

Engineering Report for Opuia Hard Stands  
Opuia Reclamation – Maritime Services  
for  
Far North Holdings Ltd

*Prepared for BOI Planning Ltd*

*Supporting Report for Applications to the Far North District Council & Northland Regional Council*

*Haigh Workman reference 15 119B*

September 2019

## Revision History


Revision N <sup>o</sup>	Issued By	Description	Date
A	John Papesch	Draft for comment	19 July 2019
B	John Papesch	Amended cycle trail access	20 September 2019

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Reviewed By



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## Executive Summary

Far North Holdings Ltd proposes to construct a new Maritime Services Facility by way of reclamation in the coastal marine area adjacent to Bay of Islands Marina boat yard. The maritime services facility comprises 1700 m<sup>2</sup> barge dock plus a 700 m<sup>2</sup> boat ramp to provide for launching and berthing of marine contractor's barges and handling of materials.

Inclusive with the project is a 6.5 m wide shared use access way to a vehicle parking and manoeuvring area of 1,400 m<sup>2</sup> to be formed. Public access will be maintained along the existing rail corridor within a shared use access with the cycle trail and commercial vehicles. In order to provide for the shared use access, excavation into the existing earth bank will be required together with construction of a retaining wall 2.5 m high x 85 m long.

The comprehensive proposal includes a public timber jetty and a pontoon which will provide a berth for TSS "The Minerva" (Kerikeri Steamship Trust). Dingy racks and a timber launching ramp will be provided adjacent to the public timber jetty.

Geotechnical – The underlying geology for the reclamation area comprises moderately deep alluvial marine deposits over Waipapa Group Greywacke, typical to the coastal Bay of Islands area. The reclamation of land will need to take into account potential for settlement of subsurface soils from the weight of fill added. It is expected that the seawall will comprise vertical sheet piling complete with tie backs in a similar format to the reclamation recently completed for Opuia Marina Stage II. Geotechnical investigation and analysis for design will be required for the reclamation sea wall as part of the detailed design process.

Earthworks – The total earthworks volume is calculated to be 9,200 m<sup>3</sup>, comprising:

- 600 m<sup>3</sup> of dredging excavation which will be used as a direct fill for the reclamation,
- 6,500 m<sup>3</sup> of filling for the reclamation area, comprising 600 m<sup>3</sup> from the dredging, 250 m<sup>3</sup> from the bank excavation, 4,750 m<sup>3</sup> of imported clean fill and hard fill and provision of 900 m<sup>3</sup> additional filling associated with potential settlements
- 1,000 m<sup>3</sup> of imported hard fill to form the boat ramp
- 2,450 m<sup>3</sup> of land-side earthworks comprising 250 m<sup>3</sup> from the bank excavation, 800 m<sup>3</sup> of cut to fill plus 600 m<sup>3</sup> of imported hard fill

Fills are required of up to 4.6 m height above seabed for the reclamation area with excavation of up to 1.0 m depth against the sea wall for the dredging. The reclaimed area will be formed at 2.5 m One Tree Point datum, completed with a hard fill capping/pavement, which is to be topped up as settlement occurs. The proposed finished ground level is the same as that at the adjacent Bay of Islands Marina boat yard site and is approximately 400 mm lower than the existing rail way. The rail way is to be lowered to match the proposed reclamation level.

The boat ramp also requires filling to form the ideal ramp gradient of 12.5 % or 1 in 8. Fills of up to 1.6 m will be required above the existing sea bed to the finished level of the concrete ramp. No dredging is required for formation of the boat ramp.

The remainder land side earthworks are associated with the access, vehicle manoeuvring and parking areas. The manoeuvring and parking areas will be subject to relatively shallow cuts and fills of around 0.5 m depth with hard filling for formation of pavements. The natural site gradients of the vehicle manoeuvring and parking areas which slope towards the south will be maintained. The formation of the access requires widening to provide for a road way and the cycle trail. This will comprise cutting into the existing bank which will require support with an engineered wall 2.5 m high x 85 m long.

During earthworks construction, appropriate erosion and sediment control measures will be deployed comprising floating silt curtains around dredge areas and silt fences and earth bund silt pits around general earthworks areas. A construction management plan will be prepared prior to commencement of works which will include sediment and erosion control and any matters arising from other reports.

The coastal site presents a relatively benign environment sheltered from the predominant tidal flows of the Kawakawa River by the adjacent headlands and as such maintenance dredging is not sought as part of the consent(s).

Access – Primary access to the site is from the existing vehicle entrance into Bay of Islands Marina boat yard. As part of creating the new access, the existing boat yard fence lines are to be shifted around 1 m into the boat yard property and realigned to make way for the new internal road way. There is a 67 m segment of road way that is to be built at 6.5 m wide which is adequate for as shared use access. There is clear line of sight along this access way with room for vehicles to pass at either end.

The public access along the rail corridor will be maintained by way of excavating into the existing bank and constructing a retaining wall 2.5 m high x 85 m long. The public access corridor will be accessed from the same gateway adjacent to Bay of Islands Marina boat yard, but will be reduced to 3.0 m wide for the length of the path way around the proposed industrial development. The pathway will divert from the rail corridor to continue hugging the toe of the bank around the manoeuvring and parking areas to be created for marine contractors.

The manoeuvring and parking area to be created for the marine contractors covers a 1,400 m<sup>2</sup> area which provides adequate space to turn a truck (outside radius 25 m) together with manoeuvring space to the boat ramp area. Six car parks are available in and around these manoeuvring areas.

Coastal Hazard – The reclamation area will be set at 2.5 m One Tree Point (OTP) datum, which translates to 4.1 m chart datum, or 1.6 m above a mean high water spring tide / 3.7 m above a mean low water spring tide. This is the same height as the Bay of Islands Marina Boat Yard.

2.5 m OTP is higher than the current 1 % AEP coastal flood hazard level of 1.73 calculated for the site in the recent Tonkin & Taylor coastal hazard assessment of the area for NRC.

This level allows provision for climate change, which is estimated to result in increased coastal flood hazard levels of 2.08 m OTP in 2065 and 2.73 m OTP in 2115. Whilst the reclamation is ideally kept low for use as a barge dock, there is potential for it to be inundated in the 2115 1 % AEP coastal flood scenario should 1 m sea level rise occur. Given that the development does not contain buildings or critical infrastructure, the proposed level is considered adequate. Should any future building or development occur, it should be constructed above the predicted coastal flood hazard determined from best available information at that time.

Stormwater Management – The new vehicle parking and manoeuvring area is intended to be gravel but in the future could be sealed; in either case these areas need to be considered as impermeable. The vehicle parking and manoeuvring areas will slope to the southwest to discharge into a surface drain. To manage stormwater quality from this area the design is to include stormwater treatment devices compliant with ARC Publication TP10/GD01 with a piped outfall to the CMA. Proprietary treatment devices such as the Humes stormwater360 or Hynds Downstream Defender which have ARC approval for removal of greater than 75% TSS are appropriate for this purpose.

The Barge Dock is also intended to have a gravel surface, but this should also be considered as impermeable. There are no industrial processing activities proposed other than the loading and unloading of barges. Machinery (such as a fork lift and cranes) are expected for regular heavy vehicle loading/unloading. The proposed activities for this area should include provision for a more robust stormwater treatment system capable of removing the required levels of copper and zinc and other suspended solids. Proprietary treatment devices such as the Humes stormwater360 or Hynds Downstream Defender are also available to treat heavy metals for this purpose.

Water Supply, Wastewater– No water supply or wastewater connection is proposed with this application, with existing amenities available at Bay of Islands Marina Boat Yard.

Firefighting – No firefighting systems are proposed for the proposed development, however it should be recorded that the 4.5 m width access is specified as such to comply with NZFS requirements for a minimum clear access width of 4.0 m should that ever be required.

# **1 Introduction**

Haigh Workman Ltd (Haigh Workman) was commissioned by Far North Holdings Limited (the client) to provide conceptual Engineering for the development of a Maritime services facility comprising the reclamation of land to create a hard stand at land to the south of Bay of Island Marina Boat Yard, Opua (the “site”). This report presents the conceptual Engineering design and aspects of the proposed development with regard to land stability, entrance and access, and earthworks, relevant to the defined objectives.

Far North Holdings Ltd is proposing to develop the site for an industrial end-use, comprising a barge dock hard stand area, boat ramp, vehicle manoeuvring and parking. Also included in the proposal is a public jetty with a berth for TSS “The Minerva” and facility to store and launch dinghies. Proposed development layout plans were created by Haigh Workman Ltd in consultation with our clients and other specialist consultants to the project and are presented in Appendix A.

Specialist assessment and reporting has been completed by other consultants to the project to provide for the necessary planning and environmental outcomes for the project.

## **1.1 Objective and Scope**

The scope of this report encompasses the general site and land suitability of the proposed development as defined on the Haigh Workman plans included in Appendix A.

The scope of our work includes;

- Visual site mapping,
- Engineering advice throughout conceptual design stages with the project team
- Conceptual Engineering solutions for access, earthworks and stormwater
- Preparation of this site suitability report

Water and wastewater services are not proposed with this application with existing facilities available in the Bay of Islands Marina boat yard. The responsibility for providing both power supply and telecommunication services will remain the responsibility of the developer.

## **1.2 Applicability**

This report has been prepared for our Client, Far North Holdings Ltd, with respect to the particular brief given to us. This report is to be used by our Client and Consultants and may be relied upon by the Far North District Council and Northland Regional Council when considering the Engineering aspects of the proposed development. The information and opinions contained within this report shall not be used in other context for any other purpose without prior review and agreement by Haigh Workman Ltd.



## 2 Site Details & Description

Site Address: Land adjacent to Bay of Islands Marina Boat Yard, Opua  
Legal Description: PT Lot 1 DP 183986 – Reclamation, Boat Ramp & Jetty  
Lot 1 DP 199153 – Vehicle access, parking and manoeuvring

### 2.1 Site Description

The site is located to the south east of Bay of Island Marine boat yard and is accessed from the existing cycle trail entrance and/or from the gated entrance to the boat yard. The site may be referred to as two separable areas;

- “Reclamation, Boat Ramp & Jetty” – being the Coastal Marine area, predominantly contained PT Lot 1 DP 183986
- “Vehicle access, parking and manoeuvring” – being land legally described as Lot 1 DP 199153. This area contains the southern part of the existing boat yard, the cycle trail and embankment / vegetated hillside above.

