

with FLNR:EX

From: Jason Schleppe <jschleppe@ecoscapeltd.com>
Sent: Monday, January 15, 2018 11:27 AM
To: Li, Yi FLNR:EX; Craig Williams
Cc: Tara Hirsekorn; Weir, Keith FLNR:EX; Mackie, John; commodore@vernonyachtclub.com
Subject: RE: VYC maintence and expansion - our file 2006-501059

Hi Yi,

Please ensure that you include me in all discussions with the engineer. As the agent, I wish to remain apprised about any concerns.


Thanks
Jason

JASON SCHLEPPE, M.SC., R.P.BIO
SENIOR NATURAL RESOURCES BIOLOGIST
ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.

Phone: 250.491.7337 ext. 202 / Fax: 250.491.7772 / Cell: 250.808.3474

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-----Original Message-----

From: Li, Yi FLNR:EX [mailto:Yi.Li@gov.bc.ca]

Sent: Monday, January 15, 2018 11:07 AM

To: Craig Williams <craig@telus.net>

Cc: Jason Schleppe <jschleppe@ecoscapeltd.com>; Tara Hirsekorn <tara@watersedgeltd.ca>; Weir, Keith FLNR:EX

<Keith.Weir@gov.bc.ca>; Mackie, John <John.Mackie@tc.gc.ca>; commodore@vernonyachtclub.com

Subject: Re: VYC maintence and expansion - our file 2006-501059

Hi Craig,

Thanks for your reply.

I understand the situation of your existing floating breakwater. It needs to be improved.

The impact of the wall on nearby waters may be a major concern in your application. Although the engineering report addresses the issue, we may need to get more insights. I'll discuss with Tara in detail soon.

Regards
Yi

----- Original message -----

From: Craig Williams <craig@telus.net>

Date: 2018-01-15 10:40 (GMT-08:00)

To: "Li, Yi FLNR:EX" <Yi.Li@gov.bc.ca>

Cc: Jason Schleppe <jschleppe@ecoscapeltd.com>, Tara Hirsekorn <tara@watersedgeltd.ca>, "Weir, Keith FLNR" <Keith.Weir@gov.bc.ca>, "Mackie, John" <John.Mackie@tc.gc.ca>, commodore@vernonyachtclub.com

Subject: RE: VYC maintence and expansion - our file 2006-501059

Hi Yi,

Sorry for the delay in responding to your email below. s.22

I can't begin to imagine the workload you must be under, especially with the flooding experienced last summer and the problems that created around the province but it is with great relief to hear you are reviewing our application. As you are no doubt aware the condition of our existing floating concrete breakwater is poor at best and worsens considerably now with every storm it is subjected to, such that we are convinced a catastrophic failure is imminent.

In answer to your question below about the 23 m-long wall at the southern end, this will confirm that wall is part of our proposal and will be constructed as part of the project. This pile driven wall is necessary to allow ingress and egress from our existing boat launch due to its narrower width compared to that of the floating sections and creates the necessary overlap to protect the marina. Please refer to the drawings submitted in the report by Ecoscape for more specific details.

Our neighbours are aware of our proposal (we have had Public outreach) and for reasons of expediency I would direct you to Keith Weir of your Kamloops office for the specific details. Note that our two newest neighbours just purchased in December 2016 and in May 2017 respectively, and we have informed them as well. It is noted here that the previous owners were also aware, and with appropriate due diligence before purchasing their respective neighbouring properties, these new owners should have been aware of the proposal prior to purchasing. The Vernon Yacht Club does not accept responsibility for a failure to disclose to the new owners of these properties, because the previous owners were aware. Keith Weir has been informed of all of these details as well.

If you haven't already done so please feel free to contact Tara directly with any questions you have.

If I can be of further assistance please be sure to let me know immediately.

Cheers,

Craig Williams
Okanagan Approval Corp. and
Sierra Mortgage Fund Ltd.
3300 - 34th Avenue
Vernon, BC V1T 2P7
Off: (250) 558-1111
Fax: (250) 558-1100
Cell: (250) 503-8993
Email: craig@telus.net

From: Li, Yi FLNR:EX [mailto:Yi.Li@gov.bc.ca]

Sent: Thursday, January 11, 2018 5:05 PM

To: 'craig@telus.net' <craig@telus.net>

Cc: 'Jason Schleppe' <jschleppe@ecoscapeltd.com>; 'Tara Hirsekorn' <Tara@WatersEdgeLTD.ca>

Subject: RE: VYC maintence and expansion - our file 2006-501059

Hi Craig,

I am reviewing your application.

A 23-m-long wall is proposed at the southern end. Have you decided to install the wall for final construction?

In addition, your neighbors have been informed of the proposed work? Particularly, those dock owners immediately south to your marina.

I may have some question on the engineering report. I'll contact your engineer, Tara Hirsekorn, PEng.

Regards

Yi

Yi Li, PEng

Regional Hydrologist / Assistant Water Manager Regional Water Management Thompson Okanagan Region BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development

102 Industrial Place, Penticton, BC V2A 7C8

E-Mail: Yi.Li@gov.bc.ca<mailto:Yi.Li@gov.bc.ca>

T: (250) 490-8265 | M: (250) 462-4871 | F: (250) 490-2231

From: Li, Yi FLNR:EX

Sent: Friday, December 22, 2017 2:11 PM

To: 'Jason Schleppe'; Mackie, John

Cc: 'craig@telus.net'; Weir, Keith FLNR:EX

Subject: RE: VYC maintence and expansion - our file 2006-501059

Hi Jason,

My review is still underway. I'll get back to you in January.

Regards

Yi

From: Jason Schleppe [mailto:jschleppe@ecoscapeltd.com]

Sent: Thursday, December 21, 2017 9:20 AM

To: Mackie, John

Cc: 'craig@telus.net'; Weir, Keith FLNR:EX; Li, Yi FLNR:EX

Subject: RE: VYC maintence and expansion - our file 2006-501059

Thanks, and understood.

Keith, can you confirm, based upon your review thus far that this is the case. We have designed it to meet our understanding of the requirements of Crown Lands, and I think we generally have. I know we had discussed the on nearshore area (i.e., the logs caballed to shore) and I had indicated that we would make sure that these fit within the tenure boundary at time of construction. Was there anything else?

Yi, can you also let us know how your review is proceeding. As we mentioned before, the current status of the breakwater is poor, and the VYC really wants to being repairs. Once approvals are in hand, the concrete works will need to start, and these will take some time. The VYC is reluctant to let that contract go until they have some confidence that this proposal will move forward.

Jason Schleppe, M.Sc., R.P.Bio
Senior Natural Resources Biologist
Ecoscape Environmental Consultants Ltd.

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P Please consider the environment before printing this e-mail

Thanks Jason,

From: Jason Schleppe [mailto:jschleppe@ecoscapeltd.com]
Sent: Thursday, December 21, 2017 8:56 AM
To: Mackie, John <John.Mackie@tc.gc.ca<mailto:John.Mackie@tc.gc.ca>>
Cc: 'craig@telus.net' <craig@telus.net<mailto:craig@telus.net>>; 'Weir, Keith FLNR:EX'
<Keith.Weir@gov.bc.ca<mailto:Keith.Weir@gov.bc.ca>>; Yi Li <Yi.Li@gov.bc.ca<mailto:Yi.Li@gov.bc.ca>>
Subject: RE: VYC maintenance and expansion - our file 2006-501059

The breakwater placement should be similar to the pile supported submission, it is just now a floating breakwater. We meet all of the requirements of Crown Lands for the submission in terms of offsets from property boundaries, etc. This was all designed with those in mind.

Out of curiosity, how does TC consider the existing tenure as it relates to neighbors comments? It is important to note that we are only building out what the VYC is already tenured for, the only change is physical infrastructure because it needs repair, within their existing tenure. The neighbors are not overly happy with the proposed structure, but, the

tenure boundary has been in place for long time and the owners of adjacent properties had access to the tenure information for many years.

Thanks
Jason

Jason Schleppe, M.Sc., R.P.Bio
Senior Natural Resources Biologist
Ecoscape Environmental Consultants Ltd.

Phone: 250.491.7337 ext. 202 / Fax: 250.491.7772 / Cell: 250.808.3474

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From: Mackie, John [mailto:John.Mackie@tc.gc.ca]
Sent: Thursday, December 21, 2017 8:34 AM
To: Jason Schleppe <jschleppe@ecoscapeltd.com<mailto:jschleppe@ecoscapeltd.com>>
Cc: 'craig@telus.net' <craig@telus.net<mailto:craig@telus.net>>; 'Weir, Keith FLNR:EX' <Keith.Weir@gov.bc.ca<mailto:Keith.Weir@gov.bc.ca>>; Yi Li <Yi.Li@gov.bc.ca<mailto:Yi.Li@gov.bc.ca>>
Subject: RE: VYC maintenance and expansion - our file 2006-501059

Thanks Jason.

Some of the information depicting the tenure and bkwr placement (nearest the direct neighbours to the south) doesn't look the same. Does the owner have a tenure and works configuration that they wish to go with? As well, are there comments from those neighbours that border the VYC? John

From: Jason Schleppe [mailto:jschleppe@ecoscapeltd.com]
Sent: Friday, November 17, 2017 11:19 AM
To: Mackie, John <John.Mackie@tc.gc.ca<mailto:John.Mackie@tc.gc.ca>>
Cc: 'craig@telus.net' <craig@telus.net<mailto:craig@telus.net>>; 'Weir, Keith FLNR:EX' <Keith.Weir@gov.bc.ca<mailto:Keith.Weir@gov.bc.ca>>; Yi Li <Yi.Li@gov.bc.ca<mailto:Yi.Li@gov.bc.ca>>
Subject: RE: VYC maintenance and expansion - our file 2006-501059

Hi John,

Attached are a summary of the different public outreach components that have been undertaken by the VYC.

- The two ads we ran in the local newspaper on two consecutive Sunday editions in August of 2016;
- A photo of the staking notice placed on site in August of 2016;

- A copy of a poster that was advertised via asocial media and placed on sandwich boards around the neighborhood extending an invitation to all in the neighborhood to a collaborative "Open House" held August 27 2016 at the VYC on August 25, 2016 where members of our Executive were available to answer questions;
- A copy of the speech given by Lawrence Johnson, our Commodore at the time, at Greater Vernon Chamber of Commerce "Business after 5:00" event sponsored by the VYC on Tuesday April 18th this year;

It is important to note that some of the properties have changed hands in close proximity to the marina (i.e., direct neighbors). The VYC had undertaken full disclosure with previous owners, and the transactions happened during the design phases of the project. As such, the VYC has had to also undertake discussions with the new owners. It is noted here that the previous owners did not fully disclose information they had to the purchasers at the time of sale, which was surprising to the VYC. A full summary of the information provided to both the previous and current owners is available if you wish, I just need to forward it off. I am just not sure whether you wish to see all of that summary, so I have left it out for now. I have only included the more "typical" public outreach information (i.e., newspapers, etc.) from Craig to pass along in this email, but will provide the rest of the information if you feel it is needed. There has been several discussions, meetings, and other actions taken to provide information to the adjacent neighbors over the last few years.

Thanks and let me know if you need anything further,

Thanks

Jason

JASON SCHLEPPE, M.SC., R.P.BIO

SENIOR NATURAL RESOURCES BIOLOGIST

ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.

Phone: 250.491.7337 ext. 202 / Fax: 250.491.7772 / Cell: 250.808.3474

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-----Original Message-----

From: Mackie, John [mailto:John.Mackie@tc.gc.ca]
Sent: Tuesday, October 10, 2017 11:06 AM
To: Jason Schleppe <jschleppe@ecoscapeltd.com<mailto:jschleppe@ecoscapeltd.com>>
Cc: 'craig@telus.net' <craig@telus.net<mailto:craig@telus.net>>; 'Weir, Keith FLNR:EX' <Keith.Weir@gov.bc.ca<mailto:Keith.Weir@gov.bc.ca>>; Yi Li <Yi.Li@gov.bc.ca<mailto:Yi.Li@gov.bc.ca>>
Subject: RE: VYC maintenance and expansion - our file 2006-501059

Thanks for this Jason.

