Kerry County Council

PROJECT:

County Kerry Wastewater & Sludge Project Advance Study South Kerry

DOCUMENT:

Kilgarvan Sewerage Scheme Preliminary Report

Water Services Capital Unit
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Table of Contents

Table of Appendices

Appendix 9 – Ecology Report

Appendix 10 – Preliminary Site Investigation – Not Applicable

Appendix 11 – Archaeology Report

Appendix 12 – Drawings

Y5349/PR/501	-	Kilgarvan Location Plan
Y5349/PR/502	-	Location Plan of Existing Sewer Network for CCTV
Y5349/PR/503	-	Flora & Fauna Survey Areas
Y5349/PR/504	-	Archaeological Layout
Y5349/PR/505	-	Proposed Development Boundary
Y5349/PR/506	-	Planning Applications 2001 – 2006
Y5349/PR/507	-	WWTP Site Location Map
Y5349/PR/508	-	Location Plan of Existing Sewer Network
Y5349/PR/509	-	Proposed Sewer Alignment Plan
Y5349/PR/510	-	Proposed Sewer Alignment & Longitudinal Sections Plan
Y5349/PR/511	-	Kilgarvan Proposed Sewer Alignment & Longitudinal Section Sheet 1 of 5
Y5349/PR/512	-	Kilgarvan Proposed Sewer Alignment & Longitudinal Section Sheet 2 of 5
Y5349/PR/513	-	Kilgarvan Proposed Sewer Alignment & Longitudinal Section Sheet 3 of 5
Y5349/PR/514	-	Kilgarvan Proposed Sewer Alignment & Longitudinal Section Sheet 4 of 5
Y5349/PR/515	-	Kilgarvan Proposed Sewer Alignment & Longitudinal Section Sheet 5 of 5
Y5349/PR/516	-	Kilgarvan Composite Map
Y5349/PR/517	-	Kilgarvan Storm Catchment Areas
Y5349/PR/518	-	Kilgarvan Proposed Storm Sewer Alignment & Longitudinal Section Sheet 1 of 3

Y5349/PR/519	-	Kilgarvan Proposed Storm Sewer Alignment & Longitudinal Section Sheet 2 of 3
Y5349/PR/520	-	Kilgarvan Proposed Storm Sewer Alignment & Longitudinal Section Sheet 3 of 3

SECTION 1 EXECUTIVE SUMMARY

1.1 Introduction

Kerry County Council has appointed the Joint Venture team of J. B. Barry & Partners Ltd/White Young Green Ireland Limited to carry out a Preliminary Report for the provision of sewerage schemes for Seven Villages in South Kerry. This report refers specifically to a proposed sewage scheme for the village settlement of Kilgarvan, which lies 11Km to the north east of Kenmare on the R569. Currently there is an existing collection system in Kilgarvan which was originally constructed in 1937 with further pipework added in 1970. The network discharges into the existing wastewater treatment plant which is located to the south of the town before being discharged into the Roughty River. The location of Kilgarvan is shown in Drawing Y5349/PR/501 in **Appendix 12**.

1.2 Project Team

The project team comprised the following Consultants:

- J. B. Barry & Partners Ltd.
- White Young Green Ireland Ltd.

In-house design meetings were held periodically throughout the study.

Four Progress meetings were held with the Client over the period of the production of this Preliminary Report.

A technical and innovations workshop and value engineering workshop was also held during the production of this Preliminary Report.

This Preliminary Report has been produced in response to the brief issued by Kerry County Council as detailed below.

1.3 Brief

The content of the Preliminary Report is set out in the brief for the Engagement of Consultants, September 2005. The main tasks to be addressed in the Preliminary Report were as follows:-

- Preparation and finalisation of a Development Boundary Map for Kilgarvan in conjunction with the Forward Planning Department of Kerry County Council;

- Identification of current and future domestic, commercial and industrial loadings for a 20 year design horizon for the Waste Water Treatment Plant (WWTP) and 50 years for the collection system, which shall be phased as necessary to meet the short, medium and long term projected populations;
- Contract Document preparation and project administration of survey work to assess the quality and flow regime of the receiving waters, namely Roughty River;
- Contract Document preparation and project administration of CCTV survey work to assess the existing sewerage network infrastructure;
- Assessment of the potential archaeological and ecological impacts of the proposed scheme;
- Proposals for proposed wastewater treatment plant, discharge systems, sludge treatment and overflow systems to cater for current and future loadings;
- Technical Assessment of the ability of the proposed receiving waters to cater for existing and all future loads / overflows while maintaining the relevant water quality standards;
- Hydraulic analysis of the proposed collection network and overflow systems;
- Detailed estimates for the capital, operational and maintenance costs of the recommended solutions;
- Water Services Pricing Policy Report;
- Preparation of a Schedule of Statutory Processes required for Phase One works;
- Proposals on management/operation requirements of the completed projects and costs based on manpower, skills, materials, related costs etc.

The recommended improvements will be in full compliance with the requirements of;

- Environmental Protection Agency Act, 1992 (Urban Waste Water Treatment) Regulations, (S.I. 254 of 2001) implementing EC Directive 91/271/EEC concerning Urban Wastewater Treatment;
- Department of the Environment, Heritage and Local Government "Procedures and Criteria in relation to Storm Water Overflows" following on from the EU Urban Waste Water Directive;
- BS 6297:1983 – British Standard for Small Sewage Treatment Works;
- The Water Research Centre – Sewerage Rehabilitation Manual;
- Department of the Environment, Heritage and Local Government Circular Letter L6/94, concerning Sludge Treatment;
- The Phosphate Regulations, SI 258 of 1998;
- Circular L10/01 on Public Private Partnership;

- EC (Use of sewage sludge in agriculture) Regulations (S.I. No. 148 of 1998 and S.I. No. 267 of 2001);
- The Irish National Sludge Strategy and the 2003 Sludge Management Plan for Kerry County Council;
- The European Communities (Quality of Bathing Water) Regulations S.I. No. 84 of 1998, S.I. No. 155 of 1992 and S.I. No. 145 of 1994 implementing EC Directive 76/160/EEC concerning the Quality of Bathing Water and other relevant Statutory Instruments;
- The European Communities Health Conditions for the production & the placing on the Market of live Bivalve Molluscs (91/492/EEC);
- The European Communities Quality of Shellfish Waters Regulations 1979 (SI No 200 of 1994 and SI No 459 of 2001);
- European Communities (Quality of Salmonid Waters) Regulations (S.I. 293 of 1998);
- Freshwater Fish Directive (78/293/EEC);
- Other National and EU legislation where applicable e.g. Waste Management Act 1996, National Monuments Act 1994, Foreshore Act 1933, the Planning Acts, Legislation on Archaeology, N.H.A.'s, S.A.C's and S.P.A.'s.
- Preparing a Water Services Pricing Policy Report taking account of the Department of Environment, Heritage and Local Government Circulars L4/00, L16/00, L11/01,L14/01,L4/02,L7/02 and L10/02 and composite circular L16/02;
- Water Framework Directive (2000/60/EEC);

1.4 Levels and Units

Levels referred to in this report relate to either Malin Head Ordnance Datum or to a local Temporary Bench Mark. It will be stated, where relevant, as to which datum applies.

Both imperial and metric measurements are given in this report. The imperial unit is used to specify the diameter of older sewers.

1.5 Preliminary Report Structure

The main body of the Preliminary Report, contained in Volume 1, comprises 6 No. sections (section 2 to section 7 inclusive) as outlined below.

Section 2 Planning & Infrastructure Issues

Section 2 gives a general description of the Kilgarvan area and the local water course. The existing public water and wastewater infrastructure has been determined and the existing and proposed catchment boundaries have determined using topography of the area, speed limits in the village and planning advice from Kerry County Council. A site inspection has then been undertaken within the agreed existing development boundary to assess the current population.

Section 3 Proposed Project

Section 3 outlines the methodology used to calculate the future populations by assessing the following:-

- Historical Central Statistic Office data population trends within the area;
- Central Statistic Office (CSO) population and labour force projects 2006-2036;
- Kerry Development Plan 2003 – 2009
- Trends in Planning Applications
- Population projections based on the scheme Boundary agreed with Kerry County Council;

It was agreed with Kerry County Council that adopted population equivalents would be used due to the difficulty to estimate a reliable growth profile within the village. The proposed population projections are summarised in **Table 1.1**.

Table 1.1 Agreed Future Population Equivalent Figures for Kilgarvan

Phase	Year	Population Equivalent
-	2006	482
One	2016	1,200
Two	2026	2,000

This section also assesses the suitable location for the proposed WWTP. An assessment is also made as to the impacts that the proposed works will have on ecology and archaeological features within the area.

Section 4 Proposed Network

Section 4 describes the hydraulic design of the proposed new foul collection system and the rehabilitation work required on the existing network system that will serve the village. It has been assumed that 50% of the existing dwellings roof drainage will enter the foul collection system. Generally the foul sewers within the village are between 225mm to 300mm diameter and are to be laid at depth of less than 2.5 metres. The sewers down to the WWTP are 300mm diameter due to flat topography and the predicted future development within the catchment. Details of the proposed future storm water management policy for the network are also given recommending that all future developments will require new storm water sewers which must be designed to discharge to ground (if ground conditions are suitable) or be conveyed into the Roughty River.

Section 5 Proposed Treatment

Section 5 details the proposed design flows and loading to the WWTP and assesses the relevant legislation with regards to discharge standards. Assessment is made as to the assimilative capacity of the proposed receiving water course and recommendations given to the treated effluent requirements for the WWTP which is summarised in **Table 1.2**.

Table 1.2 Treated Effluent Standards for Kilgarvan WWTP

Parameter	Limit	Units
BOD_5	25.0	mg/l
SS	25.0	mg/l
COD	125.0	mg/l
Total Nitrogen	15.0	mg/l - N
Nitrate(NO_3)	25	mg/l NO_3
Nitrite(NO_2)	0.05	mg/l- NO_2
Non Ionised Ammonia(NH_3)	<0.02	mg/l- NH_3
Total Phosphorus	2	mg/l - P
Ortho Phosphates	2 (1,200PE) 1 (2,000PE)	mg/l

An indicative plant design has been prepared to treat the sewage to the required standards and details of licences that will be required by Kerry County Council are discussed. The sludge produced from the proposed plant has been calculated and this

section examines the disposal routes available and discusses the current status of the Sludge Management Plan for County Kerry.

Section 6 Phasing, Costs & Procurement

Section 6 outlines the basis of the Cost Estimates for the various components of the scheme. Due to the population (both existing and future) it is recommended that the wastewater treatment plant is designed & constructed for Phase One - the 2016 projected population and Phase Two - the 2026 projected population. Following an estimate of the 2006 capital and operating costs, the Net Present Value was determined on a 20 year project life and a 5% discount rate. Details of the cost estimates are contained in **Appendix 5**. A summary of the Capital and 20 year Operating Costs is summarised in **Table 1.3** below:-

Table 1.3 Total Costs for Kilgarvan WWTP & Network

Element	Costs Phase One (incl VAT)
Treatment Plant Phase One Capital Costs (incl VAT)	€1,162,556
Treatment Plant Phase One Operating Costs (incl VAT)	€389,813
Sewer Network Phase One Capital Costs (incl VAT)	€709,564
Sewer Network Phase One Operating Costs (incl VAT)	€28,289
Total Phase One Capital & Operating Costs (incl VAT)	**€2,290,222**

Section 7 Conclusions and Recommendations

Section 7 summaries the recommendations from the previous sections of the report. Kilgarvan was assessed with regard to projected population growth, existing sewerage infrastructure, availability of receiving waters.

In order to provide a sewerage scheme for Kilgarvan and allow for future flows and compliance with modern design criteria and the relevant standards for receiving waters, it is recommended that the works described in this report and summarised below are carried out at an estimated capital cost of **€1,872,120 inclusive of VAT for Phase One. This equates to €3,884 per existing PE and €1,560 per future PE (Phase One - 2016).**

The recommended works are summarised as follows;

- Provision of 1214m of 225mm diameter precast concrete gravity sewers;
- Provision of 580m of 300mm diameter precast concrete gravity sewers;

- Provision of a Waste Water Treatment Plant to serve a PE of 1200 for Phase One and PE of 2,000 for Phase Two;
- Provision of 65m of 300mm diameter outfall pipe from the proposed Kilgarvan WWTP to Roughty River.

SECTION 2 PLANNING AND INFRASTRUCTURE ISSUES

2.1 General

Kilgarvan (**Cill Gharbháin**) is a small village in South Kerry. It is located on the R569 approximately 10 kilometres north east of Kenmare and 32 kilometres south east of Killarney. It has a current domestic population equivalent (PE) of **482**. Kilgarvan does not have a large industrial sector. The main services and institutions in the village are;

- Primary School;
- Montessori School;
- Pubs;
- B&B's
- Roman Catholic Church;
- Window Factory;
- Alzheimer's Daycare & Health Centre;
- Petrol Station;
- Small office based businesses.

Photograph 2.1 View of Kilgarvan looking west

2.2 Topography

Kilgarvan is in a valley located predominantly between the 40 and 50m contour. The natural slope of the surrounding lands is towards the Roughty River which drains to the Kenmare River. Refer to drawing Y5349/PR/501 in **Appendix 12** for further details. The Roughty River is one of the most important salmonid rivers in County Kerry and the Kenmare River is a candidate Special Area of Conservation under the EU Habitats Directive (Site Code 2158).

In geological terms the Kilgarvan area is located along the Kenmare Syncline. This syncline is characterised by lower carboniferous, siliciclastic rocks and limestones. The Ballinskelligs Sandstone formation to the north of the valley dates back to the Devonian period and comprises *'purple medium grained sandstone with siltstone, pebbly sandstone and conglomerate'*. The Old Red Sandstone (undifferentiated) formation to the south comprises, *'red conglomerate, sandstone and mudstone'*.

2.3 Planning Constraints

Kilgarvan has been subject to permanent home development pressure in the recent number of years due to its proximity to Kenmare. However the overloading of the existing wastewater system has restricted the expansion of the area.

2.4 Development Plans

2.4.1 County Development Plan 2003-2009

The Kerry County Council Development Plan 2003-2009 provides an overall plan for the sustainable development of the County. The plan became policy from 8th December 2003. In the Development Plan settlement hierarchy Kilgarvan is referred to as a village within the Killarney region. In accordance with **Objective No. SS 3-9** of the Development Plan it is a Kerry County Council objective to;

- *Promote the strengthening of existing rural villages as a focus for the development of rural areas;*
- *Prepare Plans for these villages identifying strategic objectives for the overall development within defined development limits.*

2.4.2 National Spatial Strategy

The National Spatial Strategy 2002-2020 looks at the overall strategy for Ireland until 2020. Within the South West region, there are medium sized towns that play important economic and service functions along remoter parts of the coast such as Cahersiveen and Kenmare. (Kilgarvan is situated 11km east of Kenmare).

'Accessibility and effective local planning frameworks and initiatives to release capacity in terms of land and services for sustainable growth are critical factors in activating the potential of such centres in their important county roles'.

2.5 Watercourses

The Roughty River is a relatively large, fast flowing river which rises in the uplands of the Cork / Kerry border and runs through Kilgarvan village en route to the Kenmare River. It is one of the most important salmonid rivers in County Kerry and the water quality in the river is monitored on an ongoing basis by Kerry County Council and the Environment Protection Agency (EPA). In addition, there are a number of licensed Shellfish (Mussels, scallops and oysters) farms in Kenmare River. The quality of the water in Kenmare River is monitored rigorously on an ongoing basis by the Marine Institute of Ireland. Kenmare River is a candidate Special Area of Conservation (cSAC).

Kerry County Council has water quality data from grab samples taken from the Roughty River at three of the five Environment Protection Agency (EPA) water quality monitoring points upstream of the existing waste water treatment plant outfall. The nearest EPA monitoring point upstream of Kilgarvan is at Morley's Bridge. This is located approximately 4km upstream of the village. The nearest monitoring point downstream of Kilgarvan village is less than 1km from the village and is located at the ford downstream of the confluence with the Slaheny River. The EPA monitoring records from Morley's Bridge indicate a Q value of 4-5 in 2000 and 5 in 2003. The EPA monitoring records taken downstream of Kilgarvan confirm a lower Q rating of 4, both in 2000 and 2003. A number of streams join the Roughty River between Morley's Bridge and the confluence with Slaheny River. No biological river quality investigations carried were out by the EPA in 2004.

The Kerry County Council records date between 15th September 1982 and 23rd September 2003. The results of the sampling indicate levels of Molybdate Reactive

Phosphorus ranging between <0.005 and 0.031mg/l. The most recent EPA data dates back to September 2003.

Aquafact International Limited took four kick samples in spring and summer 2006. Two of the samples were taken from a point located upstream of the proposed WWTP outfall and two samples were taken downstream of the proposed WWTP outfall. The results indicate that a Q value of 3-4/4 in spring and a Q value of 3/3-4 in summer.

Aquafact International Limited also advised that the 95% flow in the Roughty River is estimated as 0.5m^3/s and the Dry Weather Flow is 0.6m^3/s. This is based on data from the closest EPA hydrometric stations and on advice from the EPA. These figures will be used in the assimilative capacity calculations in Section 5 of this report.

Water quality records are included in Appendix 8.1.

2.6 Existing Wastewater Load

2.6.1 Background Information

The following relevant information was obtained to assist in the assessment of the current and future flows and loads sources:-

- Commercial rates list;
- Water meter readings;
- 2002 Central Statistics Office (CSO) Census Reports and relevant publications of the CSO;
- 2003-2009 Kerry County Development Plan;
- National Spatial Strategy;
- Previous Reports.

The current loads in Kilgarvan are based on physical house counts. Using the 2002 CSO Census Report figures for the average number of persons per private household in each Province, County and City, the average house occupancy rate for the Kilgarvan project has been identified as **3** persons.

The per capita flow and load has been taken from the Environmental Protection Agency (EPA) publication, 'Treatment Systems for Small Communities, Business, Leisure Centres and Hotels' and is estimated as **180 litres per capita per day (including infiltration)** and **60 grammes BOD per capita per day.**

2.6.2 Current Domestic Population

The current number of residential houses in Kilgarvan is calculated as **113**. This number was calculated from OS maps, Kerry County Council CIS data on house connections to the water supply and site visits. The estimated current domestic flow and load for Kilgarvan is shown in **Table 2.1**.

Table 2.1 Estimated Current Domestic Flows and Loads in Kilgarvan

Description	Unit	Domestic
Residential houses	Number	113
Population (average 3 per household)	persons	339
BOD loading/head/day	g	60
Total BOD loading	kg / day	**20.34**
Flow/ head/day	litres	180
Total Flow (DWF)	l / day	**61,020**
Total Flow (DWF)	l / s	0.71
Total Population Equivalent	PE	**339**

2.6.3 Current Industrial/ Commercial Loading

There is no significant industry in Kilgarvan. Many of the commercial businesses are primarily related to serving the day to day needs of the existing domestic community. In order to quantify other commercial loading in the study area, either typical loadings from previous studies or from the EPA publication, *'Treatment Systems for Small Communities, Business, Leisure Centres and Hotels'*, were applied to the various non-domestic premises, or recorded water meter readings were used where considered accurate.

It is estimated that the Population Equivalent (PE) for Non-Domestic Customers is **143** with an associated flow of **25,740 litres/day**. This is calculated as follows;

Metered Customers **– Table 2.2** on the next page estimates the peak total flow from the metered customers.

Table 2.2 Metered Customers

Customer	Estimated Peak Flow (l/day)	Estimated PE
John Foley, Publican	1,800	10
Tom Randles, The Village Inn	1,800	10
Una Shorthall, O'Reilly's Bar	1,080	6
Padraig Kelliher, The Roughty Bar	2,160	12
Daniel Healy-Rae, Publican	2,880	16
TOTAL	**9,720**	**54**

Unmetered Customers – **Table 2.3** estimates the peak total flow from the unmetered customers.

Table 2.3 Unmetered Customers

Customer	Estimated Peak Total Flow (l/day)	Estimated PE
RC Church	360	2
The Treasurer, Community Centre	720	4
Ml Healy Rae	720	4
John Quill	360	2
Garda Station	1,440	8
Conserve a Sash (Window factory)	720	4
Petrol Station	180	1
Denis O'Sullivan	180	1
The Village Grill, Restaurant	1,800	10
Shop	360	2
Primary School	3,600	20
Hair Salon	1,080	6
Alzheimer's Daycare & Health Centre	360	2
Funeral Home	180	1
Patrick Dillon	180	1
Agnes Hegarty	180	1
Barry Marrinan	720	4
Daniel O'Sullivan, Gortnaboul House B&B	1,440	8
Montessori School	720	4
SHB	720	4
TOTAL	**16,020**	**89**

Table 2.4 Total estimated Current flows and Loads for Non- domestic Customers in Kilgarvan

Description	Total Flow (l/d)	PE
Metered Customers	9,767	54
Non-metered Customers	16,020	89
Total	**25,787**	**143**

2.6.4 Current Total Flows and Loads

The current domestic and non domestic flows and loads are summarised in **Table 2.5** below.

Table 2.5 Summary of Total estimated Current Flows and Loads in Kilgarvan

Description	Total Flow (l/d)	PE
Domestic Customers	61,020	339
Metered Customers	9,767	54
Non-metered Customers	16,020	89
TOTAL	**86,807**	**482**

2.7 Existing Water Supply Infrastructure

The Public water supply in Kilgarvan is provided by a 100mm uPVC pipe dating from 1974. The main water supply line extends into the village along the R569 with service pipes extending to the north and south to service the houses within the village core.

Details of the existing location of the uPVC water main can be seen on **Appendix 2** drawing KCC – Kilgarvan Public Watermains Details. The exact location of the watermain within the village will be determined by site investigations during the detailed design stage.

2.8 Existing Wastewater Infrastructure

The existing sewerage scheme comprises 2.2km of pipework discharging to a treatment plant located adjacent to the Roughty River in the south of the village. The treatment plant has a design PE of 250 and comprises a storm overflow tank, twin settling tanks and percolating filters with the treated effluent discharging to the Roughty River. The existing sewerage scheme is currently overloaded and the existing treatment plant is in poor condition as indicated on **Photograph 2.2**.

Photograph 2.2 Ponding on the Existing Biological Filters

2.9 Private Wastewater Treatment Plants

Currently there are no private wastewater treatment plants within Kilgarvan. Recent development has connected into the existing collection system directly.

2.9.2 Private Septic Tanks

Currently there are no known private septic tanks within the core network and all dwellings are connected to the existing public sewerage system.

2.10 Existing Foul and Surface Water Infrastructure

There is no separate storm sewer network in Kilgarvan. There is however road gullies along the R569 main road through Kilgarvan which most probably discharge into the existing sewer network or local streams/Roughty River.

Details of the existing foul network which serves Kilgarvan can be seen on drawing Y5349/PR/508 in **Appendix 12** which shows that the majority of the existing foul sewers are a mix between 225mm clay and concrete pipes. **Table 2.6** summaries the

pipe sizes, materials and lengths of the existing system. It should be noted that a number of existing sewers within the network are laid at cover depths of less than 1 meter.

Table 2.6 Summary of Existing Foul Sewers

Sewer Type	Pipe Size	Material	Length (m)
Foul Sewer	150mm	Clay	204
Foul Sewer	225mm	uPVC	221
Foul Sewer	225mm	Clay	473
Foul Sewer	225mm	Concrete	800
		Total	**1,698**

2.10.1 Existing Foul Water Infrastructure

A CCTV and Manhole Survey were undertaken in all identified critical sewers in the networks of Kilgarvan, Glenbeigh and Sneem as agreed with Kerry County Council. A full survey of the existing sewers was undertaken in Kilgarvan and Glenbeigh, with a partial study undertaken in Sneem, to supplement works previously undertaken by Kerry Drains Ltd as part of a 2005 Preliminary Report (Sneem Sewerage & Water Scheme TMA Consulting Engineers 2005).

Tender documents were prepared for the survey of approximately 3,550m, 1,790m and 718m lengths of sewers in Glenbeigh, Kilgarvan and Sneem respectively and were issued to three CCTV companies. After tender evaluation the Contract was awarded to Drain Management Systems Ltd. The CCTV survey established the internal condition of all sewers in the system and was undertaken in April 2006.

This section of the report analyses the results of the CCTV survey and quantifies the number of sewer defects, together with the various methods available for sewer rehabilitation.

The results of the CCTV Survey for Kilgarvan are summarised in **Table 2.7** on the next page;

Table 2.7 – Kilgarvan CCTV Survey Summary

Item	Foul
DMS Ltd.	
No. of Sewer Surveys*	44
Length of Sewer Surveyed (m)	1,497
Number of Resurveys	7
*** - No. of surveys and length of Sewers Surveyed does not include for where a sewer has been surveyed from both ends or where a sewer has been resurveyed following cleaning.**	

Other Observations include:

High Levels of Silt and Grit were observed in many sewers. Levels of silt in excess of 25% were observed in 7 of the surveyed sewers and required resurveying.

These sewers were cleaned by jetting during the CCTV Contract and resurveyed again by CCTV.

The structural condition of sewers surveyed as part of the DMS Ltd CCTV survey were visually assessed and graded depending on their internal condition. These sewers have been assessed and are included in **Table 2.10** detailing the structural rehabilitation required within the existing network. A description of the sewer condition represented by each grade is shown in **Tables 2.8 & 2.9**;

Table 2.8: Structural Grades

Internal Condition Grade	Typical Defect Descriptions
4	Open joints slight
	Displaced joints slight
3	Cracks Circumferential & Longitudinal
	Open joints Large
2	Fractures
	Multiple Cracks (Longitudinal & Circumferential)
1	Broken and Multiple Fractures
	Intruding lateral connections
0	Already collapsed or deformation >5%

The grade for the entire sewer length is based on the highest internal grade along that sewer length. Normally sewers graded 0 or 1 will be targeted for upgrading immediately.

It should be noted that, with modern trenchless (no dig) technology, it is now possible to upgrade only the affected section of sewer.

The results of the grading process for Kilgarvan showed that, of the 1,497 m of sewer length investigated by DMS Ltd, approximately 787.2m contained defects which were graded 0 or 1 i.e. which would require structural upgrading in the short-term.

The Grading for Kilgarvan as undertaken by DMS Ltd (2006) is summarised in **Table 2.9** below;

Table 2.9 Kilgarvan Structural Internal Grades (DMS Ltd.)

Name	Grade 0 (m)	Grade 1 (m)	Grade 2 (m)	Grade 3 (m)	Grade 4 (m)
St. Garvan's Terrace (MH 12 – 12G) inc. 12L				76	99
Mid West Section (MH 6 – 25)	295	125	33		47
Southern Section (MH 19 –MH TP)		30.5	136.5	130	43.5
Northern Section (MH 2 –MH 6)	39	122.5	41.5		
Central Section (MH 6-MH 12)		175	52	37	14
Total	**334**	**453.2**	**263**	**243**	**203.5**
Total*	**1,497m**				
* Discrepancies in totals of Sewers Surveyed (Table 2.7) and Internal Grades (Table 2.9) due to incomplete surveys due to Intruding lateral connections / deformation of Sewers.					

The main sewer defects in the Kilgarvan sewer network are:

- Deformation of pipe walls.
- Collapse of pipe walls.
- Faulty connection junctions.
- Pipe breaks and holes.
- Cracking – both circumferential and longitudinal.
- Fracture – both circumferential and longitudinal.
- Joint displacement and joint openings.
- Encrustation.
- Root intrusion.
- Silt / debris build up.

2.10.2 Structural Rehabilitation and Defective Sewers

Table 2.9 (which is also detailed in **Appendix 5.0**) indicate that there are approximately 787m of defects to be repaired in the Kilgarvan sewer system in the short-term. These are encountered in 15 different lengths of sewer lines.

There are various sewer renovation systems using no-dig techniques currently in use. These systems have been proven internationally to be cost effective and of high quality. Defects in sewer lines and manholes can be repaired irrespective of their size, material or shape. No-dig technology means that disruption to traffic; businesses and the general public that can be associated with civil works are minimised. The time required to carry out repair works to defected sewers is dramatically reduced using no-dig techniques. Some of the renovation systems are discussed below.

Spray lining is a localised pipe repair system, which can be used to repair fractures, open displaced joints and breaks. Typically a two part epoxy resin or cement is applied to the inside wall of the pipe. This gives structural support by extruding out through the defect into voids outside the pipe as well as forming a collar inside tapering to pipe size at each end thus causing no obstruction to flow. The system can also be used to seal redundant connections. Lengths of up to 150 meters can be sprayed in one pass. Repairs can be carried out on lines ranging in size from 100mm to 450mm. Defects in larger diameters can be sealed using man entry methods.

Slip lining is another technique, which uses standard pipe materials to insert an undersize lining within and existing pipeline. Long lengths of pipe can then be renovated in a short space of time by use of this procedure. If required the void between lining and pipe can be grouted. A variety of lining materials can be employed using this technique.

Patching is a structural lining for use at isolated sections of sewers, allowing lengths to be upgraded in the most economic manner. If there is only a short section of sewer in need of renovation, patching offers the option of lining only the damaged section with patches of requisite length. Patches are installed via existing manholes, located in position with the aid of CCTV cameras and cured insitu.

Lines that have multiple defects can be renovated using ***Inpipe GRP*** lining system, which is a new generation seamless liner with interwoven reinforcement giving high strength. The continuous liner is inverted into the line using air pressure and cured insitu using ultra violet light. The liner cures to form a Glass Reinforced Plastic (GRP) pipe of high strength. This method also offers the option of varying the strength and chemical resistance of the liner depending on the requirements of the specific application. Laterals can be re-opened using a robotic cutter.

Another technique is ***Pipebursting***. This technique involves replacing the existing deteriorated pipe with new polyethylene pipe (PE) of the same or even larger diameter on the same line. The existing pipe is split by a nose-cone which is driven through and forces the pieces of pipe out to a larger diameter, creating a channel for the new pipe to follow on immediately behind.

The areas of existing sewer network in Kilgarvan that require structural rehabilitation or in extreme cases total replacement are outlined below in **Table 2.10**:

Table 2.10: Structural Rehabilitation – Existing Kilgarvan Network

Manhole	Size - Type	Reline / Repair	Sewer Size	Recommendation
Kilgarvan				
MH 1B –MH 2	150mm CLAY	Not Surveyed	Insufficient Capacity	Replace
MH 2 – MH 6	225mm CLAY	Repair & Reline	Sufficient Capacity	Replace**
MH 6 – MH 9	225mm CLAY	Reline	Sufficient Capacity	Replace*
MH 9 – MH 10B	225mm uPVC	Reline	Sufficient Capacity	Replace*
MH 10B – MH12	225mm Concrete	Repair	Sufficient Capacity	Replace*
MH 12 – MH12G (Inc. 12L)	225mm uPVC	No Reline Required	Sufficient Capacity	Retain
MH7 –MH14	150mm Concrete	Reline	Sufficient Capacity	Retain
MH9 – MH15	225mm Concrete	Reline	Sufficient Capacity	Retain
MH 6 – MH 16	225mm Conc	Reline	Sufficient Capacity	Replace**
MH16 – MH 19	225mm Clay	Repair	Insufficient Capacity	Replace
MH 19 – MH 24	225mm Clay	Replacement Required	Sufficient Capacity	Replace
MH 24 – MH 28	150mm Clay	Replacement Required	Insufficient Capacity	Replace
MH 19 – MH TP	225mm Concrete	Repair / Reline	Insufficient Capacity	Replace

* Section of sewer is to be removed from behind houses etc onto the main road
** Section of Sewer to be replaced due to existing insufficient invert level

Details of the costs to refurbish the existing infrastructure can be seen in **Appendix 5.5**.

2.11 Recommended Storm Water Management Policy

As per the Department of Environment Heritage and Local Government (DEHLG) policy, storm water will not be combined with foul networks and all future development will provide soakaways or separate storm networks.

As indicated in section 2.10 surface drainage from public roads enters either into local streams/Roughty River or into the existing foul water network. It has been assumed that 50% of the existing houses might have combined systems, and therefore the proposed new foul sewer is expected to get a surface water contribution in addition to foul flows. The sewer network therefore has been designed to cater for 50% storm contributions from existing dwellings. A rainfall intensity for a 2 year return period was chosen, together with an impervious area of 100m^2 for each dwelling.

During the construction of the project Kerry County Council are to ensure that local residents are aware that the new sewers being constructed are to be a foul sewer and where practicable existing residents should be encouraged to divert surface water into soakways, or local streams and the Roughty River that runs to through the south of the village and therefore only allowing foul flows into the public system. Any large areas i.e. car parks that currently discharge into the existing foul system should be reconnected into the Roughty River or local streams where practicable.

In line with DEHLG policy it is envisaged that all future developments will provide independent soakaways or separate storm water collection systems that will discharge directly into local streams or the Roughty River.

SECTION 3 PROPOSED PROJECT

3.1 Context

This section discusses the design population projections for the Waste Water Treatment Plant and the sewer network.

The various elements, which constitute the main drainage infrastructure in an urbanised area, have considerably different design lives. Pumping stations, particularly the mechanical and electrical equipment, are generally designed for a maximum life of circa 20/25 years, even with high standards of maintenance. WWTP's, similarly would have a design life of 20/25 years. In recent years, process technologies have been changing and developing, in response to industry demands, for better process efficiencies and less labour intensive methodologies.

Sewer systems are usually designed for 40-50 year horizons, as virtually no mechanical /electrical equipment is involved, and construction methods and materials are consistent with such design lives. Sewer laying in urban areas is disruptive and expensive and should be minimised as much as possible. In accordance with the brief from Kerry County Council it is proposed to design the Waste Water Treatment Plant & Pumping Stations Mechanical & Electrical plant for a 20 year lifetime and the sewer network for a 50 year period.

3.2 Future Flows and Design Loads

3.2.1 Methodology

Future domestic demand will vary from its current value due to one or more of the following factors:-

- Natural increase/decrease in population;
- Change in house occupancy rates;
- Migration into and out of supply area;
- Improvements in living and household standards;
- Increased usage of water consuming apparatus;
- Introduction of lower water using apparatus.

The main factor which affects changes in population is the natural increase/decrease in population. It was therefore deemed necessary to examine and compare four different methods to determine the appropriate future population equivalents for the various design horizons. These were:-

- Method 1 - Historical population trends;
- Method 2 - The CSO Population and Labour Force Projections 2006-2036;
- Method 3 - The 2003-2009 Kerry County Development Plan;
- Method 4 - Recent Trends in planning applications.

3.2.2 Method 1 – Historical Population Trends

There are separate CSO Census figures available for Kilgarvan. The 1996 and 2002 CSO Census figures for the DED in which Kilgarvan is located was examined and compared with census figures on a regional and national level in order to determine local, regional and national trends which are detailed in **Table 3.1** below.

Table 3.1 National and Regional Population Statistics

Area	Census 1996	Census 2002	% Growth between Censuses	Average Annual % Growth
National	3,626,087	3,917,203	8.03%	1.30%
Co. Kerry	126,130	132,527	5.07%	0.83%
Kilgarvan DED	547	599	9.51%	1.53%
Kilgarvan village	175	156	-10.86%	-1.90%

It should be noted that the population of Kilgarvan based on house counts is significantly greater than the population derived from the CSO Census. This probably relates to houses lying outside the boundary of Kilgarvan village as used by the CSO.

Kilgarvan village is located within Kilgarvan DED. The population of Kilgarvan village declined by an average of 1.9% per annum over the Census period 1996 to 2002 while the population of Kilgarvan DED increased at a rate of 1.53% per annum over the same period. As there are no other large settlements in Kilgarvan DED, it would indicate that the increase in population in rural areas of Kilgarvan DED and in the outskirts of Kilgarvan. As rural areas have had little increase in population in Kerry in recent years, it is expected that the majority of the population increase has occurred on the outskirts of Kilgarvan village.

Looking back as far as 1971, the pattern for the population of Kilgarvan village shows a population decreasing from a peak of 237 (Census 1971) to a low of 156 (Census 2002). Since the 2002 Census there has been a significant interest in the development of Kilgarvan village and it is expected that the 2006 Census results will reflect a significant increase in the population. Preliminary figures from the 2006 census shows that the population of the Kilgarvan DED increased by 27, equal to an average annual increase of 1.11%. Figures for Kilgarvan village are not yet available.

In projecting a future population based on the most recent trends, it is proposed to use the growth rate in the DED for 2002 – 2006. Refer to **Table 3.2**.

Table 3.2 Estimated Future Domestic Population Based On Historical Trends

Phase	Year	Domestic Population
-	2006	339
One	2016	378
Two	2026	422

3.2.3 Method 2 - CSO Population and Labour Force Projections 2006-2036

The Central Statistics Office (CSO) in their Report, "Population and Labour Force projections, 2006-2036", predict that the population of the State will be between 4.9 and 5.6 million by 2036. Their projections are based on a number of assumptions relating to future trends in fertility, mortality, migration and labour force participation. Six population scenarios are given ranging from High Fertility (F1) and High Migration (M1) to Low Fertility (F3) and Low Migration (M2).

It is expected that the growth in Kilgarvan would match the low migration and medium fertility (M2F2) scenario as there is little migration into the study area and the mixed age profile would suggest medium fertility.

Three further refinements of the M2F2 scenario are presented in the CSO Report, "Regional Population Projections, 2006-2021", entitled recent, medium and traditional trends. Refer to **Table 3.3** on the next page.

