



4SIGHT  
CONSULTING

PART OF  
 SLR



**STORMWATER SYSTEM SEDIMENT DISPOSAL  
MONITORING REPORT**

For Northport Ltd

April 2023

## REPORT INFORMATION AND QUALITY CONTROL

Prepared for:	Ben Sweeny Northport Ltd
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Reviewer:	Mark Poynter Technical Director (Marine) 
Approved for Release:	Mark Poynter Technical Director (Marine) 
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## CONTENTS

## Page

<b>1</b>	<b>INTRODUCTION .....</b>	<b>1</b>
<b>2</b>	<b>MONITORING .....</b>	<b>1</b>
2.1	Consent AUT.005055.35.01 .....	1
2.1.1	Results .....	3
2.1.2	Results -Summary and Discussion .....	4
2.2	Consent CON200090505532 .....	5
2.2.1	Sampling Locations and Approach .....	5
2.2.2	Results Summary and Discussion .....	5
<b>3</b>	<b>CONCLUSIONS AND RECOMMENDATIONS.....</b>	<b>7</b>

### List of Tables

Table 1: Sediment monitoring results from six locations within the canal arms and main settlement pond compared to ANZG (2018) toxicant Guideline Values. Results exceeding DGV and GV-High are shaded light and dark green respectively. ....	3
Table 2: Sediment results for the eastern and western canal arms, compared to ANZG (2018) toxicant DGV and GV-High. ....	5

### List of Figures

Figure 1: Northport sediment sampling locations. ....	2
Figure 2: Northport sediment sampling locations for western arm and eastern arm composite samples. ....	6

### List of Appendices

Appendix A: Resource Consent AUT.005055.35.01
Appendix B: Resource Consent CON2009050553
Appendix C: Sediment Monitoring Photos 15 March 2023
Appendix D: Hills Laboratories Result
Appendix E: Sampling locations and collection method: Resource Consent CON2009050553

## 1 INTRODUCTION

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There are two consent driven components to the assessment of stormwater related sediment deposits at Northport.

First, Northport Limited have consent to discharge contaminants to land at prescribed locations within the catchment of its stormwater settlement pond (Consent AUT.005055.35.01-See Appendix A to this report). The contaminants are associated with the disposal of sediment (fine sludge and coarser debris) removed from the port stormwater system authorised by CON20090505532.

Northport Ltd has engaged 4Sight Consulting Ltd (4Sight) to develop a sediment monitoring plan as required by consent condition 7 of AUT.005055.35.01 (Sediment Monitoring Plan\_V1.0 March 2023-hereafter SMP). The SMP details the monitoring approach including the location and number of samples, and sampling methodology. Consent AUT.005055.35.01 identifies a minimum of one sampling site in each stormwater canal arm and one site in the stormwater settlement pond. Condition 6 of AUT.005055.35.01 identifies the parameters to be assessed in the sediment but is silent as to the guideline sediment quality values to be used to assess monitoring results. The SMP has been provided to Northport for submission to the Northland Regional Council for approval as required by Condition 7.

Secondly, Northport hold resource consent CON20090505532 (see Appendix B to this report) to discharge stormwater associated with the operation of the port after treatment within a storage and settlement pond to the Whangarei harbour. Condition 10 of that consent requires monitoring in accordance with Schedule 1 of the consent. Table 1 of Schedule 1 requires inter alia, a one-off sampling of sediment in the western and eastern arms of the stormwater canals for copper, lead, zinc, and polycyclic aromatic hydrocarbons. Table 1/Schedule 1 indicates that ANZECC ISQG values are to be used to assess pollution status. There are no specific requirements in the consent or Schedule 1 to meet ISQG thresholds.

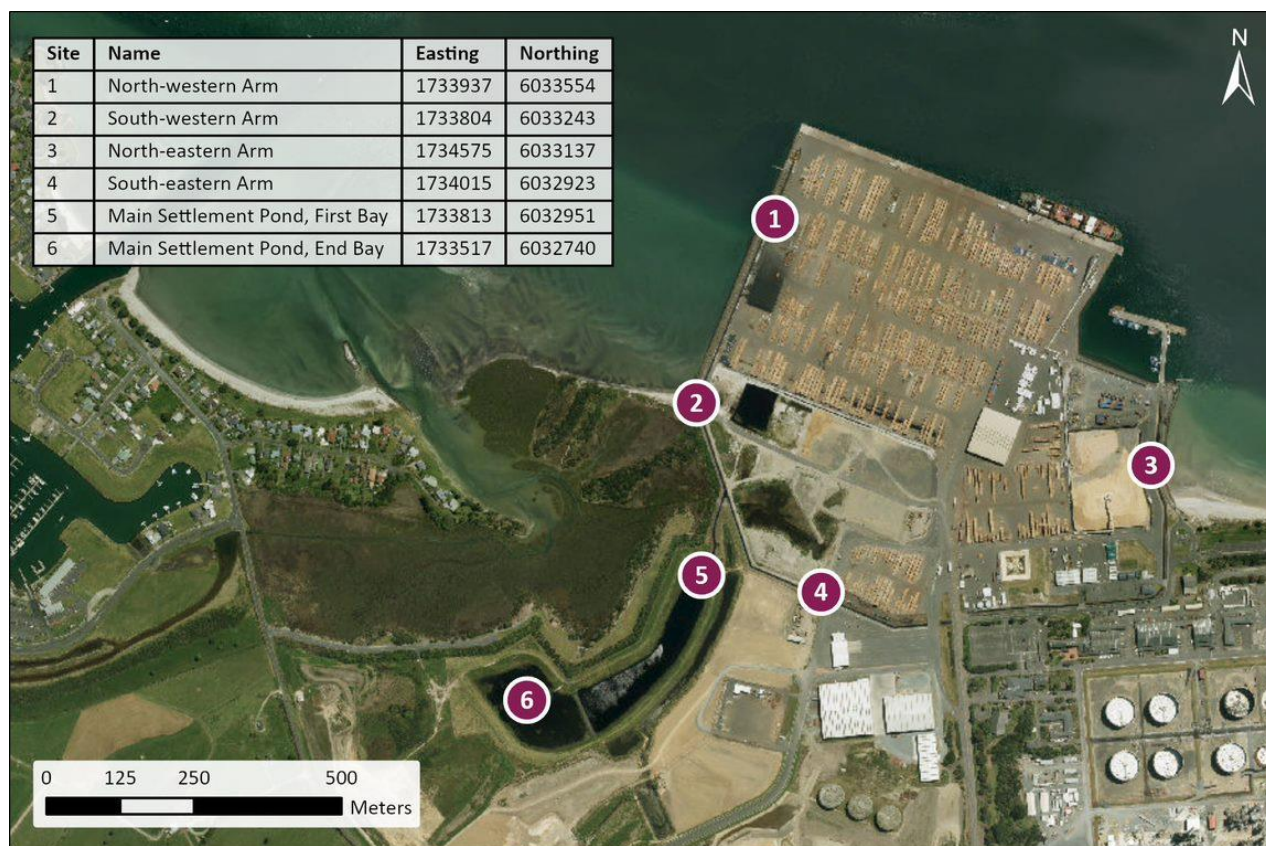
This report details monitoring undertaken as required in the SMP and has been prepared to in effect meet the requirements of both the above consents. The overall purpose is to provide information on sediment quality in the Northport stormwater system and to assist in identifying issues which may affect sediment disposal and management.

## 2 MONITORING

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### 2.1 Consent AUT.005055.35.01

Sediment samples were collected from each site within the stormwater management system shown in Figure 1. Sites 1 to 4 are locations within the stormwater canal network around the margins of the port. Sites 5 and 6 are within the stormwater detention pond which receives the port stormwater prior to discharge. This sampling approach exceeds the minimum number of monitoring locations specified in the consent. Associated photos are included in Appendix C.



**Northport Sediment Sampling Locations**

Client: Northport Ltd  
 Date: 21/03/2023  
 Version: 1.0  
 Author: PW

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**Figure 1: Northport sediment sampling locations.**

The sediment sampling (sample collection methods are detailed in the SMP), was carried out on 15 March 2023, prior to a scheduled removal of sediment from the stormwater collection canals as part of routine maintenance.

### 2.1.1 Results

The consent conditions are explicit as to the parameters to be assessed but provide no sediment quality guideline values. As is normal practice, and as suggested in Schedule 1/Table 1 of CON200090505532, results are interpreted in reference to ANZG (2018)<sup>1</sup> default guideline values (DGVs)<sup>2</sup> and 'upper' guideline values (GV-high)<sup>3</sup> (which updates ANZECC 2000 ISQG values). Sediment monitoring results are shown in Table 1 and Hills Laboratory results are attached in Appendix D.

**Table 1: Sediment monitoring results from six locations within the canal arms and main settlement pond compared to ANZG (2018) toxicant Guideline Values. Results exceeding DGV and GV-High are shaded light and dark green respectively.**

Toxicant	Type of toxicant	1 North-western Arm	2 South-western Arm	3 North-eastern Arm	4 South-eastern Arm	5 Main settlement pond, first bay	6 Main settlement pond, end bay	DGV	GV-high
Total Arsenic	Metalloids (mg/kg dry weight)	1.5	2.6	1.9	1.6	4.2	8.1	20	70
Total Cadmium	Metals (mg/kg dry weight)	0.105	0.164	0.012	0.101	0.181	0.2	1.5	10
Total Chromium	Metals (mg/kg dry weight)	7.2	12.9	6.8	8.9	17.6	25	80	370
Total Copper	Metals (mg/kg dry weight)	10.9	24	0.8	15	26	22	65	270
Total Lead	Metals (mg/kg dry weight)	3	7.6	3.3	4.1	9.4	10.2	50	220
Total Nickel	Metals (mg/kg dry weight)	3.9	8.7	1.6	4.6	40	24	21	52
Total Zinc	Metals (mg/kg dry weight)	86	124	12.4	151	280	159	200	410
Total Petroleum Hydrocarbons (TPHs) (C7-C36)	Organics (mg/kg dry weight)	3,800	2,500	< 80	4,000	2,900	< 900	280	550

<sup>1</sup> ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at [www.waterquality.gov.au/anz-guidelines](http://www.waterquality.gov.au/anz-guidelines)

<sup>2</sup> DGVs in sediment indicate the concentrations below which there is a low risk of unacceptable effects occurring, and should be used, with other lines of evidence, to protect aquatic ecosystems.

