Appendix 6A

Noise and Vibration Report

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ANV Technology

Report 25369

Cork Lower Harbour Main Drainage Scheme

Noise and Vibration Impact Assessment

August 2007

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1 INTRODUCTION

The noise and vibration impact of the proposed Cork Lower Harbour Drainage scheme was assessed. The proposed scheme will include construction of a new wastewater treatment plant (WWTP) at Shanbally, including access roads, installation of a network of sewerage lines serving the lower harbour area, with associated pumping stations.

The proposed WWTP site is located in lands zoned for this purpose in the Shanbally area, to the northwest of Carrigaline. The current use of these lands is agricultural.

The potential noise impacts during the construction phase, and during the operational phase were considered.

During the construction phase there will be noise emissions from activities at the WWTP site, including earthmoving, excavations, and construction of facilities, with associated construction traffic on routes to the site.

There will also be noise impacts along the routes of the proposed sewer lines, and at the construction sites of the proposed pumping stations.

During the operational phase of the WWTP, there will be continuous process noise emissions during both daytime and nighttime. There are minor potential impacts in terms of noise from pumping stations, which are also considered in the report.

1.1 NOISE SENSITIVE LOCATIONS

The proposed WWTP site is in a rural area, with few dwellings visible from the site. The nearest existing noise-sensitive locations to the site are the houses at Upper Shanbally, approximately 260m to the east of the site boundary. There are also lands zoned for residential use approximately 130m to the east of the site, which are treated in this assessment as noise sensitive locations.

The nearest houses to the north are approximately 430m distant. The intervening lands

are agricultural. The sports ground located 80m from the north-eastern corner of the site is moderately noise sensitive, as it is an outdoor recreational area.

The nearest house to the south is at a distance of approximately 570m.

There are no noise sensitive locations immediately to the west of the site. The ESB compound is located 160m to the west. A Bord Gáis facility is located 65m from the south-western corner of the site. There are commercial units located on the southern side of the entrance road to the site from Cogan's Road.

Houses in the vicinity of the proposed major pumping stations at Raffeen. Monkstown, Carrigaloe and West Beach Cobh, are also treated as noise sensitive locations. For houses in the vicinity of the minor pumping stations, there is lower potential for noise impact. However potential impacts at these locations are also considered.

Pipe laying will occur along the routes of the proposed new sewer lines. The associated construction works will therefore affect many houses in different areas, for limited periods during the construction phase. All of the houses along the proposed sewer routes are therefore considered as being noise sensitive locations during the construction phase.

1.2 METHODOLOGY

The existing noise environment was determined by means of baseline noise surveys at the site of the proposed WWTP and pumping stations in accordance with ISO 1996 "Description and measurement of environmental noise". The surveys were carried out in June 2007.

Noise propagation calculations in this report were made according to ISO 9613 "Attenuation of sound during propagation outdoors".

Calculation of noise due to construction plant and equipment was in accordance with BS 5228 "Noise and vibration control on open and construction sites", using standardised noise emission data for typical construction site equipment likely to be used for this development, and heavy vehicle noise levels.

Traffic noise was calculated based on the U.K. Calculation of Road Traffic Noise (CRTN), with results converted to daytime average noise levels (L_{Aeq}).

The WWTP is a Design-Build-Operate (DBO) project. One of the environmental parameters to be met by a successful bidder will be a maximum noise emission specification at the boundary of the WWTP site, and at a reference distance from the pumping stations. In this assessment report, an appropriate boundary noise criterion is proposed for the WWTP and the pumping stations. This was arrived at by first determining an appropriate noise assessment criterion at the nearest houses which would ensure negligible adverse impact. This assessment criterion noise level at the nearest house was then used to calculate back to the plant boundaries, to establish the

appropriate design noise criterion at the boundaries. The validity of the noise impact assessment relies on the proposed design noise criteria being incorporated into the contracts for the projects, and implemented through appropriate equipment specifications during the detailed design stage.

The noise assessment criterion at the nearest noise sensitive locations was determined with reference to the EPA guideline noise limits, and also by considering the change in noise environment brought about by the development, based on the methodology of British Standard BS 4142 "Rating industrial noise affecting mixed residential and industrial areas", and the potential audibility of the noise.

All noise levels presented in the text of the report represent time-averaged noise levels over the appropriate reference periods ($L_{Aeq,}$), unless otherwise indicated. An explanation of acoustics terminology is provided in Appendix A.