Figure 1 – Site Location Plan (Source: Google Earth Pro Aerial Imagery – 12.7.2018)



## 2.2 Proposed Development

The maritime services facility comprises the following;

- 1700 m<sup>2</sup> reclamation. The reclamation is a hard standing area for marine contractors; ie a “barge dock”. The hard standing area projects 30 m out from the existing railway embankment and 50 m south from the rear of the southernmost boat yard building (30 x 50 – 1500 m<sup>2</sup>). The remainder 200 m<sup>2</sup> reclamation area will encompass and tie in to the existing rock revetment of the boat yard. The intention is to construct the reclamation area at the same level as the existing boat yard. In order to create all tide access, 1200 m<sup>2</sup> of seabed will be dredged adjacent to the reclamation area.
- 700 m<sup>2</sup> boat ramp. The boat ramp extends 35 m from the railway embankment down to the CMA at a continuous gradient of 1 in 8 or 12.5 %. The boat ramp is 20 m wide in order to allow for barges to berth side-on to the ramp for ease of loading/unloading
- Vehicular access along the existing rail corridor. The intention is for commercial vehicles to utilise the existing boat yard entrance with new fencing erected along the western side of the yard to the marine facility. In order to create this vehicle access, excavation and retaining of the existing embankment is required in order to accommodate existing use of the cycle way. The narrow corridor along the rear of the railway will be formed with a 6.5 m wide shared use commercial access with public/ cycle trail access. The retaining wall to support the excavated embankment will be 85 m long x 2.5 m high
- Formation of a 1,400 m<sup>2</sup> vehicle manoeuvring and parking area. The vehicle manoeuvring area is required to enable trucks to be able to turn hence a tear-drop shape manoeuvring circle of 12.5 m radius is proposed. A manoeuvring area is also required for access to the boat ramp. Residual parking is available within and around the truck turning area
- Public facilities include a timber jetty and pontoon with a berth for TSS “The Minerva” (Kerikeri Steamship Trust). Dingy racks and a timber launching ramp will be provided adjacent to the public timber jetty. Public accesses to these facilities are available from the cycle trail / the new 3.0 m wide pathway.

The predominant activities are to provide access to the coastal marine area for marine contractors; ie for loading and unloading barges with cranes, fork hoists and temporary laydown/storage but not structures. It is recommended public access is discouraged from the industrial activities for safety and security.

### 3 **Environmental Setting**

Published environmental and historical data relating to the site has been reviewed. A summary of relevant information is provided below and drawings within Appendix A of this report.

#### 3.1 **Geology**

Sources of Information:

- GNS Science Geological Memoir 2, 2009: “Geology of the Whangarei Area”;
- GNS Sciences 1:250,000 scale map Sheet 2, 2009: “Whangarei” (Rocks);
- NZMS Sheet 290 Q04/05, 1:100,000 scale map, Edition 1, 1980: “Bay of Islands” (Soils).

##### 3.1.1 **Made Ground**

Made ground deposits are not indicated on the aforementioned geological mapping; however it is known that artificial ground deposits are present in the form of marine dredging placed across the vehicle manoeuvring and parking areas locally and hard fill/granular soils within the former railway embankment.

##### 3.1.2 **Superficial Deposits (Soils)**

Although not specifically documented on geological mapping it is recognised that the reclamation and boat ramp area of the site is coastal marine and as such it is anticipated that the majority of that area will be directly underlain by alluvial marine deposits of potentially substantial thickness. Marine deposits including silts and potentially organic matter with shells and/or gravel sized fragments are likely to have been deposited at the site in the low-flow marine environment.

##### 3.1.3 **Bedrock Geology**

The weathered soils are indicated to be underlain by solid geology comprising Waipapa (composite) Terrane strata of Jurassic to Permian age (c. 154 to 270 million years). The GNS rock map identifies the Waipapa (composite) Terrane (TJw) at the site as part of the Waipapa Group and describes it as ‘*massive to thin-bedded, lithic volcaniclastic sandstone and argillite*’, see Figure 2.

The associated geological memoir further describes the solid geology at the site as follows; ‘*all Waipapa (composite) Terrane rocks within the Whangarei map area belong to the ‘Hunua’ facies group which include tectonically intercalated material and a generally higher metamorphic grade. They form most of the rocky, indented coast north of Ocean Beach. The rocks are fresh in most coastal outcrops, but inland they are typically deeply weathered to a white to yellow-brown clay.*’

**Figure 2 – GNS Science, Geology of the Kaitiā Area, Map 2**



### 3.2 Historical Development

Table 4.2 presents a summary of site history from 1884 to 2016. It is not the intention of this report to describe in detail all of the changes that have occurred on or adjacent to the site, only those pertinent to the proposed development.

**Table 3.1 - Historical Development**

Dates	On-site Features
1884 – 1910	Railway construction completed of the original tracks by 1884. The railway operated trains/trams from coal mining at Kawakawa to newly established Opuā. The railway terminated at Opuā docks.
1910 – c.1980	The railway line was closed for industrial purposes due to the demise of the coal mining industry as a result of flooding of the mines and subsequently the closure of Opuā docks. The railway was linked to the Whangarei Line in 1910 and remained operational at the site for passenger services.
1980 – 2000	The Bay of Islands Vintage Railway was established and operated a Scenic Railway route from Kawakawa to Opuā.
2000 – 2016	The railway line was closed to traffic and lead to the creation of the present cycle trail from 2010.

### 3.3 Hydrology and Flooding

A summary of available information pertaining to hydrology and flooding is present in Table 4.1. An examination of Far North District Council (FNDC) and Northland Regional Council (NRC) online GIS databases is included below.

**Table 3.2 - Surface Water Features & Flooding**

	Presence/Location	Comments
<b>Surface Water Features (Ponds, Lakes etc).</b>	None recorded within or within 50 m of the site boundaries.	
<b>Watercourses (within 500m)</b>	Tidal Bay of Islands inlet	Whangane and Kawakawa Rivers meet in waters directly to the south of the development, attributing to the tidal Bay of Islands inlet.
<b>Flood Risk Status</b>	Coastal Flood Hazard Zone 2	NRC GIS databases indicate the site is within the coastal flood hazard zone 2 area.
<b>Flood Susceptibility</b>	Susceptible to coastal inundation (flooding by the sea) in a 1-in-100 year storm event, taking into account predicted sea-level rise over the next 100 years	Refer flood hazard assessment herein.



## 4 Coastal Hazard

### 4.1 Published Coastal Flood Hazard

This area has been subject to a recently released report by Tonkin & Taylor Ltd, for Northland Regional Council ‘Coastal Flood Hazard Zones for Select Northland Sites’, Final report issued May 2016.

The site is in an area of assessment named 25C, or cell C as presented below.

Figure 3 – Cell 25C, Opuia South (Source: Tonkin & Taylor Ltd)



Figure 4 – Storm Tide and Extreme Water Levels (Source: Tonkin & Taylor Ltd)

Site				MHWS (m OTP)	Current 1% AEP (m OTP)			2065 2% AEP (m OTP)			2115 1% AEP (m OTP)		
No.	Name	Type	Cell		Storm tide	Static WL	Run-up level	Storm tide	Static WL	Run-up level	Storm tide	Static WL	Run-up level
21	Ohawini Bay (& Parutahi Beach)	Open coast		0.97	1.5	2.2	3.7	1.9	2.4	3.8	2.5	3.2	4.7
22	Oakura Bay	Open coast		0.97	1.5	2.3	4.3	1.9	2.5	4.5	2.5	3.3	5.3
23	Bland Bay	Open coast	A	0.97	1.5	2.6	5.7	1.9	2.8	5.9	2.5	3.6	6.7
		Sheltered	B	0.97	1.5	1.7		1.9	2.0		2.5	2.7	
24	Russell	Open coast	A1	1.00	1.6	2.5	7.6	1.9	2.8	7.7	2.6	3.5	8.6
		Open coast	A2	1.00	1.6	1.8	6.4	1.9	2.1	6.6	2.6	2.8	7.4
		Sheltered	B	1.00	1.6	1.7		1.9	2.1		2.6	2.7	
25	Opuia - Okiato (25A Okiato South; 25B Okiato East / North; 25C Opuia South; 25D Opuia North)	Sheltered	A	1.00	1.7	1.8		2.0	2.2		2.7	2.8	
		Sheltered	B	1.00	1.7	1.7		2.0	2.1		2.7	2.7	
		Sheltered	C	1.00	1.7	1.7		2.0	2.1		2.7	2.7	
		Sheltered	D	1.00	1.7	1.8		2.0	2.1		2.7	2.8	
26	Taumarere Estuary	Sheltered		1.00	1.7	1.7		2.0	2.1		2.7	2.7	
27	Paīhia	Sheltered		1.00	1.7	2.3	4.7	2.0	2.6	4.9	2.7	3.3	5.7

## 4.2 Flood Hazard Assessment

The reclamation area will be set at 2.5 m One Tree Point (OTP) datum, which translates to 4.1 m chart datum, or 1.6 m above a mean high water spring tide / 3.7 m above a mean low water spring tide. This is the same height as the Bay of Islands Marina Boat Yard.

2.5 m OTP is higher than the current 1 % AEP coastal flood hazard level of 1.73 calculated for the site. This level allows provision for climate change, which is estimated to result in increased coastal flood hazard levels of 2.08 m OTP in 2065 and 2.73 m OTP in 2115. Whilst the reclamation is ideally kept low for use as a barge dock, there is potential for it to be inundated in the 2115 1 % AEP coastal flood scenario should 1 m sea level rise occur.

Given that the development does not contain buildings or critical infrastructure, the proposed level is considered adequate. Should any future building or development occur, it should be constructed above the predicted coastal flood hazard determined from best available information at that time.

**Table 4.1 – Site Level Data**

Site Level	Chart Datum	OTP Datum
Reclamation level	4.1	2.5
2115 1 % AEP	4.3	2.7
2065 2 % AEP	3.7	2.1
Current 1 % AEP	3.5	1.7
MHWS	2.5	0.9
OTP Datum	1.6	0.0
MLWS	0.4	-1.2

## **5 Geotechnical Appraisal**

### **5.1 Visual Inspection**

Based upon site walkover inspections conducted by Haigh Workman and information contained on geological and earthwork plans, it is considered that the soils directly underlying the reclamation area typically comprise marine/superficial deposits, increasing in depth from west to east. Dredging are understood to have been placed within the area to be utilised for vehicle manoeuvring and parking and it is expected that the land below this fill will also comprise marine/superficial deposits.

Above the access route is a steep batter which has been historically excavated into the existing hillside at 40-45 degrees. The batter is predominantly formed in completed weathered bedrock of the Waipapa group formation and does not display any obvious signs of instability; however it will be subject to weathering and fretting of the upper soil mantle.

