Summary of results – Clontarf Bay, Canning Estuary

Summary

The results from the various analyses do not indicate significant contamination of the surface water or sediment at Clontarf Bay: the contaminant concentrations are mostly below the interim sediment quality guideline values for the protection of aquatic ecosystems and therefore pose a low risk of adverse impacts on the aquatic ecology of the estuary. On the basis of previous studies of sediment contamination in the Swan and Canning estuaries, Clontarf Bay would be prioritised as a *Low Priorit*y site for further investigation. The surface water sampled from Clontarf Bay in October and November 2010 was also generally compliant with the *Guidelines for recreational water quality and aesthetics* (ANZECC & ARMCANZ 2000) and the *Guidelines for Managing Risks in Recreational Water* (NHMRC 2008).

Methods

Sediment collection and analysis
Sediment was sampled from Clontarf Bay on 14 October 2010. Five replicate samples were collected from uppermost 3 cm of the sediment profile at the site CLON02, situated approximately 50 m offshore from the high water mark (see Figure 1). These were analysed to determine the concentration of a range of contaminants including organic chemicals (polycyclic aromatic hydrocarbons [PAHs], polychlorinated biphenyls [PCBs], organochlorine [OC] pesticides) and bioavailable metals as well as moisture content and total organic carbon. Analyses were performed at a NATA accredited laboratory (the National Measurement Institute, NMI).

A similar investigation of sediment at 20 other sites in the Swan Canning Estuary was completed in 2009. The report produced as a result of this work: *A baseline study of contaminants in the sediments of the Swan and Canning estuaries* (Nice 2009) is available on the Department of Water website. The results of this Clontarf Bay sediment investigation were compared to the findings of the 2009 report for the other sites in the estuary.

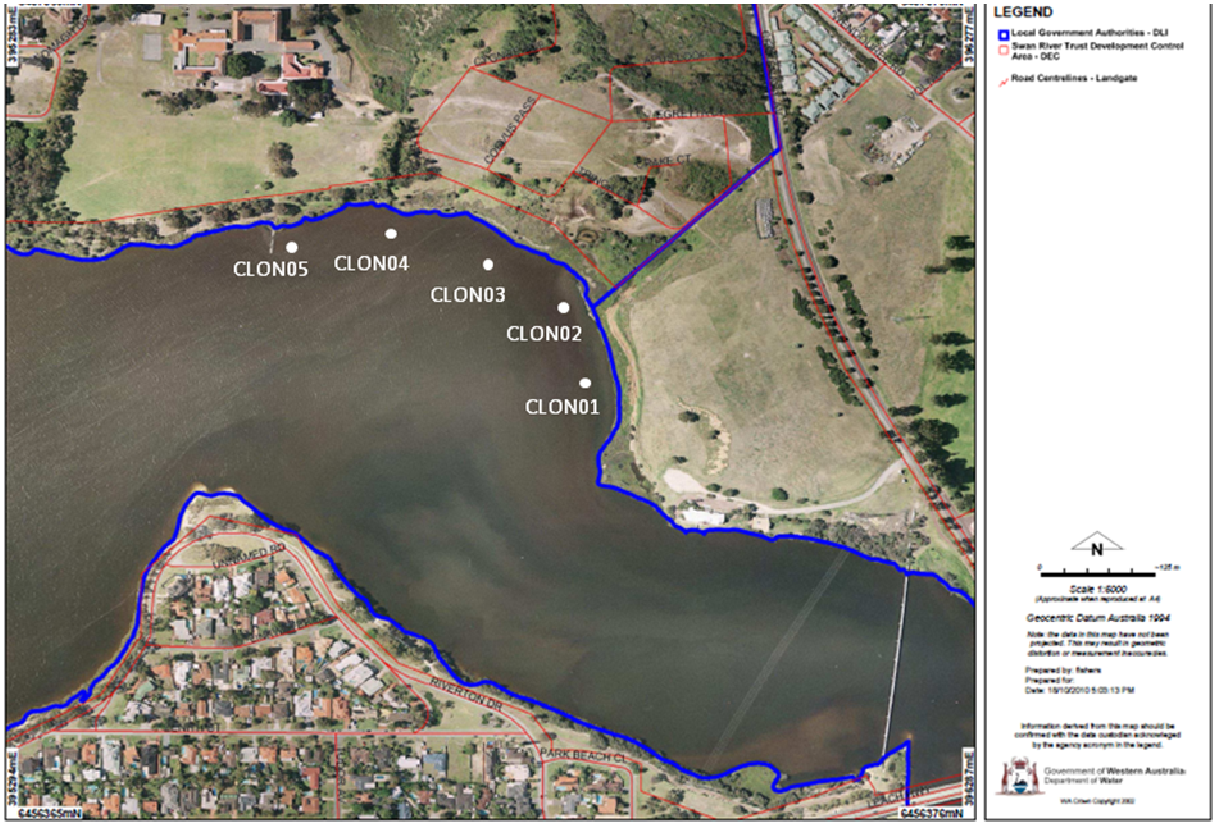

Figure 1: Map showing sampling sites in Clontarf Bay, Canning Estuary

Surface water sampling and analysis

A sample of water was also collected from the site CLON02 on 14 October 2010. The sample was submitted to the laboratory and analysed for a vast rage of chemicals. Water temperature, pH, salinity and dissolved oxygen were also measured on site.