<sup>3</sup> GV-high provide an indication of concentrations at which you might already expect to observe toxicity-related adverse effects. As such, the GV-high value should only be used as an indicator of potential high-level toxicity problems, not as a guideline value to ensure protection of ecosystems.

### 2.1.2 Results -Summary and Discussion

The ANZG (2018) approach recognises different levels of protection including ‘highly disturbed ecosystems’. Shipping ports are specially identified in the supporting material for ANZG (2018) as an example of a measurably degraded system with lower ecological values. While DGV’s should ensure no further degradation of such disturbed systems, it is acknowledged in the document that approaches for such locations can be more flexible. Also, in this case the site is an engineered stormwater sediment pond and its adjacent small defined catchment rather a location that would require consideration of wider ecosystem values per se. In this context the ANZG provide a conservative reference point from which to consider potential contaminant influences.

The sediment results for the metalloid arsenic, and heavy metals cadmium, chromium, copper, and lead were all below their respective ANZG (2018) DGVs (Table 1). Total nickel was above the ANZG (2018) DGV in the main settlement pond at both locations, but only marginally so at the lower bay site (Site 6). Total zinc was above the ANZG (2018) DGV in the main settlement pond, first bay location. All values were below GV-high. The metalloid/metal results indicate the settlement pond is functioning as expected, with sediments having higher concentrations than the source deposits which reflects accumulation within the pond system. Close to the pond outlet values are below DGV except for Nickel which is marginally higher.

Total Petroleum Hydrocarbons (TPHs) (C7-C36) were above ANZG (2018) GV-high at all canal sampling sites except Site 3 in the north-eastern arm where it was below guideline values.

Hill labs results show the C15-C36 fraction accounts for almost all the TPH in the samples. This fraction is likely due to runoff from the port surface containing lubricating and heavy fuel oils, diesel, and bitumen residuals. These fractions are reported to be relatively viscous, relatively insoluble in groundwater and have low mobility in the subsurface (2011 Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated sites in New Zealand, section 2.2.1.3 and 2.2.1.4 – the Petroleum Hydrocarbon Guidelines)<sup>4</sup>. The results suggest the canals are effective in capturing this material.

TPH results suggest a reduction in TPH in retained sediment in material that migrates to the lower end of the settlement pond system. The analytical detection limit on sample 6 which best represents sediment near the pond outlet was subject to matrix interferences (high water content and low dry matter), and therefore does not allow a conclusion as to whether the DGV or GV-High at this location is met.

By way of further comparison, the results can be considered in relation health effects and effects on soils (rather than sediment). The Petroleum Hydrocarbon Guidelines, cited above, provide soil acceptability thresholds primarily for the protection of human health at a range of depths, for different hydrocarbon fractions, and in a variety of soil types as applicable to different land uses. Tables 4.13 (Residential Use) and 4.14 (Commercial and Industrial Use) of the Petroleum Hydrocarbon Guidelines all suggest that concentrations of TPH is not limiting as the health-based criterion is significantly higher than that likely to be encountered on site (criterion for C<sub>15</sub>-C<sub>36</sub> will need to exceed 20,000 mg/kg). Of more relevance is the data presented in Table 4.20 of the Petroleum Hydrocarbon Guidelines which relates to the protection of groundwater quality. This also shows that concentrations of heavy end TPH (fractions C<sub>15</sub>-C<sub>36</sub>) required to impact groundwater quality are likely to be significantly higher than that encountered on site (<20,000 mg/kg). The sampling results show much lower concentrations than this threshold.

In the case of Northport, the dedication of sediment disposal to the catchment of the stormwater pond effectively contains any risk associated with the handling and disposal of relatively small volumes of canal material contaminated with hydrocarbons and comparatively low concentrations of metalloid/metals.

In dealing with the sediments in this way it needs to be recognised that there may be a legacy issue over time in terms of the uses to which the grassed areas around the stormwater pond used for such disposal may be put and /or the ability of the material to be re-excavated or moved elsewhere at some future point. However, this can be seen within the context of the likely progressive self-remediation of the deposits over time due to natural changes and breakdown of the hydrocarbons in the soil profile due to microbial processes. This process of remediation can be facilitated by spreading the material in thin a layer and encouraging grass and vegetation growth. The quality of this growth might

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<sup>4</sup> Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand. August 1999 Revised October 2011. Ministry for the Environment.



be further encouraged over the drier months by irrigating the pond water over the soil deposit areas to maintain a healthy sward of grass growth and encourage microbial activity.

## 2.2 Consent CON200090505532

### 2.2.1 Sampling Locations and Approach

The sampling undertaken to fulfil requirements of this consent involved a composite sample (based on three sub-samples from different points) within each canal arm as shown in Figure 2. Associated photos are included in Appendix C. Sampling location access and details are presented in Appendix E.

### 2.2.2 Results Summary and Discussion

Results in reference to ANZG (2018) are shown below in Table 2. Hills Laboratory results are attached in Appendix D.

**Table 2: Sediment results for the eastern and western canal arms, compared to ANZG (2018) toxicant DGV and GV-High.**

Toxicant	Type of toxicant	7 Western Arm Composite	8 Eastern Arm Composite	DGV	GV-high
Total Copper	Metals (mg/kg dry weight)	14	26	65	270
Total Lead	Metals (mg/kg dry weight)	4.4	6.3	50	220
Total Zinc	Metals (mg/kg dry weight)	108	260	200	410
Total Organic Carbon (TOC)	g/100g dry weight	34	20		
Total of Reported Polycyclic Aromatic Hydrocarbons (PAHs) in soil	Organics (mg/kg dry weight) normalised to 1% organic carbon*	0.65	0.067	10	50

\* Normalised to 1% OC within the limits of 0.2 to 10%. Thus, if a sediment has 34% OC, the '1% normalised' concentration would be the measured concentration divided by the upper limit of 10.

The sediment heavy metal results for copper and lead were well below their respective ANZG (2018) DGVs (Table 2). Total zinc was above the DGV for the eastern arm, but below GV-high. It is noted that zinc was also elevated in the upper parts of the stormwater detention pond (as discussed above in section 2.1.2).

The high TOC concentration of the samples reflects the highly organic nature of the material captured in predominately log yard runoff. This high TOC partitions metals and organics to sediment particles and suppresses the potential bioavailability of the Total of Reported Polycyclic Aromatic Hydrocarbons (PAHs). Adjusting the PAH concentration to 1% TOC as required in ANZG (2018), results in very low PAH, well below the applicable DGV.



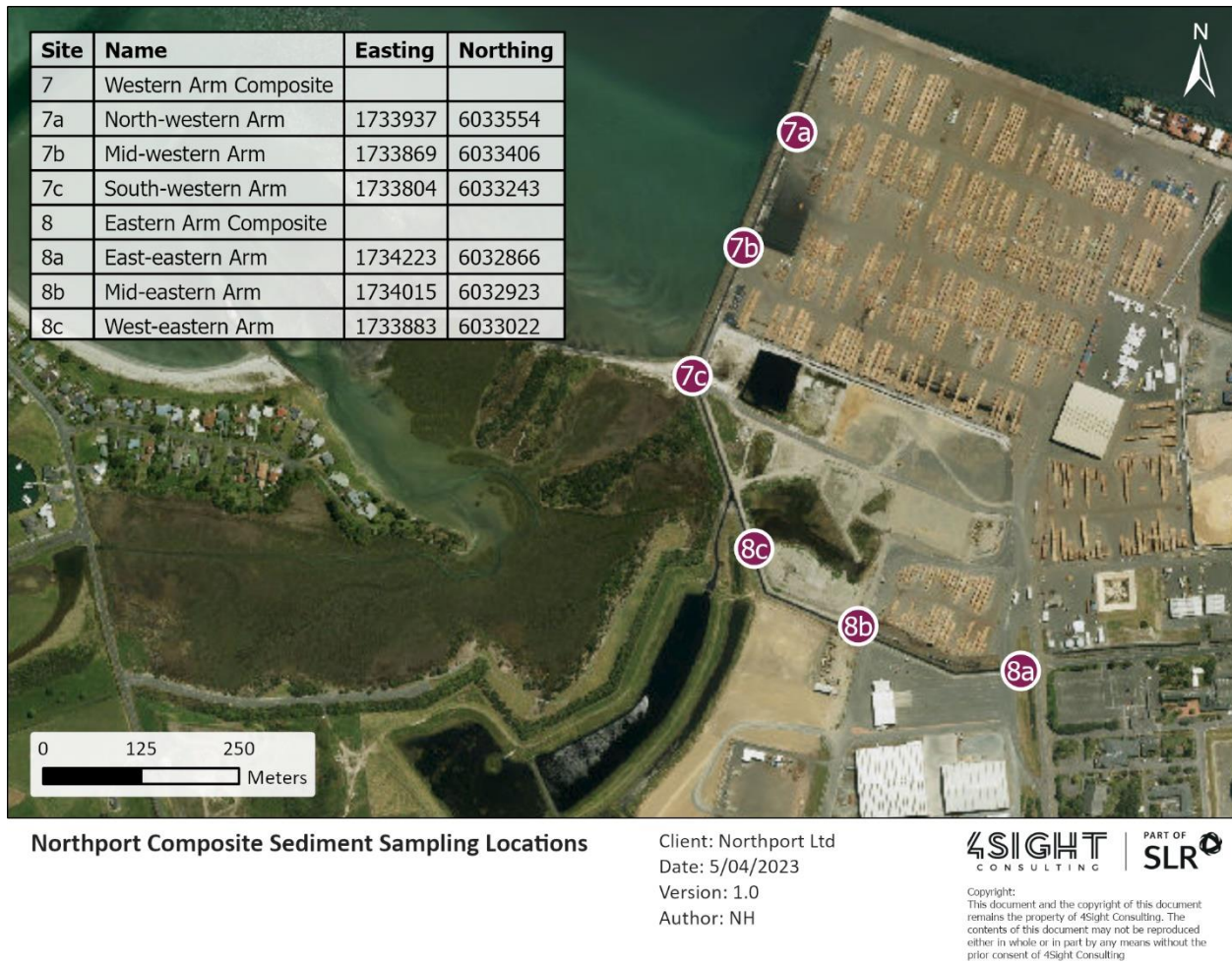


Figure 2: Northport sediment sampling locations for western arm and eastern arm composite samples.