### **5.2 Geotechnical Recommendations**

#### **5.2.1 Reclamation**

Loading of superficial soils at the site including reclamation fill and/or alluvial deposits could lead to excessive total and/or differential settlement. The reclamation fill will be subject to long term settlements thus it is recommended a flexible pavement is formed for the hard stand area

The reclamation wall will require deep piled foundations, supported on underlying bedrock. Bedrock is unlikely to be shallow under this area, hence it is expected that a tied back retaining wall will be required for formation of the reclamation wall.

#### **5.2.2 Boat ramp**

The boat ramp will also be constructed on weak alluvial deposits and hence the hard fill support should be reinforced with geogrid to reduce differential settlement. Ideally the hard fill for the boat ramp is put down and settlement monitored ahead of pouring concrete.

#### **5.2.3 Access road**

The formation of the access road includes excavation into the existing hillside. So as to not undermine/ destabilise the existing batter slope, the excavation is to be supported with a retaining wall 2.5 m high. The retaining wall design will also require through geotechnical design with consideration of protection of pedestrians from shallow landslides from the residual soils above. This may involve including a debris catch fence in the wall design.

#### **5.2.4 Timber jetty and pontoon**

It is envisaged that the timber jetty and pontoon will be constructed with driven piles to provided vertical support on the underlying bedrock

#### **5.2.5 Vehicle parking and manoeuvring area**

This area will be subject to relatively shallow earthworks hence settlement is not expected to be an issue subject to formation of flexible granular pavements designed for weak subgrade conditions.



### 5.2.6 ***Further Works***

Due to the nature of superficial soil conditions including weak, alluvial deposits it is recommended that a thorough geotechnical investigation is undertaken. A conceptual ground model is included in Appendix A which is to be confirmed with a site specific investigation.

## 6 Earthworks

### 6.1 Description of the Works

The total earthworks volume is calculated to be 9,200 m<sup>3</sup>, comprising;

- 600 m<sup>3</sup> of dredging excavation which will be used as a direct fill for the reclamation,
- 6,500 m<sup>3</sup> of filling for the reclamation area, comprising 600 m<sup>3</sup> from the dredging, 250 m<sup>3</sup> from the bank excavation, 4,750 m<sup>3</sup> of imported clean fill and hard fill and provision of 900 m<sup>3</sup> additional filling associated with potential settlements
- 1,000 m<sup>3</sup> of imported hard fill to form the boat ramp
- 2,450 m<sup>3</sup> of land-side earthworks comprising 250 m<sup>3</sup> from the bank excavation, 800 m<sup>3</sup> of cut to fill plus 600 m<sup>3</sup> of imported hard fill

**Table 6.1 – Earthworks Volumes**

Development	Cut Volume	Fill Volume	Area	Height/Depth
Dredging	600 m <sup>3</sup>		1,200 m <sup>2</sup>	1.0 m
Reclamation		6,500 m <sup>3</sup>	1,700 m <sup>2</sup>	4.6 m
Boat Ramp		1,000 m <sup>3</sup>	700 m <sup>2</sup>	1.0 m
Access road retaining wall	250 m <sup>3</sup>		200 m <sup>2</sup>	2.5 m
Land-side earthworks	800 m <sup>3</sup>	1400 m <sup>3</sup>	2,800 m <sup>2</sup>	0.5 m

Fills are required of up to 4.6 m height above seabed for the reclamation area with excavation of up to 1.0 m depth against the seal wall for the dredging. The reclaimed area will be formed at 2.5 m One Tree Point datum, completed with a hard fill capping/pavement, which is to be topped up as settlement occurs. The proposed finished ground level is the same as that at the adjacent Bay of Islands Marina boat yard site and is approximately 400 mm lower than the existing rail way. The rail way is to be cut down to match the proposed reclamation level.

The boat ramp also requires filling to form the ideal ramp gradient of 12.5 % or 1 in 8. Fills of up to 1.6 m will be required above the existing sea bed to the finished level of the concrete ramp. No dredging is required for formation of the boat ramp.

The remainder land side earthworks is associated with the access, vehicle manoeuvring and parking areas. The manoeuvring and parking areas will be subject to relatively shallow cuts and fills of around 0.5 m depth with hard filling for formation of pavements. The natural site gradients of the vehicle manoeuvring and parking areas which slope towards the south will be maintained. The formation of the access requires widening to provide for a road way and the cycle trail. This will comprise cutting into the existing bank which will require support with an engineered wall 2.5 m high x 85 m long.

## **6.2 Erosion Sediment Control**

During earthworks construction, appropriate erosion and sediment control measures will be deployed comprising floating silt curtains around dredge areas and silt fences and earth bund silt pits around general earthworks areas. A construction management plan will be prepared prior to commencement of works which will include sediment and erosion control and any matters rising from other reports.

The coastal site presents a relatively benign environment sheltered from the predominant tidal flows of the Kawakawa River by the adjacent headlands and as such maintenance dredging is not sought as part of the consent(s).

## 7 Access

### 7.1 Primary Access into the Site

Primary access to the site is from the existing vehicle entrance into Bay of Islands Marina boat yard. As part of creating the new access, the existing boat yard fence lines are to be shifted around 1 m into the boat yard property and realigned to make way for the new internal road way. There is a 67 m segment of road way that is to be built 4.5 m wide which is adequate for one-way traffic. There is clear line of sight along this road way with room for vehicles to pass at either end. This access will be gated and fenced to separate commercial vehicles and activities from the public.

### 7.2 Manoeuvring and Parking

The manoeuvring and parking area to be created for the marine contractors covers a 1,400 m<sup>2</sup> area which provides adequate space to turn a truck (outside radius 25 m) together with manoeuvring space to the boat ramp area. Six car parks are available in and around these manoeuvring areas.

#### 7.2.1 Parking

**Table 7.1 – Car Parking Spaces**

Land Use Activity	Calculation	Spaces Required
Industrial Activities – contractors depot	1 per 100 m <sup>2</sup> Gross Business Area. The definition excludes manoeuvring and loading areas but includes areas used solely or principally for storage. While the reclamation is 1700 m <sup>2</sup> , the laydown/storage activities would not exceed 500 m <sup>2</sup> .	5
Recreation – marinas/moorings	0.8 per berth, with one berth proposed for the TSS Minerva	1

### 7.3 Public Access

The public access along the rail corridor will be maintained by way of excavating into the existing bank and constructing a retaining wall 2.5 m high x 85 m long. The public access corridor will be accessed from the same gateway adjacent to Bay of Islands Marina boat yard, but will be reduced to 3.0 m wide for the length of the path way around the proposed industrial development. The pathway will divert from the rail corridor to continue hugging the toe of the bank around the manoeuvring and parking areas to be created for marine contractors.

### 7.4 Trip Generation

#### 7.4.1 Marine Service Facility

Traffic movements associated with the marine service facility are estimated as follows:

Oyster Farmers:

- 400 trucks pa. (6-8 wheelers) 80% between May and December, 20% January to April.
- 2700 cars pa. (staff/owners)
- 240 working days per year
- Daily vehicle movements =  $3100 \times 2 / 240 \text{ days} = 26 \text{ vehicle movements / day}$

Marine Contractors:

- Utility – 15 per week
- 4 wheel flat deck truck – 1 per week
- Semi truck and trailer – 1 per week
- 5 working days per week
- Daily vehicle movements =  $17 \times 2 / 5 \text{ days} = 7 \text{ vehicle movements / day}$

The peak oyster farmers and marine contractor’s traffic are unlikely to coincide, so total daily traffic movements will be less than the sum of the two components. It is conservatively estimated that total traffic from the marine service facility will be 32 vm/day with peak hour traffic of 4 vm/hour.

**7.4.2 Construction**

The proposed development includes importing approximately 7,250 m<sup>3</sup> (solid measure) of fill for the reclamation, boat ramp and pavements. The bin of a truck can hold approximately 8 m<sup>3</sup> loose, or 5 m<sup>3</sup> solid, hence this equates to 1450 vehicle movements, or 725 vehicle movements if truck and trailer units are used.

Up to 4 vehicle movements (2 truck and trailer units) per hour x 10 hours per day (40 vehicle movements per day) can be expected.

**7.4.3 Traffic Intensity Factor**

The Far North District Plan uses a ‘Traffic Intensity Factor’ (TIF) as a means of assessing the likely traffic effects from a particular new activity. Where there is more than one activity on a site the TIF is calculated separately for each activity, then added together. Construction traffic is exempt from this rule.

The Traffic Intensity Factors determined by reference to the far North District Plan Appendix 3A are:

**Table 7.2 – Traffic Intensity Factor**

Land Use Activity	Calculation	TIF
Industrial Activities – contractors depot	10 per 100 m <sup>2</sup> Gross Business Area. The definition excludes manoeuvring and loading areas but includes areas used solely or principally for storage. While the reclamation is 1700 m <sup>2</sup> , the laydown/storage activities would not exceed 500 m <sup>2</sup> .	50
Recreation – marinas/moorings	2 per berth, with one berth proposed for the TSS Minerva	2

The TIFF is well below the permitted 200 for the Industrial Zone.

## 8 Stormwater Management

### 8.1 Proposed Stormwater System

Stormwater management within the proposed development is designed to treat stormwater flows, reduce scour and ensure compliance with Regional Plan rules.

As there are no adverse effects downstream from the increased stormwater runoff, stormwater attenuation is required, however stormwater quality is the primary requirement

The new vehicle parking and manoeuvring area is intended to be gravel but in the future could be sealed; in either case these areas need to be considered as impermeable. The vehicle parking and manoeuvring areas will slope to the southwest to discharge into a surface drain. To manage stormwater quality from this area the design is to include stormwater treatment devices compliant with ARC Publication TP10/GD01 with a piped outfall to the CMA. Proprietary treatment devices such as the Humes stormwater360 or Hynds Downstream Defender which have ARC approval for removal of greater than 75% TSS are appropriate for this purpose.

The Barge Dock is also intended to have a gravel surface, but this should also be considered as impermeable. There are no industrial processing activities proposed other than the loading and unloading of barges. Machinery (such as a fork lift and cranes) are expected for regular heavy vehicle loading/unloading. The proposed activities for this area should include provision for a more robust stormwater treatment system capable of removing the required levels of copper and zinc and other suspended solids. Proprietary treatment devices such as the Humes stormwater360 or Hynds Downstream Defender are also available to treat heavy metals for this purpose.

Based upon a rainfall intensity of 120 mm/hr and a conservative (future sealed surface) run-off coefficient of 0.85 we calculate the following;

**Table 8.1 – Stormwater outfalls**

Outfall Location	Intended Use	Surface Area	10% AEP Flow	Treatment requirements
Timber Jetty - 300mm culvert	Vehicle parking and manoeuvring	1,400 m <sup>2</sup>	40 litre/sec	Suspended Solids
Reclamation – 300mm culvert	Barge dock	1,700 m <sup>2</sup>	50 litre/sec	Suspended solids, copper and zinc

## **9 Services**

### **9.1 Water and Wastewater**

No water supply or wastewater connection is proposed with this application, with existing amenities available at Bay of Islands Marina Boat Yard.

