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**REPORT: SOIL AND WATER QUALITY SAMPLING
TOMERONG, NSW**

INTRODUCTION

Environment & Natural Resource Solutions (ENRS Pty Ltd) were commissioned as independent environmental consultants by *Shoalhaven City Council (SCC)* (the client) to conduct Soil and Water Quality Sampling in Tomerong, NSW (*herein referred to as the Site*). ENRS understand the sampling was triggered by concerns that gravel applied to roads and dust from road transport of quarry materials may have entered domestic water storage tanks and dams.

This letter report documents the sample methodology and provides an assessment of the results of NATA accredited laboratory testing against the Australian Drinking Water Guidelines version 3.3 (NHMRC;2016).

The scope of work comprised the following tasks:

1. Field sampling (two sampling events in July and November 2018);
2. Submit samples to NATA accredited laboratory for chemical analysis
3. Tabulate results and compare against relevant water quality assessment criteria; and
4. Collate sampling results and prepare letter report.

REFERENCE GUIDELINES

ENRS have adopted the most appropriate criteria in accordance with current state and national guidelines. Where available, Australian and NSW EPA endorsed guidelines have been referenced in preference to international standards.

ASSESSMENT CRITERIA - SOIL

The EPA has endorsed the use of the Health Investigation Levels (HILs) given in the *National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1)* 'Schedule B (1) Guideline on the Investigation Levels for Soil and Groundwater'. The NEPM provide a framework for risk-based assessment of soil and groundwater contamination. Health Screening Levels (HILs) are provided for four (4) land use categories:

Given the Site area comprises residential properties, the relevant Site Assessment Criteria is **ASC NEPM HIL 'A'** for residential landuse with accessible soil.

Table 1 Summary of NEPM Land use Categories

NEPM	Description of Land use Categories
HIL 'A'	Residential A with garden/accessible soil also includes children's day care centres, preschools and primary schools.
HIL 'B'	Residential B with minimal opportunities for soil access; includes buildings with fully and permanently paved yard space such as high-rise buildings and apartments.
HIL 'C'	Recreational C includes public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools and unpaved footpaths.
HIL 'D'	Commercial/industrial D includes premises such as shops, offices, factories and industrial sites.

ASSESSMENT CRITERIA - WATER

The Australian Drinking Water Guidelines (ADWG) issued by the National Health and Medical Research Council (NHMRC;2016) provide the minimum requirements for drinking water of 'good' quality, although the ADWG are not mandatory legally enforceable standards.

The ADWG include two (2) different types of guideline values:

1. **Health**-related guideline value, which is the concentration or measure of a water quality characteristic that, based on present knowledge, does not result in any significant risk to the health of the consumer over a lifetime of consumption; and
2. **Aesthetic** guideline values, the concentration or measure of a water quality characteristic that is associated with acceptability of water to the consumer; for example, appearance, taste and odour.

SAMPLE METHODOLOGY

ENRS professionals accompanied by SCC carried out site inspections for soil and water quality sampling in July and November 2018. Sample locations were selected with consideration of the location of domestic water tanks and dams in respect to transport routes for quarry products. Sample Sites comprised:

1. Gravel applied to residential driveways;
2. Domestic water tanks with collection from building roofs; and
3. Surface water dams adjacent to residential buildings.

Representative grab samples were obtained directly into laboratory prepared vessels with appropriate preservatives for the analysis. Preserved metals bottles were not field filtered and labelled for analysis of total concentrations. Only disposable equipment was utilised to avoid decontamination, hence rinsate and field QAQC samples were not obtained. Samples were placed on ice and transported to the laboratory for analysis. Samples were submitted under Chain of Custody (COC) documentation.

LABORATORY ANALYSIS

Soil and Water samples were submitted for analysis of Contaminants of Potential Concern (CoPC) based on the source of potential contamination associated with gravel and quarry products.

The following points summarise the testing regime:

- pH (acidity and alkalinity);
- Electrical Conductivity (Salinity measured as EC);
- Silica (Total);
- Polycyclic aromatic hydrocarbons (PAHs);
- Total Metals (Aluminium, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Molybdenum, Nickel, Selenium, Silver, Strontium, Tin, Vanadium, Zinc, Calcium, Magnesium, Sodium, Potassium, Sulfur as S, Phosphorus, Titanium, Thallium);
- Cyanide; and
- Soil particle size.