Table 3.3 Population Projection Scenarios

Assumption	Trend	Definition
M2 F2	Recent	Low Migration and Medium Fertility
M2 F2	Medium	Low Migration and Medium Fertility
M2 F2	Traditional	Low Migration and Medium Fertility

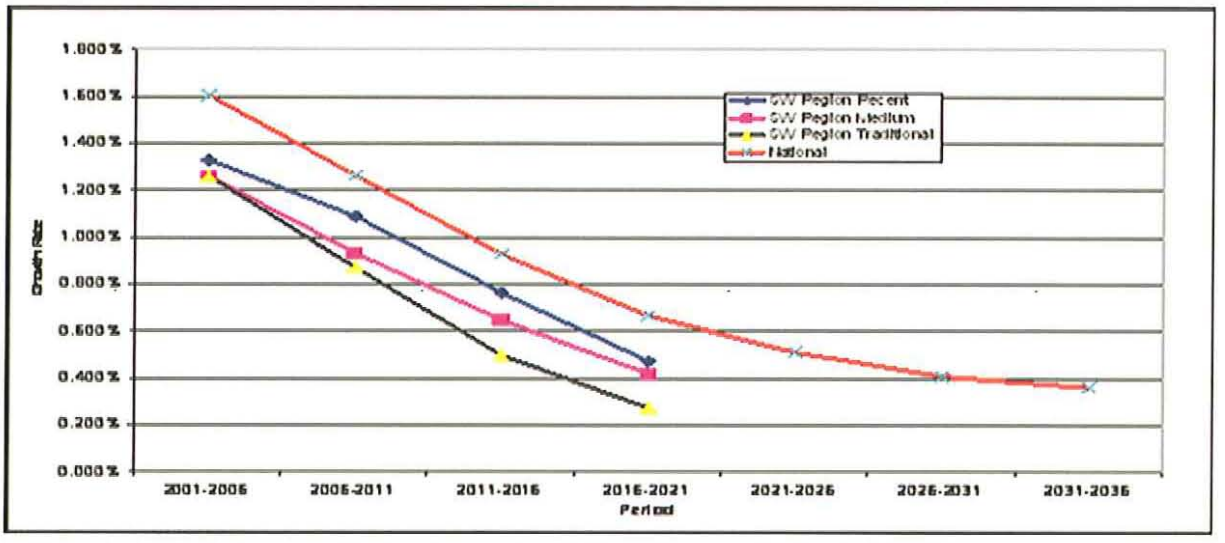
Percentage population increases over 5 year periods between 2006 and 2021 and average annual percentage increases have been calculated for the country as a whole and on a regional basis for the recent, medium and traditional trends. Kilgarvan is considered to follow the projections for the **medium** M2F2 south-west regional trend as indicated in **Table 3.4** below.

Table 3.4 Average Annual % Population Change Based On National and Regional CSO M2F2 Population Projections

Period	Recent	Medium	Traditional	National
2001 - 2006	1.328%	1.261%	1.261%	1.606%
2006 - 2011	1.089%	0.935%	0.871%	1.264%
2011 - 2016	0.763%	0.650%	0.498%	0.925%
2016 - 2021	0.473%	0.421%	0.275%	0.671%
2021 - 2026	-	-	-	0.512%
2026 - 2031	-	-	-	0.409%
2031 - 2036	-	-	-	0.363%

This trend is projected beyond 2021 in a similar profile to the national trend as shown graphically in **Graph 3.1** on the next page.

Graph 3.1: Average Annual % Population Change Based On National and South West Regional CSO - M2F2 Population Projections



The projected growth rates are set out below in **Table 3.5**

Table 3.5 Average Annual % Population Change Based On National and Medium South West Regional CSO - M2F2 Population Projections

Period	Average Annual Growth Rate
2001 - 2006	1.261%
2007 - 2011	0.935%
2012 - 2016	0.650%
2017 - 2021	0.421%
2022 - 2026	0.266%
2027 - 2031	0.163%
2032 - 2036	0.117%

Estimated future population projections for Kilgarvan village are set out in **Table 3.6** based on the above CSO population projections.

Table 3.6 Estimated Future Domestic Population Based on CSO - M2F2 Medium Population Projections

Phase	Year	Domestic Population
-	2006	339
One	2016	367
Two	2026	380

3.2.4 Method 3 - The 2003-2009 Kerry County Development Plan

The Kerry County Development Plan 2003-2009 was consulted to assess the development potential of Kilgarvan and to determine likely population growth profiles in these areas based on development plan objectives. The population of the county as a whole is expected to grow from 132,527 in 2002 to 167,000 in 2021. **Table 3.7** assess these projections as an annual percentage figure.

Table 3.7 Development Plan Population Growth Projections

Development Plan	Growth Rate	Period	Average Annual Growth Rate
Kerry County Development Plan 2003	26.01%	2002-2021	1.22%

Based on the above growth rate, the estimated future population projections for Kilgarvan are set out in **Table 3.8** below.

Table 3.8 Estimated Future Domestic Population based on Development Plan Population Growth Projections

Phase	Year	Domestic Population
-	2006	339
One	2016	383
Two	2026	432

3.2.5 Method 4 - Trends in Planning Applications

An inspection of the Kerry County Council on line Planning records showed that a planning applications have been submitted for proposed dwellings and extension of existing facilities within the Kilgarvan development boundary. These include a small number of applications for multiple house developments. They are identified in **Table 3.9** below and also on drawing Y5349/PR/506 in **Appendix 12**.

Table 3.9 Kilgarvan Planning Applications 2001-2006

Application Number	Type of Development	Location
031651	6 no. fully serviced semi-detached, 2 storey type dwellings	Main Street, Kilgarvan
032421/06512	Construct a block of 6 no. ground floor retail units and 10 no. First and second floor, two bedroom apts, 14 no. Detached 2 storey type dwellings, 1 no. Detached 2 storey type dwelling with detached garage, 1 terrace of 4 2 storey dwelling all accessed from main street, 3 no. 2 storey type dwellings	Bantry Rd., Main st., Kilgarvan
021948/062269	Construct 10 no. four bedroom storey and a half style dwelling houses, 10 no. 3 bedroom dormer houses, 5 no. 2 bedroom single storey houses and service roads complete with associated site works	Kilgarvan
031503/051983	Construct 12 no. 3 bedroom semi-detached two-storey houses, 4 no. 4- bedroom semi-detached two-storey houses and 8 no. 3-bedroom two-storey townhouses and all ancillary site works and permission to demolish existing shed	Gortnaboul, Kilgarvan
053811	Erect a semi-detached duplex structure consisting of 2 ground floor apartments with 2 storey dwellings over and associated site works	Gortnaboul, Kilgarvan
04746	Erect a dwelling house	Kilgarvan
021198	Demolish existing shed (out offices) and construct two-storey dwelling	Kilgarvan
012456	Three fully serviced two storey dwellings and three domestic garages with connection to town water supply and town sewage, All ancillary site works	Kilgarvan
061977	Construct a dwelling house and connect to public sewer	Gortnaboul, kilgarvan

The total number of domestic units granted planning permission in the last five years is 97 which amounts to an average annual increase of 13.2% based on the domestic population. Based on this growth rate the estimated future population of Kilgarvan is set out in **Table 3.10** below.

Table 3.10 Estimated Future Domestic Population Based on Planning Applications

Phase	Year	Domestic Population
-	2006	339
One	2016	1,171
Two	2026	4,044

In summary the range of the future populations calculated using the four different methods is summarised in **Table 3.11** on the next page.

Table 3.11 Summary of Range of Predicted Domestic Population for Kilgarvan

Method	Existing Domestic Population 2006	Phase One - 2016 Domestic Population	Phase Two – 2026 Domestic Population
Method 1 - CSO Census	339	378	422
Method 2 - CSO M2F2 Scenario	339	367	380
Method 3 - Development Plan	339	383	432
Method 4 - Planning Applications	339	1,171	4,044

3.2.6 Summary of Methods 1 – 4 Predicted Growth Rates

As can be seen from the above sections 3.2.1 - 3.2.4 the four methods give varying results. The predicted domestic growth rate for Kilgarvan village as shown in **Table 3.12** below is based on a combination of the most reliable profiles. It is proposed that the planning application growth rate of 13.2% be adopted to determine the population projections for the scheme for the first five years. The CSO M2F2 forecasted growth rate of 0.27% is used to predict the future population between 2021 and 2026. The growth rates for the periods in between (2011-2016 and 2016-2021) are interpolated between the 13.7% and 0.266% growth rates.

Table 3.12 Predicted Population Growth Rates

Period	Average Annual Percentage Growth Rate
2006 - 2011	13.20%
2011 - 2016	8.89%
2016 - 2021	4.58%
2021 - 2026	0.27%

Based on the above percentage growth rates the future residential population of Kilgarvan is predicted to be as shown in **Table 3.13** below;

Table 3.13 Predicted Domestic Population of Kilgarvan

Phase	Year	Domestic Population
-	2006	339
One	2016	964
Two	2026	1,223

3.2.7 Non-Domestic Flows & Design Loads

The existing non-domestic load is estimated as 143 PE (Refer to Section 2.6.2). There is no area zoned for commercial/industrial development. However an increased demand in the commercial (shop, pub, holiday home etc) sector should stem from the expected increase in population. Providing capacity in the proposed wastewater treatment plant for future non-domestic loads would result in Kerry County Council having to bear additional costs which may not be recovered. It is therefore proposed to allow for an increase in the non-domestic flow and load of 16% of the future domestic flows and loads as shown in **Table 3.14**. This is in line with previous studies and will cater for the commercial sector associated with the increased residential sector.

Table 3.14 Estimated Domestic and Non Domestic Demands

Phase	Year	Population	Non-Domestic
-	2006	339	143
One	2016	964	243
Two	2026	1,223	284

3.3 Scheme Boundary

Currently there is no Local Area Plan for Kilgarvan. Existing drawings and site inspections were used initially to establish the extent of the current development boundary (14ha.) and the future (including current) catchment area (54.3ha) for Kilgarvan. In association with a meeting with the Forward Planning Section of Kerry County Council the catchment area and the population equivalent were refined.

Based on 50% development of available land within the development boundary, with 20% open space, there will be sufficient land available for a future population of 1,306, based on a housing density of 20/ha. This would be sufficient land to cater for the 2026 estimated population of 1,223.

Refer to drawing Y5349/PR/505 in **Appendix 12** for details of the adopted catchment boundary for the proposed Kilgarvan Sewerage Scheme.

3.4 Adopted Population Equivalents

It is difficult to estimate with any reliability growth profiles for a village like Kilgarvan. This is because of its low current population, uncertain future economic growth and the

current and likely future pressure for housing due to its close proximity to Kenmare. It has been agreed therefore in discussions with Kerry County Council planning staff to adopt the Population Equivalent (PE), as shown in **Table 3.15** below, for Kilgarvan.

Table 3.15 Agreed Future Population Equivalent Figures for Kilgarvan

Phase	Year	Population Equivalent
-	2006	482
One	2016	1,200
Two	2026	2,000

This breaks down as follows;

Table 3.16 Breakdown of Agreed Domestic and Non-Domestic Population Equivalent

Phase	Year	Population	Non-Domestic	Total
-	2006	339	143	482
One	2016	958	242	1,200
Two	2026	1,647	353	2,000

3.5 Phasing

The proposed WWTP will be designed to initially serve the 2016 design flows. The plant will then be increased to cater for the 2026 design flows through modular expansion if required.

For the collection network it has been assumed that rest of the development land within the scheme boundary as indicated in section 3.3 and drawing Y5349/PR/505 in **Appendix 12** (or other lands) becomes available between 2026 and 2056 with still 20% of land still being occupied by open space and a housing occupancy of 24 houses per hectare. Therefore the predicted population for the network in 2056 is 2641PE. This figure has been used to determine the pipe diameters of the sewerage network.

3.6 Archaeological Features & Flora and Fauna

3.6.1 Introduction

The Kilgarvan Sewerage Scheme involves the provision of sewers and a WWTP. In accordance with the EC (Environmental Impact Assessment) Regulations 1989 to 1999 an Environmental Impact Statement (EIS) is required for a WWTP if the design PE is greater than 10,000 PE. The design PE for this village is less than this threshold and hence there is no statutory requirement for an EIS. However, desk studies have been carried out for Flora, Fauna and Archaeology.

It was decided by Kerry County Council that the Archaeology desk study would be undertaken in-house by Mr Michael Connolly, Kerry County Archaeologist.

For the Flora and Fauna desk study sub-consultants were invited to tender and after considering the submitted tenders, Limosa Environmental was deemed the most economically advantageous tender and were contracted to carry out the study.

3.6.2 Archaeology

An archaeological impact statement on the proposed Kilgarvan Sewerage Scheme was undertaken in May 2006 by the Kerry County Archaeologist.

The desk study was carried out in order to attempt to identify areas of archaeological potential and known archaeological sites and monuments in the study area.

There are two recorded monuments in the immediate area of Kilgarvan (Ke094 004) the late medieval parish church and (Ke094 053) a bullaun stone, possibly associated with the graveyard but until recently built into a bridge on the opposite side of the road to the church and graveyard, which has recently been taken down and the stone has been moved 5m further south as part of works to remove a dangerous bend on the road.

No previously unidentified archaeological sites or features were noted in the Greenfield areas of the scheme associated with the waste water treatment plant. However there is a possibility that sub-surface archaeological features or strata may be encountered during works in this area.

It is therefore recommended that all soil stripping and excavation associated with the construction of the treatment plant be monitored, under license from the Department of Environment, Heritage & Local Government, by a suitably qualified archaeologist.

A full copy of the Archaeology Report is contained in **Appendix 11**.

3.6.3 Flora and Fauna

A terrestrial ecological assessment was undertaken for each of the seven villages under this study in April / May 2006 by Limosa Environmental Ltd.

A desk study was carried out in order to identify areas of ecological importance that may be potentially impacted by the development. A preliminary habitat assessment was carried out for each of the potential sites following the desktop study.

The proposed development consists of an upgrade and expansion of the existing WWTP. The existing site is centred within three agricultural fields. The site is surrounded by a stone wall (BL1) with hedgerow (WL1) and tree line (WL2) in places. The field to the east of the site is classified as wet grassland and has abundant Iris in the lower lying and wetter areas. The field to the east of the site is classified as improved agricultural grassland (GA1). A thick bramble scrub (WS1) corridor extends between the site and the dwellings to the north east. The field to the south of the site lying between the site and the river is classified as wet grassland.

The further development of the WWTP site will have a minor negative impact on grasslands and a minor to moderate impact on the scrub, hedgerows, and the Roughty River due to habitat loss and disturbance.

In order to undertake a detailed ecological impact assessment it is recommended that the following studies, be undertaken including breeding bird survey, mammal survey and Phase One habitat survey.

A full copy of the Flora and Fauna Report is contained in **Appendix 9**.

3.7 Suitable Site Locations

The land immediately to the northwest and adjacent to, the site of the existing WWTP is considered the most appropriate for the location of the proposed Waste Water treatment Plant for reasons set out below.

3.7.1 Proposed Site - WWTP

A proposed site (approximately 0.6ha) for the proposed Waste Water Treatment Plant has been identified in red on drawing Y5349/PR/507 **in Appendix 12.** The site is adjacent to the existing WWTP Site and is located to the south of the village and near the Roughty River. Access to the proposed WWTP will be from the Bantry Road, north of Cahergal Bridge and through the existing WWTP site. The access road will be approximately 4m wide and 95m in length.

It is proposed to discharge the treated effluent to the Roughty River as is the current practice, via an outfall location point identified by the co-ordinates Easting 100554.8 and Northing 72909.1. A new 300mm diameter outfall is proposed as the location of the existing outfall is not best suited for the proposed WWTP layout, the condition of the eisitng outfall is unknown and its capacity is unlikely to be adequate to cater for future flows for a PE of 2,000 compared to the current design PE of 250.

The purchase of the site is currently being proceeded by Kerry County Council via active negotiations. Associated wayleaves for the outfall pipe and the access road and inflow pipe to the proposed WWTP have also been prepared. As the landowner is agreeable to the sale, **Part 8 Planning** for the WWTP and associated works can be progressed.

Photograph 3.1 View of proposed Wastewater Treatment Plant Site looking west

SECTION 4 PROPOSED NETWORK

4.1 General

This section of the Report describes the design of the proposed new collection system. The objectives of the hydraulic analysis are to design the new foul sewers to convey the peak diurnal foul flows from the existing and proposed future development areas into the new collection system.

Loadings from the existing dwelling and potential development areas are calculated in Section 3 of this Report. As discussed in this section and for the purpose of this study the Kilgarvan boundary was agreed with Kerry County Council. This included a core network which covered the current development boundary and the proposed future development boundary.

The new foul sewers must be designed to convey the peak foul flows from both the current developed lands and also the undeveloped lands in the environs of the future development boundary. It is considered essential that the design of the sewer systems allows for some flexibility with regards to future development densities and occupancy rates. Although the rates and densities assumed in Section 3 of this report may not be realised, for the purposes of sewer design all of the land within the future development boundary, with the exception of 20% provision for open space, has been assumed capable of being fully developed. Therefore all sewer designs have been designed to cater for maximum development in the part of the catchment served by that sewer. Therefore the predicted total population for the network in 2056 is **2641PE**.

The proposed new sewer systems are divided into Phase One and Phase Two. Phase One represents new/refurbished sewer systems for the existing population and infill development known as the core development. Phase Two represents the surrounding areas to be served by future development.

In the case of Kilgarvan the future development proposed in Phase Two will be adjacent to the core network and therefore it will be up to the developer to connect into the Phase One sewer network proposed for the existing dwellings.

It is expected that there will be a high level of population growth within the village following the installation of the Main Drainage Scheme.

Due to the small size and simplicity of the network no models were required to be built in order to determine the size of the sewer pipes required. Calculations were therefore undertaken using an excel spreadsheet. It has been assumed that 50% of the existing houses have combined systems, and therefore the foul sewer is expected to get a surface water contribution in addition to foul flows. The sewer network therefore has been designed to cater for 50% storm contributions from the existing dwellings. A rainfall intensity for a 2 year return period was chosen, together with an impervious area of 100m^2 for each dwelling. In line with DEHLG policy it is envisaged that all future developments will provide independent soakaways or separate storm water collection systems as stated in section 2.11.

In accordance with the brief therefore all future developments have been design to cater for flows of 6 times the average Dry Weather Flow at 180l/hd/day. The foul sewer design is based on a minimum 225mm diameter sewer laid to a minimum gradient of 1/150.

As part of this report topographic surveys were undertaken of the existing road profile within the development boundary and existing sewer manholes cover levels (if found) were levelled and then dipped to ascertain the invert of the existing drainage system.

The proposed new foul sewer layouts and long sections are shown on drawings Y5349/PR/509 – 515 included within **Appendix 12**.

4.2 Proposed Foul Network

The proposed foul network is to consist of 225mm and 300mm gravity sewers. An assessment has been made as to the most appropriate material for these assets and it is recommended that the gravity sewers are constructed of precast concrete pipes which are less susceptible to damage during construction, and maintains its shape, by not deflecting as does flexible pipe. Flexible pipe must deflect to reach its maximum installed performance. Flexible pipe is at least 95% dependent on soil support and the installation expertise of the contractor. This is the single most critical factor for using flexible pipe. Precast Concrete pipe in comparison, has an unlimited range of pipe strengths from which to choose, and strength is demonstrated prior to installation. By specifying precast concrete pipe:-

- Historical Data demonstrate a product life of 100 years or more for concrete pipes;
- Precast concrete pipes are less susceptible to damage during construction and maintains its shape, by not deflecting as does flexible pipe;

- There is less reliance on quality installation by the installer;
- There is lower embedment material cost;
- There is less compaction required;
- It is easier to maintain grade and alignment;
- There are no excess deflection concerns;
- A recent study by the BRE concluded that precast concrete over a 50 year life cycle is more environmentally sound than PVC, HDPE and polypropylene pipelines;
- There is a lower maintenance cost over the design life of the project;
- There is a reduced likelihood of failure;
- A lower risk for the owner of the project, and reduced overall liability to the public after the project has been commissioned.

The proposed foul network comprises of a main sewer that runs along the R569 with a sewer running to the north and south down to the existing WTTP. It is proposed to undertake the following upgrading / replacement of the existing network system:-

- The Eastern Collector Sewer extends from St Garvan's Terrace a new housing estate at EF30.1 to PF12 in the centre of the Village. From the CCTV survey work the existing sewers within the new housing estate are in good condition and are therefore to be retained. The existing sewer from MH 11 to MH 8 is currently located within the back gardens of private residential dwellings. It is proposed to lay a new sewer within the road to replace this existing sewer which is in poor structural condition. The sewer from PF18 to PF16 is also to be replaced as by bringing the sewer into the main road requires this section of sewer to be laid at a greater depth. The section of sewer from PF15 to PF12 is also to be upsized to a 300mm sewer to accommodate future development. Flows from PF17 to EF17.2 and EF19 to EF19.1 have also been identified as requiring relining.
- The Northern Collector Sewer extends beyond the entrance to the School and Garda Station. The existing 150mm sewer form PF16.6 to PF16.4 is to be upsized to 225mm to accommodate predicted future development within the area. The existing sewer from PF16.4 to PF16 was also found to be in poor structural condition mainly as a result of insufficient cover (less than 1 meter in places). Therefore the section of sewer is to be replaced at a minimum depth of cover of 1.2 metres.

- The Eastern Collector Sewer extends to Glenview Cottage. The existing 150mm sewer from PF12.8 to PF12.4 is to be upsized to 225mm to accommodate

predicted future development within the area. The existing sewer from PF12.4 to PF12 was also found to be in poor structural condition and requires replacement.

- The Southern Sewer which collects all flows from the catchment at PF12 and transports the flows to the existing WWTP is to be replaced and upsized from 225mm to 300mm to accommodate the future development anticipated within the whole catchment.

The proposed network infrastructure is shown on drawings Y5349 / PR / 509 – 515 in **Appendix 12** and summarised below in **Table 4.1**.

Table 4.1: Summary of Foul Network

Network	Size (mm)	Material and Length	Type	Total Length (m)
		Concrete		
PF16.6 – PF16	225mm	426m	Foul - Gravity	426m
PF12.8 – PF12	225mm	461m	Foul - Gravity	461m
PF22.1 – PF15	225mm	327m	Foul - Gravity	327m
PF15 – PF1	300mm	540m	Foul – Gravity	540m
Total		**1754m**		**1754m**

Surface water is to be limited to the contribution from existing dwellings only with all future development subject to the storm water policy outlined in section 2.11.

The majority of the foul sewers are laid at a depth less than 3.0m.

The design and hydraulic analysis on the proposed network are included in **Appendix 3**. Designs for the pipe diameters were undertaken for both the existing 2006 population and the projected population to 2056.

4.4 Proposed Storm Network

New storm sewers must be designed to convey the stormwater runoff from undeveloped lands in the environs of Kilgarvan. The surface water from new developments may be discharged to ground (if ground conditions are suitable) or be conveyed into the Roughty River. All future developments will be required to install separate foul and surface water

sewers. The proposed storm sewer network for Kilgarvan is therefore be developer driven and they will be required to install new surface water sewers into local streams/Roughty River. Any new developments should also incorporate SUDS techniques of attenuation and the use of permeable materials for car parks etc. in order to limit the amount of surface water entering the Roughty River.

Table 4.2 and **4.3** on the next page summaries the future development areas for both Phases and details the expected amount of run off assuming 10% of the area is roads 70% is developed land and 20% is open space. Details of the calculations can been seen in **Appendix 3.2**.

Table 4.2 – Storm Water from Future Developments

CATCHMENT AREA REF.	Total Area	TOTAL FLOW FROM AREA	Attenuated @ 13l/s/Ha	1 Hrs Storage Volume	Comments
	Ha	l/s	l/s	m^3	
CA 1	0.417	17	5.42	41.7	Developer to install new 225mm/300mm/375mm/450mm Storm Sewer along road to the Roughty River
CA 2	0.196	8	2.55	19.6	Developer to install new 225mm/300mm/375mm/450mm Storm Sewer along road to the Roughty River
CA 3	0.267	11	3.47	27.1	Developer to install new 225mm/300mm/375mm/450mm Storm Sewer along road to the Roughty River
CA 4	1.038	42	13.49	103	Developer to install new 225mm/300mm/375mm/450mm Storm Sewer along road to the Roughty River
CA 5	1.034	42	13.44	103	Developer to install new 225mm/300mm/375mm/450mm Storm Sewer along road to the Roughty River
CA 6	1.441	59	18.73	145	Developer to install new 225mm/300mm/375mm/450mm Storm Sewer along road to the Roughty River
CA 7	0.792	32	10.30	78.1	Developer to install new 225mm/300mm/375mm/450mm Storm Sewer along road to the Roughty River
CA 8	0.845	35	10.99	86.4	Developer to install new 225mm/300mm/375mm/450mm Storm Sewer along road to the Roughty River
CA 9	1.237	51	16.08	126	Developer to install new 225mm/300mm/375mm/450mm Storm Sewer along road to the Roughty River
CA 10	1.232	50	16.02	122	Developer to install new 225mm/300mm/375mm/450mm Storm Sewer along road to the Roughty River
CA 11	2.470	101	32.11	248	Developer to install new 225mm/300mm/375mm/450mm Storm Sewer along road to the Roughty River
CA 12	1.381	57	17.95	141	Developer to install new 225mm/300mm/375mm/450mm Storm Sewer along road to the Roughty River
CA 13	0.802	33	10.43	81.3	Flows to gravitate directly from the development into Roughty River due south
CA 14	1.156	47	15.03	115	Flows to gravitate directly from the development into Roughty River due south
CA 15	0.930	38	12.09	93.3	Flows to gravitate directly from the development into Roughty River due south
CA 16	1.401	57	18.21	140	Flows to gravitate directly from the development into Roughty River due south
CA 17	2.430	99	31.59	243	Flows to gravitate directly from the development into Roughty River due south
CA 18	0.087	4	1.13	10.3	Flows to gravitate directly from the development into Roughty River due south
CA 19	0.308	13	4.00	32.4	Developer to install new 225mm/300mm/375mm/450mm Storm Sewer along road to the Roughty River
CA 20	0.976	40	12.69	98.3	Developer to install new 225mm/300mm/375mm/450mm Storm Sewer along road to the Roughty River
CA 21	1.873	77	24.35	190	Developer to install new 225mm/300mm/375mm/450mm Storm

					Sewer along road to the Roughty River
CATCHMENT AREA		**TOTAL**	**Attenuated @ 13l/s/Ha**	**1 Hrs Storage Volume**	**Comments**
REF.	**Total Area**	**FLOW FROM AREA**			
CA 22	2.220	91	28.86	224	Developer to install new 225mm/300mm/375mm/450mm Storm Sewer along road to the Roughty River
CA 23	3.368	138	43.78	339	Developer to install new 225mm/300mm/375mm/450mm Storm Sewer along road to the Roughty River
CA 24	0.285	12	3.71	29.8	Developer to install new 225mm/300mm/375mm/450mm Storm Sewer along road to the Roughty River
CA 25	0.176	7	2.29	17	Developer to install new 225mm/300mm/375mm/450mm Storm Sewer along road to the Roughty River
CA 26	1.954	80	25.40	197	Developer to install new 225mm/300mm/375mm/450mm Storm Sewer along road to the Roughty River
CA 27	2.163	89	28.12	219	Developer to install new 225mm/300mm/375mm/450mm Storm Sewer along road to the Roughty River

Table 4.3: Summary of Surface Water Network

Network	Size (mm)	Material and Length
		Concrete
PS11.7 – PS11.4	225mm	123m
PF21 – PS18	225mm	221m
PS11.4 – PS11.3	300mm	80m
PS18 – PS13	300mm	308m
PS11.3 – PS11	375mm	193m
PS13 – PS12	375mm	54m
PS12 - PS3	375mm	300m
PS3 - Outfall	450mm	160m
Total		**1439m**

The proposed cost for laying these surface water sewers is €565,776 further details can be seen in **Appendix 5.7 & 5.8.**

Details of the proposed sections for the surface water sewers to be constructed by the developers within the roadway are shown on drawings Y5349/PR/718 - 720 within **Appendix 12.**

SECTION 5 PROPOSED TREATMENT

5.1 General

There are many suitable types of systems for treating the wastewater for medium sized communities. The appropriateness of a particular treatment system will depend on;

- the physical characteristics of the site;
- the chemical and biological make up of the wastewater load(total flow, BOD, Suspended Solids, Nitrogen, Ammonia, Phosphorus, levels etc);
- the variation in the flow and load;
- the assimilative capacity of the receiving waters;
- the type of sludge treatment and disposal; and
- the operation and maintenance capabilities of the owner.

5.2 Wastewater Treatment Load

The design flow and load for the proposed Kilgarvan Waste Water Treatment Plant (WWTP) is based on unit loads as set out in **Table 5.1** below for domestic type raw effluent*. The total flow and load has been calculated as detailed in **Table 5.2** on the next page;

Table 5.1- Unit Loads

Parameter	Load	Units
BOD_5	60	g/head
TSS	75	g/head
Flow	180	l/head
Total Nitrogen	40.6	mg/l
Ortho Phosphates	7.1	mg/l
Ammonia	31.5	mg/l

* No significant industrial or trade wastes arise in Kilgarvan catchment as previously stated.

Table 5.2 Design Flow and loading for Kilgarvan WWTP

		2006	2016	2026
Domestic	Flow (l/d)	61,020	172,440	296,460
	Load (PE)	339	958	1,647
	BOD_5	20	57	99
	SS	25	72	124
Non-Domestic	Flow (l/d)	25,740	43,560	63,540
	Load (PE)	143	242	353
	BOD_5	9	15	21
	SS	11	18	26
Total	Flow (l/d)	86,760	216,000	360,000
	Load (PE)	482	1,200	2,000
	BOD_5	29	72	120
	SS	36	90	150

5.3 Discharge Standards

5.3.1 Urban Waste Water Treatment Directive

The Urban Waste Water Treatment Regulations, (S.I. 254 of 2001) give effect to provisions of the Urban Wastewater Treatment Directive (91/271/EEC). The 2001 Regulations cover various requirements in relation to the collection and treatment of urban wastewater.

Article 3 states that a sanitary authority shall provide a collecting system for urban waste water … by 31 December 2005 for every agglomeration with a population equivalent between 2,000 and 15,000.

The PE of Kilgarvan is less than 2,000 at present and is not expected to exceed 2,000 in the foreseeable future. A collection system therefore is not required by the UWWTR.

Article 4 of the UWWTR states that in the case of urban waste water entering collecting systems, a sanitary authority shall provide treatment plants which provide for secondary treatment or an equivalent treatment –

(b) by 31 December 2005 in respect of all discharges from agglomerations with a population equivalent of between 10,000 and 15,000;

(c) by 31 December 2005 in respect of all discharges to freshwaters and estuaries from agglomerations with a population equivalent of between 2,000 and 10,000.

Neither (b) or (c) apply to Kilgarvan.

Article 7 of the UWWTR 2001 states that in respect of *discharges to freshwater and estuaries from agglomerations with a population equivalent of less than 2,000 and in* respect of *discharges to coastal water from agglomerations with a population equivalent of less than 10,000 sanitary authority shall ensure by 31 December 2005, that urban waste water entering a collection system shall before discharge be subject to **appropriate treatment'***.

"**Appropriate Treatment**" means treatment of urban waste water **by any process** and/or disposal system which after discharge allows the receiving waters to meet the relevant quality objectives and the relevant provisions of Directive and of other Community Directives.

The **Part 1 of the Second Schedule** of the UWWTR 2001 states that Treated Effluent should have the characteristics shown in **Table 5.3** below in order to meet secondary treatment standards.

Table 5.3 Treated Effluent Characteristics

Parameter	Concentration		Minimum % of Reduction
BOD_5	25.0	mg/l O_2	70-90
SS	35.0	mg/l	90
COD	125	mg/l 0_2	75

In the case of fresh water quality, such as in the Roughty River further Community Directives, in addition to the Urban Waste Water Treatment Directive that must be considered are as follows:

- Surface Water Directive(75/440/EEC) as implemented by SI 294 of 1989;
- Bathing Water Directive(76/160/EEC) as implemented by SI No 177 of 1998;
- Freshwater Fish Directive(78/659/EEC);
- Local Government (Water Pollution) Act, 1977 (Water Quality Standards for Phosphorus Regulations 1998(SI No 258 of 1998);

- Nitrates Directive(91/676/EEC) 1991;
- Water Quality (Dangerous Substances Regulations) 2001(S.I. No 12 of 2001);
- Memorandum No. 1 Water Quality Guidelines 1978.

5.3.2 Surface Water Directive

As water is not abstracted from Roughty River downstream of the site of the proposed outfall, Council Directive 75/440/EEC 1975 and the associated EC (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations 1989 (SI No 294 of 1989) are not applicable. Therefore, there are no further refinements of the treated effluent characteristics listed in **Table 5.3** arising from the Surface Water Directive.

5.3.3 Bathing Water Directive

Council Directive 76/160/EEC 1975 concerning bathing water quality and the associated Bathing Water Regulations (SI No 177 of 1998) lay down quality requirements for inland and coastal waters designated bathing areas. The quality standards rely predominantly on microbiological parameters. The Roughty River is not a designated bathing water. Therefore, the treated effluent standards will not be influenced by the Bathing Water Directive.

5.3.4 Freshwater Fish Directive

Council Directive 78/659/EEC 1978 on the quality of fresh waters needing protection in order to support fish life was given effect in Ireland through the EC (Quality of Salmonid Waters Regulations) 1988 (SI No.293 of 1988). The South Western Regional Fisheries Board has advised that the Roughty River should be considered a salmonid water although it is not designated so under the 1988 Regulations. Therefore the treated effluent should not impact on the ability of the receiving water to reach the water quality standards in the 1988 Regulations listed in **Table 5.4** below

Table 5.4 Salmonid Water Quality Standards

Parameter	Concentration		Standard
BOD_5	<5.0	mg/l O_2	>95% of samples over a period of 12 months where sampling is carried out at least once per month
SS	<25.0	mg/l	Average concentration over a period of 12 months
Nitrites	<0.05	mg/l NO_2	>95% of samples over a period of 12 months where sampling is carried out at least once per month
Total Ammonium	<1	mg/l NH_4	>95% of samples over a period of 12 months where sampling is carried out at least once per month

It should be that the Freshwater Fish Directive states a limit for BOD_5 of 3mg/l.

5.3.5 Phosphorus Regulations 1988

The Local Government (Water Pollution) Act 1977 (Water Quality Standards for Phosphorus) Regulations 1998(SI No. 258 of 1998) were introduced to counter eutrophication observed throughout Irish watercourses (rivers and lakes only) and also to comply with the 1976 Dangerous Substances Directive.

The Regulations oblige Local Authorities to maintain or improve the water quality at any part on a river or lake, by 2007, by reference to the biotic indices/Q-rating or to the concentration of molybdate-reactive phosphate (MRP) although the Q-rating is seen as a better indicator of long term water quality than the MRP. No deterioration in water quality is allowed. The target values are as indicated in **Table 5.5** below;

Table 5.5 Phosphorus Regulations Target Values

Existing Q Value	Target Q-Value	Target MRP (µg P/l)
5	5	15
4/5	4/5	20
4	**4**	**30**
3/4	4	30
3	3/4	50
2/3	3/4	50
<2	3	70

At the ford downstream of the Slaheny River confluence the EPA flow monitoring station indicated an existing Q value of 4 in September 2003. The Aquafact International Services Ltd grab samples from 2006 recorded a Q level of 3-4 upstream and downstream of the proposed WWTP outfall. The Target Q Value for the Roughty River at the location of the proposed outfall is 4 with a maximum Ortho-phosphate level of 0.03mg/l PO_4. The discharge of treated effluent from the proposed WWTP should not result in the Ortho-phosphate level exceeding 0.03mg/l PO_4 in the receiving waters.

5.3.6 Nitrates Directive

Council Directive 91/676/EEC (The Nitrates Directive) 1991 is concerned with the protection of waters from pollution caused by nitrates from Agricultural Sources. Under Ireland's implementation of the Nitrates Directive the whole country has been

designated as a Nitrate Vulnerable Zone. The South Western Regional Fisheries Board advises that although the Roughty River is, *'not designated sensitive water for Eutrophication, consideration should be given to the discharge of Total Nitrogen concentrations in the effluent of 15mg/l N'.* It is considered good practice to limit the level of nitrates in the effluent to 15mg/l in order to not adversely impact on receiving water quality.

Table 5.6 Nitrates Regulations Target Values

Parameter	Concentration	
Total Nitrogen	15	mg/l

5.3.7 Water Quality Regulations

The Water Quality (Dangerous Substances Regulations) 2001(SI No 12 of 2001) apply to, the licensing of new trade and sewerage effluents and to the review of existing licenses granted under Section 4 and Section 16 of The Local Government (Water Pollution) Act (No 1, 1977). Any new licenses granted by Kerry County Council or the Environment Protection Agency (EPA) will need to comply with the requirements of these regulations.

5.3.8 Memorandum No. 1 Water Quality Guidelines 1978

The Eight Report of the Royal Commission Standards on Sewage Disposal (dated 1912) formed the basis for Memorandum No. 1 Water Quality Guidelines 1978, as issued by the Department of the Environment's Technical Committee on Effluent and water Quality Standards.

In accordance with the Technical Memorandum No. 1 the normal effluent standards were 20mg/l BOD_5 and 30 mg/l Suspended Solids with a minimum dilution factor of **1:8** in the discharge of the treated effluent to a watercourse, regardless of treatment. In addition Technical Memorandum No. 1 advised that if a watercourse, following the discharge of a treated effluent, has a BOD_5 level of any less than 4mg/l it will not show signs of pollution. Technical Memorandum No. 1 Standards have been superseded by the Urban Waste Water Directive but the dilution factor of 1:8 is still used as a guideline when determining the assimilative capacity of a receiving water.

5.4 Waste Assimilative Capacity of Receiving Waters

5.4.1 Assimilative Capacity

Receiving waters should have a capacity to assimilate effluent discharges without showing signs of pollution. The receiving water for the proposed Kilgarvan Sewerage Scheme is the Roughty River. It is desirable that any effluent discharge to the Roughty River should not;

- increase the BOD_5 level by more than 1mg/l;
- increase the overall BOD_5 in the water to more than 4mg/l (ideally 3mg/l);
- increase the Ortho Phosphate level in the water to more than 0.03mg/l;
- increase the Phosphorus level by more than 0.010mg/l.

The estimated water quality of the Roughty River before and after discharge for a 2016 PE of 1,200 and a 2026 PE of 2,000 has been calculated as shown in **Tables 5.7** and **5.8** below.