### 3 CONCLUSIONS AND RECOMMENDATIONS

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In conclusion, the sampling of canal sediments and the stormwater pond deposits indicates a low level of contamination by metalloid/heavy metals which mostly meet ANZG 2018 DGV thresholds. In terms of these results the disposal of canal sediments within the catchment of the stormwater pond is highly unlikely to present a risk to the environment.

The TPH results suggest that the canal sediments contain hydrocarbons mostly in the C<sub>15</sub>-C<sub>36</sub> fraction but at concentrations which should not pose a risk in terms of disposal within the stormwater pond catchment in terms of human health exposure or groundwater contamination.

The PAH results suggest low concentrations taking account of the highly organic nature of the source material.

If the ability of the site to receive future volume of such material were to be fully utilised, then more investigation may be required as to the environmental risk of disposal elsewhere (beyond the stormwater detention pond catchment) and for the need or otherwise of remediation strategies.

The following recommendations are made:

1. Going forward, three yearly sediment sampling should then be undertaken in accordance with the SMP. The next sediment sampling should be scheduled for March 2026.
2. Monitoring should be undertaken of TPH concentration in a representative sample of the disposed material annually to document changes in TPH concentration over time. This is to confirm that there are not contaminated land legacy issues arising from the currently consented disposal.
3. Disposed sediment should be actively managed. This should include raking deposited sediment into thin layers, with options of spraying with collected stormwater (or other nutrient rich water) to facilitate microbial processes. This approach is recognised to work on a broad range of petroleum products and is likely to be suitable at the Northport site (Refer Section 7.5.3 of Petroleum Guidelines.)
4. Further investigation should be undertaken to quantify the ongoing potential and capacity of the stormwater detention pond catchment to receive canal sediments and any volume of material which might be periodically excavated from the detention pond to maintain its hydraulic capacity.
5. It may be advantageous to rotationally dispose such material more widely over the pond catchment in thinner deposits than to concentrate such material in the areas identified in consent AUT.005055.35.01. This should be discussed with Northland Regional Council as it may require a variation to the consent, or at least NRC acknowledgment and approval.

**Appendix A:**

**Resource Consent AUT.005055.35.01**



File: 5055  
35  
New

Document date: 22 July 2015

# *Resource Consent*

*Pursuant to the Resource Management Act 1991, the Northland Regional Council (hereinafter called "the Council") does hereby grant a Resource Consent to:*

**NORTHPORT LIMITED, PO BOX 44, RUAKAKA 0151**

To undertake the following activity on Part Lot 2 and Lot 3, DP 315167 (Marsden Point), at or about location co-ordinates 1733521E 6032730N:

**AUT.005055.35.01:** To discharge contaminants to land at various locations from the disposal of sediment removed from the stormwater system authorised by **CON20090505532**.

*Note: All location co-ordinates in this document refer to Geodetic Datum 2000, New Zealand Transverse Mercator Projection.*

Subject to the following conditions:

- 1 For the purposes of this consent, 'sediment' includes fine sludge and coarser debris removed from within the stormwater system.
- 2 All sediment removed from the stormwater system shall be deposited within the Sediment Disposal Area's shown on the **attached** Northport plan entitled 'Northport Indicative Canal Sediment Disposal Sites Site Plan', Sheet 1, Date: June 2015, unless otherwise approved in writing by the Council's monitoring officer.
- 3 At each time of exercise of this consent, the Consent Holder shall notify the Council's assigned monitoring officer in writing of the date that sediment disposal to land is intended to commence, at least one week beforehand.
- 4 The Consent Holder shall keep a record of the volume of sediment removed in cubic metres and the site(s) where the sediment has been disposed of. A copy of this record for each time this consent is exercised shall be forwarded to the Council's assigned monitoring officer within two weeks of the sediment removal work being completed. In addition, a copy of this record shall be forwarded immediately to the Council's assigned monitoring officer on written request. The records shall be in an electronic format that has been agreed to by the Council's monitoring officer.

**Advice Note:** *The keeping of records is also required under Condition 8 of CON20090505532.*

- 5 On completion of each exercise of this consent, all areas of newly deposited sediment shall be, as soon as is practicable, covered with not less than 50 millimetres of topsoil and sown with a suitable grass mixture. At least 80% vegetation groundcover shall be established within three months of the completion of the sediment removal work.
- 6 The Consent Holder shall sample and test the stormwater system sediment for the following determinands prior to 30 November 2018, and then at least once every three years thereafter:
  - (a) Total Arsenic
  - (b) Total Cadmium
  - (c) Total Chromium
  - (d) Total Copper
  - (e) Total Lead
  - (f) Total Nickel
  - (g) Total Zinc
  - (h) Total Petroleum Hydrocarbons.
- 7 Prior to undertaking the three-yearly sediment sampling for the first time, the Consent Holder shall submit a Monitoring Plan showing the proposed number and location of sediment sampling sites, and the proposed sediment sampling methodology, to the Council's monitoring officer for approval. Sampling sites shall include at least one site in each of the stormwater canals and the main settlement pond. The three yearly sediment sampling shall then be undertaken in accordance with the approved Monitoring Plan.
- 8 The Consent Holder shall report the results of the three-yearly sediment sampling to Council's assigned monitoring officer within one month of the receipt of the test results from the analytical laboratory.
- 9 The Council may, in accordance with Section 128 of the Resource Management Act 1991, serve notice on the Consent Holder of its intention to review the conditions annually during the month of March for any one or more of the following purposes:
  - (a) To deal with any adverse effects on the environment that may arise from the exercise of the consent and which it is appropriate to deal with at a later stage; or
  - (b) To require the adoption of the best practicable option to remove or reduce any adverse effect on the environment; or
  - (c) To deal with any significant changes in sediment quality.

The Consent Holder shall meet all reasonable costs of any such review.



10 This consent shall not lapse until its expiry.

**EXPIRY DATE: 2 DECEMBER 2034**

**This consent is granted this Twenty-second day of July 2015 under delegated authority from the Council by:**



**S J Savill  
Consents Programme Manager –  
Water and Wastes**



ISSUE	DATE	DETAILS	APPROVED	BY	



#### NOTES

1. AVERAGE SEDIMENT CREATION FROM EXISTING STORMWATER COLLECTION SYSTEM = 95m<sup>3</sup>
2. VOLUME OF EXISTING MATERIAL STOCKPILED INSIDE PORT = 1,050m<sup>3</sup>

**Northport**

P.O. BOX 848  
WHANGAREI, NEW ZEALAND  
TEL 09 432 5010, FAX 09 432 8749  
EMAIL [don.sweeney@northport.co.nz](mailto:don.sweeney@northport.co.nz)

NORTHPORT  
INDICATIVE CANAL SEDIMENT DISPOSAL SITES  
SITE PLAN

D SWENY

D SWENY

1:1000(A1)  
1:2000(A2)

JUNE 2015

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1



**Appendix B:**

**Resource Consent CON2009050553**

**NORTHPORT LIMITED, C/O DLA PHILLIPS FOX, PO BOX 160, SHORTLAND STREET, AUCKLAND 1140**

To discharge stormwater associated with the operation of a port after treatment within a storage and settlement pond system to the Whangarei Harbour via an existing outlet structure at location co-ordinates 1733997E 6033711N, on Crown Land comprising foreshore and seabed

*Note: All location co-ordinates in this document refer to Geodetic Datum 2000, New Zealand Transverse Mercator Projection.*

Subject to the following conditions:

1. The stormwater discharge outlet structure at the Marsden Point port terminal berthface shall be in general accordance with the attached drawings entitled "Marsden Point Port Development Stage 1 Stormwater Outfall" prepared by Civil Structural, drawing number 9101101 SO 33<sup>A</sup>, and entitled "Northport Development Layout at Western End of Wharf" prepared by Northport, drawing number D60-30-06-01-015 dated June 2002 (**attached**).

**Advice Note:** *The drawings attached to this consent are reduced copies and therefore may not be to scale and may be difficult to read. In the event that compliance and/or enforcement action is to be based on compliance with the attached drawings, it is important that the original drawings are sighted and used. The Council holds an electronic copy of these drawings and can be viewed at the Council's Whangarei Office.*

2. The Consent Holder shall make an underwater examination of the diffuser and pipelines at least once every two years, and take such measures as are necessary to ensure that the diffuser operates as designed and that all the stormwater discharges, except for the emergency overflow, pass through the diffuser.
3. A report on all such examinations and action taken to remedy defects, as required under Condition 2, shall be forwarded to Council Monitoring Manager within one month of the examination being completed.