The laboratory was NATA accredited and the laboratory Limits of Reporting (LOR) were within acceptable levels for the assessment criteria. Laboratory Certificates of Analysis (COA) indicate that for the samples collected during the scope of works, sampling techniques, transport procedures and laboratory analysis were satisfactory. The QA/QC indicators either all complied with the required standards, or showed variations that would have no significant effect on the quality of the data or the conclusions of this Water Quality Assessment. It is therefore concluded that the QA/QC results are adequate and the quality of the **data is acceptable for use in this assessment**.

LABORATORY RESULTS - SOIL

Upon receipt the NATA laboratory results were tabulated and compared against the ASC NEPM HIL 'A' (refer to **Table 2**).

In summary, the results report concentrations of all CoPC below the relevant SAC. The results are considered satisfactory and do not identify any indicators for contamination to trigger further testing or investigation.

LABORATORY RESULTS - WATER

Upon receipt the NATA laboratory results were tabulated and compared against the ADWG (refer to **Table 3**). Minor exceedances of the aesthetic criteria for Aluminium were reported in a surface water dam and in WS07 Tank3. The elevated aluminium is likely associated with sediment in the dam and tank. It is recommended the first flush systems on the Tank be cleaned and maintained regularly. The Dam water is understood to be only utilised for Stock purposes, as such the elevated aluminium is not considered to limit the ongoing water use at the Site.

In summary, the results report concentrations of all CoPC below the ADWG health criteria. The results are considered satisfactory and do not identify any indicators for contamination to trigger further testing or investigation.

DISCUSSION AND RECOMMENDATIONS

The following discussion and recommendations may be provided based on the NATA accredited laboratory results reviewed during this scope of work:

- The soil sampling regime for gravel on residential driveways reported concentration of CoPC below the relevant ASC NEPM HIL 'A'. The results are considered satisfactory and do not identify any indicators for contamination to trigger further testing or investigation;

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- The Water quality sampling regime in Tanks and Dams identified concentrations of Aluminium above the aesthetic criteria for drinking water in one Tank and one Dam. Water quality may be improved by cleaning the Tank and first flush system, whilst the Dam is understood to be used for stock purposes only and is not a source of potable water.
- The NATA laboratory results for final water samples report concentration for all CoPC below the ADWG health criteria. The results are considered satisfactory and do not identify any indicators for contamination to trigger further testing or investigation.
- It is recommended that all water tanks be inspected and maintained regularly to clean first flush systems and any accumulated silt and debris. Water users may also wish to consider regular testing of private water sources to monitor water quality against the relevant standards and guidelines.

This report must be read in full in conjunction with the attached Statement of Limitations.

Yours sincerely



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SafeWork NSW Asbestos Assessor (LA000166)

LIMITATIONS

This report and the associated services performed by ENRS are in accordance with the scope of services set out in the contract between ENRS and the Client. The scope of services was defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to Site.

ENRS derived the data in this report primarily from visual inspections, and, limited sample collection and analysis made on the dates indicated. In preparing this report, ENRS has relied upon, and presumed accurate, certain information provided by government authorities, the Client and others identified herein. The report has been prepared on the basis that while ENRS believes all the information in it is deemed reliable and accurate at the time of preparing the report, it does not warrant its accuracy or completeness and to the full extent allowed by law excludes liability in contract, tort or otherwise, for any loss or damage sustained by the Client arising from or in connection with the supply or use of the whole or any part of the information in the report through any cause whatsoever.

Limitations also apply to analytical methods used in the identification of substances (or parameters). These limitations may be due to non-homogenous material being sampled (i.e. the sample to be analysed may not be representative), low concentrations, the presence of 'masking' agents and the restrictions of the approved analytical technique. As such, non-statistically significant sampling results can only be interpreted as 'indicative' and not used for quantitative assessments.