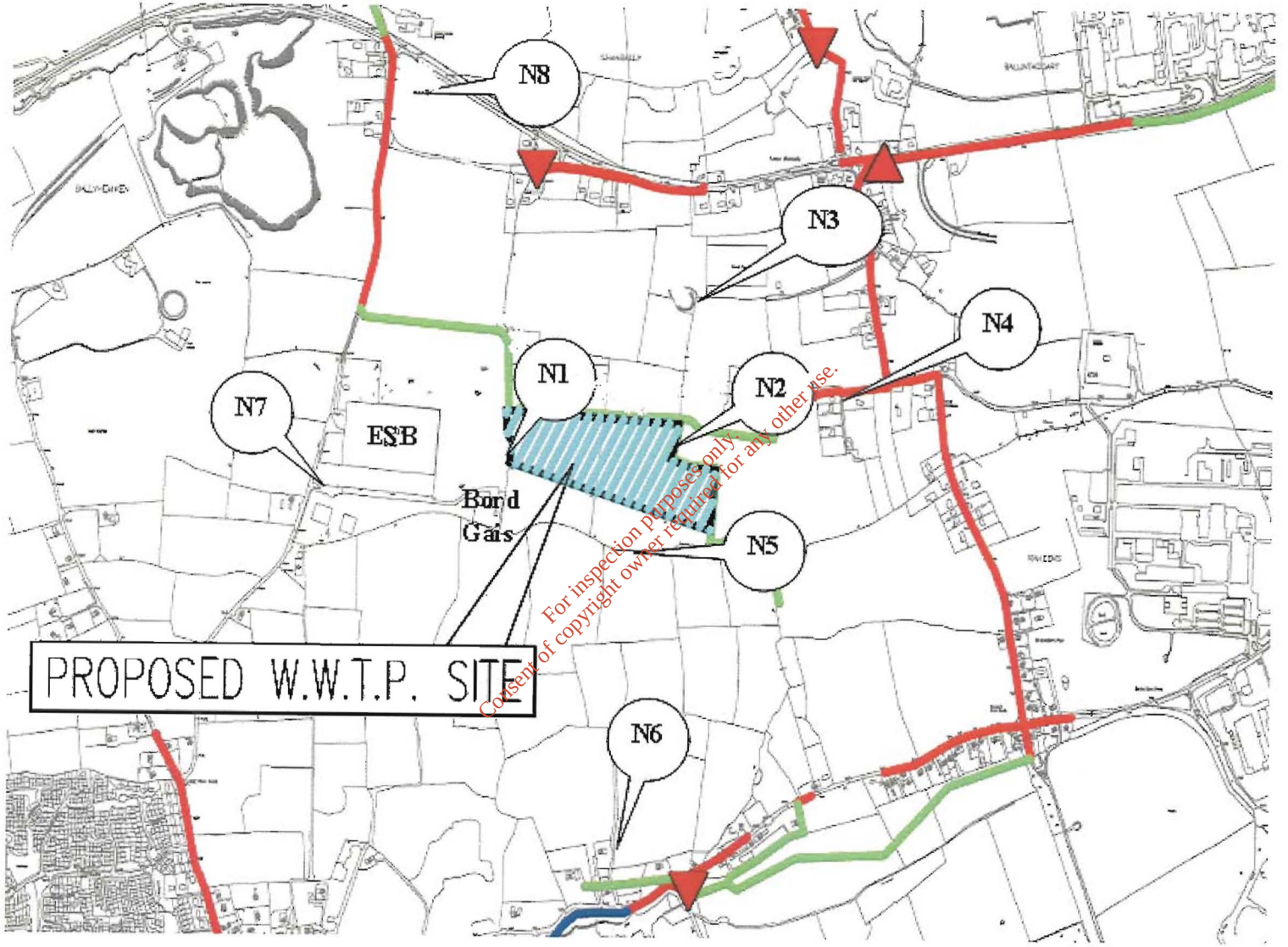

Figure 1. Location of proposed WWTP site, and baseline noise survey locations N1 to N8