Table 5.7 Roughty River Water Quality Before and After Discharge for 2016 PE of 1,200

	Parameter	Units	Treated Effluent	Roughty River before Discharge	Roughty River after Discharge
	PE		1,200		
	Flow	m^3/head/day	0.18		
	Total Flow	m^3/day	216		
	95%ile Flow	m^3/day		43,200	43,416
Concentrations	BOD_5	mg/l	25	2	2.1
	SS	mg/l	35	2	2.2
	Total Nitrogen	mg/l - N	15	0.36	0.4
	Nitrate(NO_3)	mg/l NO_3	25	<0.5	0.62
	Nitrite(NO_2)	mg/l- NO_2	0.5	<0.25	0.25
	Non ionised Ammonia	mg/l- NH_3	0.02	<0.08	0.08
	Total Phosphorus	mg/l - P	2	0.06	0.07
	Ortho Phosphates	mg/l	2	<0.01	0.02
Total Loads	Total BOD	g/day	5,400	86,400	91,800
	Total SS	g/day	5,400	86,400	91,800
	Total Nitrogen	g/day	3,240	15,552	18,792
	Total Nitrate(NO_3)	g/day	5,400	21,600	27,000
	Total Nitrite (NO_2)	g/day	108	10,800	10,908
	Total Non ionised Ammonia	g/day	4.3	3,456	3,460
	Total Phosphorus	g/day	432	2,592	3,024
	Ortho Phosphates	g/day	432	432	864

An ortho-phosphate level of 2mg/l is required in the treated effluent in order to limit the increase in the receiving waters to less than 0.01mg/l. Secondary treatment standards for BOD and SS are recommended therefore in order to provide for reduction in nutrient levels in the treatment process to required levels. Based on the discharge flow in Table 5.7 and the 95%ile flow of the Roughty River, there is a dilution capability of approximately 1:200 in the river for a PE of 1,200. The increase in the BOD_5 level is less than 1 mg/l and the levels of suspended solids, Total Nitrogen and Nitrate are within the limits required to ensure that there is no unacceptable impact on the water quality of the Roughty River. The level of Non-ionised Ammonia and Nitrite before discharge is above the standards for a salmonid river. It is expected that there would be full denitrification in the proposed WWTP during the secondary treatment process so that the effluent from the WWTP will not contribute any further to the current levels of non ionised ammonia and Nitrite in the river.

Table 5.8 Roughty River Water Quality Before and After Discharge for 2026 PE of 2,000

	Parameter	Units	Treated Effluent	Roughty River before Discharge	Roughty River after Discharge
	PE		2,000		
	Flow	m^3/head/day	0.18		
	Total Flow	m^3/day	360		
	95%ile Flow	m^3/day		43,200	43,560
Concentrations	BOD_5	mg/l	25.0	2.0	2.2
	SS	mg/l	35.0	2.0	2.3
	Total Nitrogen	mg/l - N	15.0	0.36	0.5
	Nitrate(NO_3)	mg/l NO_3	25.0	<0.5	0.70
	Nitrite(NO_2)	mg/l- NO_2	0.50	<0.25	0.25
	Non ionised Ammonia	mg/l- NH_3	0.02	<0.08	0.08
	Total Phosphorus	mg/l - P	2.0	0.06	0.08
	Ortho Phosphates	mg/l	1.0	<0.01	0.018
Total Loads	Total BOD	g/day	9,000	86,400	95,400
	Total SS	g/day	9,000	86,400	95,400
	Total Nitrogen	g/day	5,400	15,552	20,952
	Nitrate(NO_3)	g/day	9,000	21,600	30,600
	Nitrite(NO_2)	g/day	180	10,800	10,980
	Total Non ionised Ammonia	g/day	7.2	3,456	3,463
	Total Phosphorus	g/day	720	2,592	3,312
	Ortho Phosphates	g/day	360	432	792

An ortho-phosphate level of 1mg/l is required in the treated effluent in order to limit the increase in the receiving waters to less than 0.01mg/l. Secondary treatment standards for BOD and SS are recommended therefore in order to provide for reduction in nutrient levels in the treatment process to required levels. Based on the discharge flows in **Table 5.9** and the 95%ile flow of Roughty River, there is a dilution capability of approximately 1:120 in the river for a PE of 2,000. The increase in the BOD_5 level is less than 1 mg/l and the levels of suspended solids, Total Nitrogen and Nitrate are within the limits required to ensure that there is no unacceptable impact on the water quality of the Roughty River. The level of Non-ionised Ammonia before discharge is above the standards for a salmonid river. As for a PE of 1,200, it is expected that there would be full denitrification in the proposed WWTP during the secondary treatment process so that the effluent from the WWTP will not contribute any further to the current levels of non ionised ammonia and nitrite in the river.

Photograph 5.1 View of Roughty River looking West

The point of discharge of treated effluent from the proposed outfall has been identified on drawing Y5349/PR/505 in **Appendix 12** as Easting 100554.8 and Northing 72909.1. A wayleave will be required along the length of the outfall.

5.5 Discharge Specification

The proposed wastewater treatment plant will consist of primary and secondary treatment to achieve a minimum effluent standard shown in **Table 5.10** on next page.

Table 5.10 Treated Effluent Standards for Kilgarvan WWTP

Parameter	Limit	Units
BOD_5	25.0	mg/l
SS	35.0	mg/l
COD	125.0	mg/l
Total Nitrogen	15.0	mg/l - N
Nitrate(NO_3)	25	mg/l NO_3
Nitrite(NO_2)	0.05	mg/l- NO_2
Non Ionised Ammonia(NH_3)	<0.02	mg/l- NH_3
Total Phosphorus	2	mg/l - P
Ortho Phosphates	2 (1,200PE) 1 (2,000PE)	mg/l

5.6 Wastewater Treatment Plant

An indicative plant design has been prepared and includes for a control unit/building, inlet works and pump sump (including screening and grit removal), flow measurement, emergency storage, primary treatment and secondary treatment, an effluent outfall, site access road and a site boundary fence. Refer to drawing Y5349/PR/507 in **Appendix 12** for details. The pre-treatment/inlet works and the outfall of the proposed WWTP have been sized for the 2026 PE of 2,000 whereas the secondary treatment processes have been sized for the 2016 (Phase One) PE of 1,200 with provision for expansion as required.

The indicative plant layout has been designed using the hydraulic principals of **BS 6297:1983** and the design ratios shown in **Appendix 4.**

5.6.1 Pre-Treatment

The aim of the pre-treatment is to remove as much, organic load and floating and suspended objects, as possible before primary treatment. Therefore the inlet works should include a mechanical screen and a bypass screen to remove large solids. In addition, a washpactor will provide screen washing and compaction for the resultant screenings. A grit trap complete with a grit classifier is also recommended as part of the inlet works as the existing system is a combined foul and storm system. The screens should have a maximum spacing of 6mm and be sized such that the maximum flow through the screens is 90m^3/hr (6DWF for Phase Two). The inlet works should be fully covered in order to minimise odour nuisance. Due to the corrosive nature of the gases emanating from the sewage, all materials should be selected to be resistant to attack from sulphuric acid.

5.6.2 Secondary Treatment

An extended aeration plant or sequence batch reactor are both suitable processes for secondary treatment. For the purposes of preparing cost estimates and producing layout drawings, an extended aeration plant has been adopted as the treatment process for the purposes of this report. Final settlement tanks (clarifiers) can be constructed from reinforced concrete or glass coated steel. The latter is cheaper and easier to build than the former, but will have higher maintenance costs.

The design capacities of the recommended process units, based on an extended aeration plant, are shown in **Table 5.12** below.

Table 5.11 Volumes and Capacities of Unit Processes for Kilgarvan WWTP

Process Unit	Unit	Year 2016	Year 2026
Fine & Coarse screens	m^3/hour	54	90
Flow Measurement	m^3/hour	54	90
Storm Tanks	m^3	54	90
Primary Settlement Tanks (if required)	m^3	64	112
Biological Treatment (3xDWF)	m^3	300	500
Clarifiers	m^3	54	90
Gravity Sludge Thickening Tank (30 days storage)	m^3	100	167

5.6.3 Tertiary Treatment

Tertiary Treatment for nutrient reduction (phosphates) will be required. This is likely to involve chemical dosing and precipitation.

5.6.4 Constructed Wetlands

Constructed wetlands, i.e., reed beds treats waste water in a similar manner as conventional aerobic/anaerobic treatment processes. As with conventional treatment, an environment is created for the growth of bacteria. The treatment process is complex and involves interaction of various components of the wetland with pollutant removal mechanisms.

Quantification of the exact removal mechanisms is not completely understood, though it is generally recognised form empirical work that the wetland plants enhance the removal of organic loading and nutrients e.g. Nitrogen and Phosphorus. The percentage removal efficiencies for various parameters like BOD_5, Phosphorus, Suspended Solids etc. and their relationship to each other is as yet unresolved.

Reed beds have been used on a large scale to provide tertiary treatment of effluent that has received secondary treatment. Research has shown that the use of reed beds to provide secondary treatment to UWWD standards has been limited to very small catchments, i.e., less than 100 PE. There is no evidence of reed beds providing primary and secondary treatment to UWWD standards.

Land requirements for a reed bed system are significant at approximately $19m^2$/PE which includes for 50% spare capacity for when the reed beds have to be replanted and desludged. Based on this, the area of reed bed required to serve the proposed Kilgarvan Sewerage Scheme is approximately 2.3ha for Phase One (PE= 1,200). This is more than the total area of 0.6ha identified for the entire WWTP and so reedbeds are not recommended for use in this instance.

5.6.4 Monitoring and Sampling

The influent and effluent monitoring and sampling required is as follows:-

- Provision of raw sewage continuous flow monitoring and facilities for 24-hour composite sampling.

- Provision of final effluent automatic flow monitoring and facilities for 24 hour composite sampling.

5.6.5 Control and Instrumentation

Telemetry such as a SCADA system can be used to control a treatment plant remotely. This can be particularly useful in the case of medium treatment plants such as Kilgarvan where continuous Curator presence on the site would be excessive and costly.

The treatment process will be considered further at detailed design stage when a decision on the procurement process is made. This will in effect decide whether a traditional, 'end specification' type design or a Public Private Partnership (PPP) 'performance based' specification type is produced. If a PPP type procurement contract is chosen the successful Contractor will have the option to put forward alternative treatment processes capable of delivering the required discharge standards.

This decision will be made by Kerry County Council and consideration may be given to grouping Kilgarvan with other villages for the design build operate and maintain phases of the scheme.

Although there are no statutory noise or odour limits in place in Ireland, mitigation measures will be mandatory in the wastewater treatment plant to maintain noise and odour emissions within recognised international and acceptable limits at the site boundary.

5.7 Outfall/Foreshore Licence

5.7.1 Discharge Licence

The discharge of sewage effluent to Roughty River does not require a discharge licence at this time. This is likely to change in the future.

5.7.2 Foreshore Acts 1933 and 1992

The Foreshore is the land and seabed between the high water mark on Ordnance Survey Maps and the 12 nautical mile limit. It is a requirement under the above Acts to apply for a Foreshore Licence for all new and existing outfalls discharging foul or storm water

to coastal or tidal estuaries. The Department of Communications, Marine and Natural Resources (DCMNR) is the Government Department designated for reviewing applications and granting licences. This licence is subject to an annual rent payable to the government.

In the case of Kilgarvan, the treated effluent will be discharging directly to the Roughty River which is not tidal. **Therefore a Foreshore Licence will not be required.**

5.8 Sludge

5.8.1 Sludge Disposal

Treatment and disposal of sludge from medium wastewater treatment plants can be problematic and can account for up to 50% of the operation costs of a WWTP. The daily sludge production from an extended aeration plant is estimated to be 33kg dry solids/day. This sludge will typically have a dry solids content of 1%, thus the volume of sludge produced at the proposed Kilgarvan WWTP will amount to approximately 3.3m^3/day (Phase One, PE= 1,200).

It is recommended that 30 days storage to be provided in Reinforced Concrete or Glass Coated Steel Tanks. The tanks should be covered to prevent odours. The volume of storage required is approximately 100m^3. A picket fence thickener will assist the sludge to thicken to approximately 3-4% dry solids. The volume of thickened sludge to be tankered off site would amount to approximately 25m^3 every 30 days for Phase One.

Decanted sludge return liquors generated during gravity thickening will have high BOD_5 strength and the liquors will therefore be returned for full treatment to the activated sludge plant directly as shown in the process schematic. The proposed waste water treatment plant has been designed to treat return liquors generated from gravity sludge thickening.

Disposal of sludge from the proposed Kilgarvan WWTP will be subject to the recommendations of the 2003 Sludge Management Plan for Kerry County Council. County Kerry is split into two regions identified as Region 17 - North Kerry and Region 18 - South Kerry*. The current disposal strategy implemented by Kerry County Council for all wastewater sludge produced is land application. Killarney and Caherciveen have been identified as Hub Centres.

The most cost effective and appropriate sludge treatment for Kilgarvan will be assessed and identified under separate cover as part of the upcoming County Kerry Wastewater & Sludge Project.

* Kilgarvan is located in Region No. 18 – South Kerry

SECTION 6 PROJECT PHASING, COSTS & PROCURMENT

6.1 Project Phasing

As covered in Section 3.5 it is proposed that treatment plant be completed in two phases to cater for the population up to 2016 and then 2026.

The sewer network in Phase One, the core network, is designed to the development boundaries as advised by Kerry County Council Planners and Engineers. It is anticipated that the development in Phase Two of the sewer network will be private developer driven and the proposed sewer network has been designed with this future development area taken into account. The cost associated with making these connections into the proposed network within the core has been assumed to be undertaken by the developer at his cost.

6.2 Capital Costs

The contract cost estimates for the proposed Kilgarvan WWTP are summarised in **Table 6.1**. A detailed breakdown of the costs associated with the WWTP is in **Appendix 5**.

Table 6.1 Contract Costs for Kilgarvan 1,200PE WWTP– Phase One - 1,200PE

Item	Cost
Civil Works	€398,200
M&E Works	€240,000
Sub Total WWTP Contract (excl VAT & Prelims etc.)	**€638,200**
Prelims/ Contingencies @20%	€127,640
Total WWTP Contract (excl VAT)	**€765,840**
Add VAT @13.5%	€103,388
Total WWTP Contract (incl VAT)	**€869,228**
Non Contract Costs	
Site Investigation @5%	€19,910
Land Acquisition	€117,000
Wayleaves	€3,250
Overheads/Fees/Site Supervision @ 20%	€153,168
Total WWTP Capital Cost (incl VAT)	**€1,162,556**

The contract cost estimates for the proposed Kilgarvan Collection system are summarised in **Table 6.2**. A detailed breakdown of the costs associated with the collection system is in **Appendix 5**.

Table 6.2 Contract Costs for Kilgarvan Collection System (Foul Costs Only)

Item	Cost
Gravity Sewers	€156,040
Manholes	€55,500
Reinstatement	€89,749
EO Rock Excavation	€30,629
Service Connections	€55,200
Rehabilitation	€22,400
Overpumping existing sewers during replacement	€20,000
Sub Total Collection System (excl VAT & Prelims etc.)	**€429,518**
Prelims / Contingencies @20%	€85,904
Total Collection System (excl VAT)	**€515,422**
Add VAT @ 13.5%	€69,582
Total Collection System (incl VAT)	**€585,004**
Non Contract Costs	
Site Investigation @5%	€21,476
Overheads/Fees/Site Supervision @ 20%	€103,084
Total Collection System Capital Cost (incl VAT)	**€709,564**

An overall summary of the project cost is in **Table 6.3** on the next page;

Table 6.3 – Summary of Sewerage Scheme Cost for Kilgarvan Phase One – 1,200PE

Item	Cost
Waste Water Treatment Plant (WWTP) excl VAT	€638,200
Proposed Collector Foul Sewers excl VAT	€429,518
Sub Total of Sewerage Works (excl VAT)	**€1,067,718**
Prelims / Contingencies @20%	€213,544
Total Cost of Sewerage Works (excl VAT)	**€1,281,262**
V.A.T @ 13.5%	€172,970
Total Cost of Sewerage Works (incl VAT)	**€1,454,232**
Non Contract Costs	
Site Investigation @5%	€41,386
Land Acquisition	€117,000
Wayleaves	€3,250
Overheads, Fees, Site Supervision @20%	€256,252
Total Cost of Project (incl VAT)	**€1,872,120**

6.3 Scheme Operation and Maintenance Costs

The Operation and Maintenance for the initial 20 year operating period have been calculated. Costs were estimated using recent Operation and Maintenance and Design Build and Operate tender costs for similar sized WWTP's. All operating costs have been accounted for including power, chemicals, labour, maintenance, spare parts, screening disposal and delivery of sludge to Cahirciveen for processing, and capital replacement fund costs for the 20 year operating period.

The electrical consumption cost component of the operating costs was based on an estimate of energy consumption and an electrical unit cost of €0.125/KW. **Tables 6.4** and **6.5** on the next page details the estimate Operation and Maintenance costs for the first year Operation and Maintenance costs of running the collection system and WWTP plant.

Table 6.4 WWTP - Year 1 Operating & Maintenance Costs

Item	Year 1 Cost
Labour	7,000
Electricity	2,629
Materials	1,385
Parts	2,100
Sludge Transportation	4,296.96
Total Year 1 O&M Costs (excl VAT)	**17,410.69**
Add VAT @ 13.5%	3,656.25
Total Year 1 O&M Costs (incl VAT)	**21,066.94**

Table 6.5 Collection System - Year 1 Operating & Maintenance Costs

Item	Year 1 Cost
Network Costs	
Labour (Assume 4 call outs per year @ €500 per call out)	€2,000
Total Year 1 O&M Costs (excl VAT)	**€2,000**
Add VAT @ 13.5%	€270
Total Year 1 O&M Costs (incl VAT)	**€2,270**

Using the estimate of the capital costs in **Tables 6.2 & 6.3** and the operating costs in **Tables 6.4 & 6.5** the Net Present Value (NPV) was determined based on a 20 year project life and a 5% discount rate are detailed in **Table 6.6**.

Table 6.6 Collection System and WWTP 20 year Capital & Operating Costs

Element	Costs Phase One (incl VAT)
Treatment Plant Phase One Capital Costs (incl VAT)	€1,162,556
Treatment Plant Phase One Operating Costs (incl VAT)	€389,813
Sewer Network Phase One Capital Costs (incl VAT)	€709,564
Sewer Network Phase One Operating Costs (incl VAT)	€28,289
Total Phase One Capital & Operating Costs (incl VAT)	**€2,290,222**

Further detailed breakdown of the calculations of the annual operation and maintenance costs is set out in **Appendix 5**.

6.3.1 Unit Costs

In accordance with the brief unit costs have been calculated for head of population, per house and per hectare of serviced and serviceable land. The detailed calculations of the

unit costs are set out in **Appendix 5** and is summarised below in **Tables 6.6 - 6.8** below.

Table 6.6 Unit Costs for Kilgarvan WWTP

Kilgarvan WWTP		
	2006	**2016 (Phase One)**
Total Capital Costs (incl VAT)	€1,162,556	€1,162,556
Existing/Future PE	482	1200
Unit Cost / Person	**€2,412**	**€969**
Unit Cost / Dwelling	**€7,236**	**€2,907**
Unit Cost / Serviced Land (10.96ha)	**€106,073**	**-**
Unit Cost / Serviceable Land (35.24ha)	**-**	**€32,990**

Table 6.7 Unit Costs for Kilgarvan Collection System (Foul Costs Only)

Kilgarvan Collection System		
	2006	**2016 (Phase One)**
Total Capital Costs (incl VAT)	€709,564	€709,564
Existing/Future PE	482	1200
Unit Cost / Person	**€1,472**	**€591**
Unit Cost / Dwelling	**€4,416**	**€1,773**
Unit Cost / Serviced Land (10.96ha)	**€64,741**	**-**
Unit Cost / Serviceable Land (35.24ha)	**-**	**€20,135**

Table 6.8 Unit Costs for WWTP & Collection System for Kilgarvan

Kilgarvan WWTP & Collection System		
	2006	**2016 (Phase One)**
Total Capital Costs (incl VAT)	**€1,872,120**	**€1,872,120**
Existing/Future PE	482	1200
Unit Cost / Person	€3,884	€1,560
Unit Cost / Dwelling	**€11,652**	**€4,680**
Unit Cost / Serviced Land (10.96ha)	**€170,814**	**-**
Unit Cost / Serviceable Land (35.24ha)	**-**	**€53,125**

6.4 Marginal Cost Analysis

This will be carried out under separate cover once Kerry County Council approves the final version of the Kilgarvan Preliminary Report.

6.5 Technical Innovation and Cost Effectiveness

6.5.1 Waste Water Treatment Plant

As discussed in Section 5.6 the waste water treatment process will be considered further at detailed design stage when a decision on the procurement process is made. Under a PPP type procurement contract there will be room for the successful Contractor to put forward a wide variety of technically innovative and cost effective treatment processes capable of delivering the required discharge standards. This could include package treatment plants which can be modularly expanded as the population increases.

6.5.2 Collection System

At detailed design stage the option of the possible use of no dig directional drilling techniques is to be further investigated.

6.6 Procurement

The Brief for this appointment states that;

'As it is proposed that the Preliminary Reports that are prepared under the Advance Study will be incorporated into the Public Private Partnership Strategy to be prepared under the Strategy for Delivery of the County Kerry Wastewater & Sludge Project, the preparation of Public Private Assessment Policy Reports will not be a requirement of the Preliminary Reports prepared under the Advance Study'.

SECTION 7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

7.1.1 General

This section contains the conclusions and recommendations from the previous sections for both the collection system and proposed WWTP.

7.1.2 Population Projections and Design Loadings

The existing populations were assessed by information obtained from Kerry County Council on non domestic customers together with a walk around survey of the village within the agreed existing scheme development boundary to determine the current population. Four methods were then assessed to determine the projected future population for 2016 and 2026. These assessments gave varying results between 380PE and 4420PE for the project domestic population in 2026. The current growth within the village is currently restricted due to the fact the existing public sewerage infrastructure is currently overloaded and therefore development within the catchment is currently restricted. It is generally accepted that once new sewage infrastructure has been constructed within a settlement then development is incentivised to take place. Following discussions with Kerry County Council it was agreed that the projected population for Kilgarvan should be 1,200PE for 2016 and 2,000PE for 2026. Using these agreed projections the design population for the network was calculated for 2056 design horizon which gave a population equivalent of 2641PE. These figures have been used to size the collection system and Waste Water Treatment Plant

7.1.3 Collection System

Currently there is an existing public collection system within the village that currently discharges to the overload WWTP to the south of the village. It is therefore proposed to replace the majority of the existing sewer with foul only public sewer within the highway and fields to the proposed new WWTP which is to be located adjacent to the existing plant. Due to the predicted future development within the area the existing sewer network will be required to be upsized from its existing 150/225mm diameter sewers to a pipe diameter of between 225mm and 300mm to accommodate this future growth. From the CCTV survey work undertaken certain sewers within St Garvan's Terrace and in private lands do not require upsizing and will therefore be refurbished where required in

order to avoid disruption and inconvenience to local residents and would be economical. The proposed network has been designed to accommodate 50% of the existing dwellings storm water drainage and all future developments will be foul only connections with surface water being discharged into local Streams or the Roughty River from the proposed surface water network comprising of 1439m of 225mm to 450mm pipe at an estimated cost of €565,776.

7.1.4 Treated Effluent and Sludge Disposal

The treated effluent quality standard for the Kilgarvan Waste Water Treatment Plant is based on the secondary standard of treatment as set out in the Urban Waste Water Treatment Regulations, 2001. The South Western Regional Fisheries Board has advised that the Roughty River should be considered a salmoniod water although it is not designated so under the 1988 Quality of Salmonid Waters Regulations. In addition the 1998 Phosphorus Regulations must also be considered. Both these sets of regulations are more prescriptive that the Urban Waste Water Treatment Directive. The treated effluent standards for Kilgarvan WWTP are therefore as detailed in **Table 7.1**;

Table 7.1 Treated Effluent Standards for Kilgarvan WWTP

Parameter	Limit	Units
BOD_5	25.0	mg/l
SS	25.0	mg/l
COD	125.0	mg/l
Total Nitrogen	15.0	mg/l - N
Nitrate(NO_3)	25	mg/l NO_3
Nitrite(NO_2)	0.05	mg/l- NO_2
Non Ionised Ammonia(NH_3)	<0.02	mg/l- NH_3
Total Phosphorus	2	mg/l - P
Ortho Phosphates	2 (1,200PE) 1 (2,000PE)	mg/l

As stated in Section 5.8.1 disposal of sludge from the proposed Kilgarvan WWTP will be subject to the recommendations of the 2003 Sludge Management Plan for Kerry County Council.

7.2 Recommendations

7.2.1 Collection System

It is recommended that the existing public foul sewerage system is refurbished and upsized within the core network to cater for the existing flows and the predicted flows from the proposed development highlighted within the scheme boundary. The majority of the existing network within the roads is to be replaced (mainly up sized to accommodate the predicted growth) whilst those sewers at the back of existing dwellings are to be generally refurbished by no dig techniques if possible.

The sewers shall be constructed in precast concrete pipes and concrete manholes. All future connections to the collection system shall be foul only connections and surface water will be discharge to local streams or conveyed to the Roughty River. The capital cost for installing the foul collection system in the core network is **€709,564** including VAT.

7.2.2 Waste Water Treatment Plant

An extended aeration plant system is recommended for Kilgarvan. The recommended site for the proposed Kilgarvan Waste Water Treatment Plant is located to the south of the village adjacent to the existing WWTP and the Roughty River where final effluent flows in accordance with **Table 7.1** shall be discharged from the WWTP. Telemetry will be used to control the treatment plant remotely. The capital cost for installing the WWTP to treat all Phase One flows is **€1,162,556** including VAT for the 2016 design population.

In order to provide a sewerage scheme for Kilgarvan and allow for future flows and compliance with modern design criteria and the relevant standards for receiving waters, it is recommended that the works described in this report and summarised below are carried out at an estimated capital cost of **€1,872,120 inclusive of VAT for Phase One. This equates to €3,884 per existing PE and €1,560 per future PE (Phase One - 2016).**

The recommended works are summarised as follows;

- Provision of 1214m of 225mm diameter precast concrete gravity sewers;
- Provision of 580m of 300mm diameter precast concrete gravity sewers;
- Provision of a Waste Water Treatment Plant to serve a PE of 1200 for Phase One and PE of 2,000 for Phase Two;
- Provision of 65m of 300mm diameter outfall pipe from the proposed Kilgarvan WWTP to Roughty River.

Appendix 1 – Population Equivalent Estimates

Appendix 1.1 - Kilgarvan Projected Populations

Non-domestic		143	
		Calculated	Adopted
Phase 1	2016	1031	1,200
Phase 2	2026	1449	2,000

Growth Rates	
Existing nr. of houses (2006)	113
Population per house	3
Current population	339
Houses under Construction	25
Houses seeking planning	18
2008 Population	468
Future additional houses (2011)	97
Population per house	3
Future additional population (2011)	291
Total future population (2011)	630
Average annual increase (2006 - 2011)[1]	13.2%
Average annual percentage growth rate (2006-2011)[3]	7.10%
Average annual percentage growth rate (2011-2016)[2]	1.0%
Average annual percentage growth rate (2016-2026)	1.0%

Notes:
1. based on planning trends.
2. based on CSO forecasts.
3. average of 1 and 2 above.

Population Projections		
Year	Population	PE (incl. 16% non-domestic)
2006	339	393
2007	384	445
2008	434	504
2009	492	570
2010	557	646
2011	630	731
2012	675	783
2013	723	838
2014	774	898
2015	829	961
2016	888	1030
2017	897	1040
2018	905	1050
2019	915	1061
2020	924	1071
2021	933	1082
2022	942	1093
2023	952	1104
2024	961	1115
2025	971	1126
2026	981	1137
2027	990	1149
2028	1000	1160
2029	1010	1172
2030	1020	1184
2031	1031	1195
2032	1041	1207
2033	1051	1219
2034	1062	1232
2035	1072	1244
2036	1083	1256
2037	1094	1269
2038	1105	1282
2039	1116	1294
2040	1127	1307
2041	1138	1320
2042	1150	1334
2043	1161	1347
2044	1173	1360
2045	1185	1374
2046	1196	1388
2047	1208	1402
2048	1220	1416
2049	1233	1430
2050	1245	1444
2051	1257	1459
2052	1270	1473
2053	1283	1488
2054	1296	1503
2055	1308	1518
2056	1322	1533

	2026	
Development Areas		
Area currently developed	14	ha.
Area within future development boundary	54.30	ha.
Area for future development	40.3	ha.
Percentage available for development	50%	
Area available for future development	20.15	ha.
Add available are within existing boundary		ha.
Total available area	20.15	ha.
Percentage for open space	20%	
Percentage for commercial development	0%	
Area available for residential development	16.12	ha.
Housing density	20	nr./ha.
Total number of future houses	322	
2006 Number of Houses	113	
Overall total number of houses	435	
Population per house	3	
Total future population	1306	

Appendix 1.2.1 - Kilgarvan Existing Non Domestic Customers - Non Metered

CustID	CustID(T)	Address	Town	ExtRef		Estimated
	KILGARAVAN					PE
3340010	Priest In Charge	Catholic Church	Kilgarvan	Church, Kilgarvan	Church	2
3340011	The Treasurer	Community Centre	Kilgarvan	Comm Ctre, Kilgarv	Medium Commercial Water Chg	4
3340013	Ml Healy Rae	Main Street West	Kilgarvan	Garage, Main St Wst, Kilgar	Medium Commercial Water Chg	4
3340018	John Quill	Main Street	Kilgarvan	Main Str Kilgarva	Small Shops and Offices	2
3340031	Garda Station		Kilgarvan	Kilgarvan	Large Commercial/Ind Type Premises	8
	Conserve a Sash (Window factory)				Window factory	4
	Petrol Station				Petrol Station	1
	Denis O'Sullivan				Post office	1
	The Village Grill, Restaurant					10
	Shop					2
	Primary School					20
	Hair Salon					6
	Alzheimer's Daycare & Health Centre					2
	Funeral Home					1
	Patrick Dillon				Small Shop and Offices	1
	Agnes Hegarty	Main St East			Small Shop and Offices	1
	Barry Marrinan	Main St	Kilgarvan			4
	Daniel O'Sullivan	Gortnaboul			Gortnaboul House B&B	8
	Montesorri School					4
	SHB	Gortnaboul				4
					Total	89

Appendix 1.2.2 - Kilgarvan Existing Non Domestic Customers - Metered

CustID	CustID(T)	Address	Town	Ext Ref		Reading No	Reading Date	Previous Reading	Current Reading	Consum	PE Measured	PE Estimated
	KILGARVAN											
9340001	John Foley Publican	Church Street	Kilgarvan	Church St	Licenced Premises (With Accommodation)	9	31/03/2005	1261	1267	6		10
						10	30/06/2005	1267	1273	6		
						11	30/09/2005	1273	1277	4		
9340002	Tom Randles	The Village Inn	Kilgarvan	Village Inn	Licensed Premises (No Accommodation)	9	31/03/2005	1806	1812	6		10
						10	30/06/2005	1812	1812	0		
						11	30/09/2005	1812	1812	0		
9340003	Una Shorthall	O'Reilly's Bar Main St	Kilgarvan	Main St	Licenced Premises (With Accommodation)	9	31/03/2005	8529	8626	97	6	
						10	30/06/2005	8626	8729	103		
						11	30/09/2005	8729	8812	83		
9340004	Padraig Kelliher	The Roughty Bar Main Street West	Kilgarvan	Main St Wst	Licenced Premises (With Accommodation)	9	31/03/2005	3604	3618	14	2	10
						10	30/06/2005	3618	3667	49		
						11	30/09/2005	3667	3721	54		
9340005	Daniel Healy-Rae	Publican Railway Rd	Kilgarvan	Railway Rd	Licenced Premises (With Accommodation)	9	31/03/2005	6979	7240	261	16	
						10	30/06/2005	7240	7565	325		
						11	30/09/2005	7565	7778	213		
											24	30
												54

Appendix 1.3 - Kilgarvan Planning Applications 2001-2006

Application Number	Type of Development	Location	Developer	Number of units
031651	6 NO. FULLY SERVICED SEMI-DETACHED, 2 STOREY TYPE DWELLINGS	MAIN STREET, KILGARVAN	CREATIVE HOME STORE LTD	6
032421/ 06512	CONSTRUCT A BLOCK OF 6 NO. GROUND FLOOR RETAIL UNITS AND 10 NO. FIRST AND SECOND FLOOR, TWO BEDROOM APTS, 14 NO. DETACHED 2 STOREY TYPE DWELLINGS, 1 NO. DETACHED 2 STOREY TYPE DWELLING WITH DETACHED GARAGE, 1 TERRACE OF 4 2 STOREY DWELLING ALL ACCESSED FROM MAIN STREET, 3 NO. 2 STOREY TYPE DWELLINGS	BANTRY RD., MAIN ST.,KILGARVAN	MCGHOSK CONSTRUCTION	32
021948/ 062269	CONSTRUCT 10 NO. FOUR BEDROOM STOREY AND A HALF STYLE DWELLING HOUSES, 10 NO. 3 BEDROOM DORMER HOUSES, 5 NO. 2 BEDROOM SINGLE STOREY HOUSES AND SERVICE ROADS COMPLETE WITH ASSOCIATED SITE WORKS	Kilgarvan	JohnO'Sullivan	25
031503/ 051983	CONSTRUCT 12 NO. 3 BEDROOM SEMI-DETACHED TWO-STOREY HOUSES, 4 NO. 4- BEDROOM SEMI-DETACHED TWO-STOREY HOUSES AND 8 NO. 3-BEDROOM TWO-STOREY TOWNHOUSES AND ALL ANCILLARY SITE WORKS AND PERMISSION TO DEMOLISH EXISTING SHED	GORTNABOUL, KILGARVAN, CO. KERRY	ASPEN HILL CONSTRUCTION LIMITED	24
053811	ERECT A SEMI-DETACHED DUPLEX STRUCTURE CONSISTING OF 2 GROUND FLOOR APARTMENTS WTIH 2 STOREY DWELLINGS OVER AND ASSOCIATED SITE WORKS	GORTNABOUL KILGARVAN	MICHAEL HEALY RAE	4
04746	ERECT A DWELLING HOUSE	Kilgarvan	TOMMY O'SULLIVAN	1
021198	DEMOLISH EXISTING SHED (OUT OFFICES) AND CONSTRUCT TWO STOREY DWELLING	Kilgarvan	DANIEL QUILL	1
012456	THREE FULLY SERVICED TWO STOREY DWELLINGS AND THREE DOMESTIC GARAGES WITH CONNECTION TO TOWN WATER SUPPLY AND TOWN SEWAGE,ALL ANCILLARY SITE WORKS	Kilgarvan	MR AND MRS O'SULLIVAN	3
061977	CONSTRUCT A DWELLING HOUSE AND CONNECT TO PUBLIC SEWER	GORTNABOUL KILGARVAN	MARTIN AND MICHELLE O'CONNELL	1

Total number of units in 5 years	97
Subtract duplicate applications	0
Total valid number	97
Number per year	19
Existing no. of houses	113
% increase	85.8%
Average annual increase.	13.2%

Appendix 1.4 - Kilgarvan Historical Population Trend

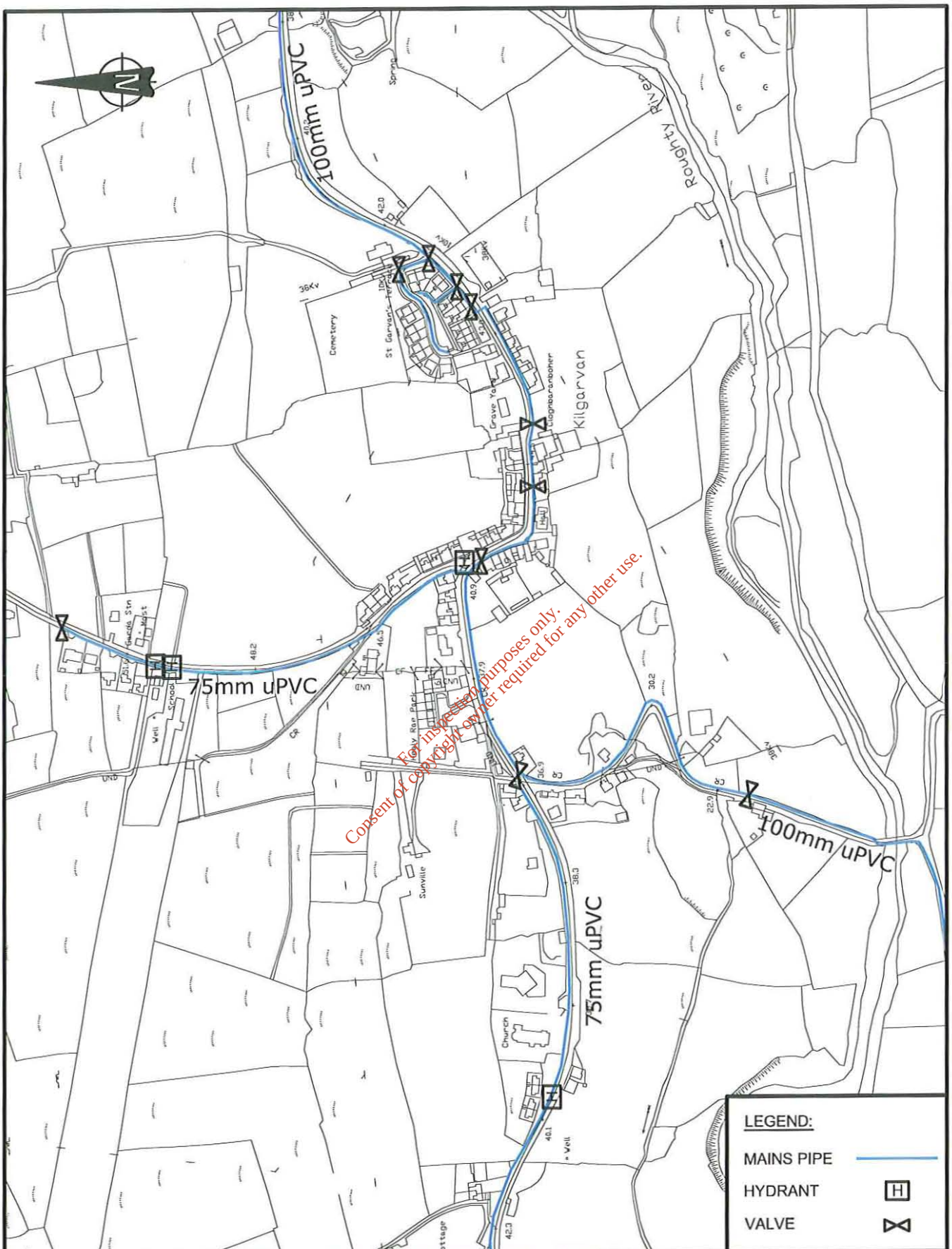
Kilgarvan DED

Year	Population	% change	Years	Average annual % change
1996	547			
2002	599	9.51%	6	1.53%
2006	626	4.51%	4	1.11%

