Comox Valley REGIONAL DISTRICT

Staff report

DATE: September 7, 2018

FILE: 3060-20 / DP 16B 18

TO: Chair and Directors
Electoral Areas Services Committee

FROM: Russell Dyson
Chief Administrative Officer

Supported by Russell Dyson
Chief Administrative Officer

R. Dyson

RE: **Shoreline Protection Devices Development Permit**
1476 Wilkinson Road (Wade/Busenius)
Lazo North (Electoral Area B)
Lot 11, District Lot 209, Comox District, Plan 13961, PID 004-448-391

Purpose

To consider an application for a Shoreline Protection Devices Development Permit (DP) for the installation of a shoreline protection device (rock slope) and replanting of native vegetation upland from the present natural boundary (PNB) (Appendix A).

Recommendation from the Chief Administrative Officer:

THAT the board approve the Shoreline Protection Devices Development Permit DP 16B 18 (Wade/Busenius) for the property described as Lot 11, District Lot 209, Comox District, Plan 13961 (1476 Wilkinson Road) for the installation of a shoreline protection device;

AND FURTHER THAT the Corporate Legislative Officer be authorized to execute the permit.

Executive Summary

- The subject property contains a single detached dwelling sited 6.9 metres from the PNB of the Strait of Georgia.
- The two abutting properties are armoured with riprap and there is evidence of erosion issues on the subject property that could eventually threaten the dwelling and septic system.
- The coastal engineering report recommends a planted, low flat stone slope using the smallest rock that is stable for the estimated wave height including sea level rise. The proposed design is flat enough to allow access and will be conductive for native plant growth. The structure will be entirely within the property boundaries.
- No significant impacts are anticipated on adjacent properties as they are protected by their own shoreline protection and the proposed design will not substantially impact existing sediment transfer patterns.
- The Qualified Environmental Professional (QEP) provided a planting plan to revegetate the rock slope, which will be more ecologically desirable than an eroding slope.
- Provided the applicants follow the recommendations in the QEP report and coastal engineering report and permit, the issuance of the Shoreline Protection Devices DP is supportable.

Prepared by:	Concurrence:
B. Labute	***A. Mullaly***
Brianne Labute Planner	Alana Mullaly, M.Pl., MCIP, RPP Acting General Manager of Planning and Development Services Branch

Stakeholder Distribution (Upon Agenda Publication)

Applicants	✔

Background/Current Situation

An application has been received to consider a Shoreline Protection Devices DP for a 0.05 hectare parcel of land situated within Lazo North (Electoral Area B) (Figure 1 and 2). The lot is bound by the Strait of Georgia to the northeast, Wilkinson Road to the southwest, and rural lots in all other directions. The property is developed with a single detached dwelling (Figure 3). The applicants wish to install a new shoreline protection device (rock slope) to protect the property from erosion.

Official Community Plan Analysis

The Official Community Plan (OCP) being the "Rural Comox Valley Official Community Plan Bylaw No. 337, 2014", designates the subject property as within the Settlement Expansion Area. Pursuant to the OCP, installation of a new shoreline protection devices requires a DP prior to the commencement of site works. The OCP contains a policy that generally prohibits the hardening of the coastal shoreline unless a qualified professional concludes that shoreline hardening is required to protect life or a principal dwelling and the effects of the proposed hardening can be mitigated. Where possible, the proposed design should incorporate soft shore ("greenshores") principles.

The applicants submitted a Coastal Engineering Report and Biophysical Assessment dated May 22, 2018, prepared by Jim Mitchell, P.Eng, QEP of Emerald Sea Engineering (Appendix A). Due to hardening on adjacent properties (Figure 4) and existing erosion issues, the engineer concludes that shoreline protection is warranted. Currently, the shoreline consists of established dune grass on a gravelly substrate and the remains of a short timber piling bulkhead, which has failed to stop erosion. The PNB at the northwest end of the subject property is approximately 4.5 metres inland of the historic PNB. Continual erosion will put the dwelling at risk as it is only 6.9 metres from the PNB. The engineer recommends a planted, low flat stone slope using the smallest rock that is stable for the estimated wave height including sea level rise. The proposed design is flat enough to allow access and will be conductive for native plant growth. The structure will be entirely within the property boundaries as confirmed by a survey plan prepared by a BC Land Surveyor. No significant impacts are anticipated on adjacent properties as they are protected by their own shoreline protection and the proposed design will not substantially impact existing sediment transfer patterns.

In response to the OCP policy that generally prohibits shoreline hardening, the engineer notes that the proposed design is above normal wave action and the rock slope is relatively flat and does not reflect or re-direct significant wave energy. The structure will not interrupt sediment transfer or deposition or damage fish habitat. There will be a temporary disruption of plant life; however, the rock slope will be replanted with Dune grass, Beach Pea and Seashore Lupine (Appendix B).

In terms of the ecological impact, the report acknowledges the importance of the subtidal and nearshore area. Impacts are expected to be minimal as the toe of the new slope is above the higher

high water large tide (average high tide) and the increased stability will allow for native plant growth between the rock crevices. Standard management practices would be employed in the rare event of a machinery spill, only clean materials will be used and material delivery will be on the upland portion of the property. The Department of Fisheries and Oceans establishes the fisheries window with the least risk as June 1 to September 1 and December 1 to February 15. If works are completed outside this window, it is the responsibility of the applicants to ensure works do not contravene Section 35 of the *Fisheries Act* prohibition against serious harm to fish. Overall, the project is not expected to significantly change the ecological health of the immediate area.

Zoning Bylaw Analysis

The property is zoned Country Residential One (CR-1) in Bylaw No. 2781, being the "Comox Valley Zoning Bylaw, 2005". The zoning bylaw permits the siting of a shoreline protection device on any portion of a lot.

Policy Analysis

Sections 488 to 491 of the *Local Government Act* (RSBC, 2015, c. 1) (LGA) authorizes a local government to manage different types of development that occur in specific areas. The LGA allows a local government to designate development permit areas and to establish guidelines within its OCPs to protect the natural environment and to protect development from hazardous conditions. Part 4, Section 83 of the OCP requires a shoreline protection devices DP prior to the construction of a shoreline protection device.

Options

The board could either approve or deny the requested DP. Based on the analysis above, staff recommends the board approve the application.

Financial Factors

Applicable fees have been collected for this application under Bylaw No. 328 being the "Comox Valley Regional District Planning Procedures and Fees Bylaw No. 328, 2014". Pursuant to Bylaw No. 328, a financial performance bond of $551.88 (125 per cent of $441.50) is required to ensure the revegetation is completed in accordance with the QEP's recommendations. The Performance Bond will be released in accordance with Bylaw No. 328.

Legal Factors

This report and the recommendations contained herein are in compliance with the LGA and Comox Valley Regional District (CVRD) bylaws. DPs are permitted in certain circumstances under Sections 488 to 491 of the LGA.

Regional Growth Strategy Implications

The subject property is designated Settlement Expansion Area in the Regional Growth Strategy (RGS), being the "Comox Valley Regional District Regional Growth Strategy Bylaw No. 120, 2010". The RGS provides objectives and supporting policies related to environmental protection and enhancement of natural systems. The applicants have provided a report and detailed design for the proposed shoreline protection device prepared by an engineer/QEP to ensure that the installation of a shoreline protection device does not adversely affect shoreline habitat and adjacent properties.

Intergovernmental Factors

No intergovernmental factors.

Interdepartmental Involvement

This proposal was referred to applicable internal departments within the CVRD. No concerns were identified.

Citizen/Public Relations

Public notification is not required for a Shoreline Protection Devices DP.

Attachments: Appendix A – "Shoreline Protection Devices Development Permit – DP 16B 18"
Appendix B – "Email from engineer, dated December 14, 2016"