4. Notwithstanding any other condition, the exercise of this consent shall not result in any of the following effects on coastal water quality at or beyond the mixing zone, as shown on Northland Regional Council Plan No: 3259A:
- (a) The temperature shall not be changed by more than 3°C;
  - (b) The pH shall not be changed by more than 0.2;
  - (c) The concentration of dissolved oxygen shall not be reduced below 80% saturation;
  - (d) The visual clarity shall not be reduced by more than 20% of the median background visual clarity at the time of measurement, as measured by black disk or an authorised alternative method;
  - (e) The hue shall not be changed by more than 10 Munsell units of the median background hue at the time of measurement;
  - (f) There shall be no conspicuous oil or grease films, scums or foams, or floatable or suspended materials, or emissions of objectionable odour;
  - (g) There shall be no destruction of natural aquatic life by reason of a concentration of toxic substances; and
  - (h) The concentrations for the following determinands shall not be exceeded;

Determinands	Concentration in milligrams per cubic metre
Total copper	1.3
Total lead	4.4
Total zinc	15

5. The quality of stormwater discharged from the storage and settlement pond system by the pumps shall meet the following:
- (a) A pH within the range of 6.5 to 9.0;
  - (b) A total suspended solids median concentration not greater than 50 grams per cubic metre and a 95 percentile concentration not greater than 100 grams per cubic metre.
6. The stormwater storage and settlement pond system shall, as far as is practicable, be maintained free of floatable solids, oil and grease, and foams, and shall not emit objectionable odours.
7. To minimise the potential for the contamination of stormwater by natural wood chemicals, the Consent Holder shall, as far as is practicable, maintain log storage areas, internal drains and any debris traps, so that they are free of wood material that is being stored on-site.
8. Sediment collected from the maintenance of the stormwater system, including internal drains and any debris traps, shall be disposed off at a site that is authorised to accept such wastes. The Consent Holder shall forward to the Council Monitoring Manager within two weeks of the disposal of any such material, details of the quantity of material disposed off and the location of where the material has been disposed off.

9. The Consent Holder shall surrender resource consent CON20060505510 before 1 May 2010.
10. The Consent Holder shall notify the Council Monitoring Manager as soon as practicable once the stormwater storage and settlement pond system reaches its design discharge level and shall then commence stormwater monitoring in accordance Schedule 1 (**attached**). The Consent Holder may make changes to Schedule 1 with the written approval of the Council Monitoring Manager.
11. The Consent Holder shall notify the Council Monitoring Manager in writing of any proposed change(s) to the materials handled through the Port Terminal as detailed in the application, at least one week prior to the proposed change(s) occurring.

**Advice Note:** *The current Port Terminal activities as described in the application are for forestry products, containers, and fertiliser & coal products. The Council will need to consider any proposed change(s) to the new materials(s) handled and determine whether the conditions of consent require reviewing as a result of the proposed change(s) due to a change in the nature or quantity of contaminants discharged.*
12. Where from any cause a contaminant (including fuel) associated with the Consent Holder's operations escapes otherwise than in conformity with this consent, the Consent Holder shall:
  - (a) Immediately take such action or execute such work as may be necessary to stop and/or contain such escape; and
  - (b) Immediately notify the Council by telephone of an escape of contaminant; and:
  - (c) Take all reasonable steps to remedy or mitigate any adverse effects on the environment resulting from the escape; and
  - (d) Report the escape to the Council within one week of its occurrence and the steps taken or being taken to clean up, remedy any adverse effects and prevent any recurrence of such escape.
13. The Council may in accordance with Section 128 of the Resource Management Act 1991, serve notice on the Consent Holder of its intention to review the conditions of these consents. Such notice may be served annually during the month of March. The review may be initiated for any one or more of the following purposes:
  - (a) To deal with any adverse effects on the environment that may arise from the exercise of the consents and which it is appropriate to deal with at a later stage, or to deal with any such effects following assessment of the results of the monitoring of the consents and/or as a result of the Council's monitoring of the state of the environment in the area;
  - (b) To require the adoption of the Best Practicable Option to remove or reduce any adverse effect on the environment;
  - (c) To provide for compliance with rules in any regional plan that has been made operative since the commencement of the consents;
  - (d) To deal with any change(s) to the materials handled through the Port Terminal. (Notice may be served at any time for this reason.); and

- (e) To deal with any material inaccuracies that may be found in the information made available with the application. (Notice may be served at any time for this reason.)

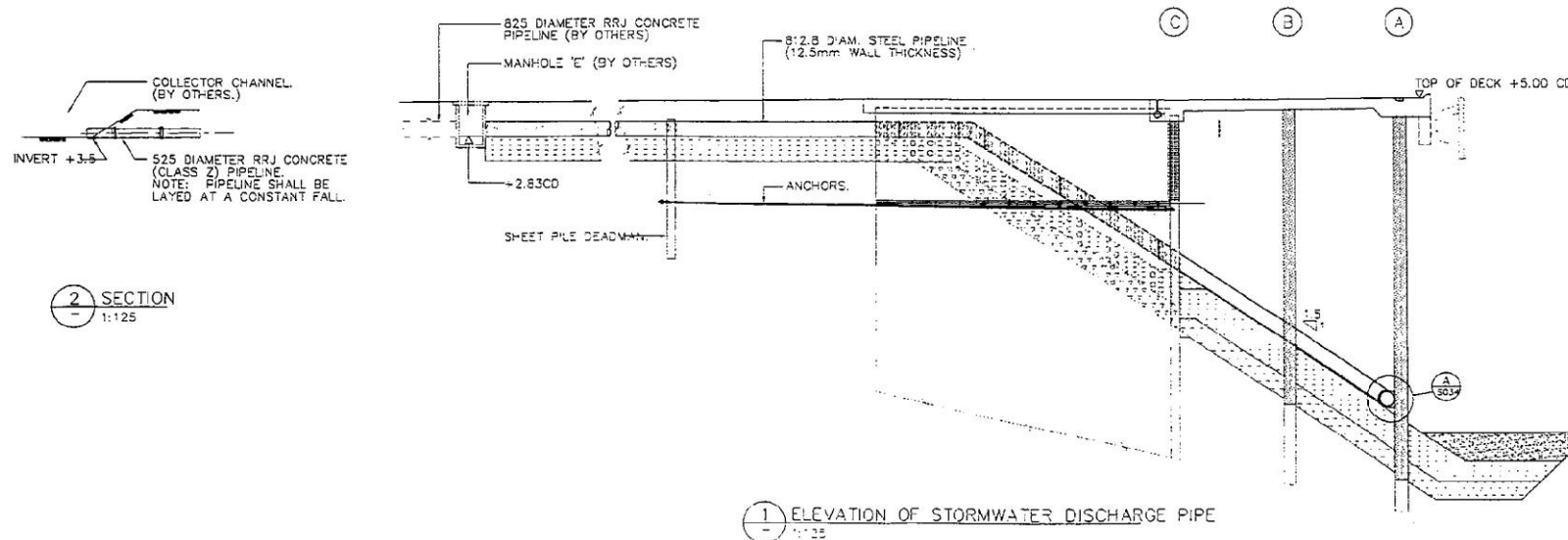
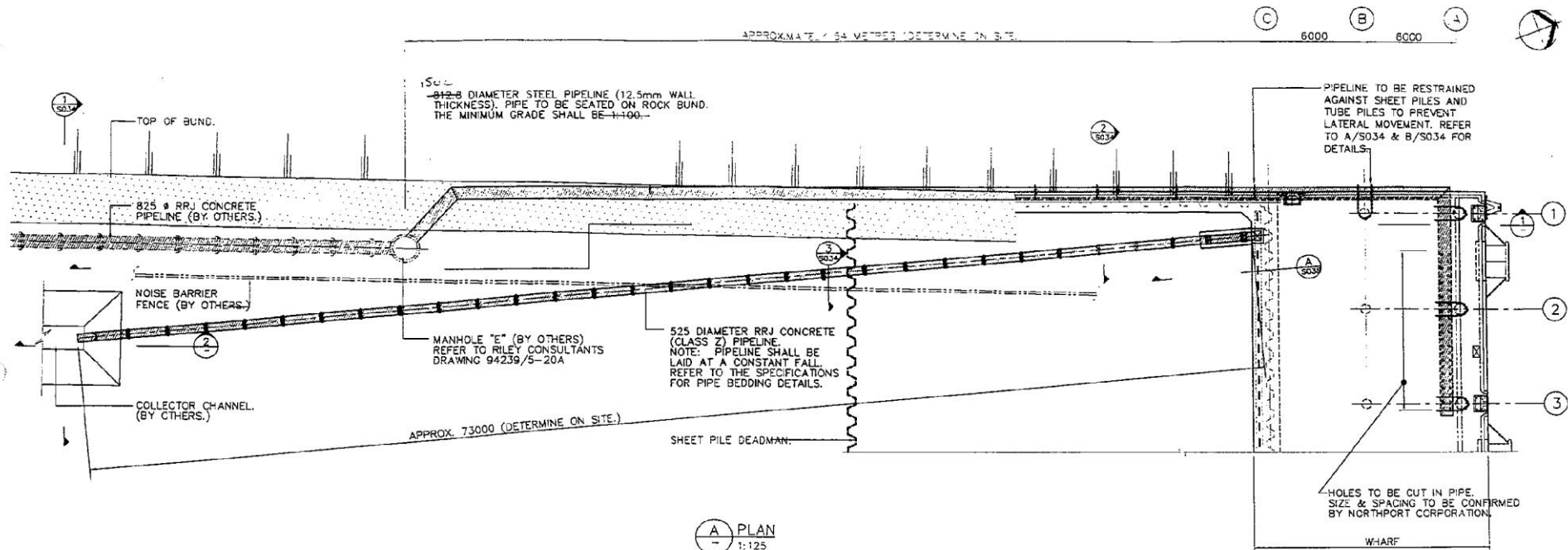
The Consent Holder shall meet all reasonable costs of any such review.

<b>EXPIRY DATE: 2 DECEMBER 2034</b>
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**This consent is granted this Thirteenth Day of April 2010 under delegated authority from the Council by:**

**Allan Richards**  
**Acting Senior Consents Programme Manager**

---



A ISSUED FOR REVIEW

S.J.L.  
A.H.R.