Further water samples were collected from five different sampling sites CLON01, CLON02, CLON03, CLON04 and CLON05 in Clontarf Bay (see Figure 1) on five occasions from 14 October 2010 to 12 November 2010 and submitted to PathWest for the determination of indicators of bacterial contamination, namely thermotolerant coliforms and enterococci. Water temperature, pH, salinity and dissolved oxygen were also measured at each of the five sites on each occasion.

Results

Sediment

No metals were detected in the sediment samples at concentrations of concern: those that were found to be present were below the Interim Sediment Quality Guideline (ISQG) values for aquatic ecosystem protection (ANZECC and ARMCANZ 2000) (see **Table 1** below).

No polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) or organochlorine pesticides (OC pesticides) were detected in sediment samples (see **Tables 2 and 3** below). It is acknowledged that the laboratory limit of reporting for some of these compounds is higher than the guideline values specified in the Interim Sediment Quality Guidelines (ISQG) for aquatic ecosystem protection (ANZECC and ARMCANZ 2000).

Therefore, non-detection results may not necessarily mean that the contaminant is not present at levels of ecological concern.

As many contaminants bind strongly to particulate material, historical and/or chronic contamination of the estuary at this site will more likely be detected in the sediments than by traditional grab sampling of the water. Sampling planned for early 2011 using passive sampler technology aims to determine the concentrations of these compounds at a lower limit of reporting and therefore provide a more definitive answer with regard to their presence/absence in the water column.

When compared with the results of the sediment investigations of 20 other sites in the Swan Canning Estuary, completed in 2009: *A baseline study of contaminants in the sediments of the Swan and Canning estuaries* (Nice 2009), the Clontarf Bay sediment quality was relatively good and the site would be prioritised as *Low Priority* for further investigation.

Water

Physical-chemical

None of the pH measurements taken in the estuary at Clontarf Bay over the sampling period are at levels of concern. The pH values recorded range from 7.31 to 8.10 (see **Table 4** below for all the water temperature, pH, salinity, and dissolved oxygen measurements).

General chemicals

None of the general chemicals analysed and listed in **Table 5** exceeded the guideline value recommended in *Guidelines for Managing Risks in Recreational Water* (NHMRC, 2008), and most of the concentrations of chemicals shown in **Table 5** do not exceed the guideline values recommended in *Table 5.2.3 Summary of water quality guidelines for recreational purposes: general* (ANZECC & ARMCANZ 2000).

It is acknowledged that the laboratory limit of reporting for some organic compounds is higher than *guidelines for recreational purposes: general* (ANZECC & ARMCANZ 2000), and these are highlighted in Table 5.

The Canning Estuary was relatively saline (approximately 20 ppt) at the time of sampling, resulting in the concentrations of sodium, chloride, sulfate and hardness in excess of the *guidelines for recreational purposes: general* (ANZECC & ARMCANZ 2000).

The total dissolved solids (TDS) was in excess of the *guidelines for recreational purposes: general* (ANZECC & ARMCANZ 2000, however this may be due to disturbance of the sediment during sample collection (samples were collected by wading).

Ammonia, boron and surfactants also exceeded the *guidelines for recreational purposes: general* (ANZECC & ARMCANZ 2000). Groundwater sampling undertaken in 2005 at the Centenary Park former landfill site found ammonia and boron in groundwater bores at concentrations above the ANZECC & ARMCANZ (2000) guidelines for ecosystem protection.

Pesticides

None of the 101 pesticides shown in **Table 6** were detected at concentrations above the laboratory limit of reporting.

One of the pesticides (diquat) had a laboratory limit of reporting greater than the ANZECC & ARMCANZ (2008) recreational water quality guideline value, however.the laboratory limit of reporting for diquat did not exceed the *Guidelines for Managing Risks in Recreational Water* (NHMRC 2008) recommended guideline value. There is no data for 42 pesticides listed

(shown as n.d. in Table 6), which were not analysed as part of this study.