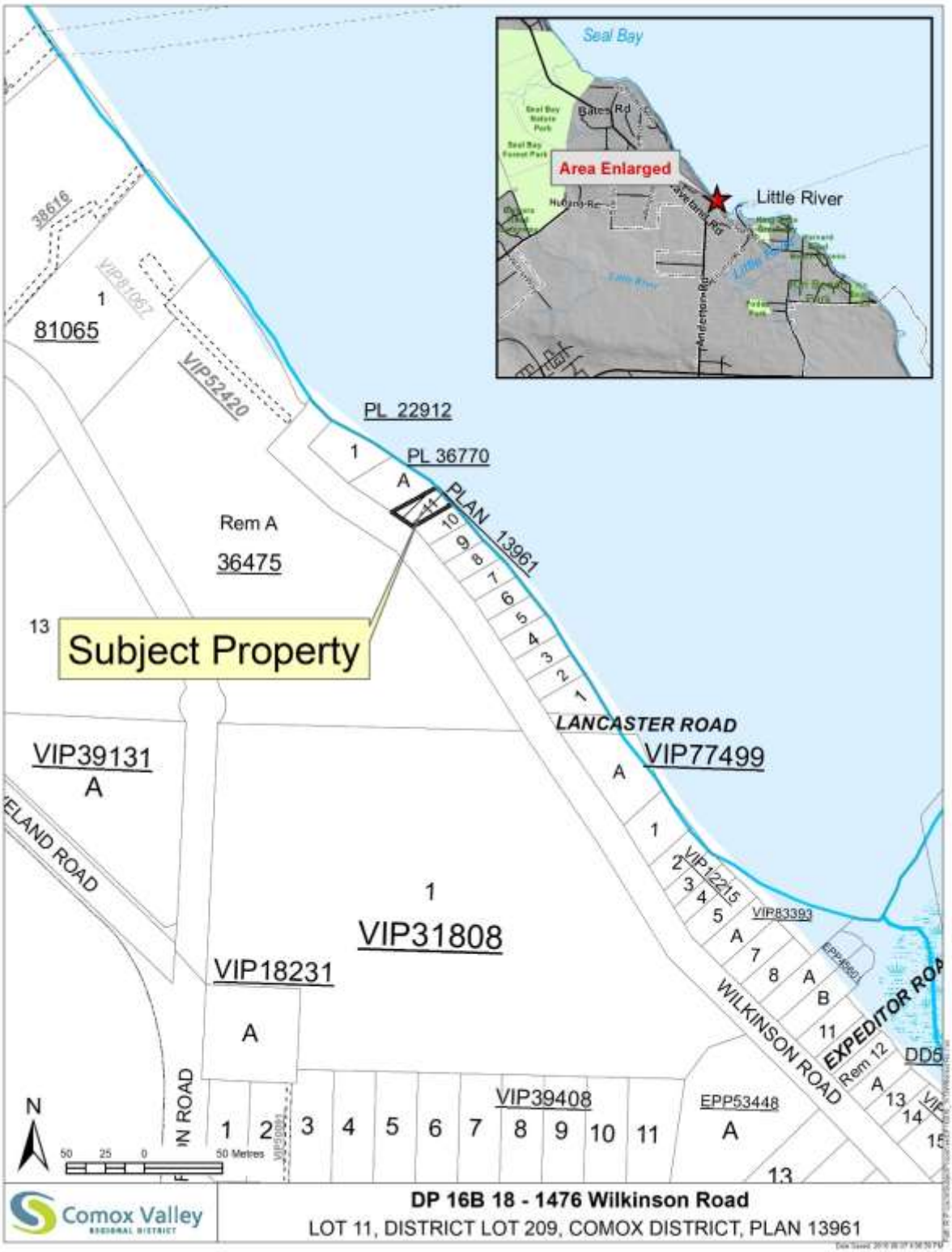


Figure 1: Subject Property Map

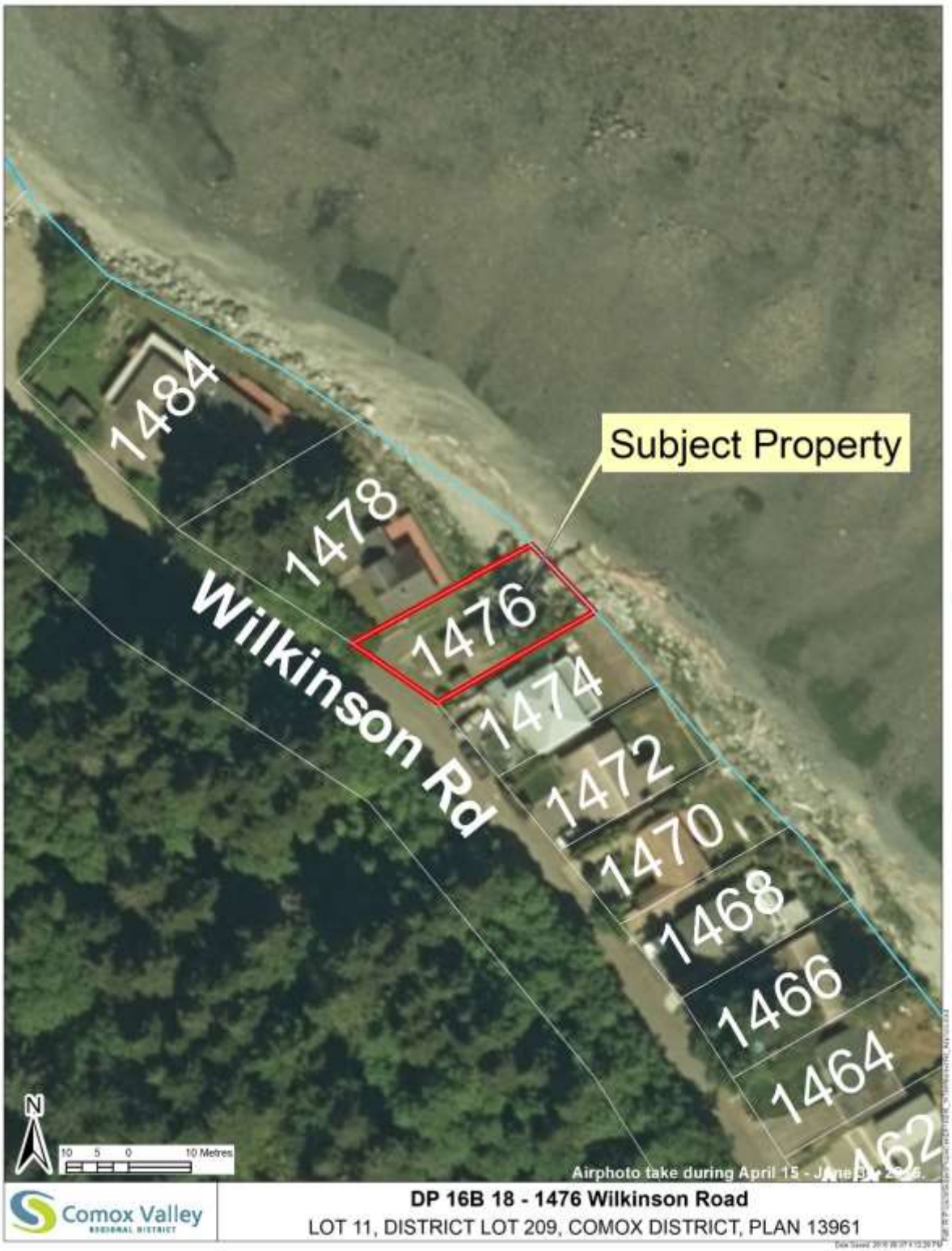


Figure 2: Air Photo

Figure 3: Single Detached Dwelling

Figure 4: Hard Shoreline Protection Devices on Neighbouring Properties

Comox Valley REGIONAL DISTRICT

Appendix A
Shoreline Protection Devices Development Permit

DP 16B 18

TO: Lawrence Wade, James Wade and Julie Busenius

1. This Development Permit (DP 16B 18) is issued subject to compliance with all of the Bylaws of the Comox Valley Regional District applicable thereto, except as specifically varied or supplemented by this permit for the **purpose of installing a shoreline protection device (rock slope) and replanting of native vegetation within the titled boundary of the subject property.**

2. This Development Permit applies to, and only to, those lands within the Comox Valley Regional District as described below:

Legal Description:	**Lot 11, District Lot 209, Comox District, Plan 13961**	
Parcel Identifier (PID):	**004-448-391**	**Folio: 771 03355.000**
Civic Address:	**1476 Wilkinson Road**	

3. The land described herein (Schedule A) shall be developed strictly in accordance with the following terms and conditions and provisions of this permit:

   i. THAT this Development Permit is for shoreline protection repairs within the titled boundary of the subject property as shown on Schedule B;

   ii. THAT shoreline protection repairs shall take place in accordance with the Coastal Engineering Report and Biophysical Assessment dated May 22, 2018, prepared by Jim Mitchell, P. Eng., QEP of Emerald Sea Engineering, attached as Schedule C;

   iii. THAT the applicant provide a Security Deposit in the form of an Irrevocable Letter of Credit or a Security Bond in the amount of $551.88 (125 per cent of $441.50) for implementation of the landscaping plan detailed in Schedule C;

   iv. THAT the project engineer must notify the Comox Valley Regional District of the timing of the proposed works and the name of the selected contractor(s) who will do the works in compliance with the engineer's report;

   v. THAT the fisheries window with the least risk is June 1 to September 1 and December 1 to February 15. If works are completed outside this window, it is the responsibility of the owners to ensure works do not contravene Section 35 of the *Fisheries Act* prohibition against serious harm to fish;

   vi. AND THAT a post development report is required from the applicable Qualified Professional providing an assessment of all works. The report must assess if the works are in compliance with the applicable development permit conditions.

4. This Development Permit is issued following the receipt of an appropriate site declaration from the Property Owner.

5. This Development Permit (DP 16B 18) shall lapse if construction is not substantially commenced within two (2) years of the Comox Valley Regional District Board's resolution regarding issuance of the development permit (see below). Lapsed permits cannot be renewed; however, a new application for a second development permit can be applied for in order to complete the remainder of the work.

