0.600	o	150
1.001	54.00	0.127	425.2	0.000	0.00	0	0.600	o	150
1.002	58.00	0.136	426.5	0.000	0.00	0	0.600	o	150
1.003	46.00	0.108	425.9	0.197	0.00	0	0.600	o	300
1.004	37.00	0.051	725.5	0.097	0.00	27	0.600	o	525
1.005	48.00	0.060	800.0	0.065	0.00	0	0.600	o	525
1.006	32.00	0.040	800.0	0.000	0.00	0	0.600	o	525
1.007	35.00	0.101	346.5	0.018	0.00	17	0.600	o	525
2.000	36.00	0.103	349.5	0.058	2.00	0	0.600	o	225
3.000	13.00	0.168	77.4	0.015	2.00	50	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.000	138.3	3.1	98.975	0.000	0	0	0	0.48	9	0
1.001	116.7	5.0	98.897	0.000	0	0	0	0.48	9	0
1.002	100.7	7.0	98.770	0.000	0	0	0	0.48	8	0
1.003	94.3	8.0	98.484	0.197	0	0	0	0.76	53	52
1.004	90.1	8.8	98.151	0.294	27	0	0	0.82	178	101
1.005	85.1	9.8	98.100	0.359	27	0	0	0.78	170	112
1.006	82.1	10.5	98.040	0.359	27	0	0	0.78	170	112
1.007	80.1	11.0	98.000	0.377	44	0	0	1.20	259	128
2.000	142.3	2.9	98.875	0.058	0	0	0	0.69	28	23
3.000	154.9	2.1	98.368	0.015	50	0	0	1.79	126	56

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Location - Scotland & Ireland

Return Period (years)	100	Volumetric Runoff Coeff.	0.77
M5-60 (mm)	22	Infiltration %	0
Ratio R	0.40	Minimum Backdrop Height (m)	0.010
Maximum Rainfall (mm/hr)	200	Depth from Soffit to G.L. (m)	0.500
Foul Sewage (l/s/ha)	0.00	Min Vel. (m/s - Auto Design Only)	0.75
O'flow Setting (*Foul only)	0	Min Slope (1:X - Optimisation)	750

Designed with Level Soffits

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	37.00	0.074	500.0	0.000	2.00	80	0.600	o	375
1.001	20.00	0.040	500.0	0.000	0.00	0	0.600	o	375
1.002	55.50	0.080	693.8	0.000	0.00	80	0.600	o	525
1.003	39.00	0.053	735.8	0.000	0.00	0	0.600	o	525
1.004	34.50	0.043	802.3	0.000	0.00	160	0.600	o	675
1.005	37.50	0.048	781.3	0.000	0.00	0	0.600	o	675
1.006	16.00	0.020	800.0	0.000	0.00	0	0.600	o	675
1.007	50.00	0.063	793.7	0.000	0.00	0	0.600	o	675
1.008	30.00	0.038	789.5	0.000	0.00	0	0.600	o	675
1.009	55.00	0.069	797.1	0.000	0.00	0	0.600	o	675
1.010	4.00	0.013	307.7	0.000	0.00	0	0.600	o	675
2.000	12.50	0.083	150.6	0.000	2.00	2	0.600	o	150
3.000	12.00	0.040	300.0	0.000	2.00	40	0.600	o	300
4.000	50.00	0.550	90.9	0.000	2.00	35	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.000	200.0	2.8	99.160	0.000	80	0	0	0.80	89	80
1.001	200.0	3.2	98.910	0.000	80	0	0	0.80	89	80
1.002	200.0	4.3	98.815	0.000	160	0	0	0.84	182	160
1.003	189.6	5.1	98.660	0.000	160	0	0	0.82	177	160
1.004	181.3	5.7	98.460	0.000	320	0	0	0.92	328	320
1.005	173.4	6.4	98.331	0.000	320	0	0	0.93	333	320
1.006	170.2	6.7	98.197	0.000	320	0	0	0.92	329	320
1.007	160.7	7.6	98.091	0.000	320	0	0	0.92	330	320
1.008	155.3	8.1	97.942	0.000	320	0	0	0.92	331	320
1.009	146.3	9.1	97.818	0.000	320	0	0	0.92	329	320
1.010	145.9	9.1	97.674	0.000	320	0	0	1.49	533	320
2.000	200.0	2.3	99.125	0.000	2	0	0	0.82	14	2
3.000	200.0	2.2	98.875	0.000	40	0	0	0.90	64	40
4.000	200.0	2.5	99.200	0.000	35	0	0	1.65	117	35

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
5.000	33.00	0.200	165.0	0.000	2.00	80	0.600	o	300
6.000	20.00	0.036	555.6	0.000	2.00	120	0.600	o	450
7.000	25.00	0.033	757.6	0.000	2.00	228	0.600	o	600
8.000	29.00	0.193	150.3	0.000	2.00	15	0.600	o	200
8.001	15.00	0.100	150.0	0.000	0.00	0	0.600	o	200

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
5.000	200.0	2.5	98.700	0.000	80	0	0	1.22	86	80
6.000	200.0	2.4	98.500	0.000	120	0	0	0.86	136	120
7.000	200.0	2.5	98.500	0.000	228	0	0	0.88	248	228
8.000	200.0	2.5	99.260	0.000	15	0	0	0.99	31	15
8.001	200.0	2.7	98.990	0.000	15	0	0	0.99	31	15

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11 The Boulevard Crawley West Sussex RH10 1UX	SHELL E&P IRELAND LTD CORRIB PROJECT PROCESS FIREWATER	Micro Drainage
Date Dec-03 File PROCESSFW.sws	Designed By DR Checked By	
Micro Drainage	Storm W.7.6 (c)1982-2001 Micro Drainage	

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Location - Scotland & Ireland

Return Period (years)	100	Volumetric Runoff Coeff.	0.77
M5-60 (mm)	23	Infiltration %	0
Ratio R	0.40	Minimum Backdrop Height (m)	0.010
Maximum Rainfall (mm/hr)	200	Depth from Soffit to G.L. (m)	0.500
Foul Sewage (l/s/ha)	0.00	Min Vel. (m/s - Auto Design only)	0.75
O'flow Setting (*Foul only)	0	Min Slope (1:X - Optimisation)	750

Designed with Level Soffits

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	30.00	0.100	300.0	0.000	2.00	80	0.600	o	375
1.001	19.00	0.026	730.8	0.000	0.00	80	0.600	o	525
1.002	17.00	0.023	739.1	0.000	0.00	0	0.600	o	525
1.003	50.00	0.069	724.6	0.000	0.00	0	0.600	o	525
1.004	41.00	0.057	719.3	0.000	0.00	0	0.600	o	525
1.005	59.00	0.081	728.4	0.000	0.00	0	0.600	o	525
2.000	49.00	0.098	500.0	0.000	2.00	118	0.600	o	450
3.000	35.00	0.078	448.7	0.000	2.00	80	0.600	o	375
4.000	53.00	0.106	500.0	0.000	2.00	118	0.600	o	450
5.000	12.00	0.046	260.9	0.000	2.00	40	0.600	o	250
6.000	33.00	0.066	500.0	0.000	2.00	80	0.600	o	375
6.001	32.00	0.043	744.2	0.000	0.00	80	0.600	o	525

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.000	200.0	2.5	98.775	0.000	80	0	0	1.04	115	80
1.001	200.0	2.9	98.623	0.000	160	0	0	0.82	178	160
1.002	200.0	3.2	98.511	0.000	160	0	0	0.82	177	160
1.003	200.0	4.2	98.402	0.000	160	0	0	0.82	178	160
1.004	193.7	5.1	98.247	0.000	160	0	0	0.83	179	160
1.005	178.3	6.2	98.104	0.000	160	0	0	0.82	178	160
2.000	200.0	2.9	98.948	0.000	118	0	0	0.90	144	118
3.000	200.0	2.7	98.912	0.000	80	0	0	0.85	94	80
4.000	200.0	3.0	98.991	0.000	118	0	0	0.90	144	118
5.000	200.0	2.2	99.105	0.000	40	0	0	0.86	42	40
6.000	200.0	2.7	98.900	0.000	80	0	0	0.80	89	80
6.001	200.0	3.3	98.784	0.000	160	0	0	0.81	176	160

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
7.000	26.00	0.217	119.8	0.000	2.00	0	0.600	o	150
8.000	46.00	0.383	120.1	0.000	2.00	0	0.600	o	100

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
7.000	200.0	2.5	99.525	0.000	0	0	0	0.92	16	0
8.000	200.0	3.1	99.442	0.000	0	0	0	0.70	6	0

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Location - Scotland & Ireland

Return Period (years)	100	Volumetric Runoff Coeff.	0.77
M5-60 (mm)	23	Infiltration %	0
Ratio R	0.40	Minimum Backdrop Height (m)	0.010
Maximum Rainfall (mm/hr)	200	Depth from Soffit to G.L. (m)	0.500
Foul Sewage (l/s/ha)	0.00	Min Vel. (m/s - Auto Design Only)	0.75
O'flow Setting (*Foul only)	0	Min Slope (1:X - Optimisation)	250

Designed with Level Soffits

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	33.00	0.078	423.1	0.000	2.00	8	0.600	o	300
1.001	54.00	0.127	425.2	0.000	0.00	8	0.600	o	300
1.002	58.00	0.136	426.5	0.000	0.00	0	0.600	o	300
1.003	46.00	0.108	425.9	0.000	0.00	16	0.600	o	300
1.004	37.00	0.051	725.5	0.000	0.00	67	0.600	o	525
1.005	48.00	0.060	800.0	0.000	0.00	0	0.600	o	525
1.006	32.00	0.040	800.0	0.000	0.00	0	0.600	o	525
1.007	35.00	0.101	346.5	0.000	0.00	0	0.600	o	525
2.000	36.00	0.103	349.5	0.000	2.00	42	0.600	o	300
3.000	13.00	0.168	77.4	0.000	2.00	50	0.600	o	300
2.001	65.00	0.372	174.7	0.000	0.00	27	0.600	o	375
1.008	1.00	0.010	100.0	0.000	0.00	0	0.600	o	525

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.000	200.0	2.7	98.975	0.000	8	0	0	0.76	54	8
1.001	200.0	3.9	98.897	0.000	16	0	0	0.76	53	16
1.002	191.6	5.2	98.770	0.000	16	0	0	0.76	53	16
1.003	178.7	6.2	98.634	0.000	32	0	0	0.76	53	32
1.004	170.4	7.0	98.376	0.000	99	0	0	0.82	178	99
1.005	159.4	8.0	98.250	0.000	99	0	0	0.78	170	99
1.006	152.9	8.7	98.165	0.000	99	0	0	0.78	170	99
1.007	148.6	9.1	98.000	0.000	99	0	0	1.20	259	99
2.000	200.0	2.7	98.875	0.000	42	0	0	0.84	59	42
3.000	200.0	2.1	98.368	0.000	50	0	0	1.79	126	50
2.001	200.0	3.5	98.125	0.000	119	0	0	1.37	151	119
1.008	148.6	9.2	97.603	0.000	218	0	0	2.24	485	218

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11 The Boulevard Crawley West Sussex RH10 1UX	SHELL E&P IRELAND LTD CORRIB PROJECT FLARE OWS - FIREWATER	Micro Drainage
Date Dec-03 File Flarefw.sws	Designed By DR Checked By	
Micro Drainage	Storm W.7.6 (c)1982-2001 Micro Drainage	

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Location - Scotland & Ireland

Return Period (years)	100	Volumetric Runoff Coeff.	0.77
M5-60 (mm)	22	Infiltration %	0
Ratio R	0.40	Minimum Backdrop Height (m)	0.010
Maximum Rainfall (mm/hr)	200	Depth from Soffit to G.L. (m)	0.500
Foul Sewage (l/s/ha)	0.00	Min Vel. (m/s - Auto Design Only)	0.75
O'flow Setting (*Foul only)	0	Min Slope (1:X - Optimisation)	250

Designed with Level Soffits

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	35.00	0.200	175.0	0.000	2.00	5	0.600	o	150
1.001	80.00	0.457	175.1	0.000	0.00	0	0.600	o	150
2.000	27.00	0.154	175.3	0.000	2.00	5	0.600	o	150
2.001	15.00	0.146	102.7	0.000	0.00	40	0.600	o	300
1.002	68.00	0.168	404.8	0.000	0.00	0	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.000	200.0	2.8	99.200	0.000	5	0	0	0.76	13	5
1.001	195.5	4.5	99.000	0.000	5	0	0	0.76	13	5
2.000	200.0	2.6	99.150	0.000	5	0	0	0.76	13	5
2.001	200.0	2.8	98.846	0.000	45	0	0	1.55	110	45
1.002	176.0	6.0	0.000	0.000	50	0	0	0.78	55	50

SECTION A6 SURFACE WATER SYSTEM

A6.1 Introduction

The surface water system collects the water run-offs from the building roofs as well as water at ground level where required for de-watering. The surface water is split into three systems to reflect the location of the various buildings, and as such there are three discharge locations.

- The roof and dewatering drainage to the:
  - Open and Closed Drains Sump
  - Generator Building
  - Firewater Pump House
  - Switchroom LER 1
- The control building discharge into the external drainage system.
- The Maintenance building and administration building complex drains into the existing ditch in the tree firebreak.

The design of the system was carried out using the Micro-drainage 'storm' program for a 1 in 10 year return period storm, derived using reference design condition of 45mm rainfall in one hour (100 year return period). This will provide a system suitable for a 100-year return period storm, when the effects of storage and surcharging are considered.

A6.1 LER / Drain Sumps / Generator Building / FW Pump House

Areas based on building roof areas and de-watering requirements local to the building. Design criteria as per Appendix A section 1, viz:
"Return period = 10 years"
"M5-60 = 22.2 mm"
"Volumetric runoff coefficient, Cv = 0.77"

The results are attached.

Client:	Shell E & P Ireland Ltd.	Job Ref.
Plant:	Gas Reception Terminal	L3882
Location:	Corrib On-Plot Storm Drainage	Sheet no./rev

Calc. by	Date	Chck'd by	Date	App'd by	Date
IM	Nov '03				

6.2 ON-PLOT ROOF DRAINS SYSTEM – TIE IN POINT 8

Outfall Ditch System - Areas Draining to Ditches

Description	Contributing to Pipe Length	Drain Length (m)	Area Length (m)	Area Breadth (m)	Cv, Runoff Coefficient (If Partially Pervious)	Area (m2)	Sum of Areas (m2)	Comment
On - Plot Roof Drains System								
Roof & Road	1.000	81	32	17	1	544	544 m2	
Roof & Road	2.000	28	32	16	1	512		
Pervious Area			32	10	0.6	192	704 m2	
	1.001	38	0	0	0		Carrier	
Roof & Road	3.000	18	19	19	1	361	361 m2	
Roof & Road	1.002	54	15	37	1	555	555 m2	
Roof & Road	1.003	22	15	12	1	180	180 m2	
Roof & Road	4.000	50	19	19	1	361	361 m2	
	1.004	15	0	0	0		Carrier	
Roof & Road	1.005	48	27	12	1	324	324 m2	
Roof & Road	5.000	37	27	12	1	324	324 m2	
	1.006	22	0	0	0		Carrier	
	1.007	35	35	22	1	770	770 m2	
	1.008	41	60	13	1	780	780 m2	
	6.000	31	20	15	1	300	300 m2	
	1.009	100	0	0	0		Carrier	
Total							$\boxed{5203}$ m2	

amec	Client: Shell E & P Ireland Ltd. Plant: Gas Reception Terminal				Job Ref. L3882	
	Location: Corrib On-Plot Storm Drainage				Sheet no./rev	
	Calc. by IM	Date Nov '03	Chck'd by	Date	App'd by	Date

A6.3 Control building

Area drained from Block C building :

"Roof: $40 \times 12 = 480\ m^2$

"Roads (3m road width to north and south of building. Outer half
"of perimeter road is taken to drain out to perimeter ditches
"without specific drain provision). $50 \times 6 = 300\ m^2$

"General area drainage: $50 \times 9 \times 0.6 = 270\ m^2$

"Total: $= \mathbf{1050}\ m^2$."

A6.4 Admin Buildings

These calculations are based on the roof areas for the administration and maintenance buildings

Runoff areas to be allowed for:

"Run 1.000:

"Block G (Warehouse) $39 \times 20 = \mathbf{780}\ m^2$

"Run 2.000:

"Block E (Admin) $54 \times 10 = 540\ m^2$

"(Area between Blocks G and B, in contradiction of above statement) $19 \times 20 \times 0.6 = 228\ m^2$

" Run 2.000 Total $= \mathbf{768}\ m^2$

"Run 1.001:

"Block A $14 \times 9 = \mathbf{126}\ m^2$

"Run 1.002:

"Block B $38 \times 9 = \mathbf{342}\ m^2$

"Run 3.000:

"Block F $11 \times 9 = 99\ m^2$

"Block D $15 \times 9 = 135\ m^2$

"Allow some of Block B drainage here $9 \times 10 = 90\ m^2$

" Run 3.000 Total $= \mathbf{324}\ m^2$."

Results are shown in the attached Micro Drainage files.

amec	Client: Shell E & P Ireland Ltd. Plant: Gas Reception Terminal Location: Corrib On-Plot Storm Drainage	Job Ref. L3882 Sheet no./rev

Calc. by	Date	Chck'd by	Date	App'd by	Date
IM	Nov '03				

A6.5 DESIGN SUMMARY

The summary of surface water system outfalls from the main process plot roofs is as below:

Drainage System	Tie in point number	Outflow Invert Level (m)	Time of Concentration (min)	Max Flow (l/s)
LER, Drains Sump, Generator Building, Firewater Pump House	8	96.500 (At N 32820m)	10.0	147 *(SEE NOTE)
Control Building	7	98.025 (At N 32820m)	5.1	38
Admin Area Buildings (roofs only)	9	97.600 (At N 32816m)	5.6	74

These calculations have been run only using the Micro Drainage 'Storm' program, based on a 10-year return period storm, without consideration of storage within the system. The tie-in point numbers refer to the interface with the external drainage system on drawing COR-AP-SD-001. The results of initial calculations were made available to the designers of the external drainage system. The final calculations included here show some variation to these figures, but the latest figures are generally less critical. For simplicity, it has been decided that the figures given in the summary report should be left unchanged. Minor variations in the results of the detailed calculations are considered to be of no consequence.

