

Assessment of Wastewater Backup into Residential Dwellings at Dolphin House, Dublin 8

August 2010

DRAFT

TOBIN CONSULTING ENGINEERS



REPORT

PROJECT:

Wastewater Backup Study at Dolphin House

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Please note, the house numbers where the analyses for this report were carried out have been withheld for reasons of confidentiality and sensitivity to the needs of the residents and their families.

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1 INTRODUCTION

TOBIN Consulting Engineers (hereafter referred to as TOBIN) were engaged by Barnardos to undertake an assessment of wastewater backup into domestic dwellings at Dolphin House, Dublin 8 (see Appendix A). The client has confirmed that both grey and black wastewater has been observed intermittently backing up into household fixtures such as sinks, showers, baths and washing machines for a period of approximately 10 years.

As part of TOBIN's assessment, samples of the wastewater backup were required to be sent for chemical analysis at an approved laboratory (ALcontrol Laboratories Ltd.). Backup within the drainage system occurs intermittently, and in various households, so TOBIN could not anticipate a specific sampling date or location. To achieve a satisfactory sample the client contacted TOBIN immediately following a contamination backup event, allowing a TOBIN representative to visit the site to make an on-site assessment.

The client contacted TOBIN on 28th June 2010 with regard to a wastewater backup that was occurring at No 36, Dolphin House. A TOBIN representative went on site and observed a wastewater backup within the household drainage system, with significant wastewater backup into the household bath and bathroom sink. This wastewater within the bathroom was sampled on 28th June 2010 and sent for laboratory analysis to identify the components of the wastewater.

2 METHODOLOGY

A site visit to Dolphin House was undertaken by TOBIN personnel on Tuesday the 28th June 2010 following a phone call from the Rialto Rights In Action Group that potentially contaminated water was visible in a resident's bath and sink. One sample (in two laboratory approved containers) was taken within the dwelling -No. 36 Dolphin House. The sample was collected from the bathroom sink and bath. Plates 2-2 and 2-3 below detail the backup extent at No. 36 Dolphin House during the monitoring event.

Water sampling was undertaken by TOBIN, using the "grab" sampling method. The laboratory supplied containers were submerged beneath the surface of the water and squeezed gently when screwing on the cap to ensure an airtight seal. The filled sample containers were stored in a coolbox for transport to the laboratory.

There was visible and olfactory evidence of contamination observed at the monitoring point during the sampling event. Alcontrol Geochem, an ISO 17025 and UKAS accredited laboratory, carried out laboratory analyses on the wastewater sample.

Examples of wastewater backup are shown in Plates 2-1 to 2-3 below. Note: Plate 2-1 shows visible evidence of potentially contaminated water at a separate property within Dolphin House on May 13th 2010.



Plate 2-1 Wastewater Backup Observed on 13th May 2010 – House No xx



Plate 2-2 Wastewater Backup Observed on June 28th 2010



Plate 2-3 Wastewater Backup Observed on June 28th 2010

The bathroom fixtures sampled during this event are connected to the mains sewer via an integrated internal piping network. This network connects the household showers, baths and toilet to the mains sewer. Wastewater from the household exits the dwelling and is sent for treatment via the Dolphins Barn sewer network. This sewer is not a closed sewer network and as a result may not be independent of surface water factors occurring as a result of inclement conditions. Note: From June 14th to June 27th, no rainfall was recorded at the Met Éireann station at Dublin airport (0mm). On June 28th 2010, 2.7mm of rainfall was recorded at Dublin Airport.

The outflow from the household sewer to the local drainage network is not licensed through the local authority discharge licensing system. No site-specific water quality concentration criteria have been assigned to the quality of the wastewater discharged.

3 RESULTS

Laboratory analysis parameters were selected in order to identify the constituents of the wastewater sample, including testing for parameters that can potentially affect human health. This suite of analysis included toxic metals, coliforms, pH, conductivity, BOD, volatile organic compounds (VOCs) and detergents.

Table 3-1 Parameters Tested^[1]

Parameter	Units
Anions	ug/l
BOD	mg/l
Coliforms	CFU/100ml
Conductivity (@ 20 °C)	mS/cm
Dissolved Metals by ICP-MS	ug/l
Methylene Blue Active Substances	mg/l
pH Value	pH Units
Total Dissolved Solids	mg/l
Total Metals by ICP-MS	mg/l
Total Suspended Solids	mg/l
VOC MS (W)	ug/l

¹ A full list of parameters and results are contained in Appendix B

3.1 LABORATORY ANALYSIS

As mentioned above, no site-specific water quality concentration criteria have been assigned to the quality of the wastewater discharge by a statutory body. There are no directly applicable water quality standards for the comparison of wastewater quality.