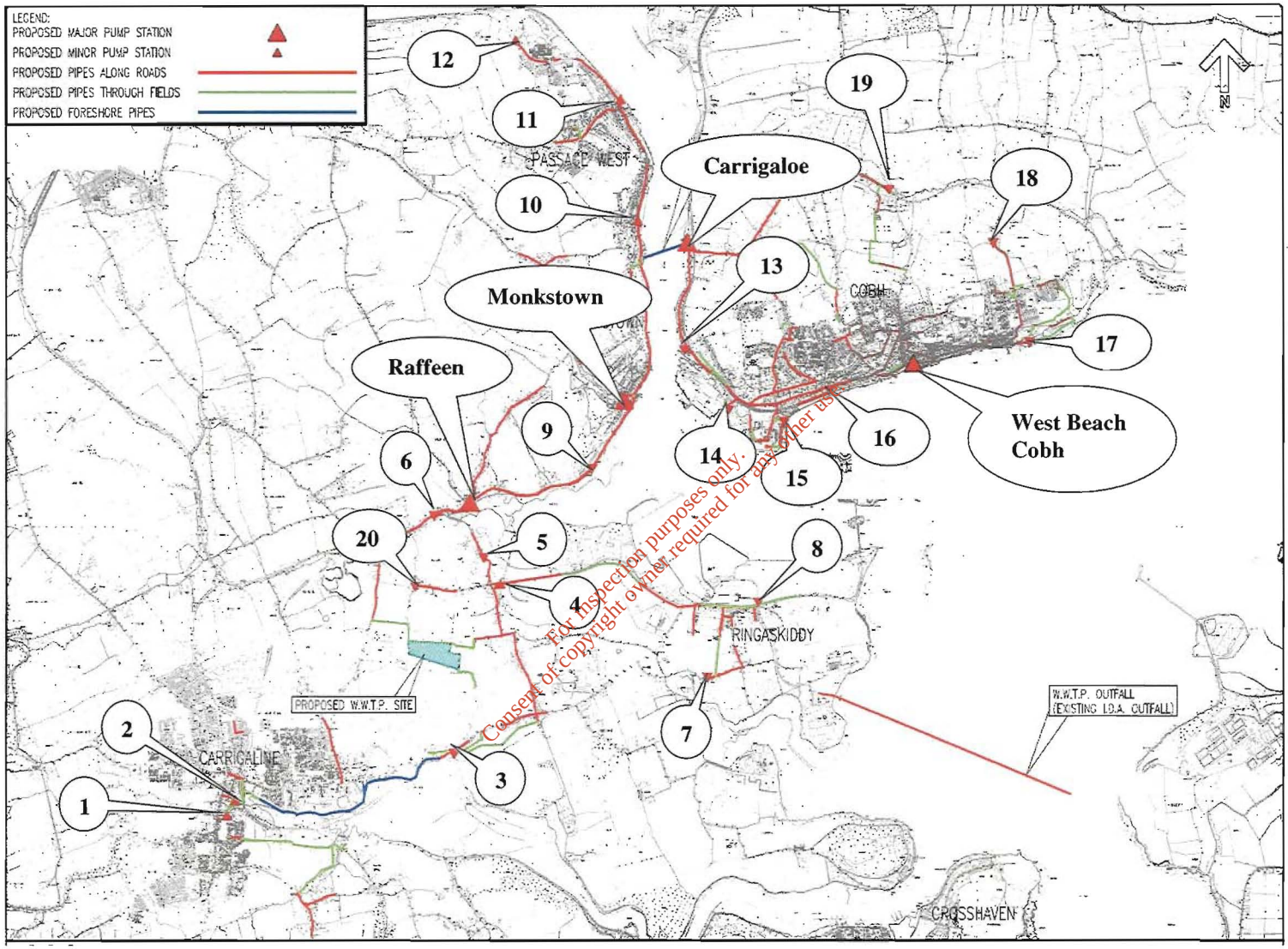

Figure 2. Layout of Cork Lower Harbour Main Drainage Scheme, showing sewerage network, and major pumping station locations at Raffeen, Monkstown, Carrigaloe, and West Beach where detailed noise surveys were carried out. Also shown are the minor pumping station locations 1 to 20, where short-duration noise surveys were carried out

2 EXISTING ENVIRONMENT

2.1 RECEIVING NOISE ENVIRONMENT

The proposed WWTP site is located within a predominantly rural area, with a low density of housing.

The main contribution to the existing ambient noise level is from the distant traffic noise on the N28, located 490m to the north of the site. There is a lower component of noise from distant agricultural machinery, aircraft, and natural noise sources such as wind noise, birds and animals. Along the entrance road to the site from Cogan's Road, there is audible electrical hum from the ESB compound, and occasional work activity noise from the Brown & Gilmer premises at the entrance from Cogan's Road.

The overall noise environment in the vicinity of the proposed WWTP site can be described as quiet rural.

2.2 BASELINE NOISE SURVEYS

2.2.1 DESCRIPTION OF MEASUREMENT LOCATIONS

Noise surveys over 24-hour periods were carried out at three locations in the vicinity of the WWTP site, denoted N1, N2 and N3 in Figure 1.

Surveys of three hours duration during daytime and nighttime were conducted at five additional representative positions, including nearest noise sensitive locations, in the Carrigaline East/Shanbally areas, denoted N4 to N8 in Figure 1.

N1: Western boundary of proposed site, beside electricity pylon
N2: Eastern boundary of proposed site, adjacent gate
N3: 200 m to the north of site, southwest corner of sports ground
N4: Upper Shanbally, at entrance to playing field
N5: 70 m south of proposed site
N6: Nearest house to south of site, at approximately 570m
N7: Entrance to Bord Gais, 20m from roadway
N8: At 12 m from N28 Ringaskiddy Road

Surveys of three hours duration during daytime and nighttime were also conducted at the proposed sites of the four major pumping stations at Raffeen, Monkstown, Carrigaloe, and West Beach Cobh, the locations of which are shown in Figure 2.

Short orientation noise measurements were carried out during daytime and nighttime at the sites of twenty proposed minor pumping stations, as indicated in Figure 2.

2.2.2 WEATHER CONDITIONS:

Date	Measurement Period	Description of weather conditions
25/06/2007	Daytime	Light SW breeze, overcast, showers.
	Nighttime	Showers, light SW breeze.
26/06/2007	Daytime	Moderate SW breeze, overcast, warm, dry.
	Nighttime	Moderate breeze - calm, cool, clear night.
27/06/2007	Daytime	Light SW Breeze, dry, overcast, warm.
	Nighttime	Calm, clear, cool.
28/06/2007	Daytime	Heavy showers, moderate SW with gusts, warm.
	Nighttime	Showery, moderate SW breeze, cool.
29/06/2007	Daytime	Showers, light SW breeze

Table 1. Summary of weather conditions during noise surveys

2.2.3 PERSONNEL

The baseline surveys were carried out by Kevin Downes B.Sc, and Alan Hanley B.Sc. of ANV Technology. The assessment was undertaken by Colin Doyle M.Sc. MIOA of ANV Technology.

2.2.4 INSTRUMENTATION

Manufacturer	Instrument	Calibrated Laboratory	Calibration reference	Last Laboratory Calibration
Brüel & Kjær	SLM 2260 (Type 1) serial no.1875380	Pennine Instruments	07062-1	20/01/06
Brüel & Kjær	SLM 2250-L Class1 serial no. 2579999	Bruel & Kjaer	Certificate of conformance 2579999	19/3/2007
Svantek	SLM 949 (Type 1)	Svantek	No. 8183	27/09/05
Brüel & Kjær	Calibrator 4231 serial no. 1859044	AV Calibration	0611490	7/11/06
Castle	Calibrator GA 607 serial no. 040520	Castle Group	40520/ 45338	27/10/05

Table 2. Noise measurement instrumentation used during the surveys. Calibration checks were carried out before and after each survey period.