Kilgarvan Village

Year	Population	Years	% change	Average annual % change
1961	183			
1966	203	5	10.93%	2.10%
1971	237	5	16.75%	3.15%
1979	212	8	-10.55%	-1.38%
1981	214	2	0.94%	0.47%
1986	188	5	-12.15%	-2.56%
1996	175	10	-6.91%	-0.71%
2002	156	6	-10.86%	-1.90%
2006	NA			

Appendix 2 – Design Assessment of Existing Scheme



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Project: CO. KERRY WASTEWATER & SLUDGE PROJECT ADVANCE STUDY - SOUTH KERRY

Title: KILGARVAN PUBLIC WATERMAINS

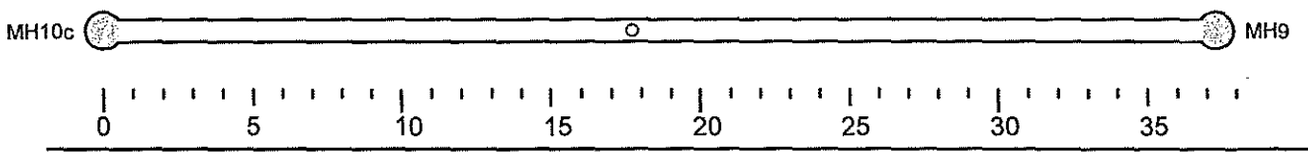
Drawn:	Checked:	Date:	Scales:	Dwg No.
M.H.	R.K.	30.01.07	1:5000 @ A4	Y5349 / PR / 550

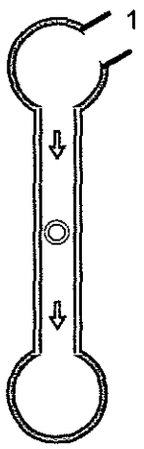
Appendix 3 – Design of Proposed Collection Network and Pumping Station (Not Applicable)

Protokol number	60				
Town	Kilgarvan				
Street	off Main Street				
Section	**MH10c - MH9** in flow direction				
Pipe material	PVC **Di225**			*operator*	Kreisel
kind of drain	foul drain			*length of pipe*	6 m
Insp.-Date	23.04.2006	*Video No.*	Kilga-2		
classification	**not acceptable =**	**0**	**1** **2** **3** **4**	**= acceptable**	

DMS
WWW.DMSLtd.ie
Tel. 021/4303556

section plot scale 1 : 250 flow direction →





0.00 m 0:44:05	{1}	Nr: MH10c Manhole (0.90/0.90) MH depth = 1.26 m inlet main drain left PVC Di 225
0.45 m 0:44:30	(PA)	Start of pipe
17.70 m 0:45:44	(SE-O) (3)	Connection piece protruding, crown Pos 12 length 2 cmQv 5 %
36.83 m 0:46:57	(PE)	End of pipe
37.28 m 0:47:05		Nr: MH9 Manhole (0.90/0.90)

Protokol number	61				
Town	Kilgarvan				
Street	off Main Street				
Section	**MH10c - MH10b** against flow direction				
Pipe material	PVC **Di225**			*operator*	Kreisel
kind of drain	foul drain			*length of pipe*	6 m
Insp.-Date	23.04.2006	*Video No.*	Kilga-2		
classification	**not acceptable =**	**0**	**1** **2** **3** **4**	**= acceptable**	

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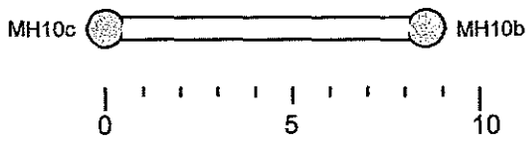
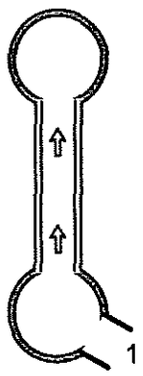
section plot scale 1 : 200 ← flow direction





0.00 m 0:47:26		Nr: MH10c Manhole (0.90/0.90)
0.45 m 0:47:26	(PA)	Start of pipe
8.12 m 0:48:29	(PE)	End of pipe
8.57 m 0:50:03	{1}	Nr: MH10b Manhole (0.90/0.90) MH depth = 0.84 m inlet main drain right, Concrete Di 225 (2) Defective invert

Protokol number	62				
Town	Kilgarvan				
Street	off Main Street				
Section	**MH10b - MH10a** against flow direction				
Pipe material	Conc **Di225**			*operator*	Kreisel
kind of drain	foul drain			*length of pipe*	1 m
Insp.-Date	23.04.2006	*Video No.*	Kilga-2		
classification	**not acceptable =**	**0**	**1**	**2**	**3** **4** **= acceptable**

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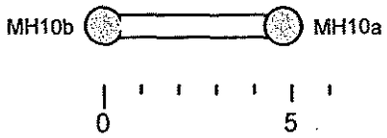
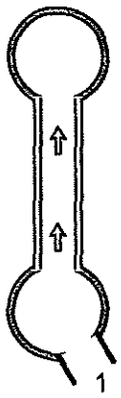
section plot scale 1 : 200 ← flow direction





0.00 m 0:50:56		Nr: MH10b Manhole (0.90/0.90)
0.45 m 0:51:15	(PA)	Start of pipe
4.18 m 0:51:44	(PE)	End of pipe
4.78 m 0:51:57	{1}	Nr: MH10a Manhole (1.20/0.80) MH depth = 0.80 m inlet main drain right Concrete Di 225

Protokol number	63				
Town	Kilgarvan				
Street					
Section	**MH10a - MH10** against flow direction				
Pipe material	Conc **Di225**			*operator*	Kreisel
kind of drain	foul drain			*length of pipe*	1 m
Insp.-Date	23.04.2006	*Video No.*	Kilga-2		
classification	**not acceptable =**	**0**	**1** **2** **3** **4**	**= acceptable**	

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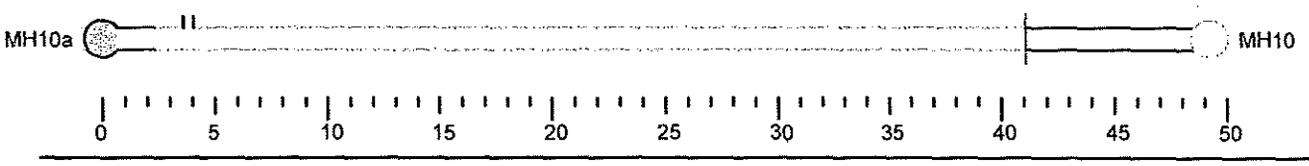
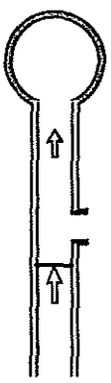
section plot scale 1 : 333 ← flow direction





0.00 m 0:52:19		Nr: MH10a Manhole (1.20/0.80)
0.60 m 0:52:43	(PA)	Start of pipe
3.78 m 0:53:11	(A--L)	Branch, lefthand Pos 9
8.13 m 0:53:53	(GE)	Opposite side reached

Protokol number	64	Seite : 2
Town	Kilgarvan	
Street	Main Street	
Section	**MH2 - MH3** in flow direction	

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67.13 m
1:05:40

Nr: MH3 Manhole (1.20/0.80)

Protokol number	64				
Town	Kilgarvan				
Street	Main Street				
Section	**MH2 - MH3** in flow direction				
Pipe material	Conc **Di225**			*operator*	Kreisel
kind of drain	foul drain			*length of pipe*	1 m
Insp.-Date	23.04.2006	*Video No.*	Kilga-2		
classification	**not acceptable =**	**0**	**1**	**2**	3 **4** **= acceptable**

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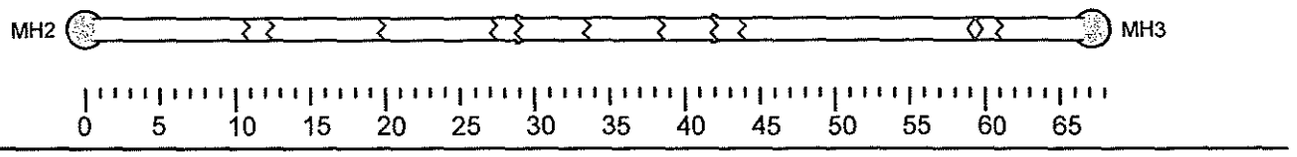
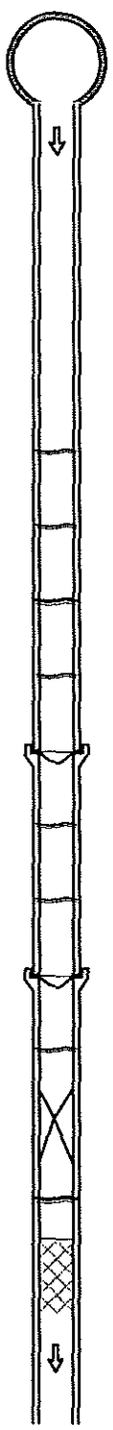
section plot scale 1 : 500 flow direction →





0.00 m 0:54:09		Nr: MH2 Manhole (1.20/0.80)
0.60 m 0:54:15	(PA)	Start of pipe
1.50 m 0:54:36	(WV)	Change of pipe material : Conc to PVC
2.71 m 0:55:21	(WN--) (2)	Sewer rehabilitation measures incorrectly carried out, compelte circumference
3.44 m 0:55:33	(WV)	Change of pipe material : PVC to Concrete
10.70 m 0:56:07	(RQ--) (2)	Transversal crack, compelte circumference width 3.0 mm
12.35 m 0:56:43	(RQ--) (2)	Transversal crack, compelte circumference width 2.0 mm
19.75 m 0:57:31	(RQ--) (1)	Transversal crack, compelte circumference width 5.0 mm
27.24 m 0:58:38	(RQ--) (2)	Transversal crack, compelte circumference width 3.0 mm length 20 cm
28.95 m 0:59:04	(RC--) (2)	Crack in area of connection, compelte circumference width 4.0 mm length 20 cm
33.47 m 0:59:47	(RQ--) (2)	Transversal crack, compelte circumference width 4.0 mm
38.44 m 1:00:37	(RQ--) (2)	Transversal crack, compelte circumference width 2.0 mm
41.94 m 1:01:18	(RC--) (2)	Crack in area of connection, compelte circumference width 4.0 mm length 30 cm
43.81 m 1:01:34	(RQ--) (2)	whole section Transversal crack, compelte circumference width 4.0 mm
59.11 m 1:04:03	(RS--) (1)	Formation of fragments, compelte circumference width 5.0 mm length 25 cm
60.97 m 1:04:43	(RQ--) (1)	Transversal crack, compelte circumference width 5.0 mm
62.05 m 1:04:57	(C--U) (4/3)	whole section Internal corrosion, in area of pipe sole 4 % wall thickness Pos 5-7
66.53 m 1:05:23	(PE)	End of pipe

Protokol number	65				
Town	Kilgarvan				
Street					
Section	**MH12 - MH2a** against flow direction				
Pipe material	Conc **Di225**			*operator*	Kreisel
kind of drain	foul drain			*length of pipe*	1 m
Insp.-Date	23.04.2006	*Video No.*	Kilga-2		
classification	**not acceptable =**	**0**	**1**	**2**	3 **4** **= acceptable**

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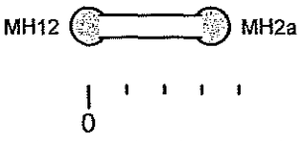
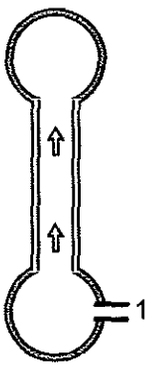
section plot scale 1 : 200 ← flow direction





0.00 m 1:06:01		Nr: MH12 Manhole (0.55/0.55)
0.27 m 1:06:15	(PA)	Start of pipe
2.99 m 1:06:51	(PE)	End of pipe
3.26 m 1:07:21	{1}	Nr: MH2a Manhole (0.55/0.55) Anfangsschacht junction right Clay DI 150

Protokol number	66				
Town	Kilgarvan				
Street					
Section	**MH23 - MH24** against flow direction				
Pipe material	Clay **Di225**			*operator*	Kreisel
kind of drain	foul drain			*length of pipe*	1 m
Insp.-Date	23.04.2006	*Video No.*	Kilga-2		
classification	**not acceptable =**	**0**	**1**	**2**	**3** **4** **= acceptable**

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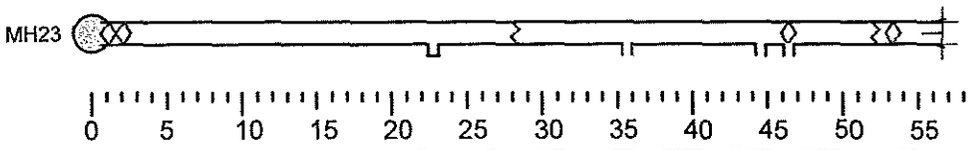
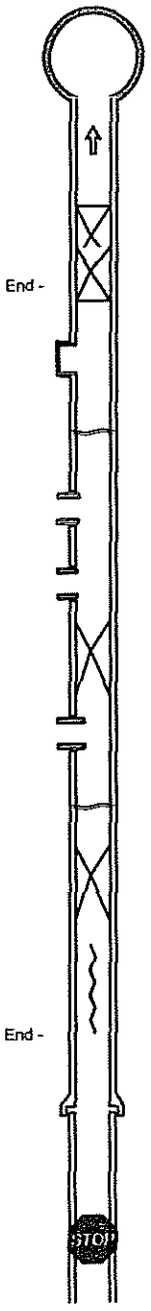
section plot scale 1 : 500 ← flow direction





0.00 m 1:08:09		Nr: MH23 Manhole (1.20/0.80)
0.60 m 1:08:16	(PA)	Start of pipe
0.60 m 1:08:41	(RSB-) (0)	Start - Formation of fragments, soil visible, compelte circumference width 10.0 mm
2.31 m 1:09:14	(RSB-) (0)	End - Formation of fragments, soil visible, compelte circumference width 10.0 mm length 1.71 m
22.80 m 1:10:38	(AU-R)	Branch closed, righthand Pos 3
28.23 m 1:11:16	(RQ--) (2)	Transversal crack, compelte circumference width 2.0 mm length 20 cm
35.67 m 1:12:01	(SE-R) (4/3)	Connection piece protruding, righthand Pos 2-3 length 2 cmQv 3 %
44.60 m 1:12:46	(SN-R) (3/2)	Connection piece incorrectly installed, righthand Pos 2
46.21 m 1:13:10	(RS-O) (1)	Formation of fragments, crown Pos 11-1 width 5.0 mm length 56 cm
46.46 m 1:13:23	(SE-R) (3/2)	Connection piece protruding, righthand Pos 1 length 5 cmQv 18 %
52.13 m 1:14:04	(RQ-L) (2)	Transversal crack, lefthand Pos 6-12 width 3.0 mm
53.11 m 1:14:44	(RSBU) (0)	Formation of fragments, soil visible, invert Pos 3-9 width 10.0 mm length 8 cm
55.30 m 1:15:15	(RL--) (2)	Start - Longitudinal crack, compelte circumference width 4.0 mm
56.59 m 1:15:29	(RL--) (2)	End - Longitudinal crack, compelte circumference width 4.0 mm length 1.29 m
56.59 m 1:15:35	(LVBO) (1/0)	Vertical mismatch, soil visible, above flow level Pos 12 8 cm 40 % wall thickness settlement
56.59 m 1:15:43	(TVS)	Camera can not move further (stop)
56.59 m 1:15:45	(IAB)	Discontinuation of inspection

Protokol number	67				
Town	Kilgarvan				
Street	Kenmare Road				
Section	**MH23 - MH22** in flow direction				
Pipe material	Clay **Di225**			*operator*	Kreisel
kind of drain	foul drain			*length of pipe*	1 m
Insp.-Date	23.04.2006	*Video No.*	Kilga-2		
classification	**not acceptable =**	**0**	**1**	**2**	**3**	**4**	**= acceptable**

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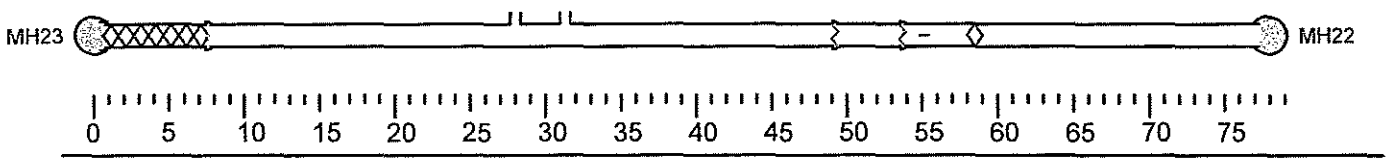
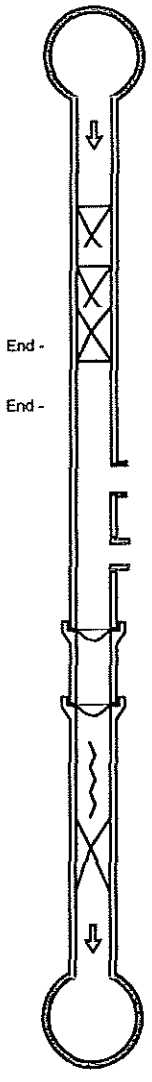
section plot scale 1 : 500 flow direction →





0.00 m 1:16:24		Nr: MH23 Manhole (1.20/0.80)
0.60 m 1:16:24	(PA)	Start of pipe
0.60 m 1:16:33	(RS--) (0)	Start - Formation of fragments, compelte circumference width 10.0 mm
0.60 m 1:16:36	(LB-U)	Start - Dropped invert, invert Pos 6 38 % of cross section
7.56 m 1:17:12	(RS--) (0)	End - Formation of fragments, compelte circumference width 10.0 mm length 6.96 m
7.56 m 1:17:12	(LB-U)	End - Dropped invert, invert Pos 6 38 % of cross section
27.99 m 1:18:58	(AR-L) (2)	Crack in the branch, lefthand Pos 9 width 4.0 mm closed
31.28 m 1:19:59	(SN-L) (3)	Connection piece incorrectly installed, lefthand Pos 10-11
49.20 m 1:21:24	(RC-O) (3)	Crack in area of connection, crown Pos 12 width 1.0 mm length 15 cm
53.69 m 1:22:22	(RC--) (4/3)	Crack in area of connection, compelte circumference width 0.5 mm length 60 cm
55.13 m 1:22:42	(RL-L) (4/3)	Longitudinal crack, lefthand Pos 6-12 width 0.5 mm length 100 cm
58.27 m 1:23:06	(RS-R) (2)	Formation of fragments, righthand Pos 3 width 4.0 mm length 8 cm
77.28 m 1:24:31	(PE)	End of pipe
77.88 m 1:24:51		Nr: MH22 Manhole (1.20/0.80)

Protokol number	68				
Town	Kilgarvan				
Street	Kenmare Road				
Section	**MH22 - MH21** in flow direction				
Pipe material	Clay **Di225**			*operator*	Kreisel
kind of drain	foul drain			*length of pipe*	1 m
Insp.-Date	23.04.2006	*Video No.*	Kilga-2		
classification	**not acceptable =**	**0**	**1**	**2**	**3** **4** **= acceptable**

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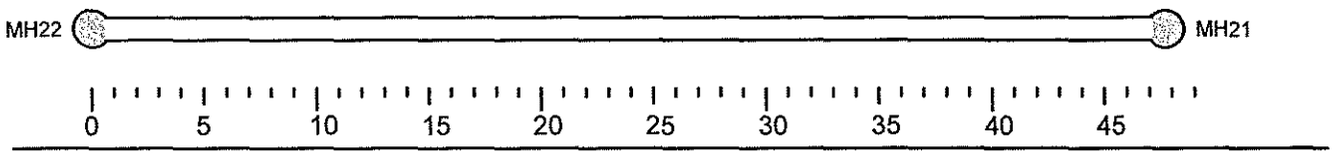
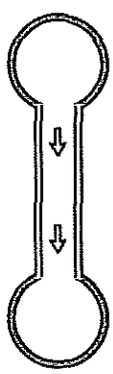
section plot scale 1 : 333 flow direction →





0.00 m 1:25:03		Nr: MH22 Manhole (1.20/0.80)
0.60 m 1:25:26	(PA)	Start of pipe
47.10 m 1:28:56	(PE)	End of pipe
47.70 m 1:29:15		Nr: MH21 Manhole (1.20/0.80)

MH-ID number : 1

MH - number : MH12I

town : Kilgarvan street : St. Garvans terrace

operator : Kreisel date : 20.04.2006 DVD-No : Kilga-1 videotime : 0:00:16

classification **severe damage = 0 1 2 3 4 = light damage**

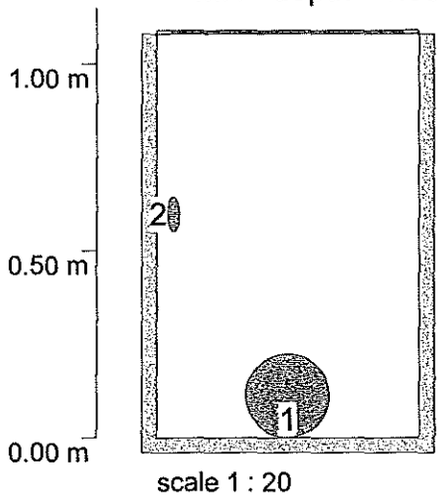
manhole : material : brick depth : 1.09 m

MH shape : rect. L0.70 m B : 0.70 m cover type : B C.L.: 46.60 m

connection

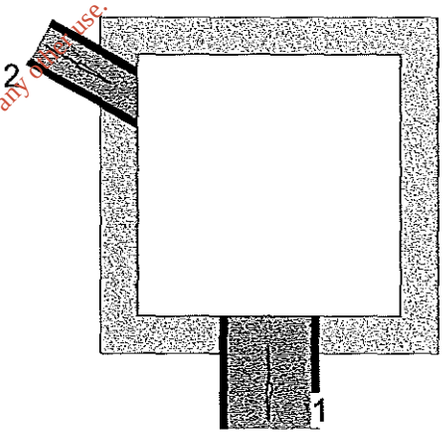
No.	mat.	diameter	depth	text	invert level : 45.51 m
1	PVC	225	1.09 m	outlet main drain	45.51 m
2	PVC	100	0.54 m	inlet right	46.06 m

MH - depth =1.09 m



scale 1 : 20

height cover slab = 0.05 m



MH-ID number : 2

MH - number : MH12H

town : Kilgarvan street : St. Garvans terrace

operator : Kreisel date : 20.04.2006 DVD-No : Kilga-1 videotime : 0:07:21

classification **severe damage = 0 1 2 3 4 = light damage**

manhole : material : insitu concrete depth : 1.61 m

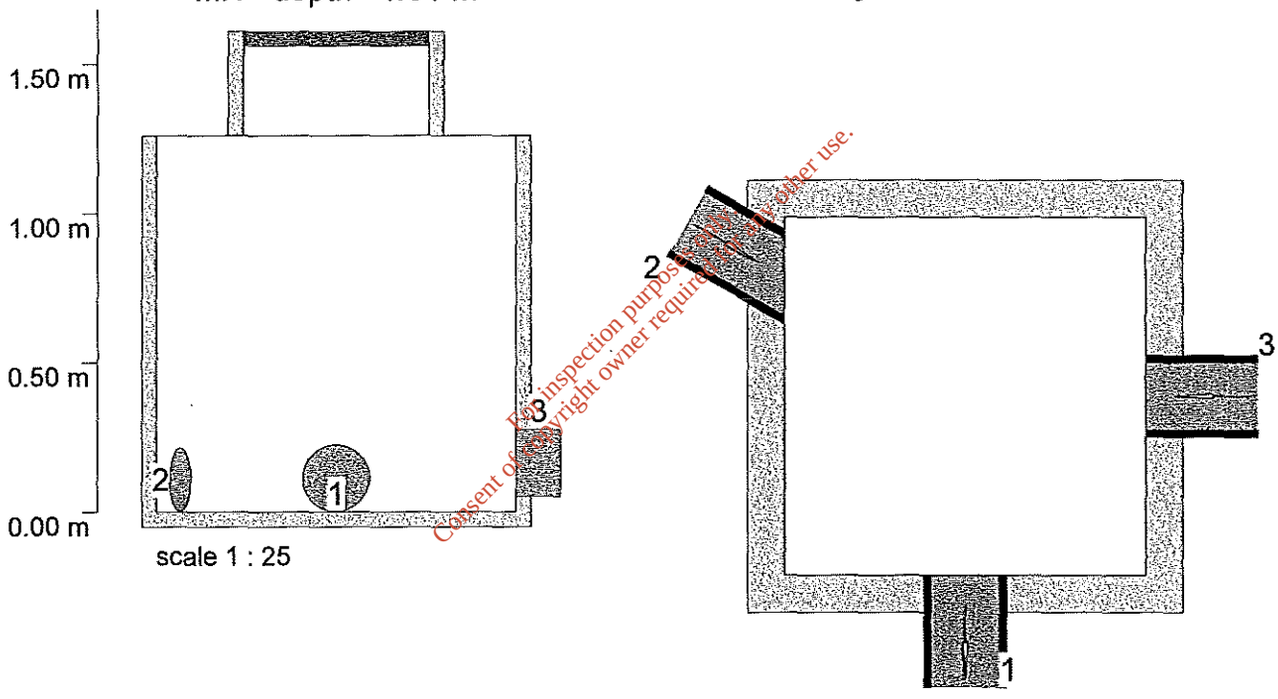
MH shape : rect. L1.20 m B : 1.20 m cover type : B C.L.: 46.50 m

connection

No.	mat.	diameter	depth	text	invert level : 44.89 m
1	PVC	225	1.61 m	outlet main drain	44.89 m
2	PVC	225	1.61 m	inlet main drain	44.89 m
3	PVC	225	1.56 m	inlet main drain	44.94 m

MH - depth =1.61 m

height cover slab = 0.40 m



scale 1 : 25

MH-ID number : 3

MH - number : MH12G

town : Kilgarvan street : St. Garvans terrace

operator : Kreisel date : 20.04.2006 DVD-No : Kilga-1 videotime : 0:10:09

classification **severe damage = 0 1 2 3 4 = light damage**

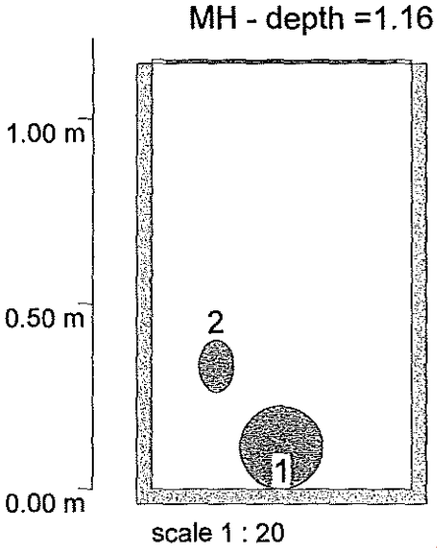
manhole : material : brick depth : 1.16 m

MH shape : rect. L0.70 m B : 0.70 m cover type : B C.L.: 46.32 m

connection

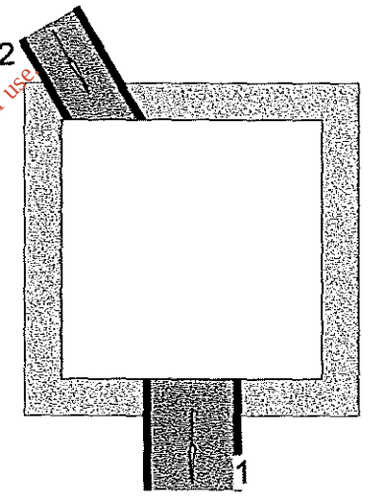
No.	mat.	diameter	depth	text	invert level : 45.16 m
1	PVC	225	1.16 m	outlet main drain	45.16 m
2	PVC	150	0.90 m	inlet right	45.42 m

MH - depth =1.16 m



scale 1 : 20

height cover slab = 0.05 m



MH-ID number : 4

MH - number : MH12F

town : Kilgarvan street : St. Garvans terrace

operator : Kreisel date : 20.04.2006 DVD-No : Kilga-1 videotime : 0:12:56

classification **severe damage = 0 1 2 3 4 = light damage**

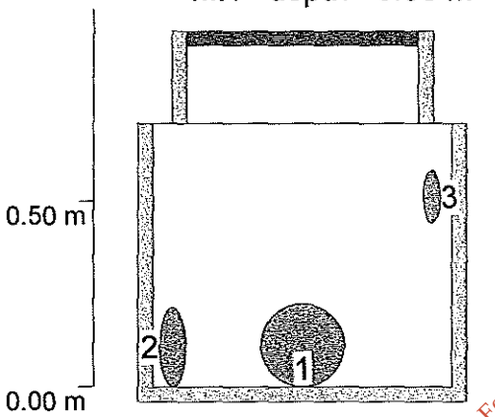
manhole : material : insitu concrete depth : 0.96 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 44.09 m

connection

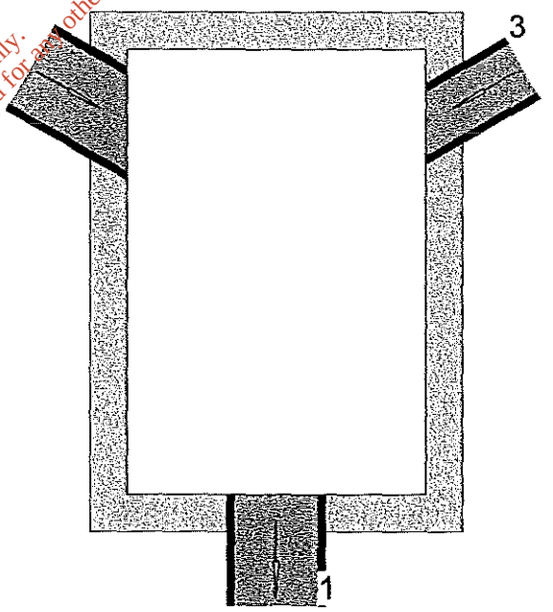
No.	mat.	diameter	depth	text	invert level : 43.13 m
1	PVC	225	0.96 m	outlet main drain	43.13 m
2	PVC	225	0.96 m	inlet main drain	43.13 m
3	PVC	150	0.52 m	inlet left	43.57 m

MH - depth =0.96 m



scale 1 : 20

height cover slab = 0.29 m



MH-ID number : 6

MH - number : MH12C

town : Kilgarvan street : St. Garvans terrace

operator : Kreisel date : 20.04.2006 DVD-No : Kilga-1 videotime : 0:19:43

classification **severe damage = 0 1 2 3 4 = light damage**

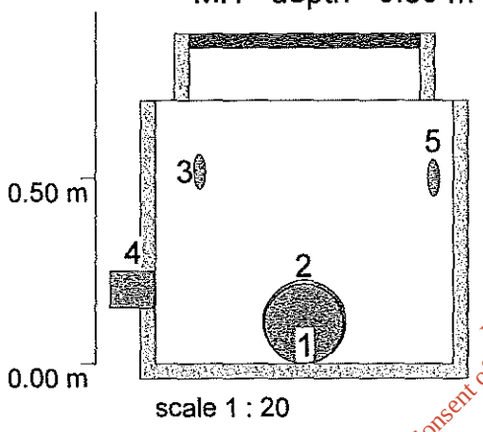
manhole : material : insitu concrete depth : 0.89 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 43.68 m

connection

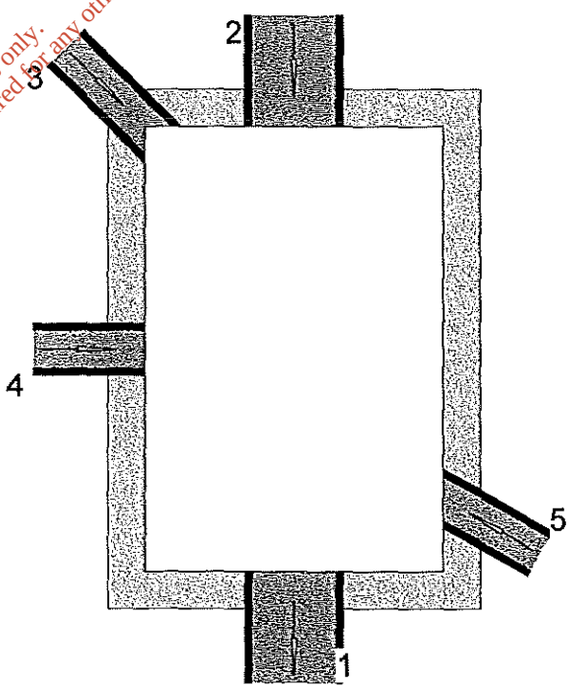
No.	mat.	diameter	depth	text	invert level : 42.79 m
1	PVC	225	0.89 m	outlet main drain	42.79 m
2	PVC	225	0.89 m	inlet main drain	42.79 m
3	PVC	100	0.42 m	inlet right	43.26 m
4	PVC	100	0.74 m	inlet right	42.94 m
5	PVC	100	0.44 m	inlet left	43.24 m

MH - depth =0.89 m



scale 1 : 20

height cover slab = 0.22 m



MH-ID number : 7

MH - number : MH12D

town : Kilgarvan street : St. Garvans terrace

operator : Kreisel date : 20.04.2006 DVD-No : Kilga-1 videotime : 0:22:01

classification **severe damage = 0 1 2 3 4 = light damage**

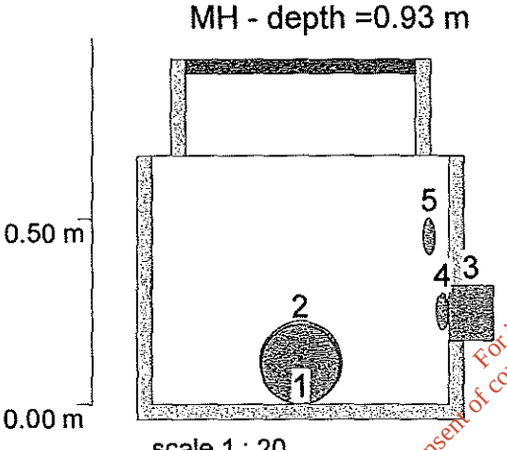
manhole : material : insitu concrete depth : 0.93 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 43.77 m

connection

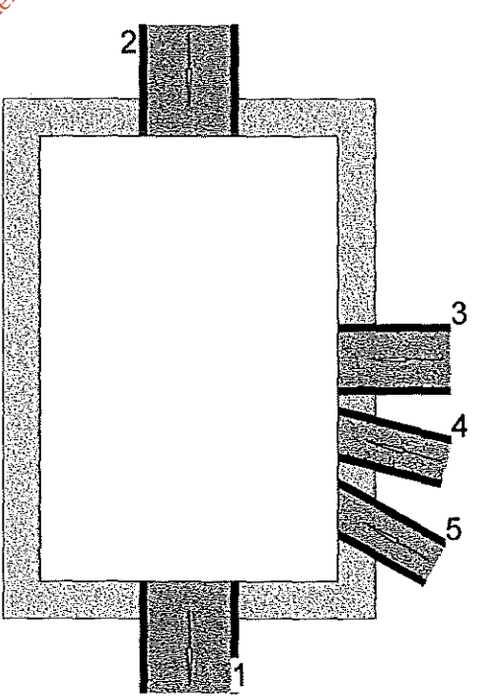
No.	mat.	diameter	depth	text	invert level : 42.84 m
1	PVC	225	0.93 m	outlet main drain	42.84 m
2	PVC	225	0.93 m	inlet main drain	42.84 m
3	PVC	150	0.76 m	inlet left	43.01 m
4	PVC	100	0.73 m	inlet left	43.04 m
5	PVC	100	0.53 m	inlet left	43.24 m