6. This Development Permit is ***not*** a Building Permit.

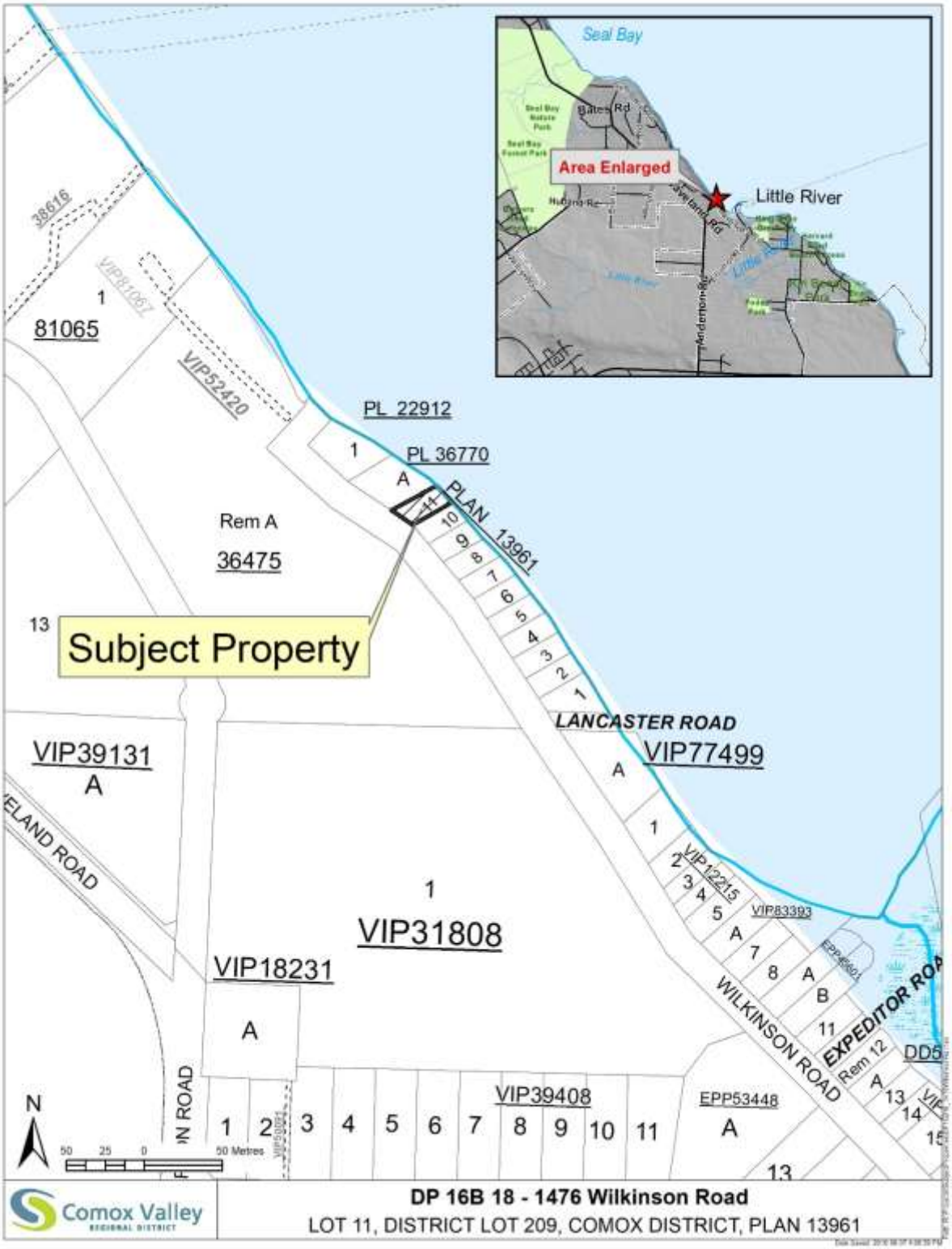
CERTIFIED as the **DEVELOPMENT PERMIT** issued by resolution of the board of the Comox Valley Regional District on _____.

_____
James Warren
Corporate Legislative Officer

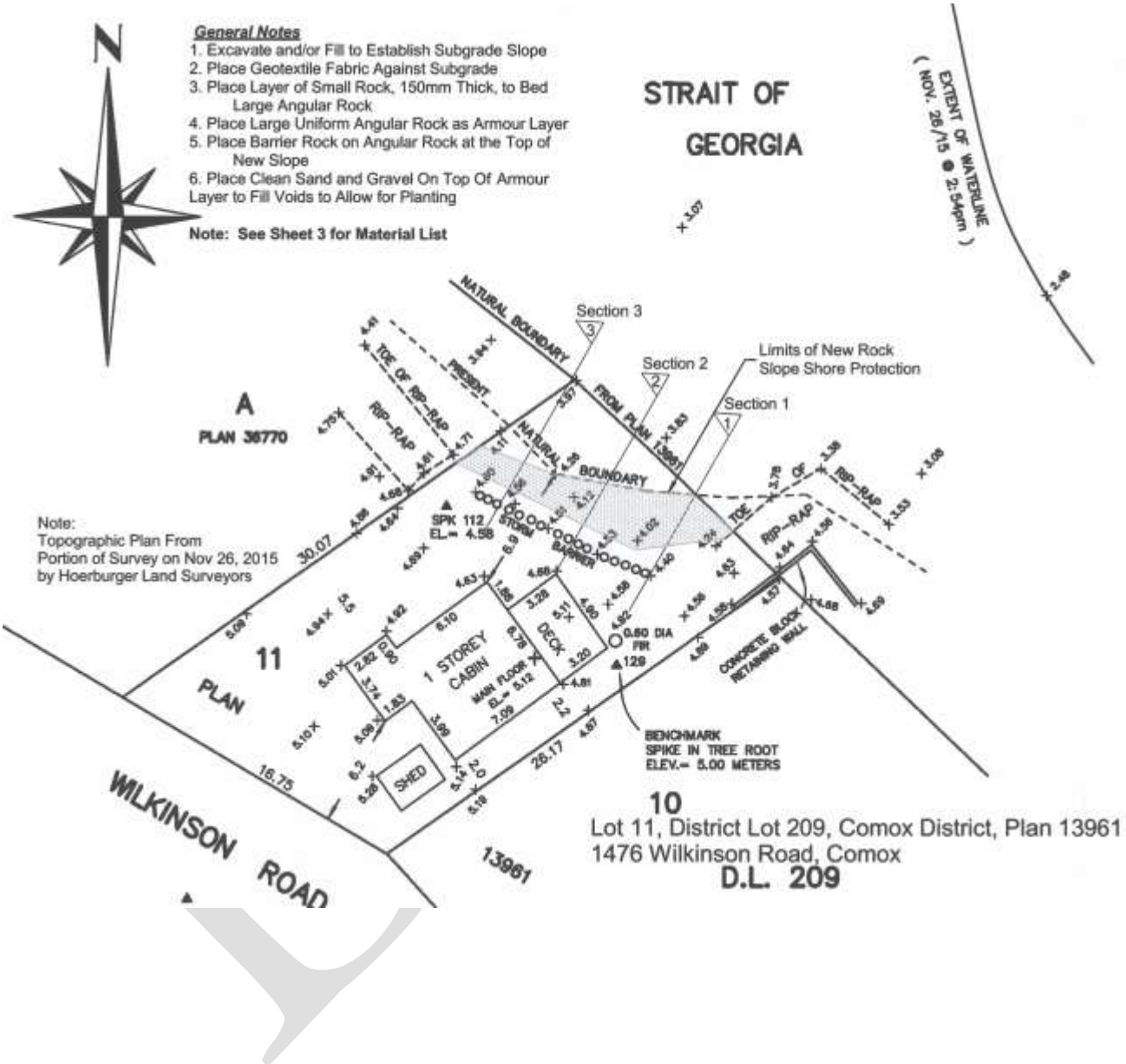
Certified on _____

Attachments: Schedule A – "Subject Property Map"
Schedule B – "Site Plan"
Schedule C – "Coastal Engineering Report and Biophysical Assessment, dated May 22, 2018"

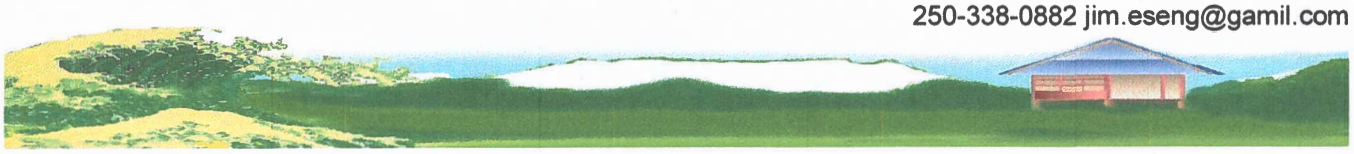
Schedule A
Subject Property Map



Schedule B
Site Plan



EMERALD SEA ENGINEERING 4920 Island Highway North, Courtenay, BC V9N 5Z1
250-338-0882 jim.eseng@gamil.com



Green Shores Green Sites Green Buildings

May 22, 2018

Planning Department
Comox Valley Regional District
600 Comox Road
Courtenay, BC V9N 3P6
Attn: Planning Services

Project: **1476 Wilkinson Road**
Shore Protection and Shoreline Enhancement
Courtenay, B.C.
Subject: **Report for Development Permit Area (DPA): Shore Protection Devices**

Dear Sir:

Introduction

Emerald Sea Engineering has completed this report in support of a Development Permit for Shore Protection Devices.