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11 The Boulevard Crawley West Sussex RH10 1UX	Enterprise Oil Corrib Project Dewatering & SWS	Micro Drainage®
Date 17-November-2003 File DW-Sumps to FWPH.S...	Designed By IM Checked By	
Micro Drainage	Storm W.7.6 (c)1982-2001 Micro Drainage	

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Location - Scotland & Ireland

Return Period (years)	10	Volumetric Runoff Coeff.	0.77
M5-60 (mm)	22	Infiltration %	0
Ratio R	0.40	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	200	Depth from Soffit to G.L. (m)	0.300
Foul Sewage (l/s/ha)	0.00	Min Vel. (m/s - Auto Design only)	0.75
O'flow Setting (*Foul only)	0	Min Slope (1:X - optimisation)	750

Designed with Level Soffits

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	81.00	0.310	261.3	0.056	3.00	0	0.060	o	225
2.000	28.00	0.200	140.0	0.070	3.00	0	0.600	o	225
1.001	37.50	0.350	107.1	0.000	0.00	0	0.600	o	225
3.000	18.00	0.067	268.7	0.037	3.00	0	0.600	o	225
1.002	54.00	0.500	108.0	0.112	0.00	0	0.600	o	300
1.003	22.00	0.375	58.7	0.037	0.00	0	0.600	o	300
4.000	50.00	0.200	250.0	0.052	3.00	0	0.600	o	225
1.004	15.00	0.130	115.4	0.000	0.00	0	0.600	o	375
1.005	48.00	0.150	320.0	0.033	0.00	0	0.600	o	450
5.000	37.00	0.250	148.0	0.033	3.00	0	0.600	o	150

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.000	123.2	4.4	99.175	0.056	0	0	0	0.99	39	19
2.000	134.4	3.4	99.175	0.070	0	0	0	1.10	44	26
1.001	118.1	4.9	98.800	0.126	0	0	0	1.26	50	41
3.000	135.0	3.4	98.800	0.037	0	0	0	0.79	32	14
1.002	112.6	5.5	98.375	0.275	0	0	0	1.51	107	86
1.003	111.1	5.6	97.875	0.312	0	0	0	2.06	145	96
4.000	127.1	4.0	98.500	0.052	0	0	0	0.82	33	18
1.004	109.9	5.8	97.425	0.364	0	0	0	1.69	186	111
1.005	104.4	6.5	97.220	0.397	0	0	0	1.13	180	115
5.000	130.3	3.7	99.175	0.033	0	0	0	0.82	15	12

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.006	22.00	0.090	244.4	0.000	0.00	0	0.600	o	450
1.007	35.00	0.060	583.3	0.058	0.00	0	0.600	o	450
1.008	41.00	0.070	585.7	0.078	0.00	0	0.600	o	525
6.000	31.00	0.100	310.0	0.030	3.00	0	0.600	o	225
1.009	100.00	0.180	555.6	0.000	0.00	0	0.600	o	525

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.006	102.4	6.8	97.070	0.430	0	0	0	1.30	206	122
1.007	97.7	7.5	96.980	0.488	0	0	0	0.83	133	133
1.008	93.2	8.2	96.845	0.566	0	0	0	0.92	199	147
6.000	130.9	3.7	97.800	0.030	0	0	0	0.74	29	11
1.009	84.3	10.0	96.775	0.596	0	0	0	0.94	204	147

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Location - Scotland & Ireland

Return Period (years)	10	Volumetric Runoff Coeff.	0.77
M5-60 (mm)	22	Infiltration %	0
Ratio R	0.40	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	200	Depth from Soffit to G.L. (m)	0.300
Foul Sewage (l/s/ha)	0.00	Min Vel. (m/s - Auto Design Only)	0.75
O'flow Setting (*Foul only)	0	Min Slope (1:X - Optimisation)	750

Designed with Level Soffits

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	50.00	0.400	125.0	0.105	3.00	0	0.600	o	225
1.001	80.00	0.300	266.7	0.000	0.00	0	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.000	130.7	3.7	98.800	0.105	0	0	0	1.17	46	38
1.001	115.8	5.1	98.325	0.105	0	0	0	0.96	68	38

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Location - Scotland & Ireland

Return Period (years)	10	Volumetric Runoff Coeff.	0.77
M5-60 (mm)	22	Infiltration %	0
Ratio R	0.40	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	200	Depth from Soffit to G.L. (m)	0.300
Foul Sewage (l/s/ha)	0.00	Min Vel. (m/s - Auto Design only)	0.75
O'flow Setting (*Foul only)	0	Min Slope (1:X - Optimisation)	750

Designed with Level Soffits

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	45.00	0.350	128.6	0.078	3.00	0	0.600	o	225
2.000	70.00	0.350	200.0	0.078	3.00	0	0.600	o	225
1.001	34.00	0.250	136.0	0.016	0.00	0	0.600	o	300
1.002	61.00	0.350	174.3	0.032	0.00	0	0.600	o	300
3.000	67.00	0.250	268.0	0.034	3.00	0	0.600	o	225
1.003	6.00	0.040	150.0	0.000	0.00	0	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.000	131.5	3.7	98.700	0.078	0	0	0	1.15	46	29
2.000	124.3	4.3	98.900	0.078	0	0	0	0.92	37	27
1.001	119.8	4.7	98.275	0.172	0	0	0	1.35	95	57
1.002	111.9	5.5	98.025	0.204	0	0	0	1.19	84	63
3.000	122.7	4.4	98.800	0.034	0	0	0	0.79	32	12
1.003	111.2	5.6	97.675	0.238	0	0	0	1.28	91	74

amec	Client: Shell E & P Ireland Ltd. Plant: Gas Reception Terminal				Job Ref. L3882	
	Location: Corrib On-Plot Storm Drainage				Sheet no./rev.	
	Calc. by IM	Date Nov '03	Chck'd by	Date	App'd by	Date

SECTION A7 ACCESS ROAD AND CAR PARK DRAINAGE SYSTEM

A7.1 Introduction

The access road and main car park drain to a sump located near the site entrance. The access road is kerbed along its length to ensure that any accidental spillage from a tanker is contained. All runoff is pumped to the oily water system on the terminal site (refer to the waste storage area system).

For this part of the oily water system there are two design conditions:

- Storm rainfall or
- Oil arising from an accidental tanker spill.

Any accidental spillage will be contained with the kerbed area. These calculations check the system's ability to cope with rainfall.

The design of the system is run on the Micro Drainage 'Storm' program, using a 1 in 10-year storm profile, derived form the reference design condition of 45mm rainfall in one hour (100 year return period). Pipes are laid to normal falls and the pipes are sized for the maximum flow only.

A7.2 Access Road Impermeable Areas

The ground around the Administration Area buildings and car park is drained by Arup. The roads in this area are provided with a kerb. The kerb is required to contain any accidental oil spillage. Runoff into the road drainage system is, therefore, limited to runoff from the net road areas.

Road areas are calculated below. Area numbers are marked on the sketch plan of the drainage system.

amec						
Client:	Shell E & P Ireland Ltd.				Job Ref. L3882	
Plant:	Gas Reception Terminal					
Location:	Corrib On-Plot Storm Drainage				Sheet no./rev.	
Calc. by IM	Date Nov '03	Chck'd by	Date		App'd by	Date

Description	Contributing to Pipe Length	Drain Length (m)	Area Length (m)	Area Breadth (m)	Cv, Runoff Coefficient (If Partially Pervious)	Area (m2)	Sum of Areas (m2)	Comment
Area Nos								
1	1.000	32	25	15	1	375		
2	1.001	53	48	10	1	480		
5	1.002	20	50	6	1	300		
3	1.003	68	10	6	1	60		
4	1.003		10	6	1	60		
6A	1.003		50	8	1	400		
							520	
6B	1.004	40	40	8	1	320		
7	1.005	45	10	10	1	100		
8	1.005		35	12	1	420		
							520	
12	2.000	40	55	16	1	880		
	2.001	52						Carrier
9	1.006	82	10	10	1	100		
10	1.006		20	8	1	160		
11	1.006		67	6	1	402		
							662	
12	1.007	32	31	6	1	186		
13	1.008	72	72	6	1	432		
14	3.000	63	78	6	1	468		
radius			12	12	1	144		
							612	

A7.3 Outflows from Access Road and Car Park Drains:

The detailed Micro Drainage 'Storm' calculations follow.

The outflow from the Access Road and Car Park drain system is shown below. These figures are based on the results of the 1 in 10 year 'Storm' program output.

It should be noted that the flow from the Access Road and Car Park system does not drain directly to the perimeter ditch system. It drains to a local sump and is then pumped to the terminal oily water system.

The summary of the Access Road and Car Park drain system outflow is as below:

Ditch System	**Outflow Invert Level (m)**	**Time of Concentration (min)**	**Max Flow (l/s)**
Access Road and Car Park Drains	97.755	11.2	110

Amec Capital Projects Ltd		Page 1
11 The Boulevard Crawley West Sussex RH10 1UX	Shell E&P Ireland Ltd Corrib Project Access Road and Car Park	Micro Drainage
Date November 2003 File Access Road.SWS	Designed By IM Checked By	
Micro Drainage	Storm W.7.6 (c)1982-2001 Micro Drainage	

STORM SEWER DESIGN by the Modified Rational Method

Global Variables

Location - Scotland & Ireland

Return Period (years)	10	Volumetric Runoff Coeff.	0.77
M5-60 (mm)	22	Infiltration %	0
Ratio R	0.40	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	200	Depth from Soffit to G.L. (m)	1.200
Foul Sewage (l/s/ha)	0.00	Min Vel. (m/s - Auto Design only)	0.70
O'flow Setting (*Foul only)	0	Min Slope (1:X - Optimisation)	1000

Designed with Level Soffits

Network Design Table

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
1.000	32.00	0.120	266.7	0.038	2.00	0	0.600	o	225
1.001	53.00	0.140	378.6	0.048	0.00	0	0.600	o	300
1.002	20.00	0.050	400.0	0.030	0.00	0	0.600	o	300
1.003	68.00	0.180	377.8	0.050	0.00	0	0.600	o	300
1.004	40.00	0.080	500.0	0.000	0.00	0	0.600	o	375
1.005	45.00	0.100	450.0	0.050	0.00	0	0.600	o	375
2.000	40.00	0.100	400.0	0.090	2.00	0	0.600	o	300
2.001	52.00	0.150	346.7	0.000	0.00	0	0.600	o	300
1.006	82.00	0.140	585.7	0.067	0.00	0	0.600	o	450
1.007	32.00	0.050	640.0	0.019	0.00	0	0.600	o	450
1.008	72.00	0.130	553.8	0.043	0.00	0	0.600	o	450
3.000	63.00	0.230	273.9	0.061	2.00	0	0.600	o	225
1.009	10.00	0.030	333.3	0.000	0.00	0	0.600	o	450

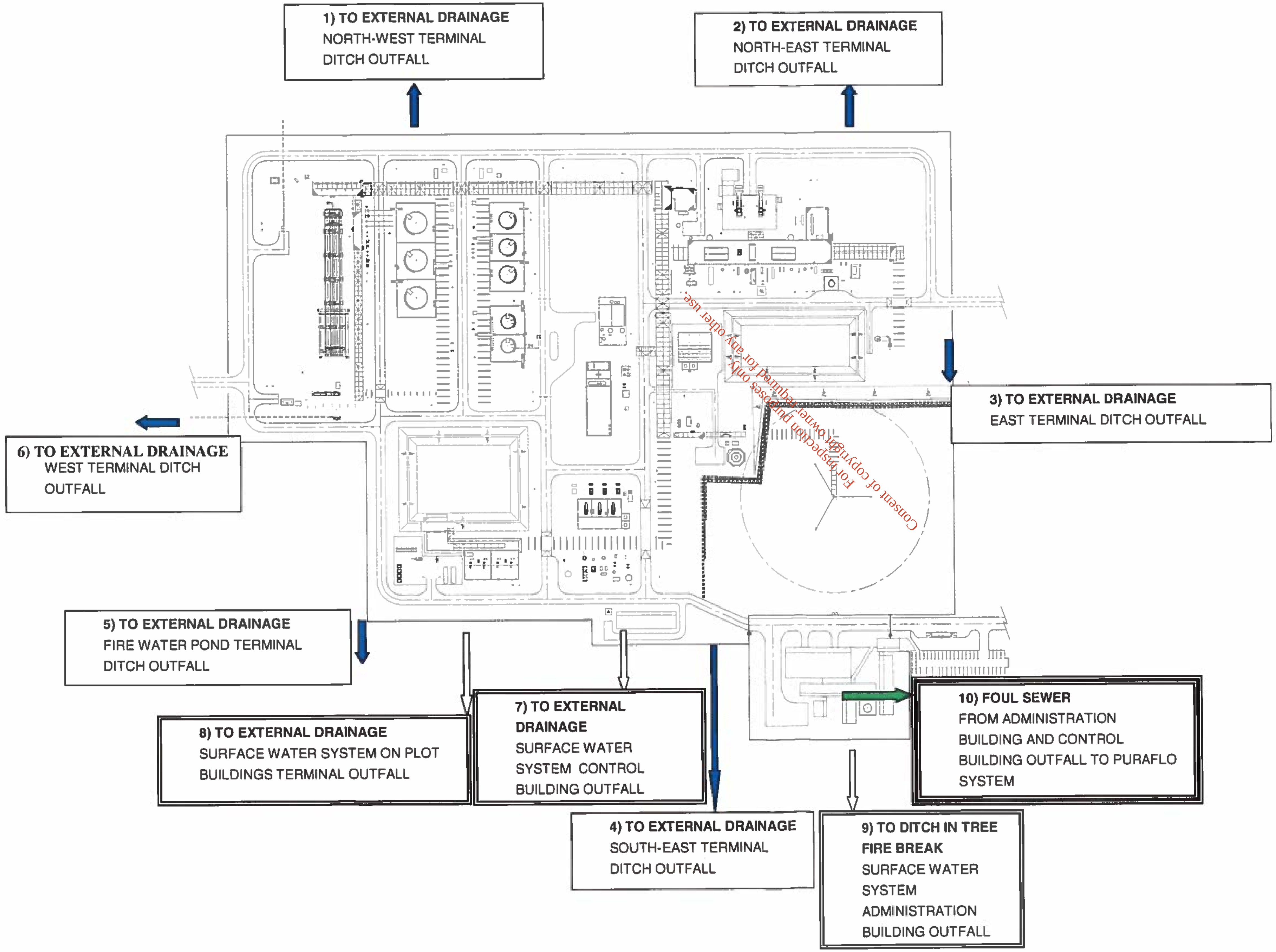
Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E.Area (ha)	E.DWF (l/s)	Foul (l/s)	Infil. (l/s)	Vel (m/s)	CAP (l/s)	Flow (l/s)
1.000	145.3	2.7	99.000	0.038	0	0	0	0.80	32	15
1.001	130.0	3.8	98.805	0.086	0	0	0	0.80	57	31
1.002	125.0	4.2	98.665	0.116	0	0	0	0.78	55	40
1.003	111.3	5.6	98.615	0.166	0	0	0	0.80	57	51
1.004	104.7	6.4	98.360	0.166	0	0	0	0.80	89	51
1.005	98.7	7.3	98.280	0.216	0	0	0	0.85	94	59
2.000	142.5	2.9	98.800	0.090	0	0	0	0.78	55	36
2.001	128.6	3.9	98.700	0.090	0	0	0	0.84	59	36
1.006	89.2	9.0	98.105	0.373	0	0	0	0.83	132	92
1.007	85.9	9.6	97.965	0.392	0	0	0	0.80	127	94
1.008	79.8	11.0	97.915	0.435	0	0	0	0.86	136	97
3.000	135.6	3.3	98.700	0.061	0	0	0	0.79	31	23
1.009	79.2	11.2	97.785	0.496	0	0	0	1.11	176	109

SECTION A8 SUMMARY OF DRAINAGE SYSTEMS

The schematic drawing attached summarises the terminal drainage systems, and the interface locations with the external drainage system

Client:	Shell E & P Ireland Ltd.			Job Ref. L3882	
Plant:	Gas Reception Terminal				
Location:	Corrib On-Plot Storm Drainage			Sheet no./rev.	
Calc. by IM	Date Nov '03	Chck'd by	Date	App'd by	Date

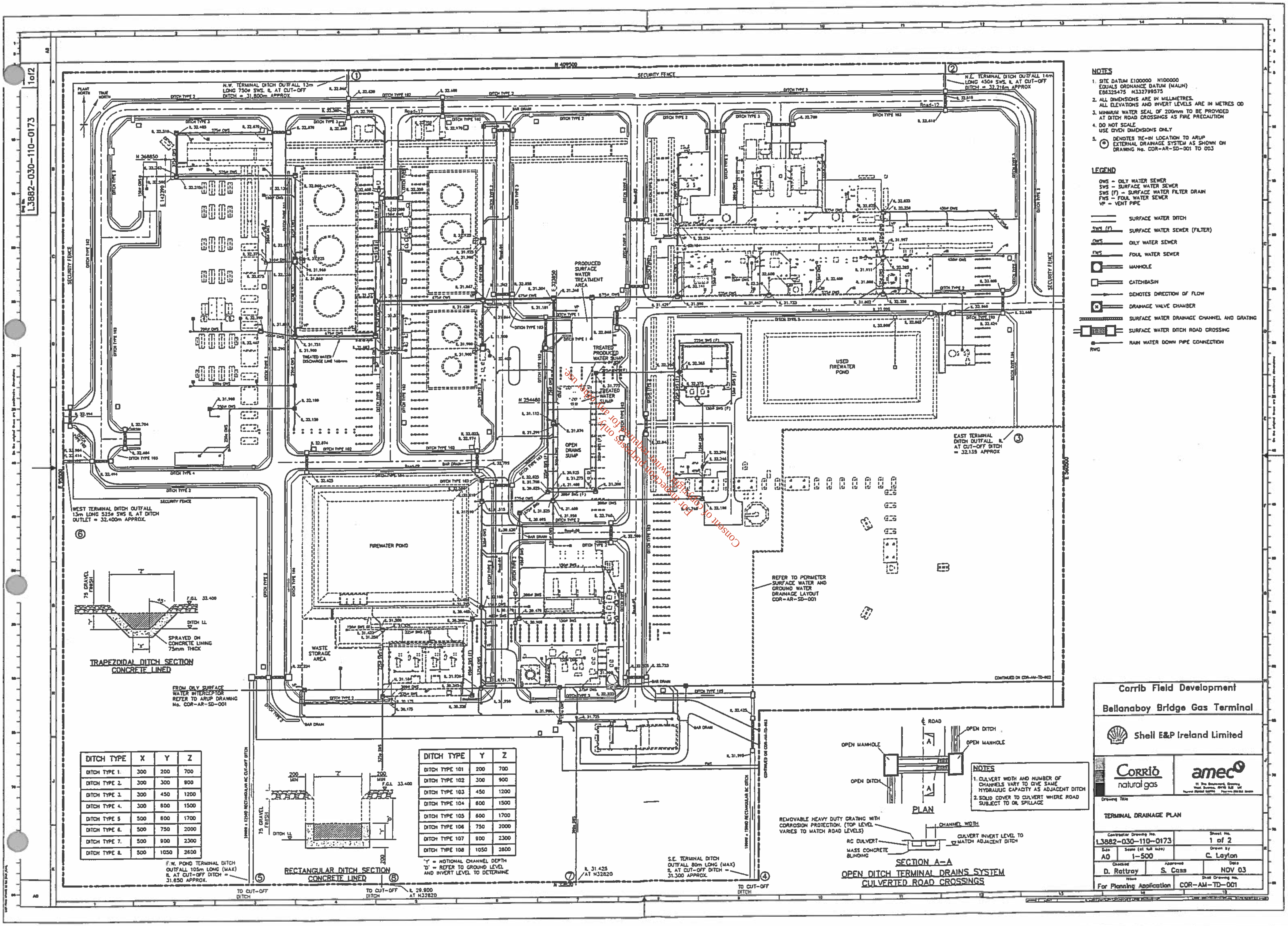


SCHEMATIC OF TERMINAL DRAIN SYSTEMS DISCHARGE LOCATIONS

amec	Client: Shell E & P Ireland Ltd. Plant: Gas Reception Terminal			Job Ref. L3882	
	Location: Corrib On-Plot Storm Drainage			Sheet no./rev. 1	
	Calc. by IM	Date 27/11/2003	Chck'd by	Date	App'd by	Date