Organic chemicals

A further 129 organic chemicals were analysed in the water sample for which guideline values are not specified in the *Guidelines for recreational water quality and aesthetics* (ANZECC & ARMCANZ (2000). None of these were detected above the laboratory limit of reporting (see **Table 7**). There are guideline values for 20 of these 129 chemicals in *Guidelines for Managing Risks in Recreational Water* (NHMRC 2008), however, as shown in **Table 8** the laboratory limits of reporting did not exceed these guideline values.

The abovementioned sampling planned for early 2011 using passive sampler technology aims enable the determination of some of these compounds (i.e. pesticides and organic chemicals) at a lower limit of reporting and therefore provide a more definitive answer with regard to their presence/absence.

Microbes

Results from the microbiological analysis of the water samples collected from CLON01, CLON02, CLON03, CLON04 and CLON05 on five occasions in October and November 2010 are shown in **Table 9**. Based on these, neither the water quality guidelines for secondary contact activities (such as boating and fishing) nor primary contact activities (such as swimming) were triggered at any site for the 4-week duration of the sampling program according to the ANZECC & ARMCANZ (2000) guidelines. Neither were they triggered across the spatial extent of the sampling sites on any one sampling occasion.

The NHMRC (2008) *Guidelines for Managing Risks in Recreational Water* recommends using concentrations of intestinal enterococci as an indicator of marine water quality. Unlike the ANZECC & ARMCANZ (2000) guidelines, the NHMRC (2008) guidelines do not specify thermotolerant coliforms as an indicator of water quality, however; their concentrations do provide additional information regarding more recent contamination events.

Using the 95th percentile of colony forming units (CFU) of enterococci per 100 mL of water as the measure, water may be categorised into one of four categories A to D (best to worst) describing the protection of healthy adult bathers in marine waters (see Table 5.7, NHMRC 2008). These guideline values may also be applied to fresh and estuarine waters in the absence of data specific to these environments.

The 95th percentile of enterococci concentrations of all 25 water samples collected from Clontarf Bay over the four week duration of the sampling program was 83 CFU/100mL assuming all of the samples where enterococci were not detected contained 10 organisms per 100 mL. This falls into category B of the four categories. While it might be argued that the sample set of 25 is too small to perform a rigorous statistical analysis, all but six of the samples collected contained fewer than 40 enterococci per 100 mL, and five of these six were measured on the same day (5 November 2010).

It should be noted that several birds inhabit Clontarf Bay, including a flock of approximately 20 swans present on each of the sampling occasions. The NHMRC (2008) guidelines acknowledge that where animals and/or birds are the primary source of faecal material, the health significance of microorganisms is reduced.

References

ANZECC & ARMCANZ 2000, *Australian and New Zealand guidelines for fresh and marine water quality*, Australia and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand.

NHMRC 2008, *Guidelines for Managing Risks in Recreational Water*, National Health and Medical Research Council, Canberra.

NHMRC & NHMMC 2004, *Australian Drinking Water Guidelines*, National Health and Medical Research Council & Natural Resource Management Ministerial Council, Canberra.

Nice HE 2009. *A baseline study of contaminants in the sediments of the Swan and Canning estuaries.* Water Science Technical Series No. 6. Department of Water, WA.

Table 1 Metal and metalloid concentrations (bioavailable) measured in sediments collected from CLON02 on 14 October 2010. Values preceded by the < symbol did not exceed the laboratory limit of reporting (0.5 mg/kg except mercury, 0.1 mg/kg). Instances where interim sediment quality guidelines are not available are denoted as n.a. Alternative guidelines* for cobalt, manganese and selenium of 50, 1100 and 2 mg/kg respectively (Ontario Sediment Quality Guidelines 1993 & Lemly 1996) were also not exceeded.

	Sediment metal concentrations (bioavailable) mg/kg dry weight												
	Aluminium	Arsenic	Cadmium	Chromium	Cobalt*	Copper	Iron	Lead	Manganese*	Mercury	Nickel	Selenium*	Zinc
Site													
CLON02$_{(i)}$	330	1.2	<0.5	1.4	0.59	3.4	2070	7.4	17	<0.1	<0.5	<0.5	33
CLON02$_{(ii)}$	270	1.3	<0.5	1.3	0.64	3.2	1190	6.9	27	<0.1	<0.5	<0.5	30
CLON02$_{(iii)}$	320	1.7	<0.5	1.5	0.71	3.6	2280	8.2	30	<0.1	0.53	<0.5	40
CLON02$_{(iv)}$	350	1.7	<0.5	1.6	0.68	3.3	2430	7.9	26	<0.1	<0.5	<0.5	37
CLON02 $_{(v)}$	280	1.5	<0.5	1.3	0.62	3.3	1970	7.1	21	<0.1	<0.5	<0.5	35
CLON02 $_{(Average)}$	310	1.5	<0.5	1.4	0.65	3.4	2150	7.5	24	<0.1	<0.5	<0.5	35
Interim Sediment Quality Guideline - Low	n.a.	20	1.5	80	n.a.	65	n.a.	50	n.a.	0.15	21	n.a.	200
Interim Sediment Quality Guideline - High	n.a.	70	10	370	n.a.	270	n.a.	220	n.a.	1.0	52	n.a.	410