### **9.2 Fire Fighting**

No firefighting systems are proposed for the proposed development. The access as specified does comply with NZFS requirements for a minimum clear access width of 4.0 m should that ever be required.

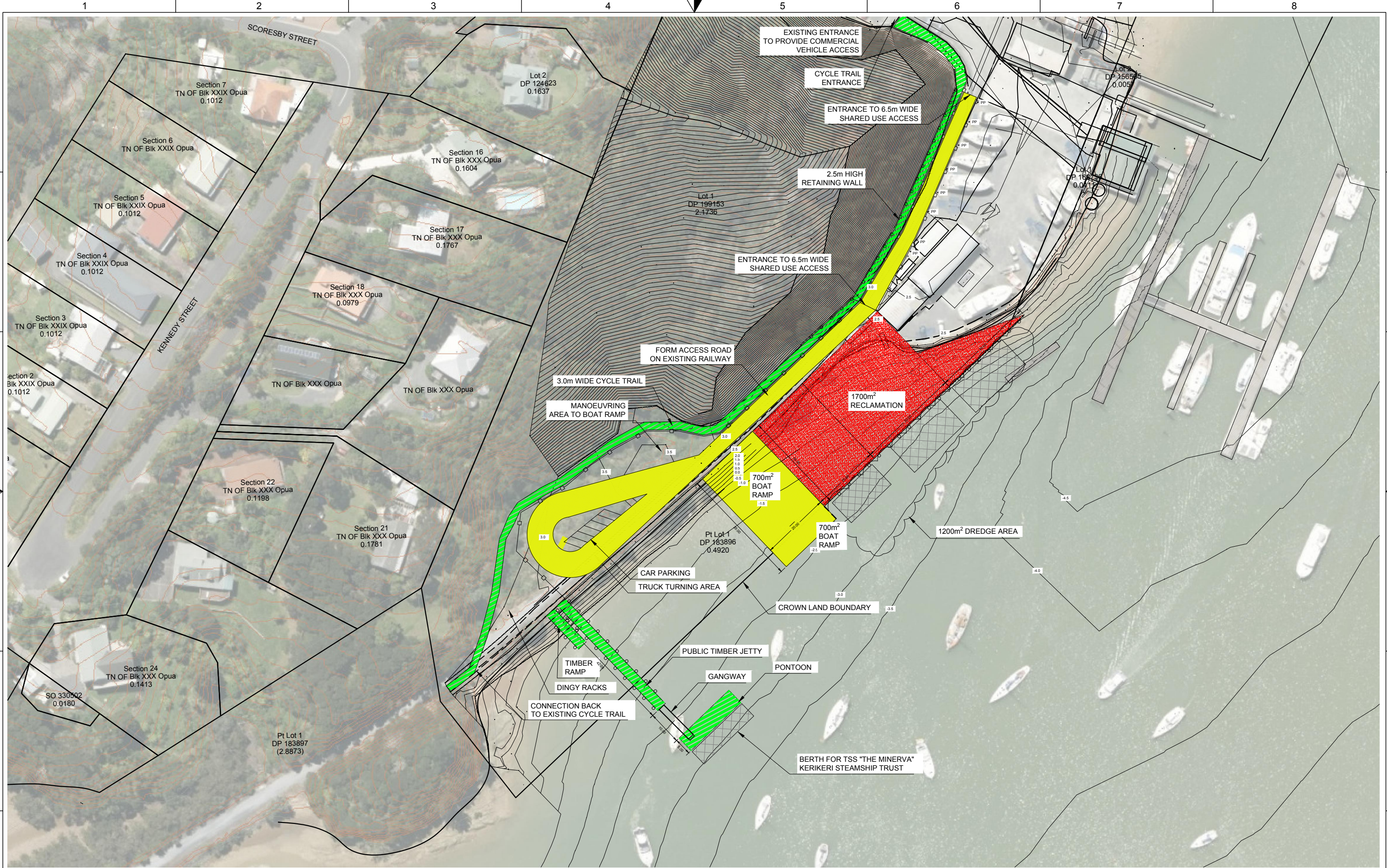
### **9.3 Power and Telecommunications**

Power may be extended to the site from the Bay of Islands Marina Boat Yard site, however no special provisions for power and telecommunications are considered necessary

## ***Appendix A – Drawings***

<b>Drawing No.</b>	<b>Title</b>	<b>Scale</b>
15 119/01	Site Location Plan	1:5,000
15 119/02	Proposed Development Plan	1:500
15 119/03	Proposed Access Plan	1:500
15 119/04	Proposed Access – Typical Cross Section	1:200
15 119/05	Proposed Reclamation – Typical Cross Section	1:200
15 119/06	Proposed Boat Ramp – Typical Cross Section	1:200
15 119/07	Proposed Jetty– Typical Cross Section	1:200





Issue	Date	Revision
-	19/3/2019	WORK IN PROGRESS
1	28/5/2019	RESOURCE CONSENT
B	20/9/2019	AMENDED CYCLE TRAIL ACCESS

DWG **Site Location Plan**

Scale 1:1000 @A3

Drawn JP Checked EC Approved

Date 23/1/2018

**HAIGH WORKMAN**  
Civil & Structural Engineers

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Kerikeri, BOI.

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E: info@haghworkman.co.nz

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Project **Opua Hard Stands Extension**  
Ashby's Boat Yard, Opua

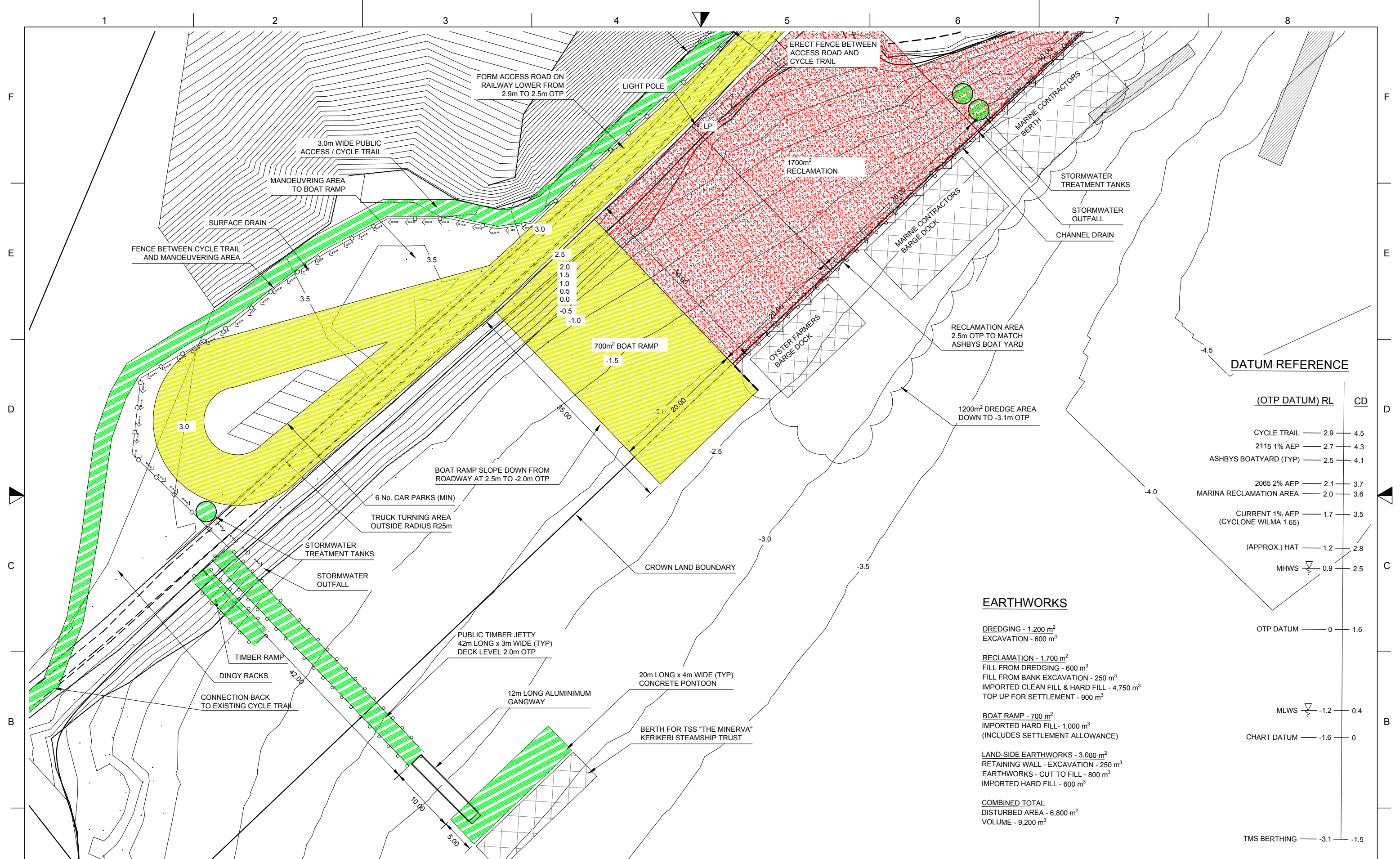
Client **Far North Holdings Ltd**

Project No. 15 119 RC no.