Over the past few months, TC has received a few concerns from the community regarding the expansion part of the project. Can you provide me with a record of public consultations? John

-----Original Message-----From: Jason Schleppe [mailto:jschleppe@ecoscapeltd.com]

Sent: Tuesday, October 10, 2017 9:56 AM

To: Mackie, John <John.Mackie@tc.gc.ca<mailto:John.Mackie@tc.gc.ca>>

Cc: 'craig@telus.net' <craig@telus.net<mailto:craig@telus.net>>; 'Weir, Keith FLNR:EX' <Keith.Weir@gov.bc.ca<mailto:Keith.Weir@gov.bc.ca>>

Subject: RE: VYC maintenance and expansion - our file 2006-501059

Hi John,

We have now finalized the design for the Vernon Yacht Club maintenance project associated with the breakwaters. Let me know if I need to submit anything else. Note that the breakwaters have not transitioned from pile supported to a floating breakwater. Aside from that, the application is nearly identical. If you want the wave attenuation report by the engineer, please advise and I will send along.

Thanks

Jason

From: Katrina Black [mailto:kblack@ecoscapeltd.com]

Sent: Wednesday, November 16, 2016 10:10 AM

To: Mackie, John <John.Mackie@tc.gc.ca<mailto:John.Mackie@tc.gc.ca>>

Cc: Jason Schleppe <jschleppe@ecoscapeltd.com<mailto:jschleppe@ecoscapeltd.com>>; 'craig@telus.net' <craig@telus.net<mailto:craig@telus.net>>; 'Weir, Keith FLNR:EX' <Keith.Weir@gov.bc.ca<mailto:Keith.Weir@gov.bc.ca>>

Subject: RE: VYC maintence and expansion - our file 2006-501059

Hi John,

I am following up on the Vernon Yacht Club on behalf of Jason, I know he was corresponding with you back in September (see below).

At this stage, the design is still being finalized with an aim to submit the finalized design by late November/early December. Are you able to send along any comments you have received from neighbours/interested parties as the owner would like to see if they can address any concerns?

Thanks for your time.

Regards

Katrina Black, BSc, BIT

Natural Resource Biologist

ECOSCAPE Environmental Consultants Ltd.

#102 – 450 Neave Court

Kelowna, BC V1V 2M2

Tel: 250.491.7337 ext. 215

Email: kblack@ecoscapeltd.com<mailto:kblack@ecoscapeltd.com>

-----Original Message-----

From: Mackie, John [mailto:John.Mackie@tc.gc.ca]

Sent: Wednesday, September 14, 2016 6:59 AM

To: Jason Schleppe <jschleppe@ecoscapeltd.com<mailto:jschleppe@ecoscapeltd.com>>; 'craig@telus.net' <craig@telus.net<mailto:craig@telus.net>>; 'Weir, Keith FLNR:EX' <Keith.Weir@gov.bc.ca<mailto:Keith.Weir@gov.bc.ca>>

Cc: Katrina Black <kblack@ecoscapeltd.com<mailto:kblack@ecoscapeltd.com>>

Subject: Re: VYC maintence and expansion - our file 2006-501059

Thanks Jason.

This will do for now.

The breakwater is of particular interest to neighbours.? John

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Jason Schleppe

Sent: Tuesday, September 13, 2016 5:39 PM

To: Mackie, John; 'craig@telus.net'; 'Weir, Keith FLNR:EX'

Cc: Katrina Black

Subject: Re: VYC maintence and expansion - our file 2006-501059

HI John

Currently we are looking at breakwater alternatives due to the required depth of piles. At this point we have nothing new to submit. The application is preceeding but finer points in engineering are being finalized.

I am out in the fielderly for a bit. Does this suffice for now? I can elaborate more later on or in phone call.

Thanks

Jason

Sent from my Samsung device

----- Original message -----

From: "Mackie, John" <John.Mackie@tc.gc.ca<mailto:John.Mackie@tc.gc.ca>>

Date: 2016-09-13 2:23 PM (GMT-08:00)

To: "Mackie, John" <John.Mackie@tc.gc.ca<mailto:John.Mackie@tc.gc.ca>>, Jason Schleppe
<jschleppe@ecoscapeltd.com<mailto:jschleppe@ecoscapeltd.com>>, "craig@telus.net"
<craig@telus.net<mailto:craig@telus.net>>, "Weir, Keith FLNR:EX"
<Keith.Weir@gov.bc.ca<mailto:Keith.Weir@gov.bc.ca>>

Cc: Katrina Black <kblack@ecoscapeltd.com<mailto:kblack@ecoscapeltd.com>>

Subject: RE: VYC maintence and expansion - our file 2006-501059

Hello Jason,

We are receiving comments from members of the community concerned with the YC proposal. Can you give me an update on the expansion? John Mackie

From: Mackie, John

Sent: Thursday, May 12, 2016 11:04 AM

To: 'Jason Schleppe'; 'craig@telus.net'; Weir, Keith FLNR:EX

Cc: Katrina Black

Subject: RE: VYC maintence and expansion - our file 2006-501059

Thanks Jason,

1) Regarding a breakwater; we will need general arrangement drawings that show plan and profiles (piles, chains, mooring lines, etc.) of the works within the provincial license area.

2) Not likely. The greatest impact on the review will be the expansion of the works. The current suggested proposal shows the expansion primarily to the south and not toward the middle of the lake. We should be able to deal with this in terms and conditions of and approval. We are however, interested in what the adjacent property owner has to say.

3) No. We will still need to approve any change / maintenance to the marina.

4) If the adjacent neighbor is not supportive, our interest is navigation only, so narrow. We are also interested in potential impacts on the neighbor's riparian access to his property (provincial).

Hope this helps. I will wait for further info. John

From: Jason Schleppe [mailto:jschleppe@ecoscapeltd.com]

Sent: Thursday, May 12, 2016 10:21 AM

To: Mackie, John; 'craig@telus.net'; Weir, Keith FLNR:EX

Cc: Kameron Black

Subject: RE: VYC maintenance and expansion - our file 2006-501059

Hi John,

We are currently working with Keith Weir of Crown Lands (CCd) to decide the best path forward for this project. We need to discern what Crown Lands requirements are (specifically what the triggers are for addition of new slips, and what results in only a minor amendment to the Crown Land Lease versus that of a major amendment which is more similar to a new tenure as I understand), and may adjust what has been presented. These adjustments would likely only be a reduction in slips, if any, with the breakwater aspects remaining the same.

Key information for us from you includes:

- 1) If we propose only a breakwater, does this affect your review?
- 2) If we proposed a breakwater with fewer slips, does this affect your review?
- 3) If we trigger only a minor Crown Land Lease amendment, does this affect your review?
- 4) What happens if the adjacent neighbor is not supportive, but this infrastructure is needed to protect vessels in an operational facility? What is the pathway forward for the VYC?

The key to this application is that the current breakwater is failing, is not 100% consistent with the existing lease boundary, and that the proposed design is optimal based upon the engineering reviews to date. Further, the proposed full design moves the first rows of slips into deeper water to be more consistent with current BMP's. Given that the proposed works will bring the breakwater and slips into better compliance with the existing tenure and BMP's, it should presumably be better for the adjacent neighbor that what is currently onsite. Amending the designs back to a floating structure are not optimal, and not likely to stand the tests of time, given past experience with a similar type of structure.

Craig and I will pass along any correspondence from the neighbor we get through dialogue.

Thanks for following up. We are working on the file, but sorting out stuff with Provincial agencies currently is the critical pathway. Once these issues are resolved, we will then have a look to see where we stand.

Jason

Jason Schleppe, M.Sc., R.P.Bio

Senior Natural Resources Biologist

Ecoscape Environmental Consultants Ltd.

Phone: 250.491.7337 ext. 202 / Fax: 250.491.7772 / Cell: 250.808.3474

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From: Mackie, John [mailto:John.Mackie@tc.gc.ca]

Sent: Thursday, May 12, 2016 9:44 AM

To: Jason Schleppe
<jschleppe@ecoscapeltd.com<mailto:jschleppe@ecoscapeltd.com<mailto:jschleppe@ecoscapeltd.com%3cmailto:jschleppe@ecoscapeltd.com>>>; 'craig@telus.net'
<craig@telus.net<mailto:craig@telus.net<mailto:craig@telus.net%3cmailto:craig@telus.net>>>

Subject: RE: VYC maintence and expansion - our file 2006-501059

Hello Jason and Craig,

Any word from the adjacent property owner regarding the expansion? John Mackie

From: Jason Schleppe [mailto:jschleppe@ecoscapeltd.com]

Sent: Tuesday, April 19, 2016 12:14 PM

To: Mackie, John

Cc: 'craig@telus.net'

Subject: RE: VYC maintence and expansion - our file 2006-501059

Hi John,

While there is a little expansion on this side, it all falls within the existing Crown Land tenure.

The VYC is actively discussing with the adjacent property owner, but I do not think anything has been formalized. I will ask Craig (CCd) to provide a brief summary to me for submission to you regarding efforts to discuss things with that owner.

Thanks

Jason

Jason Schleppe, M.Sc., R.P.Bio

Senior Natural Resources Biologist

Ecoscape Environmental Consultants Ltd.

Phone: 250.491.7337 ext. 202 / Fax: 250.491.7772 / Cell: 250.808.3474

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From: Mackie, John [mailto:John.Mackie@tc.gc.ca]

Sent: Tuesday, April 19, 2016 12:07 PM

To: Jason Schleppe
<jschleppe@ecoscapeltd.com<mailto:jschleppe@ecoscapeltd.com<mailto:jschleppe@ecoscapeltd.com%3cmmailto:jschleppe@ecoscapeltd.com>>>

Subject: VYC maintence and expansion - our file 2006-501059

Hello Jason.

I will be reviewing this application pursuant to the NPA.

I note the expansion of the existing yacht club, primarily at the western side. I recall that there is a property owner on that side of the club, have they be approached about the expansion? John

John Mackie

Navigation Protection Officer, Navigation Protection Program Transport Canada | Government of Canada Agente de protection de la navigation, Programme de protection de la navigation Transports Canada | Gouvernement du Canada
john.mackie@tc.gc.ca<mailto:john.mackie@tc.gc.ca<mailto:john.mackie@tc.gc.ca%3cmmailto:john.mackie@tc.gc.ca>> / 604-775-8890

Visit our website @ <https://www.tc.gc.ca/eng/programs-624.html>

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Weir "eith FLNR:EX

From: Jason Schleppe <jschleppe@ecoscapeltd.com>
Sent: Tuesday, November 21, 2017 2:31 PM
To: Li, Yi FLNR:EX
Cc: 'craig@telus.net'; Tara Hirsekorn; Weir, Keith FLNR:EX
Subject: RE: Vernon Yacht Club Marina Expansion Approval Application #8003608

Hi Yi,

While I do not speak for the executive, I would suggest that this application has a high safety element to it. If you read the report, a strong rationale is presented for value of infrastructure and current state of the breakwater. Again, I am not an "engineer", but the status of the breakwater is pretty bad, with numerous emergency repairs needed during the floods. With the onset of the winter season, there is a strong need to proceed with works to protect the millions of dollars of assets and infrastructure behind the breakwater. I might suggest that you read the information in the report regarding the value of assets and infrastructure provided to support the need for a quick review so that you fully understand what risks are present.

Thanks,
Jason

JASON SCHLEPPE, M.Sc., R.P.Bio
SENIOR NATURAL RESOURCES BIOLOGIST
ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.