MH - depth =0.93 m



scale 1 : 20

height cover slab = 0.30 m



MH-ID number : 8

MH - number : MH12E

town : Kilgarvan street : St. Garvans terrace

operator : Kreisel date : 20.04.2006 DVD-No : Kilga-1 videotime : 0:24:21

classification **severe damage = 0 1 2 3 4 = light damage**

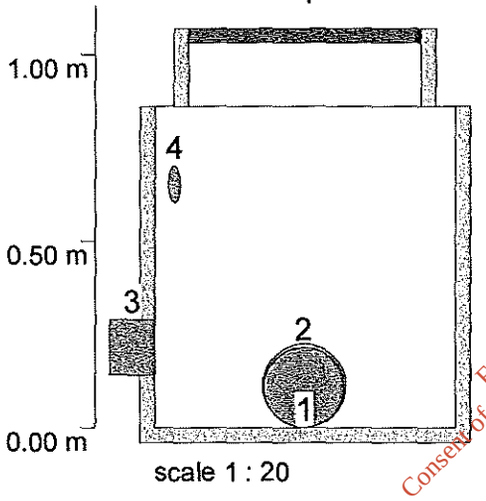
manhole : material : insitu concrete depth : 1.07 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 43.92 m

connection

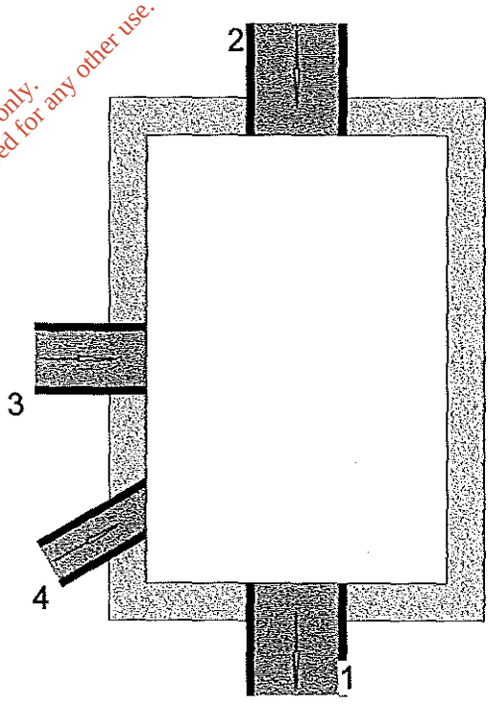
No.	mat.	diameter	depth	text	invert level : 42.85 m
1	PVC	225	1.07 m	outlet main drain	42.85 m
2	PVC	225	1.07 m	inlet main drain	42.85 m
3	PVC	150	0.93 m	inlet right	42.99 m
4	PVC	100	0.47 m	inlet right	43.45 m

MH - depth =1.07 m



scale 1 : 20

height cover slab = 0.25 m



MH-ID number : 10

MH - number : MH12J

town : Kilgarvan street : St. Garvans terrace

operator : Kreisel date : 20.04.2006 DVD-No : Kilga-1 videotime : 0:27:41

classification **severe damage = 0 1 2 3 4 = light damage**

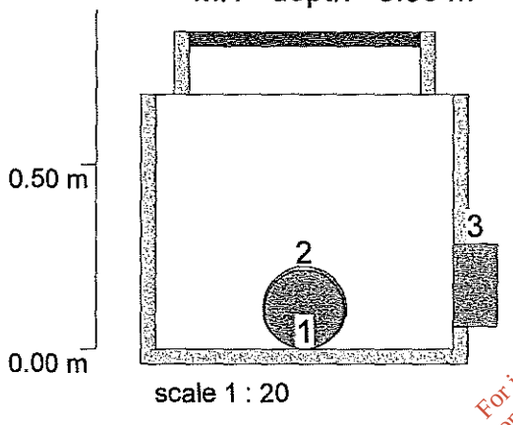
manhole : material : insitu concrete depth : 0.86 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 43.62 m

connection

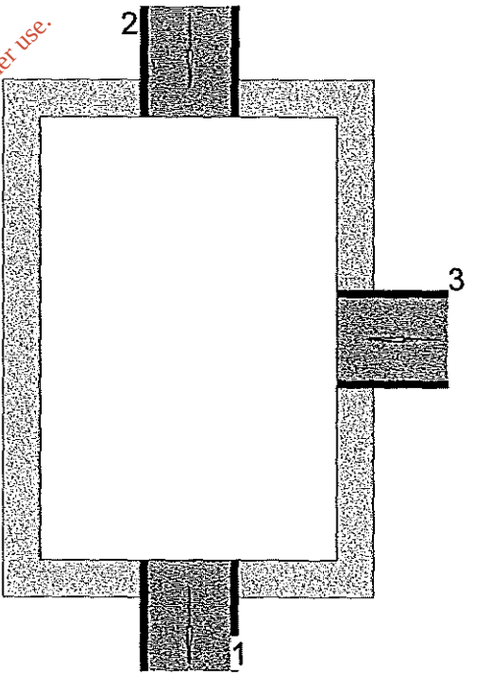
No.	mat.	diameter	depth	text	invert level : 42.76 m
1	PVC	225	0.86 m	outlet main drain	42.76 m
2	PVC	225	0.86 m	inlet main drain	42.76 m
3	PVC	225	0.80 m	inlet main drain	42.82 m

MH - depth =0.86 m



scale 1 : 20

height cover slab = 0.21 m



MH-ID number : 11

MH - number : MH12K

town : Kilgarvan street : St. Garvans terrace

operator : Kreisel date : 20.04.2006 DVD-No : Kilga-1 videotime : 0:31:20

classification **severe damage = 0 1 2 3 4 = light damage**

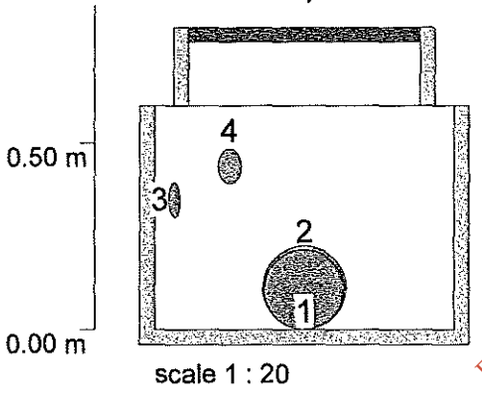
manhole : material : insitu concrete depth : 0.81 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 43.62 m

connection

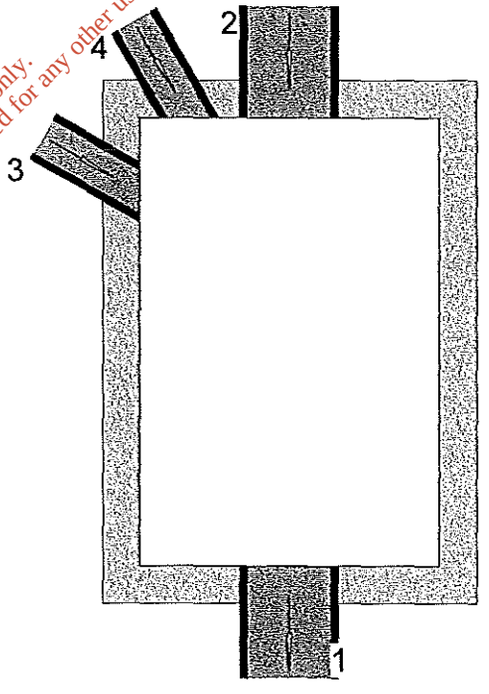
No.	mat.	diameter	depth	text	invert level : 42.81 m
1	PVC	225	0.81 m	outlet main drain	42.81 m
2	PVC	225	0.81 m	inlet main drain	42.81 m
3	PVC	100	0.51 m	inlet right	43.11 m
4	PVC	100	0.42 m	inlet right	43.20 m

MH - depth =0.81 m



scale 1 : 20

height cover slab = 0.25 m



MH-ID number : 14

MH - number : MH12

town : Kilgarvan street : Main Street

operator : Kreisel date : 20.04.2006 DVD-No : Kilga-1 videotime : 0:36:14

classification **severe damage = 0 1 2 3 4 = light damage**

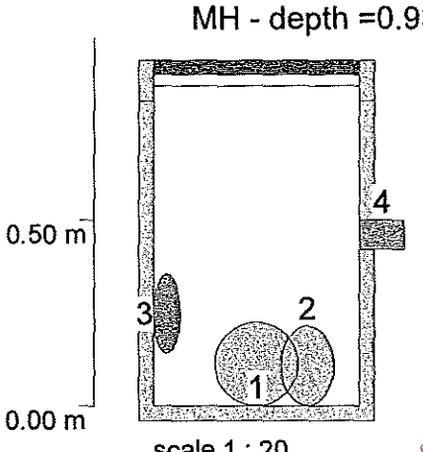
manhole : material : insitu concrete depth : 0.93 m

MH shape : rect. L0.55 m B : 0.55 m cover type : D C.L.: 43.46 m

connection

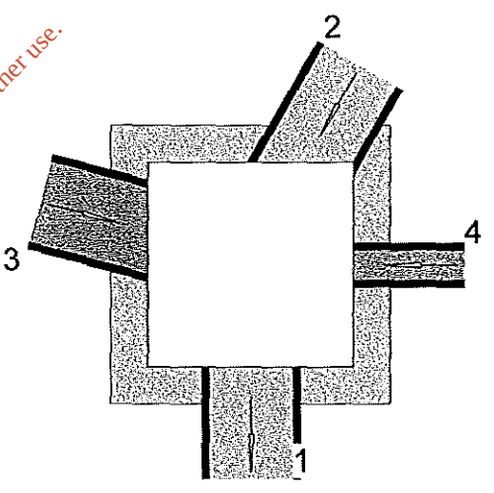
No.	mat.	diameter	depth	text	invert level : 42.53 m
1	Conc	225	0.93 m	outlet main drain	42.53 m
2	Concrete	225	0.93 m	inlet main drain	42.53 m
3	PVC	225	0.79 m	inlet main drain	42.67 m
4	PVC	80	0.51 m	inlet left	42.95 m

MH - depth =0.93 m



scale 1 : 20

height cover slab = 0.11 m



MH-ID number : 15

MH - number : MH15R

town : Kilgarvan street : off Main Street

operator : Kreisel date : 20.04.2006 DVD-No : Kilga-1 videotime : 0:49:38

classification **severe damage = 0 1 2 3 4 = light damage**

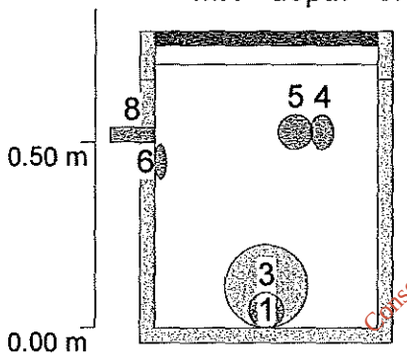
manhole : material : insitu concrete depth : 0.80 m

MH shape : rect. L0.60 m B : 0.60 m cover type : D C.L.: 44.39 m

connection

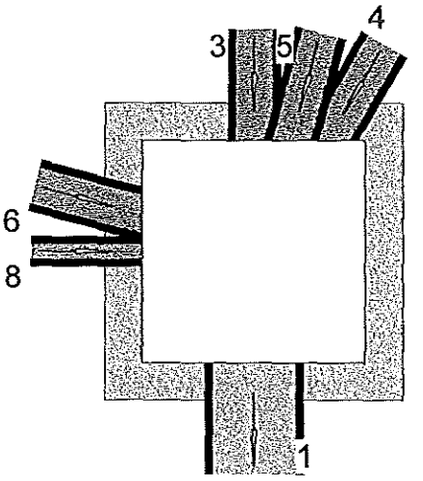
No.	mat.	diameter	depth	text	invert level : 43.59 m
1	Conc	225	0.80 m	outlet main drain	43.59 m
2	PVC	100	0.80 m	inlet right	43.59 m
3	PVC	100	0.80 m	inlet right	43.59 m
4	PVC	100	0.32 m	inlet left	44.07 m
5	PVC	100	0.32 m	inlet left	44.07 m
6	PVC	100	0.40 m	inlet right	43.99 m
7	PVC	40	0.30 m	inlet right	44.09 m
8	PVC	40	0.30 m	inlet right	44.09 m

MH - depth =0.80 m



scale 1 : 20

height cover slab = 0.13 m



MH-ID number : 17

MH - number : MH2R

town : Kilgarvan street : Main Street

operator : Kreisel date : 21.04.2006 DVD-No : Kilga-1 videotime : 1:01:07

classification **severe damage = 0 1 2 3 4 = light damage**

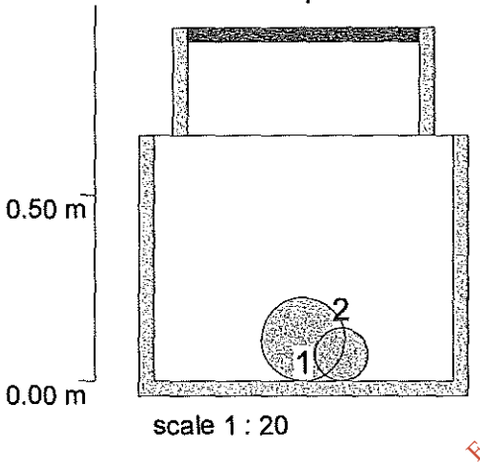
manhole : material : insitu concrete depth : 0.95 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 47.62 m

connection

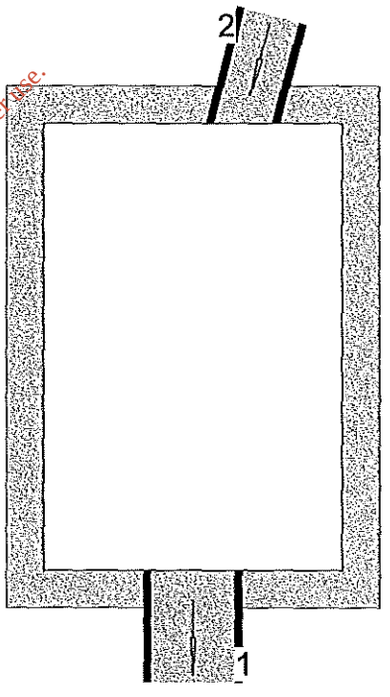
No.	mat.	diameter	depth	text	invert level : 46.67 m
1	Conc	225	0.95 m	outlet main drain	46.67 m
2	Concrete	150	0.95 m	inlet main drain	46.67 m

MH - depth =0.95 m



scale 1 : 20

height cover slab = 0.33 m



MH-ID number : 18

MH - number : MH3

town : Kilgarvan street : Main Street

operator : Kreisel date : 21.04.2006 DVD-No : Kilga-1 videotime : 1:04:33

classification **severe damage = 0 1 2 3 4 = light damage**

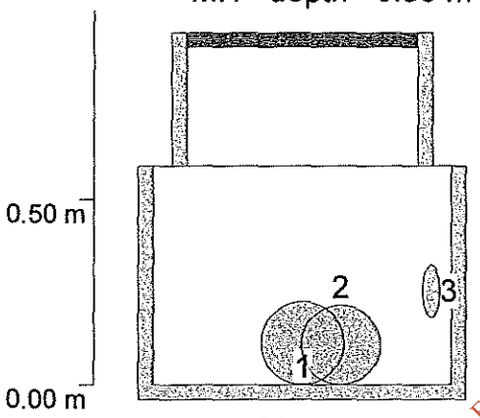
manhole : material : insitu concrete depth : 0.95 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 46.86 m

connection

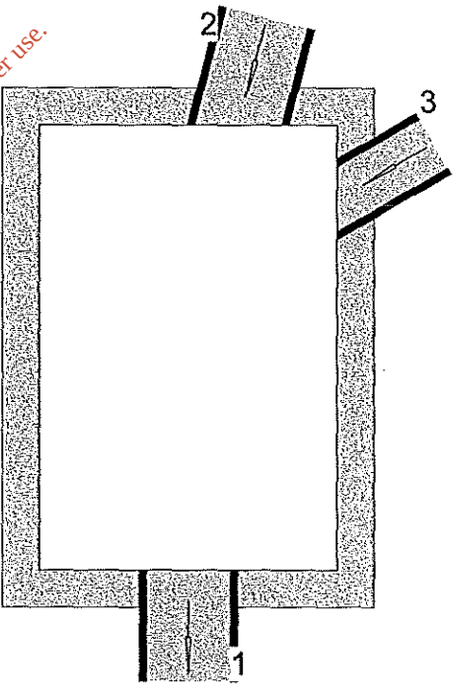
No.	mat.	diameter	depth	text	invert level : 45.91 m
1	Conc	225	0.95 m	outlet main drain	45.91 m
2	Concrete	225	0.95 m	inlet main drain	45.91 m
3	Clay	150	0.77 m	inlet left	46.09 m

MH - depth =0.95 m



scale 1 : 20

height cover slab = 0.40 m



MH-ID number : 19

MH - number : MH4

town : Kilgarvan street : Main Street

operator : Kreisel date : 21.04.2006 DVD-No : Kilga-1 videotime : 1:26:53

classification **severe damage = 0 1 2 3 4 = light damage**

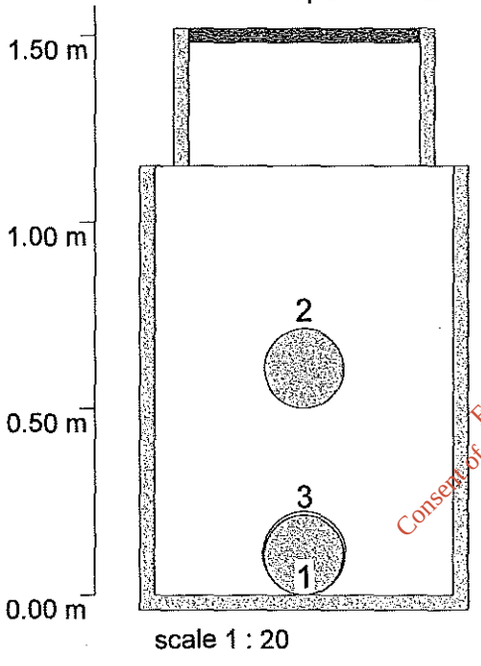
manhole : MH with back drop material : insitu concrete depth : 1.52 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 44.72 m

connection

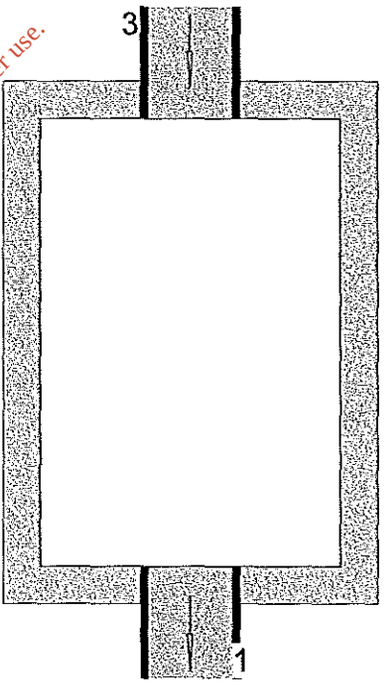
No.	mat.	diameter	depth	text	invert level : 43.20 m
1	Conc	225	1.52 m	outlet main drain	43.20 m
2	Concrete	225	1.02 m	inlet main drain	43.70 m
3	Concrete	225	1.52 m	inlet right Bach drop	43.20 m

MH - depth =1.52 m



scale 1 : 20

height cover slab = 0.41 m



MH-ID number : 20

MH - number : MH5

town : Kilgarvan street : Main Street

operator : Kreisel date : 21.04.2006 DVD-No : Kilga-1 videotime : 1:27:44

classification **severe damage = 0 1 2 3 4 = light damage**

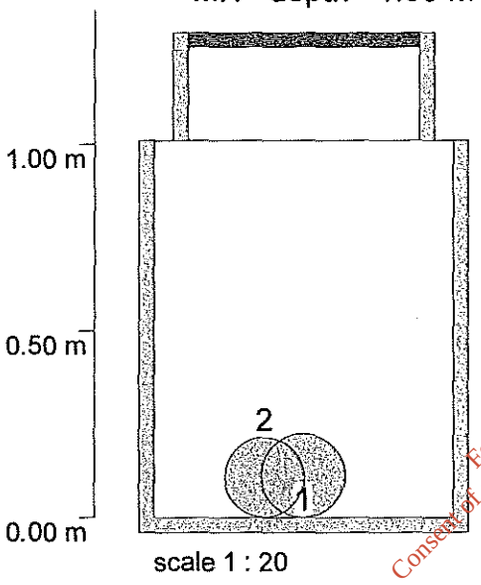
manhole : material : insitu concrete depth : 1.30 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 42.62 m

connection

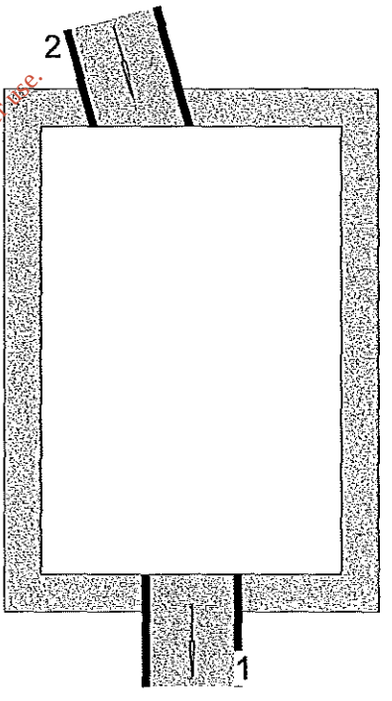
No.	mat.	diameter	depth	text	invert level : 41.32 m
1	Conc	225	1.30 m	outlet main drain	41.32 m
2	Concrete	225	1.30 m	inlet main drain	41.32 m

MH - depth =1.30 m



scale 1 : 20

height cover slab = 0.33 m



MH-ID number : 21

MH - number : MH6

town : Kilgarvan street : Kenmare Road

operator : Kreisel date : 21.04.2006 DVD-No : Kilga-1 videotime : 1:37:18

classification **severe damage = 0 1 2 3 4 = light damage**

manhole : material : insitu concrete depth : 1.21 m

MH shape : rect. L0.80 m B : 1.20 m cover type : D C.L.: 41.55 m

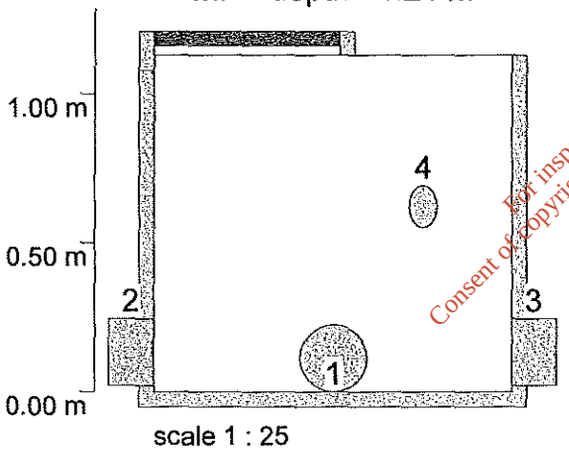
damages

code	class	comments
SGM	1	Defective invert

connection

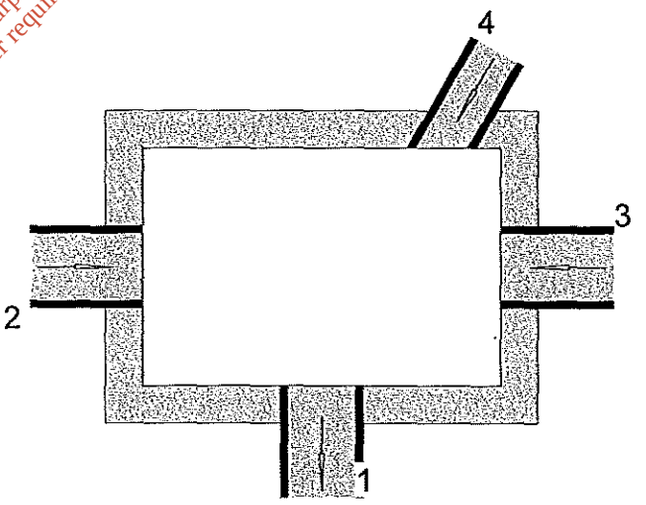
No.	mat.	diameter	depth	text	invert level : 40.34 m
1	Conc	225	1.21 m	outlet main drain	40.34 m
2	Concrete	225	1.19 m	inlet main drain	40.36 m
3	Concrete	225	1.19 m	inlet main drain	40.36 m
4	Clay	150	0.66 m	inlet left	40.89 m

MH - depth =1.21 m



scale 1 : 25

height cover slab = 0.13 m



MH-ID number : 22

MH - number : MH7

town : Kilgarvan street : Main Street

operator : Kreisel date : 21.04.2006 DVD-No : Kilga-1 videotime : 1:58:33

classification **severe damage = 0 1 2 3 4 = light damage**

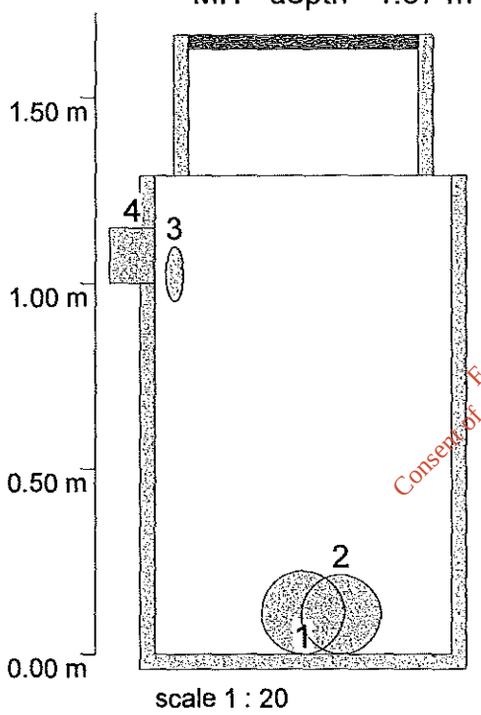
manhole : material : insitu concrete depth : 1.67 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 42.63 m

connection

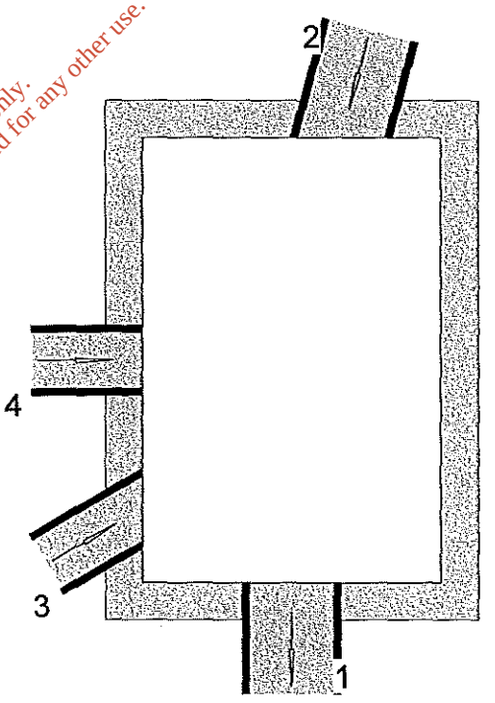
No.	mat.	diameter	depth	text	invert level : 40.96 m
1	Conc	225	1.67 m	outlet main drain	40.96 m
2	Concrete	225	1.67 m	inlet main drain	40.96 m
3	Concrete	150	0.72 m	inlet right	41.91 m
4	Concrete	150	0.67 m	inlet main drain	41.96 m

MH - depth =1.67 m



scale 1 : 20

height cover slab = 0.42 m



MH-ID number : 23

MH - number : MH9

town : Kilgarvan street : off Main Street

operator : Kreisel date : 21.04.2006 DVD-No : Kilga-1 videotime : 2:06:39

classification **severe damage = 0 1 2 3 4 = light damage**

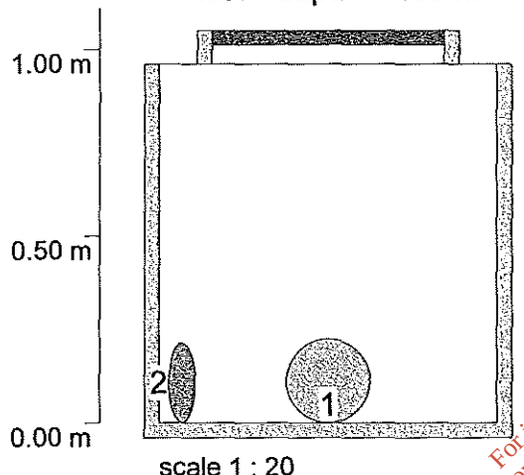
manhole : material : insitu concrete depth : 1.05 m

MH shape : rect. L0.90 m B : 0.90 m cover type : D C.L.: 42.22 m

connection

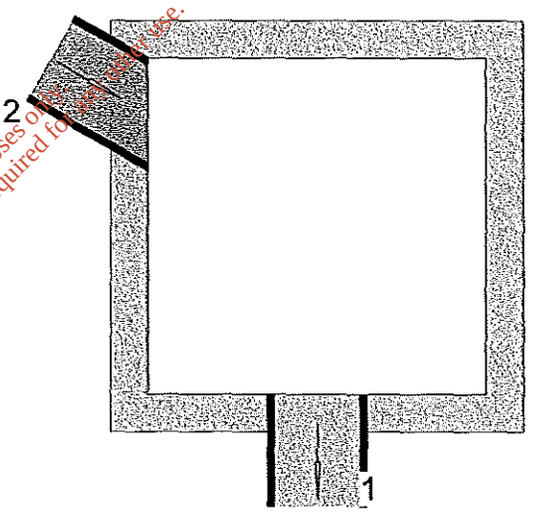
No.	mat.	diameter	depth	text	invert level : 41.17 m
1	Conc	225	1.05 m	outlet main drain	41.17 m
2	PVC	225	1.05 m	inlet main drain	41.17 m

MH - depth =1.05 m



scale 1 : 20

height cover slab = 0.13 m



MH-ID number : 28

MH - number : MH17

town : Kilgarvan street : Kenmare Road

operator : Kreisel date : 21.04.2006 DVD-No : Kilga-1 videotime : 2:35:15

classification **severe damage = 0 1 2 3 4 = light damage**

manhole : material : insitu concrete depth : 1.19 m

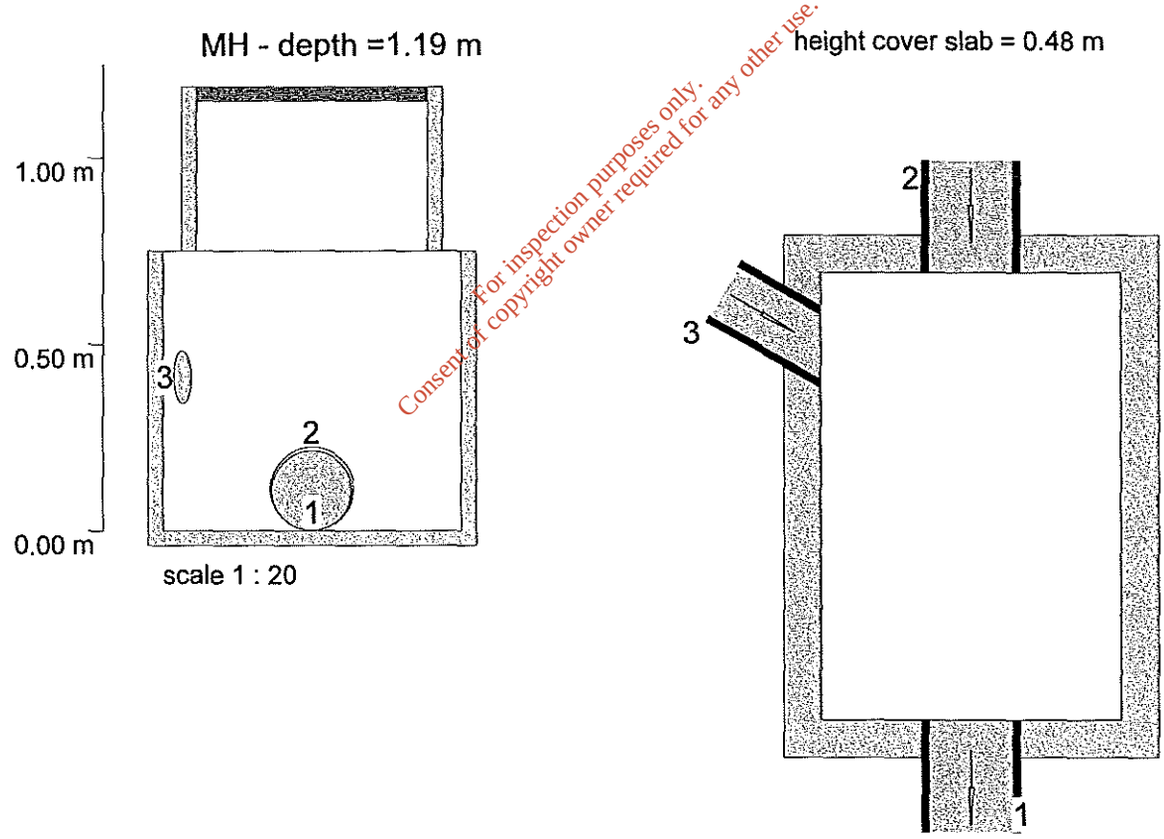
MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 38.16 m

damages

code	class	comments
AAI	2	Incrustation pipe connection outlet-side

connection

No.	mat.	diameter	depth	text	invert level : 36.97 m
1	Clay	225	1.19 m	outlet main drain	36.97 m
2	Clay	225	1.19 m	inlet main drain	36.97 m
3	Clay	150	0.85 m	inlet right	37.31 m



MH-ID number : 29

MH - number : MH17a

town : Kilgarvan street : Kenmare Road

operator : Kreisel date : 21.04.2006 DVD-No : Kilga-1 videotime : 2:42:21

classification **severe damage = 0 1 2 3 4 = light damage**

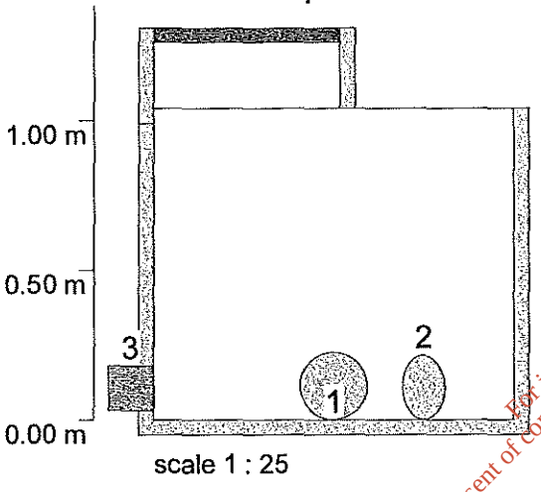
manhole : material : concrete depth : 1.31 m

MH shape : circular Di 1200 cover type : B C.L.: 37.98 m

connection

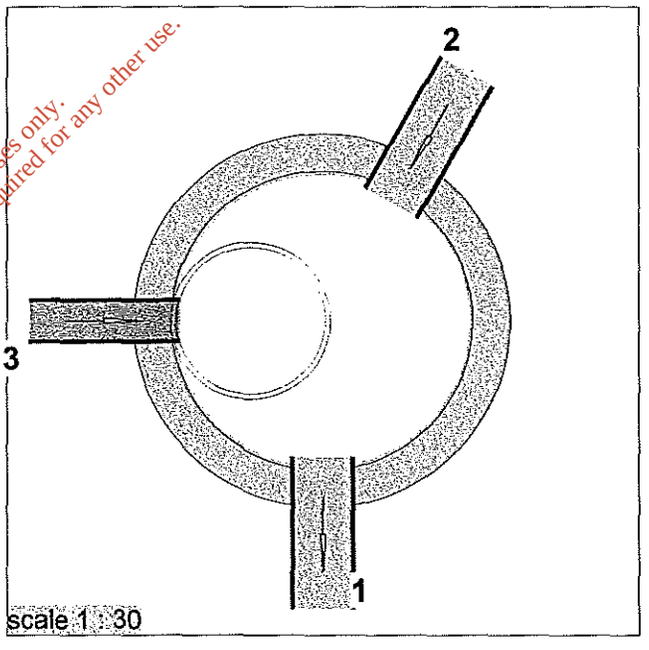
No.	mat.	diameter	depth	text	invert level : 36.67 m
1	Clay	225	1.31 m	outlet main drain	36.67 m
2	Clay	225	1.31 m	inlet main drain	36.67 m
3	PVC	150	1.28 m	inlet right	36.70 m

MH - depth =1.31 m



scale 1 : 25

height cover slab = 0.32 m



scale 1 : 30

MH-ID number : 30

MH - number : MH18

town : Kilgarvan street : Kenmare Road

operator : Kreisel date : 21.04.2006 DVD-No : Kilga-1 videotime : 2:51:15

classification **severe damage = 0 1 2 3 4 = light damage**

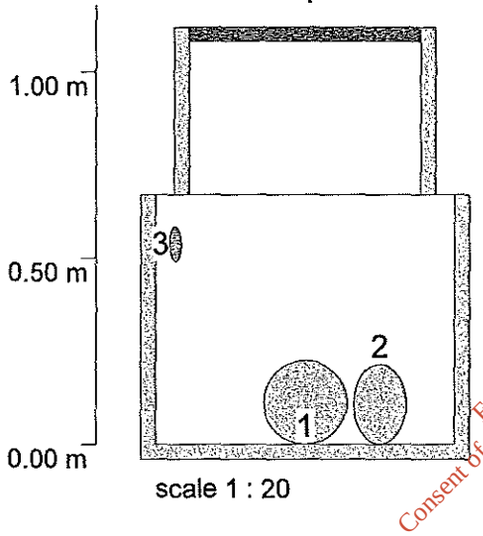
manhole : material : insitu concrete depth : 1.12 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 37.56 m

connection

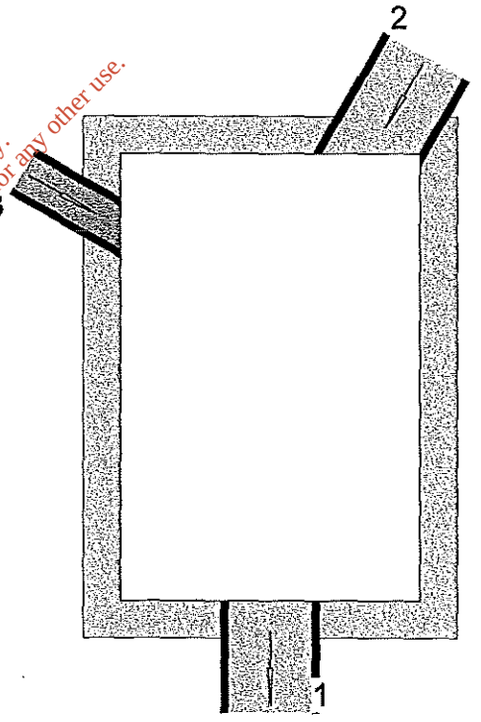
No.	mat.	diameter	depth	text	invert level : 36.44 m
1	Clay	225	1.12 m	outlet main drain	36.44 m
2	Clay	225	1.12 m	inlet main drain	36.44 m
3	PVC	100	0.63 m	inlet right	36.93 m