SECTION A9 TERMINAL DRAINAGE PLAN

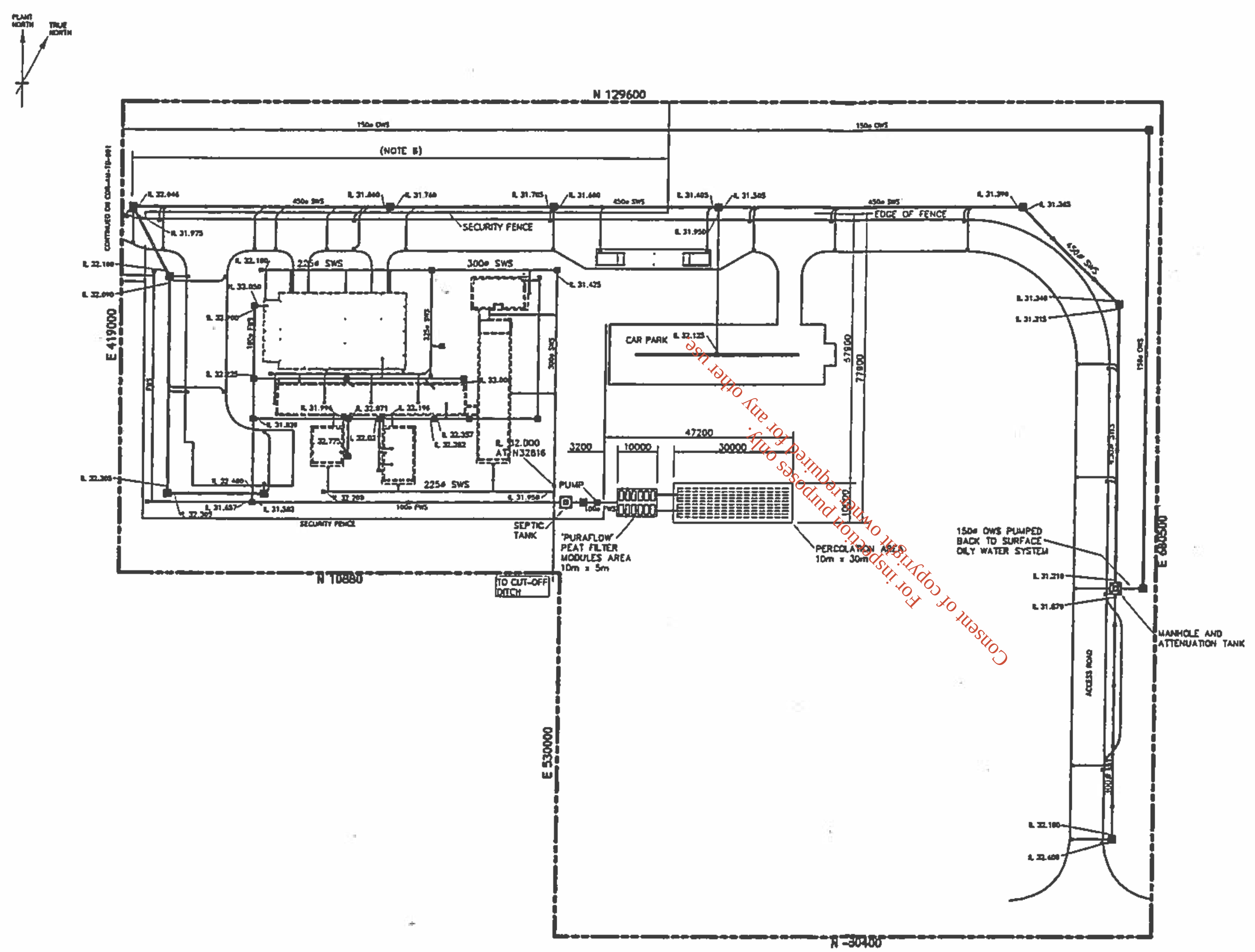
Drawing COR-AM-TD-001 and COR-AM-TD-002, terminal drainage plan.



DITCH TYPE	X	Y	Z
DITCH TYPE 1	300	200	700
DITCH TYPE 2	300	300	900
DITCH TYPE 3	300	450	1200
DITCH TYPE 4	300	600	1500
DITCH TYPE 5	500	600	1700
DITCH TYPE 6	500	750	2000
DITCH TYPE 7	500	900	2300
DITCH TYPE 8	500	1050	2600

DITCH TYPE	Y	Z
DITCH TYPE 101	200	700
DITCH TYPE 102	300	900
DITCH TYPE 103	450	1200
DITCH TYPE 104	600	1500
DITCH TYPE 105	600	1700
DITCH TYPE 106	750	2000
DITCH TYPE 107	900	2300
DITCH TYPE 108	1050	2600

'Y' = NOTIONAL CHANNEL DEPTH
'D' = REFER TO GROUND LEVEL AND INVERT LEVEL TO DETERMINE



NOTES

1. SITE DATUM E100000 N100000 EQUALS ORDNANCE DATUM (MALIN) E08325475 N332798575
2. ALL DIMENSIONS ARE IN MILLIMETRES. ALL ELEVATIONS AND INVERT LEVELS ARE IN METRES OD
3. MINIMUM WATER SEAL OF 200mm TO BE PROVIDED AT DITCH ROAD CROSSINGS AS FIRE PRECAUTION
4. DO NOT SCALE USE GIVEN DIMENSIONS ONLY
5. ⊙ DENOTES TIE-IN LOCATION TO ARUP EXTERNAL DRAINAGE SYSTEM AS SHOWN ON DRAWING No. COR-AR-SD-001 TO 003
6. REFER TO DRAWING No. COR-AR-SD-001 FOR DRAINAGE OF SURROUNDING AREA

LEGEND

OWS – OILY WATER SEWER
SWS – SURFACE WATER SEWER
SWS (F) – SURFACE WATER FILTER DRAIN
FWS – FOUL WATER SEWER
VP – VENT PIPE

- SURFACE WATER DITCH
- SWS (F) SURFACE WATER SEWER (FILTER)
- OWS OILY WATER SEWER
- FWS FOUL WATER SEWER
- MANHOLE
- CATCHBASIN
- DENOTES DIRECTION OF FLOW
- DRAINAGE VALVE CHAMBER
- SURFACE WATER DRAINAGE CHANNEL AND GRATING
- SURFACE WATER DITCH ROAD CROSSING
- RWG RAIN WATER DOWN PIPE CONNECTION

Corrib Field Development

Bellanaboy Bridge Gas Terminal

Shell E&P Ireland Limited

Corrib natural gas — amec

Drawing Title: TERMINAL DRAINAGE PLAN

Contractor Drawing No.	Sheet No.
L3882-030-110-0173	2 of 2
Size: A0 — Scale (at full size): 1–500	Drawn by: C. Layton
Checked: D. Rattray — Approved: S. Cass	Date: Oct 03
Issue: For Planning Application	Shell Drawing No.: COR-AM-TD-002

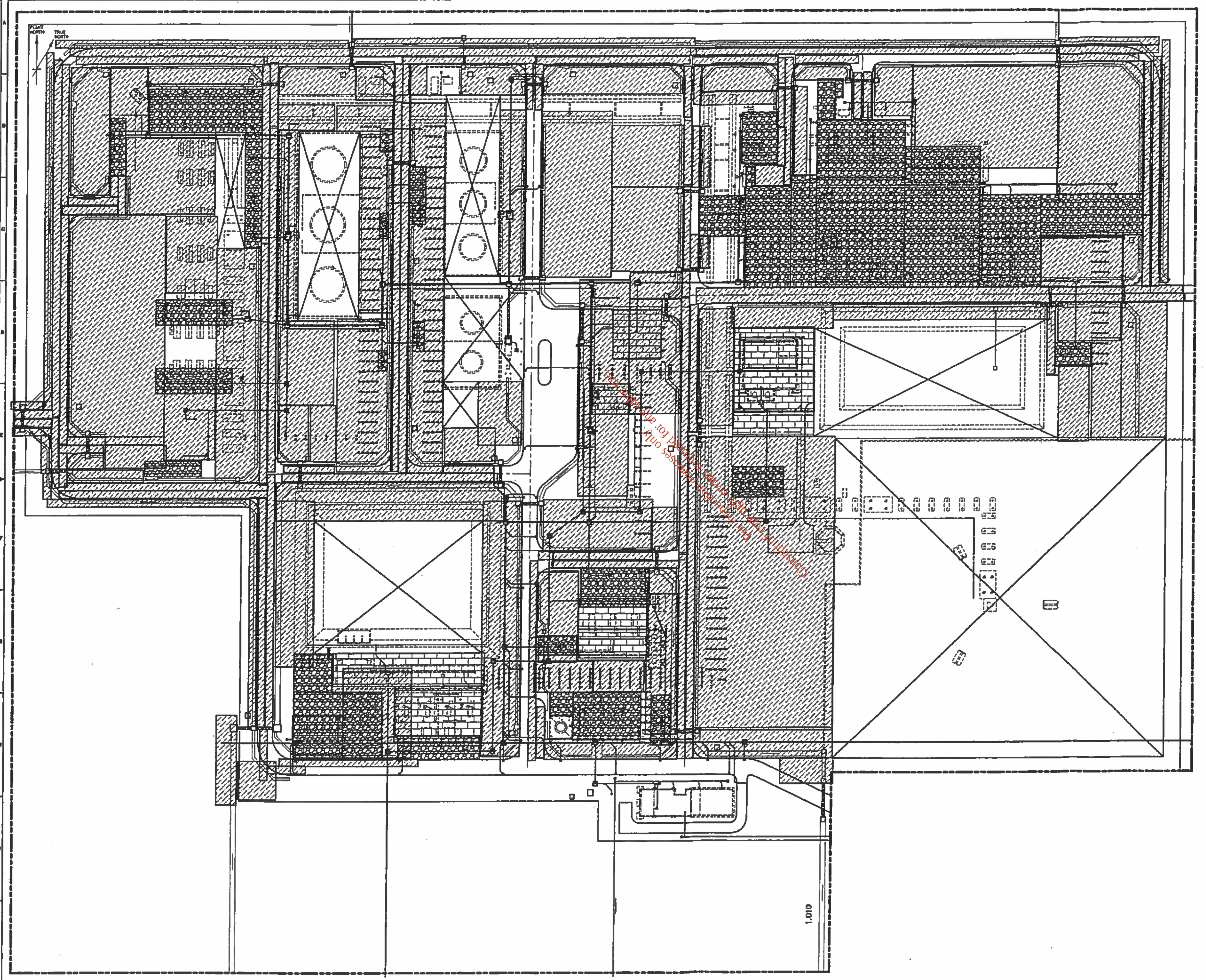
L3882-030-110-0173 2of2

	Client: Shell E & P Ireland Ltd.	Job Ref. L3882	
	Plant: Gas Reception Terminal		
	Location: Corrib On-Plot Storm Drainage	Sheet no./rev. 1	
	Calc. by IM / Date 27/11/2003 / Chck'd by / Date	App'd by	Date

SECTION A10 CATCHMENT AREAS

The drawings in this section indicate the catchment areas used for the design of the terminal drainage systems. Refer to the applicable calculation section for the derivation of the catchment areas.

- CATCHMENT AREA PLAN – OVERALL
- CATCHMENT AREA PLAN – NW DITCH SYSTEM
- CATCHMENT AREA PLAN – NE DITCH SYSTEM
- CATCHMENT AREA PLAN – E DITCH SYSTEM
- CATCHMENT AREA PLAN – SE DITCH SYSTEM
- CATCHMENT AREA PLAN – FW DITCH SYSTEM
- CATCHMENT AREA PLAN – W DITCH SYSTEM
- CATCHMENT AREA PLAN – SURFACE WATER SYSTEM ON PLOT BUILDINGS
- CATCHMENT AREA PLAN – OILY WATER SYSTEM SLUG CATCHER AREA
- CATCHMENT AREA PLAN – OILY WATER SYSTEM PROCESS AREA
- CATCHMENT AREA PLAN – OILY WATER SYSTEM WASTE STORAGE AREA
- CATCHMENT AREA PLAN – OILY WATER SYSTEM FLARE AREA
- CATCHMENT AREA PLAN – NO FLOW AREAS (NO WATER RUN-OFF)



NOTES

1. SITE DATUM E100000 N100000 EQUALS ORDNANCE DATUM (MALIN) E86325475 N332799575
2. ALL DIMENSIONS ARE IN MILLIMETRES. ALL ELEVATIONS AND INVERT LEVELS ARE IN METRES OD
3. DO NOT SCALE USE GIVEN DIMENSIONS ONLY

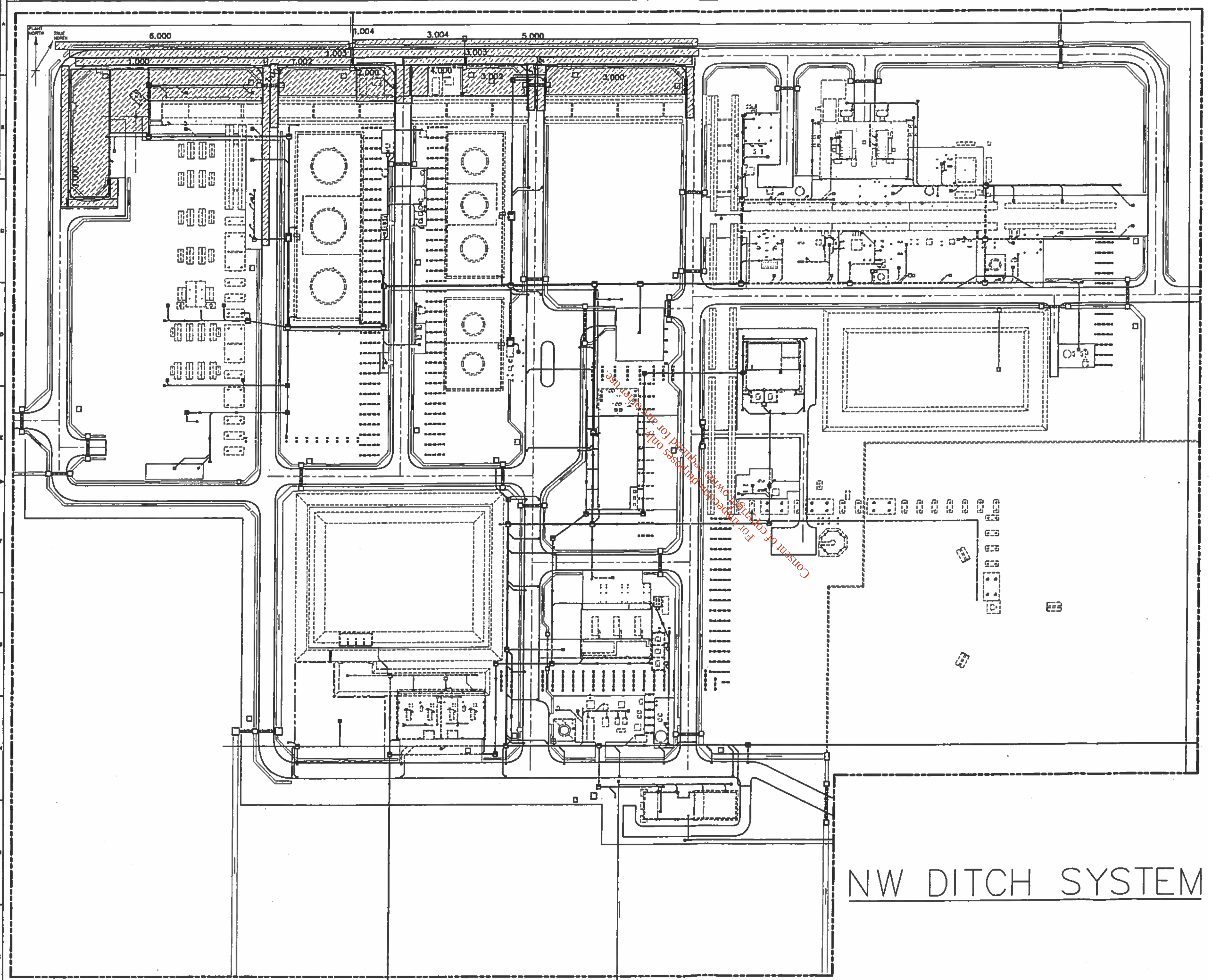
LEGEND

OWS – OILY WATER SEWER
SWS – SURFACE WATER SEWER
SWS (F) – SURFACE WATER FILTER DRAIN
FWS – FOUL WATER SEWER
VP – VENT PIPE

Corrib Field Development
Bellanaboy Bridge Gas Terminal
Shell E&P Ireland Limited
Corrib natural gas
amec

Drawing Title
CATCHMENT AREA PLAN

Contractor Drawing No.		Sheet No.
Size: A0	Scale (at full size): 1-500	Drawn by: C. Layton
Checked: D. Rattray	Approved	Date
Issue: For Planning Application		Shell Drawing No.