Phone: 250.491.7337 ext. 202 / Fax: 250.491.7772 / Cell: 250.808.3474

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From: Li, Yi FLNR:EX [mailto:Yi.Li@gov.bc.ca]
Sent: Tuesday, November 21, 2017 2:25 PM
To: Jason Schleppe <jschleppe@ecoscapeltd.com>
Cc: 'craig@telus.net' <craig@telus.net>; Tara Hirsekorn <Tara@WatersEdgeLTD.ca>; Weir, Keith FLNR:EX <Keith.Weir@gov.bc.ca>
Subject: RE: Vernon Yacht Club Marina Expansion Approval Application #8003608

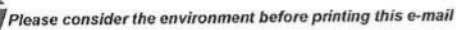
Hi Jason,

Due to the floods and associated issues, our process is slow now. Particularly, safety-related applications take priority, for example bank erosion protections and bridge works.

I appreciate for your understandings.

For this application, hopefully the review can be done in January.

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Page 20 of 317

Look forward to the latest design.

Yi

From: Jason Schleppe [<mailto:jschleppe@ecoscapeltd.com>]
Sent: Thursday, September 1, 2016 11:59 AM
To: Patterson, Laura FLNR:EX
Cc: 'craig@telus.net'; Lacey, Cathy M ENV:EX; Li, Yi FLNR:EX; Katrina Black; Tara Hirsekorn
Subject: RE: Vernon Yacht Club Marina Expansion Approval Application #8003608

Hi Laura,

Please see the response to your questions below, in green. I will follow this up with a phone call, please just let me know when may work best for you. Note, I have also included other members of the project team on this response to keep them posted.

On another note, Yi, please be advised that detailed engineering designs for the pile supported breakwater are undergoing. At this point, there is consideration being given to transition back to a floating breakwater, due to the engineering requirements (i.e., depths, pile size requirements, angles needed for supports and construction challenges as examples). These details are not sorted yet, and revisions to the submitted plan may occur, once sorted out. Once they are finalized, Ecoscape will provide a revised plan in conjunction with the team. It is important to note, this is not 100% certain at this time, and our timing on delivery of details was delayed because the Section 9 (now Section 11) notification to place the temporary piles took more time than anticipated to attain.

Thanks,
Jason

JASON SCHLEPPE, M.Sc., R.P.BIO
SENIOR NATURAL RESOURCES BIOLOGIST
ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.

Phone: 250.491.7337 ext. 202 / Fax: 250.491.7772 / Cell: 250.808.3474

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Please consider the environment before printing this e-mail

From: Patterson, Laura FLNR:EX [<mailto:Laura.Patterson@gov.bc.ca>]
Sent: Thursday, September 1, 2016 11:09 AM
To: Jason Schleppe <jschleppe@ecoscapeltd.com>
Cc: 'craig@telus.net' <craig@telus.net>; Lacey, Cathy M ENV:EX <Cathy.Lacey@gov.bc.ca>; Li, Yi FLNR:EX <Yi.Li@gov.bc.ca>
Subject: Vernon Yacht Club Marina Expansion Approval Application #8003608

Hi Jason

The Ecosystems Section is in the process of reviewing the Water Sustainability Act Section 11 application to expand the Vernon Yacht Club Marina. Could you please clarify the following pertaining to this application:

- 1) Was a survey specifically targeting Rocky Mountain Ridged Mussel performed at the project site? If so, could you please provide the survey methodology and results of the survey. Please note that if a survey was not performed for Rocky Mountain Ridged Mussel, this work will be required prior to Ecosystems approval of the project as Rocky Mountain Ridged Mussels have recently been observed very near the marina. I can provide survey methodology if this work has not yet been completed. No, this survey has not been conducted. I am sure we have the methods, but please provide and we will conduct one shortly and get the results back to you in a separate memo. During our field visits, we did not document shells, but having said that, this does not constitute a survey.
- 2) The environmental assessment states that the row of slips closest to the shoreline will be removed, but these structures do not appear to be removed (not highlighted in yellow) in the schematic provided. Can you please confirm that these slips will be removed and provide the expected water depth (at low water) at the shallowest boat bay. Removed is maybe not the best choice of words. Rather, they will be moved to deeper water. Some are removed, some are added, etc., as per the presented plan. The intent was to move the first row of slips deeper to reduce littoral zone coverage and improve current site conditions from is currently operating. The contour ranges from 341 to 340.5 or so. These slips would be close, but maybe not quite attaining the 1.5 m depth at low water requirement, but are a substantial improvement over what is currently present, which currently sits at 341.5 or so. Given the fact that the contours are not matching with the alignment of the first dock, this would be a challenge to accommodate within the current lease area, a key design criteria (as we had initially tried to avoid a Major Crown Land Tenure amendment in discussions with Keith Weir). To attain the 1.5 m depth, the whole marina would need to be shifted out 5 to 10 m. as the depths do not increase rapidly at this location. Thus, this design attempted to trade off benefits by shifting slips deeper, while still working within the existing lease of a larger facility.
- 3) The mitigation for silt management states that silt curtains will be used if turbidity becomes a significant concern. Given the high number of piles being installed for this project and nature of the substrate could you please provide further information on how turbidity levels will be quantified on site and/or provide more detailed mitigation measures for this environmental effect. Turbidity would be measured in situ using a van Dorn to get water at depth and a handheld Hack Turbidity meter most likely if needed. Visual observation would also be used to assess if plumes were present. In our experience, pile driving does not typically result in significant sediment disruption, with the exception of a very localized effect (i.e., usually within 1 m of the pile placement itself). Our observations have been that sediment disruption is somewhat independent of the number of piles and more so dependent upon method. Ultimately, the effects of sediment disruption are related mostly to how piles are placed (i.e., are they dragged or lifted into place). This means that one poorly placed pile could disrupt substantially more sediment than 10 well placed piles. Burton Marina has extensive experience placing piles, in even more sensitive habitats (i.e., Mabel Lake Marina), meaning we have a high level of confidence that placement will occur with efficiency and diligence, and risks of poor pile placement are low. If sediment was a concern, mitigation would likely be to amend methods to avoid sediment mobilization. If necessary, silt curtains could be established, noting that this would be a last resort given the difficulties with containing piles, the barge, etc. Personally, I have yet to see significant sediment disruption from placement of piles on numerous marinas or docks, and therefore, I would categorize risks of significant sediment disruption to be very low. I have not yet seen sediment curtains deployed for placement of piles, except in cases when they needed for other aspects of instream works associated with piles.

Note that if the designs transition to a floating breakwater, the quantity of piles will be reduced. Thus, while I have provided a response, further information may change this response.

- 4) Please provide a rationale for the need for the expanded landing adjacent to the shoreline, as this expansion is not consistent with what Ecosystems would recommend for a walkway leading to the marina. This is for storage

of life jackets, etc., as indicated on the figures. The relocation is to replace the previously existing landing that occurs (shown in grey on Figure 3, white CAD file). If we consider what is removed, and slips shifted to deeper water, etc., the overall footprint in the littoral zone is reduced. If this area is a significant sticking point, we could consider relocation. I will need to liaise with VYC to confirm a different location.

- 5) Lastly, as the timeframe for works listed in the application is no longer feasible, could you please provide a new timeline for these works. Timeframe is dependent upon receipt of Crown Land Tenure and Section 11. Given the status of the marina, and state of repair, works would likely begin immediately. The marina is in dire need of repair, and significant risks exists to internal infrastructure, boats, etc.

Note that our hydrologist is also in the process of review and may have further questions in addition to the above. Understood.

Please feel free to contact me if you have any questions or concerns.

Thanks,

Laura Patterson, M.Sc., R.P.Bio.

Ecosystems Biologist
Ministry of Forests, Lands and Natural Resource Operations
Thompson-Okanagan Region
Office: (250) 490-2254
Email: Laura.Patterson@gov.bc.ca

Weir with FLNR:EX

From: Jason Schleppe <jschleppe@ecoscapeltd.com>
Sent: Friday, November 17, 2017 11:19 AM
To: Mackie, John
Cc: 'craig@telus.net'; Weir, Keith FLNR:EX; Li, Yi FLNR:EX
Subject: RE: VYC maintence and expansion - our file 2006-501059
Attachments: Newspaper ad (Aug.07-16).pdf; Newspaper ad (Aug.14-16).pdf; Staking (2).jpg; Open House Poster.png; GVCC SPEACH.PDF; FW: Minutes from Aug 22 meeting ; re: FW: Minutes from Aug 22 meeting

Hi John,

Attached are a summary of the different public outreach components that have been undertaken by the VYC.

- The two ads we ran in the local newspaper on two consecutive Sunday editions in August of 2016;
- A photo of the staking notice placed on site in August of 2016;
- A copy of a poster that was advertised via asocial media and placed on sandwich boards around the neighborhood extending an invitation to all in the neighborhood to a collaborative “Open House” held August 25, 2016 at the VYC on August 25, 2016 where members of our Executive were available to answer questions;
- A copy of the speech given by Lawrence Johnson, our Commodore at the time, at Greater Vernon Chamber of Commerce “Business after 5:00” event sponsored by the VYC on Tuesday April 18th this year;

It is important to note that some of the properties have changed hands in close proximity to the marina (i.e., direct neighbors). The VYC had undertaken full disclosure with previous owners, and the transactions happened during the design phases of the project. As such, the VYC has had to also undertake discussions with the new owners. It is noted here that the previous owners did not fully disclose information they had to the purchasers at the time of sale, which was surprising to the VYC. A full summary of the information provided to both the previous and current owners is available if you wish, I just need to forward it off. I am just not sure whether you wish to see all of that summary, so I have left it out for now. I have only included the more “typical” public outreach information (i.e., newspapers, etc.) from Craig to pass along in this email, but will provide the rest of the information if you feel it is needed. There has been several discussions, meetings, and other actions taken to provide information to the adjacent neighbors over the last few years.

Thanks and let me know if you need anything further,

Thanks
Jason

JASON SCHLEPPE, M.SC., R.P.BIO
SENIOR NATURAL RESOURCES BIOLOGIST
ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.

Phone: 250.491.7337 ext. 202 / Fax: 250.491.7772 / Cell: 250.808.3474

$$\langle \dots \rangle = \frac{1}{N} \sum_{\alpha=1}^N \langle \dots \rangle_{\alpha}$$

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II Please consider the environment before printing this e-mail

-----Original Message-----

From: Mackie, John [mailto:John.Mackie@tc.gc.ca]
Sent: Tuesday, October 10, 2017 11:06 AM
To: Jason Schleppe <jschleppe@ecoscapeltd.com>
Cc: 'craig@telus.net' <craig@telus.net>; 'Weir, Keith FLNR:EX' <Keith.Weir@gov.bc.ca>; Yi Li <Yi.Li@gov.bc.ca>
Subject: RE: VYC maintence and expansion - our file 2006-501059

Thanks for this Jason.

Over the past few months, TC has received a few concerns from the community regarding the expansion part of the project. Can you provide me with a record of public consultations? John

-----Original Message-----From: Jason Schleppe [mailto:jSchleppe@ecoscapeltd.com]
Sent: Tuesday, October 10, 2017 9:56 AM
To: Mackie, John <John.Mackie@tc.gc.ca>
Cc: 'craig@telus.net' <craig@telus.net>; 'Weir, Keith FLNR:EX' <Keith.Weir@gov.bc.ca>
Subject: RE: VYC maintence and expansion - our file 2006-501059

Hi John,

We have now finalized the design for the Vernon Yacht Club maintenance project associated with the breakwaters. Let me know if I need to submit anything else. Note that the breakwaters have not transitioned from pile supported to a floating breakwater. Aside from that, the application is nearly identical. If you want the wave attenuation report by the engineer, please advise and I will send along.

Thanks
Jason

JASON SCHLEPPE, M.SC., R.P.BIO
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ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.

Phone: 250.491.7337 ext. 202 / Fax: 250.491.7772 / Cell: 250.808.3474

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-----Original Message-----

From: Mackie, John [mailto:John.Mackie@tc.gc.ca]
Sent: Wednesday, November 16, 2016 11:45 AM
To: Katrina Black <kblack@ecoscapeltd.com>
Cc: Jason Schleppe <jschleppe@ecoscapeltd.com>; 'craig@telus.net' <craig@telus.net>; 'Weir, Keith FLNR:EX' <Keith.Weir@gov.bc.ca>
Subject: RE: VYC maintence and expansion - our file 2006-501059

Hello Katrina,

I have not heard from the neighbours or interested parties lately.