MH - depth =1.12 m



scale 1 : 20

height cover slab = 0.49 m



MH-ID number : 31

MH - number : MH16

town : Kilgarvan street : Kenmare Road

operator : Kreisel date : 21.04.2006 DVD-No : Kilga-1 videotime : 2:55:15

classification **severe damage = 0 1 2 3 4 = light damage**

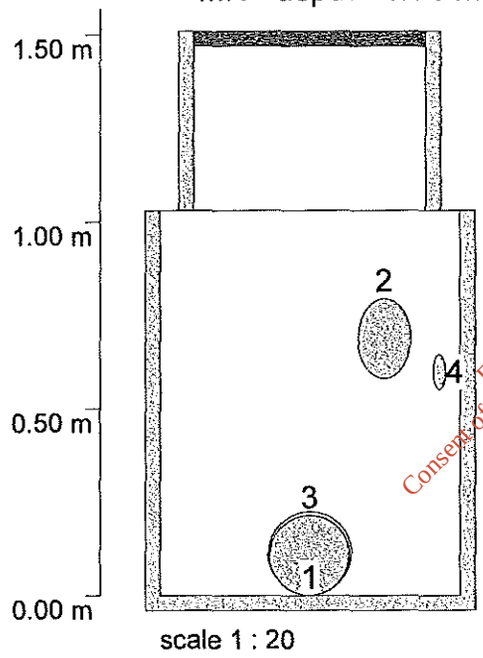
manhole : MH with back drop material : insitu concrete depth : 1.51 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 39.82 m

connection

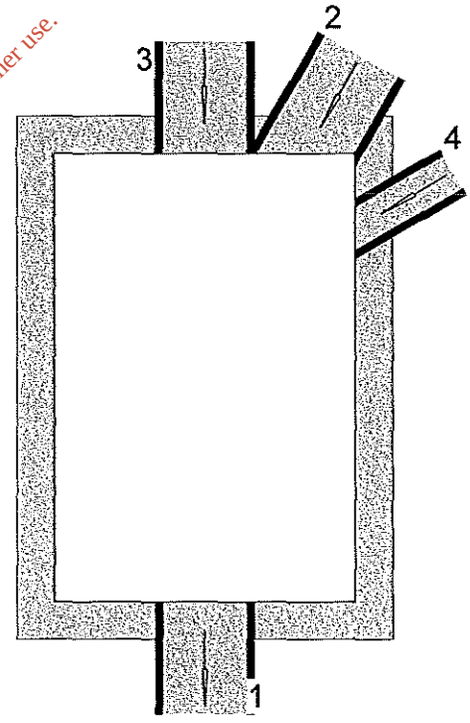
No.	mat.	diameter	depth	text	invert level : 38.31 m
1	Clay	225	1.51 m	outlet main drain	38.31 m
2	Concrete	225	0.93 m	inlet main drain	38.89 m
3	Concrete	225	1.51 m	inlet right Bach drop	38.31 m
4	Clay	100	0.96 m	inlet left	38.86 m

MH - depth =1.51 m



scale 1 : 20

height cover slab = 0.52 m



MH-ID number : 33

MH - number : MH19

town : Kilgarvan street : Kenmare Road

operator : Kreisel date : 21.04.2006 DVD-No : Kilga-1 videotime : 3:08:31

classification **severe damage = 0 1 2 3 4 = light damage**

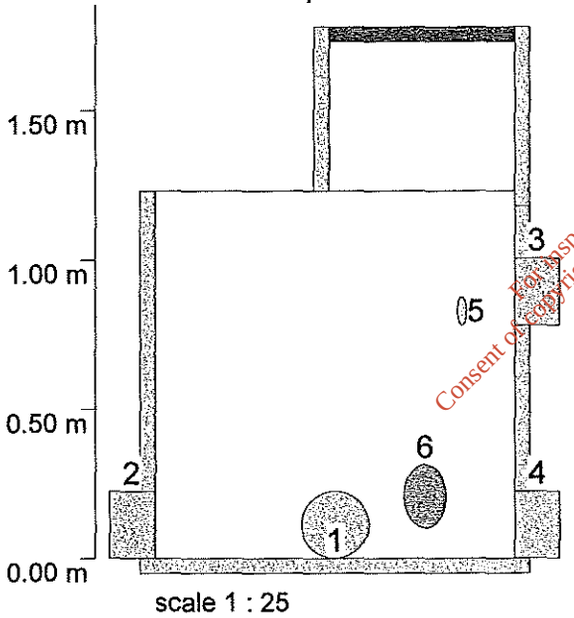
manhole : material : insitu concrete depth : 1.78 m

MH shape : rect. L0.80 m B : 1.20 m cover type : D C.L.: 36.74 m

connection

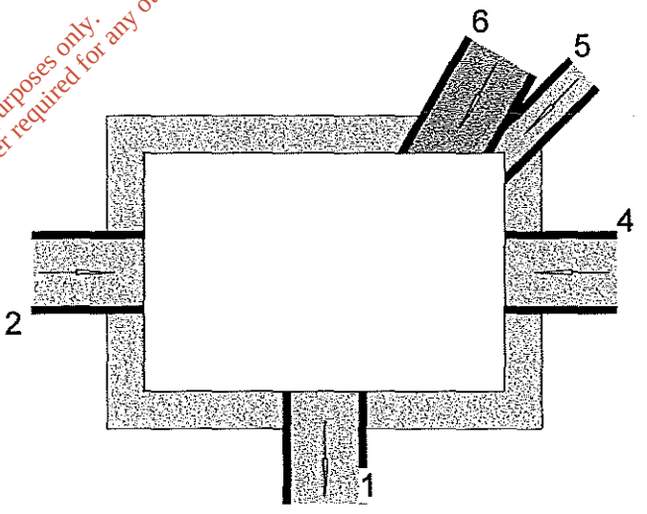
No.	mat.	diameter	depth	text	invert level : 34.96 m
1	Conc	225	1.78 m	outlet main drain	34.96 m
2	Concrete	225	1.78 m	inlet main drain	34.96 m
3	Clay	225	1.00 m	inlet main drain	35.74 m
4	Concrete	225	1.78 m	inlet main drain	34.96 m
5	Clay	100	1.00 m	inlet left	35.74 m
6	PVC	225	1.68 m	inlet main drain	35.06 m

MH - depth =1.78 m



scale 1 : 25

height cover slab = 0.60 m



MH-ID number : 34

MH - number : MH30

town : Kilgarvan street : to T.P

operator : Kreisel date : 21.04.2006 DVD-No : Kilga-1 videotime : 3:15:25

classification **severe damage = 0 1 2 3 4 = light damage**

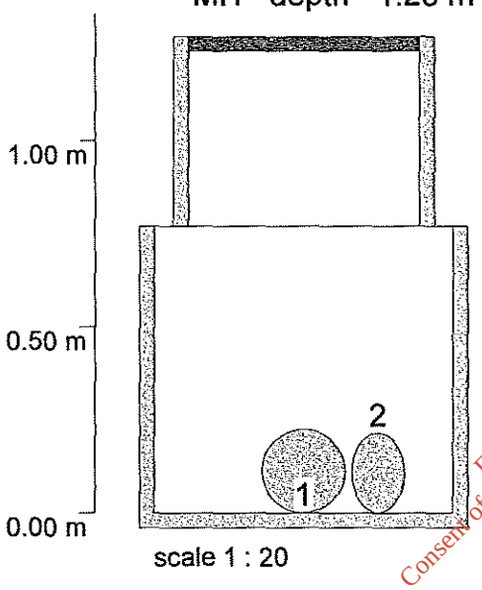
manhole : material : insitu concrete depth : 1.28 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 33.71 m

connection

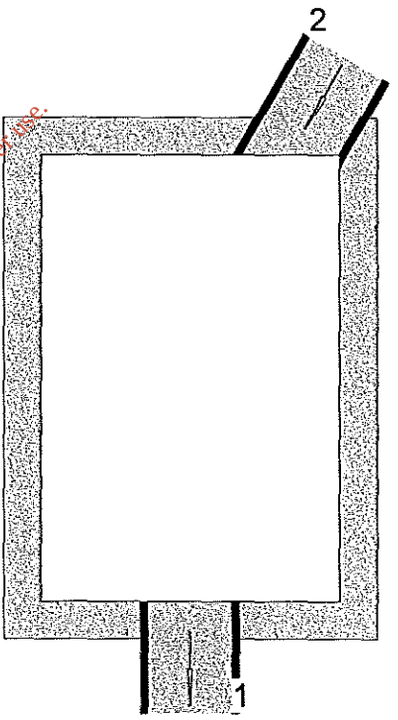
No.	mat.	diameter	depth	text	invert level : 32.43 m
1	Conc	225	1.28 m	outlet main drain	32.43 m
2	Concrete	225	1.28 m	inlet main drain	32.43 m

MH - depth =1.28 m



scale 1 : 20

height cover slab = 0.55 m



MH-ID number : 35

MH - number : MH31

town : Kilgarvan street : to T.P

operator : Kreisel date : 21.04.2006 DVD-No : Kilga-1 videotime : 3:20:30

classification **severe damage = 0 1 2 3 4 = light damage**

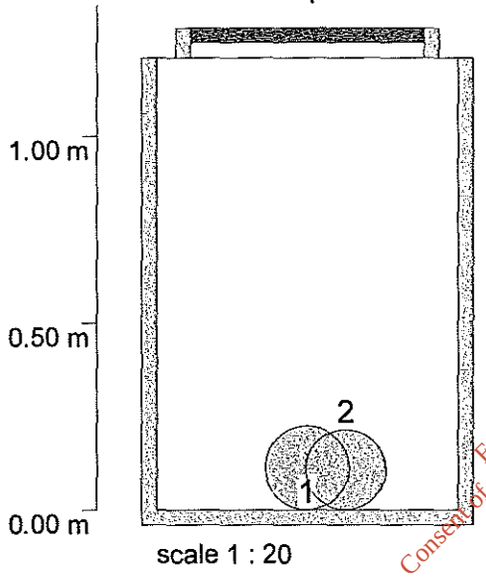
manhole : material : insitu concrete depth : 1.29 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 32.88 m

connection

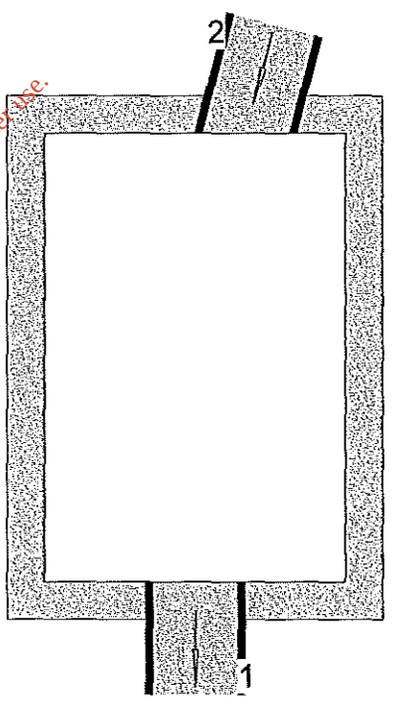
No.	mat.	diameter	depth	text	invert level : 31.59 m
1	Conc	225	1.29 m	outlet main drain	31.59 m
2	Concrete	225	1.29 m	inlet main drain	31.59 m

MH - depth =1.29 m



scale 1 : 20

height cover slab = 0.12 m



MH-ID number : 36

MH - number : MH32

town : Kilgarvan street : to T.P

operator : Kreisel date : 21.04.2006 DVD-No : Kilga-1 videotime : 3:25:56

classification **severe damage = 0 1 2 3 4 = light damage**

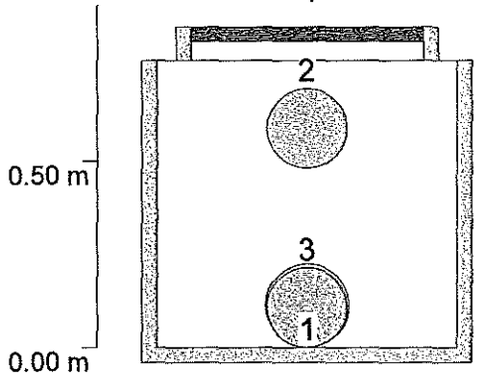
manhole : MH with back drop material : insitu concrete depth : 0.86 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 30.35 m

connection

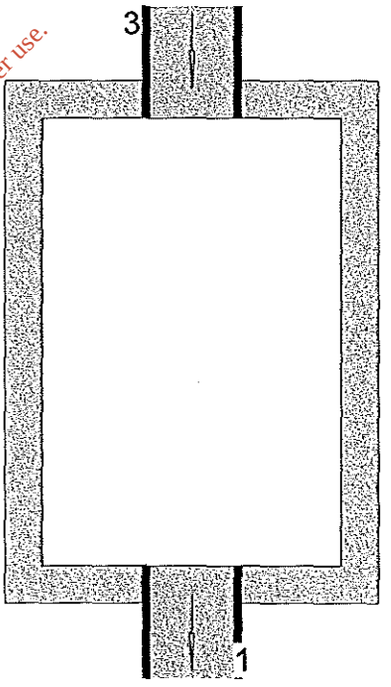
No.	mat.	diameter	depth	text	invert level : 29.49 m
1	Conc	225	0.86 m	outlet main drain	29.49 m
2	Concrete	225	0.38 m	inlet main drain	29.97 m
3	Concrete	225	0.86 m	inlet right Bach drop	29.49 m

MH - depth =0.86 m



scale 1 : 20

height cover slab = 0.13 m



MH-ID number : 38

MH - number : MH23R

town : Kilgarvan street : Kenmare Road

operator : Kreisel date : 22.04.2006 DVD-No : Kilga-1 videotime : 3:31:40

classification **severe damage = 0 1 2 3 4 = light damage**

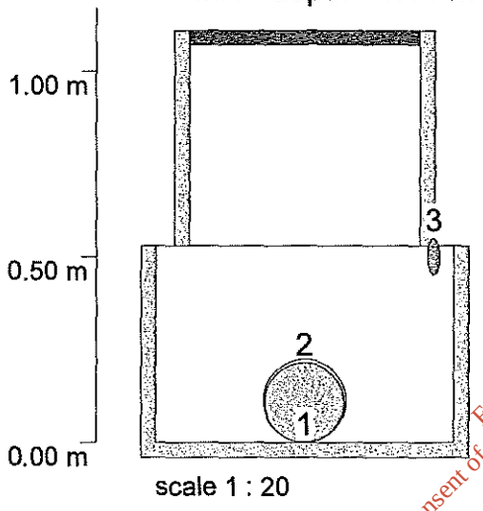
manhole : material : insitu concrete depth : 1.11 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 38.55 m

connection

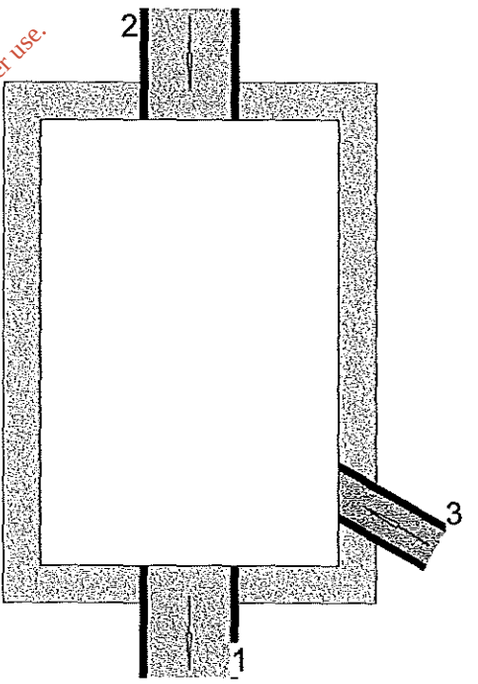
No.	mat.	diameter	depth	text	invert level : 37.44 m
1	Clay	225	1.11 m	outlet main drain	37.44 m
2	Clay	225	1.11 m	inlet main drain	37.44 m
3	PVC	100	0.66 m	inlet left	37.89 m

MH - depth =1.11 m



scale 1 : 20

height cover slab = 0.62 m



MH-ID number : 39

MH - number : MH22R

town : Kilgarvan street : Kenmare Road

operator : Kreisel date : 22.04.2006 DVD-No : Kilga-1 videotime : 3:32:47

classification **severe damage = 0 1 2 3 4 = light damage**

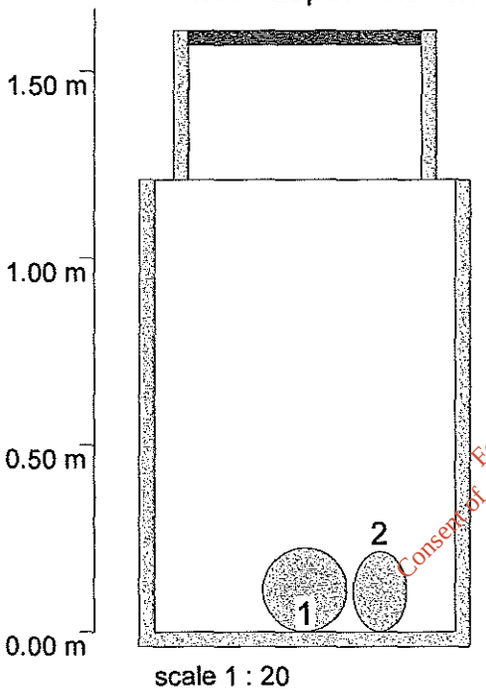
manhole : material : insitu concrete depth : 1.61 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 38.30 m

connection

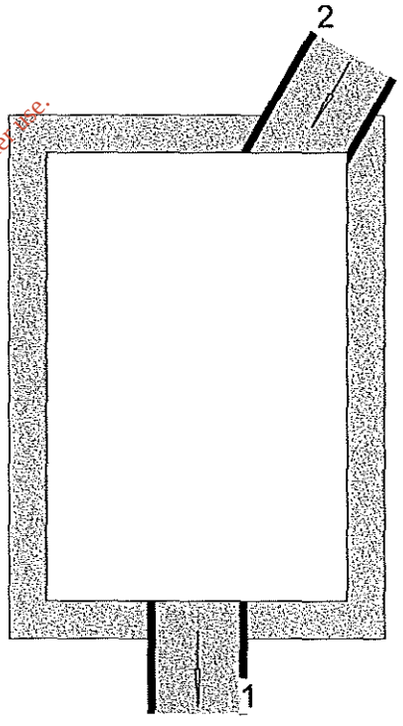
No.	mat.	diameter	depth	text	invert level : 36.69 m
1	Clay	225	1.61 m	outlet main drain	36.69 m
2	Clay	225	1.61 m	inlet main drain	36.69 m

MH - depth =1.61 m



scale 1 : 20

height cover slab = 0.44 m



MH-ID number : 40

MH - number : MH21

town : Kilgarvan street : Kenmare Road

operator : Kreisel date : 22.04.2006 DVD-No : Kilga-1 videotime : 3:38:15

classification **severe damage = 0 1 2 3 4 = light damage**

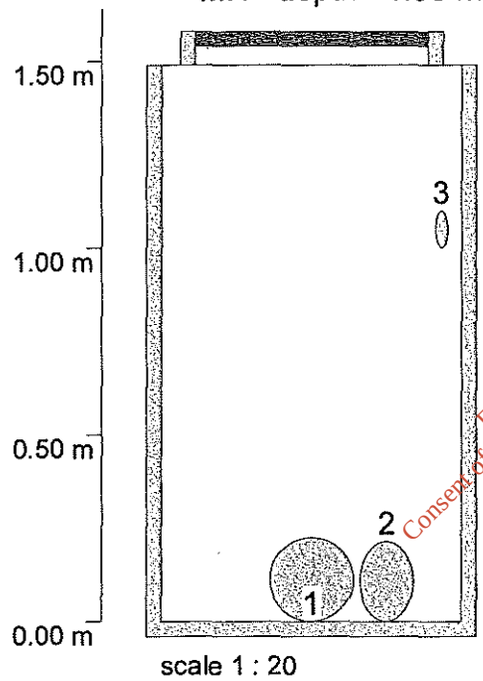
manhole : material : insitu concrete depth : 1.58 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 37.76 m

connection

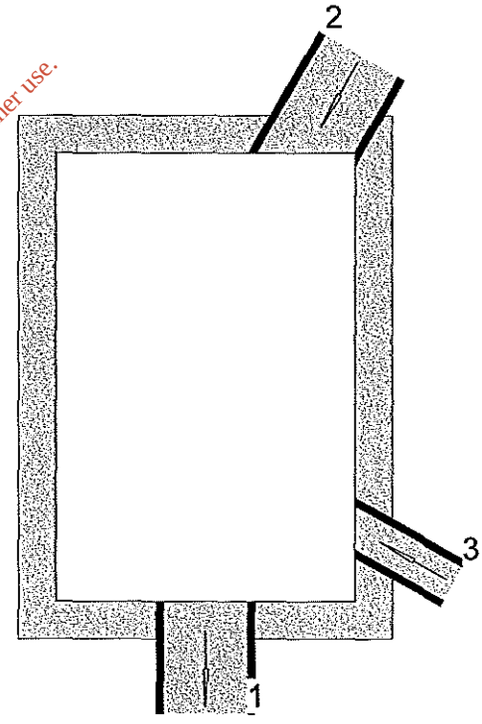
No.	mat.	diameter	depth	text	invert level : 36.18 m
1	Clay	225	1.58 m	outlet main drain	36.18 m
2	Clay	225	1.58 m	inlet main drain	36.18 m
3	Concrete	100	0.58 m	inlet left	37.18 m

MH - depth =1.58 m



scale 1 : 20

height cover slab = 0.13 m



MH-ID number : 42

MH - number : MH25

town : Kilgarvan street : Kenmare Road

operator : Kreisel date : 22.04.2006 DVD-No : videotime : 3:49:17

classification **severe damage = 0 1 2 3 4 = light damage**

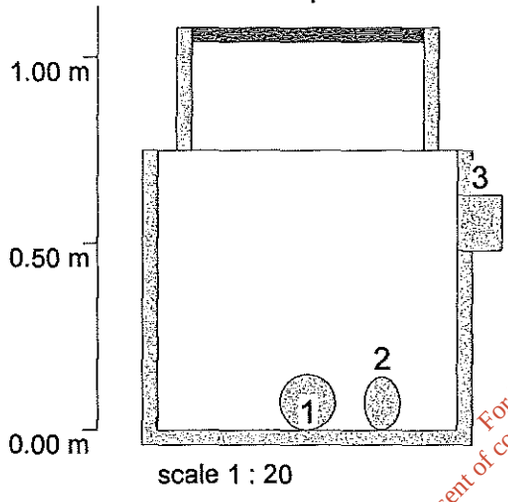
manhole : material : insitu concrete depth : 1.08 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 39.99 m

connection

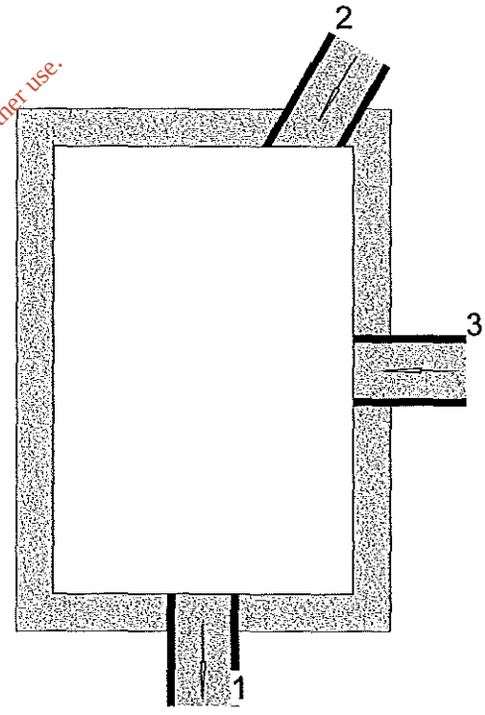
No.	mat.	diameter	depth	text	invert level : 38.91 m
1	Clay	150	1.08 m	outlet main drain	38.91 m
2	Clay	150	1.08 m	inlet main drain	38.91 m
3	Clay	150	0.60 m	inlet left	39.39 m

MH - depth =1.08 m



scale 1 : 20

height cover slab = 0.37 m



MH-ID number : 43

MH - number : MH28

town : Kilgarvan street : Kenmare Road

operator : Kreisel date : 22.04.2006 DVD-No : videotime : 3:49:17

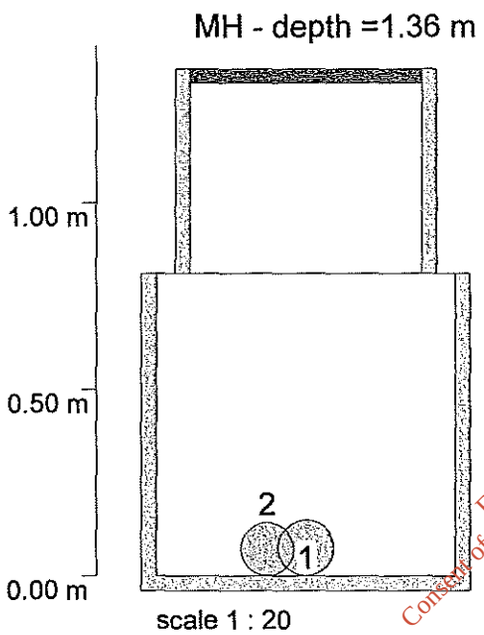
classification **severe damage = 0 1 2 3 4 = light damage**

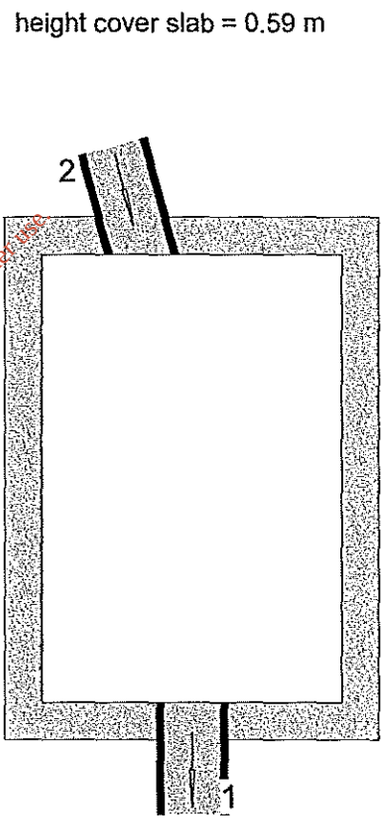
manhole : material : insitu concrete depth : 1.36 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 41.66 m

connection

No.	mat.	diameter	depth	text	invert level : 40.30 m
1	Clay	150	1.36 m	outlet main drain	40.30 m
2	Clay	150	1.36 m	inlet main drain	40.30 m





MH-ID number : 44

MH - number : MH29

town : Kilgarvan street : Kenmare Road

operator : Kreisel date : 22.04.2006 DVD-No : videotime : 3:49:17

classification **severe damage = 0 1 2 3 4 = light damage**

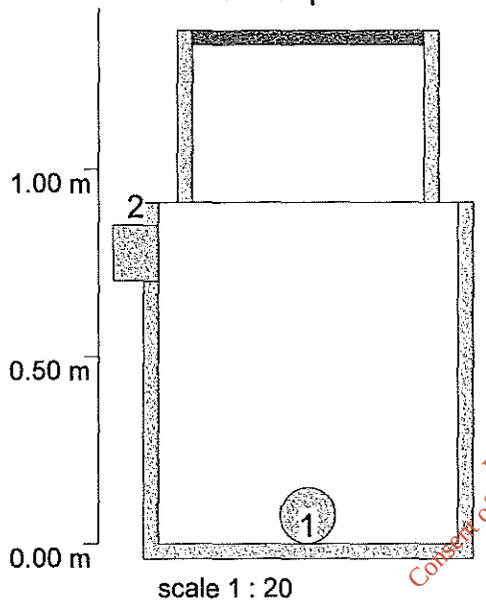
manhole : material : insitu concrete depth : 1.37 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 42.76 m

connection

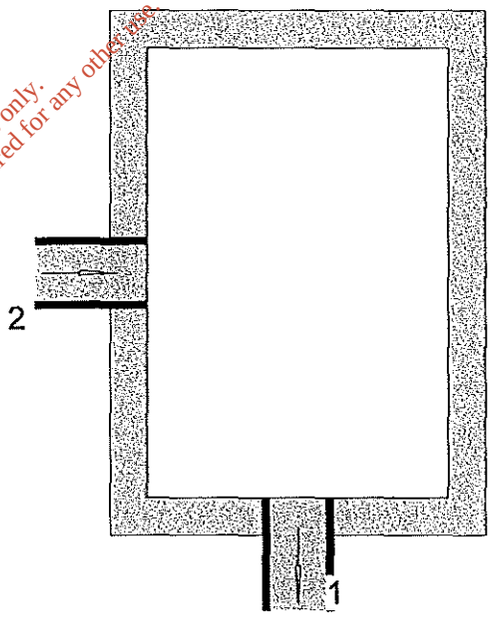
No.	mat.	diameter	depth	text	invert level : 41.39 m
1	Clay	150	1.37 m	outlet main drain	41.39 m
2	Clay	150	0.67 m	inlet right	42.09 m

MH - depth =1.37 m



scale 1 : 20

height cover slab = 0.50 m



MH-ID number : 45

MH - number : MH1B

town : Kilgarvan street : Main Street

operator : Kreisel date : 22.04.2006 DVD-No : videotime : 3:49:17

classification **severe damage = 0 1 2 3 4 = light damage**

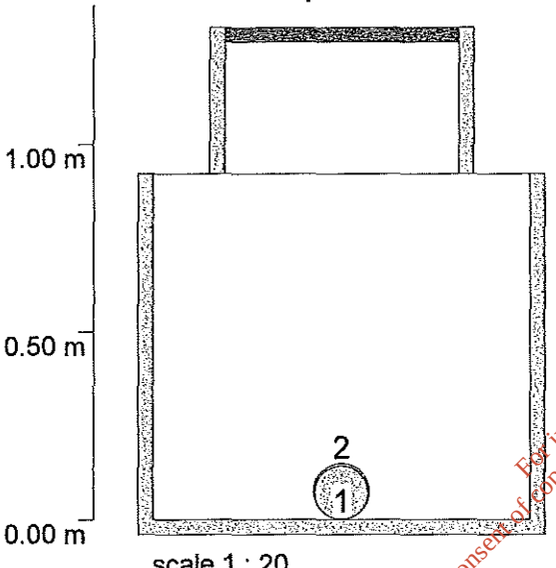
manhole : material : concrete depth : 1.31 m

MH shape : circular Di 1000 cover type : D C.L.: 52.52 m

connection

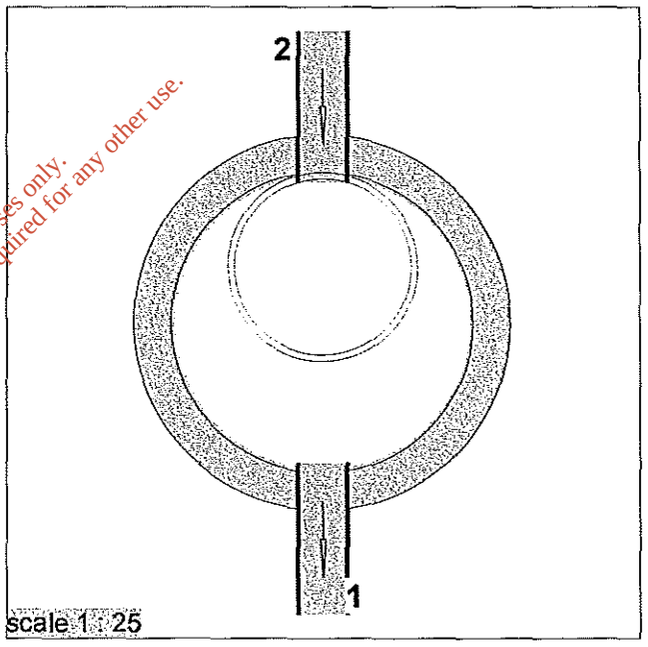
No.	mat.	diameter	depth	text	invert level : 51.21 m
1	Conc	150	1.31 m	outlet main drain	51.21 m
2	Concrete	150	1.31 m	inlet right	51.21 m

MH - depth =1.31 m



scale 1 : 20

height cover slab = 0.43 m



scale 1 : 25

MH-ID number : 46

MH - number : MH1A

town : Kilgarvan street : Main Street

operator : Kreisel date : 22.04.2006 DVD-No : videotime : 3:49:17

classification **severe damage = 0 1 2 3 4 = light damage**

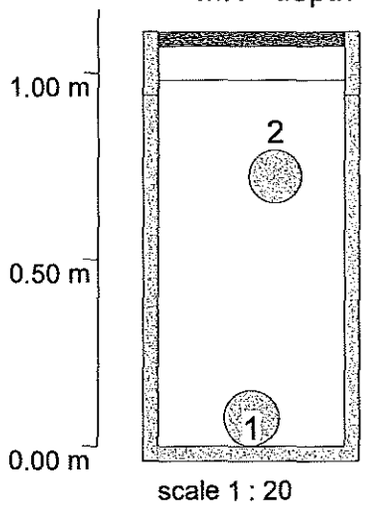
manhole : MH with dropping invert acrossmaterial : insitu concrete depth : 1.11 m

MH shape : rect. L0.70 m B : 0.50 m cover type : D C.L.: 50.57 m

connection

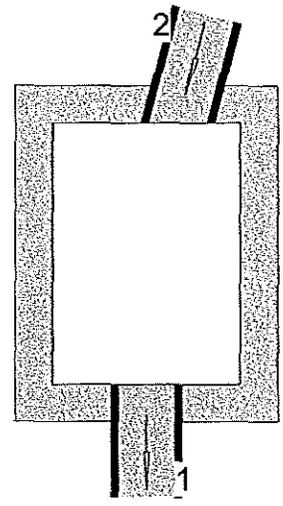
No.	mat.	diameter	depth	text	invert level : 49.46 m
1	Conc	150	1.11 m	outlet main drain	49.46 m
2	Concrete	150	0.46 m	inlet main drain	50.11 m

MH - depth =1.11 m



scale 1 : 20

height cover slab = 0.17 m



MH-ID number : 47

MH - number : MH1

town : Kilgarvan street : Main Street

operator : Kreisel date : 22.04.2006 DVD-No : videotime : 3:49:17

classification **severe damage = 0 1 2 3 4 = light damage**

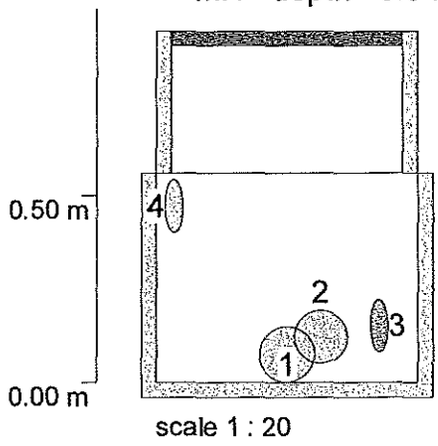
manhole : MH with dropping invert acrossmaterial : insitu concrete depth : 0.94 m

MH shape : rect. L1.00 m B : 0.70 m cover type : D C.L.: 49.43 m

connection

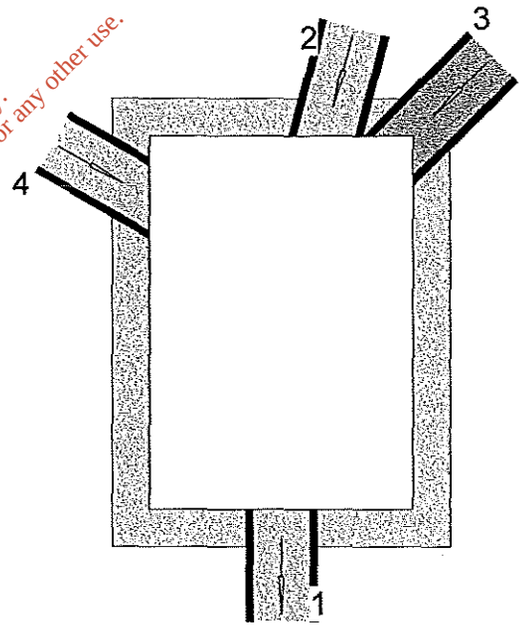
No.	mat.	diameter	depth	text	invert level : 48.49 m
1	Conc	150	0.94 m	outlet main drain	48.49 m
2	Concrete	150	0.89 m	inlet main drain	48.54 m
3	PVC	150	0.86 m	inlet left	48.57 m
4	Clay	150	0.54 m	inlet right	48.89 m