NOTES

1. SITE DATUM E100000 N100000 EQUALS ORDNANCE DATUM (MALIN) E86325475 N332799575
2. ALL DIMENSIONS ARE IN MILLIMETRES. ALL ELEVATIONS AND INVERT LEVELS ARE IN METRES OD
3. DO NOT SCALE USE GIVEN DIMENSIONS ONLY

LEGEND

OWS – OILY WATER SEWER
SWS – SURFACE WATER SEWER
SWS (F) – SURFACE WATER FILTER DRAIN
FWS – FOUL WATER SEWER
VP – VENT PIPE

Corrib Field Development

Bellanaboy Bridge Gas Terminal

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Corrib natural gas

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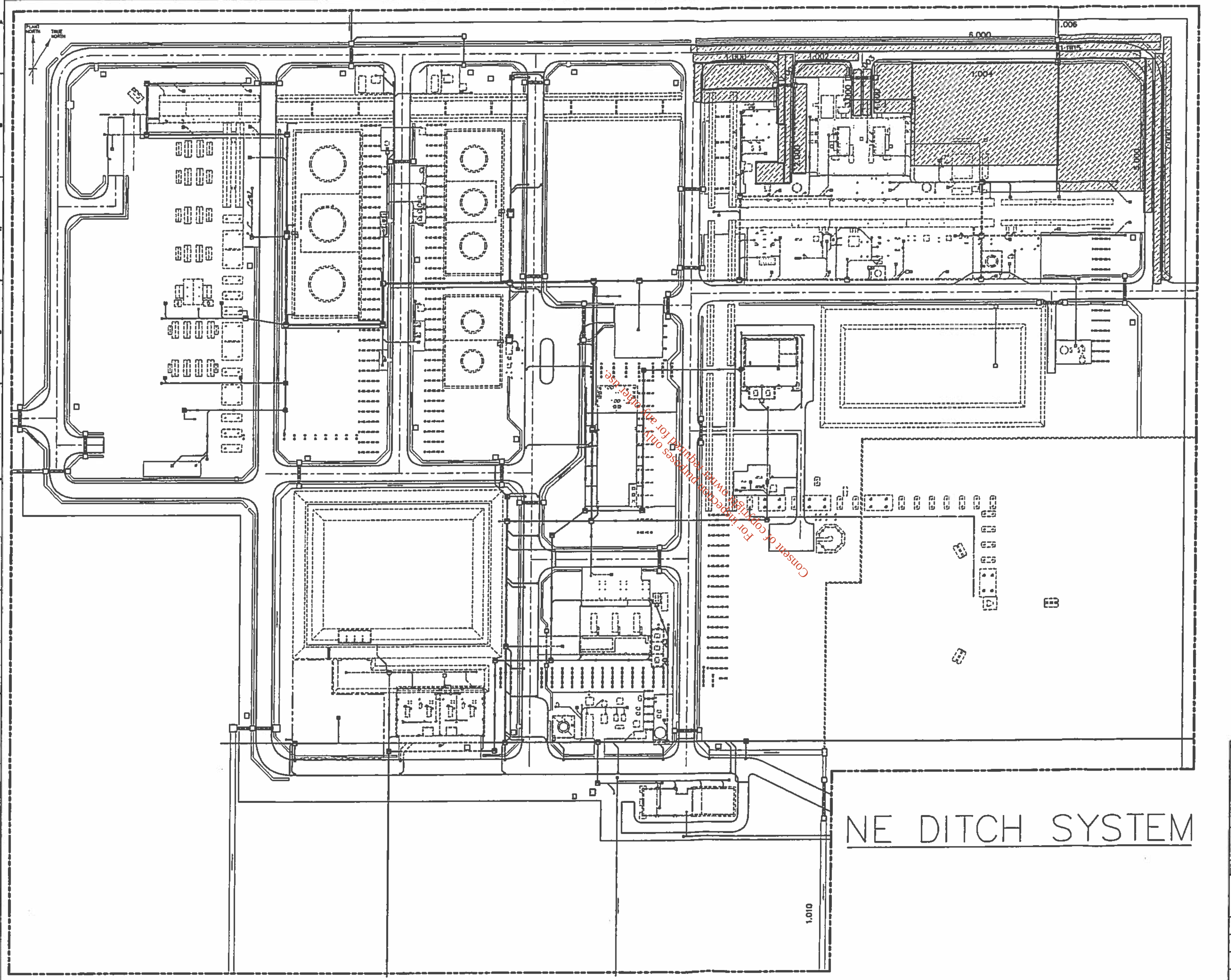
Drawing Title

CATCHMENT AREA PLAN

Contractor Drawing No.	Sheet No.
Size: A0 · Scale (at full size): 1–500	Drawn by: C. Layton
Checked: D. Rattray · Approved	Date
Issue: For Planning Application	Shell Drawing No.



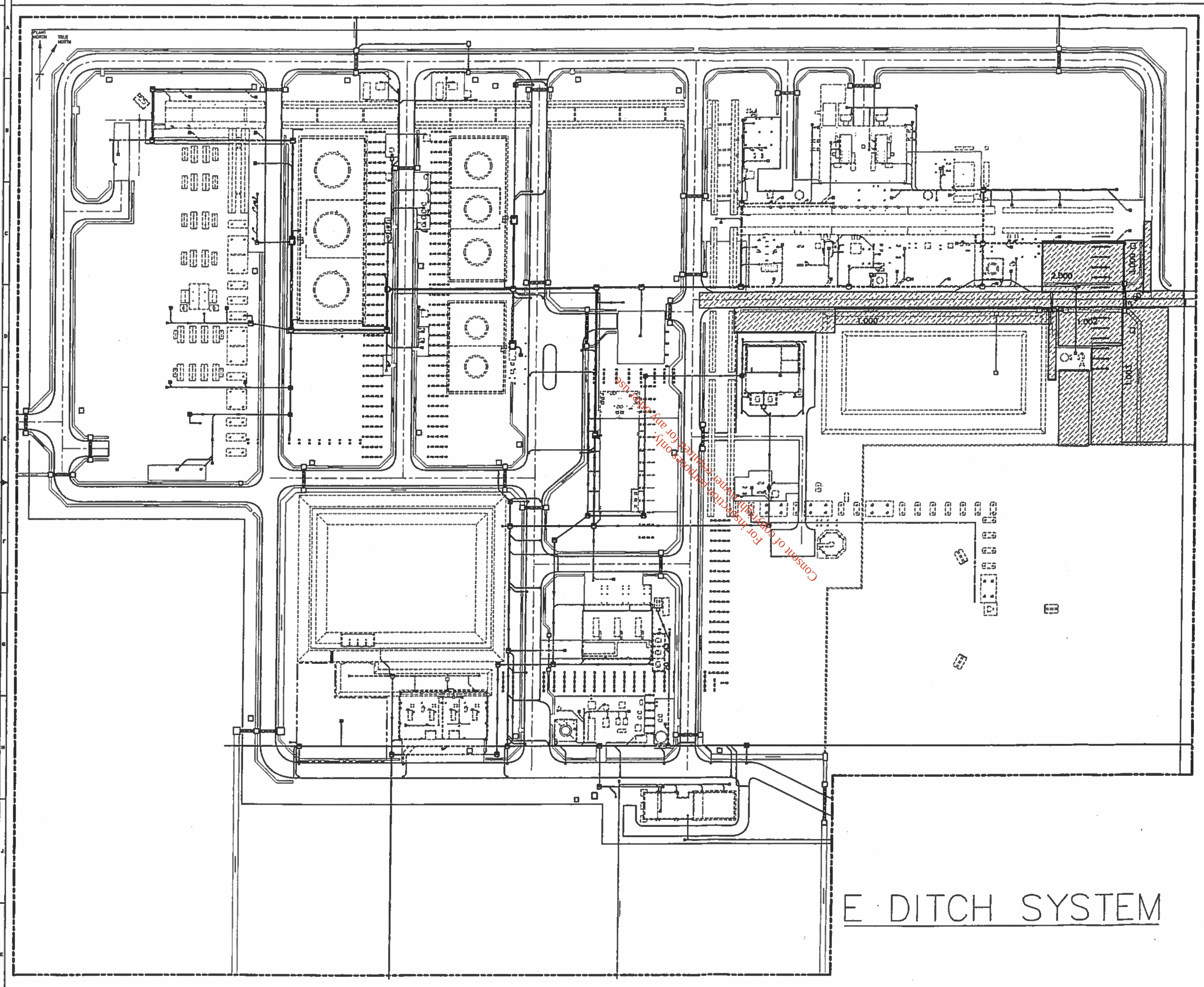
NOTES

1. SITE DATUM E100000 N100000 EQUALS ORDNANCE DATUM (MALIN) E86325475 N332799575
2. ALL DIMENSIONS ARE IN MILLIMETRES. ALL ELEVATIONS AND INVERT LEVELS ARE IN METRES OD
3. DO NOT SCALE USE GIVEN DIMENSIONS ONLY

LEGEND

DWS – OILY WATER SEWER
SWS – SURFACE WATER SEWER
SWS (F) – SURFACE WATER FILTER DRAIN
FWS – FOUL WATER SEWER
VP – VENT PIPE

Corrib Field Development	
Bellanaboy Bridge Gas Terminal	
Shell E&P Ireland Limited	
Corrib natural gas	amec
Drawing Title: CATCHMENT AREA PLAN	
Contractor Drawing No.	Sheet No.
Size: A0 / Scale (at full size): 1–500	Drawn by: C. Layton
Checked: D. Rattray / Approved	Date
Issue: For Planning Application	Shell Drawing No.



NOTES

1. SITE DATUM E100000 N100000 EQUALS ORDNANCE DATUM (MALIN) E86325475 N332799575
2. ALL DIMENSIONS ARE IN MILLIMETRES. ALL ELEVATIONS AND INVERT LEVELS ARE IN METRES OD
3. DO NOT SCALE. USE GIVEN DIMENSIONS ONLY

LEGEND

OWS – OILY WATER SEWER
SWS – SURFACE WATER SEWER
SWS (F) – SURFACE WATER FILTER DRAIN
FWS – FOUL WATER SEWER
VP – VENT PIPE

Corrib Field Development

Bellanaboy Bridge Gas Terminal

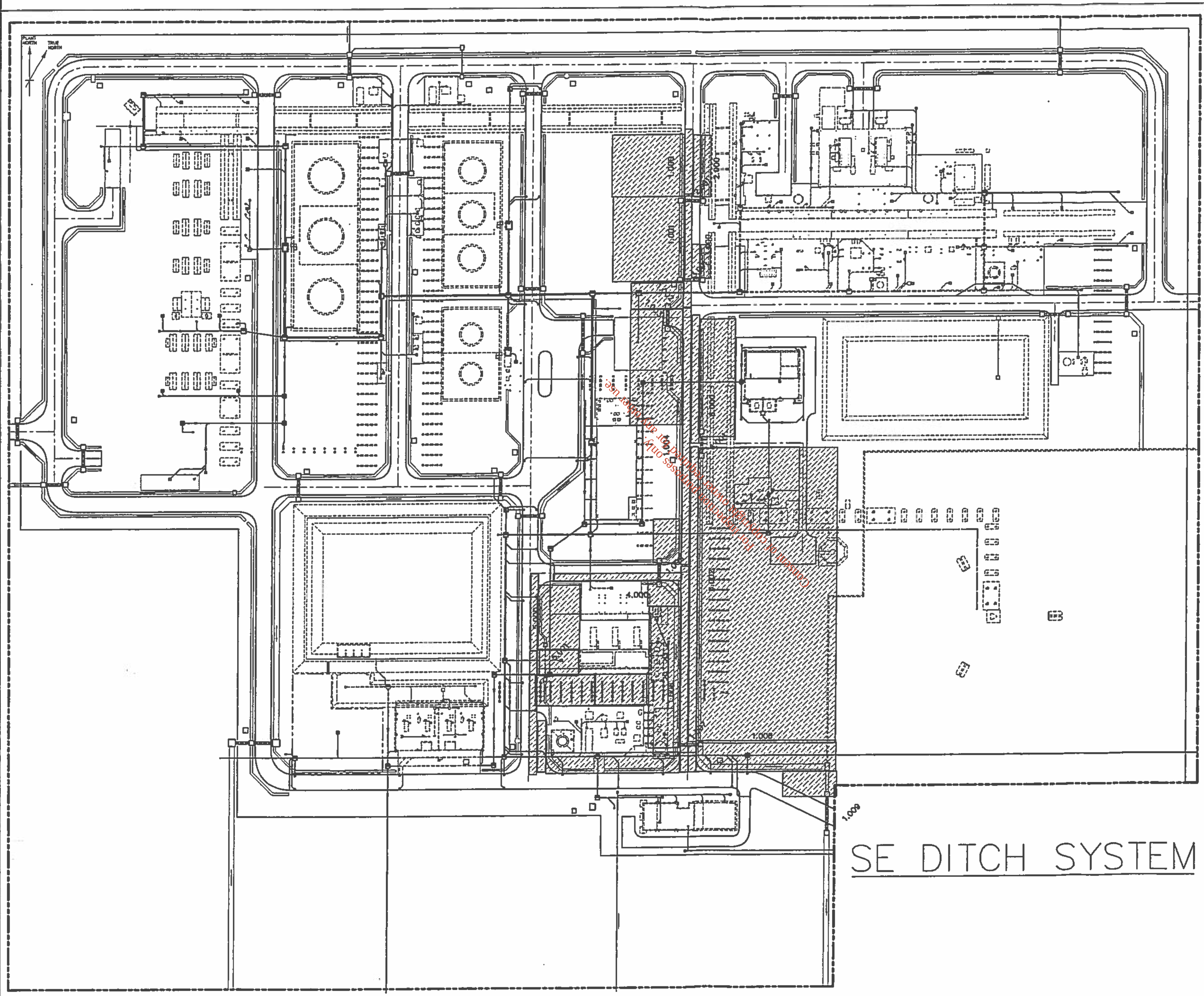
Shell E&P Ireland Limited

Corrib natural gas

amec

Drawing Title: CATCHMENT AREA PLAN

Contractor Drawing No.		Sheet No.
Size: A0	Scale (at full size): 1–500	Drawn by: C. Layton
Checked: D. Rattray	Approved	Date
Issue: For Planning Application		Shell Drawing No.



NOTES

1. SITE DATUM E100000 N100000 EQUALS ORDNANCE DATUM (MALIN) E88325475 N332799575
2. ALL DIMENSIONS ARE IN MILLIMETRES. ALL ELEVATIONS AND INVERT LEVELS ARE IN METRES OD
3. DO NOT SCALE USE GIVEN DIMENSIONS ONLY

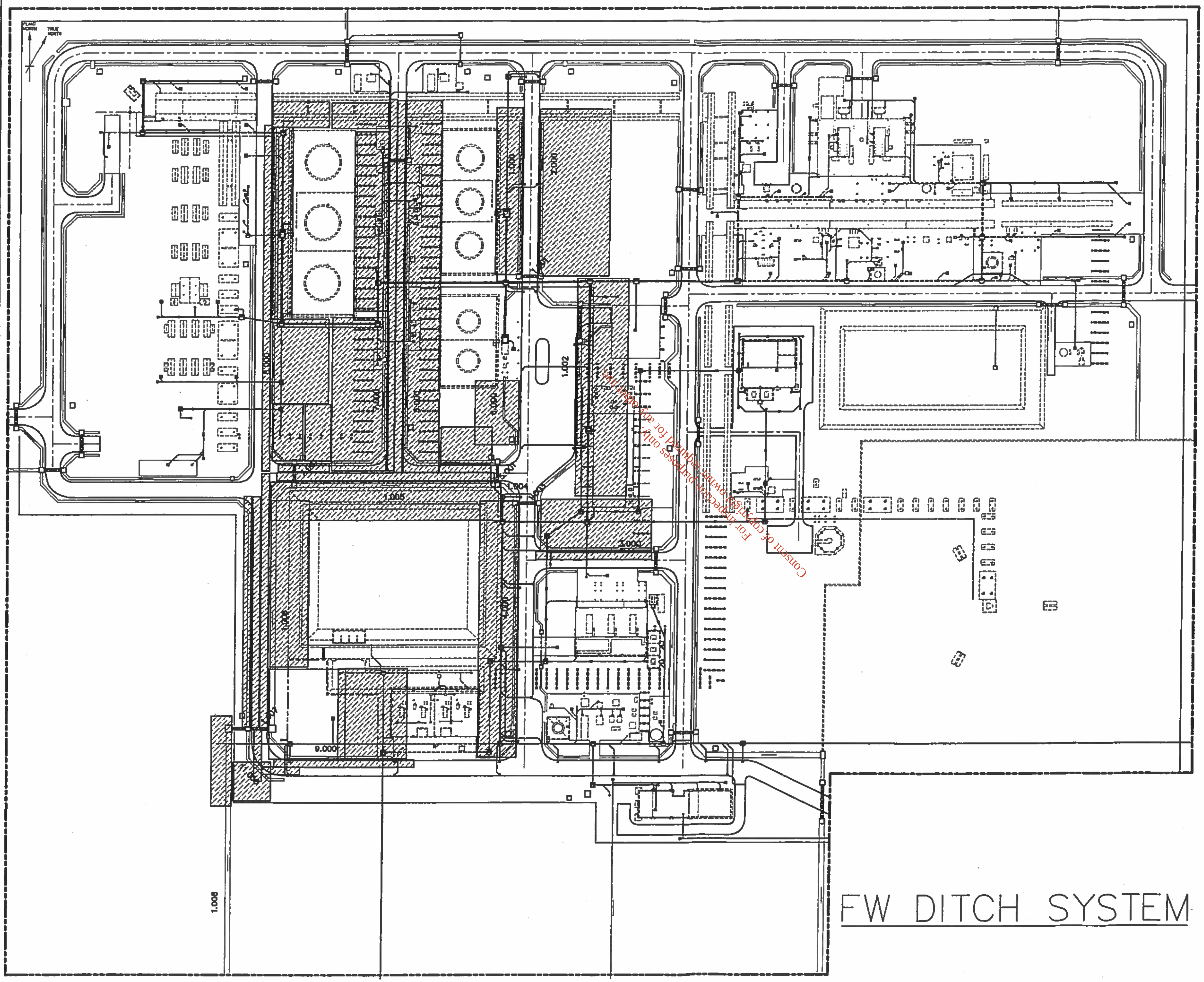
LEGEND

OWS – OILY WATER SEWER
SWS – SURFACE WATER SEWER
SWS (F) – SURFACE WATER FILTER DRAIN
FWS – FOUL WATER SEWER
VP – VENT PIPE

Corrib Field Development
Bellanaboy Bridge Gas Terminal
Shell E&P Ireland Limited
Corrib natural gas
amec

Drawing Title: CATCHMENT AREA PLAN

Size	Scale (at full size)	Drawn by
A0	1–500	C. Layton
Checked	Approved	Date
D. Rattray		
Issue		Shell Drawing No.
For Planning Application		



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3. DO NOT SCALE USE GIVEN DIMENSIONS ONLY

LEGEND

OWS – OILY WATER SEWER
SWS – SURFACE WATER SEWER
SWS (F) – SURFACE WATER FILTER DRAIN
FWS – FOUL WATER SEWER
VP – VENT PIPE

Corrib Field Development
Bellanaboy Bridge Gas Terminal
Shell E&P Ireland Limited
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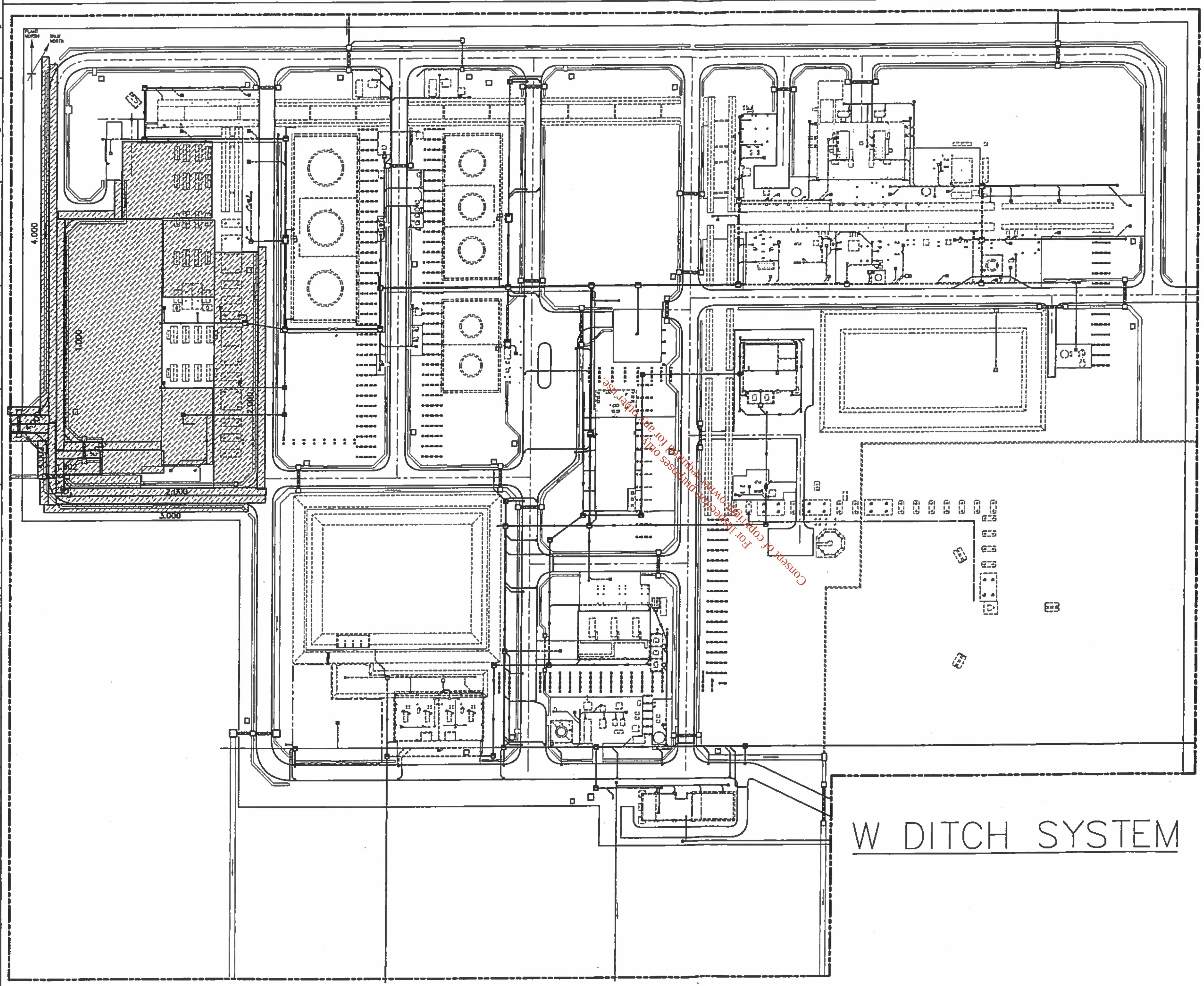
Drawing Title
CATCHMENT AREA PLAN