Will the proposal be subject to the municipal process? I would expect you might get an earful at that time. John

-----Original Message-----

From: Katrina Black [mailto:kblack@ecoscapeltd.com]

Sent: Wednesday, November 16, 2016 10:10 AM

To: Mackie, John <John.Mackie@tc.gc.ca>

Cc: Jason Schleppe <jschleppe@ecoscapeltd.com>; 'craig@telus.net' <craig@telus.net>; 'Weir, Keith FLNR:EX' <Keith.Weir@gov.bc.ca>

Subject: RE: VYC maintence and expansion - our file 2006-501059

Hi John,

I am following up on the Vernon Yacht Club on behalf of Jason, I know he was corresponding with you back in September (see below).

At this stage, the design is still being finalized with an aim to submit the finalized design by late November/early December. Are you able to send along any comments you have received from neighbours/interested parties as the owner would like to see if they can address any concerns?

Thanks for your time.

Regards

Katrina Black, BSc, BIT
Natural Resource Biologist

ECOSCAPE Environmental Consultants Ltd.
#102 – 450 Neave Court
Kelowna, BC V1V 2M2
Tel: 250.491.7337 ext. 215
Email: kblack@ecoscapeltd.com

-----Original Message-----

From: Mackie, John [mailto:John.Mackie@tc.gc.ca]

Sent: Wednesday, September 14, 2016 6:59 AM

To: Jason Schleppe <jschleppe@ecoscapeltd.com>; 'craig@telus.net' <craig@telus.net>; 'Weir, Keith FLNR:EX' <Keith.Weir@gov.bc.ca>

Cc: Katrina Black <kblack@ecoscapeltd.com>

Subject: Re: VYC maintence and expansion - our file 2006-501059

Thanks Jason.

This will do for now.

The breakwater is of particular interest to neighbours. John

Sent from my BlackBerry 10 smartphone on the Rogers network.
From: Jason Schleppe

Sent: Tuesday, September 13, 2016 5:39 PM
To: Mackie, John; 'craig@telus.net'; 'Weir, Keith FLNR:EX'
Cc: Katrina Black
Subject: Re: VYC maintenance and expansion - our file 2006-501059

Hi John

Currently we are looking at breakwater alternatives due to the required depth of piles. At this point we have nothing new to submit. The application is preceeding but finer points in engineering are being finalized.

I am out in the fielderly for a bit. Does this suffice for now? I can elaborate more later on or in phone call.

Thanks
Jason

Sent from my Samsung device

----- Original message -----

From: "Mackie, John" <John.Mackie@tc.gc.ca>
Date: 2016-09-13 2:23 PM (GMT-08:00)
To: "Mackie, John" <John.Mackie@tc.gc.ca>, Jason Schleppe <jschleppe@ecoscapeltd.com>, "'craig@telus.net'" <craig@telus.net>, "'Weir, Keith FLNR:EX'" <Keith.Weir@gov.bc.ca>
Cc: Katrina Black <kblack@ecoscapeltd.com>
Subject: RE: VYC maintenance and expansion - our file 2006-501059

Hello Jason,

We are receiving comments from members of the community concerned with the YC proposal. Can you give me an update on the expansion? John Mackie

From: Mackie, John
Sent: Thursday, May 12, 2016 11:04 AM
To: 'Jason Schleppe'; 'craig@telus.net'; Weir, Keith FLNR:EX
Cc: Katrina Black
Subject: RE: VYC maintenance and expansion - our file 2006-501059

Thanks Jason,

- 1) Regarding a breakwater; we will need general arrangement drawings that show plan and profiles (piles, chains, mooring lines, etc.) of the works within the provincial license area.
- 2) Not likely. The greatest impact on the review will be the expansion of the works. The current suggested proposal shows the expansion primarily to the south and not toward the middle of the lake. We should be able to deal with this in terms and conditions of and approval. We are however, interested in what the adjacent property owner has to say.
- 3) No. We will still need to approve any change / maintenance to the marina.

4) If the adjacent neighbor is not supportive, our interest is navigation only, so narrow. We are also interested in potential impacts on the neighbor's riparian access to his property (provincial).

Hope this helps. I will wait for further info. John

From: Jason Schleppe [mailto:jschleppe@ecoscapeltd.com]
Sent: Thursday, May 12, 2016 10:21 AM
To: Mackie, John; 'craig@telus.net'; Weir, Keith FLNR:EX
Cc: Katrina Black
Subject: RE: VYC maintenance and expansion - our file 2006-501059

Hi John,

We are currently working with Keith Weir of Crown Lands (CCd) to decide the best path forward for this project. We need to discern what Crown Lands requirements are (specifically what the triggers are for addition of new slips, and what results in only a minor amendment to the Crown Land Lease versus that of a major amendment which is more similar to a new tenure as I understand), and may adjust what has been presented. These adjustments would likely only be a reduction in slips, if any, with the breakwater aspects remaining the same.

Key information for us from you includes:

- 1) If we propose only a breakwater, does this affect your review?
- 2) If we proposed a breakwater with fewer slips, does this affect your review?
- 3) If we trigger only a minor Crown Land Lease amendment, does this affect your review?
- 4) What happens if the adjacent neighbor is not supportive, but this infrastructure is needed to protect vessels in an operational facility? What is the pathway forward for the VYC?

The key to this application is that the current breakwater is failing, is not 100% consistent with the existing lease boundary, and that the proposed design is optimal based upon the engineering reviews to date. Further, the proposed full design moves the first rows of slips into deeper water to be more consistent with current BMP's. Given that the proposed works will bring the breakwater and slips into better compliance with the existing tenure and BMP's, it should presumably be better for the adjacent neighbor than what is currently onsite. Amending the designs back to a floating structure are not optimal, and not likely to stand the tests of time, given past experience with a similar type of structure.

Craig and I will pass along any correspondence from the neighbor we get through dialogue.

Thanks for following up. We are working on the file, but sorting out stuff with Provincial agencies currently is the critical pathway. Once these issues are resolved, we will then have a look to see where we stand.

Jason

Jason Schleppe, M.Sc., R.P.Bio
Senior Natural Resources Biologist
Ecoscape Environmental Consultants Ltd.

Phone: 250.491.7337 ext. 202 / Fax: 250.491.7772 / Cell: 250.808.3474

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P Please consider the environment before printing this e-mail

From: Mackie, John [mailto:John.Mackie@tc.gc.ca]
Sent: Thursday, May 12, 2016 9:44 AM
To: Jason Schleppe <jschleppe@ecoscapeltd.com<mailto:jschleppe@ecoscapeltd.com>>; 'craig@telus.net' <craig@telus.net<mailto:craig@telus.net>>
Subject: RE: VYC maintence and expansion - our file 2006-501059

Hello Jason and Craig,

Any word from the adjacent property owner regarding the expansion? John Mackie

From: Jason Schleppe [mailto:jschleppe@ecoscapeltd.com]
Sent: Tuesday, April 19, 2016 12:14 PM
To: Mackie, John
Cc: 'craig@telus.net'
Subject: RE: VYC maintence and expansion - our file 2006-501059

Hi John,

While there is a little expansion on this side, it all falls within the existing Crown Land tenure.

The VYC is actively discussing with the adjacent property owner, but I do not think anything has been formalized. I will ask Craig (CCd) to provide a brief summary to me for submission to you regarding efforts to discuss things with that owner.

Thanks
Jason

Jason Schleppe, M.Sc., R.P.Bio
Senior Natural Resources Biologist
Ecoscape Environmental Consultants Ltd.

Phone: 250.491.7337 ext. 202 / Fax: 250.491.7772 / Cell: 250.808.3474

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P Please consider the environment before printing this e-mail

From: Mackie, John [mailto:John.Mackie@tc.gc.ca]
Sent: Tuesday, April 19, 2016 12:07 PM
To: Jason Schleppe <jschleppe@ecoscapeltd.com<mailto:jschleppe@ecoscapeltd.com>>
Subject: VYC maintence and expansion - our file 2006-501059

Hello Jason.

I will be reviewing this application pursuant to the NPA.

I note the expansion of the existing yacht club, primarily at the western side. I recall that there is a property owner on that side of the club, have they be approached about the expansion? John

John Mackie

Navigation Protection Officer, Navigation Protection Program Transport Canada | Government of Canada Agente de protection de la navigation, Programme de protection de la navigation Transports Canada | Gouvernement du Canada
john.mackie@tc.gc.ca<mailto:john.mackie@tc.gc.ca> / 604-775-8890

Visit our website @ <https://www.tc.gc.ca/eng/programs-624.html>

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**Introduction: Welcome GVCC members and visitors to the Vernon Yacht Club
Introduce sponsors Cracked pepper catering, BX press Cidery and Ex Nihilo
Vineyards.**

As commodore I act as the CEO of the yacht club overseeing operations of the club, enforcing the by-laws to ensure the rules and regulations are followed and supervise and consult with the other Flag officers of the club. Our flag officers and directors are all volunteer positions and include

- John Halper V.C.**
- Craig Williams Rear C**
- Al Cuttriss Fleet Captain**
- Pamela St. Pierre Staff Captain**
- Bob Gilowski Treasurer**
- Betty Day Secretary**
- Pamela Miller Director of Publicity**
- Norm Bryan Membership Director**
- Ken Hodgeson Entertainment Director**
- Ron Mclean Director of projects Doug Fleming Director at large and Fred Haight Director at large and manager of this years Boat show.**

The Yacht is a non - profit society incorporated on June 23, 1953 and is the second largest marina on Okanagan lake.

Our mission statement is to promote the enhancement of boating as a recreational and pleasurable pastime, and to encourage inter-community nautical activities and to provide facilities for all of these activities.

**We share this shoreline with sister organizations such as
The Okanagan Landing and District Community Association
The Vernon Paddling Centre
The North Okanagan Sailing Association
The Vernon Yacht Club
The VYC Sailing Fleet**

The club is a local entity serving the North Okanagan and offers membership to all residents living within 100k of Vernon. There are two types of Membership. Regular member and Social member (explain)

Our club is a full service facility that is open to our members and their guests 7 days a week . Our Marina has 285 slips from 20 to 38 feet and are currently in application for expansion of another 24 slips along with the upgrade of our breakwater. Our marina & break water protects all of the park facilities and businesses along the shore in the bay to the East of us.

We are currently renovating the Marina and hope to start construction of the expansion this fall and be ready for the spring boating season.

Our clubhouse offers a menu to our members as well as a full service bar, Friday evening Buffet and Sunday morning brunch. We hold numerous annual events such as the Pig Roast, Rib-off, sailing regatta, interclub invasions and host a boat show open to the public every spring and again this May 6 & 7TH. As well we hold charity regattas every year to raise funds for local charities and also participate annually at Remembrance Day ceremonies; participation in the Winter Carnival and are heavily involved in the Landing community.

We are open to new memberships throughout the year and applications are available at the door and you can speak with our membership director Norm Bryan who will be happy to help you with the application.

Thank-you for joining us this evening and please feel free to ask any of our Flag officers or executive here tonight any questions about our wonderful club.

Page 033 to/à Page 034

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From: Jason Schleppe [<mailto:jschleppe@ecoscapeltd.com>]
Sent: Thursday, September 1, 2016 11:59 AM
To: Patterson, Laura FLNR:EX
Cc: 'craig@telus.net'; Lacey, Cathy M ENV:EX; Li, Yi FLNR:EX; Katrina Black; Tara Hirsekorn
Subject: RE: Vernon Yacht Club Marina Expansion Approval Application #8003608

Hi Laura,

Please see the response to your questions below, in green. I will follow this up with a phone call, please just let me know when may work best for you. Note, I have also included other members of the project team on this response to keep them posted.

On another note, Yi, please be advised that detailed engineering designs for the pile supported breakwater are undergoing. At this point, there is consideration being given to transition back to a floating breakwater, due to the engineering requirements (i.e., depths, pile size requirements, angles needed for supports and construction challenges as examples). These details are not sorted yet, and revisions to the submitted plan may occur, once sorted out. Once they are finalized, Ecoscape will provide a revised plan in conjunction with the team. It is important to note, this is not 100% certain at this time, and our timing on delivery of details was delayed because the Section 9 (now Section 11) notification to place the temporary piles took more time than anticipated to attain.