MH - depth =0.94 m



scale 1 : 20

height cover slab = 0.42 m



MH-ID number : 48

MH - number : MH33

town : Kilgarvan street : to T.P

operator : Kreisel date : 22.04.2006 DVD-No : Kilga-1 videotime : 3:52:22

classification **severe damage = 0 1 2 3 4 = light damage**

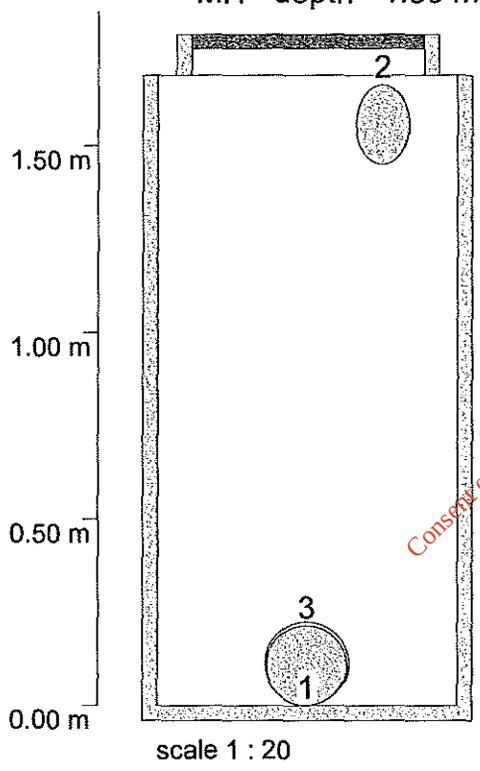
manhole : MH with back drop material : insitu concrete depth : 1.80 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 28.88 m

connection

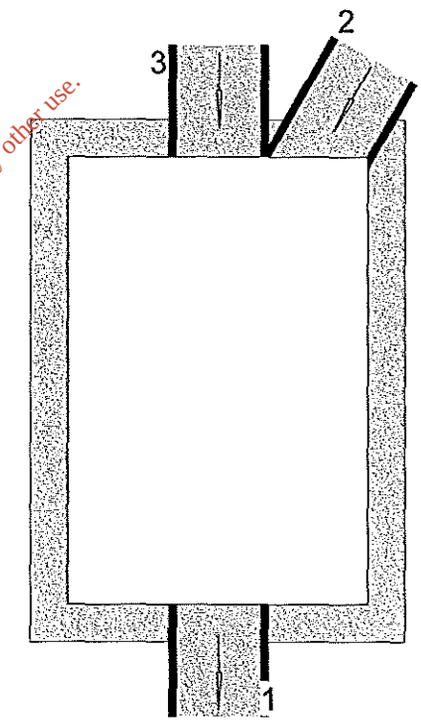
No.	mat.	diameter	depth	text	invert level : 27.08 m
1	Conc	225	1.80 m	outlet main drain	27.08 m
2	Concrete	225	0.35 m	inlet main drain	28.53 m
3	Concrete	225	1.80 m	inlet right Bach drop	27.08 m

MH - depth =1.80 m



scale 1 : 20

height cover slab = 0.15 m



MH-ID number : 49

MH - number : MH34

town : Kilgarvan street : to T.P

operator : Kreisel date : 22.04.2006 DVD-No : Kilga-1 videotime : 3:53:00

classification **severe damage = 0 1 2 3 4 = light damage**

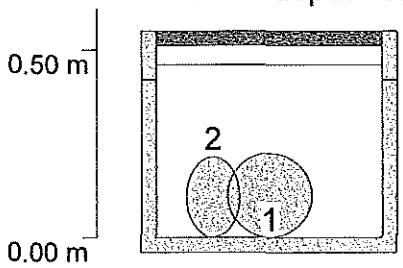
manhole : material : insitu concrete depth : 0.55 m

MH shape : rect. L0.60 m B : 0.60 m cover type : D C.L.: 26.89 m

connection

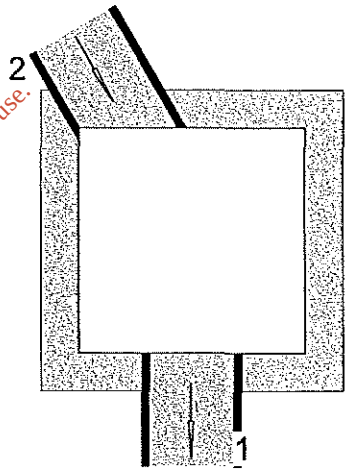
No.	mat.	diameter	depth	text	invert level : 26.34 m
1	Conc	225	0.55 m	outlet main drain	26.34 m
2	Concrete	225	0.55 m	inlet main drain	26.34 m

MH - depth =0.55 m



scale 1 : 20

height cover slab = 0.13 m



MH-ID number : 50

MH - number : MH35

town : Kilgarvan street : to T.P

operator : Kreisel date : 22.04.2006 DVD-No : Kilga-1 videotime : 3:57:43

classification **severe damage = 0 1 2 3 4 = light damage**

manhole : MH with back drop material : insitu concrete depth : 1.14 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 25.87 m

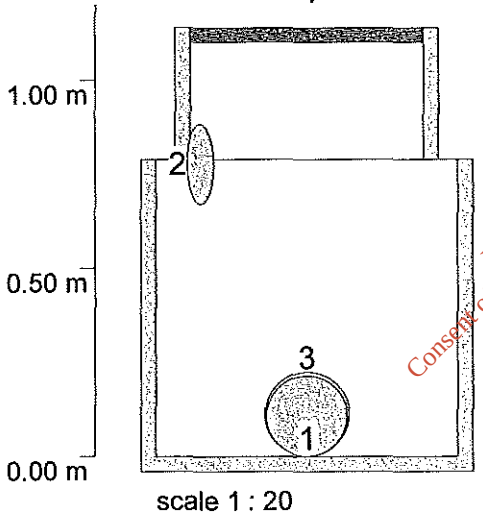
damages

code	class	comments
SGM	2	Defective invert

connection

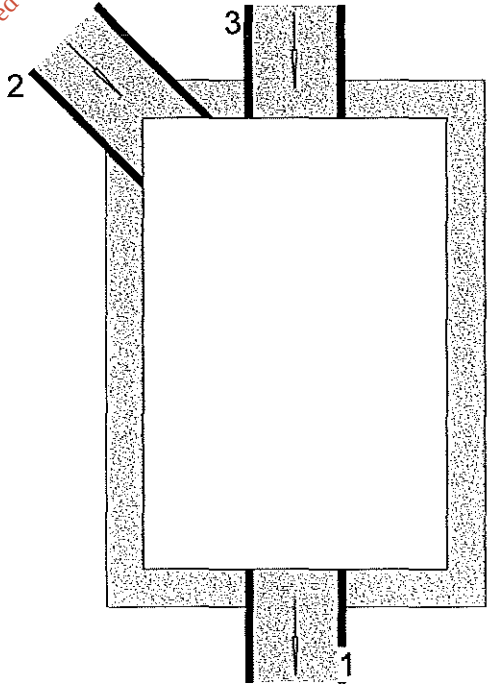
No.	mat.	diameter	depth	text	invert level : 24.73 m
1	Conc	225	1.14 m	outlet main drain	24.73 m
2	Concrete	225	0.47 m	inlet main drain	25.40 m
3	Concrete	225	1.14 m	inlet right Bach drop	24.73 m

MH - depth =1.14 m



scale 1 : 20

height cover slab = 0.39 m



MH-ID number : 51

MH - number : MH36

town : Kilgarvan street : to T.P

operator : Kreisel date : 22.04.2006 DVD-No : Kilga-1 videotime : 4:01:12

classification **severe damage = 0 1 2 3 4 = light damage**

manhole : MH with back drop material : insitu concrete depth : 1.98 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 24.48 m

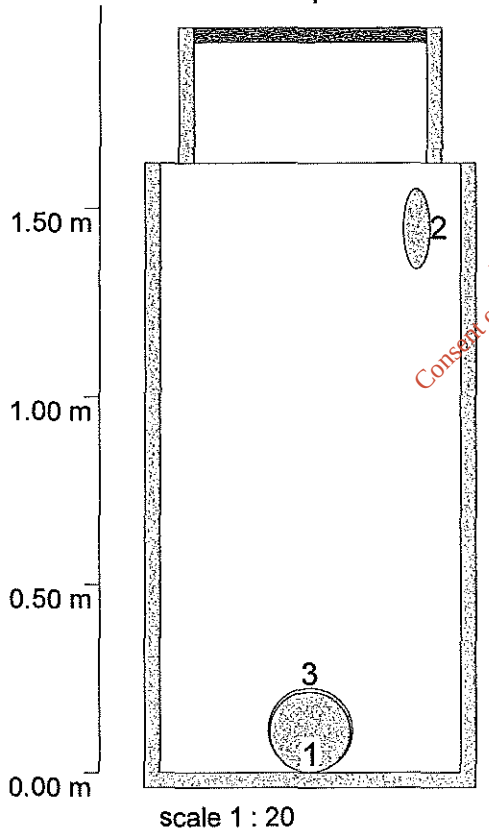
damages

code	class	comments
SE	2	Step missing 5 no.

connection

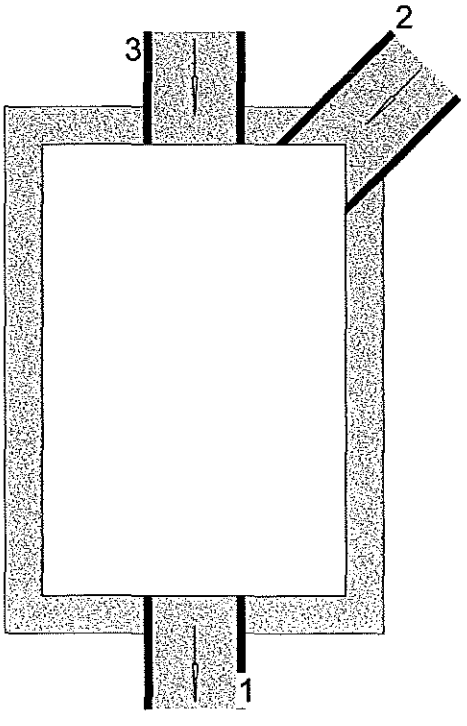
No.	mat.	diameter	depth	text	invert level : 22.50 m
1	Conc	225	1.98 m	outlet main drain	22.50 m
2	Concrete	225	0.64 m	inlet main drain	23.84 m
3	Concrete	225	1.98 m	inlet right Bach drop	22.50 m

MH - depth =1.98 m



scale 1 : 20

height cover slab = 0.40 m



MH-ID number : 52

MH - number : MH37

town : Kilgarvan street : to T.P

operator : Kreisel date : 22.04.2006 DVD-No : Kilga-1 videotime : 0:00:12

classification **severe damage = 0 1 2 3 4 = light damage**

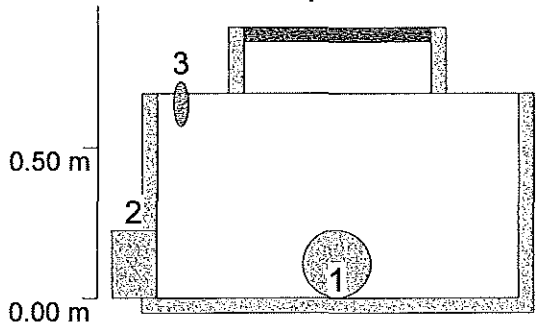
manhole : material : insitu concrete depth : 0.90 m

MH shape : rect. L0.80 m B : 1.20 m cover type : D C.L.: 22.20 m

connection

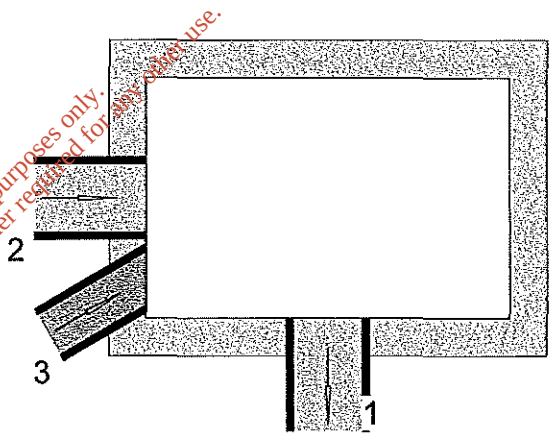
No.	mat.	diameter	depth	text	invert level : 21.30 m
1	Conc	225	0.90 m	outlet main drain	21.30 m
2	Concrete	225	0.90 m	inlet main drain	21.30 m
3	PVC	150	0.33 m	inlet right	21.87 m

MH - depth =0.90 m



scale 1 : 25

height cover slab = 0.27 m



MH-ID number : 53

MH - number : MH38

town : Kilgarvan street : to T.P

operator : Kreisel date : 22.04.2006 DVD-No : Kilga-1 videotime : 0:05:42

classification **severe damage = 0 1 2 3 4 = light damage**

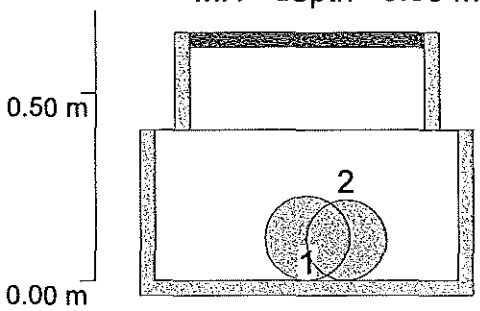
manhole : material : insitu concrete depth : 0.66 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 21.17 m

connection

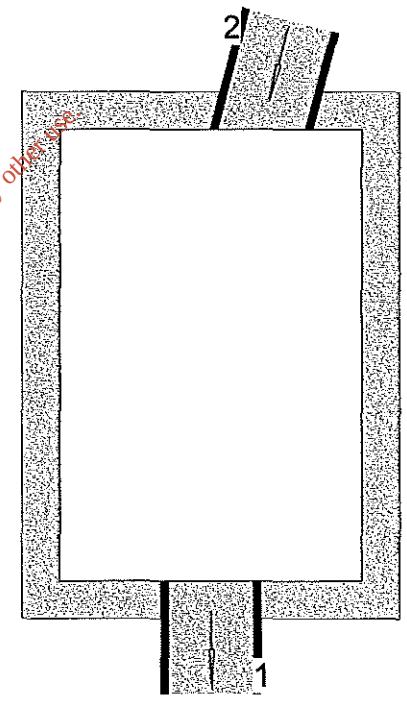
No.	mat.	diameter	depth	text	invert level : 20.51 m
1	Clay	225	0.66 m	outlet main drain	20.51 m
2	Clay	225	0.66 m	inlet main drain	20.51 m

MH - depth =0.66 m



scale 1 : 20

height cover slab = 0.30 m



MH-ID number : 54

MH - number : MH12L

town : Kilgarvan street : to T.P

operator : Kreisel date : 22.04.2006 DVD-No : Kilga-1 videotime : 0:11:20

classification **severe damage = 0 1 2 3 4 = light damage**

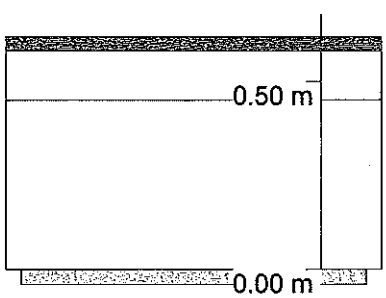
manhole : material : insitu concrete depth : 0.62 m

cover type : D C.L.: 22.20 m

connection

No.	mat.	diameter	depth	text	invert level : 21.58 m

MH - depth =0.62 m ight cover slab = 0.21 m



scale 1 : 20

MH-ID number : 55

MH - number : MH12L

town : Kilgarvan street : St. Garvans terrace

operator : Kreisel date : 23.04.2006 DVD-No : Kilga-1 videotime : 0:16:31

classification **severe damage = 0 1 2 3 4 = light damage**

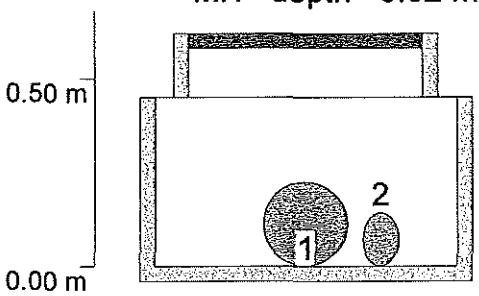
manhole : material : insitu concrete depth : 0.62 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 43.69 m

connection

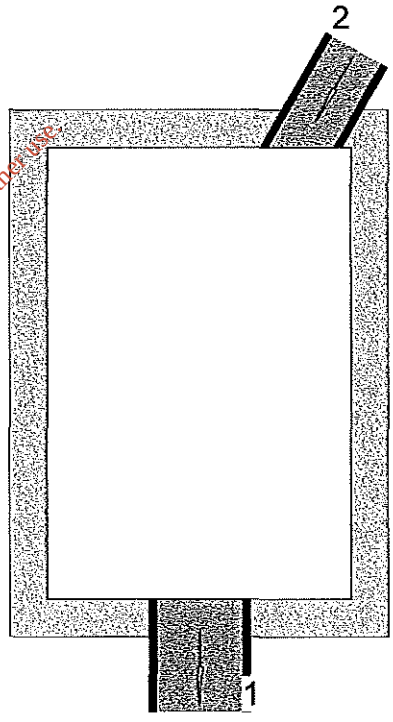
No.	mat.	diameter	depth	text	invert level : 43.07 m
1	PVC	225	0.62 m	outlet main drain	43.07 m
2	PVC	150	0.62 m	inlet left	43.07 m

MH - depth =0.62 m



scale 1 : 20

height cover slab = 0.21 m



MH-ID number : 57

MH - number : MH11

town : Kilgarvan street : Main Street

operator : Kreisel date : 23.04.2006 DVD-No : Kilga-2 videotime : 0:33:45

classification **severe damage = 0 1 2 3 4 = light damage**

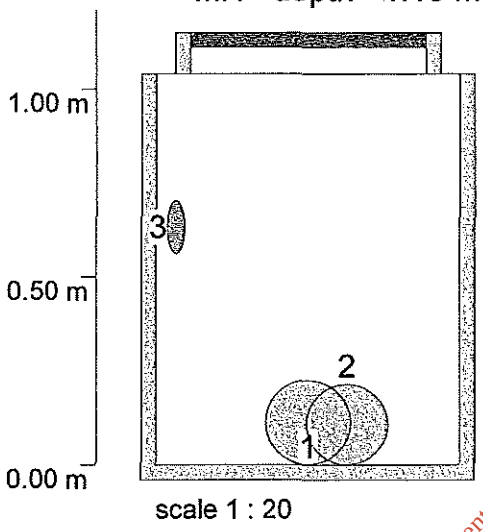
manhole : material : insitu concrete depth : 1.15 m

MH shape : rect. L1.20 m B : 0.80 m cover type : D C.L.: 43.29 m

connection

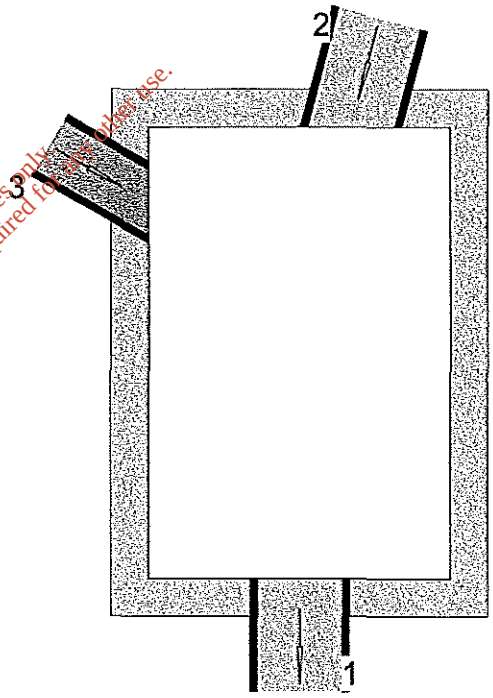
No.	mat.	diameter	depth	text	invert level : 42.14 m
1	Conc	225	1.15 m	outlet main drain	42.14 m
2	Concrete	225	1.15 m	inlet main drain	42.14 m
3	PVC	150	0.59 m	inlet right	42.70 m

MH - depth =1.15 m



scale 1 : 20

height cover slab = 0.15 m



MH-ID number : 59

MH - number : MH10

town : Kilgarvan street : Main Street

operator : Kreisel date : 23.04.2006 DVD-No : Kilga-2 videotime : 0:36:34

classification **severe damage = 0 1 2 3 4 = light damage**

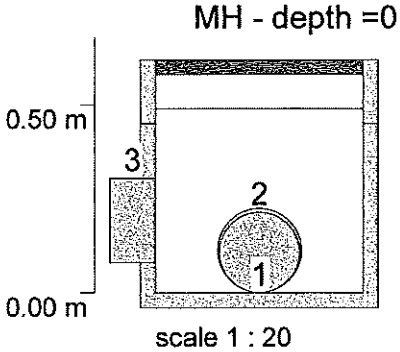
manhole : material : insitu concrete depth : 0.62 m

MH shape : rect. L0.55 m B : 0.55 m cover type : D C.L.: 42.42 m

connection

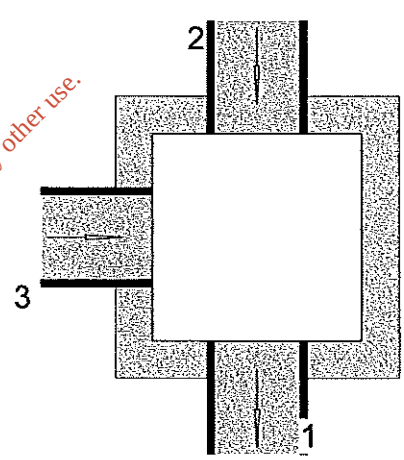
No.	mat.	diameter	depth	text	invert level : 41.80 m
1	Conc	225	0.62 m	outlet main drain	41.80 m
2	Concrete	225	0.62 m	inlet main drain	41.80 m
3	Concrete	225	0.54 m	inlet main drain	41.88 m

MH - depth =0.62 m



scale 1 : 20

height cover slab = 0.17 m



MH-ID number : 60

MH - number : MH10c

town : Kilgarvan | street : off Main Street

operator : Kreisel | date : 23.04.2006 | DVD-No : Kilga-2 | videotime : 0:44:05

classification | **severe damage = 0 1 2 3 4 = light damage**

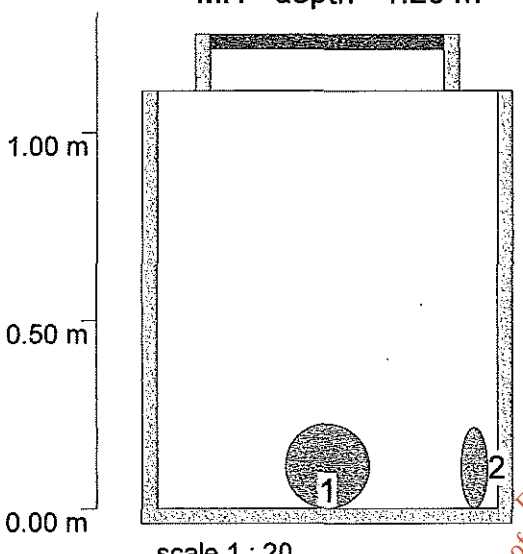
manhole : | material : concrete | depth : 1.26 m

MH shape : rect. L0.90 m B : 0.90 m | cover type : B | C.L.: 42.54 m

connection

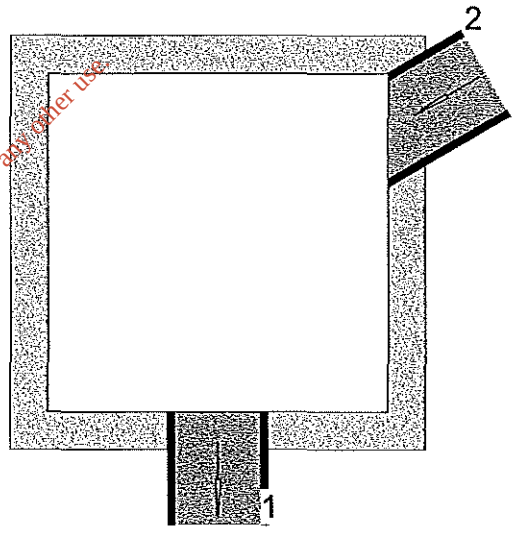
No.	mat.	diameter	depth	text	invert level : 41.28 m
1	PVC	225	1.26 m	outlet main drain	41.28 m
2	PVC	225	1.26 m	inlet main drain	41.28 m

MH - depth =1.26 m



scale 1 : 20

height cover slab = 0.19 m



MH-ID number : 61

MH - number : MH10b

town : Kilgarvan | street : off Main Street

operator : Kreisel | date : 23.04.2006 | DVD-No : Kilga-2 | videotime : 0:50:03

classification | **severe damage = 0 1 2 3 4 = light damage**

manhole : | material : concrete | depth : 0.84 m

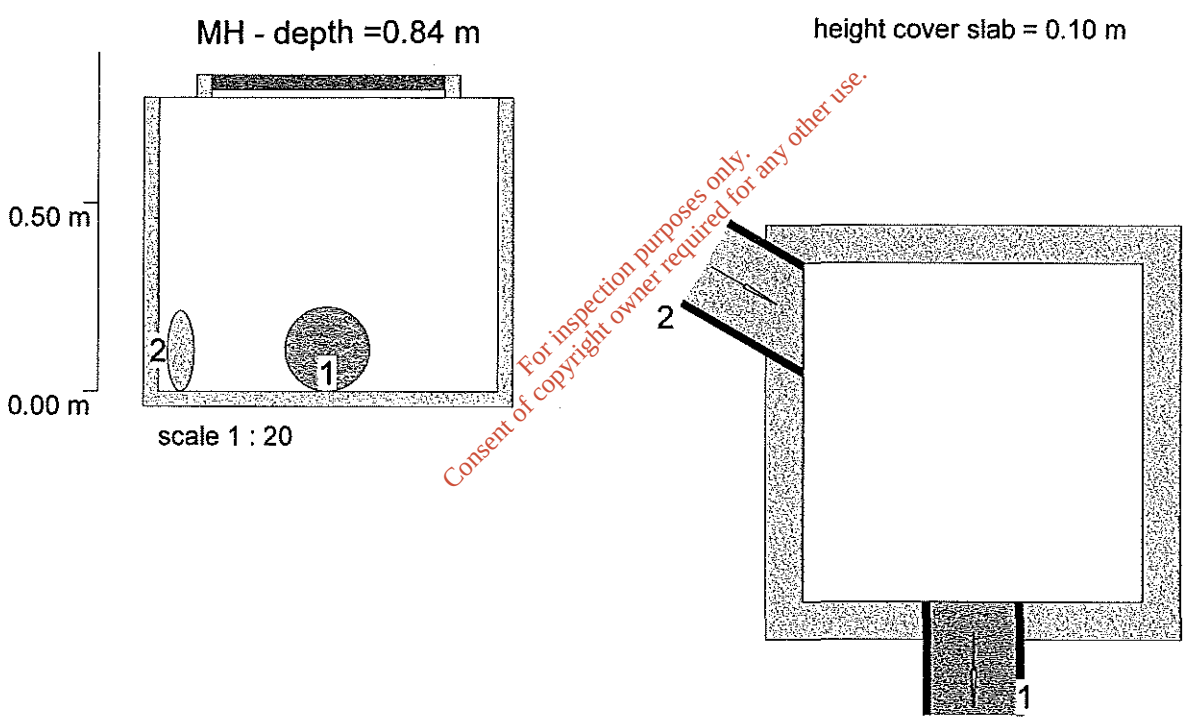
MH shape : rect. L0.90 m B : 0.90 m | cover type : B | C.L.: 42.28 m

damages

code	class	comments
SGM	2	Defective invert

connection

No.	mat.	diameter	depth	text	invert level : 41.44 m
1	PVC	225	0.84 m	outlet main drain	41.44 m
2	Concrete	225	0.84 m	inlet main drain	41.44 m



Appendix 8 – Existing Water Quality / Flow Load Survey Report (Not Applicable)

Appendix 8.1 - Kilgarvan Existing Water Quality Data

Parameter					Molybdate Reactive Phosphorous	Total Phosphorous	Conductivity @ 20 oC	pH	Total Oxidised Nitrogen (TON)	Dissolved Oxygen	Temp	Alkalinity	Ammonium	Colour	Nitrite	BOD	Q Biological Rating	Faecal Streptococci
					P	P			NO3	O2		CaCO3	NH4	Hz	NO2	O2		
Max					0.03	0.066	--	9	--	15	--	--	Varies	--	0.01	--	--	--
Target					--	--	--	--	--	--	--	--	--	--	--	--	--	--
Min					--	--	--	6	--	5	--	--	--	--	--	--	4	--
Category	Project	Location	Location Easting	Location Northing	Sample Template	Sample Date	Sample Method	Sampled By	Comments	mg/l	mg/l	µS/cm	pH units	mg/l	mg/l	Degrees C	mg/l	mg/l	Hazen	mg/l	mg/l	Rating	no./100mls
Rivers	Roughty	Morley's Bridge	104732	75221	River quality: Standard form	15-Sep-82	Grab	EPA														5	
Rivers	Roughty	Morley's Bridge	104732	75221	River quality: Standard form	15-Sep-86	Grab	EPA														4.5	
Rivers	Roughty	Inchee Bridge Left Hand Side	107709	73915	River quality: Standard form	15-Sep-90	Grab	EPA														*3*	
Rivers	Roughty	Ford Downstream Slaheny River Confluences	99842	72855	River quality: Standard form	15-Sep-90	Grab	EPA														4	
Rivers	Roughty	Ford Northwest Of Kilgortaree House	96032	72122	River quality: Standard form	15-Sep-90	Grab	EPA														4	
Rivers	Roughty	Bridge (Ford) Near Knockanruddig	108767	70909	River quality: Standard form	15-Sep-90	Grab	EPA														4.5	
Rivers	Roughty	Morley's Bridge	104732	75221	River quality: Standard form	15-Sep-90	Grab	EPA														4.5	
Rivers	Roughty	Inchee Bridge Right Hand Side	107757	73876	River quality: Standard form	15-Sep-90	Grab	EPA														4.5	
Rivers	Roughty	Morley's Bridge	104732	75221	River quality: Standard form	15-Sep-93	Grab	EPA														4.5	
Rivers	Roughty	Ford Northwest Of Kilgortaree House	96032	72122	River quality: Standard form	15-Sep-93	Grab	EPA														4	
Rivers	Roughty	Bridge (Ford) Near Knockanruddig	108767	70909	River quality: Standard form	15-Sep-93	Grab	EPA														4	
Rivers	Roughty	Ford Downstream Slaheny River Confluences	99842	72855	River quality: Standard form	15-Sep-93	Grab	EPA														4	
Rivers	Roughty	Inchee Bridge Right Hand Side	107757	73876	River quality: Standard form	15-Sep-93	Grab	EPA														4	
Rivers	Roughty	Inchee Bridge Left Hand Side	107709	73915	River quality: Standard form	15-Sep-93	Grab	EPA														4	
Rivers	Roughty	Inchee Bridge Left Hand Side	107709	73915	River quality: Standard form	15-Sep-97	Grab	EPA														4.5	
Rivers	Roughty	Morley's Bridge	104732	75221	River quality: Standard form	15-Sep-97	Grab	EPA														4.5	
Rivers	Roughty	Inchee Bridge Right Hand Side	107757	73876	River quality: Standard form	15-Sep-97	Grab	EPA														4.5	
Rivers	Roughty	Ford Northwest Of Kilgortaree House	96032	72122	River quality: Standard form	15-Sep-97	Grab	EPA														4	
Rivers	Roughty	Bridge (Ford) Near Knockanruddig	108767	70909	River quality: Standard form	15-Sep-97	Grab	EPA														4.5	
Rivers	Roughty	Ford Downstream Slaheny River Confluences	99842	72855	River quality: Standard form	15-Sep-97	Grab	EPA														4	
Rivers	Roughty	Morley's Bridge	104732	75221	Phosphorous Monthly	21-Oct-99	Grab	Administrator		< 0.005	0.012	61	7.2	1.05	11.1	9.5		< 0.02	30	< 0.003	< 1		
Rivers	Roughty	Ford Northwest Of Kilgortaree House	96032	72122	River quality: Standard form	21-Oct-99	Grab	Administrator		< 0.005	0.012	98	7.6	2.56	10.9	10.3		< 0.02	25	< 0.003	< 1		
Rivers	Roughty	Inchee Bridge Right Hand Side	107757	73876	River quality: Standard form	21-Oct-99	Grab	Administrator		0.006	0.011	57	7	0.91	10.8	9.8		< 0.02	30	< 0.003	1.1		
Rivers	Roughty	Br S Of Ardtully Bridge	98648	72808	River quality: Standard form	21-Oct-99	Grab	Administrator		< 0.005	0.011	87	7.2	2.1	10.7	10.7		< 0.02	35	< 0.003	< 1		
Rivers	Roughty	Cahergal Bridge	100660	72886	River quality: Standard form	21-Oct-99	Grab	Administrator		< 0.005	< 0.01	78	7.3	1.8	10.8	10		< 0.02	45	< 0.003	< 1		
Rivers	Roughty	Bridge (Ford) Near Knockanruddig	108767	70909	River quality: Standard form	21-Oct-99	Grab	Administrator		< 0.005	< 0.01	45	7	0.43	10.6	9.2		< 0.02	40	< 0.003	1.2		
Rivers	Roughty	Morley's Bridge	104732	75221	River quality: Standard form	22-Feb-00	Grab	Administrator		< 0.005		48	6.3	0.39	11.8	6.4		< 0.02			< 1		
Rivers	Roughty	Ford Northwest Of Kilgortaree House	96032	72122	River quality: Standard form	22-Feb-00	Grab	Administrator		0.006		57	6.7	0.84	11.7	6.4		< 0.02			< 1		
Rivers	Roughty	Inchee Bridge Right Hand Side	107757	73876	River quality: Standard form	22-Feb-00	Grab	Administrator		< 0.005	< 0.01	47	6.5	0.37	11.5	6.2		< 0.02			< 1		
Rivers	Roughty	Inchee Bridge Right Hand Side	107757	73876	River quality: Standard form	23-Mar-00	Grab	Administrator		< 0.005	< 0.01	63	7.4	1				< 0.02					
Rivers	Roughty	Morley's Bridge	104732	75221	River quality: Standard form	23-Mar-00	Grab	Administrator		< 0.005	0.01	68	7.3	1.16				< 0.02			< 1		
Rivers	Roughty	Ford Northwest Of Kilgortaree House	96032	72122	River quality: Standard form	23-Mar-00	Grab	Administrator		0.005	0.02	110	7.5	3.3				< 0.02			< 1		
Rivers	Roughty	Inchee Bridge Right Hand Side	107757	73876	River quality: Standard form	03-May-00	Grab	Administrator		< 0.005	0.012	64	7.2	0.51				0.05			< 1		
Rivers	Roughty	Morley's Bridge	104732	75221	River quality: Standard form	03-May-00	Grab	Administrator		< 0.005	0.012	67	7.4	0.46				0.03			< 1		
Rivers	Roughty	Ford Northwest Of Kilgortaree House	96032	72122	River quality: Standard form	03-May-00	Grab	Administrator		< 0.005	0.015	101	7.6	1.73				< 0.02			< 1		
Rivers	Roughty	Bridge (Ford) Near Knockanruddig	108767	70909	River quality: Standard form	15-Sep-00	Grab	EPA														4.5	
Rivers	Roughty	Inchee Bridge Left Hand Side	107709	73915	River quality: Standard form	15-Sep-00	Grab	EPA														4.5	
Rivers	Roughty	Ford Downstream Slaheny River Confluences	99842	72855	River quality: Standard form	15-Sep-00	Grab	EPA														4	
Rivers	Roughty	Inchee Bridge Right Hand Side	107757	73876	River quality: Standard form	15-Sep-00	Grab	EPA														4.5	
Rivers	Roughty	Ford Northwest Of Kilgortaree House	96032	72122	River quality: Standard form	15-Sep-00	Grab	EPA														4	
Rivers	Roughty	Morley's Bridge	104732	75221	River quality: Standard form	15-Sep-00	Grab	EPA														4.5	
Rivers	Roughty	Inchee Bridge Right Hand Side	107757	73876	River quality: Standard form	22-Nov-00	Grab	Administrator		< 0.005	< 0.01	45	6.9	0.23				< 0.02			1.4		
Rivers	Roughty	Ford Northwest Of Kilgortaree House	96032	72122	River quality: Standard form	22-Nov-00	Grab	Administrator		0.009	0.015	64	7.2	1.34				< 0.02			1.4		
Rivers	Roughty	Morley's Bridge	104732	75221	River quality: Standard form	22-Nov-00	Grab	Administrator		< 0.005	< 0.01	47	7.2	0.29				< 0.02			2.8		
Rivers	Roughty	Morley's Bridge	104732	75221	Phosphorous Regs	27-Feb-01	Grab	Derry Bowler		< 0.005	0.011	54	6.8	1.08	13	2.7		< 0.02			1.7		
Rivers	Roughty	Inchee Bridge Left Hand Side	107709	73915	Phosphorous Regs	27-Feb-01	Grab	Derry Bowler		< 0.005	< 0.01	54	7	1.01	12.9	2.3		< 0.02			2.2		
Rivers	Roughty	Ford Northwest Of Kilgortaree House	96032	72122	Phosphorous Regs	27-Feb-01	Grab	Derry Bowler		0.012	0.019	73	7	2.01	12.9	2.5		< 0.02			1.5		
Rivers	Roughty	Inchee Bridge Left Hand Side	107709	73915	Phosphorous Regs	01-May-01	Grab	Derry Bowler		< 0.005	< 0.01	49	7	0.49	11.8	10.6		< 0.02			1.4		
Rivers	Roughty	Morley's Bridge	104732	75221	Phosphorous Regs	01-May-01	Grab	Derry Bowler		0.007	< 0.01	49	6.9	0.45	11.5	10.1		< 0.02			1.1		
Rivers	Roughty	Ford Northwest Of Kilgortaree House	96032	72122	Phosphorous Regs	19-Jun-01	Grab	Derry Bowler		0.018	0.02	59		0.91	10.2	14.3		< 0.02			< 1		7
Rivers	Roughty	Morley's Bridge	104732	75221	Phosphorous Regs	19-Jun-01	Grab	Derry Bowler		0.005	0.013			0.48	10.4	13.8		< 0.02			< 1		7
Rivers	Roughty	Inchee Bridge Right Hand Side	107757	73876	Phosphorous Regs	19-Jun-01	Grab	Derry Bowler		< 0.005	< 0.01	45		0.45	10.3	13.9		< 0.02			< 1		7
Rivers	Roughty	Inchee Bridge Left Hand Side	107709	73915	Phosphorous Regs	22-Aug-01	Grab	Derry Bowler		0.005	*35*	39	*4.8*	0.7	10.2	12.7		< 0.02			< 1		
Rivers	Roughty	Ford Northwest Of Kilgortaree House	96032	72122	Phosphorous Regs	22-Aug-01	Grab	Derry Bowler		0.005	0.021	58	6.8	1.61	10	14.1		< 0.02			< 1		
Rivers	Roughty	Morley's Bridge	104732	75221	Phosphorous Monthly	22-Aug-01	Grab	Derry Bowler		0.005	0.027	40	6.8	0.75	10.4	13.1		< 0.02			< 1		
Rivers	Roughty	Morley's Bridge	104732	75221	Phosphorous Monthly	21-Nov-01	Grab	Derry Bowler		0.017	*0.125*	52	6.8	0.51	11.4	9.9		< 0.02			< 1		
Rivers	Roughty	Ford Northwest Of Kilgortaree House	96032	72122	Phosphorous Regs	21-Nov-01	Grab	Derry Bowler		0.022	0.055	72	7.1	1.04	11.5	10		< 0.02			< 1		
Rivers	Roughty	Inchee Bridge Right Hand Side	107757	73876	Phosphorous Regs	21-Nov-01	Grab	Derry Bowler		0.01	0.054	48	6.7	0.48	11.1	9.7		< 0.02			< 1		
Rivers	Roughty	Ford Northwest Of Kilgortaree House	96032	72122	Phosphorous Regs	08-Jan-02	Grab	Derry Bowler		0.005		83	7.1	2.85	12.6	8.2	19.8	< 0.02			< 1		
Rivers	Roughty	Inchee Bridge Right Hand Side	107757	73876	Phosphorous Regs	08-Jan-02	Grab	Derry Bowler		< 0.005		52	6.8	1.3	11.9	7.2	8.9	< 0.02			1		
Rivers	Roughty	Inchee Bridge Left Hand Side	107709	73915	Phosphorous Regs	08-Jan-02	Grab	Derry Bowler		< 0.005		52	6.8	1.32	11.6	7.3	8.7	< 0.02			< 1		
Rivers	Roughty	Morley's Bridge	104732	75221	Phosphorous Regs	08-Jan-02	Grab	Derry Bowler		< 0.005		55	6.9	1.48	12.3	7.6	8.2	< 0.02			1.1		
Rivers	Roughty	Morley's Bridge	104732	75221	Phosphorous Monthly	07-Feb-02	Grab	Derry Bowler		0.006		51	6.4	0.57	11.7	8.2	2.2	< 0.02	30	< 0.003	< 1		
Rivers	Roughty	Inchee Bridge Left Hand Side	107709	73915	Phosphorous Regs	07-Feb-02	Grab	Derry Bowler		< 0.005		50	6.2	0.52	11.3	8.2	2.6	< 0.02	20	< 0.003	< 1		
Rivers	Roughty	Inchee Bridge Right Hand Side	107757	73876	Phosphorous Regs	07-Feb-02	Grab	Derry Bowler		0.014		47	6.2	0.52	11.7	8.2	3.1	< 0.02	15	< 0.003	< 1		
Rivers	Roughty	Ford Downstream Slaheny River Confluences	99842	72855	Phosphorous Regs	07-Feb-02	Grab	Derry Bowler		0.005		68	6.9	1.21	11.8	8.2	8.9	< 0.02	15	< 0.003	< 1		
Rivers	Roughty	Bridge (Ford) Near Knockanruddig	108767	70909	Phosphorous Regs	07-Feb-02	Grab	Derry Bowler		0.006		47	6	0.33	11.9	8.2	1.9	< 0.02	15	< 0.003	< 1		