Proposed Shore Protection with Minimal Environmental Impact and Hardening

The existing dune grass and beach gravels and sands have not proved successful at preventing erosion at this site and the use of rock is required to provide a stable shoreline. While this will somewhat harden the shoreline, this shoreline is very flat with no vertical banks so we can use stone placed at a flat slope to create a shore protection berm with a low environmental impact and minimal hardening of the shoreline. The slope will be very flat at 4 horizontal to 1 vertical and will be relatively easy to walk on. It is quite different than traditional steep large riprap shore protection and will have a slope about half to a quarter of what is typical of traditional designs. Most of the stone will be buried in the sand with the inland side only about a couple feet above the existing ground at the row of existing shrubs. In addition to being flat enough to allow easy access, stone placed at this slope doesn't significantly reflect waves so any issues with scour of beach sands is minimized. A flat slope also allows the use of smaller rock (~2 feet) which provides more areas for planting and allows dune grass to grow in between rocks at a spacing similar to that which occurs naturally. Since waves tend to gradually roll over the placed stone rather than striking with a high impact, it also forms an area that is more conducive to establishing native plants, primarily dune grass and beach pea.

Assessment Methodology

1. Emerald Sea Engineering has completed a field review, including physical and biological observations and measurements of nearshore shoreline geometry.
2. A topographic and property survey was completed by Hoerberger Land Surveyors on November 26, 2015 (See attached Plan and Sections).
3. Estimates have been completed for probable wave heights, extreme water levels and stable rock sizes.
4. A design has been completed to construct a flat rock slope/berm shore protection with the smallest stable stone size and plantings (See attached Plan and Typical Sections and Planting Plan).

Need for Shore Protection

The survey shows the current natural boundary at the north end of the site is approximately 4.5m inland of the historic natural boundary so the shoreline has eroded significantly since subdivision. However, on the south side, the current natural boundary is seaward of the historic natural boundary due to construction of concrete walls and riprap on the property to the south. The property to the north also has riprap shore protection but it is well inland of the historic natural boundary. The need to provide the shore protection is clearly demonstrated for this project by the movement of the natural boundary on the middle to north side of the lot. It is particularly important at this small cottage lot as the cottage is only 6.9m to the natural boundary and at a similar elevation. This threatens the cottage structure and the onsite wastewater system next to it. At this time, there is no stone shore stabilization on the site, although there is the remains of a short timber piling bulkhead (noted storm barrier on the survey) about 4m from the cottage that would have primarily served to block driftwood but to a certain extent would inhibit wave runup from impacting the cottage.

Biophysical Assessment

The Strait of Georgia is an important and globally recognized marine habitat. Located between Vancouver Island and the mainland of British Columbia, the Strait receives an influx of cold water that is nutrient and oxygen rich from the north and to the south it receives the warmer waters from the Pacific at the southern end Vancouver Island. All pacific salmonids and most of the over 98 species of rockfish present in the Pacific Northwest are present in the Strait of Georgia. There is also a frequent occurrence of marine mammals including humpback, grey

and killer whales, seals, sea lions and porpoises. The Strait is very deep, dropping to from 140 to almost 200m deep half way to the mainland. In addition to pelagic fishes, there is also an abundant and diverse amount of benthic flora and fauna and the Strait is a world recognized SCUBA diving location. The fisheries of the area, particularly salmon, halibut and rockfish are heavily regulated and carefully managed.

The Strait can be a physically harsh environment with potentially 5m high waves. While these waves are reduced by shoaling and refraction as they approach the shoreline of Vancouver Island, waves several metres high can still occur quite close to shore. More information on the wave climate will be presented in the section on Shoreline Protection Design as these wave heights are what drive the design. Water levels fluctuate significantly and the average tide range is 5m.

The majority of biodiversity occurs in the subtidal areas but the nearshore areas still comprise a small but important part of the habitat. In the nearshore area, the lower intertidal areas are more productive and biodiverse areas than the upper shoreline and as we proceed to the normal high tideline this decreases further. The upper shoreline is a highly dynamic environment with moving rocks, gravels and sands forming an unstable environment. Above the natural boundary, the habitat transitions to terrestrial flora and fauna with increased stability and diversity.

One of the important functions of the upper intertidal area is as a habitat for juvenile fish. Many of the fish inhabiting the Strait of Georgia are in the area for different stages of their life cycle and juvenile fish commonly browse the shallow waters for plankton, terrestrial detritus and insects. To a limited extent, the shoreline plants and trees will also offer shade, organic detritus and habitat for insects that may provide food for juvenile fish browsing the upper intertidal areas.

The upper shoreline also provides an important habitat for birds and crabs to scavenge shoreline detritus and to a lesser extent, some terrestrial mammals like bear, mink, raccoon, otter and deer also scavenge and hunt on the shoreline. However, this use is typically transient, as with high tides and/or any significant wave action, the movement of sands, gravel and rock is hazardous to most marine life and the high water levels limit use by most terrestrial mammals.

The location of the toe of the new stone is at an elevation of about 5.6m Lowest Normal Tide(LNT-Chart Datum), about 0.9m above the Higher High Water Mean Tide (HHWMT). HHWMT is 4.7LNT and is the average of all high tides. Higher High Water Large Tide is 5.3 LNT and is the average of the highest tide of each year over a tidal epoch. This water level occurs about once a year and the toe of the structure is about 0.3m above this level. The highest recorded water level is 5.9 LNT or about 0.3m above the toe of the structure. In summary, average tide levels are well below the stone slope elevation, and would require significant wave action for the new stone to be wetted by waves. About once a year, water levels are expected to be high enough that small waves, 0.3 to 0.6m high may run up the shoreline and wet the new stone. Under extreme conditions the water may be over 0.3m deep at the stone and with an allowance for sea level rise as much as 0.6m deep fifty years in the future.

The existing substrate at the location of the new stone is primarily gravelly sand just above the existing natural boundary. Farther down the shore slope, there is a transient cover of moderate size driftwood and the beach transitions to larger cobbles and boulders. Quite large rock and boulders occur near the low tide line.

The sands and gravels in front of the lot are primarily not vegetated (see attached Photograph). Primarily dune grass plants (elymus mollis) and beach pea (Lathyrus japonicus) occur at and above the present natural boundary and in between the adjacent riprap. Above the natural boundary there is a "hedge" of snowberries (Symphoricarpus albus) and a row of salmonberries (Rubus spectabilis). The yard inland of the shrubs is a domestic lawn (fescues, rye grasses and bluegrasses).

Environmental Management Plan

We don't consider there to be a significant environmental risk to this project. It is well above all but the most extreme tide levels and the materials used will be clean rock, gravels and sands without significant silts or clays and any silty/clayey runoff will quickly infiltrate into the sandy gravelly soils. Large armour rock will be clean, inert basaltic or granitic rock and have only traces of fine silts or clays. This is also true of the small bedding rock which will be from similar materials. Filter fabric is inert and long lived and will be trimmed back to be hidden

below the placed stone and gravels. Construction equipment is a risk and fuels, lubricating and hydraulic oils could be spilled in a failure but standard practices have been developed for working in fish habitat and this will include having spill kits on hand and the use of organic oils and fuels where possible. Material delivery will be from land and will not significantly impact the shoreline outside the footprint of the construction.

Proposed Shore Protection

The substrate is primarily gravelly sand with a significant growth of dune grass (elymus mollis) and some beach pea (Lathyrus japonicus). The established dune grass on a gravelly sand substrate has failed to stop the erosion and harder shore stabilization than gravel and dune grass is required. As a result, as the next least impact measure, it is proposed to provide a planted, low, flat stone slope shore protection using the smallest rock that is stable for the wave heights estimated at the natural boundary with 50 years of sea level rise. The flat slope provides a non-reflective and low wave impact shoreline that allows maximum establishment of native plants and which will not impact neighbours significantly by changing sediment transport patterns. The stone will be replanted with dune grass and other native waterfront plants and shrubs. A plan and sections for the slope protection design and planting is attached. The plan and sections show elevations referenced to a project datum.

Coastal Engineering Design

The design of rock shore protection requires an estimation of extreme tidal elevations, approximate extreme wave height at the structure and estimation of the rock size required to be stable for the estimated wave height.

To estimate potential offshore wave conditions, first fetch calculations are completed which is the distance over which storm winds will blow to generate waves. The attached Full and Cropped Fetch Plans show the fetch distances used as input to the deepwater wave calculations. These fetches are averaged over a 30 degree wave generation heading and combined with extreme wind data from Comox Airport to estimate potential deepwater wave heights. A summary of these estimates is presented in the attached wave rose of Extreme Deep Water Wave Heights. Extreme waves as large as 1.8m high can be expected during extreme events from the NNW and diminishing to 1.0 to 1.2m for extreme events from the NE and ENE. The site is fairly protected from the southeast although waves refracting and diffracting around the Little River Ferry terminal will likely approach the size of the waves that

directly impact the site. These waves exceed what is expected to be the largest waves that can exist in the shallow near shore water so the design wave height becomes limited by the water depth at the new structure.