DWG No. **01**

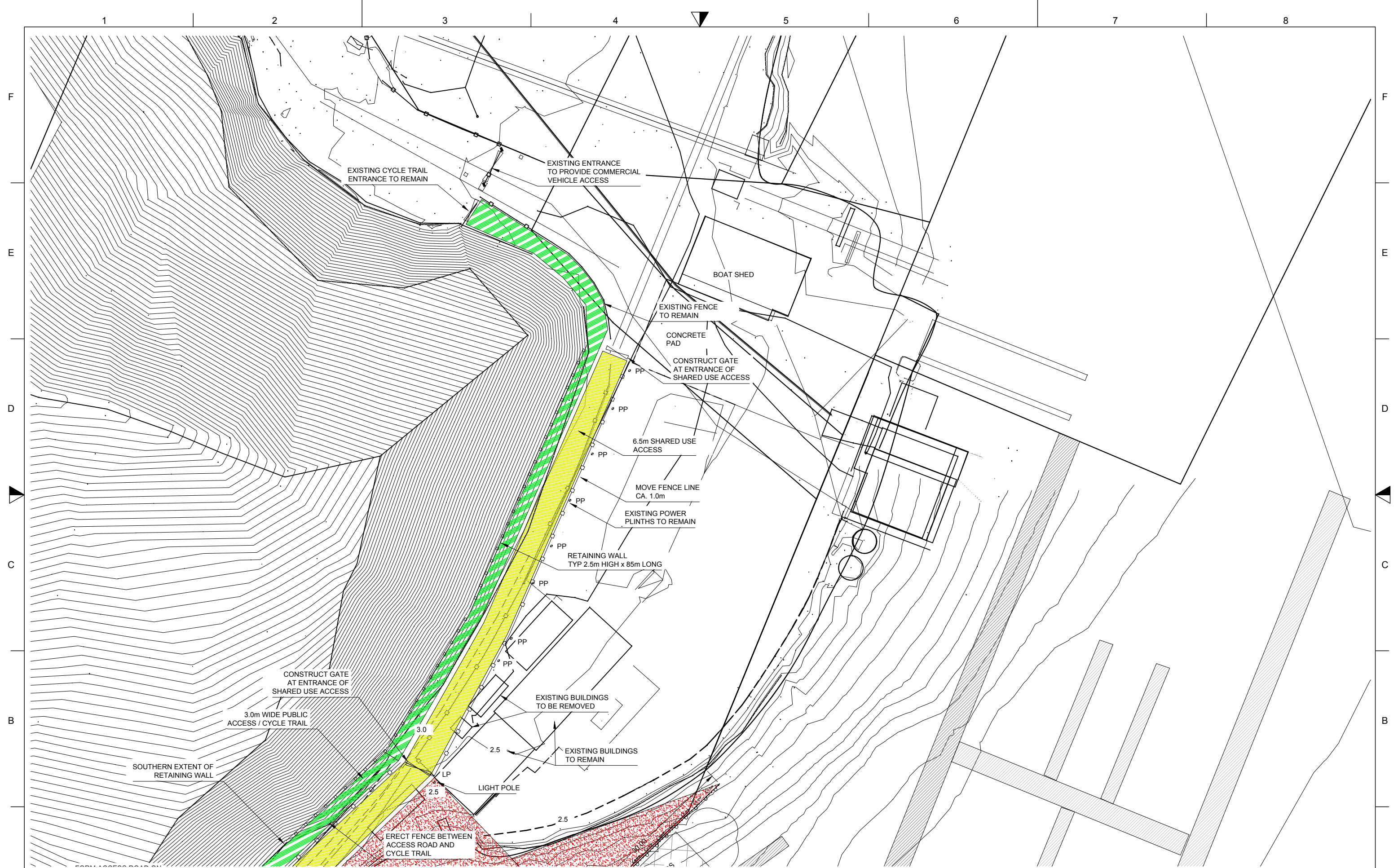
Sheet No. **1 of 7**





A	Issue	Date	Revision	DWG Proposed Development Plan		Date 23/1/2018	<b>HAIGH WORKMAN</b> Civil & Structural Engineers 6 Fairway Drive Kerikeri, BOI. T: 09 407 8327 F: 09 407 8378 E: info@haighworkman.co.nz	Project Opua Hard Stands Extension		DWG No. 02
	-	19/3/2019	WORK IN PROGRESS					Client Far North Holdings Ltd		Sheet No. 2 of 7
	1	28/5/2019	RESOURCE CONSENT					Project No. 15 119		RC no.
	B	20/9/2019	AMENDED CYCLE TRAIL ACCESS					Drawn JP	Checked EC	Approved





Issue	Date	Revision
-	19/3/2019	WORK IN PROGRESS
1	28/5/2019	RESOURCE CONSENT
B	20/9/2019	AMENDED CYCLE TRAIL ACCESS

DWG **Proposed Access Plan**

Scale 1:500 @A3

Drawn JP Checked EC Approved

Date 23/1/2018

File

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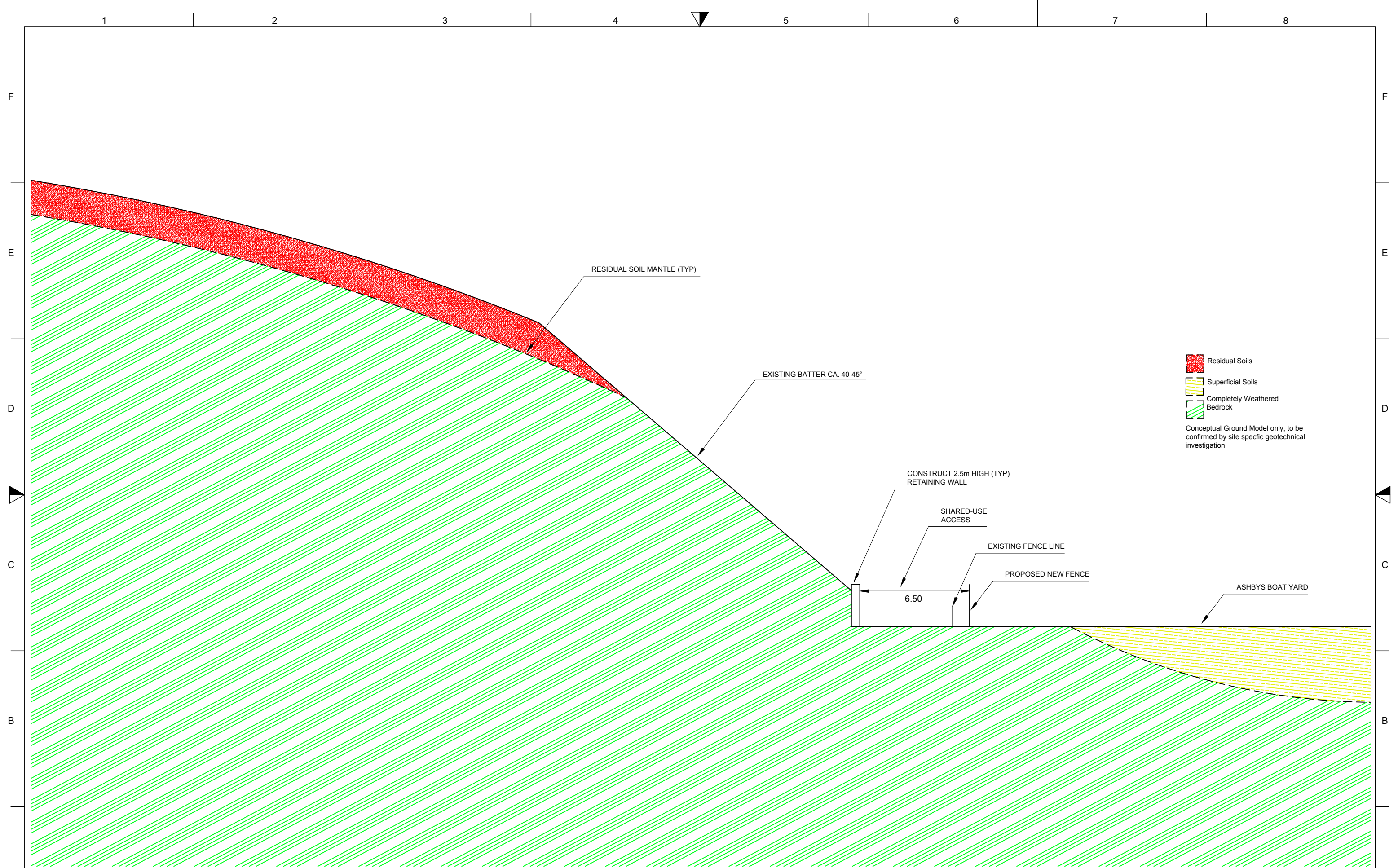
Project **Opua Hard Stands Extension**  
Ashby's Boat Yard, Opua

Client **Far North Holdings Ltd**

Project No. 15 119 RC no.

DWG No. **03**

Sheet No. **3 of 7**



Residual Soils  
 Superficial Soils  
 Completely Weathered Bedrock  
 Conceptual Ground Model only, to be confirmed by site specific geotechnical investigation

Issue	Date	Revision
-	19/3/2019	WORK IN PROGRESS
1	28/5/2019	RESOURCE CONSENT
B	20/9/2019	AMENDED CYCLE TRAIL ACCESS