Thanks,
Jason

JASON SCHLEPPE, M.Sc., R.P.BIO
SENIOR NATURAL RESOURCES BIOLOGIST
ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.

Phone: 250.491.7337 ext. 202 / Fax: 250.491.7772 / Cell: 250.808.3474

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From: Patterson, Laura FLNR:EX [<mailto:Laura.Patterson@gov.bc.ca>]
Sent: Thursday, September 1, 2016 11:09 AM
To: Jason Schleppe <jschleppe@ecoscapeltd.com>
Cc: 'craig@telus.net' <craig@telus.net>; Lacey, Cathy M ENV:EX <Cathy.Lacey@gov.bc.ca>; Li, Yi FLNR:EX <Yi.Li@gov.bc.ca>
Subject: Vernon Yacht Club Marina Expansion Approval Application #8003608

Hi Jason

The Ecosystems Section is in the process of reviewing the Water Sustainability Act Section 11 application to expand the Vernon Yacht Club Marina. Could you please clarify the following pertaining to this application:

- 1) Was a survey specifically targeting Rocky Mountain Ridged Mussel performed at the project site? If so, could you please provide the survey methodology and results of the survey. Please note that if a survey was not

performed for Rocky Mountain Ridged Mussel, this work will be required prior to Ecosystems approval of the project as Rocky Mountain Ridged Mussels have recently been observed very near the marina. I can provide survey methodology if this work has not yet been completed. No, this survey has not been conducted. I am sure we have the methods, but please provide and we will conduct one shortly and get the results back to you in a separate memo. During our field visits, we did not document shells, but having said that, this does not constitute a survey.

- 2) The environmental assessment states that the row of slips closest to the shoreline will be removed, but these structures do not appear to be removed (not highlighted in yellow) in the schematic provided. Can you please confirm that these slips will be removed and provide the expected water depth (at low water) at the shallowest boat bay. Removed is maybe not the best choice of words. Rather, they will be moved to deeper water. Some are removed, some are added, etc., as per the presented plan. The intent was to move the first row of slips deeper to reduce littoral zone coverage and improve current site conditions from is currently operating. The contour ranges from 341 to 340.5 or so. These slips would be close, but maybe not quite attaining the 1.5 m depth at low water requirement, but are a substantial improvement over what is currently present, which currently sits at 341.5 or so. Given the fact that the contours are not matching with the alignment of the first dock, this would be a challenge to accommodate within the current lease area, a key design criteria (as we had initially tried to avoid a Major Crown Land Tenure amendment in discussions with Keith Weir). To attain the 1.5 m depth, the whole marina would need to be shifted out 5 to 10 m. as the depths do not increase rapidly at this location. Thus, this design attempted to trade off benefits by shifting slips deeper, while still working within the existing lease of a larger facility.
- 3) The mitigation for silt management states that silt curtains will be used if turbidity becomes a significant concern. Given the high number of piles being installed for this project and nature of the substrate could you please provide further information on how turbidity levels will be quantified on site and/or provide more detailed mitigation measures for this environmental effect. Turbidity would be measured in situ using a van Dorn to get water at depth and a handheld Hack Turbidity meter most likely if needed. Visual observation would also be used to assess if plumes were present. In our experience, pile driving does not typically result in significant sediment disruption, with the exception of a very localized effect (i.e., usually within 1 m of the pile placement itself). Our observations have been that sediment disruption is somewhat independent of the number of piles and more so dependent upon method. Ultimately, the effects of sediment disruption are related mostly to how piles are placed (i.e., are they dragged or lifted into place). This means that one poorly placed pile could disrupt substantially more sediment than 10 well placed piles. Burton Marina has extensive experience placing piles, in even more sensitive habitats (i.e., Mabel Lake Marina), meaning we have a high level of confidence that placement will occur with efficiency and diligence, and risks of poor pile placement are low. If sediment was a concern, mitigation would likely be to amend methods to avoid sediment mobilization. If necessary, silt curtains could be established, noting that this would be a last resort given the difficulties with containing piles, the barge, etc. Personally, I have yet to see significant sediment disruption from placement of piles on numerous marinas or docks, and therefore, I would categorize risks of significant sediment disruption to be very low. I have not yet seen sediment curtains deployed for placement of piles, except in cases when they needed for other aspects of instream works associated with piles.

Note that if the designs transition to a floating breakwater, the quantity of piles will be reduced. Thus, while I have provided a response, further information may change this response.

- 4) Please provide a rationale for the need for the expanded landing adjacent to the shoreline, as this expansion is not consistent with what Ecosystems would recommend for a walkway leading to the marina. This is for storage of life jackets, etc., as indicated on the figures. The relocation is to replace the previously existing landing that occurs (shown in grey on Figure 3, white CAD file). If we consider what is removed, and slips shifted to deeper water, etc., the overall footprint in the littoral zone is reduced. If this area is a significant sticking point, we could consider relocation. I will need to liaise with VYC to confirm a different location.

- 5) Lastly, as the timeframe for works listed in the application is no longer feasible, could you please provide a new timeline for these works. Timeframe is dependent upon receipt of Crown Land Tenure and Section 11. Given the status of the marina, and state of repair, works would likely begin immediately. The marina is in dire need of repair, and significant risks exists to internal infrastructure, boats, etc.

Note that our hydrologist is also in the process of review and may have further questions in addition to the above. Understood.

Please feel free to contact me if you have any questions or concerns.

Thanks,

Laura Patterson, M.Sc., R.P.Bio.

Ecosystems Biologist

Ministry of Forests, Lands and Natural Resource Operations

Thompson-Okanagan Region

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VERNON YACHT CLUB MARINA EXPANSION AND BREAKWATER REPAIRS

Environmental Assessment

Prepared For:
Vernon Yacht Club

Prepared By:

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Kelowna, B.C.
V1W 3A1



September, 2017
Project No. 15-1461



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FIGURES

Figure 1:	Site Location
Figure 2:	Bathymetry and Existing Marina Structures
Figure 3:	Proposed Marina Repair Plan

APPENDIX

Appendix A:	Rocky Mountain Ridge Mussel Survey Summary
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1.0 INTRODUCTION

1.1 Background

Ecoscape Environmental Consultants Ltd. (Ecoscape) was retained by the Vernon Yacht Club to complete an environmental assessment and mitigation plan for breakwater repairs on Okanagan Lake, along the south shoreline of Vernon Arm in Okanagan Lake (Figure 1). The proposed works involve the addition of new floating breakwaters, reconfiguring, relocating and repairing existing concrete and log breakwaters. Previous works have included shifting the existing marina north into deeper water, away from the foreshore, to better comply with current marina design guidelines and better conform to best management practices for depths of moorage (MFLRNORD File: R8003814). The proposed works will remain within the existing Crown Lands tenure, with the exception of anchoring systems and a small portion near shore, which will be constructed outside of tenure boundaries. The small portion near shore is very similar to the current condition, and required to protect nearshore boats. Other previous works have included rocky mountain ridged mussel surveys, which were completed in September 2016 (appended to this report)

This report documents the existing conditions present along the foreshore and riparian area at the site. The report also provides an assessment of the potential environmental impact associated with the proposed marina upgrades. The main focus of this report is to support the *Water Act* Section 9 notification permitting required for the proposed works.

1.2 Project Contacts

The following section details the main project contacts.

1.2.1 Vernon Yacht Club

The applicant is the Vernon Yacht Club, proponent and upland owner. The owner currently has a Crown Land tenure for the area (File #: 34750).

Main Contact:	Craig Williams, Rear Commodore
Address:	Vernon Yacht Club 7919 Okanagan Landing Road Vernon, B.C. V1H 1H1
Phone:	250.558.1111
Email:	craig@telus.net



1.2.2 Ecoscape Environmental Consultants Ltd.

The environmental professional overseeing this report is a Senior Aquatic Biologist from Ecoscape.

Main Contact: Jason Schleppe, M.Sc., RPBio – Senior Aquatic Biologist
Address: 102-450 Neave Court
Kelowna, BC V1V 2M2
Phone: 250.491.7337 x 202
Email: jschleppe@ecoscapeltd.com

An engineer has been retained to consider potential effects the proposed repairs will have on wind and wave patterns and subsequent sediment scour and deposition patterns within and proximal to the proposed marina. The engineer undertaking these works is:

Main Contact: Tara Hirsekorn, P.Eng.
Address: Kelowna, BC
Phone: 250.300.3479
Email: Tara@WatersEdgeLTD.ca

Structural engineering is being conducted by Craig Work, at Herold Engineering Ltd. The structural engineer is being engaged by the contractor completing the work, listed below. The detailed designs will be provided shortly, once finalized.

1.2.3 Burton Marine Pile Driving Inc.

The main contractor for the proposed marina construction is Burton Pile Driving Inc.

Main Contact: Steve Burton
Address: 1609 Munson Road
Kelowna, BC V1W 2G8
Phone: 778.478.9755
Email: info@burtonpiledriving.com

2.0 PROJECT IDENTIFICATION

Project Title/Type: Vernon Yacht Club
Project Location: Foreshore at 7919 Okanagan Landing Road, Vernon, BC

Figure 1 provides an overview of the site and project location.

3.0 PROJECT DESCRIPTION

The proposed repairs to the marina and breakwater system, as shown in Figure 3, are as follows:

- Shift the existing log breakwater located at the north end of the marina slightly towards the north, to facilitate the shifting of the marina structure.
- Install a new floating breakwater. The breakwater is intended to replace the failing concrete floating breakwater along this edge. The new breakwater will be adjusted so that it is positioned 5 m within the existing Crown Land tenure boundary. The only exception to this is in the near shore area, to allow an entrance to the existing boat launch.
- Relocate, repair, and reinstall the original breakwater in adjusted and new locations as depicted in Figure 3.

3.1 Location and Site Description

The property is located at 7919 Okanagan Landing Road, Vernon, BC.

The existing water lease number is 343750. The legal description of for the tenured area is DL 5344, ODYD.

Geographic coordinates for the property are:

Latitude: 50° 14' 2.5"

Longitude: 119° 21' 49.2"

The lease area is shown in Figure 2.

3.2 Overview

The intent of the proposed marina and breakwater repairs is to provide a permanent solution for recurring damage at the west end of the facility. The existing floating breakwater has a long history of needed repairs, with damage occurring as early as July, 1997 and as recent as July 2015. The breakwater has continued to deteriorate, and noticeable damage occurred during the high water spring of 2017.