Table 2 Polycyclic aromatic hydrocarbon (PAH) concentrations normalised to 1% organic carbon in sediments collected from CLON02 on 14 October 2010. Values preceded by the < symbol did not exceed the laboratory limit of reporting (10 µg/kg). Instances where the interim sediment quality guidelines are not available are denoted by n.a.

Sediment polycyclic aromatic hydrocarbon concentrations (µg/kg) normalised to 1% organic carbon*															
	Naphthalene	Acenaph-thylene	Acenaph-thene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz[a]a-nthracene	Chrysene	Benzo[b]&[k]-fluoranthene	Benzo[a]-pyrene	Indeno[1,2,3-cd]pyrene	Dibenz[ah]-anthracene	Benzo(ghi)-perylene
Site															
CLON02(i)	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 40	< 20	< 20	< 20	< 20
CLON02(ii)	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 40	< 20	< 20	< 20	< 20
CLON02(iii)	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 40	< 20	< 20	< 20	< 20
CLON02(iv)	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 40	< 20	< 20	< 20	< 20
CLON02 (v)	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 40	< 20	< 20	< 20	< 20
CLON02 (Average)	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 40	< 20	< 20	< 20	< 20
ISQG Low	160	44	16	19	240	85	600	665	261	384	n.a.	430	n.a.	63	n.a.
ISQG High	2100	640	500	540	1500	1100	5100	2600	1600	2800	n.a.	1600	n.a.	260	n.a.

**Data normalised to 1% organic carbon according to Simpson et al. 2005.*

Table 3 Organochlorine (OC) pesticide concentrations normalised to 1% organic carbon in sediments collected from CLON02 on 14 October 2010. Values preceded by the < symbol did not exceed the laboratory limit of reporting (1 µg/kg). Other pesticides determined but not shown here were HCB, heptachlor, heptachlor epoxide, Aldrin, α-BHC, β-BHC, δ-BHC, oxychlordane, endrin aldehyde, endrin ketone, α-endosulfan, β-endosulfan, endosulfan sulphate and methoxychlor, none of which exceeded the limit of reporting.

Sediment organochlorine pesticide and PCB concentrations (µg/kg) normalised to 1% organic carbon*										
	γ-BHC (lindane)	*trans*-chlordane	*cis*-chlordane	dieldrin	*p,p'*-DDE	*p,p'*-DDT	*p,p'*-DDD	Σ-DDT	endrin	Σ-PCBs
Site										
CLON02(i)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 6	< 2	< 21
CLON02(ii)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 6	< 2	< 19
CLON02(iii)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 6	< 2	< 17
CLON02(iv)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 6	< 2	< 18
CLON02 (v)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 6	< 2	< 21
CLON02 (Average)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 6	< 2	< 19
ISQG Low	0.32	0.5	0.5	0.02	2.2	1.6	2	1.6	0.02	23
ISQG High	1	6	6	8	27	46	20	46	8	n.a.

Table 4 *In situ* physicochemical measurements of water collected on five occasions in October to November 2010 from five sites in Clontarf Bay.

In-situ water physical chemistry variables												
Date	14 Oct 2010				22 Oct. 2010				29 Oct. 2010			
Site	Temp. (ºC)	pH	Salinity (ppt)	DO (%sat)	Temp. (ºC)	pH	Salinity (ppt)	DO (%sat)	Temp. (ºC)	pH	Salinity (ppt)	DO (%sat)
CLON01	25.0	8.00	20.4	137.9	22.5	7.58	25.8	89.7	25.1	7.99	19.4	152.6
CLON02	24.2	7.87	20.5	120.8	22.3	7.41	25.7	63.2	24.6	7.91	19.7	135.6
CLON03	23.6	7.71	20.5	104.5	21.9	7.38	25.3	63.2	24.0	7.88	20.7	130.9
CLON04	23.1	7.63	20.6	102.3	22.1	7.34	24.9	60.5	24.6	7.84	20.7	126.0
CLON05	23.3	7.68	20.6	106.2	22.6	7.40	26.3	60.1	23.9	7.79	21.7	117.4

Table (4 continued) *In situ* physicochemical measurements of water collected on five occasions from five sites in Clontarf Bay.