Size	Scale (at full size)	Drawn by
A0	1–500	C. Layton
Checked	Approved	Date
D. Rattray		

For Planning Application



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LEGEND

OWS – OILY WATER SEWER
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Corrib Field Development

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Shell E&P Ireland Limited

Corrib natural gas

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Drawing Title: CATCHMENT AREA PLAN

Contractor Drawing No.		Sheet No.
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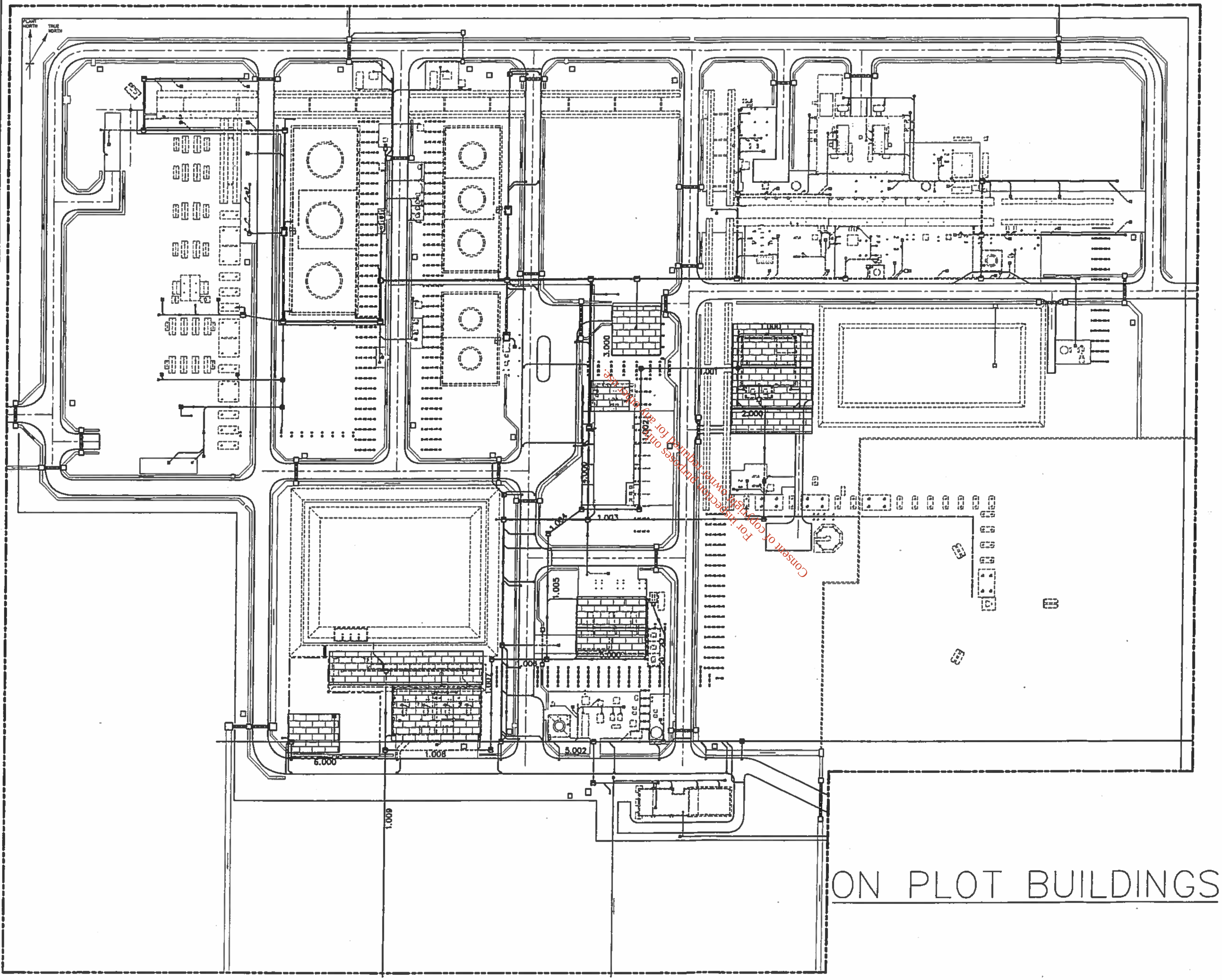
Checked: D. Rattray	Approved	Date
Issue: For Planning Application		Shell Drawing No.



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LEGEND

OWS - OILY WATER SEWER
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Corrib Field Development

Bellanaboy Bridge Gas Terminal

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Drawing Title

CATCHMENT AREA PLAN

Contractor Drawing No.			Sheet No.
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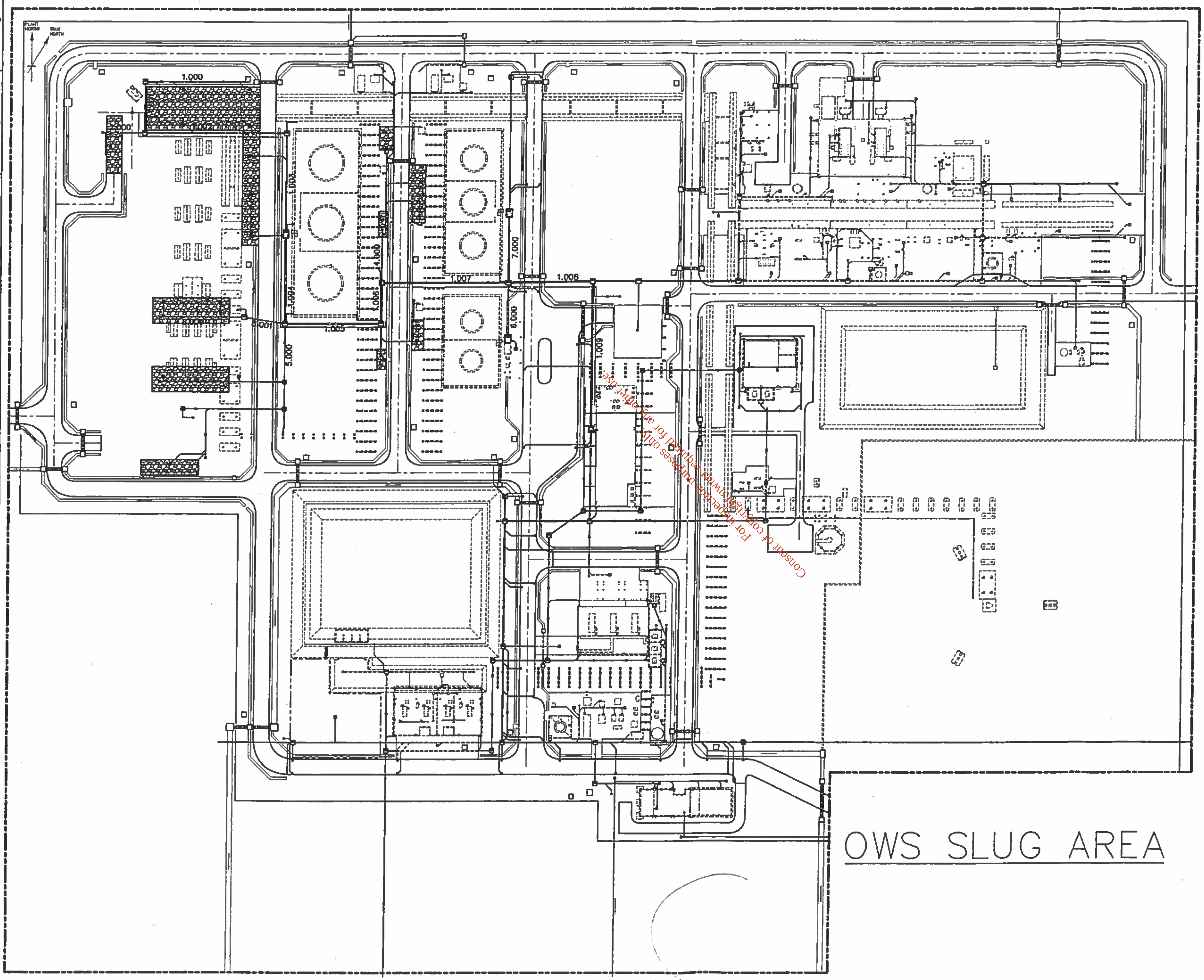

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LEGEND

OWS – OILY WATER SEWER
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Corrib Field Development

Bellanaboy Bridge Gas Terminal

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Drawing Title

CATCHMENT AREA PLAN

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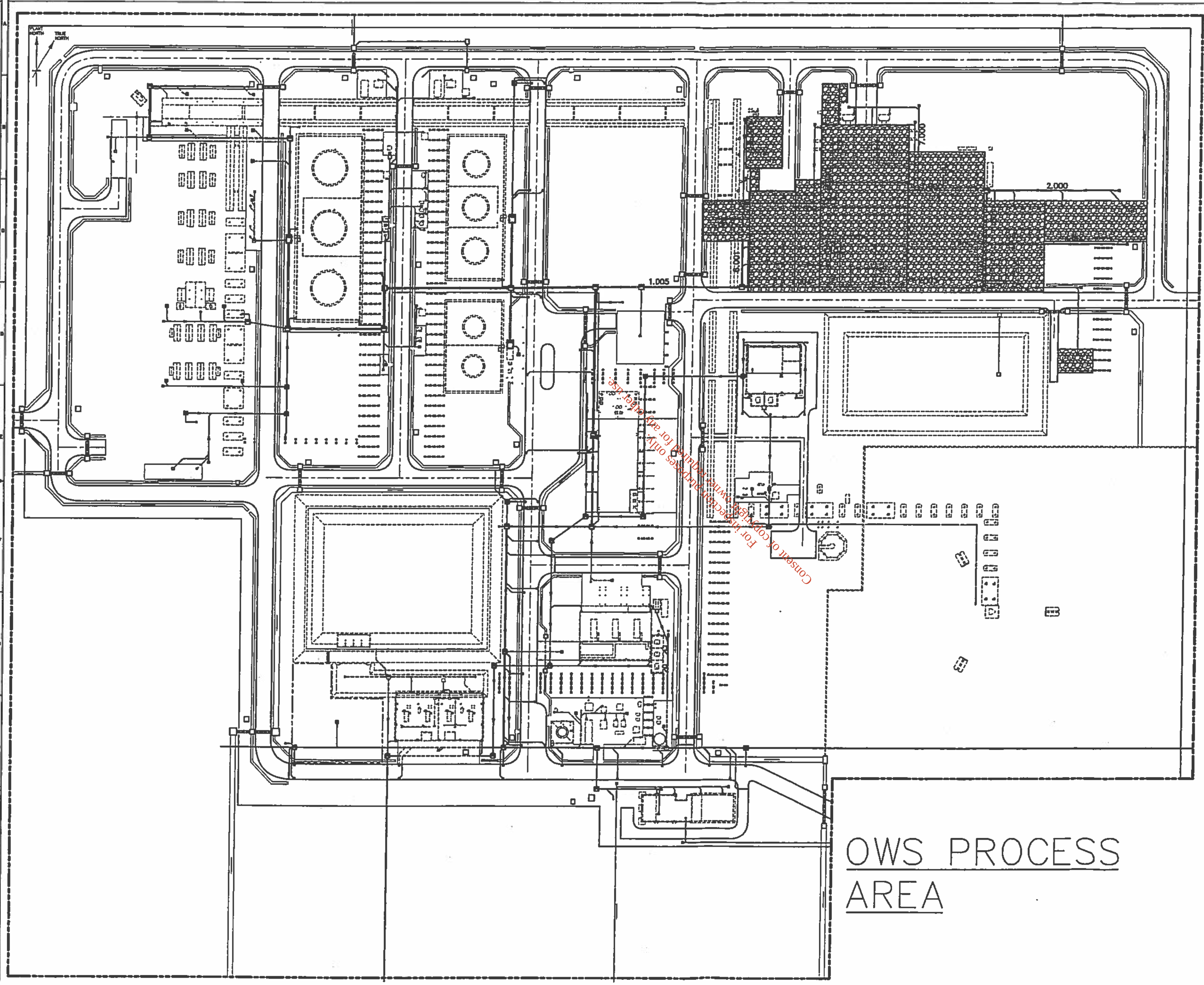

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Corrib Field Development
Bellanaboy Bridge Gas Terminal

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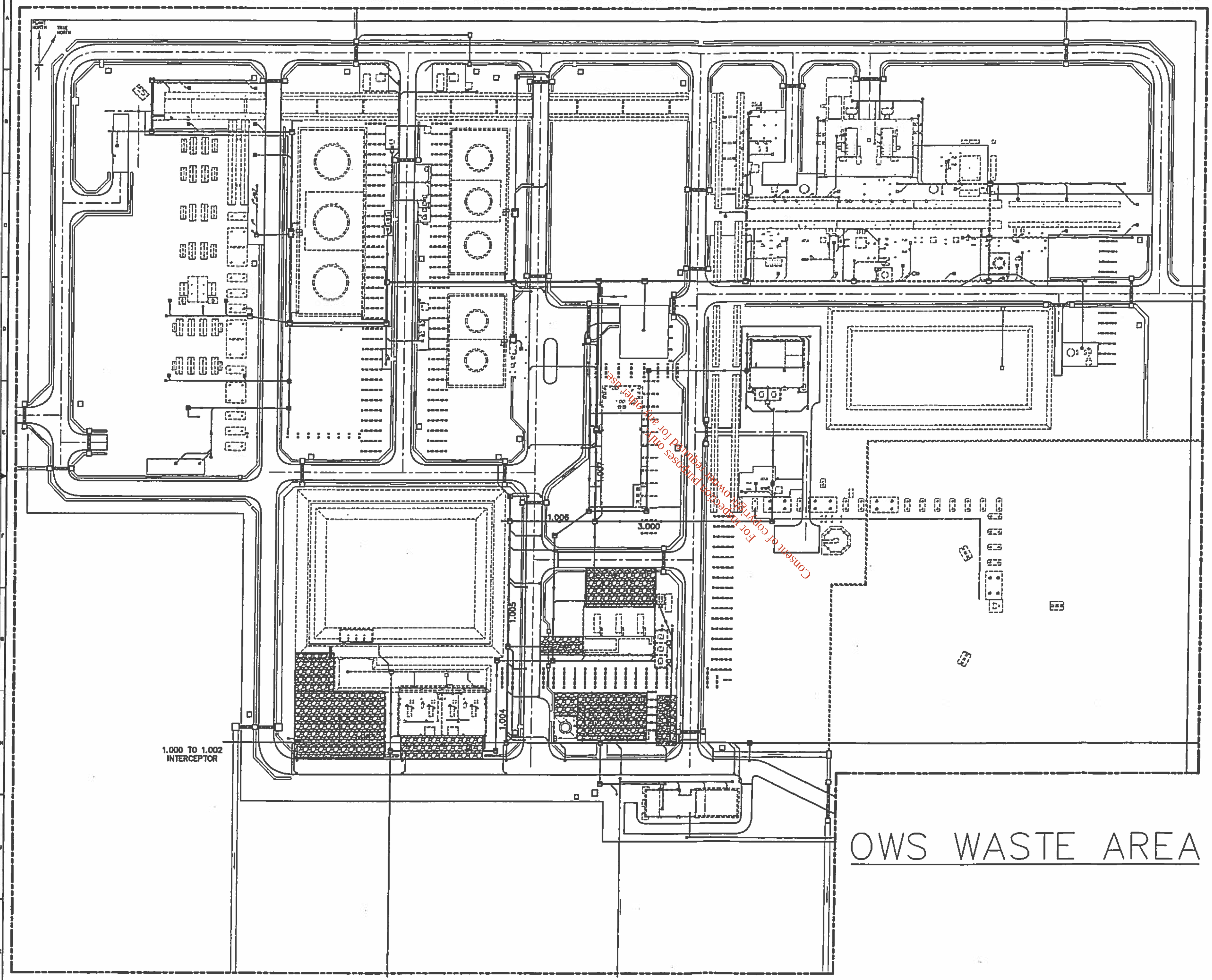
Drawing Title
CATCHMENT AREA PLAN

Contractor Drawing No.		Sheet No.
Size: A0	Scale (at full size): 1–500	Drawn by: C. Layton
Checked: D. Rattray	Approved	Date
Issue: For Planning Application		Shell Drawing No.