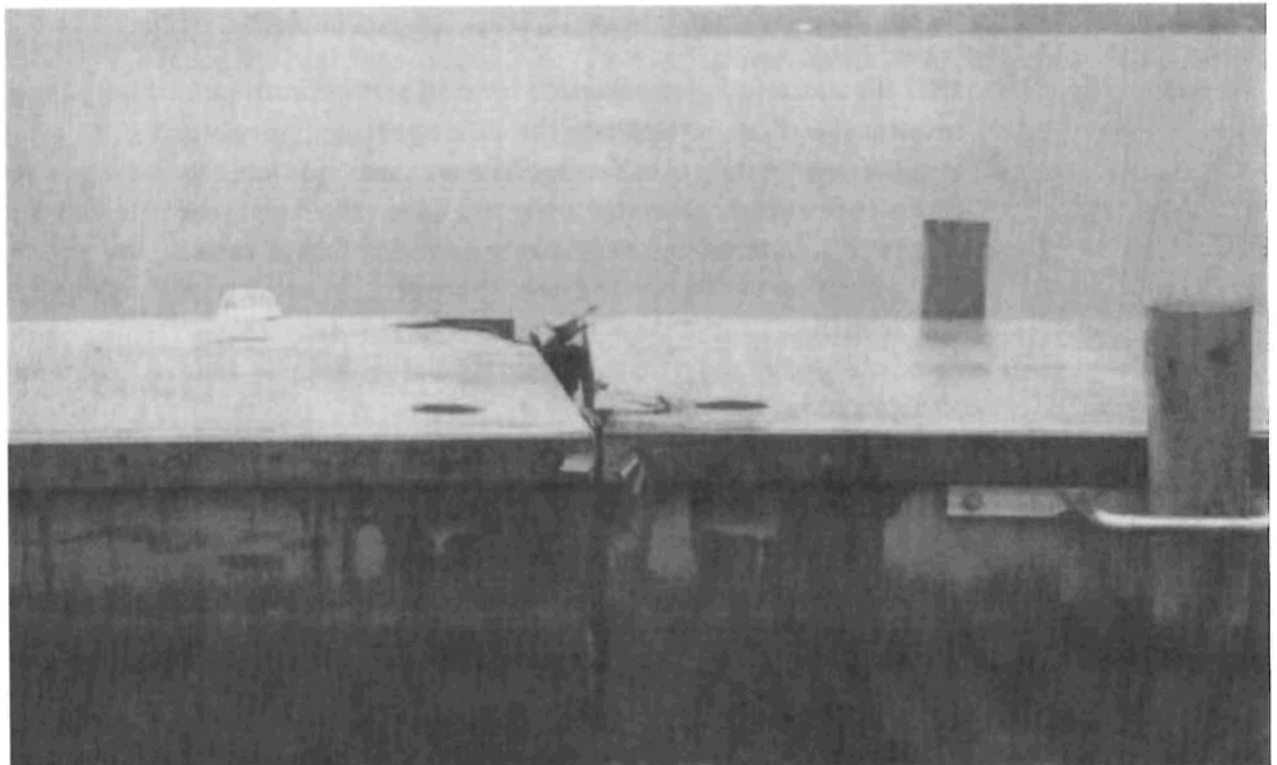


Photo 1: Image of breakwater damage in July, 1997.



Photo 2: Image of breakwater damage occurring in July, 2015.



Photo 3: Image of breakwater in August, 2017.

The proposed breakwater upgrades will enhance protection from wave action and sediment deposition patterns inside the marina should remain largely unchanged. This report focuses on the foreshore and riparian area of Okanagan Lake as it relates to the subject property, and is intended to provide a summary of potential environmental effects with mitigation strategies for construction and operation to mitigate potential effects, noting that the focus of the impact statement is to address how the facility will affect biological conditions from the current condition, rather than from a pre disturbance condition because the facility currently operates under an existing Crown Lands lease.

3.3 Project Components and Structures

The current marina includes approximately 285 moorage slips (Figure 2), and the proposed upgrades will increase the moorage area and allow additional slips to be potentially added in the future, noting there are *no new slips proposed* at this time (Figure 3). The placement of the breakwater along the tenure boundaries, while increasing the area potentially available for moorage, is ultimately intended to improve the functionality of the breakwater. The main walkout pier is a fixed and elevated walkway. A ramp connects to the end of the main marina will connect the floating portion of the moorage to the

breakwater to allow easy inspections. The breakwater system surrounding the marina is currently made up of logs on the north and east side of the marina, and consists of concrete floats on the west side. The west end of the existing log breakwater located north of the marina will be moved deeper

The fixed elevation access pier and connecting ramp that leads from the floating portion of the marina will be made with an aluminum frame and either concrete or wood decking. Anchors used for the moorages and breakwater system will include galvanized chain connected to polypropylene rope that leads to a concrete anchor, and pilings will be either untreated Douglas-fir or steel.

Figure 2 shows the bathymetry and depths associated with the proposed marina.

3.4 Project Activities

The following section briefly outlines the activities associated with marina construction, operation and decommissioning.

3.4.1 Construction

Most of the marina components will be constructed off site, transported to the Vernon Yacht club and assembled at the site. Any instream works will be from a floating barge with a smaller boat to assist. Concrete sections for the breakwater will be trucked to the site and launched from the existing boat launch or another industrial launching facility that is appropriate.

3.4.2 Operation

Activities likely to be associated with operation of the marina include launching, storage, fueling at the designated fueling area as allowed under the existing lease, and use of boats. Other activities associated with the marina will include maintenance of the marina structure. Maintenance activities like dredging are not likely needed, because the design has moved most infrastructure to deeper water to avoid environmental risks associated with dredging. No maintenance of boats is to occur within the marina.

3.4.3 Decommissioning or Expansion

The structure upgrades are expected to have a minimum 20 year lifespan (noting it could be longer depending upon site conditions), and decommissioning would likely only be required if the marina needed to be replaced by a new structure. Demand for moorage on Okanagan Lake is expected to continue into the future and as a result Ecoscape anticipates that the proposed moorage will not need to be decommissioned unless required by regulatory agencies. Upgrades to the structure in the future are currently being considered, with the proponent working through public consultation. Proposed future additions include new mains/floats, slips, possible extension of the lease area, the possible addition



of fueling facilities, and associated breakwater structures. All infrastructure will require routine maintenance, typical of larger marine facilities, including occasional pile replacement, repairs or replacement of floating slips, etc.

3.5 Project Schedule

The study area is located along a section of Okanagan Lake which is not considered to be suitable kokanee spawning habitat. Furthermore, there are no known kokanee spawning creeks or shore spawning areas within 500 m of the proposed works. Because substrates are not exclusively mud or silts in the study area, the timing windows are June 1 to September 30. Since works to repair the facility are required immediately, works are proposed outside of the work window. It is important to note that there is not likely any salmonid spawning occurring on the larger substrates within the study area based upon habitat suitability. For this reason, works outside the window are not likely to pose significant risks to salmonids. In terms of non salmonids such as Cyprinids, risks are considered very low because these species are highly tolerant, very fecund, and are less affected by routine construction such as pile driving or overwater works.

3.6 Project Justification

In July 2014, a storm incurred damage on the concrete breakwater floats located on the west end of the marina. More specifically the two most northerly sections of the breakwater system detached, opening a significant portion of the breakwater exposing the marina. Prior to this most recent event, previous repairs have been attempted at various times, but have not been successful at providing a long term solution. The ongoing repairs and maintenance have resulted in designing and installing a solution that will require less maintenance and help to reduce risks to the significant value of assets occurring within the marina. The new and relocated breakwater structures will improve mitigation against detrimental wind and wave action and alter current sediment deposition patterns to any significant extent.

During the spring of 2017, flooding on Okanagan Lake further damaged the structures at the facility. Emergency shoring up of the breakwater was undertaken, but repairs are currently considered to be an immediate priority. An email from the Vernon Yacht Club summarizes the value of infrastructure and property in the facility, highlighting potential risks of failure to undertake repairs.

4.0 EXISTING BIOPHYSICAL CONDITIONS

The biophysical and socio-economic components relevant to the project are described in this section. A site assessment was completed on June 23 by Jason Schleppe, M.Sc., R.P.Bio. Photographs were taken to document field features and these have been included in the Photographs section at the end of this report. Most data for this report references previous

works completed, such as the Foreshore Inventory and Mapping, or Sensitive Terrestrial Inventory and Mapping. Detailed wildlife or fisheries inventories were not conducted because of the temporal variation in habitat use, making firm conclusions difficult to determine from point surveys and inventories. Additional inventory was completed in September, 2016 to document mussel presence within the proposed construction area and is attached as an Appendix to this report.

4.1 Vegetation and Wetlands

The Biogeoclimatic Ecosystem Classification (BEC) is a land classification system that groups similar terrestrial ecosystems based on climate, soils, and vegetation. This classification system was developed in British Columbia and is used as a framework for resource management. The property is located within the Okanagan Very Dry Hot Interior Douglas-fir variant (IDF_{h1}) Biogeoclimatic Zone (Ministry of Forests 1998). The IDF zone occurs at low to mid-elevations (400-1250m), typically above the Ponderosa Pine zone. It occurs in areas with a warm, dry climate with a relatively long growing season, in which moisture deficits are a regular occurrence. Tree species typical of climax stands include Douglas-fir, and some Ponderosa Pine. The IDF_{h1} subzones are separated from the remaining IDF subzones by the absence of western larch and western red cedar. IDF understory is typically dominated by pinegrass. *Due to the extensive historic anthropogenic alterations at the site, it is currently considered urban in nature.*

The riparian area at the site is highly disturbed and includes a boat launch, a parking lot, the yacht club building, a lease extend some rip-rap and retaining walls along the shoreline. Some native vegetation does exist within the riparian area and includes tall Oregon-grape (*Mahonia aquifolium*). There is very limited emergent vegetation present along the shore and submerged vegetation includes Eurasian watermilfoil (*Myriophyllum spicatum*), an invasive species.

No wetlands were observed in proximity to the proposed marina development.

4.2 Aquatic Resource Values

Kokanee (*Oncorhynchus nerka*) are the fish species of primary concern with respect to shoreline development and aquatic habitat alteration along Okanagan Lake. A review of Kokanee shore spawning zoning information for Okanagan Lake, as of April 2015, revealed that the subject property is located within a Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) Kokanee No Colour Zone (Figure 1).

The provincial No Colour Zone designation indicates that there has been no recent or historic observed Kokanee shore spawning activity within this area (BC MoE, 2009). The subject property is located approximately 1190 m to the southwest of the nearest kokanee Yellow Zone. The Yellow Zone rating is applied to areas of shoreline recognized as providing moderate to high value habitat required for long-term maintenance of Kokanee

productivity. Yellow Zone designation is given to areas where aggregations of 50 or fewer fish were observed in recent years (2001-present), historic shore spawning activity of less than 1000 fish has been documented, in proximity to mouths of streams, or locations with Rocky Mountain ridged mussel (*Gonidea angulata*) shells (BC MoE, 2009). There was no evidence of Rocky Mountain ridged mussel shells or live mussels during the June 2015 site assessment, but it is important to note that there are occurrences within the Vernon Arm of Okanagan Lake, meaning that non detect does not necessarily mean there are no individuals present at the site.

The Vernon Yacht Club occurs along Okanagan Lake Foreshore Inventory and Mapping (FIM) Segment 135, which is described as being 100% commercial, with 100% disturbance occurring over of the approximately 236 m segment (Schleppe, 2010). The shore type along the segment is described as being 100% "other" due to the extensive historical alterations, with substrates in the nearshore area being described as 80% gravel and 20% sand (Schleppe, 2010). The littoral zone width was described as moderate (10 - 50m). Moorages along the segment were documented at a density of 4.25 docks/km. This FIM segment description is generally consistent with the current state of the subject property. The Aquatic Habitat Index (AHI) criteria is currently Very Low for this segment of shoreline with juvenile rearing potential ranked as moderate (Schleppe, 2010). While shore spawning Kokanee have not previously been documented within 3.3 km of the subject property, substrates may provide suitable spawning, foraging and general living habitat for a number of mostly coarse fish species such as Cyprinids. Table 1 provides a list of native and non-native fish species documented to occur in Okanagan Lake.

Table 1. Species of fish found in Okanagan Lake (BC MFLNRO, 2015)

Common Name	Scientific Name
Eastern Brook Trout	<i>Salvelinus fontinalis</i>
Burbot	<i>Lota</i>
Carp	<i>Cyprinus carpio</i>
Chiselmouth	<i>Acrocheilus alutaceus</i>
Cutthroat Trout	<i>Oncorhynchus clarki lewisi</i>
Kokanee	<i>Oncorhynchus nerka</i>
Lake Trout	<i>Salvelinus namaycush</i>
Lake Whitefish	<i>Coregonus clupeaformis</i>
Largescale Sucker	<i>Catostomus macrocheilus</i>
Leopard Dace	<i>Rhinichthys falcatus</i>
Longnose Dace	<i>Rhinichthys cataractae</i>
Longnose Sucker	<i>Catostomus</i>
Mountain Whitefish	<i>Prosopium williamsoni</i>
Northern Pike minnow	<i>Ptychocheilus oregonensis</i>
Pearmouth Chub	<i>Mylocheilus caurinus</i>
Prickly Sculpin	<i>Cottus asper</i>
Pumpkinseed	<i>Lepomis gibbosus</i>
Pygmy Whitefish	<i>Prosopium coulteri</i>
Rainbow Trout	<i>Oncorhynchus mykiss</i>
Redside Shiner	<i>Richardsonius balteatus</i>
Slimy Sculpin	<i>Cottus cognatus</i>
Yellow Perch	<i>Perca flavescens</i>

4.3 Wildlife/Habitat

Wildlife habitat at the site is limited because of the developed nature of the riparian area, however, some riparian habitat does exist. It is possible to find some bird species such as grouse, woodpecker and flycatcher. Eagles, osprey and other raptors also likely utilize neighbouring trees along the shoreline as habitat. There is the potential for small mammals such as beavers, muskrat and others to be present although the likelihood is considered to be low because of the developed nature of the shoreline. Some amphibians may also be present. No wildlife was observed during the field visit, likely due to timing of the assessment.