The data, findings, observations, conclusions and recommendations in the report are based solely upon the state of Site at the time of the investigation. The passage of time, manifestation of latent conditions or impacts of future events (e.g. changes in legislation, scientific knowledge, land uses, etc) may render the report inaccurate. In those circumstances, ENRS shall not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on, the contents of the report.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between ENRS and the Client. ENRS accepts no liability or responsibility whatsoever and expressly disclaims any responsibility for or in respect of any use of or reliance upon this report by any third party or parties.

It is the responsibility of the Client to accept if the Client so chooses any recommendations contained within and implement them in an appropriate, suitable and timely manner.

**Table 2: Total Concentration Results - Soil
Site: SCC Tomerong**

Sample number: EW1802953002 EW1802953003 EW1802953004 EW1802953007
Sample date: 24/07/2018 24/07/2018 24/07/2018 24/07/2018
Sample ID: S1/0.1 (Parnell Rd - rear driveway) S2/0.1 (Parnell Rd - Front driveway Nth) S3/0.1 (Parnell Rd - Front driveway Sth) S4/0.1 (Bayley Rd)

CAS Number	Analyte Metals	Units	LOR	NEPM (2013) Soil Investigation Levels: NEPM A (Residential, Primary Schools and Accessible Soil)				
7429-90-5	Aluminum	mg/kg	50	-	11800	8250	8030	7730
7440-36-0	Antimony (metallic)	mg/kg	5	<5	<5	<5	<5	<5
7440-38-2	Arsenic, Inorganic	mg/kg	5	100	8	7	8	7
7440-39-3	Barium	mg/kg	10	-	120	90	100	110
7440-41-7	Beryllium and compounds	mg/kg	1	60	<1	<1	<1	<1
7440-42-8	Boron And Borates Only	mg/kg	50	4500	<50	<50	<50	<50
7440-43-9	Cadmium	mg/kg	1	20	<1	<1	<1	<1
7440-47-3	Chromium	mg/kg	2	100	23	16	16	15
7440-48-4	Cobalt	mg/kg	2	100	14	11	10	9
7440-50-8	Copper	mg/kg	5	6000	48	20	16	16
7439-89-6	Iron	mg/kg	50	-	29300	21700	20700	20100
7439-92-1	Lead and Compounds	mg/kg	5	300	20	16	17	15
7439-96-5	Manganese	mg/kg	5	3800	366	193	214	215
7439-98-7	Molybdenum	mg/kg	2	-	<2	<2	<2	<2
7440-02-0	Nickel	mg/kg	2	400	27	29	26	25
7782-49-2	Selenium	mg/kg	5	200	<5	<5	<5	<5
7440-22-4	Silver	mg/kg	2	-	<2	<2	<2	<2
7440-24-6	Strontium, Stable	mg/kg	2	-	19	20	31	33
7440-28-0	Thallium (Soluble Salts)	mg/kg	5	-	<5	<5	<5	<5
7440-31-5	Tin	mg/kg	5	-	<5	<5	<5	<5
7440-32-6	Titanium	mg/kg	10	-	140	130	120	120
7440-62-2	Vanadium and Compounds	mg/kg	5	-	51	22	22	20
7440-66-6	Zinc and Compounds	mg/kg	5	7400	115	88	70	70
	Polynuclear Aromatic Hydrocarbons (PAHs)							
91-20-3	Naphthalene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
208-96-8	Acenaphthylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
83-32-9	Acenaphthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
86-73-7	Fluorene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
85-01-8	Phenanthrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
120-12-7	Anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
206-44-0	Fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
129-00-0	Pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
56-55-3	Benzo(a)anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
218-01-9	Chrysene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
205-99-2 205-82-3	Benzo(b+j)fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
207-08-9	Benzo(k)fluoranthene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
50-32-8	Benzo(a)pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
193-39-5	Indeno(1.2.3.cd)pyrene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
53-70-3	Dibenz(a,h)anthracene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
191-24-2	Benzo(g,h,i)perylene	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Sum of polycyclic aromatic hydrocarbons	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Benzo(a)pyrene TEQ (zero)	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Benzo(a)pyrene TEQ (half LOR)	mg/kg	0.5	-	0.6	0.6	0.6	0.6
	Benzo(a)pyrene TEQ (LOR)	mg/kg	0.5	3	1.2	1.2	1.2	1.2