1:125

1:250

MARSDEN POINT  
PORT DEVELOPMENT  
STAGE 1

STORMWATER OUTFALL

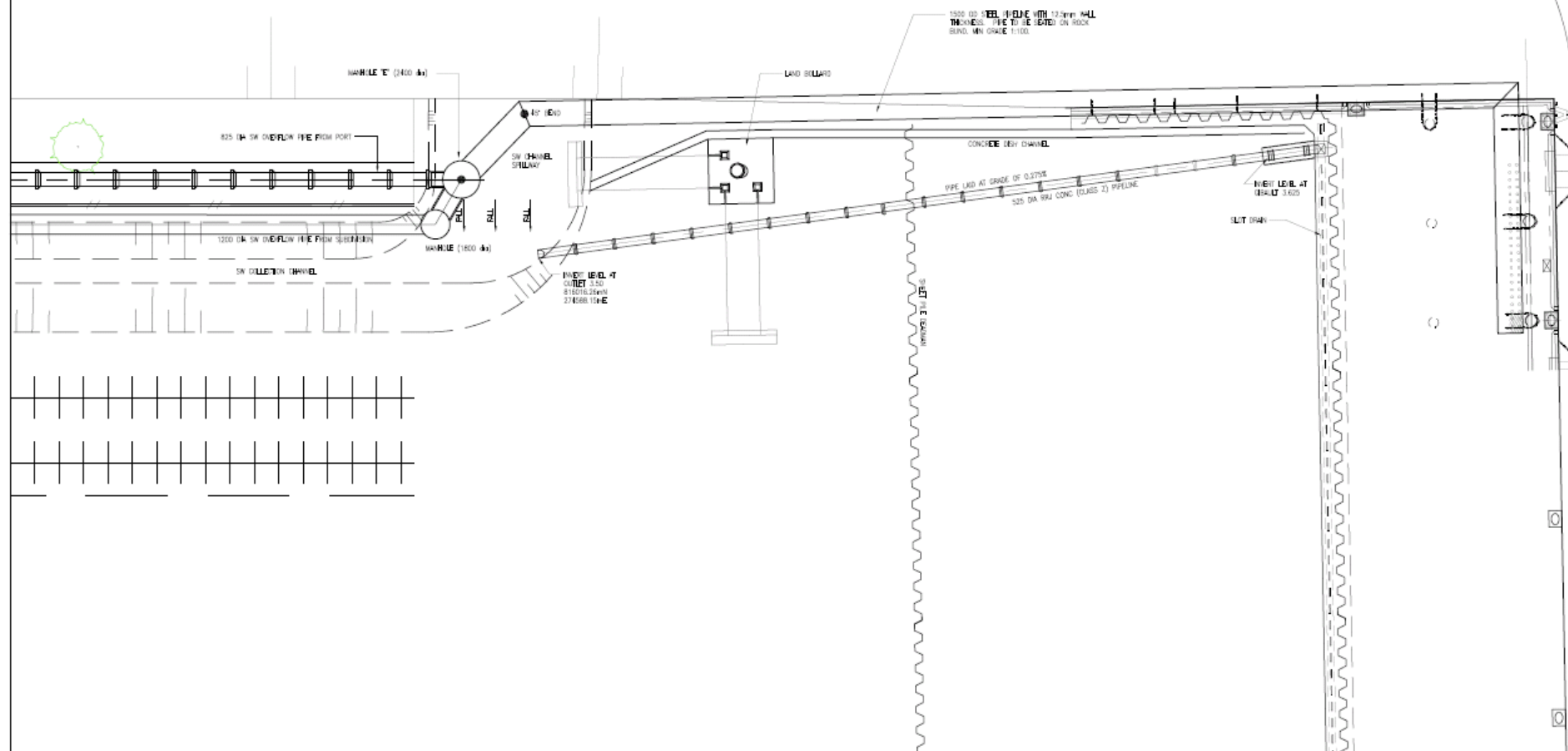
CIVIL STRUCTURAL  
9101101 S033 A

FOR REVIEW




# SCHEDULE OF COORDINATES

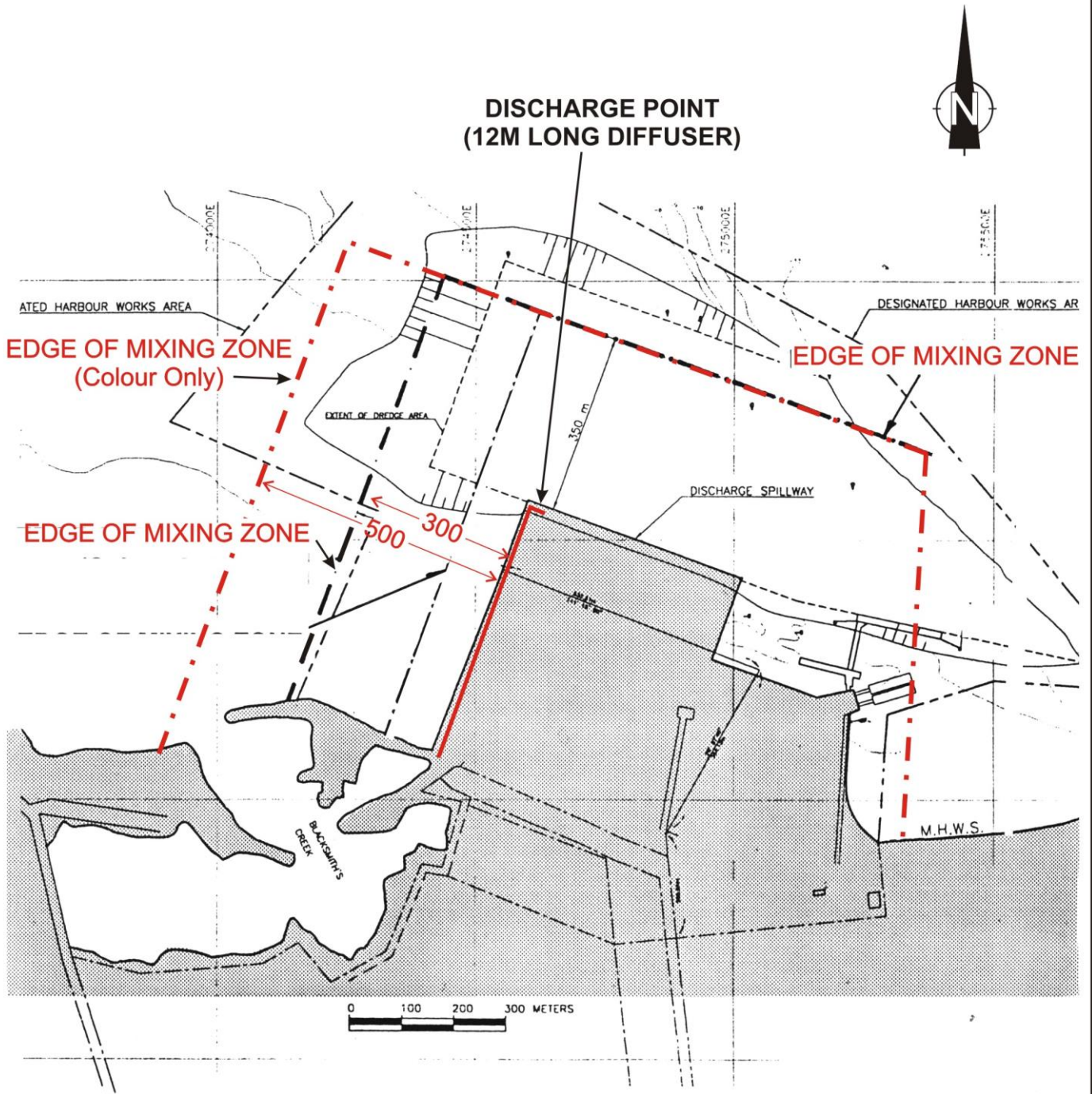
45° BEND 816018.57mN 274579.81mE  
CENTRE OF MANHOLE E 816013.51mN 274582.18mE



A	29.9.09	AMEND PIPE DIFFER DIA		GJB
0	12.9.02	ISSUED FOR CONSTRUCTION		DWP
ISSUE	DATE	DETAILS	APPROV	BY

 <p>P.O. BOX 848 WHANGAREI, NEW ZEALAND TEL 09 432 8740, FAX 09 432 8749 EMAIL <a href="mailto:tracy@northport.co.nz">tracy@northport.co.nz</a></p>					<p>NORTHPORT DEVELOPMENT LAYOUT AT WESTERN END OF WHARF</p>				
Drawn by		Project No		Rev		Date		Sheet	
B. PRESTON		D60-30-06-01-015		A		1:125(A1) 1:250(A3)		JUNE 2002	
								1	





**Location Co-ordinates:**  
 Datum: NZTM  
 Easting: 1733997  
 Northing: 6033711

**NORTHLAND  
REGIONAL  
COUNCIL**

**RESOURCE CONSENT CON20090505532**  
 for  
**Northport Ltd**  
**Stormwater Mixing Zone**

Scale: N.T.S.

Drawn: CNA 02/10

App'd:

Plan No.

**3259A**

## SCHEDULE 1

### MONITORING PROGRAMME – RESOURCE CONSENT CON20090505532

The Consent Holder shall undertake the monitoring as follows:

#### 1 WATER QUALITY OF DISCHARGES FROM THE STORMWATER SETTLEMENT AND STORAGE POND SYSTEM

##### 1.1 Routine Water Monitoring for Discharges from the stormwater settlement and storage pond to Whangarei Harbour

The stormwater system and discharges shall be monitored in accordance with Table 1 attached below

If any of the following determinands in the stormwater being discharged to the coastal marine area exceed the Action Values specified in Table A, the Consent Holder will notify the NRC within two weeks of receiving the sample result and investigate the source of the contaminant and advise the NRC as to the findings of the investigation and any management response.

**Table A**

Determinands	Action values: Concentration in milligrams per cubic metre
Total Aluminium	5
Total copper	13
Total lead	44
Total zinc	150
PAHs	
– Acenaphthene	58
– Anthracene	0.1
– Benzo(α)anthracene	0.18
– Benzo(α)pyrene	0.1
– Fluoranthene	10
– Fluorene	30
– Napthalene	500
– Phenanthrene	6
– Pyrene	0.25

*Note: ANZECC for PAH, 99% protection level as recommended in Section 8.3.7.7 and also CEQG (Canadian aquatic guidelines). For aluminium, ANZECC 8.3.7 Marine guidelines recommend 0.5 mg/m as an indicative low reliability figure.*

Values in Table A are intended to act as an early warning to identify if concentrations are increasing relative to previously documented monitoring values/trends and warrant investigation notwithstanding that they may be well below levels of environmental concern taking into account mixing and dilution.