4.4 Species at Risk

The CDC Mapped Known Locations online mapping application was queried for mapped records of species at risk. Shape ID 74373, Occurrence ID 10214, which spans a vast area east of Okanagan Lake, is present on the subject property and represents a sighting of an American Badger (*Taxidea taxus*), last observed in 2012 (BC CDC 2015).

Shape ID 7892, Occurrence ID 1667, is present on the subject property, and represents observations of Blue Vervain (*Verbena hastata* var. *scabra*). Blue Vervain was not observed during the June, 2015 site visit.

Shape ID 47799, Occurrence ID 8098 is located immediately east of the subject property. This occurrence is related to observations of Western Screech Owl (*Megascops kennicottii macfarlanei*).

Shape ID 19093, Occurrence ID 6094 is located approximately 1.3 km east of the subject property, and is associated with observations of Grasshopper Sparrow (*Ammodramus savannarum*). The disturbed nature of the subject property has drastically reduced its suitability for Grasshopper Sparrow habitat.

Shape ID 8448, Occurrence ID 3735 is located approximately 1.7 km northeast of the subject property, and is associated with observations of Great Basin Spadefoot (*Spea intermontana*). The disturbed nature of the subject property has drastically reduced its suitability for Great Basin Spadefoot habitat.

No species at risk were observed during the field review at the subject property although formal rare wildlife and plant surveys were not within the scope of this assessment. The proposed development area was scanned for species presence at a reconnaissance level. The likelihood of encountering these species is not considered to be high because the habitats associated with the marina and adjacent areas are highly developed and disturbed and there is little opportunity for life history processes to occur. However, a non detect does not infer that use may not occur at some point, but the probability of high use or permanent residence on the site is considered very low. Finally, because the work is

primarily occurring at depth in the lake and not in nearshore or shoreline areas, there is a low probability of rare and endangered risks associated with the proposed works.

5.0 ENVIRONMENTAL EFFECTS AND MITIGATION

The following section outlines potential effects associated with the proposed marina and breakwater upgrades. For some of the components, no effects are anticipated. There is the potential for positive effects to occur also. The following components are unlikely to be affected by the proposed marina:

Terrain/Topography: No upland works are proposed as part of marina construction. As a result significant changes to the terrain and topography are not anticipated. Potential changes to sediment transport are covered under soil and sediment.

Wildlife Habitat: The proposed works are not anticipated to substantially change the overall character of the foreshore and riparian area associated with the subject property.

Species at Risk: No species at risk were encountered during the field surveys and additional impacts to potential habitat for species at risk are not anticipated.

The following table outlines potential effects along with an assessment of the significance of the effect and proposed mitigation measures. Many of the operational effects are those that might take place during operation of the existing marina. For each potential effect Ecoscape has outlined measures to mitigate effects to the receiving environment. Many of these mitigation measures were sourced from common best management practices documents. The following are examples of some of the documents that were referenced:

- Alaska Best Management Practices for Harbor, Marina and Boat Operations. Prepared for State of Alaska, Office of the Governor. (Prepared by Neil Ross Consultants and Concepts Unlimited. 2004.)
- Best Management Practices for Wharf, Pier, Dock, Boathouse and Mooring (Ministry of Environment and Fisheries and Oceans Canada. Date Unknown).
- Habitat Officer's Terms and Conditions (Ministry of Environment Habitat Officers, Okanagan Region. April 2011).
- Land Development Guidelines for the Protection of Aquatic Habitat (Department of Fisheries and Oceans and Ministry of Environment, Lands and Parks 1992).
- Marina Development Guidelines for the Protection of Aquatic Habitat (Fisheries and Oceans Canada and Ministry of Environment, Lands and Parks 1995).

- Marine Guide to Small Boat Moorage Factsheet (Fisheries and Oceans Canada Habitat Enhancement Branch 2001).
- Operational Statement for Construction of Docks in Freshwater Systems (Department of Fisheries and Oceans 2007).
- Standards and Best Practices for Instream Works (Ministry of Water, Land and Air Protection 2004).

Table 2 provides an outline of potential effects associated with construction and operation of the marina. No mitigation is provided for decommissioning as there are no plans to decommission the proposed marina, future plans would likely include maintenance and replacement of degraded components over time only. Groundwater and surface water have been addressed together in the table as the impacts that are likely to affect surface water are likely to be the same as those that affect groundwater. There are also no groundwater wells mapped within close proximity to the marina (i.e. below the high water mark) although there is a water intake at depth.

<p>bris from removal of unused portions of the na and/or breakwater system could be osited in the lake and could impact water ity.</p>	<p>of the Effect</p> <p>ME</p>	<p>--Existing piles that will not be reused should be cut or broken off as close to the lake bottom as possible if they cannot be safely and successfully pulled out (Ministry of Environment 2006). --All material from damaged or relocated structures that will not be used in the upgrades should be taken offsite and disposed of in an appropriate location. --Waste should be taken offsite as soon as possible and should not be stored within 15 m of the high water mark of Okanagan Lake. --Burning of piles and wooden dock components along the foreshore is not an acceptable form of disposal and must not occur (Ministry of Environment 2006). -Cutting of wood decking, steel or concrete over the water must not occur due to the potential release of toxins. Any cutting that is to occur on site should take place over a tarp or suitable containment area, and all cuttings/byproduct should be removed from the site and not disposed of in water.</p>	<p>If mitigation measures are followed, there are unlikely to be residual effects.</p>
<p>struction activities such as pile driving and cement and securing of marina components the potential to cause sedimentation and idity.</p>	<p>ME</p>	<p>--Prevent the release of silt, sediment, or sediment-laden water. If works are expected to significantly disrupt lake bottom substrates, then containment measures must be undertaken. --Sufficient water depths must be present to prevent the barge from grounding on the foreshore and the use of barge stabilizing spuds should be avoided (Fisheries and Oceans Canada and Ministry of Environment, date unknown). During construction, prop scour from the barge or tending vessels must not occur. --It may be necessary to install a floating/hanging silt curtain during pile driving and other construction activities if turbidity becomes a significant concern. The need for a silt curtain could be determined by the dock builder, proponent and environmental monitor based on the construction activities and associated turbidity concerns.</p>	<p>If mitigation measures are followed, there are unlikely to be residual effects.</p>
<p>ills of various substances during struction such as fuels, concrete, lubricants, have the potential to impact water quality. nstruction materials have the potential to act water quality if they leach substances the water.</p>	<p>ME</p>	<p>--No concrete pours should occur on site. All marina components should be pre-cast or a. --Ensure that onsite machinery is in good operating condition, clean and free of leaks, excess oil, or grease. --Operators should take care when fueling equipment to prevent spills. Fueling should occur over an impermeable surface so that incidental spills or drips can be cleaned up with the appropriate spill response materials. All of the construction crew should be familiar with the location and proper use of these materials and how to respond in the event of a spill or spill related emergency. --Any equipment left in proximity to water over night should be secure. Place a clean piece of cardboard or some sheeting underneath equipment parked overnight to detect incidental leaks or drips. --Any equipment working from a barge over the water should contain a spill kit with adequate response materials to clean up potential spills. --Equipment operating from the barge should be serviced with "environmentally friendly" hydraulic fluid. --No equipment is to sit within the wetted perimeter of Okanagan Lake during construction. -- Lumber, if required during construction, should be treated with environmentally friendly stains. Cut, seal and stain all lumber away from the water using only environmentally-friendly stains (http://www.dfo-mpo.gc.ca/Library/245973.pdf). All sealed and stained lumber must be completely dry before being used near water. --Any spills of a deleterious substance of reportable quantities must be immediately reported to Emergency Management BC's 24 hour hotline at 1-800-663-3456 as well as Fisheries and Oceans Canada and Ministry of Environment. --Pads used for the boat launch extension should be pre-cast. No cast in place works are to occur during expansion of the boat launch.</p>	<p>If mitigation measures are followed, there are unlikely to be residual effects.</p>

rates if they are dragged across the m.		<p>adjacent and of similar water depth following guidelines of the Department of Fisheries and Oceans Operational Statement for Construction of Docks in Freshwater Systems.</p> <p>--Sufficient water depths must be present to prevent the barge from grounding on the foreshore and the use of barge stabilizing spuds should be minimized (Fisheries and Oceans Canada and Ministry of Environment, date unknown). During construction, prop scour from the barge or tending vessels must not occur.</p> <p>--Marina components including piles and anchors must be towed or lifted into place and not dragged across the bottom of the lake.</p> <p>--Work on the proposed boat launch must be limited to the existing and proposed footprint and must not encroach beyond these limits.</p> <p>-- Engineering review of the proposed facility has determined that the proposed repairs will not substantially alter shoreline processes. A letter under separate cover is provided in the application with design criteria that will be used to reach this determination. Detailed designs will be submitted once finalized.</p>	
struction activities will likely result in a orary increase in air emissions associated construction and operation of equipment machinery.	ME	<p>--Limit idling of equipment.</p> <p>--Make sure equipment is serviced and in good working order.</p>	If mitigation measures are followed, there are unlikely to be residual effects.
struction activities will likely result in a orary increase in noise associated with driving and operation of equipment and inery.	ME	--Limit noise impacts to daytime activities only between 7 am and 7 pm.	No residual effects are anticipated after construction complete.
struction activities have the potential to t the existing riparian area.	ME	--No riparian vegetation should be removed during construction. Works should occur from the water and no work is to be completed within the vegetated riparian area other than restoration planting. This work is to be completed by hand. No heavy equipment is to be used along the beach.	If mitigation measures are followed, there are unlikely to be residual effects.
struction activities have the potential to t aquatic macrophytes.	ME	<p>--Pilings and anchors should be positioned such that they are not impacting aquatic vegetation wherever possible. In the case of Eurasian watermilfoil, this is a non-native invasive species and disturbance with piling or anchor placement is not a concern.</p> <p>--Limit the width of walkways wherever possible, and thru flow decking should be used on the access pier to limit shade.</p>	If mitigation measures are followed, there are unlikely to be residual effects.
ks completed outside the timing windows nated for Okanagan Lake have the itial to impact important life stages of fish ations in Okanagan Lake.	ME	<p>--Works will be completed during the least risk timing window for Okanagan Lake which is June 1 – September 30.</p> <p>-- No works can occur below the high water mark of Okanagan Lake without having a Provincial <i>Water Act</i> Section 9 Notification application submitted, approved and in the possession of the property owner and contractor prior to any instream works.</p>	If mitigation measures are followed, there are unlikely to be residual effects.
driving activities may impact fish during ruction activities.	ME / M	<p>--Both wood piles and steel piles will be used, where steel piles are known to have larger percussions than wood.</p> <p>-- All percussions from pile driving should be within the limits provided within the guidelines for use of explosives near water (http://www.dfo-mpo.gc.ca/Library/232046.pdf)</p> <p>--If there is any evidence of impacts from piles affecting fish (i.e. observed mortality or other observable impacts) work should stop and a bubble curtain may need to be put in place.</p> <p>--Pile driving should begin with a few strikes followed by a pause to allow fish to swim out of the area.</p> <p>--Limit the number of piles that are put in each day where impacts to fish are a concern.</p> <p>--Push piles into substrates rather than pounding or driving piles where possible.</p>	If mitigation measures are followed, there are unlikely to be residual effects.

		structure will be floating and therefore not disturb the lakebed and the construction of the new moorage area will adhere to mitigations described in this table.	
Construction activities have the potential to interfere with boat traffic on Okanagan Lake.	ME	--Construction crews should adhere to all boating guidelines and should be clearly visible to boating traffic	If mitigation measures are followed, there are unlikely to be residual effects.

effect ME: Minor adverse effect/mitigable effect (not significant) NS: Not significant adverse environmental effect UN: Uncertain/unknown effect M: Monitoring required

6.0 ENVIRONMENTAL MONITORING

A suitably qualified environmental monitor should be retained to provide part time environmental monitoring during instream works. Monitoring should be completed on an as needed basis and depending upon risks. For works proposed outside of the standard work window, weekly visits are likely appropriate given anticipated risks of the project. For works within the work window, monthly or bi weekly visits are appropriate given the level of anticipated risk. The environmental monitor should document adherence to best management practices and provide guidance as necessary. It is the proponent's responsibility to retain an environmental monitor during construction.