In-situ water physical chemistry variables								
Date	5 Nov. 2010				12 Nov. 2010			
Site	Temp. (ºC)	pH	Salinity (ppt)	DO (%sat)	Temp. (ºC)	pH	Salinity (ppt)	DO (%sat)
CLON01	21.6	7.31	25.7	80.6	25.3	7.96	26.1	156.5
CLON02	21.9	7.44	25.2	79.8	24.9	8.10	25.0	168.4
CLON03	22.2	7.41	26.1	69.6	24.2	7.75	24.9	117.9
CLON04	22.1	7.50	26.6	81.5	24.3	7.54	23.6	92.4
CLON05	22.1	7.53	26.6	82.9	23.9	7.64	25.1	94.3

Table 5 Summary of water quality guidelines for recreational purposes: general chemicals (Table 5.2.3 ANZECC & ARMCANZ 2000), and 10 times the concentration stipulated in the Australian Drinking Water Guidelines (NHMRC & NHMMC 2004) as recommended in NHMRC 2008 compared with concentrations measured in a water sample collected from Clontarf Bay (CLON02, 14 Oct. 2010). Values preceded by the < symbol did not exceed the laboratory limit of reporting. Analytes which were not determined are denoted as n.d. ID denotes insufficient data to set a guideline based on health considerations.

Variable	**Guideline value (µg/L)**		**Measured value at CLON02 (µg/L)**
Inorganic:	ANZECC & ARMCANZ 2000 recreational purposes	NHMRC 2008	
Arsenic	50	70	<5
Asbestos	Insufficient data to set a guideline		Not detected
Barium	1000	7000	35
Boron	1000	40 000	2800
Cadmium	5	20	< 2
Chromium	50	500	< 5
Cyanide	100	800	< 10
Lead	50	100	< 1
Mercury	1	10	< 0.1
Nickel	100	200	< 5
Nitrate (N)	10 000	500 000	< 10
Nitrite (N)	1000	30 000	< 10
Selenium	10	100	< 5
Silver	50		< 1
Organic			
Benzene	10	10	< 1.0
Benzo(a)pyrene	0.01	0.1	< 0.01
Carbon tetrachloride	3	30	<1
1,1-Dichloroethene	0.3	300	<1
1,2-Dichloroethane	10	30	<1
Pentachlorophenol	10	100	< 2
Polychlorinated biphenyls	0.1		< 0.01 per congener
Tetrachloroethene	10	500	< 1
2,3,4,6-tetrachlorophenol	1		< 2
Trichloroethene	30	ID	< 1
2,4,5-Trichlorophenol	1		< 2
2,4,6-Trichlororphenol	10	200	< 2
Radiological			
Gross alpha activity	0.1 Bq/L		0.016 Bq/L
Gross beta activity	0.1 Bq/L		0.010 Bq/L

Table 5 (continued) Summary of water quality guidelines for recreational purposes: general chemicals (Table 5.2.3 ANZECC & ARMCANZ 2000) and 10 times the concentration stipulated in the Australian Drinking Water Guidelines as recommended in NHMRC 2008, compared with concentrations measured in a water sample collected from Clontarf Bay (CLON02, 14 Oct. 2010). Aesthetic* denotes guideline concentrations for aesthetic acceptability from the Australian Drinking Water Guidelines (NHMRC/NRMMC 2004) which have not been multiplied by a factor of 10. Values preceded by the < symbol did not exceed the limit of reporting. Analytes which were not determined are denoted as n.d.

Variable	**Guideline value (µg/L)**		**Measured value at CLON02 (µg/L)**
Other chemicals	ANZECC & ARMCANZ 2000 recreational purposes	NHMRC 2008	
Aluminium	200		30
Ammonia (as N)	10	500 (aesthetic)*	57
Chloride	400 000	250 000 (aesthetic)*	12 000 000
Copper	1000	20 000	< 5
Oxygen	> 6.5 mg/L (> 80 % sat)	> 80% saturation	8.7 mg/L
Hardness (as CaCo3)	500 000		3 800 000
Iron	300	300 (aesthetic)*	220
Manganese	100	5000	19
Organics (CCE & CAE)	200		n.d.
pH	6.5 – 8.5 pH units	6.5 – 8.5 pH units	7.8
Phenolics	2		<1 (phenol) , <2 (others), < 20 (sum phenolics)
Sodium	300 000	180 000 (aesthetic)*	6 000 000
Sulfate	400 000	5 000 000	1 600 000
Sulfide	50		< 20
Surfactants (MBAS)	200		750
Total dissolved solids	1 000 000		18 500 000
Zinc	5000	3000 (aesthetic)*	12

Table 6 Summary of water quality guidelines for recreational purposes: pesticides (Table 5.2.4 ANZECC & ARMCANZ 2000), and 10 times the concentration stipulated in the Australian Drinking Water Guidelines as recommended in NHMRC 2008, compared with concentrations measured in a single sample of water collected from Clontarf Bay (CLON02, 14 Oct. 2010). Values preceded by the < symbol did not exceed the limit of reporting. Analytes which were not determined are denoted by n.d.