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OWS – OILY WATER SEWER
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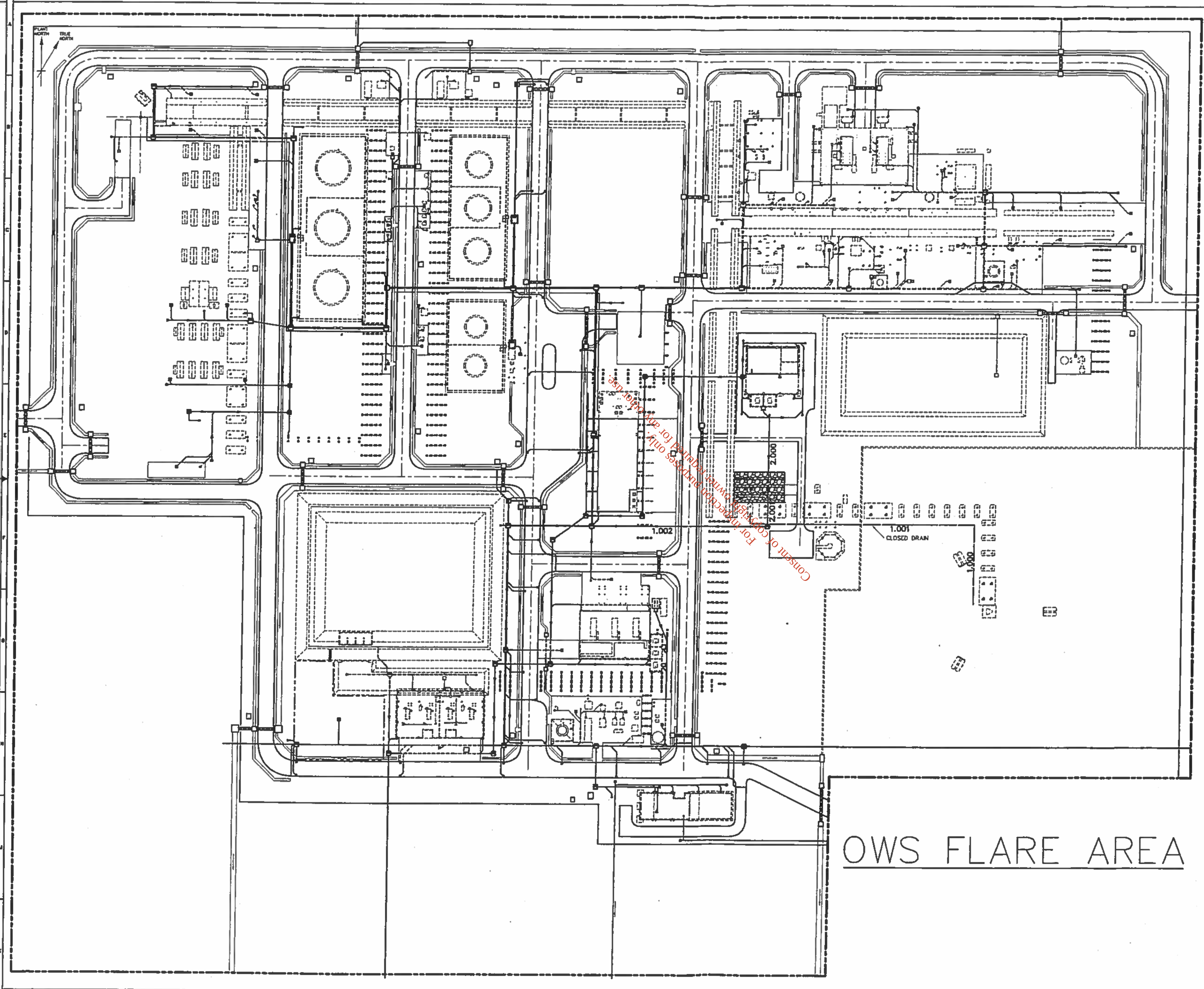
Corrib Field Development	
Bellanaboy Bridge Gas Terminal	
Shell E&P Ireland Limited	
Corrib natural gas	amec
Drawing Title: CATCHMENT AREA PLAN	
Contractor Drawing No.	Sheet No.
Size: A0 / Scale (at full size): 1–500	Drawn by: C. Layton
Checked: D. Rattray / Approved	Date
Issue: For Planning Application	Shell Drawing No.



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LEGEND

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Corrib Field Development

Bellanaboy Bridge Gas Terminal

Shell E&P Ireland Limited

Corrib natural gas

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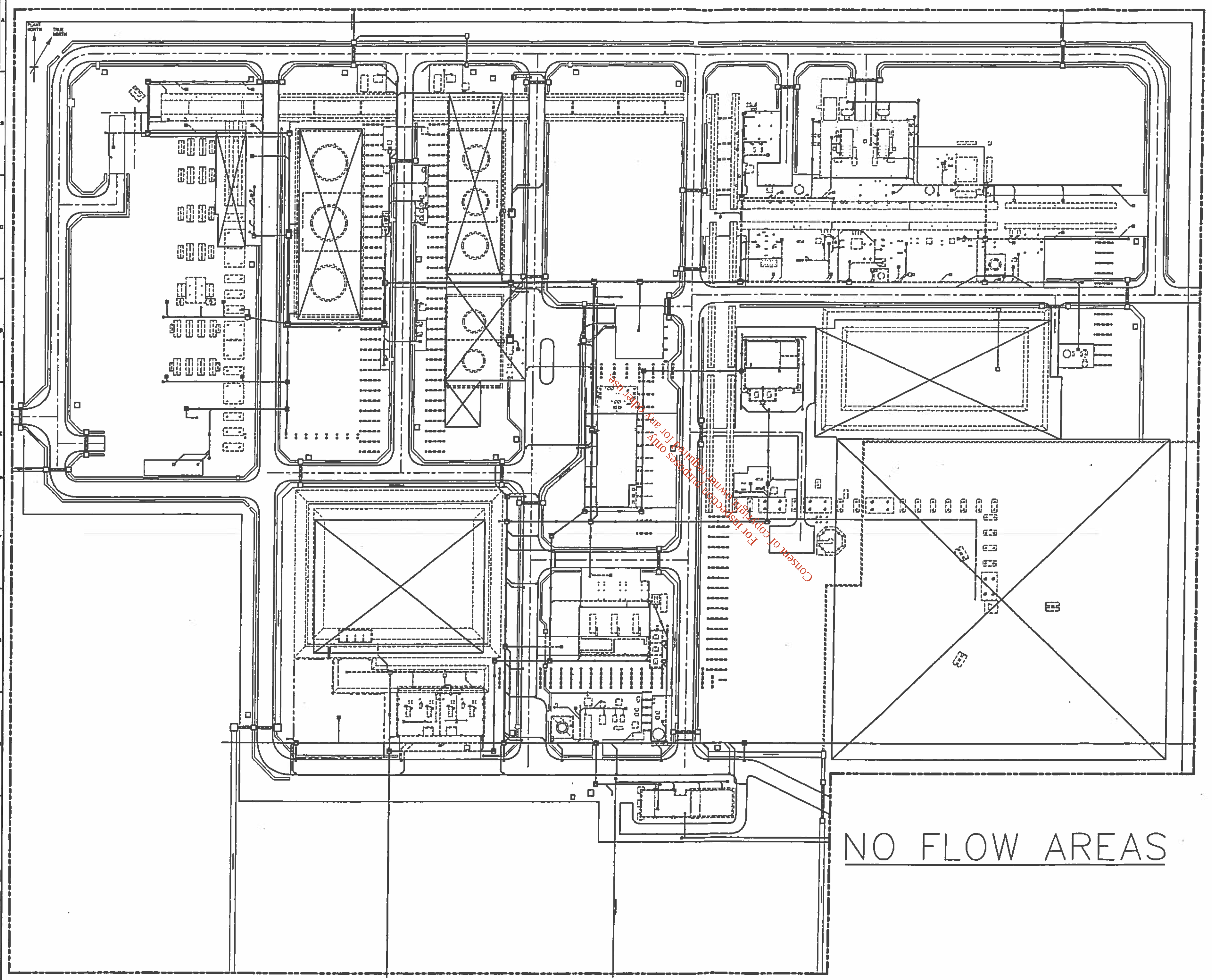
Drawing Title: CATCHMENT AREA PLAN

Contractor Drawing No.		Sheet No.
Size: A0	Scale (at full size): 1–500	Drawn by: C. Layton
Checked: D. Rattray	Approved	Date
Issue: For Planning Application		Shell Drawing No.



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LEGEND

OWS – OILY WATER SEWER
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Corrib Field Development
Bellanaboy Bridge Gas Terminal
Shell E&P Ireland Limited
Corrib natural gas
amec

Drawing Title: CATCHMENT AREA PLAN

Size	Scale (at full size)	Drawn by
A0	1–500	C. Layton

Checked: D. Rattray
Issue: For Planning Application

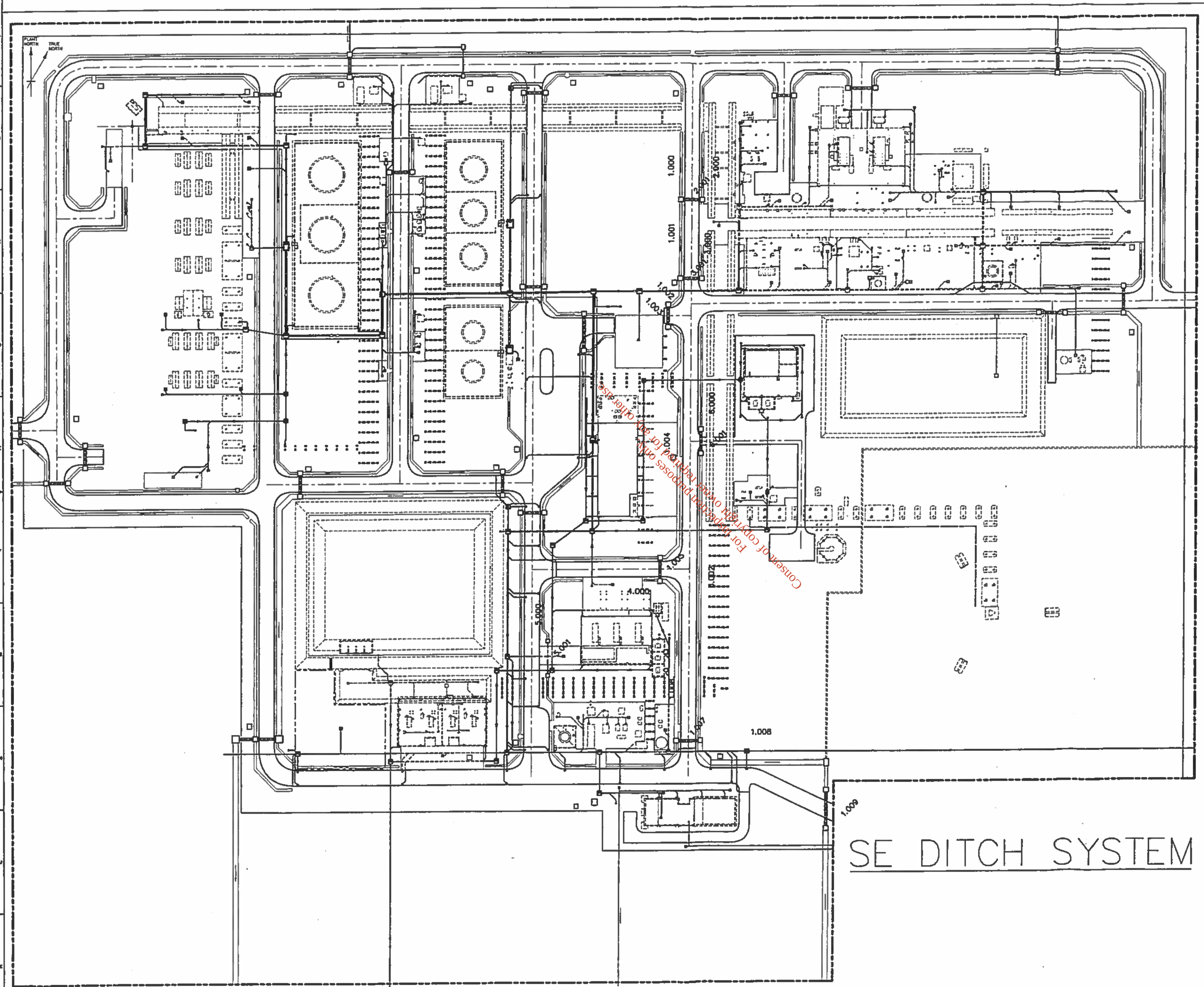
	Client: Shell E & P Ireland Ltd. Plant: Gas Reception Terminal			Job Ref. L3882	
amec	Location: Corrib On-Plot Storm Drainage			Sheet no./rev. 1	
	Calc. by IM	Date 27/11/2003	Chck'd by	Date	App'd by	Date

- **SECTION A11 SYSTEM NUMBER DRAWINGS**

The drawings in this section indicate the run numbers used for the design of the terminal drainage systems. Refer to the applicable calculation section for the micro drainage calculation.

- SYSTEM NUMBERS – NW DITCH SYSTEM
- SYSTEM NUMBERS – NE DITCH SYSTEM
- SYSTEM NUMBERS – E DITCH SYSTEM
- SYSTEM NUMBERS – SE DITCH SYSTEM
- SYSTEM NUMBERS – FW DITCH SYSTEM
- SYSTEM NUMBERS – W DITCH SYSTEM
- SYSTEM NUMBERS – SURFACE WATER SYSTEM ON PLOT BUILDINGS
- SYSTEM NUMBERS – OILY WATER SYSTEM SLUG CATCHER AREA
- SYSTEM NUMBERS – OILY WATER SYSTEM PROCESS AREA
- SYSTEM NUMBERS – OILY WATER SYSTEM WASTE STORAGE AREA
- SYSTEM NUMBERS – OILY WATER SYSTEM FLARE AREA
- SYSTEM NUMBERS – ADMINISTRATION BUILDINGS

amec	Client: Shell E & P Ireland Ltd. Plant: Gas Reception Terminal			Job Ref. L3882	
	Location: Corrib On-Plot Storm Drainage			Sheet no./rev. 1	
Calc. by IM	Date 27/11/2003	Chck'd by	Date	App'd by	Date



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LEGEND

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Corrib Field Development

Bellanaboy Bridge Gas Terminal

Shell E&P Ireland Limited

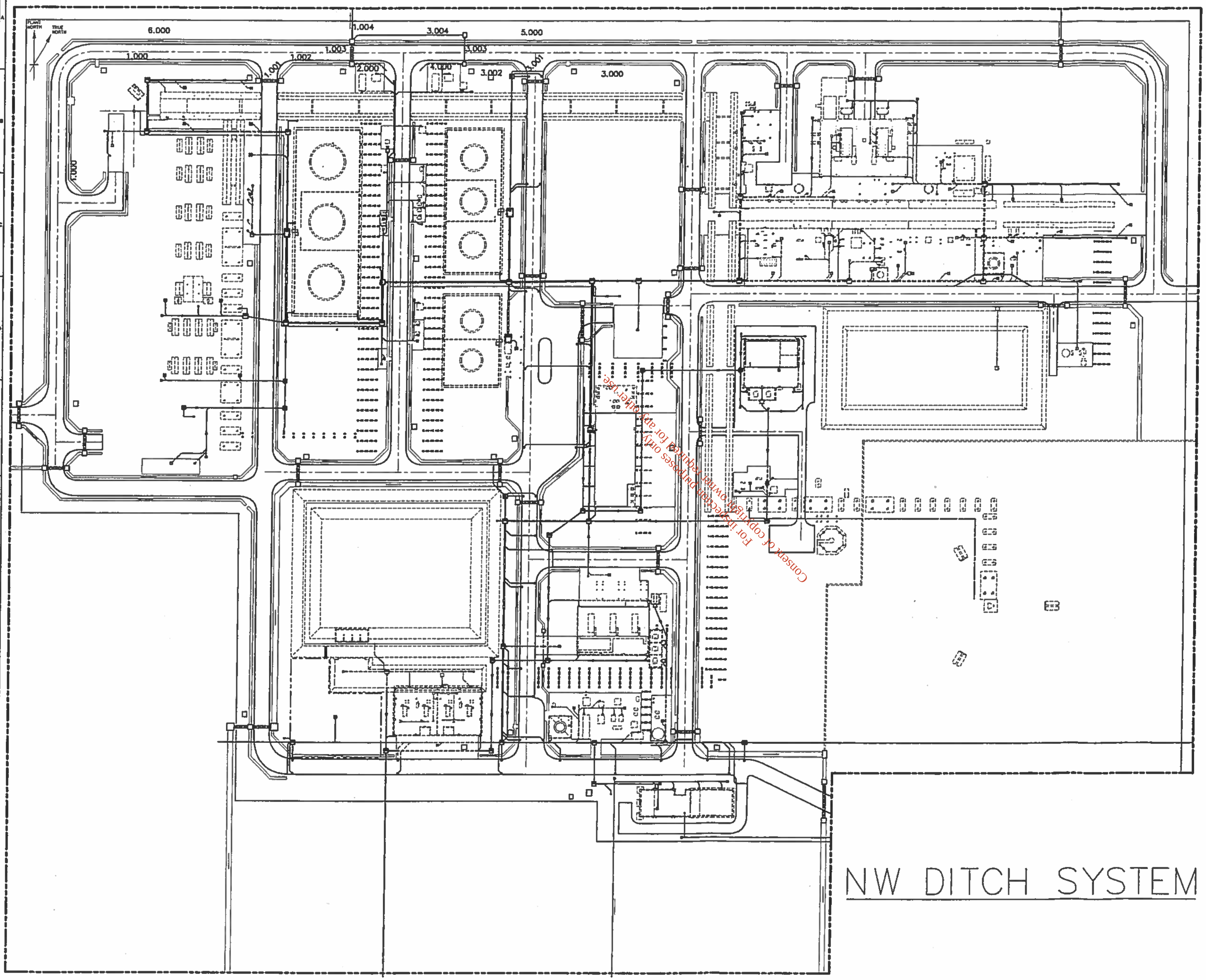
Corrib natural gas

amec

Drawing Title

CATCHMENT AREA PLAN

Contractor Drawing No.		Sheet No.
Size: A0	Scale (at full size): 1–500	Drawn by: C. Layton
Checked: D. Rattray	Approved	Date
Issue: For Planning Application		Shell Drawing No.



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LEGEND

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Corrib Field Development
Bellanaboy Bridge Gas Terminal
Shell E&P Ireland Limited
Corrib natural gas
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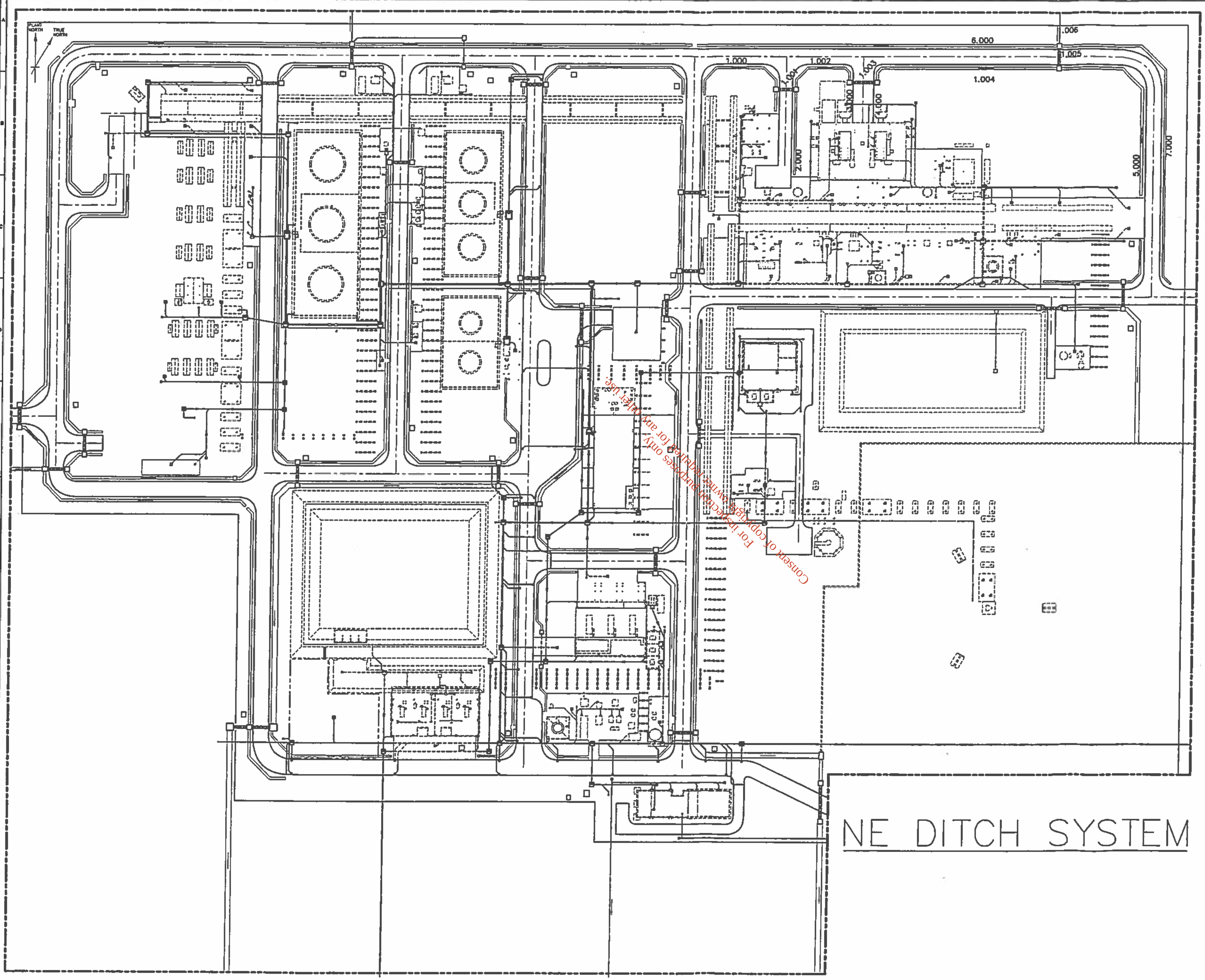
Drawing Title: CATCHMENT AREA PLAN

Contractor Drawing No.		Sheet No.	
Size: A0	Scale (at full size): 1–500	Drawn by: C. Layton	
Checked: D. Rattray	Approved	Date	
Issue: For Planning Application		Shell Drawing No.	