2.3 MEASURED EXISTING NOISE LEVELS

The results of the noise survey for the measurements positions in the vicinity of the WWTP site are presented in Table 3. At locations N1, N2, N3, the mean measured noise levels are averaged over continuous 24 hours measurement. At locations N4 to N8, the mean measured noise levels are derived from noise levels measured during a 3 hour period in daytime and in nighttime.

Time plots of the 24-hour measurements at N1, N2 and N3 are shown in Figure 3. The measured hourly noise levels for measurement positions N4 to N8 are presented in Tables 4 and 5 for daytime and nighttime periods respectively.

The results of the noise surveys at the sites of the proposed major pumping stations are presented in Tables 6 and 7 for daytime and nighttime periods respectively.

The results of the short-term orientation surveys at the sites of the proposed minor pumping stations are presented in Tables 8 and 9 for daytime and nighttime periods respectively.

2.3.1 EXISTING NOISE ENVIRONMENT IN VICINITY OF WWTP SITE

The noise environment in this area was determined primarily by distant traffic, agricultural machinery, wind noise, birds/ animals, with a contribution from aircraft noise during daytime.

Referring to Table 3, at the measurement locations N1 and N2 at the proposed WWTP site boundaries, the average daytime noise level was 44 and 47 dB(A) L_{Aeq} respectively. This reduced to 36 and 38 dB(A) L_{Aeq} respectively at nighttime. At N3, 230m to the north of the proposed site boundary, the mean daytime noise level was 47 dB(A) L_{Aeq}, reducing to 39 dB(A) L_{Aeq} at nighttime. The noise measurements at locations N2 and N3 represent the noise environment in the lands zoned residential to the east of the proposed site.

The L_{A90} parameter is the noise level exceeded for 90% of the measurement period. This represents the steady component of the underlying background noise. At locations N1 to N3, the mean L_{A90} value for the day/evening periods ranged from 39 to 41 dB(A). At nighttime this reduced to 30 to 31 dB(A) L_{A90}.

Measurements location N4 was at the nearest house to the proposed site, at a distance of 280m from the eastern site boundary. At this position, the average daytime noise level was 55 dB(A) L_{Aeq} due to local traffic, reducing to 50 dB(A) L_{Aeq} at nighttime. The steady underlying background noise at this location was 48 dB(A) L_{A90} during daytime, and 40 dB(A) L_{A90} at nighttime.

At location N5, 100m to the south of the site, the average daytime noise level was 45 dB(A) L_{Aeq}, reducing to 43 dB(A) L_{Aeq} at nighttime. The steady underlying background noise at this location was 41 dB(A) L_{A90} during daytime, and 39 dB(A) L_{A90} at nighttime.

Measurement location N6 was at the nearest house to the south of the proposed site, which is at a distance of approximately 600m. The average daytime noise level was 55dB(A) L_{Aeq}, reducing to 48 dB(A) L_{Aeq} at nighttime. The steady underlying background noise at this location was 42 dB(A) L_{A90} during daytime, and 31 dB(A) L_{A90} at nighttime.

Measurement location N7 was at Cogan's Road, and measurements from this position represent the existing noise exposures of houses along this road. The average daytime noise level was 54dB(A) L_{Aeq}, reducing to 46 dB(A) L_{Aeq} at nighttime. The steady underlying background noise at this location was 46 dB(A) L_{A90} during daytime, and 38 dB(A) L_{A90} at nighttime.

Measurement location N8 was at the N28, and measurements from this position represent the existing noise exposures of houses along this road. The average daytime noise level was 62dB(A) L_{Aeq}, reducing by 13 dB, to a level of 49 dB(A) L_{Aeq} at nighttime. The steady underlying background noise at this location was 53 dB(A) L_{A90} during daytime, and 35 dB(A) L_{A90} at nighttime.

2.3.2 EXISTING NOISE ENVIRONMENT AT SITES OF PROPOSED MAJOR PUMPING STATIONS

Referring to Tables 6 and 7, at Raffeen, the average daytime noise level was 57 dB(A) L_{Aeq}, due to local traffic, reducing to 46 dB(A) at nighttime. The steady underlying background noise at this location was 50 dB(A) L_{A90} during daytime, and 40 dB(A) L_{A90} at nighttime.

At Monkstown, the average daytime noise level was 55 dB(A) L_{Aeq}, due to local traffic and local activity noise, reducing to 42 dB(A) at nighttime. The steady underlying background noise at this location was 43 dB(A) L_{A90} during daytime, and 38 dB(A) L_{A90} at nighttime.

At West Beach Cobh, the average daytime noise level was 58 dB(A) L_{Aeq}, due to local traffic and local activity noise, and 57 dB(A) at nighttime, due to noise from a docked boat and local activity noise. The steady underlying background noise at this location was 50 dB(A) L_{A90} during daytime, and 47 dB(A) L_{A90} at nighttime.

At Carrigaloe, the average daytime noise level was 63dB(A) L_{Aeq}, due to local road traffic, ferry traffic, and noise from the ferry, and reduced to 57 dB(A) at nighttime. The steady underlying background noise at this location was 49 dB(A) L_{A90} during daytime, and 39 dB(A) L_{A90} at nighttime.

2.3.3 EXISTING NOISE ENVIRONMENT AT SITES OF MINOR PUMPING STATIONS

Referring to Tables 8 and 9, daytime noise levels at the sites of the proposed minor pumping stations ranged from 44 to 69 dB(A) L_{Aeq}, depending on the local traffic flows. The underlying background noise levels during daytime ranged from 38 to 53 dB(A) L_{A90}.