Compound	Concentration (µg/L)			Compound	Concentration (µg/L)		
	Guidelines		Measured CLON02 14/10/2010		Guidelines		Measured CLON02 14/10/2010
	ANZECC & ARMCANZ	NHMRC			ANZECC & ARMCANZ	NHMRC	
Acephate	20	100	< 2	Fenvalerate	40	500	< 0.01
Alachlor	3		n.d.	Flamprop-methyl	6	30	n.d.
Aldrin	1		< 0.001	Fluometuron	100	500	n.d.
Amitrol	1	100	n.d.	Formthion	100	500	< 0.1
Asulam	100	500	n.d.	Fosamine (ammonium salt)	3000	300	n.d.
Azinphos-methyl	10	30	< 0.01	Glyphosate	200	10 000	< 10
Barban	300		n.d.	Heptachlor	3	3	< 0.001
Benomyl	200	1000	n.d.	Hexaflurate	60	300	n.d.
Bentazone	400	300	n.d.	Hexazinone	600	3000	< 0.01
Bioresmethrin	60	1000	< 0.1	Lindane	10	200	< 0.001
Bromazil	600	3000	< 1	Maldison	100	500	n.d.
Bromophos-ethyl	20	100	< 0.1	Methidathion	60	300	< 0.1
Bromoxynil	30	300	n.d.	Methomyl	60	300	< 1
Carbaryl	60	300	< 0.1	Metolachlor	800	3000	< 2
Carbendazim	200	1000	< 1	Metribuzin	5	500	< 0.01
Carbofuran	30	100	< 1	Mevinphos	6	50	< 0.1
Carbophenothion	1	5	< 0.1	Molinate	1	50	< 0.1
Chlordane	6	10	< 0.001	Monocrotophos	2	10	< 2
Chlordimeform	20		n.d.	Nabam	30		n.d.
Chlorfenvinphos	10	50	< 0.01	Nitralin	1000	5000	n.d.
Chloroxuron	30	100	n.d.	Omethoate	0.4		< 1
Chlorpyrifos	2	100	< 0.01	Oryzalin	60	3000	n.d.
Chlopyralid	1000	10 000	n.d.	Paraquat	40	300	< 20
Cyhexatin	200		n.d.	Parathion	30	100	n.d.
2,4-D	100	300	< 1	Parathion-methyl	6	1000	< 0.01
DDT	3	200	< 0.001	Pendimethalin	600	3000	< 0.1
Demeton	30		n.d.	Perfluidone	20		n.d.
Diazinon	10	30	< 0.01	Permethrin	300	1000	< 0.01

Table 6 (continued) Summary of water quality guidelines for recreational purposes: pesticides (Table 5.2.4 ANZECC & ARMCANZ 2000) and 10 times the concentration stipulated in the Australian Drinking Water Guidelines as recommended in NHMRC 2008, compared with concentrations measured in a single sample of water collected from Clontarf Bay (CLON02, 14 October 2010). Values preceded by the < symbol did not exceed the limit of reporting. Analytes which were not determined are denoted by n.d.

Compound	Concentration (µg/L)			Compound	Concentration (µg/L)		
	Guidelines (Max.)		Measured		Guidelines (Max.)		Measured
	ANZECC & ARMCANZ	NHMRC	CLON02 14/10/2010		ANZECC & ARMCANZ	NHMRC	CLON02 14/10/2010
Dicamba	300	1000	< 1	Picrolam	30	3000	< 1
Dichlobenil	20	100	n.d.	Piperonyl butoxide	200	1000	< 0.1
3.6-dichloropicolinic acid	1000		n.d.	Pirimicarb	100	50	< 0.1
Dichlorvos	20	10	< 0.01	Pirimiphos-ethyl	1	5	< 0.01
Dichlofop-methyl	3	50	n.d.	Pirimiphos-methyl	60	500	< 0.01
Dicofol	100	30	< 0.1	Profenofos	0.6	3	< 0.1
Dieldrin	1		< 0.001	Promecarb	60	300	n.d.
Difenzoquat	200	1000	n.d.	Propanil	1000	5000	n.d.
Dimethoate	100	500	< 0.01	Propargite	1000	500	< 0.1
Diquat	10	50	< 20	Propoxur	1000		n.d.
Disulfoton	6	30	n.d.	Pyrazophos	1000	300	n.d.
Diuron	40	300	< 1	Quintozene	6	300	n.d.
DPA	500	5000	n.d.	Sulprofos	20	100	n.d.
Endosulfan	40	300	< 0.001	2,4,5-T	2	1000	< 1
Endothal	600	1000	< 2	Temephos	30	3000	< 2
Endrin	1		< 0.001	Thiobencarb	40	300	n.d.
EPTC	60	300	n.d.	Thiometon	20	30	< 0.1
Ethion	6	30	< 0.01	Thiophanate	100	50	n.d.
Ethoprophos	1	10	n.d.	Thiram	30	30	n.d.
Fenchlorphos	60	300	< 0.1	Trichlorofon	10	50	n.d.
Fenitrothion	20	100	< 0.01	Triclopyr	20	100	< 1
Fenoprop	20	100	n.d.	Trifluralin	500	500	< 0.1
Fensulfothion	20	100	n.d.				