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LEGEND

OWS – OILY WATER SEWER
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SWS (F) – SURFACE WATER FILTER DRAIN
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Corrib Field Development
Bellanaboy Bridge Gas Terminal
Shell E&P Ireland Limited
Corrib natural gas
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Drawing Title
CATCHMENT AREA PLAN

Contractor Drawing No.		Sheet No.
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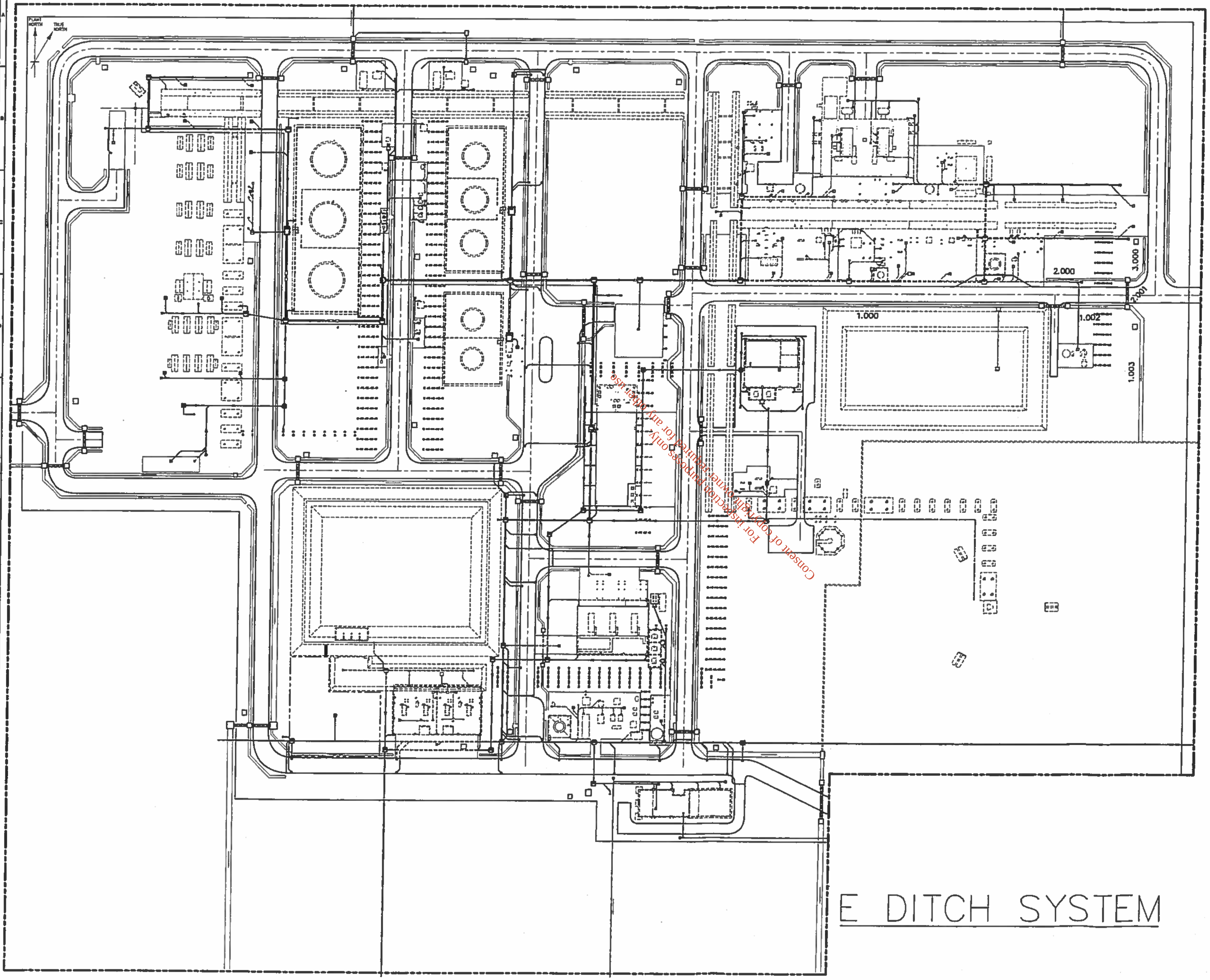
Checked: D. Rattray	Approved	Date
Issue: For Planning Application		Shell Drawing No.



NOTES

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2. ALL DIMENSIONS ARE IN MILLIMETRES. ALL ELEVATIONS AND INVERT LEVELS ARE IN METRES OD
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LEGEND

DWS – OILY WATER SEWER
SWS – SURFACE WATER SEWER
SWS (F) – SURFACE WATER FILTER DRAIN
FWS – FOUL WATER SEWER
VP – VENT PIPE

Corrib Field Development Bellanaboy Bridge Gas Terminal		
Shell E&P Ireland Limited		
Corrib natural gas	amec	
Drawing Title: CATCHMENT AREA PLAN		
Contractor Drawing No.		Sheet No.
Size: A0	Scale (at full size): 1–500	Drawn by: C. Layton
Checked: D. Rattray	Approved	Date
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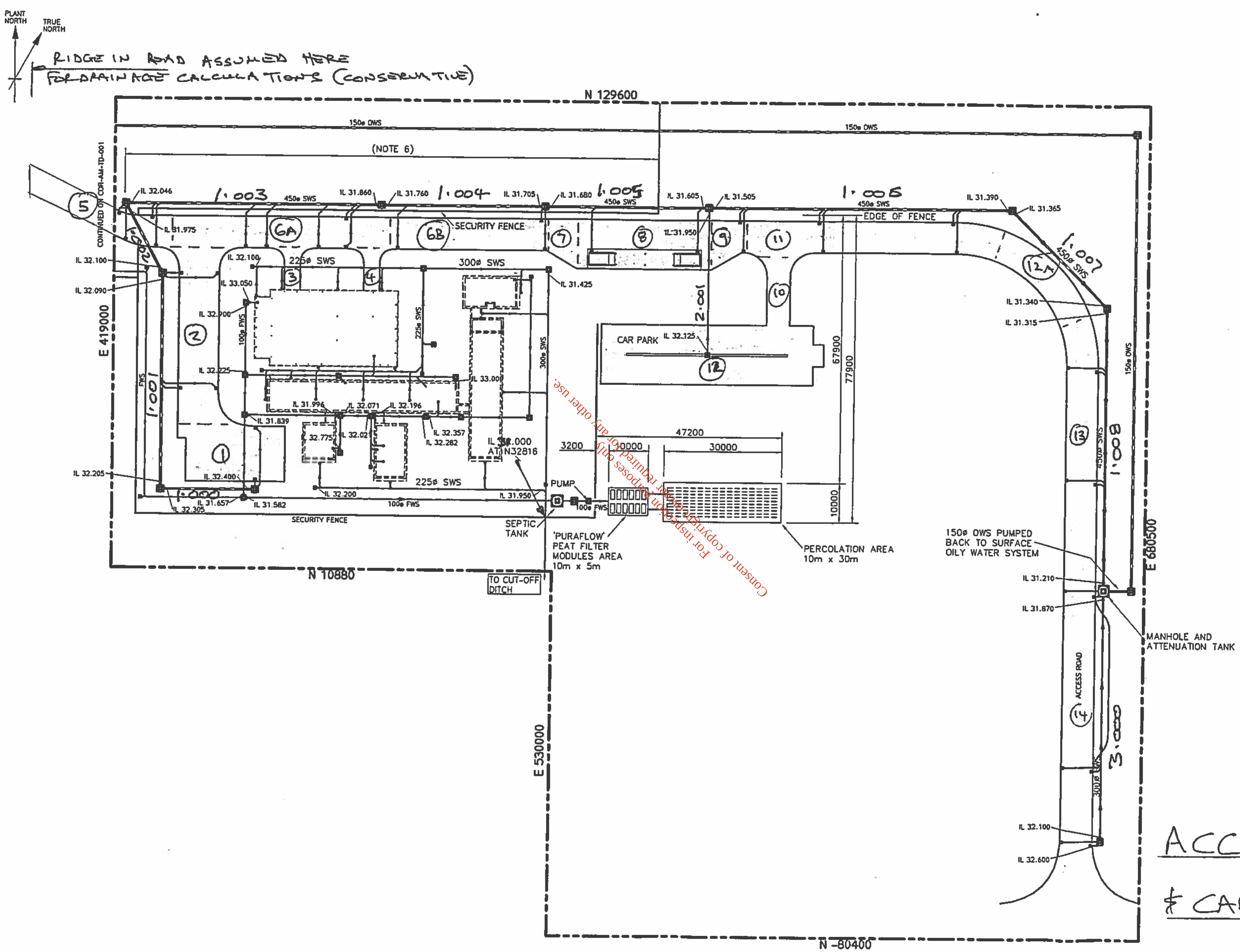
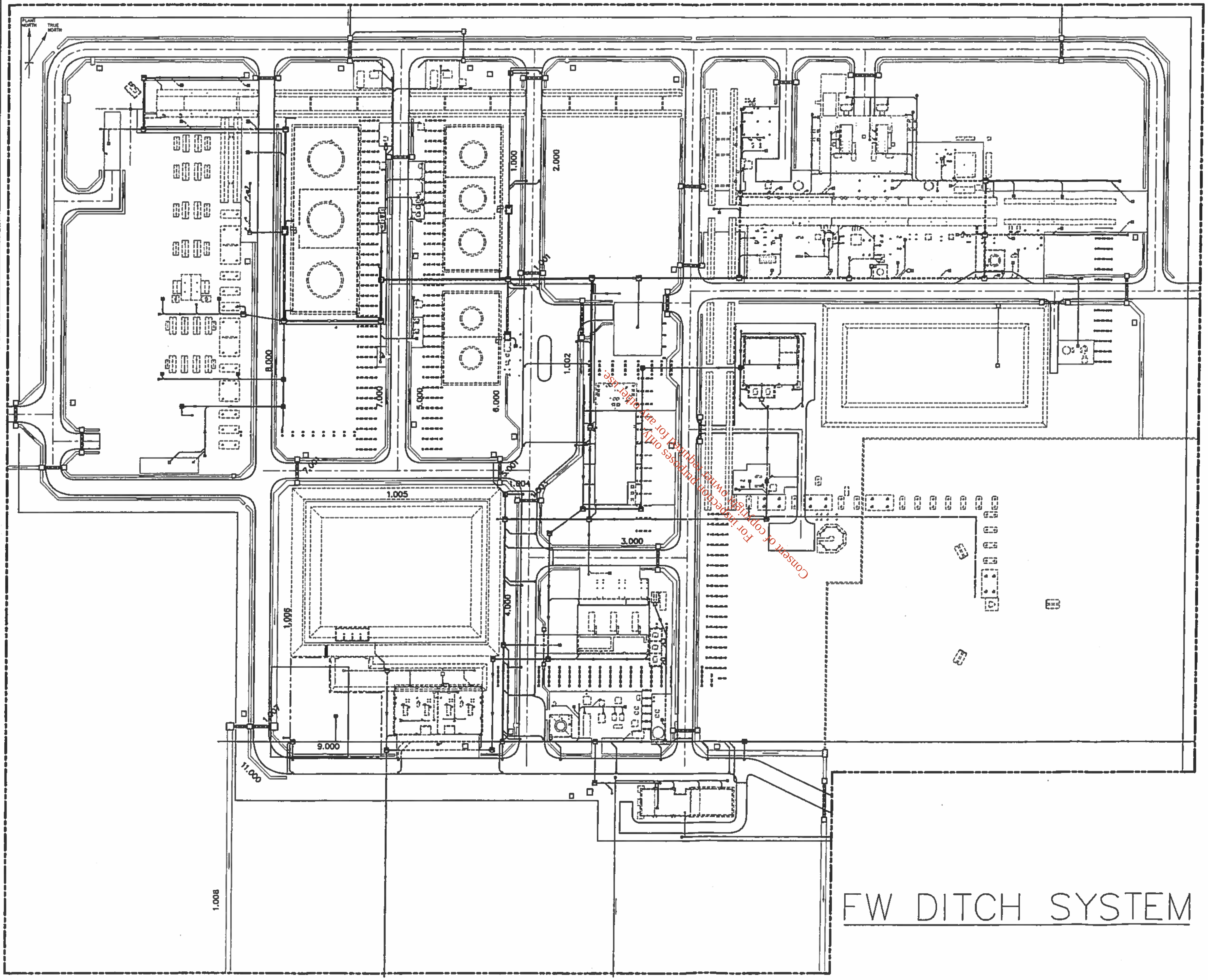


ACCESS ROAD
& CAR PARK



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LEGEND

OWS – OILY WATER SEWER
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Corrib Field Development

Bellanaboy Bridge Gas Terminal

Shell E&P Ireland Limited

Corrib natural gas

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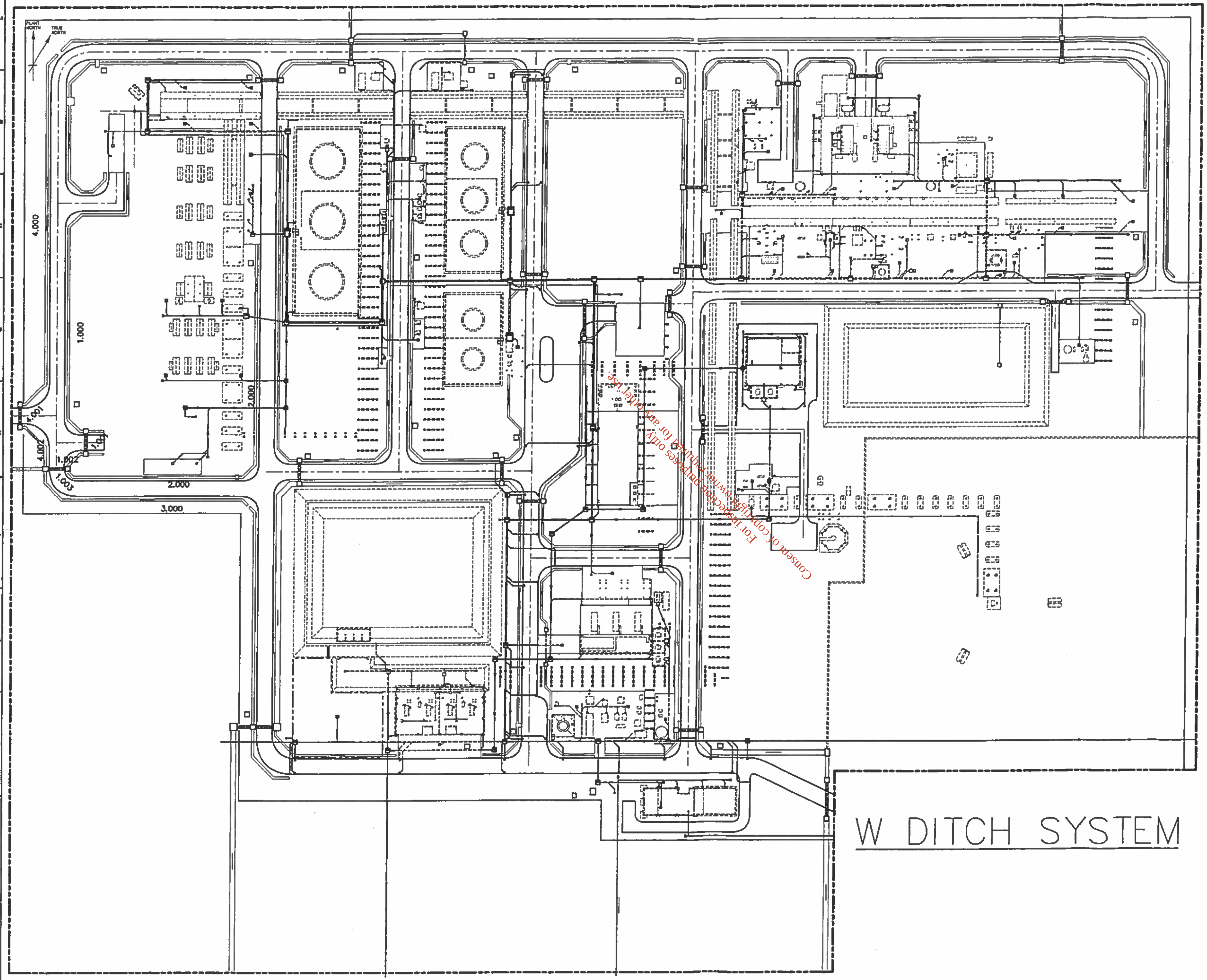
Drawing Title

CATCHMENT AREA PLAN

Contractor Drawing No.		Sheet No.
Size A0	Scale (at full size) 1–500	Drawn by C. Layton
Checked D. Rattray	Approved	Date
Issue For Planning Application		Shell Drawing No.