**TABLE 1: SCHEMATIC MONITORING DIAGRAM –**

Location	Sampling Frequency	Parameters	Criteria	Notes
<b>Point of discharge from treatment pond system</b>	First discharge per season, and two other discharge events each year			Advice NRC when ponds reach design discharge level for the first time each year prior to discharge occurring
	Three samples spaced evenly over each day (operational hours) until discharge has ceased. First sample to be taken as close as possible to when discharge first occurs.	TSS, VSS, NTU and pH	TSS as in Condition 5(b)	T and DO are considered not useful in this situation as they will reflect conditions intrinsic to the wetland and in any event cannot have any influence on water quality in this particular marine receiving environment.
	Taken with first sample from first discharge event only.	Al, Cu, Pb, Zn, PAH, and resin acids. Total N and Total P to be included if fertiliser products have been stored on site in the previous season.	<b>Action values</b> see table A in 1.1 above. Resin acids, Total N and P concentrations will be assessed against available literature and previous concentrations to determine potential for adverse effects. All parameters to be assessed for any increasing trends over time.	If the resin acid results for the first discharge of the season are below any applicable ANZECC effect threshold after theoretical mixing, resin acids need not be further analysed in that season.
	One-off under existing regime	WETT (Toxicity Testing)	As specified in point 1.3 below	One further WETT will be undertaken under the present port conditions. The need for any further WETT will be considered only if new port operations introduce new contaminant(s) into the stormwater.
<b>Pond Influent</b>	To be done with "First discharge per season" referred to above	T, pH, DO, TSS, Cu, Pb, Zn, resin acids, phenols, PAH, VSS	Trend data only, no compliance limits.	Test to be used as an indication of pond effectiveness under different conditions eg size of storm, contributing area

<b>Stormwater Canals, western/eastern arms</b>	One off	<p><u>Sediment samples:</u></p> <p>Cu, Pb, Zn, PAH</p> <p><u>Water</u>: Winter months (when ponding in canals following rainfall)</p> <p>pH, Cu, Pb, Zn, resin acids, phenols, PAH</p>	<p>Trend data only but reference to ANZECC ISQG values to assess pollution status.</p> <p>Trend data only. No compliance limits</p>	<p>Samples to be taken at: Join of arms, 100m upstream on eastern arm, 100m upstream on western arm</p> <p>Test to be used to determine any disposal issues for sediment</p> <p>Both sediment and water samples to be representative based on 3 sub-samples from different points of each arm composited for analytical purposes</p>
<b>Groundwater</b>				<p>All results from the water quality and sediment quality monitoring will be reviewed after 5 years of exercise of this consent for the purpose of determining if groundwater quality is at risk.</p>

### **Abbreviations**

ANZECC	The Australian and New Zealand Environment and Conservation Council
T	Temperature
DO	Dissolved oxygen (both g/m <sup>3</sup> and % saturation)
TSS	Total Suspended Solids
Total N	Total Nitrogen
Total P	Total Phosphorus
FC	Faecal Coliforms
Cu	Copper
Pb	Lead
Zn	Zinc
PAH	Polycyclic aromatic hydrocarbon
WETT	Whole Effluent Toxicity Test
VSS	Volatile Suspended Solids
NTU	Nephelometric Turbidity Unit

## **1.2 Pumping Hours**

The Consent Holder shall measure the pumping hours, the date, the time, and the quantity of water when the discharge to Whangarei Harbour occurs.

**Advice Note:** *The application states that the approximately average volume of stormwater to be discharged is assessed at 200,000 cubic metres per annum. The size of the discharge pipe and the proposed capacity of the pumps limit the pumped discharge rate to approximately 2,520 cubic metres per hour.*

## **1.3 Wett Method**

The WETT method for toxicity analyses shall be undertaken on not less than three representative marine species, including at least one algae, one invertebrate, and one fish. The choice of toxicity test species, dilutions, test endpoints to be measured, and "toxicity effect" shall be submitted to the Council for approval at least twenty working days prior to stormwater sampling. For each of the three [3] toxicity tests the EC<sub>25</sub> (the concentration of stormwater estimated to produce a toxic effect in 25% of the test organisms) shall be greater than the equivalent of a 200-fold dilution of the stormwater. The dilution water used for toxicity tests shall be an uncontaminated sample of Whangarei Harbour water, collected on an incoming tide at the harbour entrance, at a point agreed to by the Council. There shall be no significant toxicity after a 200-fold dilution of the stormwater. For the purposes of this condition "significant toxicity" is defined as no more than a 25% toxic effect measured in the most sensitive test species used. Testing of the samples shall be carried out in accordance with the methodology outlined in the NIWA document entitled "Standard Methods for Whole Effluent Toxicity Testing: Development and Application" dated November 1998.

- 1.4** The pH and TSS results taken in accordance with Table 1 will be recorded in an ongoing spreadsheet a copy of which shall be forwarded to the Council Monitoring Manager as required by Condition 2 below. Any results recorded which do not achieve the criteria included in Condition 5 shall be reported to the Council Monitoring Manager together with an explanation within seven days of their receipt by Northport.

## **2 REPORTING**

- 2.1** The Consent Holder shall forward to the Council Monitoring Manager by 31 August each year an annual report for the previous period 1 July to 30 June detailing the results of the monitoring required by Section 1 of this monitoring programme and an assessment of compliance with the conditions of consent.

## **3 REVIEW**

The Regional Council, in conjunction with the Consent Holder, may undertake a review of the monitoring programme every two years. The review will take into account the Consent Holders monitoring results, any monitoring undertaken by the Regional Council and the level of development within the catchment areas. The Consent Holder shall meet the reasonable costs of any such review.

## **4 FIELD MEASUREMENTS, RECORDS, SAMPLE COLLECTION, SAMPLE TRANSPORT, DETECTION LIMITS, AND LABORATORY REQUIREMENTS**

### **4.1 Records**

A record of rainfall conditions preceding and during sampling shall be kept. This record shall be based on a nearby rainfall recording site agreed by the Council.

### **4.2 Sample Collection**

All samples collected as part of this monitoring programme shall be collected using standard methods and approved containers.

### **4.3 Sample Transport**

All samples collected as part of this monitoring programme shall be transported in accordance with standard procedures and under chain of custody to the laboratory.

### **4.4 Detection Limits**

The detection limits for the analysis of metals in sediment and water samples collected shall be equivalent to, or better than, those specified below:

Metal	Sediment samples (milligrams per kilogram)	Water samples (milligrams per cubic metre)
total copper	2	1.0
total lead	0.4	0.2
total zinc	4	2.0
total arsenic	2	N/A
total cadmium	0.1	N/A
total chromium	2	N/A

### **4.5 Laboratory Requirements**

All samples collected as part of this monitoring programme shall be analysed at a laboratory with registered quality assurance procedures (see definition below), and all analyses shall be conducted using standard methods.

Registered quality assurance procedures are procedures that ensure that the laboratory meets good management practices and would include registrations such as ISO 9000, ISO Guide 25, and Ministry of Health Accreditation.

**Appendix C:**

**Sediment Monitoring Photos 15 March 2023**



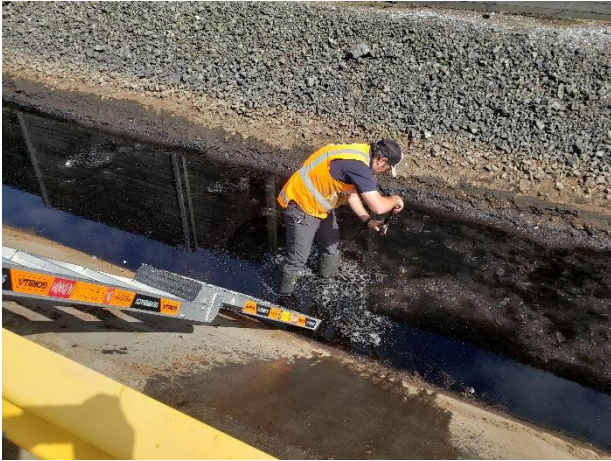


Photo 1: Site 1 – North-western arm. Also, site 7a.

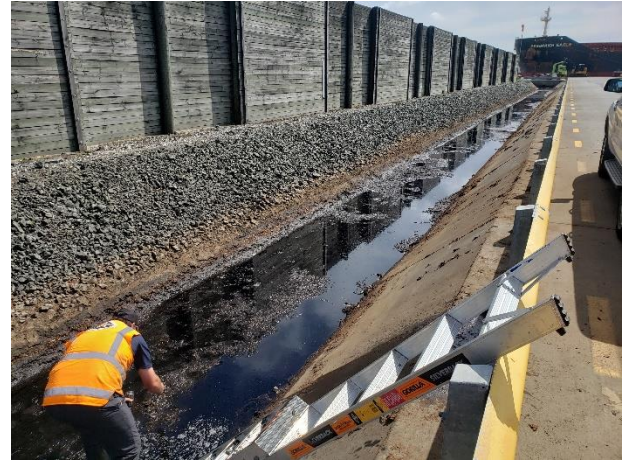


Photo 2: Site 1 – North-western arm, 100m south of beginning of canal. Also, site 7a.



Photo 3: Site 2 – South-western arm. Also, site 7c.



Photo 4: Site 2 – South-western arm, at bend near manhole. Also, site 7c.



Photo 5: Site 3 – North-eastern arm, 100m south of beginning of canal.



Photo 6: Site 3 – North-eastern arm, sediment sample.



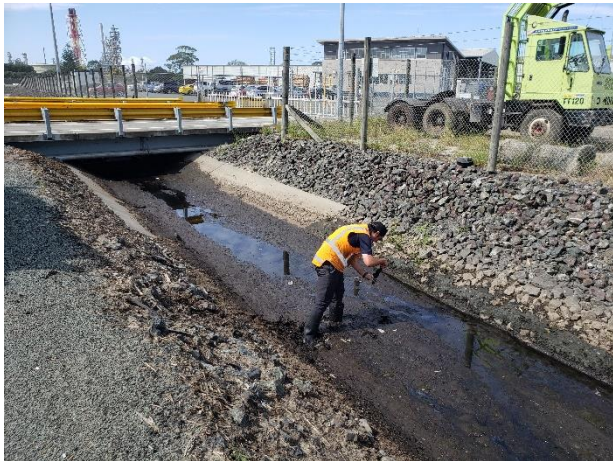


Photo 7: Site 4 – South-eastern arm, west of bridge.  
Also, site 8b (mid-eastern arm).