Appendix 8.1 - Kilgarvan Existing Water Quality Data

Parameter					Molybdate Reactive Phosphorous	Total Phosphorous	Conductivity @ 20 oC	pH	Total Oxidised Nitrogen (TON)	Dissolved Oxygen	Temp	Alkalinity	Ammonium	Colour	Nitrite	BOD	Q Biological Rating	Faecal Streptococci
					P	P			NO3	O2		CaCO3	NH4	Hz	NO2	O2		
Max.					0.03	0.066	--	9	--	15	--	--	Varies	--	0.01	--	--	--
Target					--	--	--	--	--	--	--	--	--	--	--	--	--	--
Min.					--	--	--	6	--	5	--	--	--	--	--	--	4	--
Category	Project	Location	Location Easting	Location Northing	Sample Template	Sample Date	Sample Method	Sampled By	Comments	mg/l	mg/l	µS/cm	pH units	mg/l	mg/l	Degrees C	mg/l	mg/l	Hazen	mg/l	mg/l	Rating	no./100mls
Rivers	Roughty	Ford Northwest Of Kilgortaree House	96032	72122	Phosphorous Regs	07-Feb-02	Grab	Derry Bowler		0.015		67	6.8	1.48	11.6	8.4	7.5	< 0.02	20	< 0.003	< 1		
Rivers	Roughty	Bridge (Ford) Near Knockanruddig	108767	70909	Phosphorous Monthly	05-Mar-02	Grab	Derry Bowler		0.017		59	6.7	0.78	11.8	5.7							
Rivers	Roughty	Morley's Bridge	104732	75221	Phosphorous Monthly	05-Mar-02	Grab	Derry Bowler		0.027		73	7	1.19	11.9	6.2							
Rivers	Roughty	Ford Northwest Of Kilgortaree House	96032	72122	Phosphorous Monthly	05-Mar-02	Grab	Derry Bowler		0.025		106	7.2	3.15	11.7	7.5							
Rivers	Roughty	Inchee Bridge Left Hand Side	107709	73915	Phosphorous Monthly	05-Mar-02	Grab	Derry Bowler		0.02		67	6.9	1.04	11.9	6.2							
Rivers	Roughty	Ford Downstream Slaheny River Confluences	99842	72855	Phosphorous Monthly	05-Mar-02	Grab	Derry Bowler		0.014		86	7	2.39	11.8	7.1							
Rivers	Roughty	Inchee Bridge Right Hand Side	107757	73876	Phosphorous Monthly	05-Mar-02	Grab	Derry Bowler		*0.031*		68	6.9	1.04	11.8	6.1							
Rivers	Roughty	Ford Northwest Of Kilgortaree House	96032	72122	Phosphorous Monthly	04-Apr-02	Grab	Derry Bowler		0.011		85	7.1	1.82	12.1	7.2							
Rivers	Roughty	Inchee Bridge Left Hand Side	107709	73915	Phosphorous Monthly	04-Apr-02	Grab	Derry Bowler		0.011		57	6.8	0.84	12	6.8							
Rivers	Roughty	Morley's Bridge	104732	75221	Phosphorous Monthly	04-Apr-02	Grab	Derry Bowler		0.005		60	6.8	0.86	12.3	6.7							
Rivers	Roughty	Inchee Bridge Right Hand Side	107757	73876	Phosphorous Monthly	04-Apr-02	Grab	Derry Bowler		0.007		57	6.7	0.78	12.1	6.8							
Rivers	Roughty	Ford Downstream Slaheny River Confluences	99842	72855	Phosphorous Monthly	04-Apr-02	Grab	Derry Bowler		0.009		70	7	1.4	12	7.6							
Rivers	Roughty	Bridge (Ford) Near Knockanruddig	108767	70909	Phosphorous Monthly	04-Apr-02	Grab	Derry Bowler		0.011		50	6.9	0.7	12.4	5.8							
Rivers	Roughty	Inchee Bridge Right Hand Side	107757	73876	Phosphorous Monthly	08-May-02	Grab	Derry Bowler		0.015		61	7.2	0.36	11.1	11.3							
Rivers	Roughty	Bridge (Ford) Near Knockanruddig	108767	70909	Phosphorous Monthly	08-May-02	Grab	Derry Bowler		0.01		53	7	0.21	10.7	11.2							
Rivers	Roughty	Inchee Bridge Left Hand Side	107709	73915	Phosphorous Monthly	08-May-02	Grab	Derry Bowler		0.019		61	7.2	0.21	11	11.4							
Rivers	Roughty	Ford Downstream Slaheny River Confluences	99842	72855	Phosphorous Monthly	08-May-02	Grab	Derry Bowler		0.016		84	7.3	1.23	11.1	12							
Rivers	Roughty	Bridge (Ford) Near Knockanruddig	108767	70909	Phosphorous Monthly	08-May-02	Grab	Derry Bowler		0.02		103	7.5	1.75	11.5	12.5							
Rivers	Roughty	Morley's Bridge	104732	75221	Phosphorous Monthly	08-May-02	Grab	Derry Bowler		0.008		66	7.2	0.37	10.9	11.7							
Rivers	Roughty	Inchee Bridge Right Hand Side	107757	73876	Phosphorous Monthly	06-Jun-02	Grab	Derry Bowler		0.007		49	6.7	0.67	11.5	11.5	6.9						
Rivers	Roughty	Ford Northwest Of Kilgortaree House	96032	72122	Phosphorous Monthly	06-Jun-02	Grab	Derry Bowler		0.013		83	7.1	1.02	11.7	12.3	20.2						
Rivers	Roughty	Morley's Bridge	104732	75221	Phosphorous Monthly	06-Jun-02	Grab	Derry Bowler		0.007		51	6.7	0.68	11.6	11.4	7.4						
Rivers	Roughty	Inchee Bridge Left Hand Side	107709	73915	Phosphorous Monthly	06-Jun-02	Grab	Derry Bowler		0.007		49	6.7	0.62	11.4	11.6	6.8						
Rivers	Roughty	Ford Downstream Slaheny River Confluences	99842	72855	Phosphorous Monthly	06-Jun-02	Grab	Derry Bowler		0.008		65	7.1	1.07	11.4	12.6	2.9						
Rivers	Roughty	Bridge (Ford) Near Knockanruddig	108767	70909	Phosphorous Monthly	06-Jun-02	Grab	Derry Bowler		0.01		44	6.5	0.48	11.5	10.5	5.1						
Rivers	Roughty	Ford Downstream Slaheny River Confluences	99842	72855	Phosphorous Monthly	04-Jul-02	Grab	Derry Bowler		< 0.005		60	7	1.09	10.9	11.9	11.8						
Rivers	Roughty	Ford Northwest Of Kilgortaree House	96032	72122	Phosphorous Monthly	04-Jul-02	Grab	Derry Bowler		< 0.005		71	7	1.28	11	12	17.2						
Rivers	Roughty	Morley's Bridge	104732	75221	Phosphorous Monthly	04-Jul-02	Grab	Derry Bowler		0.015		50	6.8	0.7	10.9	12	9.3						
Rivers	Roughty	Bridge (Ford) Near Knockanruddig	108767	70909	Phosphorous Monthly	04-Jul-02	Grab	Derry Bowler		< 0.005		42	6.9	0.59	10.6	11.9	7.7						
Rivers	Roughty	Inchee Bridge Right Hand Side	107757	73876	Phosphorous Monthly	04-Jul-02	Grab	Derry Bowler		< 0.005		49	6.9	0.7	10.7	11.9	9.3						
Rivers	Roughty	Inchee Bridge Left Hand Side	107709	73915	Phosphorous Monthly	04-Jul-02	Grab	Derry Bowler		< 0.005		48	6.8	0.68	10.8	11.8	8.5						
Rivers	Roughty	Morley's Bridge	104732	75221	Phosphorous Monthly	14-Aug-02	Grab	Derry Bowler		< 0.005		31	6.3	0.4	10.4	15.1	2.4						
Rivers	Roughty	Inchee Bridge Left Hand Side	107709	73915	Phosphorous Monthly	14-Aug-02	Grab	Derry Bowler		< 0.005		31	6.5	0.65	10	14.9	1.9						
Rivers	Roughty	Bridge (Ford) Near Knockanruddig	108767	70909	Phosphorous Monthly	14-Aug-02	Grab	Derry Bowler		< 0.005		26	6.5	0.34	10.1	14.8	1.7						
Rivers	Roughty	Ford Northwest Of Kilgortaree House	96032	72122	Phosphorous Monthly	14-Aug-02	Grab	Derry Bowler		0.005		41	6.9	0.56	11	15.1	6.8						
Rivers	Roughty	Ford Downstream Slaheny River Confluences	99842	72855	Phosphorous Monthly	14-Aug-02	Grab	Derry Bowler		0.005		41	6.8	0.57	10.9	15.1	6.7						
Rivers	Roughty	Inchee Bridge Right Hand Side	107757	73876	Phosphorous Monthly	14-Aug-02	Grab	Derry Bowler		< 0.005		28	6.1	0.35	10.1	14.9	2.2						
Rivers	Roughty	Ford Downstream Slaheny River Confluences	99842	72855	Phosphorous Monthly	09-Sep-02	Grab	Derry Bowler		< 0.005		78	7.7	1.4	10.9	12.1	19.3						
Rivers	Roughty	Ford Northwest Of Kilgortaree House	96032	72122	Phosphorous Monthly	09-Sep-02	Grab	Derry Bowler		0.008		90	7.7	1.35	11	12.3	25.2						
Rivers	Roughty	Inchee Bridge Left Hand Side	107709	73915	Phosphorous Monthly	09-Sep-02	Grab	Derry Bowler		0.01		62	7.3	0.63	10.9	11.9	14						
Rivers	Roughty	Bridge (Ford) Near Knockanruddig	108767	70909	River quality: Standard form	09-Sep-02	Grab	Derry Bowler				52	7.2	0.47	10.6	11.3	10.5						
Rivers	Roughty	Inchee Bridge Right Hand Side	107757	73876	Phosphorous Monthly	09-Sep-02	Grab	Derry Bowler		< 0.005		62	7.3	0.64	11	11.9	14.7						
Rivers	Roughty	Morley's Bridge	104732	75221	Phosphorous Monthly	09-Sep-02	Grab	Derry Bowler		< 0.005		68	7.4	0.73	10.6	12.2	16.9						
Rivers	Roughty	Inchee Bridge Right Hand Side	107757	73876	Phosphorous Monthly	07-Oct-02	Grab	Derry Bowler		< 0.005		54	7.2	0.42	10.5	12.6	11						
Rivers	Roughty	Inchee Bridge Left Hand Side	107709	73915	Phosphorous Monthly	07-Oct-02	Grab	Derry Bowler		< 0.005		54	7.2	0.41	10.4	12.6	12						
Rivers	Roughty	Ford Northwest Of Kilgortaree House	96032	72122	Phosphorous Monthly	07-Oct-02	Grab	Derry Bowler		< 0.005		83	7.4	1.39	10.6	12.9	20.9						
Rivers	Roughty	Ford Downstream Slaheny River Confluences	99842	72855	Phosphorous Monthly	07-Oct-02	Grab	Derry Bowler		< 0.005		68	7.3	1.23	10.5	12.8	15.5						
Rivers	Roughty	Morley's Bridge	104732	75221	Phosphorous Monthly	07-Oct-02	Grab	Derry Bowler		< 0.005		57	7.3	0.53	10.6	12.9	11.4						
Rivers	Roughty	Bridge (Ford) Near Knockanruddig	108767	70909	Phosphorous Monthly	07-Oct-02	Grab	Derry Bowler		< 0.005		45	7.3	0.19	10.5	12.6	9.2						
Rivers	Roughty	Bridge (Ford) Near Knockanruddig	108767	70909	River quality: Standard form	23-Sep-03	Grab	EPA														4.5	
Rivers	Roughty	Inchee Bridge Left Hand Side	107709	73915	River quality: Standard form	23-Sep-03	Grab	EPA														4.5	
Rivers	Roughty	Ford Downstream Slaheny River Confluences	99842	72855	River quality: Standard form	23-Sep-03	Grab	EPA														4	
Rivers	Roughty	Ford Northwest Of Kilgortaree House	96032	72122	River quality: Standard form	23-Sep-03	Grab	EPA														4	
Rivers	Roughty	Inchee Bridge Right Hand Side	107757	73876	River quality: Standard form	23-Sep-03	Grab	EPA														4.5	
Rivers	Roughty	Morley's Bridge	104732	75221	River quality: Standard form	23-Sep-03	Grab	EPA														5	

Appendix 9 – Ecology Report

LIMOSA ENVIRONMENTAL
ECOLOGICAL AND ENVIRONMENTAL CONSULTANCY

Ecological Scoping Document for the proposed South Kerry 7 Villages Sewerage Scheme – terrestrial flora, fauna and habitats - Kilgarvan

Report for

J B Barry & Partners Ltd / White Young Green Ireland Ltd

June 2006

Report Reference:	RP06-GW033-05-0
Draft:	Final Report
Prepared by:	Dr Lesley J. Lewis
Date:	12th June 2006.

Signature:

TABLE OF CONTENTS

Figure 1 Caherdaniel - Location and layout of proposed development and designated areas for nature conservation within the area

1.0 INTRODUCTION

Limosa Environmental was commissioned by J B Barry & Partners Limited / White Young Green Ireland Limited to prepare an Ecological Scoping Document for the proposed South Kerry 7 Villages Sewerage Scheme

The proposed sewerage scheme consists of the development of a waste water treatment plant and associated sewer pipelines in seven villages of South Kerry: Caherdaniel, Chapeltown, the Glen, Glenbeigh, Glenflesk, Kilgarvan and Sneem.

The advance ecological study is concerned with the terrestrial elements of the proposed scheme (flora, fauna and habitats). Aquatic habitats are not considered in this report.

This Scoping Document details the results of the scoping procedure (as outlined in Section 1.1 below) which included site visits by Dr L J Lewis during early March 2006. Additional field visits were made in mid April 2006 to additional sites at three locations (Chapeltown, Caherdaniel and Sneem). A preliminary habitat assessment was carried out during each site visit. Habitat classification follows Fossitt (2000). Vascular plant nomenclature follows Stace (1997) and Latin names are given at first mention. Plant frequency of occurrence within Ireland follows Webb *et al.* (1996).

1.1 Ecological Scoping

Scoping is defined as 'the process of determining the content and extent of matters that should be covered in the environmental information to be submitted to a competent authority or other decision making body' (ERM, 2001). The main aims of scoping are to define the ecological resources (features) that may be potentially impacted within a defined radius of the proposed development ('zone of influence') and where necessary to recommend further studies to be undertaken as part of the ecological impact assessment process (EcIA). An ecological resource can occur at many different levels and may, for example, be an ecosystem, a habitat, a species, population or community The stages of ecological scoping are given in Box 1, in line with that recommended by the Institute of Ecology and Environmental Management (IEEM, 2005).

Box 1: Stages of Ecological Scoping (after IEEM, 2005):

- General literature review/data collation to cover aspects of the ecology of the proposed development site and surrounding environment.
- Identify and consult with key stakeholders and consultees relevant to the ecology of the area.
- Review the status of designated sites within the area. Define the criteria for site selection for site designation (e.g. Annex I Habitats, Annex II species, Red Data Species etc).
- Identify the important and/or sensitive ecological resources within the area.
- Identify the ecological resources that are likely to be affected by the proposed development.
- Determine the 'zone of influence' (area that may be affected by the proposed development).
- Identify ecological resources that require further studies (baseline studies, ecological assessment, evaluation, impact prediction) as part of the EIA process. Determine gaps in existing information.
- Recommend studies as part of ecological impact assessment (EcIA) process.
- Predict potential impacts of the proposed development on the ecological resources within the zone of influence.
- Consider potential impacts of cumulative developments in the area.
- Production of Scoping Document.
- Undertake on-going scoping throughout EcIA process and refine scope as required.

2.0 CHARACTERISTICS OF THE RECEIVING ENVIRONMENT

Appendix 1 shows the site synopses (National Parks and Wildlife Service) for designated sites for nature conservation mentioned in the text (where available). Appendix 2 shows a record of consultees contacted during the scoping process and their responses.

2.1 KILGARVAN

2.1.1 Location of the proposed development and existing surrounding environment

Kilgarvan lies 11 km to the north-east of Kenmare on the R569. The proposed development consists of the upgrade and expansion of an existing waste water treatment plant located at W 006 732 (Figure 6).

2.1.2 Habitats within and adjacent to the proposed development site

The proposed development site is located within agricultural fields just north of the Roughty River. The proposed development comprises the upgrade and expansion of an existing waste water treatment plant.

The existing site is centred within three agricultural fields. The site is surrounded by a stone wall ((BL1) with a hedgerow (WL1) and treeline (WL2) in places. Hawthorn (*Crataegus monogyna)* dominates the hedgerow. The field to the north of the site is classified as wet grassland and has abundant *Iris* in the lower-lying and wetter areas. The field to the east of the site is classified as improved agricultural grassland (GA1). A thick bramble scrub (WS1) corridor extends between the site and the dwellings to the north-east. The field to the south of the site, lying between the site and the river is classified as wet grassland.

The surrounding habitats are similar comprising improved agricultural grassland and wet grassland habitats.

2.1.3 Potential ecological resources within the area of the development

The River Roughty rises near the Kerry/Cork border and flows west until it reaches the sea at Kenmare. With regard to fisheries, the river is primarily a salmon river. In terms of ecology, the river would be classed as of high local importance due to the flora and fauna associated with the aquatic and riparian (river bank) habitats.

Birds

A wide diversity of birds associated with farmland, woodland, river corridor and hedgerows will occur within the proposed sites and in the general area (Appendix 3).

Mammals

The following species are likely to occur within the general area: foxes, badgers, rabbits, stoats, brown rats, wood mouse, bank vole, pygmy shrew and hedgehogs. Otters are known to be

Appendix 4 - Design Of Proposed Treatment Process

Appendix 4.1 - Design Calculations for WWTP - Phase 1

Design Data

PE 1,200

	per PE	Total
Flow (DWF)	180 l/day	216 m^3/day
BOD	60 g/day	72 kg/day
SS	75 g/day	90 kg/day

1 x DWF = 216 m^3/day
3 x DWF = 648 m^3/day

6 x DWF from Kilgarvan = 1,296 m^3/day
Total peak flow to WWTP = 1,296 m^3/day

Screens

Maximum flow = 54 m^3/hour (6 x peak flow)

Grit Removal

Maximum flow = 54 m^3/hour (6 x peak flow)

Inlet Flow Measurement

Capacity = 54 m^3/hour (6 x peak flow)

Storm Water Holding Tank

Provide for peak flow - (3 x DWF) for 2 hours

	Volume =	54 m^3
Square tank	Height =	3.5 m
	Plan Area =	15.4 m^2
	Side =	3.93 m
Circular tank	Height =	3 m
	Plan Area =	18.0 m^2
	Diameter =	4.79 m

Appendix 4.1 - Design Calculations for WWTP - Phase 1

Primary Settlement (if required)

Use circular tank with hopper bottom (cone)

Maximum flow =	27 m^3/hour	(3 x DWF)
Upward velocity =	1.2 m/hour	
Plan Area =	22.5 m^2	
Diameter =	5.35 m	
Volume of cone =	10.0 m^3	
Volume of tank above cone =	54 m^3	(3 x DWF for 2 hours)
Height =	2.4 m	

Extended Aeration

Take F/M =	0.06	
F (BOD) =	72	kgs
M =	1200	kgs
MLSS =	4,000	mg/l
Volume =	300	m^3
Depth =	2.5	m
Plan area =	120.0	m^2
say Length =	20.0	m
Width =	6.0	m

Clarifier

Use circular tank with hopper bottom (cone)

Maximum flow =	27 m^3/hour	(3 x DWF)
Upward velocity =	0.9 m/hour	
Plan Area =	30.0 m^2	
Diameter =	6.18 m	
Volume of tank above cone =	54 m^3	(3 x DWF for 2 hours)
Height =	1.8 m	

Outlet Flow Measurement / Sampling Chamber

Capacity =	27 m^3/hour	(3 x DWF)

Appendix 4.1 - Design Calculations for WWTP - Phase 1

Sludge Thickener / Storage

Excess sludge production = 0.5 kg/kg BOD removed.

BOD in =	72	kg/day	
BOD out =	5.4	kg/day	
BOD removed =	66.6	kg/day	
Excess sludge =	33.3	kg/day dry solids	
Sludge volume =	3.33	m^3/day	pre-thickening at 1% DS
Sludge volume =	0.8	m^3/day	post-thickening at 4% DS
Sludge storage =	100	m^3 for 30 days	

Sludge tank dimensions

Circular tank

Height =	3	m
Diameter =	6.5	m

Appendix 4.2 - Design Calculations for WWTP - Phase 2

Design Data

PE 2,000

	per PE	Total
Flow (DWF)	180 l/day	360 m^3/day
BOD	60 g/day	120 kg/day
SS	75 g/day	150 kg/day

1 x DWF = 360 m^3/day
3 x DWF = 1,080 m^3/day
6 x DWF = 2,160 m^3/day

Screens

Maximum flow = 90 m^3/hour (6 x DWF)

Grit Removal

Maximum flow = 90 m^3/hour (6 x DWF)

Inlet Flow Measurement

Capacity = 90 m^3/hour (6 x DWF)

Storm Water Holding Tank

Provide for 3 x DWF for 2 hours

	Volume =	90 m^3
Square tank	Height =	3 m
	Plan Area =	30.0 m^2
	Side =	5.48 m
Circular tank	Height =	3 m
	Plan Area =	30.0 m^2
	Diameter =	6.18 m

Appendix 4.2 - Design Calculations for WWTP - Phase 2

Primary Settlement

Use circular tank with hopper bottom (cone)

Maximum flow =	45	m^3/hour	(3 x DWF)
Upward velocity =	1.2	m/hour	
Plan Area =	37.5	m^2	
Diameter =	6.91	m	
Volume of cone =	21.6	m^3	
Volume of tank above cone =	90	m^3	(3 x DWF for 2 hours)
Height =	2.4	m	

Extended Aeration

Take F/M =	0.06		
F (BOD) =	120	kgs	
M =	2000	kgs	
MLSS =	4,000	mg/l	
Volume =	500	m^3	
Depth =	2.5	m	
Plan area =	200.0	m^2	
say Length =	25.0	m	
Width =	8.0	m	

Clarifier

Use circular tank with hopper bottom (cone)

Maximum flow =	45	m^3/hour	(3 x DWF)
Upward velocity =	0.9	m/hour	
Plan Area =	50.0	m^2	
Diameter =	7.98	m	
Volume of tank above cone =	90	m^3	(3 x DWF for 2 hours)
Height =	1.8	m	

Outlet Flow Measurement / Sampling Chamber

Capacity =	45	m^3/hour	(3 x DWF)

Appendix 4.2 - Design Calculations for WWTP - Phase 2

Sludge Thickener / Storage

Excess sludge production = 0.5 kg/kg BOD removed.

BOD in =	120	kg/day	
BOD out =	9	kg/day	
BOD removed =	111	kg/day	
Excess sludge =	55.5	kg/day dry solids	
Sludge volume =	5.55	m^3/day	pre-thickening at 1% DS
Sludge volume =	1.4	m^3/day	post-thickening at 4% DS
Sludge storage =	167	m^3 for 30 days	

Sludge tank dimensions

Circular tank

Height =	3	m
Diameter =	8.4	m

Appendix 5 - Cost Estimates

Appendix 5.1 - Estimate of Quantities - Collection System

Road Reinstatement (m2)	
Trench	Min. Trench Width
225	600
300	700
375	950
450	1050
525	1150
600	1250

Sewer Line	225mm Road	225mm Field	300mm Road	300mm Field	375mm Road	375mm Field	450mm Road	450mm Field	525mm Road	525mm Field	MH's	Comments
PF16.6 - PF16	426											
PF12.8 - PF12	461										37	
PF22.1 - PF1	327		430	150								
Total	**1214**	**0**	**430**	**150**	**0**	**0**	**0**	**0**	**0**	**0**	**37**	

Rock Excavation					
Pipe Size	**225**	**300**	**375**	**450**	**525**
Length	1214	580	0	0	0
Est. 30% Rock Excavation					
Subject to SI	364.2	174	0	0	0
Average Trench Width	0.6	0.7	0.95	1.05	1.15
Average Depth	2.25	2.25	2.25	2.25	2.25
Rock Excavation (m3)	**492**	**274**	**0**	**0**	**0**

Road Reinstatement					
Pipe Size	**225**	**300**	**375**	**450**	**525**
Length	1214	430	0	0	0
Trench Width (m)	0.6	0.7	0.95	1.05	1.15
Reinstatement (m2)	728.4	301	0	0	0
Total Reinstatement (m2)			**1029**		

Field Reinstatement					
Pipe Size	**225**	**300**	**375**	**450**	**525**
Length	0	150	0	0	0
Easement Width (m)	15	15	15	15	15
Reinstatement (m2)	0	2250	0	0	0
Total Reinstatement (m2)			**2250**		

Appendix 5.2 - Cost Estimate - Foul Collection System

	Unit	Quantity	Rate, €	Total, €
225mm gravity sewers in roads	m	1,214	85	103,190
300mm gravity sewers in roads	m	430	95	40,850
375mm gravity sewers in roads	m	0	105	0
450mm gravity sewers in roads	m	0	115	0
525mm gravity sewers in roads	m	0	135	0
600mm gravity sewers in roads	m	0	160	0
225mm gravity sewers in fields	m	0	70	0
300mm gravity sewers in fields	m	150	80	12,000
375mm gravity sewers in fields	m	0	90	0
450mm gravity sewers in fields	m	0	100	0
525mm gravity sewers in fields	m	0	120	0
600mm gravity sewers in fields	m	0	140	0
Manholes	no	37	1,500	55,500
Rock Excavation	m^3	766	40	30,629
Service connections	no	184	300	55,200
Temporary Road Reinstatement	m^2	1,029	35	36,029
Permanent Road reinstatement	m^2	1,029	50	51,470
Reinstatement in fields	m^2	2,250	1	2,250
Minor Stream crossing (<5m)	no	0	2,500	0
Overpumping existing sewers during replacement	item	1	20,000	20,000
Rehabilation of Extisting Network	item	1	22,400	22,400
Sub Total Collection System excl VAT & Prelims				**429,518**
Add Prelims and Contingencies @ 20%				85,904
Sub Total excl VAT				**515,422**
Add VAT @13.5%				69,582
Total Collection System Incl VAT				**585,004**
Add Site Investigation @ 5%				21,476
Overheads/Fees/Site Supervision @ 20%				103,084
Total Collection Network				**709,564**

Assumes sewers generally laid at 2.0m - 2.5m deep.
Bedding and Granular Surround included

**** Existing No. of Houses 204 Assume 90% have to be reconnected to the new sewer @ reduced rate of €300 per reconnection***

Appendix 5.3 WWTP Contract Costs Phase 1

Treatment -Civil Works	Unit	Quantity	Rate, €	Total, €
Site Clearence	m^2	5,850	1	5,850
Stormwater Tank	m^3	54	300	16,200
Anoxic Tank	m^3	27	300	8,100
Aeration Tank	m^3	300	300	90,000
Clarifier	m^3	54	300	16,200
Sludge holding and Thickening	m^3	100	300	30,000
Tidal Tank	m^3	0	300	-
Control Building	m^2	40	2,000	80,000
Reed Bed	m^2	0	100	-
Outfall pipe within site	m	65	75	4,875
Outfall pipe to sea	m	0	750	-
Surface drainage	m	400	75	30,000
Manholes	no	4	1,500	6,000
Pipework between units	m	175	50	8,750
Valves and fittings	no	30	750	22,500
Ducting	m	175	15	2,625
Rock excavation	m^3	100	30	3,000
Access road	m^2	75	40	3,000
Internal roadway	m^2	150	40	6,000
Fencing site (palisade)	m	320	100	32,000
Fencing access road (post and rail)	m	140	40	5,600
Entry gates	no	1	1,500	1,500
Landscaping	m^2	200	20	4,000
75mm water supply	m	175	40	7,000
3 phase power supply	item	1	15,000	15,000
Sub total Treatment Civil Works				**398,200**

Treatment- Mechanical+ Electrical Works	Unit	Quantity	Rate, €	Total, €
Secondary Treatment	PE	1,200	200	240,000
Extra for Disinfection	PE		50	-
Extra for Phosphorus removal	PE		25	-
Sub-Total of Treatment Mechanical Works				**240,000**
Sub Total for Civil and Mechanical Works				**638,200**

Add Prelims and Contengencies @ 20%				127,640
Sub Total(Civil and M&E) excl VAT				765,840
Add VAT @ 13.5%				103,388
TOTAL CONTRACT COSTS				**869,228**

NON CONTRACT COSTS				
Add Site Investigation @ 5% of civil works				19,910
Add Land Acquisition	h.a.	0.6	200,000	117,000
Wayleaves for outfall	ha	0.065	50,000	3,250
Overheads/Fees/Site Supervision @ 20%				153,168
TOTAL NON CONTRACT COSTS				**293,328**

CAPITAL COSTS **1,162,556**

Appendix 5.4 - Kilgarvan - Structural Rehabilitation Costs

Sewer Ref: Upstream	Downstream	Road Name	Use	Grade	Pipe Size	Length	Estimated Cost:	Total
MH12I	MH12H	St. Garvans Terrace	Foul - uPVC	3	225	42	€4,032	
MH12L	MH22	St. Garvans Terrace	Foul - uPVC	3	225	35	€3,360	
MH7	MH13*	Centre Kilgarvan	Foul - Concrete	3	150	10	€920	
MH13	MH14*	Centre Kilgarvan	Foul - Concrete	3	150	23	€2,116	
MH10	MH15*	Graveyard	Foul - Concrete	3	*225*	*18*	€1,728	
SUB-TOTAL								**€12,156**

NOTES*

1	Preliminary Items (Bond, Insurances, mobilisation etc.)	**€1,820**
2	The above prices do not include for reopening of laterals after lining or for cleaning of sewers before rehabilitation works. Cost of reopening laterals is €200 / lateral. *Allow €2,000*	**€2,000**
3	Overpumping	**€5,000**
4	Add Contingency @ 2%	**€1,468**
	Sub Total (Excl VAT)	**€22,400**
	VAT	**€3,024**
COST OF SEWER REHABILITATION	**Grand Total (Incl VAT)**	**€25,424**

Note* Not surveyed due to Manholes Covered

Appendix 5.5 - Kilgarvan Wastewater Treatment Plant - Operation & Maintenance Costs

Year	PE load	Labour	Electricity	Chemicals	Parts	Sludge disposal	Actual sub-total	NPV factor	NPV
	482								
1	554	7,000	2,629	1,385	2,100	€4,296.96	€17,410.69	0.9524	€16,581.61
2	626	7,000	2,970	1,565	2,100	€4,855.41	€18,490.78	0.9070	€16,771.68
3	698	7,000	3,312	1,745	2,100	€5,413.86	€19,570.87	0.8638	€16,906.06
4	770	7,000	3,654	1,925	2,100	€5,972.31	€20,650.96	0.8227	€16,989.60
5	842	7,000	3,995	2,105	2,100	€6,530.76	€21,731.05	0.7835	€17,026.85
6	914	7,000	4,337	2,285	2,100	€7,089.21	€22,811.14	0.7462	€17,022.03
7	986	7,000	4,679	2,465	2,100	€7,647.66	€23,891.23	0.7107	€16,979.05
8	1,058	7,000	5,020	2,645	2,100	€8,206.11	€24,971.32	0.6768	€16,901.57
9	1,128	7,000	5,352	2,820	2,100	€8,749.05	€26,021.41	0.6446	€16,773.63
10	1,200	7,000	5,694	3,000	2,100	€9,307.50	€27,101.50	0.6139	€16,637.97
11	1,280	10,000	5,887	3,200	3,000	€9,928.00	€32,014.72	0.5847	€18,718.34
12	1,360	10,000	6,255	3,400	3,000	€10,548.50	€33,203.14	0.5568	€18,488.75
13	1,440	10,000	6,623	3,600	3,000	€11,169.00	€34,391.56	0.5303	€18,238.58
14	1,520	10,000	6,990	3,800	3,000	€11,789.50	€35,579.98	0.5051	€17,970.31
15	1,600	10,000	7,358	4,000	3,000	€12,410.00	€36,768.40	0.4810	€17,686.23
16	1,680	10,000	7,726	4,200	3,000	€13,030.50	€37,956.82	0.4581	€17,388.46
17	1,760	10,000	8,094	4,400	3,000	€13,651.00	€39,145.24	0.4363	€17,078.94
18	1,840	10,000	8,462	4,600	3,000	€14,271.50	€40,333.66	0.4155	€16,759.47
19	1,920	10,000	8,830	4,800	3,000	€14,892.00	€41,522.08	0.3957	€16,431.70
20	2,000	10,000	9,198	5,000	3,000	€15,512.50	€42,710.50	0.3769	€16,097.14
							Sub Total (Ex VAT)		**€343,447.96**
							Add VAT @13.5%		€46,365.48
							Grand Total (Incl VAT)		**€389,813.44**

Appendix 5.6 - Collection System Operating Costs

Kilgarvan Network O&M Costs

Collection System Costs

	Cost
Labour (Assume 4 call outs per year @ €500 per call out)	€2,000.00
Sub - Total Excl VAT	**€2,000.00**
Add VAT @ 13.5%	**€270**
Grand Total Incl VAT	**€2,270**

discount rate 0.05
20 year
1/(1+r)^N

Opertaing Cost Net Present Value

Year	Operating Costs	NPV factor	NPV
1	2,270	0.9524	2,162
2	2,270	0.9070	2,059
3	2,270	0.8638	1,961
4	2,270	0.8227	1,868
5	2,270	0.7835	1,779
6	2,270	0.7462	1,694
7	2,270	0.7107	1,613
8	2,270	0.6768	1,536
9	2,270	0.6446	1,463
10	2,270	0.6139	1,394
11	2,270	0.5847	1,327
12	2,270	0.5568	1,264
13	2,270	0.5303	1,204
14	2,270	0.5051	1,147
15	2,270	0.4810	1,092
16	2,270	0.4581	1,040
17	2,270	0.4363	990
18	2,270	0.4155	943
19	2,270	0.3957	898
20	2,270	0.3769	856
Grand Total Incl VAT			**28,289**