**Table 3: Total Concentration Results - Water
Site: SCC Tomerong**

Sample number: EW1802953001 EW1804765001 EW1804765002 EW1802953005 EW1802953006 EW1802953008 EW1802953009 EW1804765003 EW1802953010
 Sample date: 24/07/2018 15/11/2018 15/11/2018 24/07/2018 24/07/2018 24/07/2018 15/11/2018 24/07/2018
 Sample ID: WS01 (Parnell Rd Tank) WS01 (Parnell Rd Tank) WS02 (Parnell Rd Tap) WS03 (Parnell Rd Tank2) WS04 (Bayly Rd Tank1) WS05 (Gumden Lane Dam) WS06 (Bayly Rd Tank2) WS06 (Bayly Rd Tank2) WS07 (Bayly Rd Tank3)

CAS Number	Analyte	Units	LOR	Assessment Criteria: ADWG 2016 Health	WS01 (Parnell Rd Tank)	WS01 (Parnell Rd Tank)	WS02 (Parnell Rd Tap)	WS03 (Parnell Rd Tank2)	WS04 (Bayly Rd Tank1)	WS05 (Gumden Lane Dam)	WS06 (Bayly Rd Tank2)	WS06 (Bayly Rd Tank2)	WS07 (Bayly Rd Tank3)
-	pH Value	pH Unit	0.01	>4 - <11	-	6.02	5.53	6.73	7.39	6.33	-	7.04	4.99
-	Electrical Conductivity @ 25Å°C	ÅµS/cm	1	-	-	25	28	72	200	79	-	78	33
-	Total Dissolved Solids @180Å°C	mg/L	10	<600	-	18	19	36	114	52	-	55	18
14464-46-1	Silicon as SiO2	mg/L	0.1	-	0.3	-	-	1.6	2.9	2.1	0.6	-	1.8
-	Total Metals	-	-	-	-	-	-	-	-	-	-	-	-
7429-90-5	Aluminium	mg/L	0.01	<0.1* (Desirable - No current health based guideline)	-	0.02	0.02	0.04	0.07	0.3	-	0.03	0.44
7440-36-0	Antimony	mg/L	0.001	0.003	-	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001
7440-38-2	Arsenic	mg/L	0.001	0.01	-	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001
7440-41-7	Beryllium	mg/L	0.001	0.06	-	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001
7440-39-3	Barium	mg/L	0.001	2	-	0.003	0.004	0.004	0.009	0.004	-	0.006	0.01
7440-69-9	Bismuth	mg/L	0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001
7440-43-9	Cadmium	mg/L	0.0001	0.002	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	<0.0001	<0.0001
7440-45-1	Cerium	mg/L	0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001
7440-46-2	Caesium	mg/L	0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001
7440-47-3	Chromium	mg/L	0.001	0.05* (As CrVI)	-	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	0.002
7440-48-4	Cobalt	mg/L	0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001
7440-50-8	Copper	mg/L	0.001	2	-	0.022	0.206	0.03	0.002	0.001	-	0.033	0.003
7439-92-1	Lead	mg/L	0.001	0.01	-	<0.001	0.006	0.004	<0.001	<0.001	-	<0.001	0.001
7439-93-2	Lithium	mg/L	0.001	-	-	0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001
7439-96-5	Manganese	mg/L	0.001	0.5	-	0.009	0.01	<0.001	0.016	0.033	-	0.003	0.01
7439-98-7	Molybdenum	mg/L	0.001	0.05	-	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001
7440-02-0	Nickel	mg/L	0.001	0.02	-	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	0.002
7440-17-7	Rubidium	mg/L	0.001	-	-	<0.001	<0.001	0.002	0.002	0.002	-	<0.001	0.001