Statutory Instrument No.294 of 1989, European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations, regulates the quality of water treatment required for a surface water abstraction to be adequately treated for potable use as drinking water. This statutory instrument provides guidance so that a sanitary authority will classify surface water in their area, in accordance with the quality standards specified in the Schedule (Part II) of the regulations, into three categories, A1, A2, A3, which corresponds to the methods of water treatment that would be required for the surface water source to become adequately treated.

These treatment categories, and their associated quality standards, are used for the comparison of the quality of the wastewater/stormwater backup described in this report, for indicative purposes.

The full chemical analysis datasets as issued by ALcontrol Geochem are available in Appendix B.

Table 3-2 Chemical analyses of the Wastewater Sample on 28th June 2010

Parameter	Units	No 36 Dolphin House	[Note 1] A1 treatment	[Note 1] A2 treatment	[Note 1] A3 treatment
Faecal Coliforms (W)	CFU/100ml	570,000,000	1,000	5,000	40,000
Coliforms, Total	CFU/100ml	570,000,000	5,000	25,000	100,000
Total Suspended Solids	mg/l	1870	50	NS [Note 2]	NS [Note 2]
BOD	mg/l	1190	5	5	7
Conductivity at 20 °C	mS/cm	0.232	1	1	1
Total Dissolved Solids	mg/l	160	NS [Note 2]	NS [Note 2]	NS [Note 2]
pH Value	pH Units	6.65	5.5 - 8.5	5.5 - 9.0	5.5 - 9.0
Surfactants, Anionic (MBAS)	mg/l	4.39	0.2	0.2	0.2
Nitrate as NO ₂	mg/l	<0.05	NS [Note 2]	NS [Note 2]	NS [Note 2]
Nitrate as NO ₃	mg/l	<0.3	50	50	50
Phosphate (Ortho) as PO ₄	mg/l	6.81	0.334*	0.468*	0.468*
Phosphorous (Total)	mg/l	12.1	0.109*	0.152*	0.152*
Arsenic (Dissolved)	mg/l	0.000664	0.05	0.05	0.1
Boron (Dissolved)	mg/l	0.0207	2	2	2
Cadmium (Dissolved)	mg/l	<0.0001	0.005	0.005	0.005
Chromium (Dissolved)	mg/l	<0.00247	0.05	0.05	0.05
Copper (Dissolved)	mg/l	0.00619	0.05	0.1	1
Lead (Dissolved)	mg/l	0.000123	0.05	0.05	0.05
Nickel (Dissolved)	mg/l	0.0015	NS [Note 2]	NS [Note 2]	NS [Note 2]
Selenium (Dissolved)	mg/l	0.00107	0.01	0.01	0.01
Zinc (Dissolved)	mg/l	0.00183	3	5	5
Sulphate	mg/l	33.6	200	200	200
Chloride	mg/l	17.3	250	250	250
Volatile Organic Compounds (VOC's)	ug/l	<LOD	LOD**	LOD**	LOD**

Note 1: S.I. No. No.294 of 1989, European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations

Note 2: NS - No water quality standard quoted in this treatment category.

* Extrapolated P and PO₄ limits from P₂O₅ (Phosphates) limits set out in S.I. No. No.294 of 1989.

**LOD – Laboratory Limit of Detection.

4 DISCUSSION

The analytical results in Table 3.2 above indicate that, in general, the quality of the wastewater sample taken from the bathroom of No. 36, Dolphin House is highly polluted and has constituents which can be described as harmful to human health.

The measured **pH** values show that the wastewater sample has a pH of 6.65, which is within the range quoted in S.I. No.294 of 1989.

The **Electrical Conductivity** measurement for the wastewater sample was 0.232 mS/cm. This result is less than the limit of 1 mS/cm set out in S.I. No. 294 of 1989.

The **Biological Oxygen Demand (BOD)** result for the wastewater sample shows an elevated value (1190 mg/l) for BOD measurement. This recorded concentration (1190mg/l) is exceptionally elevated when compared to the S.I. No. 294 of 1989 limit of 5mg/l for A1 quality and 7mg/l for A3 quality. A BOD value of 1190 mg/l indicates that the sample comprises material with a high biological content.

The **Faecal Coliform** result for the wastewater sample was extremely elevated with a concentration of 570 million CFU/100ml. This concentration vastly exceeds S.I. No. 294 of 1989 A3 limit of 40,000 CFU/100ml and is consistent with faecal coliform concentrations within raw sewage.