Table 7 Concentrations of chemicals (µg/L) measured in a sample of water collected from Clontarf Bay (CLON02) in addition to those specified in Tables 5 and 6. Values preceded by the < symbol did not exceed the limit of reporting.

Compound	Conc.	Compound	Conc.	Compound	Conc	Compound	Conc
HCB	< 0.001	PCB # 52	< 0.01	Vinyl chloride	< 2	Bromodichloromethane	< 1
Heptachlor epoxide	< 0.001	PCB # 66	< 0.01	Bromomethane	< 5	Dibromochloromethane	< 1
α-BHC	< 0.001	PCB # 77	< 0.01	Chloroethane	< 5	Bromoform	< 1
β-BHC	< 0.001	PCB # 101	< 0.01	Trichlorofluoromethane	< 5	Acetone	< 10
δ-BHC	< 0.001	PCB # 105	< 0.01	1,1-Dichloroethane	< 1	Vinylacetate	< 10
oxychlordane	< 0.001	PCB # 118	< 0.01	Dichloromethane	< 1	2-Butanone (MEK)	< 10
p,p'-DDE	< 0.001	PCB # 126	< 0.01	trans-1,2-Dichloroethene	< 1	4-Methyl-2-pentanone (MIBK)	< 10
p,p'-DDD	< 0.001	PCB # 128	< 0.01	2,2-Dichloropropane	< 1	2-Hexanone (MBK)	< 10
Endrin Aldehyde	< 0.001	PCB # 138	< 0.01	cis-1,2-Dichloroethene	< 1	Methyl tert-Butyl Ether (MTBE)	< 10
Endrin Ketone	< 0.001	PCB # 153	< 0.01	Bromochloromethane	< 1	Carbon disulfide	< 10
Endosulfan Sulfate	< 0.001	PCB # 169	< 0.01	1,1,1-Trichloroethane	< 1	Naphthalene	< 0.01
Methoxychlor	< 0.001	PCB # 170	< 0.01	1,1-Dichloropropene	< 1	Acenaphthylene	< 0.01
AMPA	< 10	PCB # 180	< 0.01	1,2-Dichloropropane	< 1	Acenaphthene	< 0.01
Glufosinate	< 10	PCB # 187	< 0.01	Dibromomethane	< 1	Fluorene	< 0.01
2-Chlorophenol	< 1	PCB # 195	< 0.01	cis-1,3-Dichloropropene	< 1	Phenanthrene	< 0.01
2-Methylphenol	< 1	PCB # 206	< 0.01	1,1,2-Trichloroethane	< 1	Anthracene	< 0.01
2,4-Dichlorophenol	< 1	PCB # 209	< 0.01	1,3-Dichloropropane	< 1	Fluoranthene	< 0.01
3-& 4-Methylphenols	< 2	Demeton-S-Methyl	< 0.01	1,2-Dibromoethane	< 1	Pyrene	< 0.01
2,4-Dimethyphenol	< 1	Chlorpyrifos Methyl	< 0.01	1,1,1,2-Tetrachloroethane	< 1	Benz(a)anthracene	< 0.01
2,6-Dichlorophenol	< 1	Malathion	< 0.01	1,1,2,2-Tetrachloroethane	< 1	Chrysene	< 0.01
2-Nitrophenol	< 1	Fenthion	< 0.01	1,2,3-Trichloropropane	< 1	Benz(b+k)fluoranthene	< 0.02
4-Chloro-3-methylphenol	< 2	Azinphos Ethyl	< 0.01	1,2-Dibromo-3-chloropropane	< 1	Benzo(a)pyrene	< 0.01
4-Nitrophenol	< 1	Parathion Ethyl	< 0.01	Hexachlorobutadiene	< 1	Indeno(1,2,3,c,d)pyrene	< 0.01
MCPA	< 1	Styrene	< 1	Chlorobenzene	< 1	Dibenz(a,h)anthracene	< 0.01
Dichlorprop	< 1	Isopropylbenzene	< 1	Bromobenzene	< 1	Benzo(g,h,i)perylene	< 0.01
2, 4, 5 - TP	< 1	n-Propylbenzene	< 1	2-Chlorotoluene	< 1	Total PAH's (as above)	< 0.16
2, 4 - DB	< 1	1,3,5-Trimethylbenzene	< 1	4-Chlorotoluene	< 1	Toluene	< 1.0
MCPP	< 1	tert-Butylbenzene	< 1	1,3-Dichlorobenzene	< 1	Ethylbenzene	< 1.0
Diclofop	< 1	1,2,4-Trimethylbenzene	< 1	1,4-Dichlorobenzene	< 1	Xylene	< 2.0
PCB # 8	< 0.01	sec-Butylbenzene	< 1	1,2-Dichlorobenzene	< 1	Total BTEX	< 5.0
PCB # 18	< 0.01	4-Isopropyltoluene	< 1	1,2,4-Trichlorobenzene	< 1		
PCB # 28	< 0.01	n-Butylbenzene	< 1	1,2,3-Trichlorobenzene	< 1		
PCB # 44	< 0.01	Chloromethane	< 5	Chloroform	< 1		