Photo 8: Site 5 – Main settlement pond, middle of first bay.



Photo 9: Ponar dredge used to collect sediment samples at Site 5 and 6 in the main settlement pond.



Photo 10: Site 5 – Main settlement pond, middle of first bay, sediment sample.



Photo 11: Site 6 – Main settlement pond, middle of end bay, near discharge point.



Photo 12: Site 6 – Main settlement pond, middle of end bay, near discharge point, sediment sample.



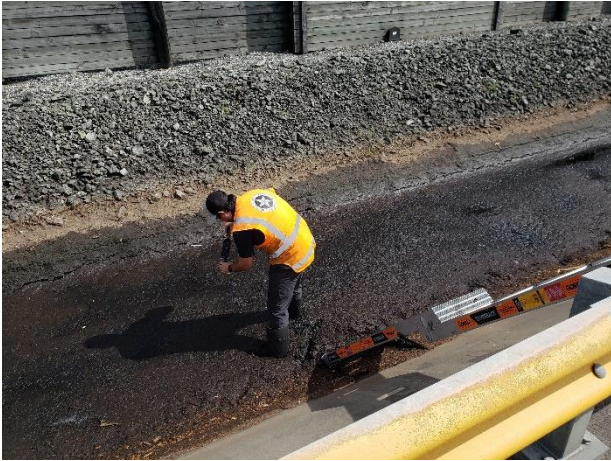


Photo 13: Site 7b, mid-western arm.



Photo 14: Site 8a, east-eastern arm, and sediment sample.



Photo 15: Site 8a, east-eastern arm, and sediment sample.



Photo 16: Site 8a, east-eastern arm.



Photo 17: Site 8a, east-eastern arm. Located corner of Port Marsden Highway and Ralph Trimmer Drive.



Photo 18: Site 8c, west-eastern arm.

**Appendix D:**

**Hills Laboratories Result**





## Certificate of Analysis

Page 1 of 4

<b>Client:</b>	4SIGHT Consulting Limited	<b>Lab No:</b>	3207956	SPv2
<b>Contact:</b>	Pamela Kane-Sanderson	<b>Date Received:</b>	20-Mar-2023	
	C/- 4SIGHT Consulting Limited	<b>Date Reported:</b>	17-Apr-2023	(Amended)
	PO Box 402053	<b>Quote No:</b>	122302	
	Tutukaka 0153	<b>Order No:</b>		
		<b>Client Reference:</b>	14204	
		<b>Submitted By:</b>	Pamela Kane-Sanderson	

### Sample Type: Sediment

Sample Name:	North Western Arm 15-Mar-2023 11:40 am	South Western Arm 15-Mar-2023 11:25 am	North Eastern Arm 15-Mar-2023 12:15 pm	South Eastern Arm 15-Mar-2023 11:55 am	Main Settlement Pond, First Bay 15-Mar-2023 11:00 am
Lab Number:	3207956.1	3207956.2	3207956.3	3207956.4	3207956.5
Individual Tests					
Dry Matter g/100g as rcvd	29	35	77	25	23
Heavy metal, trace level As,Cd,Cr,Cu,Ni,Pb,Zn					
Total Recoverable Arsenic mg/kg dry wt	1.5	2.6	1.9	1.6	4.2
Total Recoverable Cadmium mg/kg dry wt	0.105	0.164	0.012	0.101	0.181
Total Recoverable Chromium mg/kg dry wt	7.2	12.9	6.8	8.9	17.6
Total Recoverable Copper mg/kg dry wt	10.9	24	0.8	15.0	26
Total Recoverable Lead mg/kg dry wt	3.0	7.6	3.3	4.1	9.4
Total Recoverable Nickel mg/kg dry wt	3.9	8.7	1.6	4.6	40
Total Recoverable Zinc mg/kg dry wt	86	124	12.4	151	280
Total Petroleum Hydrocarbons in Solids					
C7 - C9 mg/kg dry wt	< 100	< 80	< 20	< 110	< 120
C10 - C14 mg/kg dry wt	185	182	< 20	168	138
C15 - C36 mg/kg dry wt	3,600	2,300	41	3,800	2,700
Total hydrocarbons (C7 - C36) mg/kg dry wt	3,800	2,500	< 80	4,000	2,900

Sample Name:	Main Settlement Pond, End Bay 15-Mar-2023 11:10 am	Western Composite 15-Mar-2023 11:25 am	Eastern Composite 15-Mar-2023 11:50 am
Lab Number:	3207956.6	3207956.7	3207956.8
Individual Tests			
Dry Matter g/100g as rcvd	10.5	23	41
Total Recoverable Copper mg/kg dry wt	-	14.0	26
Total Recoverable Lead mg/kg dry wt	-	4.4	6.3
Total Recoverable Zinc mg/kg dry wt	-	108	260
Total Organic Carbon* g/100g dry wt	-	34	20
Heavy metal, trace level As,Cd,Cr,Cu,Ni,Pb,Zn			
Total Recoverable Arsenic mg/kg dry wt	8.1	-	-
Total Recoverable Cadmium mg/kg dry wt	0.20	-	-
Total Recoverable Chromium mg/kg dry wt	25	-	-
Total Recoverable Copper mg/kg dry wt	22	-	-
Total Recoverable Lead mg/kg dry wt	10.2	-	-
Total Recoverable Nickel mg/kg dry wt	24	-	-
Total Recoverable Zinc mg/kg dry wt	159	-	-



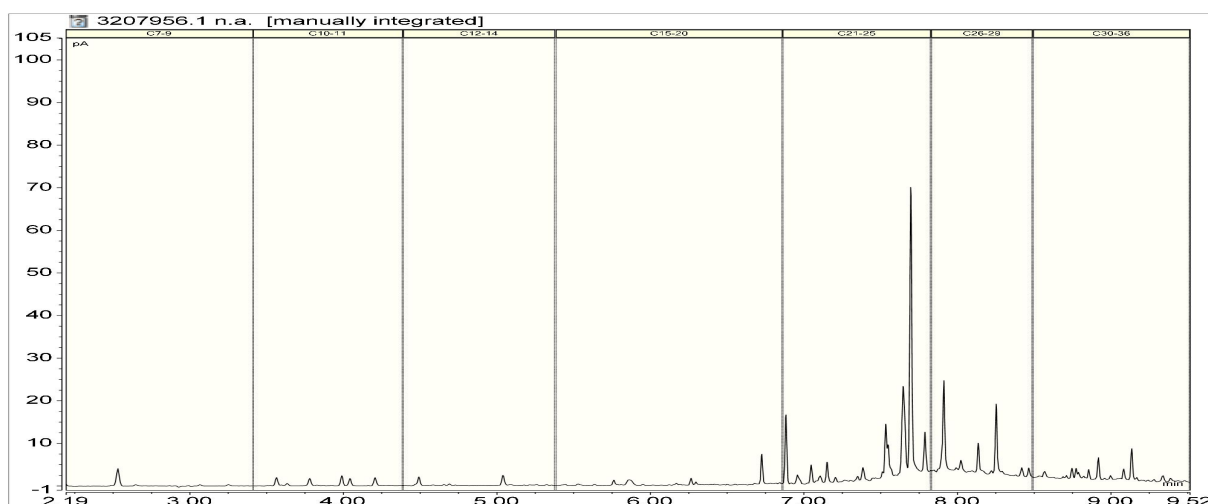
This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised. The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked \* or any comments and interpretations, which are not accredited.

Sample Type: Sediment				
Sample Name:		Main Settlement Pond, End Bay 15-Mar-2023 11:10 am	Western Composite 15-Mar-2023 11:25 am	Eastern Composite 15-Mar-2023 11:50 am
Lab Number:		3207956.6	3207956.7	3207956.8
Polycyclic Aromatic Hydrocarbons Trace in Soil*				
Total of Reported PAHs in Soil	mg/kg dry wt	-	6.5	0.67
1-Methylnaphthalene	mg/kg dry wt	-	0.71	0.051
2-Methylnaphthalene	mg/kg dry wt	-	1.07	0.052
Acenaphthene	mg/kg dry wt	-	0.050	0.003
Acenaphthylene	mg/kg dry wt	-	0.054	0.018
Anthracene	mg/kg dry wt	-	0.078	0.007
Benzo[a]anthracene	mg/kg dry wt	-	0.24	0.022
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	0.22	0.022
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	-	0.35	0.035
Benzo[e]pyrene	mg/kg dry wt	-	0.32	0.038
Benzo[g,h,i]perylene	mg/kg dry wt	-	0.30	0.066
Benzo[k]fluoranthene	mg/kg dry wt	-	0.050	0.006
Chrysene	mg/kg dry wt	-	0.41 #1	0.033
Dibenzo[a,h]anthracene	mg/kg dry wt	-	0.055	0.005
Fluoranthene	mg/kg dry wt	-	0.40	0.061
Fluorene	mg/kg dry wt	-	0.26	0.017
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	0.097	0.015
Naphthalene	mg/kg dry wt	-	0.27	0.019
Perylene	mg/kg dry wt	-	0.012	0.004
Phenanthrene	mg/kg dry wt	-	1.14	0.075
Pyrene	mg/kg dry wt	-	0.45	0.123
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	-	0.35	0.036
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	-	0.35	0.036
Total Petroleum Hydrocarbons in Solids				
C7 - C9	mg/kg dry wt	< 300	-	-
C10 - C14	mg/kg dry wt	< 300	-	-
C15 - C36	mg/kg dry wt	< 500	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 900	-	-