DWG **Proposed Access - Typical Cross Section**

Scale 1:200 @A3 Date 23/1/2018

Drawn JP    Checked EC    Approved

File

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Ashby's Boat Yard, Opua

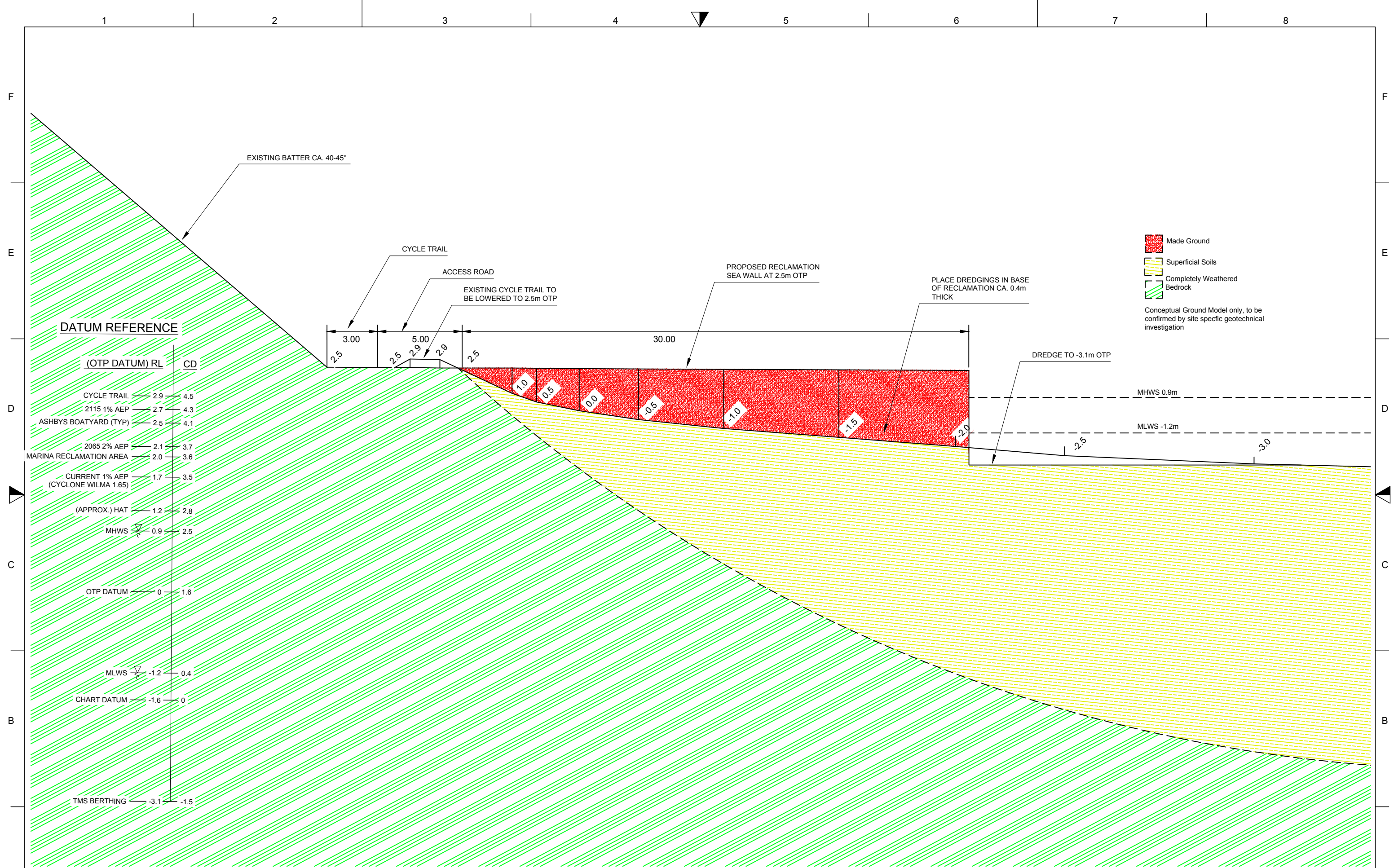
Client **Far North Holdings Ltd**

Project No. 15 119    RC no.

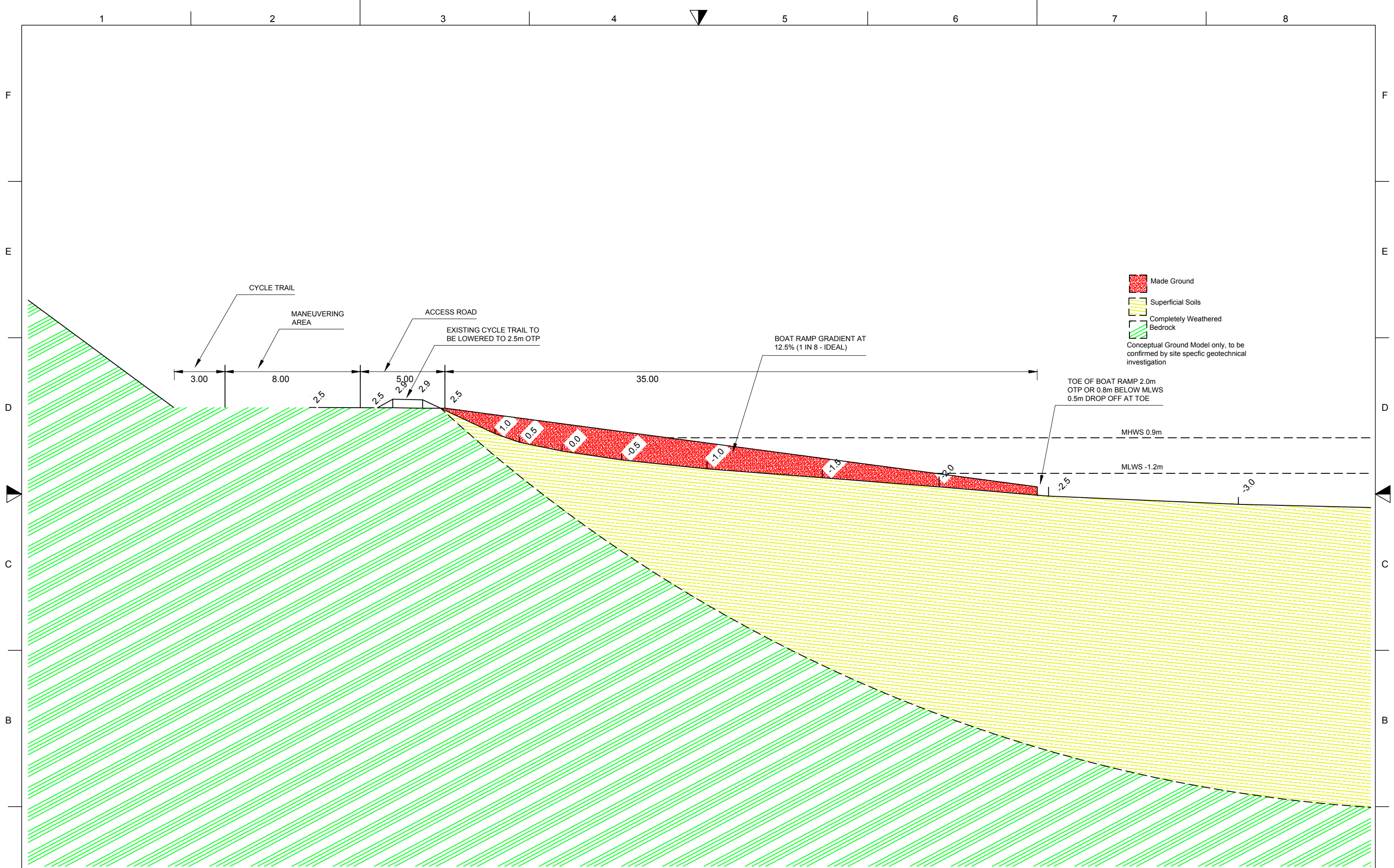
DWG No. **04**

Sheet No. **4** of **7**





A	Issue	Date	Revision	DWG Proposed Reclamation - Typical Cross Section	 6 Fairway Drive Kerikeri, BOI. T: 09 407 8327 F: 09 407 8378 E: info@haighworkman.co.nz	Project	Opua Hard Stands Extension		DWG No.	05	
	-	19/3/2019	WORK IN PROGRESS			Client	Far North Holdings Ltd		Sheet No.		5 of 7
	1	28/5/2019	RESOURCE CONSENT			Project No.	15 119	RC no.			
	B	20/9/2019	AMENDED CYCLE TRAIL ACCESS			Scale	1:200 @A3	Date	23/1/2018		
			Drawn	JP	Checked	EC	Approved				
			File				<small>DIMENSIONS MUST NOT BE SCALE MEASURED FROM THESE DRAWINGS. THE CONTRACTOR SHALL CHECK &amp; VERIFY ALL DIMENSIONS INCLUDING SITE LEVELS, HEIGHTS AND ANGLES ON SITE PRIOR TO COMMENCING ANY WORK. THE COPYRIGHT TO THESE DRAWINGS AND ALL PARTS THERE OF REMAIN THE PROPERTY OF HAIGH WORKMAN. ©2006</small>				



Made Ground  
 Superficial Soils  
 Completely Weathered Bedrock  
 Conceptual Ground Model only, to be confirmed by site specific geotechnical investigation


TOE OF BOAT RAMP 2.0m  
 OTP OR 0.8m BELOW MLWS  
 0.5m DROP OFF AT TOE

MHS 0.9m

MLWS -1.2m

Issue	Date	Revision
-	19/3/2019	WORK IN PROGRESS
1	28/5/2019	RESOURCE CONSENT
B	20/9/2019	AMENDED CYCLE TRAIL ACCESS

DWG **Proposed Boat Ramp - Typical Cross Section**

Scale 1:200 @A3  Date 23/1/2018

Drawn JP Checked EC Approved

File

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Project **Opua Hard Stands Extension**  
Ashby's Boat Yard, Opua

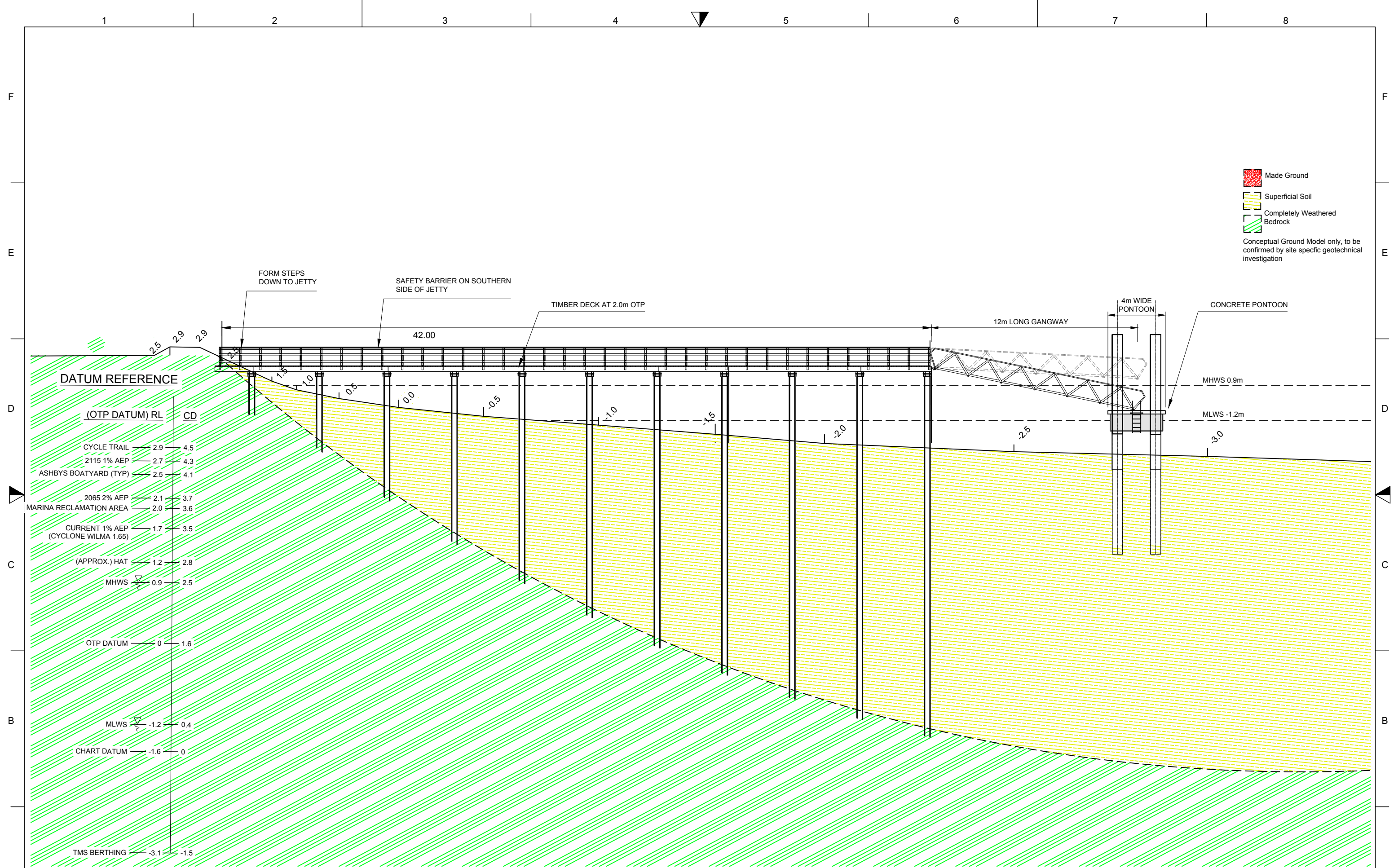
Client **Far North Holdings Ltd**

Project No. 15 119 RC no.