The extreme recorded high still water level at this location (HWX) is estimated to be 5.9m LNT and this water level occurs about once every thirty years. Another tidal level of interest is the Highest High Water Large Tide which is estimated to be 5.30m LNT. This is the average of the highest tide each year over a 19 year tidal epoch. In other words, on average, this is the elevation of the highest tide of each year. Higher High Water Mean Tide (HHWMT) 4.70m LNT is the average of all the high tides in the 19 year tidal epoch and is basically an average high tide.

As can be seen on the sections, the toe of the proposed small stone berm is approximately at 4.0m Project Datum or 5.6m LNT. This means the structure is well above the current average high tide (MHHW), 0.3m the average highest tide of each year (HHWLT) and about 0.3m below the extreme recorded high still water level (HWX). As a result, the structure is rarely in contact with water. When waves contact the structure it is normally it is due to wave runup above the tidal level.

If we take the still water depth of the toe of the structure to be about 0.3m at the extreme High Water level (HWX) and add an allowance for fifty years of sea level rise of 0.3m we end up with a water depth of 0.6m once a year after fifty years of sea level rise. The maximum wave height under these conditions is 0.8m which has been used to estimate stable rock sizes for a 4:1 slope. The estimated stable 50% gradation of rock is 45 kgs and 300mm in diameter. To provide a safety factor, this has been used as the smallest rock size and armour stone specified for the design is between 300 and 600 mm.

Potential Impact on Neighbours

The existing substrate in front of the site is sand and gravel and while there is active sediment transport along the shoreline, generally to the northwest, impacts to neighbours will not be significant since they are already armoured by riprap and/or concrete walls.

The project has been designed with a very flat slope (4:1) of small stone (less than 2 foot) buried in at the toe and will be very none reflective and very low impact and this also minimizes potential impacts on neighbours.

Frequency of Wave Contact with the Stone Berm

The extreme recorded water level has an approximate return period of 30 years so a water depth of 0.6m is expected to occur at the toe of the stone berm with this frequency after 50 years of sea level rise.

The actual frequency of wave runup on the shore protection is very complicated and must consider the combined probabilities of water (tide) levels, wind speed, wind direction, wave height, wave direction, shoaling and depth limited waves and it typically is not feasible to complete a full wave runup probability study for a residential project.

Ecological Impact Review
Current Conditions

The area of the proposed shoreline protection is currently bare gravelly sand. The native growth is predominantly scattered to dense Dune Grass (Elymus mollis) growing on the gravelly sand with less frequent occurrences of Beach Pea (Lathyrus japonicus).

Conditions after Proposed Shore Protection Construction

After construction, there will be medium stone over smaller rock in the footprint as described above. A scattering of large boulders will be placed on top to prevent driftwood from accumulating inland. The entire area will be replanted with dune grass and other native shrubs anchored into the crevices between rocks (See attached Planting Plan. With the use of smaller stone and flatter slopes than traditional large rock armour slopes, the spacing of plants can remain very similar to what occurs in the native gravelly sand substrate.

Summary of Ecological Impact

The ecological impact is that bare gravelly sand and dune grass will be replaced with dune grass and other native plants growing in a flat small stone substrate with occasional large boulders. Erosion will be controlled at the natural boundary providing a stable environment for optimum establishment of plants. The new stone slope is considered more ecologically desirable than an eroding shore. The stone allows excellent drainage and provides improved habitat by providing a stable area with crevices and openings that plants, insects and small animals can occupy. The replanted shore protection is effectively status quo with no significant change.

Conclusion

In conclusion, the affect of this project has not significantly changed the ecological health of the immediate area. The project has primarily maintained the status quo with small changes occurring that potentially improve the ecology as a result of elimination of erosion and stabilization of planted areas. We conclude that the project to construct a flat slope stone berm shore protection to protect this residential site from erosion is safe and suitable for the intended use and has minimal ecological impacts.

Post Construction Review

It is recommended that a post construction review be completed by Emerald Sea Engineering to insure that construction and landscaping has been completed in accordance with the shore protection design plans, sections and planting plan.

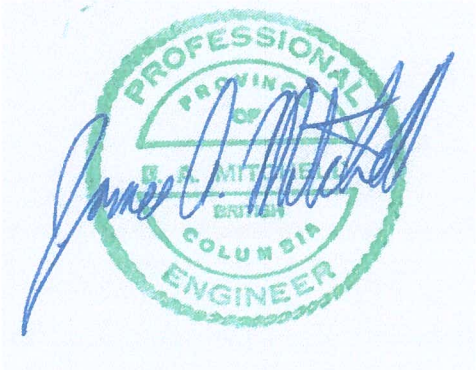
Limitations

The conclusions and recommendations submitted in this report are based upon the data obtained from a limited number of observations. The nature and extent of variations may not become evident until further investigation. If unanticipated conditions are discovered, we should be contacted immediately to allow reassessment of the conclusions provided.

Closure

I hope this provides you the information you require to process the Development Permit Application for this project. Please contact me if you have any questions.

Sincerely,



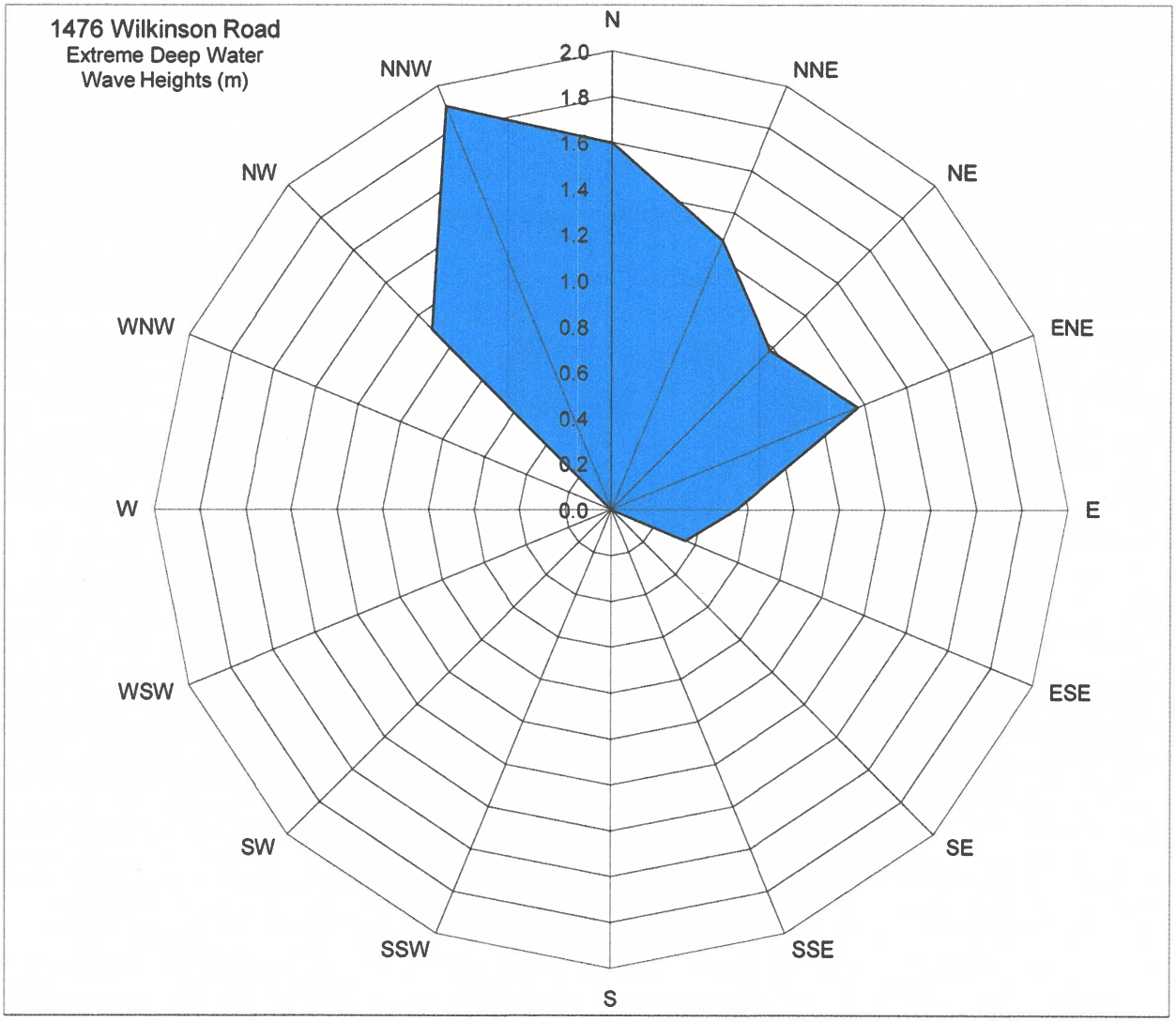
Jim Mitchell, PEng, QEP, MS Ocean Engineering
Emerald Sea Engineering

Attachments:

- Project Location
- Aerial Project Location
- Shore Protection Plan and Sections; 3-11"x17" drawings
- Planting Plan 11"x17"
- Full Fetch Plan
- Cropped Fetch Plan
- Deepwater Wave Rose
- High Water and Maximum Wave Height Tables
- Stable Rock Size