7782-49-2	Selenium	mg/L	0.01	0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01
7440-22-4	Silver	mg/L	0.001	0.1	-	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001
7440-24-6	Strontium	mg/L	0.001	-	-	0.004	0.005	0.02	0.04	0.014	-	0.02	0.008
22541-49-7	Tellurium	mg/L	0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	-	<0.005	<0.005
7440-28-0	Thallium	mg/L	0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001
7440-29-1	Thorium	mg/L	0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001
7440-31-5	Tin	mg/L	0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001
7440-32-6	Titanium	mg/L	0.01	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01
7440-61-1	Uranium	mg/L	0.001	0.017	-	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001
7440-62-2	Vanadium	mg/L	0.01	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01
7440-66-6	Zinc	mg/L	0.005	>3 (Affects Taste)	-	0.11	0.297	0.044	0.008	0.016	-	0.092	0.369
7440-42-8	Boron	mg/L	0.05	4	-	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05
7439-89-6	Iron	mg/L	0.05	<0.3 (Taste threshold)	-	<0.05	<0.05	<0.05	0.16	1.75	-	<0.05	0.37
7726-95-6	Bromine	mg/L	0.1	0.02 (Bromate)	-	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1
57-12-5	Total Cyanide	mg/L	0.004	0.08	<0.004	-	-	<0.004	<0.004	<0.004	<0.004	-	<0.004
-	Polynuclear Aromatic Hydrocarbons (PAHs)	-	-	-	-	-	-	-	-	-	-	-	-
91-20-3	Naphthalene	Åµg/L	1	-	<1.0	-	-	<1.0	<1.0	<1.0	<1.0	-	<1.0
208-96-8	Acenaphthylene	Åµg/L	1	-	<1.0	-	-	<1.0	<1.0	<1.0	<1.0	-	<1.0
83-32-9	Acenaphthene	Åµg/L	1	-	<1.0	-	-	<1.0	<1.0	<1.0	<1.0	-	<1.0
86-73-7	Fluorene	Åµg/L	1	-	<1.0	-	-	<1.0	<1.0	<1.0	<1.0	-	<1.0
85-01-8	Phenanthrene	Åµg/L	1	-	<1.0	-	-	<1.0	<1.0	<1.0	<1.0	-	<1.0
120-12-7	Anthracene	Åµg/L	1	-	<1.0	-	-	<1.0	<1.0	<1.0	<1.0	-	<1.0
206-44-0	Fluoranthene	Åµg/L	1	-	<1.0	-	-	<1.0	<1.0	<1.0	<1.0	-	<1.0
129-00-0	Pyrene	Åµg/L	1	-	<1.0	-	-	<1.0	<1.0	<1.0	<1.0	-	<1.0
56-55-3	Benz(a)anthracene	Åµg/L	1	-	<1.0	-	-	<1.0	<1.0	<1.0	<1.0	-	<1.0
218-01-9	Chrysene	Åµg/L	1	-	<1.0	-	-	<1.0	<1.0	<1.0	<1.0	-	<1.0
205-99-2 205-82-3	Benzo(b+g)fluoranthene	Åµg/L	1	-	<1.0	-	-	<1.0	<1.0	<1.0	<1.0	-	<1.0
207-08-9	Benzo(k)fluoranthene	Åµg/L	1	-	<1.0	-	-	<1.0	<1.0	<1.0	<1.0	-	<1.0
50-32-8	Benzo(a)pyrene	Åµg/L	0.5	-	<0.5	-	-	<0.5	<0.5	<0.5	<0.5	-	<0.5
193-39-5	Indeno(1,2,3-cd)pyrene	Åµg/L	1	-	<1.0	-	-	<1.0	<1.0	<1.0	<1.0	-	<1.0
53-70-3	Dibenz(a,h)anthracene	Åµg/L	1	-	<1.0	-	-	<1.0	<1.0	<1.0	<1.0	-	<1.0
191-24-2	Benzo(g,h,i)perylene	Åµg/L	1	-	<1.0	-	-	<1.0	<1.0	<1.0	<1.0	-	<1.0
-	Sum of polycyclic aromatic hydrocarbons	Åµg/L	0.5	-	<0.5	-	-	<0.5	<0.5	<0.5	<0.5	-	<0.5
-	Benzo(a)pyrene TEQ (zero)	Åµg/L	0.5	-	<0.5	-	-	<0.5	<0.5	<0.5	<0.5	-	<0.5