DWG No. **06**

Sheet No. **6** of **7**





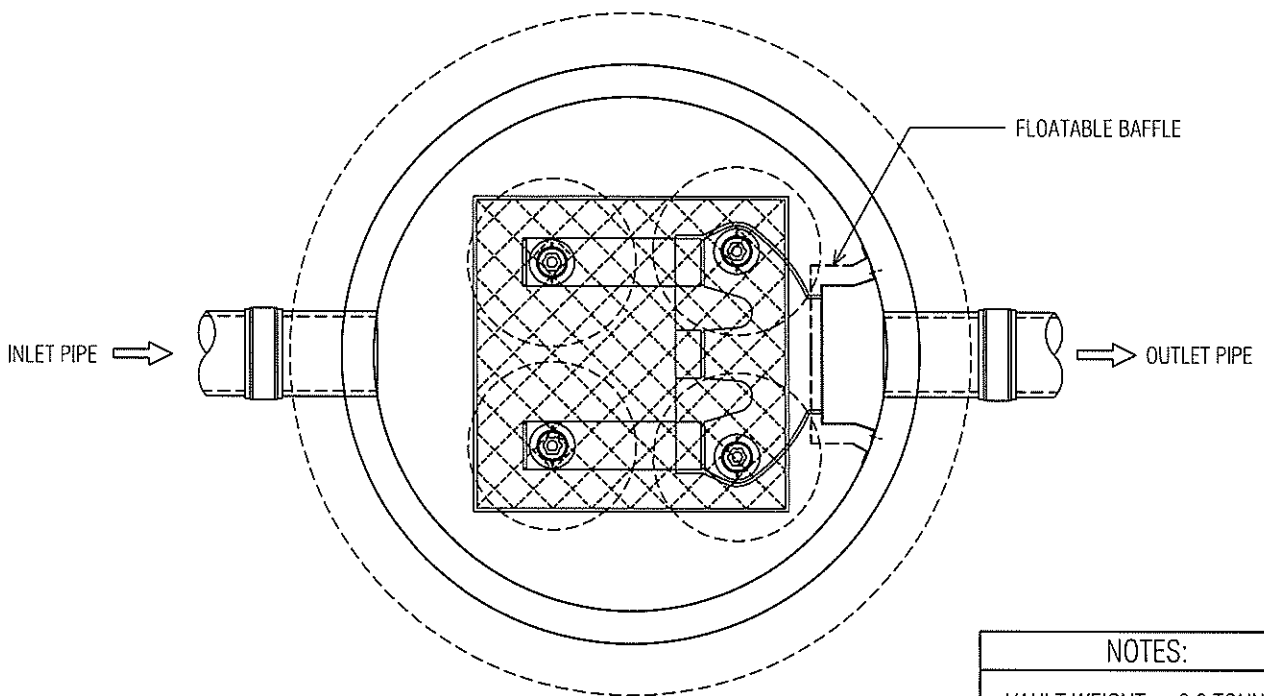
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Issue	Date	Revision																								
-	19/3/2019	WORK IN PROGRESS																								
1	28/5/2019	RESOURCE CONSENT																								
B	20/9/2019	AMENDED CYCLE TRAIL ACCESS																								
Scale 1:200 @A3						Date 23/1/2018			Client Far North Holdings Ltd			Sheet No. <b>7</b> of <b>7</b>														
Drawn JP			Checked EC			Approved			Project No. 15 119			RC no.														
File			File			File			Project No. 15 119			RC no.														

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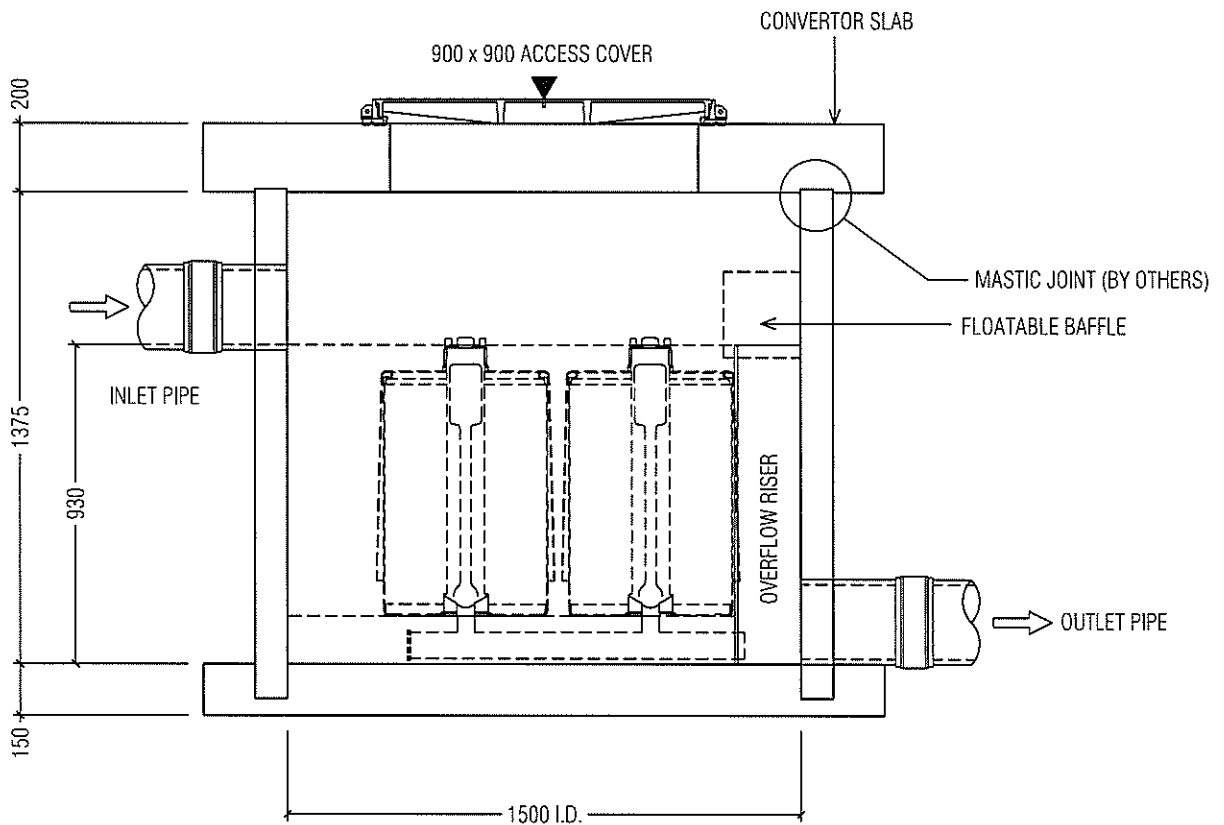
## ***Appendix B – Stormwater360 Typical Details***





**MANHOLE STORMFILTER - PLAN**

NOTES:	
VAULT WEIGHT =	2.6 TONNES
LID WEIGHT =	0.65 TONNES



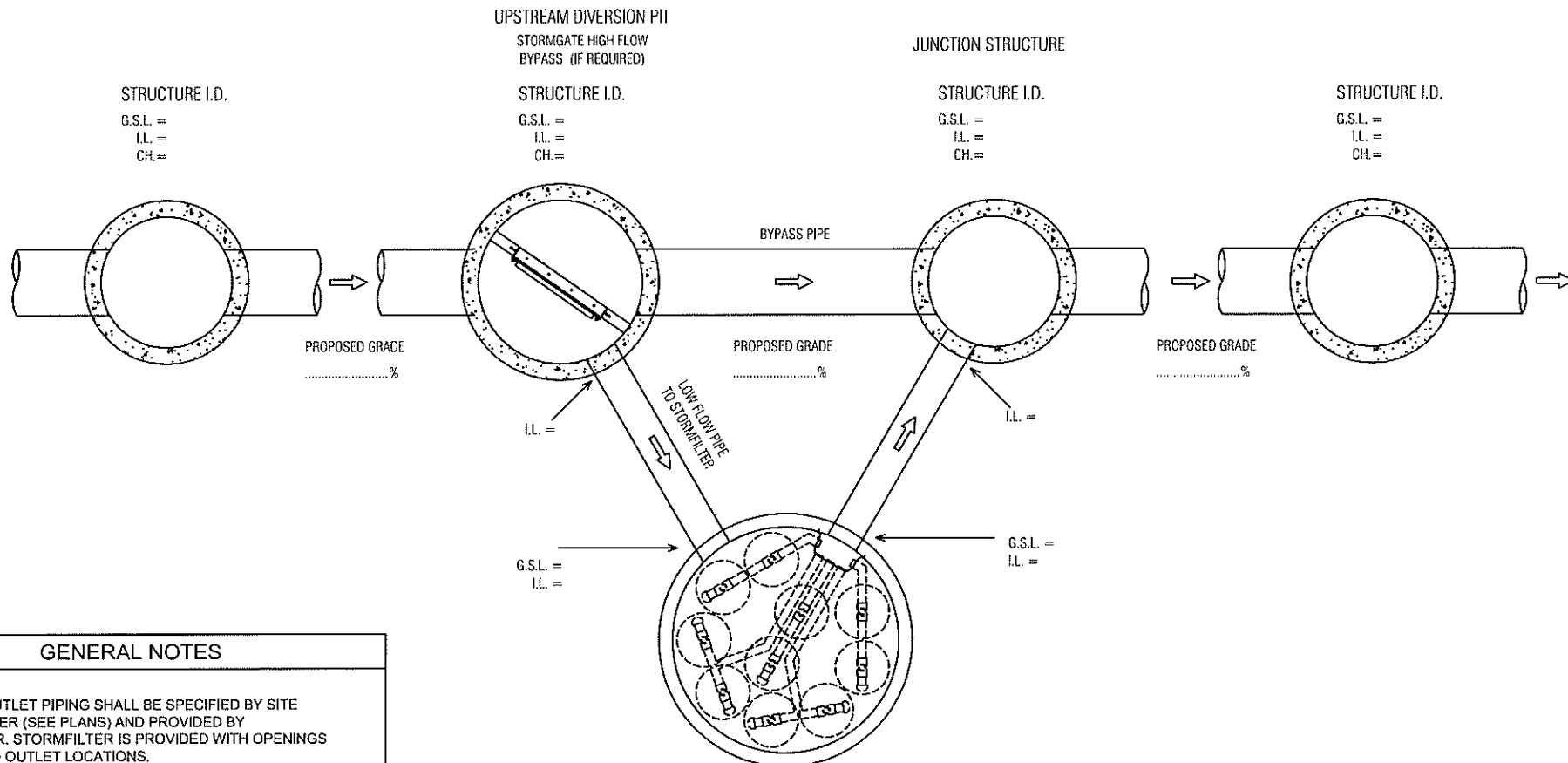
**MANHOLE STORMFILTER - SECTION**



STORMWATER360  
 4 CARTRIDGE MANHOLE STORMFILTER SYSTEM  
 Ø 1500 MANHOLE x 1500 DEEP  
 PRODUCT DRAWING

DRAWING
1
A

DATE: 22.04.08	SCALE: N.T.S.	FILE NAME: NZ-SF46-04-MH-1515	DRN: R.P.	CHK: M.W.
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UPSTREAM DIVERSION PIT  
STORMGATE HIGH FLOW  
BYPASS (IF REQUIRED)