1476 Wilkinson Road
Project Location

1476 Wilkinson Road
Aerial Project Location


1476 Wilkinson Road
Extreme Deep Water
Wave Heights (m)
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0

Maximum Wave Height at Structure (Hb)
AS PER USACOE SPM 1984

Wilkinson Rd Water Depths at Toe of Structure (ds) ds (m)	Design Water Levels w 0.3m SLR (m) LNT	Elevation of Toe @ 5.6
Highest Recorded	6.2	0.6
HHWLT	5.6	0
HHWMT	5.0	-0.60

Depth of Breaking (db) and
Required Deepwater Wave Height (Ho)
to generate Hb at structure
Nearshore Slope, m=0.07 (~1:15)

ds=0.25m, Toe El=2.25m GSC				ds=0.5m, Toe El=2.0m GSC			
Period T=	4	6	7.5	Period T=	4	6	7.5
Hb(m)=	0.4	0.4	0.4	Hb(m)=	0.7	0.8	0.8
db(m)=	0.3	0.3	0.3	db(m)=	0.7	0.7	0.7
Ho(m)=	0.2	0.2	0.2	Ho(m)=	0.5	0.4	0.4

ds=1m, Toe El=1.5m GSC				ds=1.5m, Toe El=1.0m GSC			
Period T=	4	6	7.5	Period T=	4	6	7.5
Hb(m)=	1.3	1.5	1.6	Hb(m)=	1.7	2.1	2.3
db(m)=	1.2	1.4	1.3	db(m)=	1.9	2.0	2.0
Ho(m)=	1.1	1.0	0.9	Ho(m)=	1.4	1.6	1.5

ds=2m, Toe El=0.5m GSC				ds=2.5m, Toe El=0.0m GSC			
Period T=	4	6	7.5	Period T=	4	6	7.5
Hb(m)=	2.0	2.6	2.9	Hb(m)=	2.3	3.3	3.5
db(m)=	2.6	2.6	2.7	db(m)=	3.1	3.6	3.3
Ho(m)=	1.8	2.1	2.1	Ho(m)=	2.3	2.7	2.7

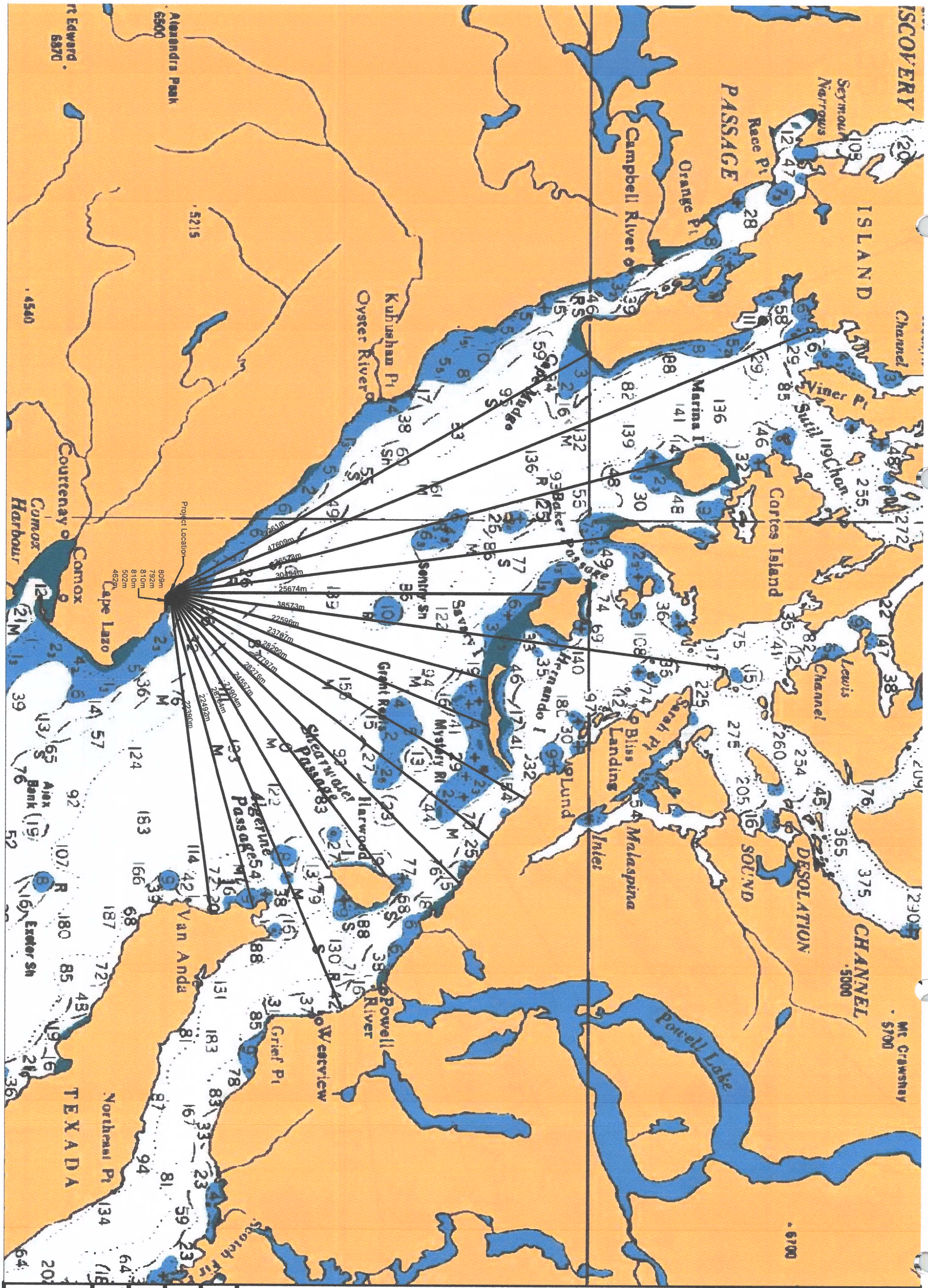
FINAL ROCK SIZE SUMMARY
ROCK SHORE PROTECTION DESIGN
FINAL DESIGN - WAVE HEIGHT ASSUMED TO BE 0.8m FOR ARMOUR ROCK
Wilkinson

AS PER 1984 USACOE SPM

Armour Rock - Wave		0.8 m		
Slope		1 : 1		
Thickness, tRR	1.66 feet			
	0.51 metres			
	Max.	50%	Min.	
Weight (lbs)	119	95	71	
Diameter (ft)	1.03	0.96	0.87	
Diameter (mm)	314	292	265	
Underlayer				
Thickness, tUL	0.36 feet			
	0.11 metres			
Weight (lbs)	1.113	0.278	0.035	
Diameter (ft)	0.218	0.137	0.069	
Diameter (mm)	66	42	21	

RECOMMENDED FINAL GRADATIONS AND ROCK CLASSES

	Rock Size (mm) Per Cent By Weight Smaller Than				
	100%	85%	50%	15%	0%
Area I					
Armour Rock	600	-	450	-	300
Bedding Rock	150		75		25



REVISIONS BY	
DATE: 14 Sept 16	
250,000:1 @ 11x17	
Drawn: DBB	
Wilkinson Rd	
Sheet 1 of 2 Sheets	