Nighttime noise levels ranged from 44 to 64 dB(A) L_{Aeq} , depending on the local traffic flows. The underlying background noise levels ranged from 27 to 49 dB(A) L_{A90}.

Location	Measured Noise Levels dB(A) (mean of measured values at 15-minute intervals)				Comment
	$L_{Aeq,15mins}$	L_{A90}	L_{A50}	L_{A10}	
Day/Evening (07.00 -23.00)					
N1	44	39	41	45	Distant traffic, tractors, aircraft, wind noise
N2	47	41	44	48	
N3	47	41	45	49	
N4	55	48	50	56	
N5	45	41	43	47	
N6	55	42	50	59	Light traffic, tractors, wind noise
N7	54	46	49	55	Noise form commercial unit, light traffic
N8	62	53	60	65	Traffic, wind noise
Night (23.00 -07.00)					
N1	36	31	34	37	Low-level distant traffic, aircraft, animals, wind noise
N2	38	30	33	40	
N3	39	30	34	42	
N4	50	40	44	51	
N5	43	39	41	42	
N6	48	31	34	44	Aircraft, occasional traffic
N7	46	38	39	42	Low-level noise from commercial unit, distant traffic
N8	49	35	39	49	Occasional traffic, wind noise

EU [1] noise descriptors for 24-hr locations N1 to N3 (power averaged noise levels)

Location	L_{day} $L_{Aeq,}$ 07.00-19.00	$L_{evening}$ $L_{Aeq,}$ 19.00-23.00	L_{night} $L_{Aeq,}$ 23.00-07.00	L_{den}	
N1	45	46	39	48	
N2	50	44	42	50	
N3	48	44	48	54	

Table 3. Overview of measured noise levels.(see also plots of measured noise levels over 24 hrs at N1, N2 N3 Further details in Figure 3, and measured noise levels at N4 to N8 in Tables 4 and 5)

[1] The standard EU noise descriptors are L_{Aeq} values over the daytime, evening and nighttime periods. However in low noise areas such as this, the noise environment is more reliably described by the arithmetic mean of the measured noise levels at 15-minute intervals. In low noise areas, the EU noise descriptors are biased by short duration noise events, which may be of no significance (eg. animal/bird sounds near the meter). The description of noise environment is therefore based on the mean values rather than the EU descriptors.

Location	Date	Time	$L_{Aeq,\ 15mins}$	L_{A90}	L_{A50}	L_{A10}	Comment
Daytime Survey							
N4	25/06/2007	16.58	53	49	51	55	Very little Traffic. Wind moderate. Aircraft
		17.59	58	46	49	58	Church bells. Moderate breeze
		18.58	54	48	51	56	Gentle breeze
		mean	55	48	50	56	
N5	26/06/2007	14.56	44	40	42	47	Airplane. Moderate breeze
		17.2	45	42	44	47	Cattle in crush. Gentle breeze
		17.36	45	42	43	46	Moderate wind. Traffic.
		mean	45	41	43	47	
N6	26/06/2007	14.27	51	39	46	55	Moderate Breeze. Rustling of hedges and leaves. Very little traffic on road.
		16.25	57	44	53	62	Tractors
		17	57	45	52	60	Traffic
		mean	55	42	50	59	
N7	25/06/2007	16.13	56	49	52	58	Work at Brown & Gilmer Ltd. Very traffic on road.
		17.18	53	45	48	55	Door closing at Brown & Gilmer Ltd. Very little traffic on road.
		18.21	51	44	47	53	Dogs barking
		mean	54	46	49	55	20m from road edge
N8	25/06/2007	16.37	63	56	61	65	Traffic. Light breeze.
		17.41	61	55	59	64	Rustling of trees and hedges.
		18.4	61	54	59	65	Little traffic. Light breeze.
		mean	62	53	60	65	At 12m road edge

Table 4. Expanded details of daytime noise surveys at WWTP survey locations N4 to N8

Location	Date	Time	$L_{Aeq,\ 15mins}$	L_{A90}	L_{A50}	L_{A10}	Comment
Night Time Survey							
N4	25/06/2007	22.51	52	46	50	55	Moderate breeze. Rustling from leaves.
		23.51	54	38	43	50	Moderate breeze
		00.48	44	35	38	47	Light breeze
		mean	50	40	44	51	
N5	26/06/2007	00.09	45	40	41	43	Aircraft, cattle
		00.52	43	40	41	43	Distant traffic
		01.32	41	38	39	41	Distant traffic
		mean	43	39	41	42	
N6	26/06/2007	23.49	53	32	37	51	Aircraft
		00.32	51	31	34	45	Aircraft
		01.13	41	29	31	37	Very little traffic.
		mean	48	31	34	44	
N7	25/06/2007	23.30	44	41	43	47	Very little traffic. Rustling of leaves.
		00.30	45	38	39	43	Gentle hum coming from Brown & Gilmer Ltd.
		01.27	49	35	36	37	Gentle hum coming from Brown & Gilmer Ltd.
		mean	46	38	39	42	20m from road edge
N8	25/06/2007	23.12	53	42	47	55	Very little traffic
		00.11	46	32	35	43	Rustling leaves
		01.09	48	31	36	49	Calm
		mean	49	35	39	49	12m road edge