Table 8 Concentrations of chemicals (µg/L) measured in a sample of water collected from Clontarf Bay (CLON02) specified in the Guidelines for Managing Risks in Recreational Water (NHMRC 2005) but not in the Guidelines for recreational water quality (ANZECC & ARMCANZ 2000). The guideline values are 10 times the concentration stipulated in the Australian Drinking Water Guidelines as recommended in NHMRC 2008, Values preceded by the < symbol did not exceed the limit of reporting. I.D. denotes insufficient data to set a guideline based on health considerations; <LOR denotes the guideline value is below the limit of reporting.

Compound	Concentration (µg/L)	
	Guideline	Measured
Chlorobenzene	300	< 1
2-Chlorophenol	3000	< 1
1,2-Dichlorobenzene	15 000	< 1
1,3-Dichlorobenzene	< LOR	< 1
1,4-Dichlorobenzene	400	< 1
1,1-Dichloroethane	< LOR	< 1
cis-1,2-Dichloroethene	600	< 1
trans-1,2-Dichloroethene	600	< 1
Dichloromethane	40	< 1
2,4-Dichlorophenol	2000	< 1
Ethylbenzene	3000	< 1.0
Heptachlor epoxide	3	< 0.001
Methoxychlor	3000	< 0.001
Styrene	300	< 1
Toluene	800	< 1.0
1,2,4-Trichlorobenzene	300 (total)	< 1
1,2,3-Trichlorobenzene	300 (total)	< 1
1,1,1-Trichloroethane	I.D.	< 1
Vinyl chloride	3	< 2
Xylene	6000	< 2.0

Table 9 Microbiological characteristics of water collected on five occasions from five sites in Clontarf Bay. Values preceded by the < symbol did not exceed the limit of reporting. Thermotolerant coliforms (confirmed) are expressed as CFU / 100 mL; Enterococci (confirmed) are presented as most probable number (MPN) / 100 mL

Bacterial content (organisms per 100 mL)										
	14 Oct 2010		22 Oct. 2010		29 Oct. 2010		5 Nov. 2010		12 Nov. 2010	
Site	Thermotolerant coliforms	Enterococci	Thermotolerant coliforms	Enterococci	Thermotolerant coliforms	Enterococci	Thermotolerant coliforms	Enterococci	Thermotolerant coliforms	Enterococci
CLON01	est. < 10	20	est. 30	30	est. < 10	< 10	est. 10	74	est. 10	< 10
CLON02	est. < 10	< 10	est. 27	< 10	est. 10	< 10	est. 20	74	est. 10	< 10
CLON03	est. 10	10	est. 60	10	est. < 10	< 10	est. 36	140	est. 10	10
CLON04	est. < 10	< 10	est. 560	31	est. < 10	< 10	est. 20	74	est. 30	10
CLON05	est. < 10	10	est. 450	63	est. 10	20	est. 73	85	est. 30	10
Median	**est. < 10**	**10**	**est. 60**	**30**	**est. < 10**	**< 10**	**est. 20**	**74**	**est. 10**	**10**
Primary contact recreational water quality guideline (median of at least five measurements)									150	35
Secondary contact recreational water quality guideline (median of at least five measurements)									1000	230