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LEGEND

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Corrib Field Development

Bellanaboy Bridge Gas Terminal

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Corrib natural gas

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Drawing Title

CATCHMENT AREA PLAN

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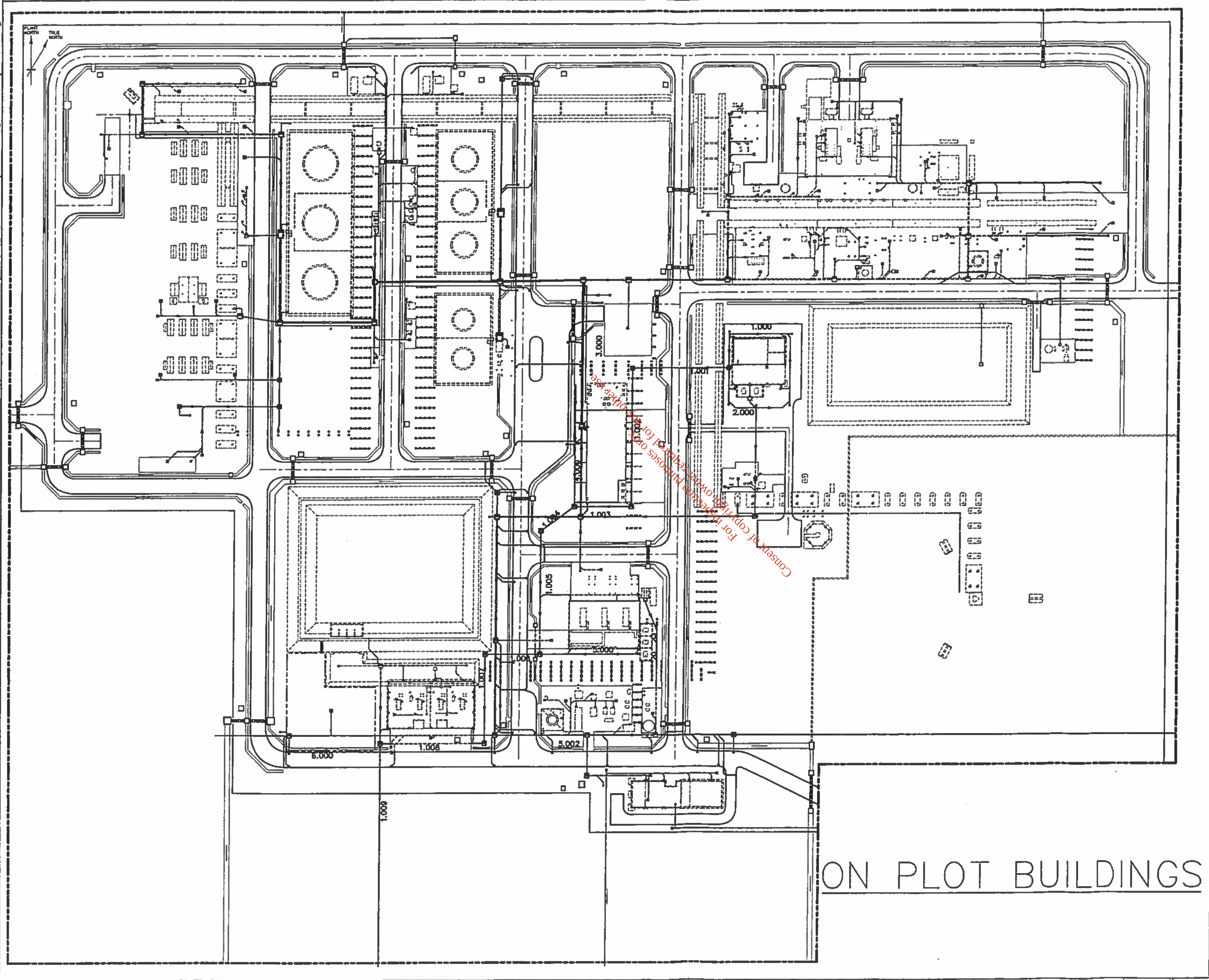
Size AO	Scale (at full size) 1-500	Drawn by C. Layton
Checked D. Rattray	Approved	Date
Issue For Planning Application		Shell Drawing No.



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LEGEND

OWS – OILY WATER SEWER
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SWS (F) – SURFACE WATER FILTER DRAIN
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Corrib Field Development
Bellanaboy Bridge Gas Terminal
Shell E&P Ireland Limited
Corrib natural gas
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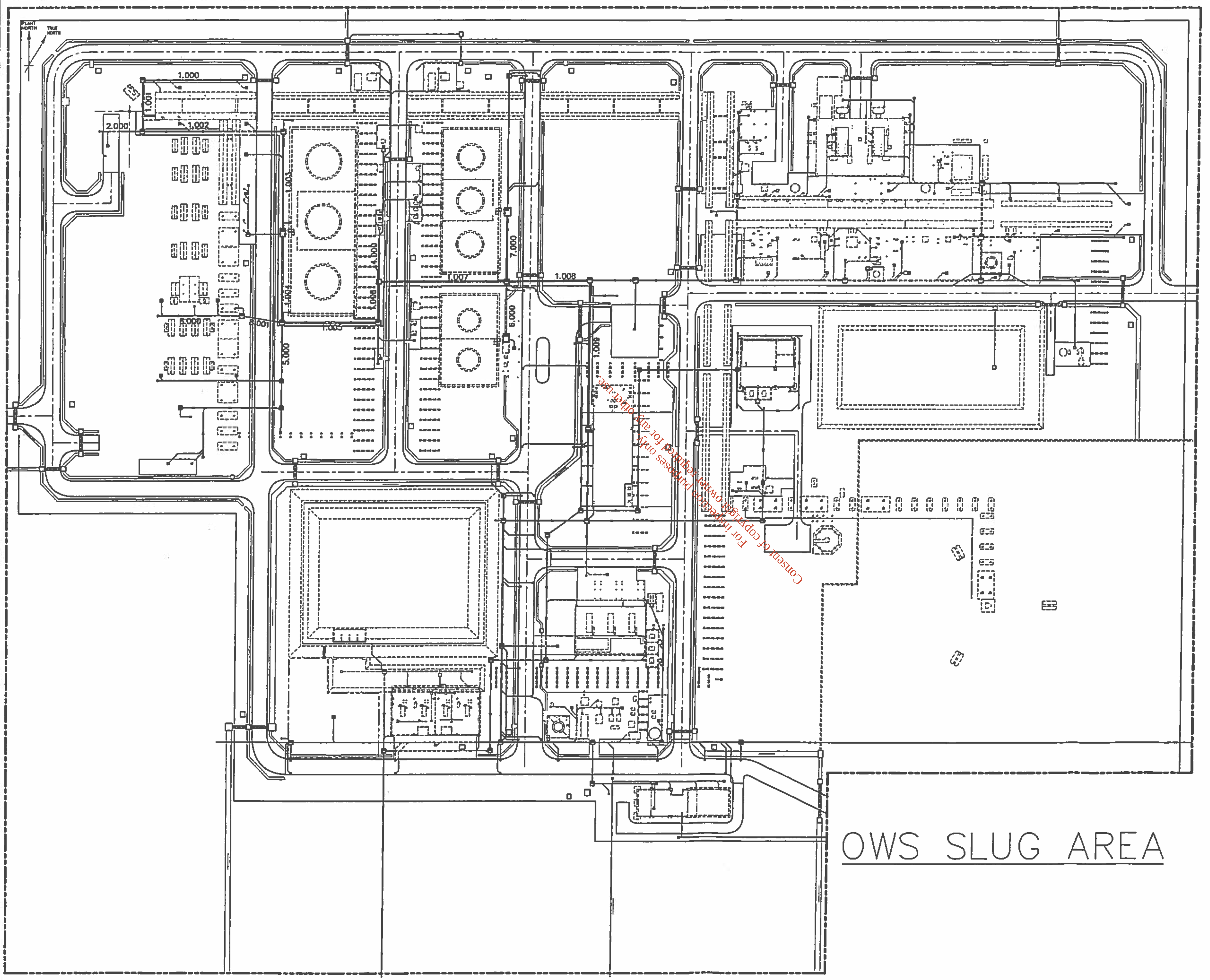
Drawing Title: CATCHMENT AREA PLAN

Size	Scale (at full size)	Drawn by
A0	1-500	C. Layton
Checked	Approved	Date
D. Rattray		
Issue		Shell Drawing No.
For Planning Application		



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Bellanaboy Bridge Gas Terminal

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Drawing Title

CATCHMENT AREA PLAN

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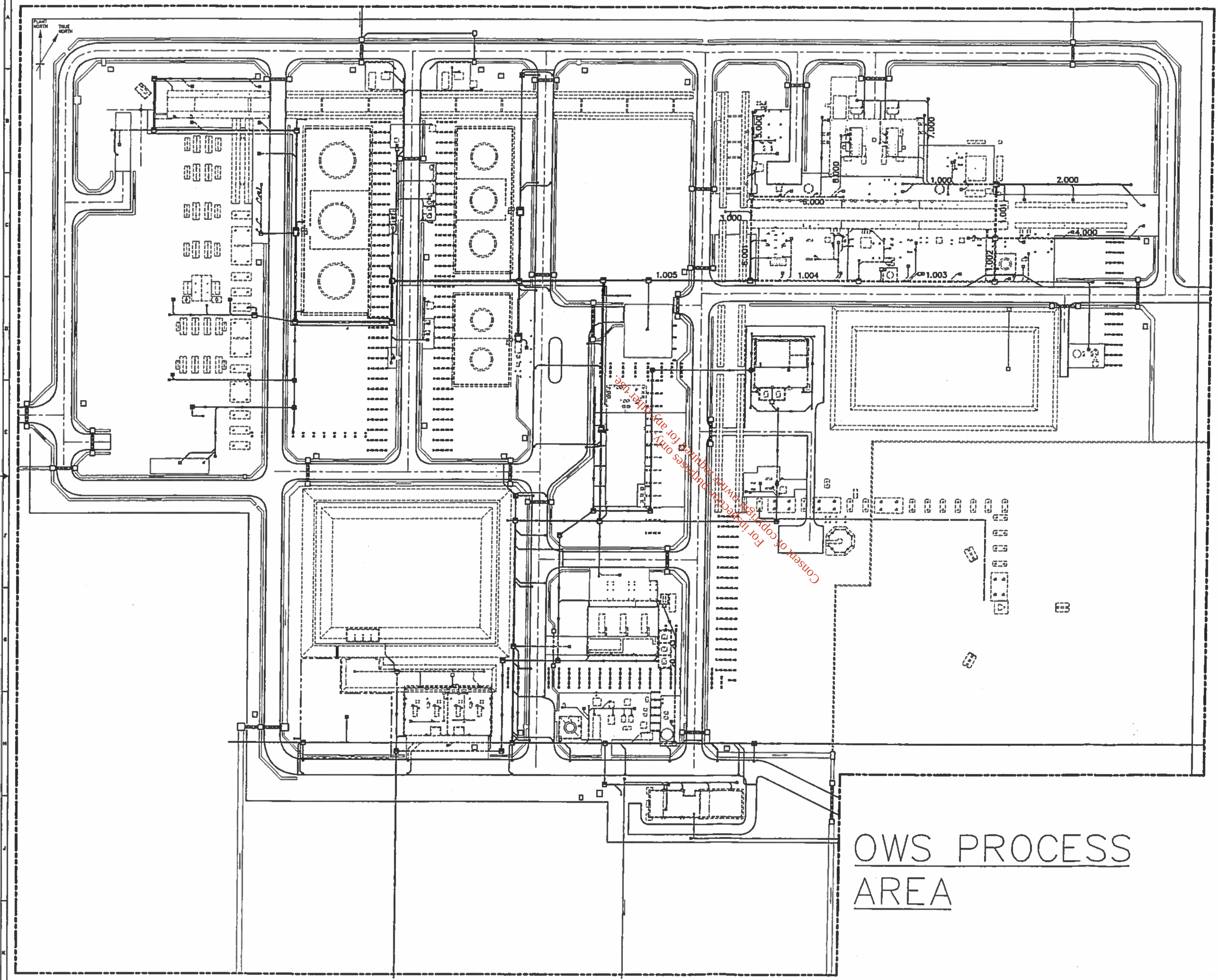

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LEGEND

OWS – OILY WATER SEWER
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Corrib Field Development
Bellanaboy Bridge Gas Terminal
Shell E&P Ireland Limited
Corrib natural gas
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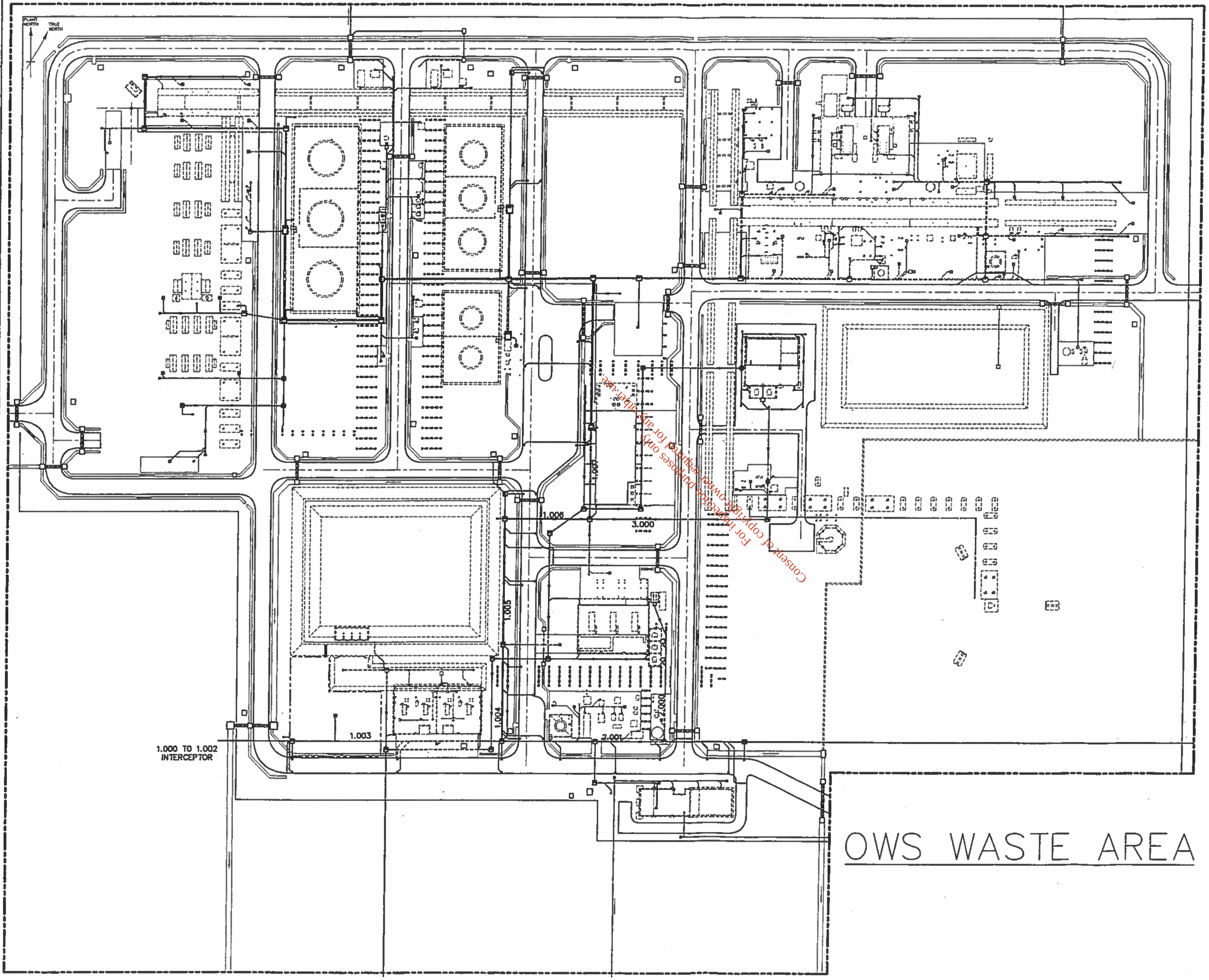

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LEGEND

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Corrib Field Development

Bellanaboy Bridge Gas Terminal

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Corrib natural gas

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Drawing Title

CATCHMENT AREA PLAN

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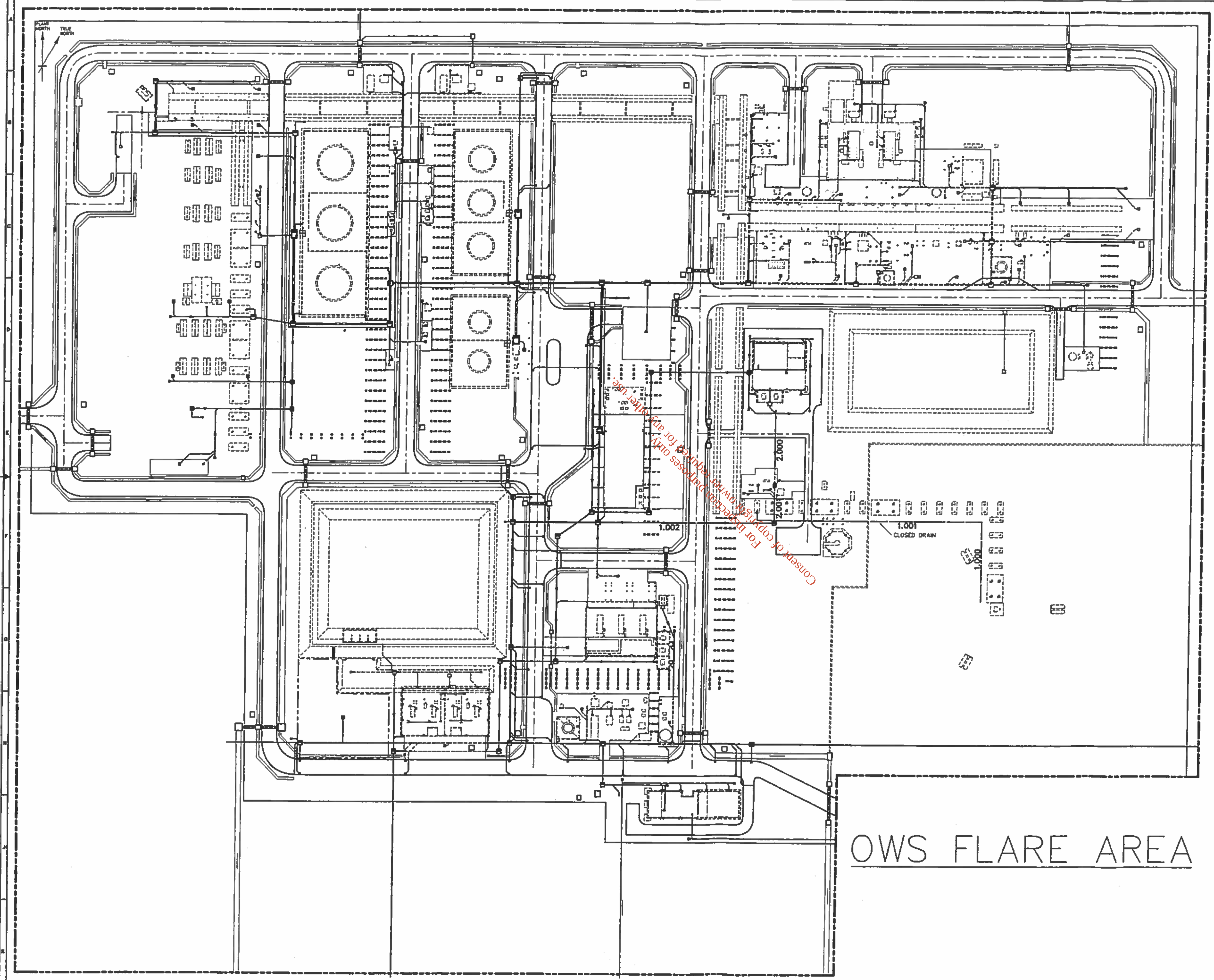
Checked: D. Rattray / Approved	Date
Issue: For Planning Application	Shell Drawing No.



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CATCHMENT AREA PLAN

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Size: A0	Scale (at full size): 1–500	Drawn by: C. Layton	
Checked: D. Rattray	Approved	Date	
Issue: For Planning Application		Shell Drawing No.	