Table 5. Expanded details of nighttime noise surveys at WWTP survey locations N4 to N8

Location	Date	Time	$L_{Aeq,\ 15mins}$	L_{A90}	L_{A50}	L_{A10}	Comment
Daytime							
Raffeen	26/06/2007	16:24	56	50	54	59	Local traffic, distant construction noise from nearby reservoir site, flowing stream barely audible.
		17:10	57	51	55	60	Noise from local traffic, stream barely audible, distant intermittent construction works.
		mean	57	50	55	60	
Monkstown	26/06/2007	15:46	57	43	48	59	Noise from children in adjacent playground, intermittent local and distant traffic, tree movement in breeze, stream flowing barely audible (roadside position)
		16:45	52	41	46	54	Local traffic noise, children in playground, birdsong, distant traffic noise, tree movement in breeze.
		17:55	55	45	51	58	Local traffic noise, children playing, dogs barking, nearby lawnmower.
		mean	55	43	49	57	
West Beach	27/06/2007	13.15	57	49	55	60	People walking by. Traffic
		14.16	60	52	58	63	People walking by. Jetski's in water. Church bells ringing. Construction noise.
		15.05	58	50	55	60	Lots of people walking by. Church bells ringing. Construction noise
		mean	58	50	56	61	
Carrigaloe	27/07/2006	12.32	63	49	55	67	Traffic
		13.55	62	49	54	66	Traffic. Ferry crossing. Aircraft
		14.38	63	49	57	66	Traffic, wind freshening
		mean	63	49	56	67	

Table 6. Daytime noise surveys at the sites of the proposed major pumping stations

Location	Date	Time	$L_{Aeq,15mins}$	L_{A90}	L_{A50}	L_{A10}	Comment
Nighttime							
Raffeen	26/06/2007	23:24	48	52	39	37	Trees in breeze, intermittent local traffic.
		00:30	47	34	37	47	Intermittent distant and local traffic (light), noise from trees in breeze and nearby stream.
		01:15	42	34	35	39	Noise from nearby stream, very quiet, occasional local car/distant car.
		mean	46	40	37	41	
Monkstown	26/06/2007	23:45	45	37	39	44	Noise from water flowing in nearby stream, distant and intermittent traffic noise, very calm, clear.
		00:53	40	38	38	40	Steady noise from nearby stream.
		00:00	41	39	39	42	Noise from running stream, light breeze, light tree movement, very quiet.
		mean	42	38	39	42	
West Beach Cobh	27/07/2006	23.27	56	48	50	58	Boat docked. Voices
		0.09	56	48	50	59	Boat docked.
		0.51	60	47	49	55	Boat Docked. Voices
		mean	57	47	50	57	
Carrigaloe	27/06/2007	22.3	57	43	49	62	Very Little traffic. Ferry crossing
		23.48	57	41	49	62	Ferry Crossing. Little traffic. No wind
		0.29	57	32	36	56	Ferry has stopped crossing
		mean	57	39	45	60	

Table 7. Nighttime noise surveys at the sites of the proposed major pumping stations