The **Total Coliform** result for the wastewater sample was extremely elevated with a concentration of 570 million CFU/100ml. This concentration vastly exceeds the S.I. No. 294 of 1989 A3 limit of 100,000 CFU/100ml and is consistent with total coliform concentrations within highly polluted waters.

The **Suspended Solids** concentration of the wastewater sample was 1870 mg/l. This amount of suspended material exceeds the limit of 50mg/l set out in S.I. No. 294 of 1989 for A1 quality, no limits have been set for A2 or A3. However, a concentration of 1870mg/l would indicate a significant suspended solid presence within the sample.

The **Phosphorous (Ortho as PO₄)** concentration of the wastewater sample was 6.81mg/l. This exceeds the extrapolated A3 limit value (0.468mg/l) from S.I. No. 294 of 1989 (limit extrapolated from phosphates P₂O₅).

The **Phosphorous (Total)** concentration of the wastewater sample was 12.1mg/l. This exceeds the extrapolated A3 limit value of 0.153mg/l from S.I. No. 294 of 1989 (limit extrapolated from

phosphates P_2O_5).

The **Nitrite (as NO_2)** concentration of the wastewater sample was $<0.05\text{mg/l}$, which is below the laboratory detection limit for this parameter. There is no specific limit level set out in S.I. No. 294 of 1989, however as the result is below the laboratory limit of detection it can be said to be present in minute concentrations or non-existent.

The **Nitrate (as NO_3)** concentration of the wastewater sample was $<0.3\text{mg/l}$, which is below the laboratory detection limit for this parameter. The limit level for Nitrate (50mg/l) as NO_3 is set out in S.I. No. 294 of 1989, however as the result is below the laboratory limit of detection it can be said to be present in minute concentrations or non-existent.

The **Surfactants (MBAS)** concentration of the wastewater sample was 4.39mg/l . This concentration of surfactant exceeds the A3 treatment limit of 0.2mg/l set out in S.I. No. 294 of 1989. This elevated level of surfactant is consistent with wastewater from household activities such as clothes washing, dish washing etc. Elevated concentrations of surfactants can indicate the presence of detergents, wetting agents, emulsifiers, foaming agents, and dispersants.

The **Toxic Metal** concentrations were below A1 limits set out in S.I. No. 294 of 1989 for all parameters.

The **Sulphate** concentration of the sample was 33.6mg/l and remained below the A1 limit of 200mg/l set out in S.I. No. 294 of 1989.

The **Chloride** concentration of the sample was 17.3mg/l and remained below the A1 licence limit of 250mg/l set out in S.I. No. 294 of 1989.

The **Volatile Organic Compound (VOCs)** concentrations recorded during this sampling event were below the laboratories limit of detection for all tested parameters. There are no specific limits for VOCs set out in S.I. No.294 of 1989. However, as no VOCs were detected during analysis the presence of VOCs can be assessed as low or non-existent.

5 POSSIBLE CAUSES/SOLUTIONS

It appears that the external foul drainage system is blocking up resulting in regular foul water back-up within various and random residences within in the Dolphin House development.

We would recommend that a full investigation is carried out to examine the cause of this foul water back-up i.e. that an external and internal audit is carried out on the local foul drainage network within the Dolphin House development.

6 CONCLUSION

There are no directly applicable water quality standards for the comparison of wastewater quality. However, it has been determined from chemical analyses of the wastewater sample taken from No. 36, Dolphin House that the wastewater is in a highly polluted state, when compared broadly with the categories given in Statutory Instrument No.294 of 1989 - European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water), as described in Section 5 above.

Evaluation of the chemical composition of the wastewater (bathroom sample) from the 28th June 2010 indicates that the sample comprises extremely high biological content. This can be delineated by the exceptionally high level of faecal and total coliforms, total suspended solids, phosphate (ortho), Phosphorous (total) and an elevated BOD. Elevated surfactant levels relative to limits set out in S.I. No. 294 of 1989 were also recorded during this sampling event. These elevated parameters can be consistent with grey and black water discharge from households. The elevated coliforms, suspended solids, phosphate (ortho), phosphorous (total) and BOD are consistent with partially treated and untreated sewage waste and the elevated suspended solids and surfactants are consistent with effluent from washing machines, dishwashers or showers and baths.

Toxic metal concentrations were below A1 limit levels set out in S.I. No. 294 of 1989 for all parameters for this monitoring event.

Sulphate and chloride concentrations were significantly below A1 limit levels set out in S.I. No. 294 of 1989. VOC's were below laboratory detection limits for all tested parameters and can assumed to be in either very low concentrations or non-existent.

APPENDIX A

Sampling Location Map

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APPENDIX B

Laboratory Analysis

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