Emerald Sea Engineering

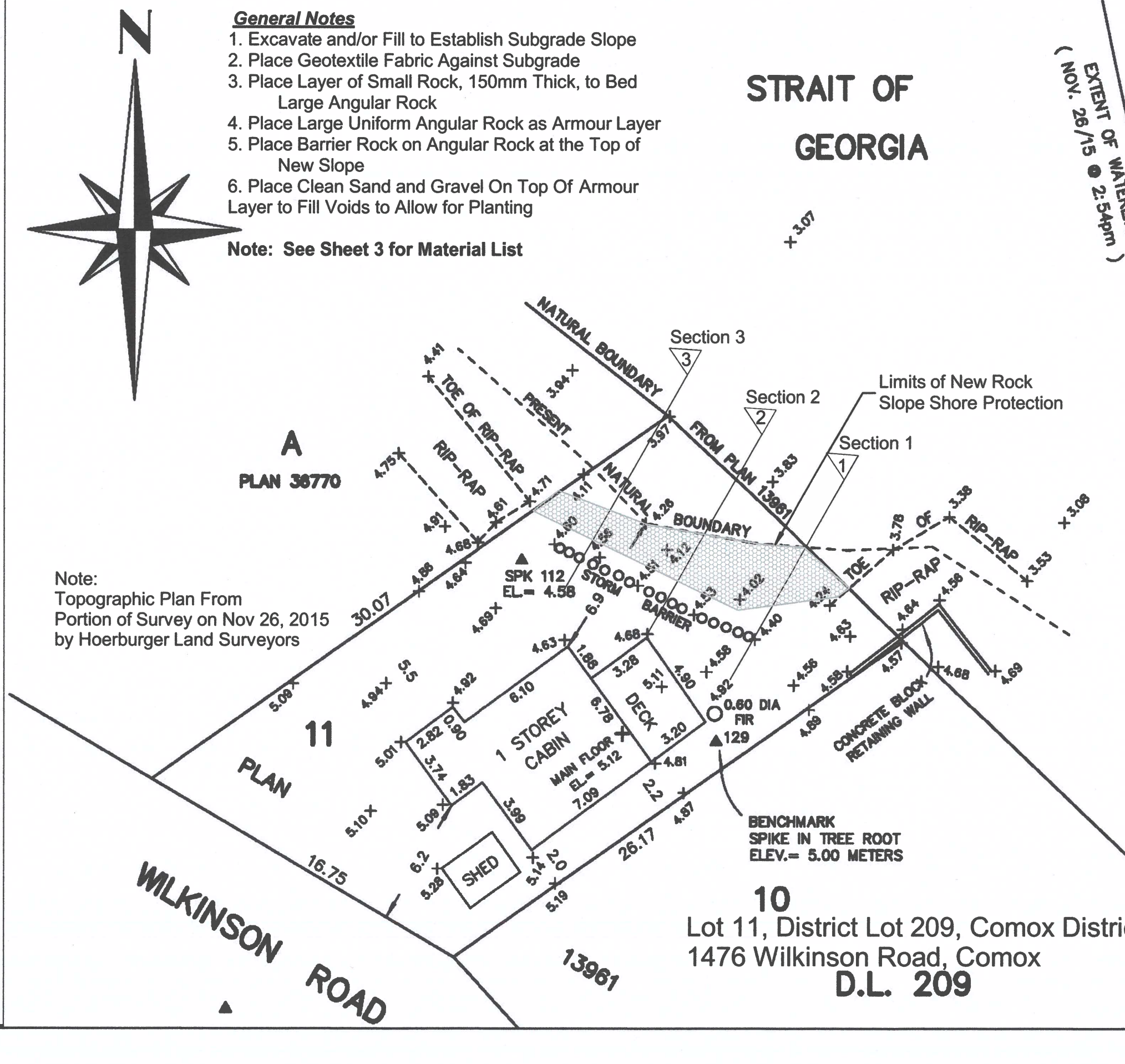
4920 Island Highway North
Courtenay, BC V9N 5Z1
250-338-0882
jim.eseng@gmail.com

1476 Wilkinson Road
Full Fetch Plan

General Notes

1. Excavate and/or Fill to Establish Subgrade Slope
2. Place Geotextile Fabric Against Subgrade
3. Place Layer of Small Rock, 150mm Thick, to Bed Large Angular Rock
4. Place Large Uniform Angular Rock as Armour Layer
5. Place Barrier Rock on Angular Rock at the Top of New Slope
6. Place Clean Sand and Gravel On Top Of Armour Layer to Fill Voids to Allow for Planting

Note: See Sheet 3 for Material List



Note:
Topographic Plan From
Portion of Survey on Nov 26, 2015
by Hoerburger Land Surveyors

Lot 11, District Lot 209, Comox District, Plan 13961
1476 Wilkinson Road, Comox
D.L. 209

REVISIONS BY	

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1476 Wilkinson Rd
Shore Protection Plan

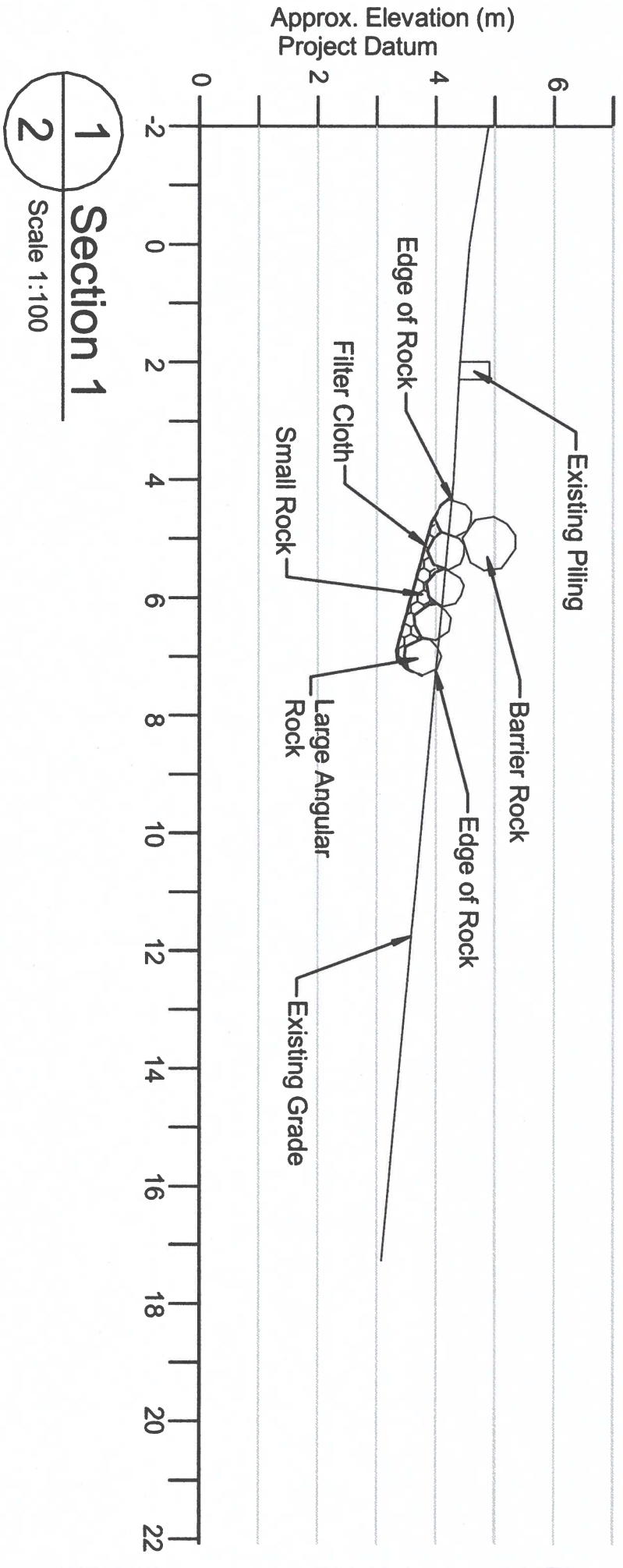
DATE: 14 Sept 16

Scale 1:200

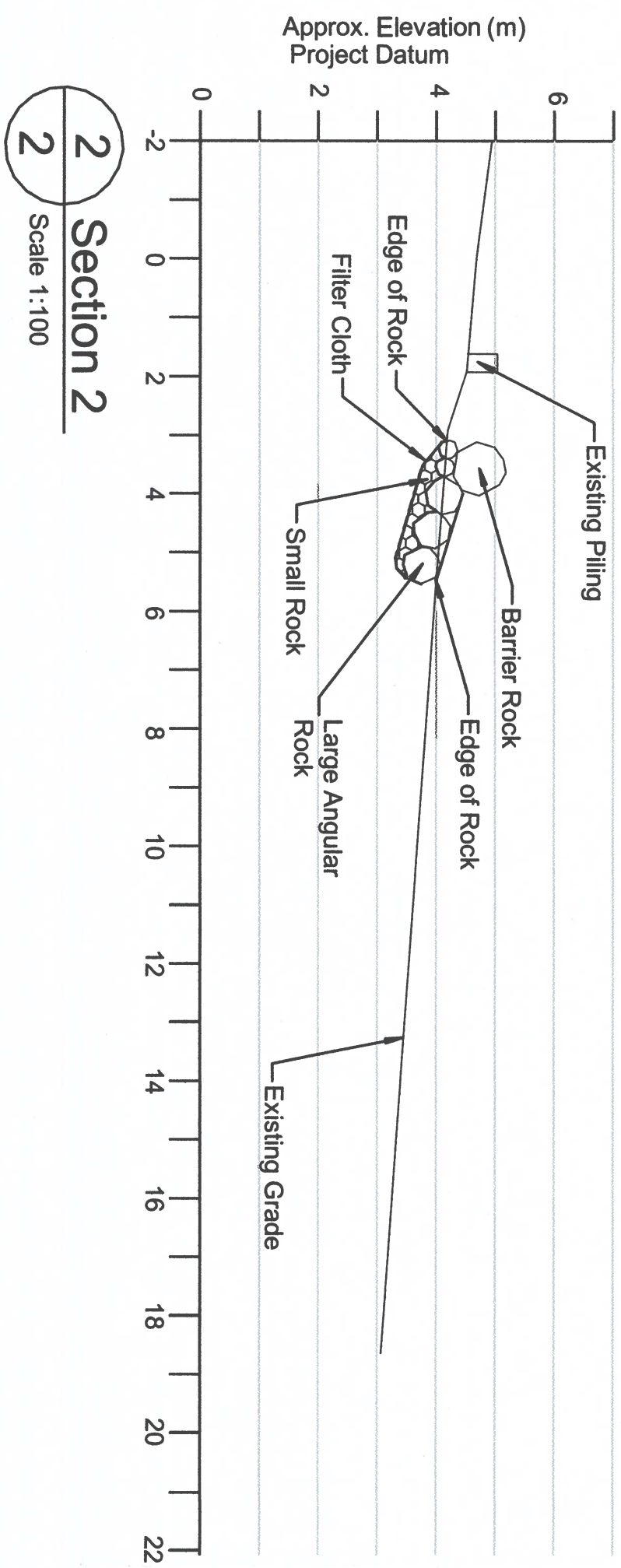
Drawn: DBB

Wilkinson Road

Sheet 1 of 3 Sheets



1 2 Section 1
Scale 1:100



2 2 Section 2
Scale 1:100

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As Shown	
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Wilkinson Road	
Sheet 2 of 3 Sheets	