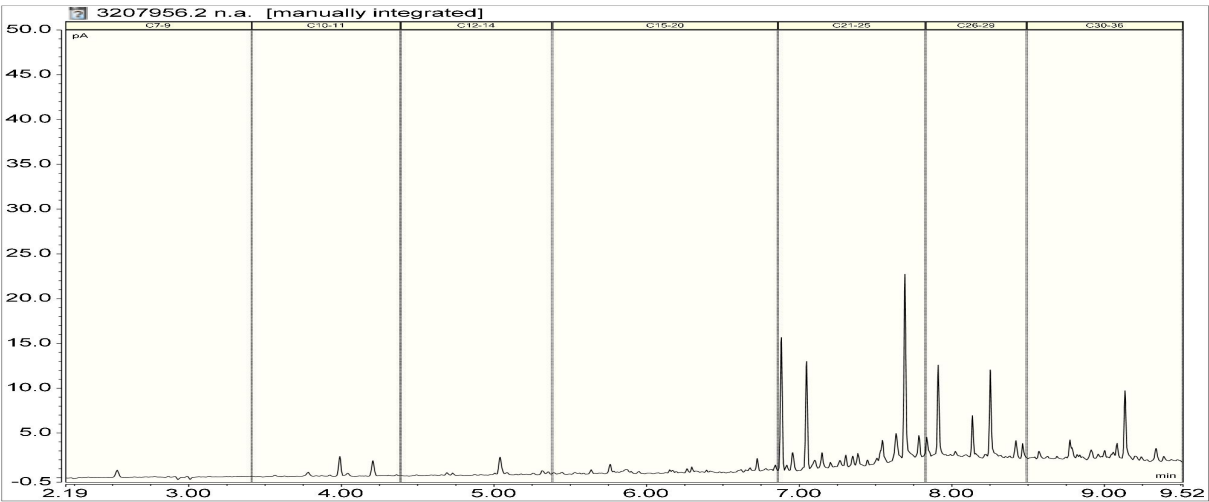
3207956.1

North Western Arm 15-Mar-2023 11:40 am

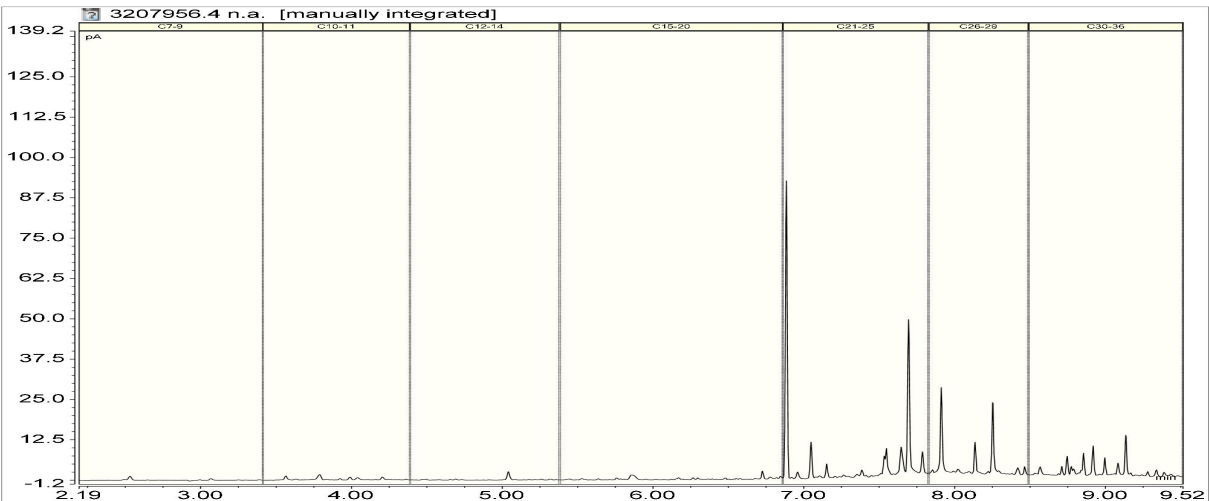
Client Chromatogram for TPH by FID



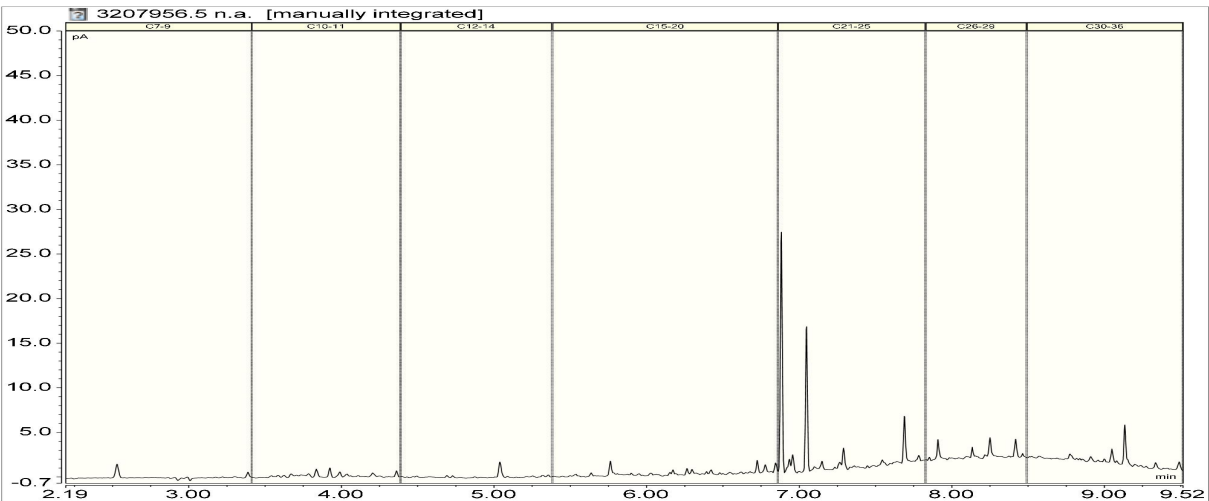
3207956.2  
South Western Arm 15-Mar-2023 11:25 am  
Client Chromatogram for TPH by FID



3207956.4  
South Eastern Arm 15-Mar-2023 11:55 am  
Client Chromatogram for TPH by FID



3207956.5  
Main Settlement Pond, First Bay 15-Mar-2023 11:00 am  
Client Chromatogram for TPH by FID





## Analyst's Comments

#1 Chrysene is higher than expected when compared to Benzo[a]anthracene. It is possible that Benzo(l)phenanthrene is present which co-elutes with Chrysene.

**Amended Report:** This certificate of analysis replaces report '3207956-SPv1' issued on 27-Mar-2023 at 3:34 pm.  
Reason for amendment: At the client's request, TOC analyses have been added to two samples.

## Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Sediment			
Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-8
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation May contain a residual moisture content of 2-5%.	-	1-8
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1-8
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-8
Total Recoverable Copper	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, trace level. US EPA 200.2.	0.2 mg/kg dry wt	7-8
Total Recoverable Lead	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, trace level. US EPA 200.2.	0.08 mg/kg dry wt	7-8
Total Recoverable Zinc	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, trace level. US EPA 200.2.	0.8 mg/kg dry wt	7-8
Total Organic Carbon*	Acid pretreatment to remove carbonates present followed by Catalytic Combustion (O <sub>2</sub> ), separation, Thermal Conductivity Detector [Elementar Analyser].	0.05 g/100g dry wt	7-8
Heavy metal, trace level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, trace level.	0.010 - 0.8 mg/kg dry wt	1-6
Polycyclic Aromatic Hydrocarbons Trace in Soil*	Sonication extraction, GC-MS analysis. Tested on as received sample. In-house based on US EPA 8270.	0.002 - 0.03 mg/kg dry wt	7-8
Total Petroleum Hydrocarbons in Solids			
Client Chromatogram for TPH by FID	Small peaks associated with QC compounds may be visible in chromatograms with low TPH concentrations. QC peaks are as follows: one peak in the C12 - 14 band, the C21 - 25 band and the C30 - 36 band. All QC peaks are corrected for in the reported TPH concentrations.	-	1-2, 4-5
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	20 mg/kg dry wt	1-6
C10 - C14	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	20 mg/kg dry wt	1-6
C15 - C36	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	40 mg/kg dry wt	1-6
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	70 mg/kg dry wt	1-6

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 21-Mar-2023 and 17-Apr-2023. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.

Ara Heron BSc (Tech)  
Client Services Manager - Environmental

## Appendix E:

**Sampling locations and collection method: Resource Consent CON2009050553**

Monitoring locations, sample collection method and GPS coordinate -NZGD 2000 New Zealand Transverse Mercator.

Sample Number	Sample Name	Location	Access	Easting	Northing
7a	North-western arm	Western canal arm, 100m south of beginning of canal	Utilising a ladder, climb down into canal. A plastic trowel is used to transfer sediment into the composite sample container provided by the analytical laboratory.	1733937.31E	6033554.02N
7b	Mid-western arm	Western canal arm, approximately halfway between sites 7A and 7C.	Utilising a ladder, climb down into canal. Sample collection as above.	1733869.37E	6033406.38N
7c	South-western arm	Western canal arm, at bend near manhole	Utilising a ladder, climb down into canal. Sample collection as above.	1733804.16E	6033242.81N
8a	East-eastern arm	Eastern canal arm, corner of Port Marsden Highway and Ralph Trimmer Drive (Public Access).	A small ponar dredge is dropped by hand, collecting a sediment sample. The ponar dredge is then lifted and deposited on a flat surface and a sample is taken using a plastic trowel to transfer sediment into the composite sample container provided by the analytical laboratory. The ponar should be thoroughly cleaned/rinsed before sampling and between sample sites either with distilled water or pond water.	1734222.61E	6032865.90N
8b	Mid-eastern arm	Eastern canal arm, west of bridge	Climb down rock face into canal. Sample collection as above for 7a – 7c.	1734015.41E	6032923.04N
8c	West-eastern arm	Eastern canal arm, approximately 100m upstream from join of arm	Climb down rock face into canal. Sample collection as above.	1733882.66E	6033021.84N