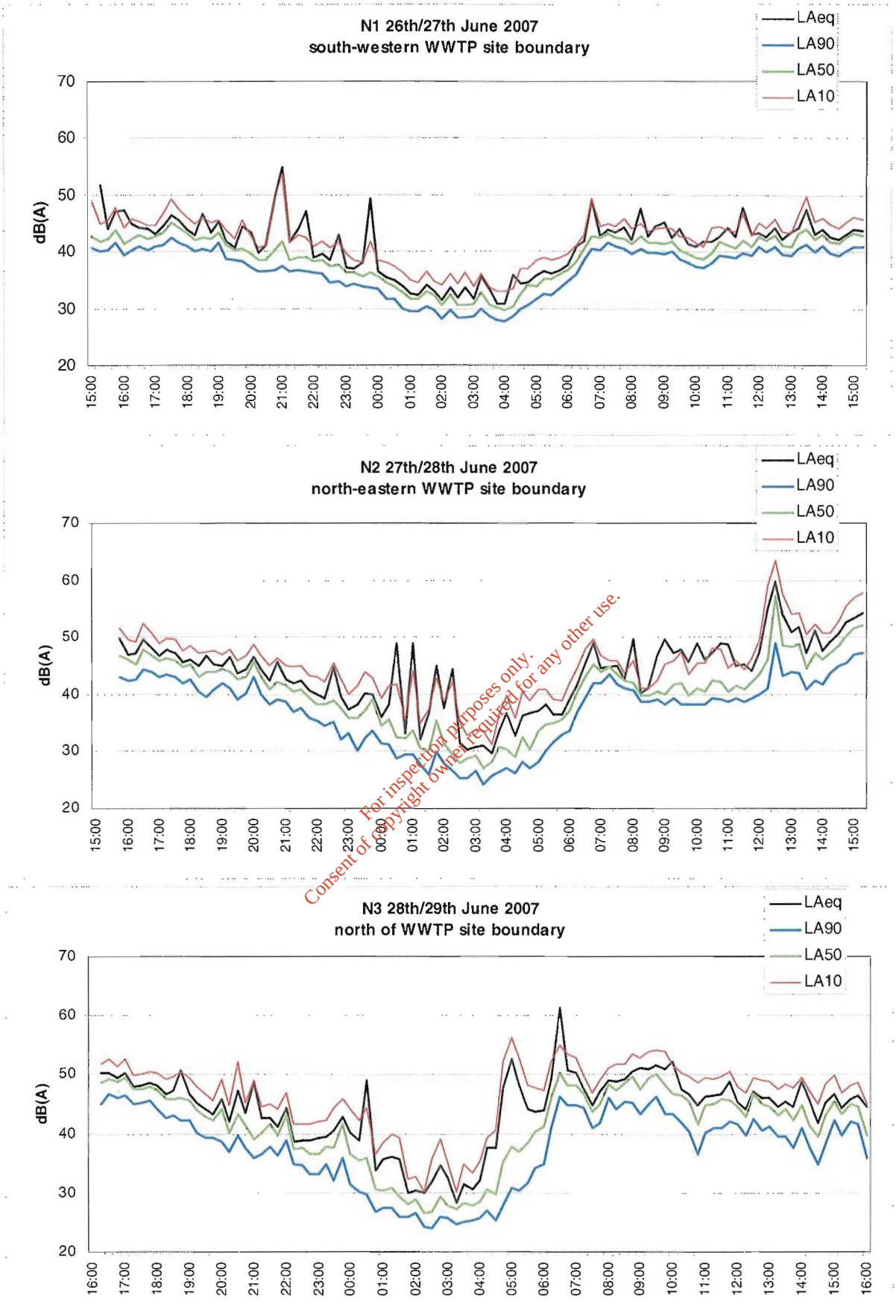

Figure 3 Plot of measured noise levels at 24-hour measurements positions at WWTP site

Daytime	Date	Time	$L_{Aeq,\ 15mins}$	L_{A90}	L_{A50}	L_{A10}	Comment
1	26/06/2007	15.47	58	51	55	60	Significant traffic.
2	26/06/2007	16.05	64	53	60	67	Traffic, voices, horns beeping.
3	26/07/2007	16.42	57	44	52	61	Tractors.
4	26/06/2007	12:44	63	47	57	66	Local and distant traffic noise, distant motor noise on main road, nearby silage machinery, high % HGV's on road.
5	26/06/2007	13:43	44	38	42	45	Distant and local traffic noise, golf course mowers.
6	26/06/2007	18:15	61	44	55	65	Heavy local traffic noise, trees in breeze
7	27/06/2007	12:15	55	45	49	55	Local and distant traffic, tree movement in wind.
8	27/06/2007	11:32	62	47	51	61	Noise from nearby vehicle distribution centre, intermittent local traffic, distant trucks audible.
9	27/06/2007	17:33	64	41	53	67	Local traffic noise, trees in breeze.
10	27/06/2007	14:58	63	47	53	67	Noise from local and distant traffic, birds, water lapping against sea wall.
11	27/06/2007	16:55	62	49	55	61	Heavy local traffic, distant traffic noise, cars in car park, children playing in nearby playground.
12	27/06/2007	16:25	69	53	65	73	Heavy local traffic, roadside position 3-4 meters, trees moving in breeze.
13	27/06/2007	12.5	69	50	67	72	Traffic
14	28/06/2007	12:57	55	48	52	58	Noise from local traffic, trees in breeze, distant traffic. ~ 20m from roadside and water front.
15	28/06/2007	13:30	49	44	47	51	Distant traffic noise, birdsong, light rain, construction noise from island across the water, distant boat noise.
16	27/06/2007	13.36	66	46	58	71	Traffic
17	28/06/2007	13:55	58	50	52	57	Wind & water lapping against seashore (20m below), trees in breeze, distant traffic barely audible, light rain.
18	28/06/2007	14:24	47	41	44	50	Noise from nearby construction site, trees in breeze.
19	28/06/2007	14:46	54	40	43	54	Intermittent local traffic, birdsong - stopped due to rain after 10 minutes.
20	26/06/2007	13:15	59	49	55	62	Local traffic noise, high % HGV's on road, distant and local traffic.

Table 8. Short-term orientation noise surveys at the sites of the proposed minor pumping during daytime

Nighttime	Date	Time	$L_{Aeq,\ 15mins}$	L_{A90}	L_{A50}	L_{A10}	Comment
1	26/06/2007	22.5	53	47	48	56	Dry night. Little traffic on road. River running close to site.
2	26/06/2007	23.12	63	49	52	65	Road works being carried out 75m away
3	26/07/2007	23.33	47	33	36	45	Aircraft
4	26/06/2007	23:50	57	35	44	62	Intermittent local and distant traffic, low level distant plant noise audible in lulls. Calm & Clear
5	26/06/2007	00:35	45	29	31	38	Noise from airplanes, water flowing in nearby stream barely audible, distant low level plant noise barely audible.
6	26/06/2007	23:00	55	38	42	56	Distant traffic barely audible, intermittent local traffic, stream flowing nearby barely audible
7	27/06/2007	23:25	44	42	43	46	Low level distant plant noise, and distant traffic, trees in breeze.
8	27/06/2007	23:05	51	37	40	46	Intermittent traffic and distant traffic noise, low level rumble, boat?, tree movement in breeze.
9	27/06/2007	00:10	54	34	36	52	Intermittent local and distant traffic, low level plant noise across water from Pfizer barely audible, hedge growth/trees in breeze.
10	27/06/2007	00:57	54	27	34	51	Distant traffic barely audible, occasional car pass by.
12	27/06/2007	01:38	53	33	35	42	Intermittent distant and local traffic, low level plant noise across water audible. Calm, clear, cold night. Stream barely audible.
13	27/06/2007	22.5	64	38	53	70	Little traffic. Little or no breeze
16	27/06/2007	23.09	64	38	50	66	Traffic
20	28/06/2007	00:10	49	32	41	53	Intermittent local and distant traffic.