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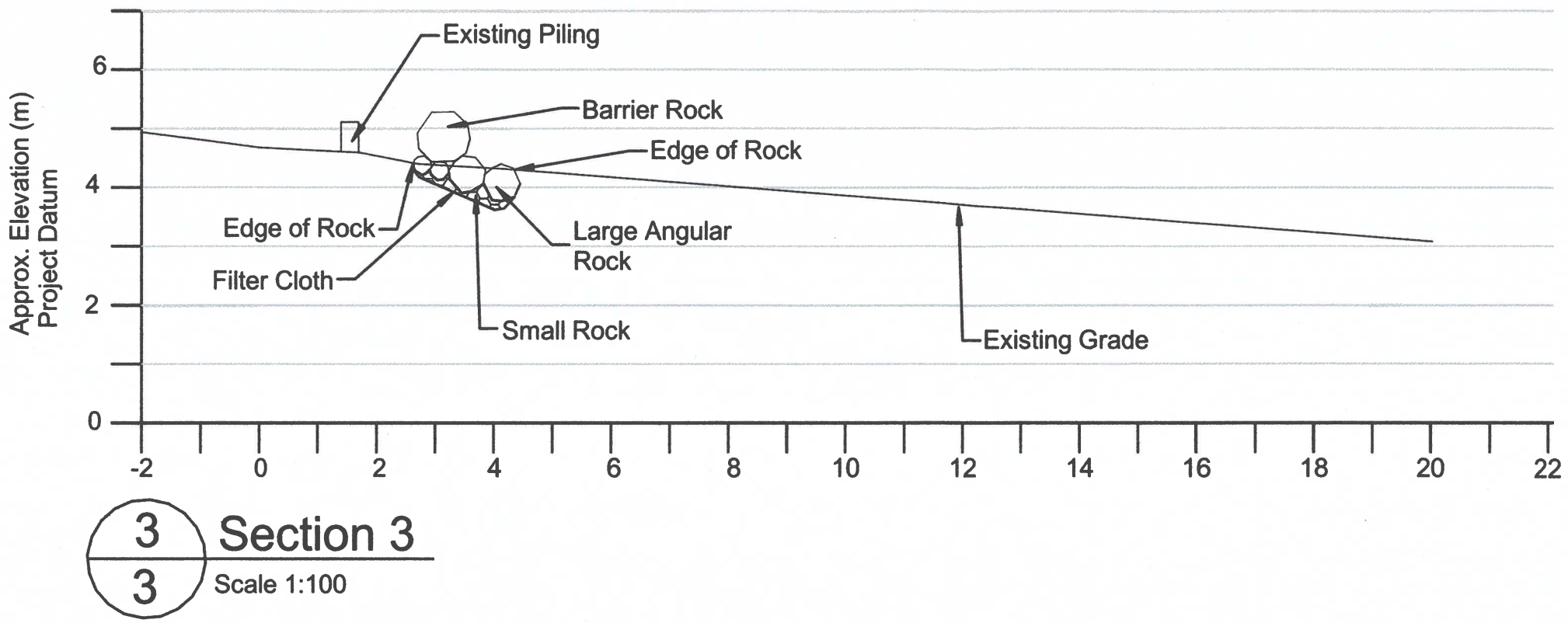
1476 Wilkinson Rd
Construction Sections
Sections 1 & 2



3/3 Section 3

Scale 1:100

Materials

1. Geotextile Fabric Shall Be Nonwoven Armco 400 or Equal.
2. Small Rock For Bedding Armour Rock Shall Be 150mm Minus Angular Quarry Rock.
3. Angular Rock Shall be Sorted Hard Dense, Basaltic and/or Granitic Quarry Blast Rock.
4. Large Angular Rock Shall be 0.3 to 0.6m with Larger Rock (0.6m) Used for the Seaward Rock and Smaller Rock (0.3m) used for the Landward Rock.
5. Large Angular Armour Rock Shall Be Measured by Averaging of Three Perpendicular Dimensions.
6. No Single Dimension Shall Be Less Than 0.2m.
7. Barrier Rock Shall be 0.8 to 1.0m and Placed Approximatily Every 2m.

REVISIONS BY	

Engineering

1476 Wilkinson Rd
Construction Sections
Section 3

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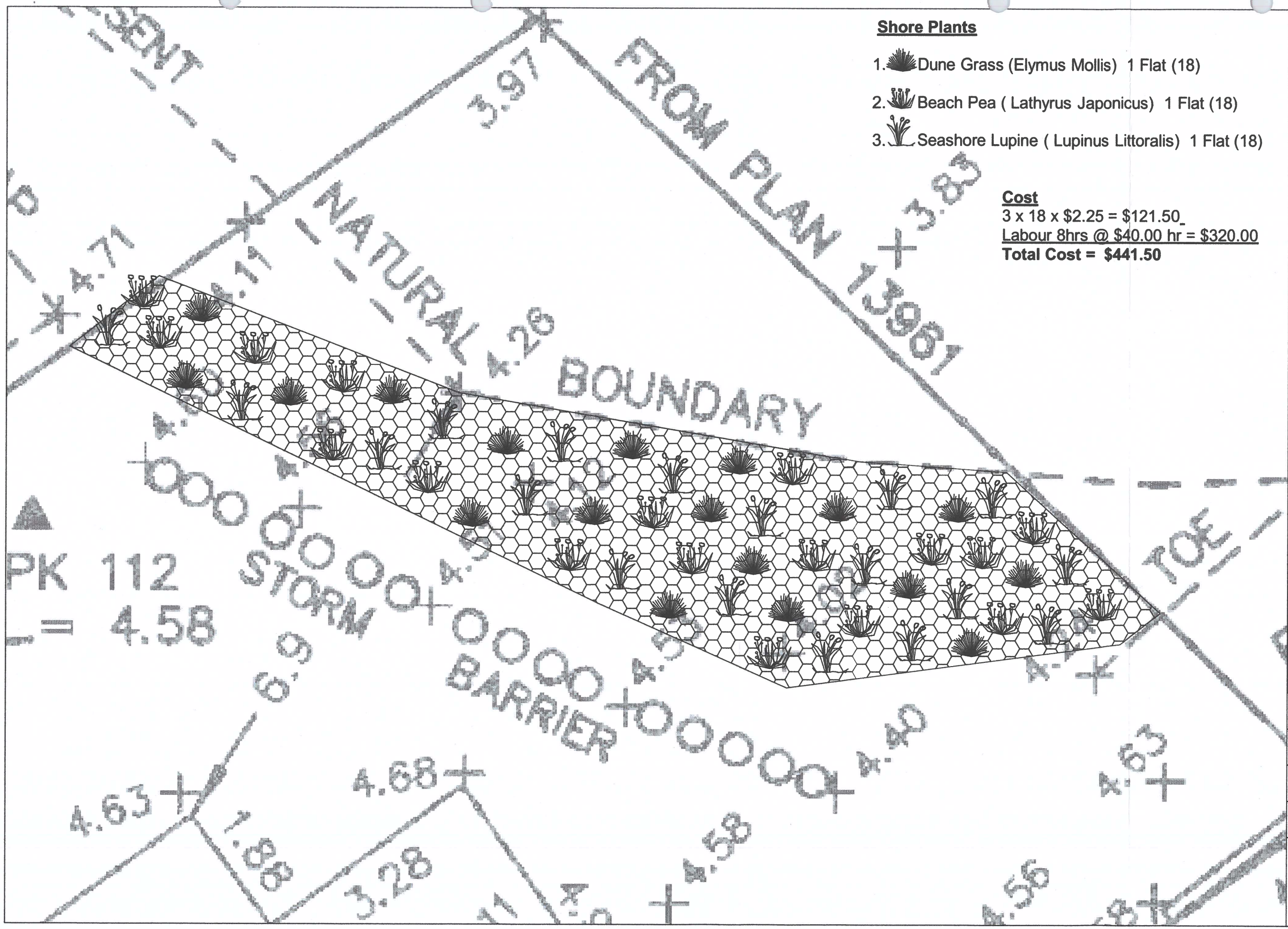
DATE: 14 Sept 16

As Shown

Drawn: DBB

Wilkinson Road

Sheet 3 of 3 Sheets



Shore Plants

1. Dune Grass (Elymus Mollis) 1 Flat (18)
2. Beach Pea (Lathyrus Japonicus) 1 Flat (18)
3. Seashore Lupine (Lupinus Littoralis) 1 Flat (18)

Cost
3 x 18 x $2.25 = $121.50
Labour 8hrs @ $40.00 hr = $320.00
Total Cost = $441.50

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1476 Wilkinson Rd
Shore Protection
Planting Plan

DATE: 20 Sept 16

Scale 1:50

Drawn: DBB

Wilkinson Road

Sheet 1 of 1 Sheets