JUNCTION STRUCTURE

STRUCTURE I.D.  
G.S.L. =  
I.L. =  
CH. =

STRUCTURE I.D.  
G.S.L. =  
I.L. =  
CH. =

STRUCTURE I.D.  
G.S.L. =  
I.L. =  
CH. =

STRUCTURE I.D.  
G.S.L. =  
I.L. =  
CH. =

GENERAL NOTES

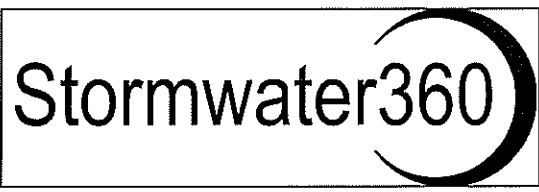
1. INLET AND OUTLET PIPING SHALL BE SPECIFIED BY SITE CIVIL ENGINEER (SEE PLANS) AND PROVIDED BY CONTRACTOR. STORMFILTER IS PROVIDED WITH OPENINGS AT INLET AND OUTLET LOCATIONS.
2. IF THE PEAK FLOW RATE, AS DETERMINED BY THE SITE CIVIL ENGINEER, EXCEEDS THE PEAK HYDRAULIC CAPACITY OF THE PRODUCT, AN UPSTREAM BYPASS STRUCTURE IS REQUIRED. PLEASE CONTACT STORMWATER360 FOR OPTIONS.
3. THE FILTER CARTRIDGE(S) ARE SIPHON-ACTUATED AND SELF-CLEANING. THE STANDARD DETAIL DRAWING SHOWS THE MAXIMUM NUMBER OF CARTRIDGES. THE ACTUAL NUMBER SHALL BE SPECIFIED BY THE SITE CIVIL ENGINEER ON SITE PLANS OR IN DATA TABLE BELOW. PRECAST STRUCTURE TO BE CONSTRUCTED IN ACCORDANCE WITH AS3600.
4. FOR SHALLOW, LOW DROP OR SPECIAL DESIGN CONSTRAINTS, CONTACT STORMWATER360 FOR DESIGN OPTIONS.
5. ALL WATER QUALITY PRODUCTS REQUIRE PERIODIC MAINTENANCE AS OUTLINED IN THE O&M GUIDELINES. PROVIDE MINIMUM CLEARANCE FOR MAINTENANCE ACCESS.
6. STRUCTURE AND ACCESS COVERS DESIGNED TO MEET AUSTRROADS T44 LOAD RATING WITH 0-2m FILL MAXIMUM.
7. THE STRUCTURE THICKNESSES SHOWN ARE FOR REPRESENTATIONAL PURPOSES AND VARY REGIONALLY.
8. ANY BACKFILL DEPTH, SUB-BASE, AND OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY SITE CIVIL ENGINEER.
9. STORMFILTER BY STORMWATER360:  
SYDNEY (AU) PHONE: (02) 9525 5833,  
BRISBANE (AU) PHONE: (07) 3272 1872.

STRUCTURE I.D.

STORMFILTER CHAMBER  
BY STORMWATER 360

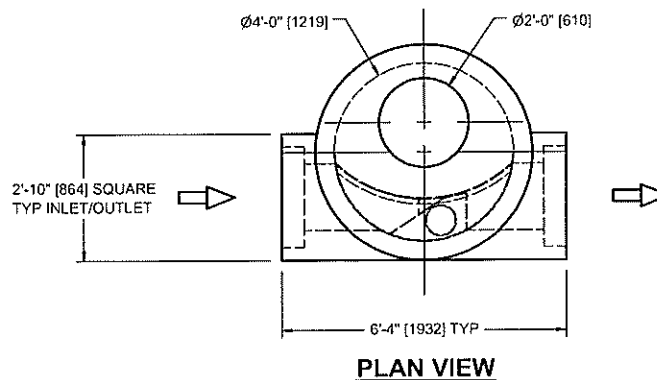
REFER TO PRODUCT DRAWING .....  
FOR SYSTEM DETAILS

PLAN OF TYPICAL OFFLINE LAYOUT

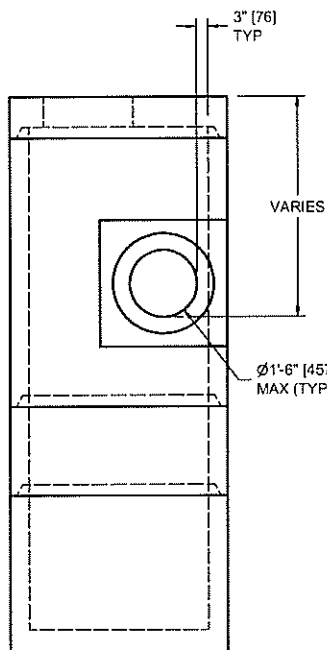


STORMWATER360		DRAWING
TYPICAL OFFLINE LAYOUT STORMGATE HIGH FLOW BYPASS (OPTIONAL) WITH PRECAST VAULT STORMFILTER		
DATE: 09.03.08		1
SCALE: N.T.S.		A
FILE NAME: SFMH_OFFLINE_LAYOUT		CHK: M.W.
DWRN: R.P.		

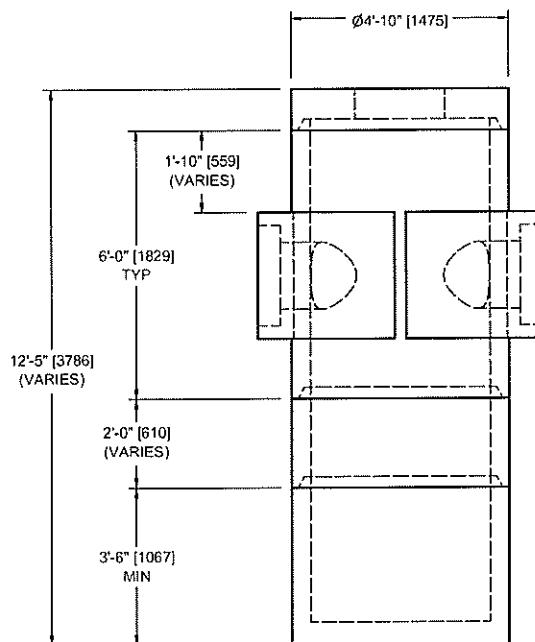
THE VORTCAPTURE SECTION SHALL BE STENCILED WITH THE CONTECH STORMWATER SOLUTIONS NAME AND LOGO. PIPE OPENINGS SHALL BE STENCILED "INLET" OR "OUTLET" AS APPROPRIATE



**PLAN VIEW**



**LEFT SIDE VIEW**

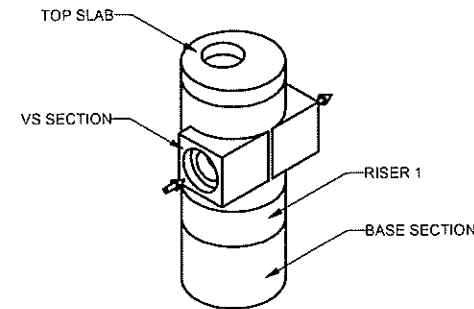


**ELEVATION VIEW**

(ALUMINUM COMPONENTS OMITTED FOR CLARITY)  
ALTERNATE UNITS [ ] ARE IN MILLIMETERS UNLESS NOTED OTHERWISE

**NOTES:**

1. STORMWATER TREATMENT SYSTEM (SWTS) SHALL BE DESIGNED TO MEET PERFORMANCE GOALS BASED ON FULL SCALE LABORATORY PERFORMANCE DATA
2. SWTS SHALL BE DESIGNED TO RETAIN FLOATABLES AND TRAPPED SEDIMENT AT FLOW RATES UP TO AND INCLUDING PEAK TREATMENT CAPACITY
3. SWTS INVERTS IN AND OUT SHALL BE AT THE SAME ELEVATION
4. SWTS SHALL NOT BE COMPROMISED BY EFFECTS OF DOWNSTREAM TAILWATER
5. SWTS SHALL HAVE NO INTERNAL COMPONENTS THAT OBSTRUCT MAINTENANCE ACCESS
6. PIPE ORIENTATION MAY VARY; SEE SITE PLAN FOR SIZE AND LOCATION
7. PURCHASER SHALL NOT BE RESPONSIBLE FOR ASSEMBLY OF INTERNAL COMPONENTS
8. (1) MANHOLE FRAME AND COVER SUPPLIED WITH SYSTEM, NOT INSTALLED
9. PURCHASER TO PREPARE EXCAVATION AND PROVIDE LIFTING EQUIPMENT
10. VORTCAPTURE BY CONTECH STORMWATER SOLUTIONS; PORTLAND, OR (800) 548-4667; SCARBOROUGH, ME (877) 907-8676; ELKRIDGE, MD (866) 740-3318



**ASSEMBLY VIEW**

STANDARD DETAIL  
STORMWATER TREATMENT SYSTEM  
VORTCAPTURE™ VC40 US PATENT No. 6,991,114



SCALE: NONE
DRAWN: JBS
CHECKED: NDG
FILE NAME: STDVC40
DATE: 4/7/06

**FOR INFORMATIONAL PURPOSES ONLY - NOT INTENDED FOR CONSTRUCTION**

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