Table 9. Short-term orientation noise surveys at the sites of the proposed minor pumping stations during nighttime

2.4 DO-MINIMUM SCENARIO

In the do-minimum scenario, with no development at the site, it is expected that the environmental noise sources will remain essentially unchanged in terms of noise emission. However, the proposed realignment of the N28 will result in a change in noise environment at the proposed WWTP site.

The realigned road will be 100m from the northern boundary of the site at its closest approach. Based on published NRA traffic flow data for this road, it is calculated to generate a daytime traffic noise level of 52 dB(A) L_{Aeq} at the northern site boundary. The additional nighttime traffic noise level is expected to be approximately 39 dB(A) L_{Aeq} (calculated based on a 13 dB difference between daytime and nighttime noise levels as measured at the N28, measurement position N8). When added to the existing nighttime noise, of level 36 to 39 dB(A), this will increase the nighttime ambient noise to approximately 40 to 42 dB(A) L_{Aeq}.

As the steady underlying background noise is determined mainly by the distant traffic noise component, the realignment of the N28 is not expected to significantly alter the steady underlying background noise levels (L_{A90}) in the vicinity of the site, and is consequently not a consideration in setting design noise criteria for the WWTP site.

The noise environment is expected to remain unchanged at the locations of the proposed pumping stations.

3 NOISE IMPACTS OF THE DEVELOPMENT

3.1 ASSESSMENT CRITERIA

3.1.1 CONSTRUCTION NOISE CRITERIA

Criteria for daytime construction noise are generally set at a level higher than for other permanent intrusive noise sources, because it is recognised that it is a short-term activity. For prolonged exposures above 70dB(A), the level of noise intrusion into houses may however prove unacceptable.

A level of 70 dB(A) is the construction noise limit proposed in the National Roads Authority guidelines for road construction projects, during normal daytime working hours, as shown in Table 10. (Guidelines for Treatment of Noise and Vibration in National Roads Schemes, published draft, NRA, 2004).

The National Road Authority guidelines for road construction projects do not include limits for works between the hours of 22:00 hrs. and 07:00 hrs. However for any

essential nighttime works it would be reasonable to assign a limit of 45 dB(A) $L_{Aeq,1hr}$, which is the EPA guideline industrial nighttime noise limit.

Days & Times	$L_{Aeq\ (1hr)}$ dB	L_{Amax} dB
Monday to Friday 07.00 to 19.00	70	80
Monday to Friday 19.00 to 22.00	60	65
Saturday 08.00 to 16.30	65	75
Sundays and Bank Holidays 08.00 to 16.30	60	65
Vibration Limits: For protection of buildings 8 mm/s (vibration frequency <10Hz) 12.5mm/s (vibration frequency 10 to 50Hz) 20 mm/s (vibration frequency >50 Hz) Continuous piling: 2.5mm/s (tolerable level)		

$L_{Aeq(1hr)}$ is the one hour average noise level.
L_{Amax} is the measured maximum noise level.

Table10 Maximum permissible noise levels at the façade of dwellings during construction. Source: "Guidelines for the Treatment of Noise & Vibration in National Road Schemes", NRA, 2004

The NRA construction noise limits represent a reasonable compromise between the practical limitations of a construction project, and the need to ensure an acceptable ambient noise level for the residents. The degree of adverse impact depends on the construction noise level, and the duration of the construction project. The descriptive scale of adverse construction noise impacts used in this report is presented in Table 11.

Approximate Duration of Exposure	Construction Noise Level L_{Aeq} dB					
	<55	55-60	60-70	70-75	75-80	>80
Days	Negligible	Negligible	Negligible	Slight	Moderate	Significant
Weeks	Negligible	Negligible	Slight	Moderate	Significant	Severe
Months	Negligible	Slight	Moderate	Significant	Severe	Severe
Year	Negligible	moderate	Significant	Severe	Severe	Severe

Table 11. Gradation of adverse noise impact as function of construction noise level, and duration of noise exposure

3.1.2 OPERATIONAL PHASE NOISE IMPACT CRITERIA

As this is a Design-Build-Operate (DBO) project, there are no details at this planning stage on the exact equipment to be installed in the Waste Water Treatment Plant.

The project management team has requested that design noise criteria be specified at the plant boundary, in order to accommodate the contractual requirements of the DBO project. Since equipment at the plant will operate continuously, equipment noise emissions would need to be controlled to ensure that acceptable night-time noise levels are achieved at the nearest noise sensitive locations.

The approach taken in this report is to determine a suitably low assessment noise criterion at the nearest houses, such that the resulting noise impact of the proposed development will be negligible, and comfortably within acceptable guideline levels. This assessment noise criterion is then used to calculate back to the plant boundaries, to establish the appropriate design criteria at the plant boundaries.

The validity of the noise impact assessment relies on the final design noise criteria being incorporated into the contracts for the projects, and implemented through appropriate equipment specifications during the detailed design stage.

3.1.2.1 EPA NOISE LIMITS

The EPA (Environmental Protection Agency) guidelines, which set a nighttime limit of 45dB(A), and a daytime noise limit of 55 dB(A), at noise sensitive locations. The EPA guidelines should however be viewed as maximum tolerable levels rather than levels of negligible impact. Where existing background noise levels are low, a lower noise criterion would be required, as described below.