7.0 CLOSURE

This report has been prepared by Ecoscape Environmental Consultants Ltd. (Ecoscape) for the Vernon Yacht Club and considers the existing and potential site conditions of the site with respect to aquatic and terrestrial ecosystems and intrinsic ecological values. Ecoscape has prepared this report with the understanding that all available information on the past, present, and proposed conditions of the property have been disclosed. The Vernon Yacht Club has acknowledged that in order for Ecoscape to properly provide the professional service, Ecoscape is relying upon full disclosure and accuracy of this information.

If you have any questions or comments, please contact the undersigned at your convenience.

Respectfully Submitted
ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.

Written By:



Mike Schutten, M.A.Sc
Environmental Scientist
Direct Line: (250) 491-7337 ext. 206

Reviewed By:



Jason Schleppe, M.Sc., RPBio
Senior Natural Resource Biologist
Direct Line: (250) 491-7337 ext. 202

REFERENCES

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PHOTOS





Photo 1. View of the existing shoreline near the north end of the site (all photos taken on June 23, 2015, unless otherwise specified).



Photo 2. Looking south along the existing shoreline.



Photo 3. Looking northeast towards the log breakwater located north of the marina.



Photo 4. Looking at the damage done to the concrete breakwater floats west of the marina during the July 2014 storm (photo submitted by client)



Photo 5. A close look at damage done to the concrete breakwater floats west of the marina during the July 2014 storm.

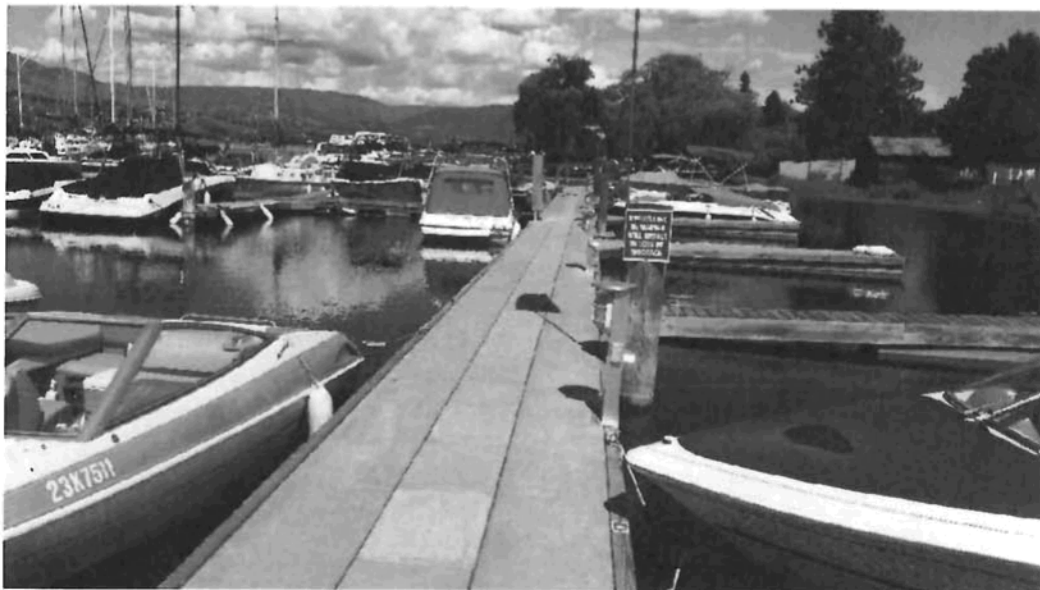


Photo 6. A mix of concrete a wooden docks currently occupy the marina. All upgrades will be concrete.



Photo 5. A close look at damage done to the concrete breakwater floats west of the marina during the July 2014 storm.



Photo 6. A mix of concrete a wooden docks currently occupy the marina. All upgrades will be concrete.

FIGURES



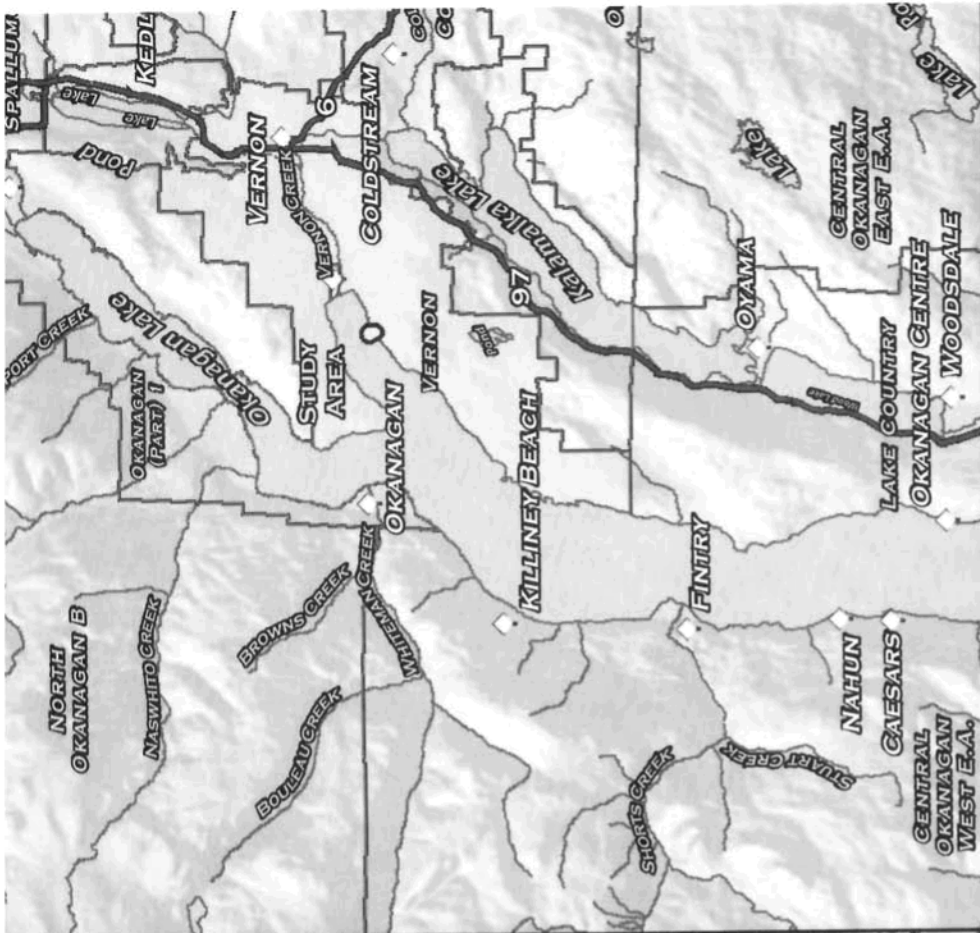
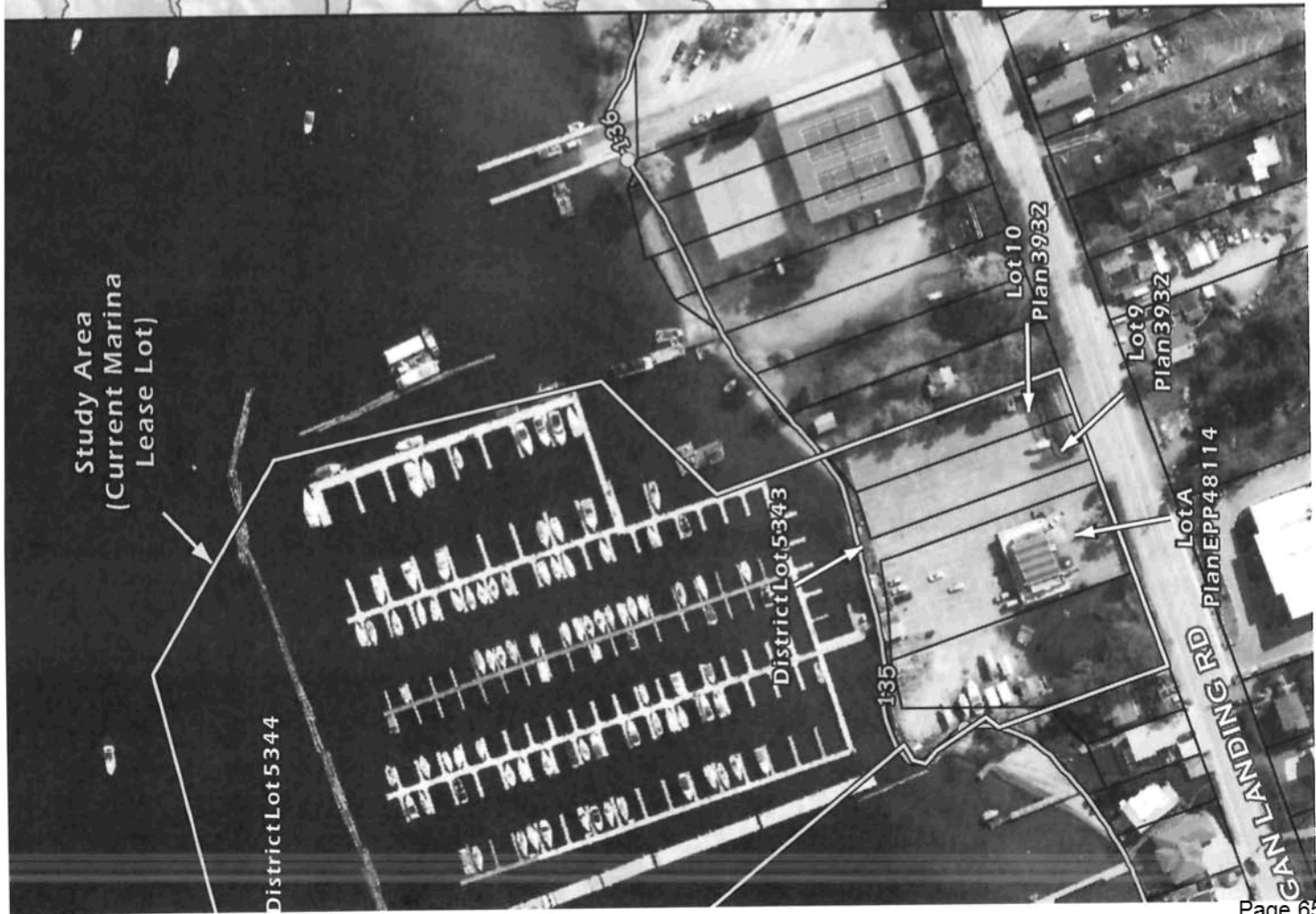


FIGURE 1
Site Location

Project: Section 9 Application
 Location: City of Vernon
 Project No.: 15-1461
 Prepared for: Vernon Yacht Club
 Prepared by: Ecoscape Environmental Consultants Ltd.
 Drawn by: Robert Wagner
 Checked by: Jason Schleppe
 Projection: NAD83-UTM Zone 11
 Date: March 16, 2016

LEGEND

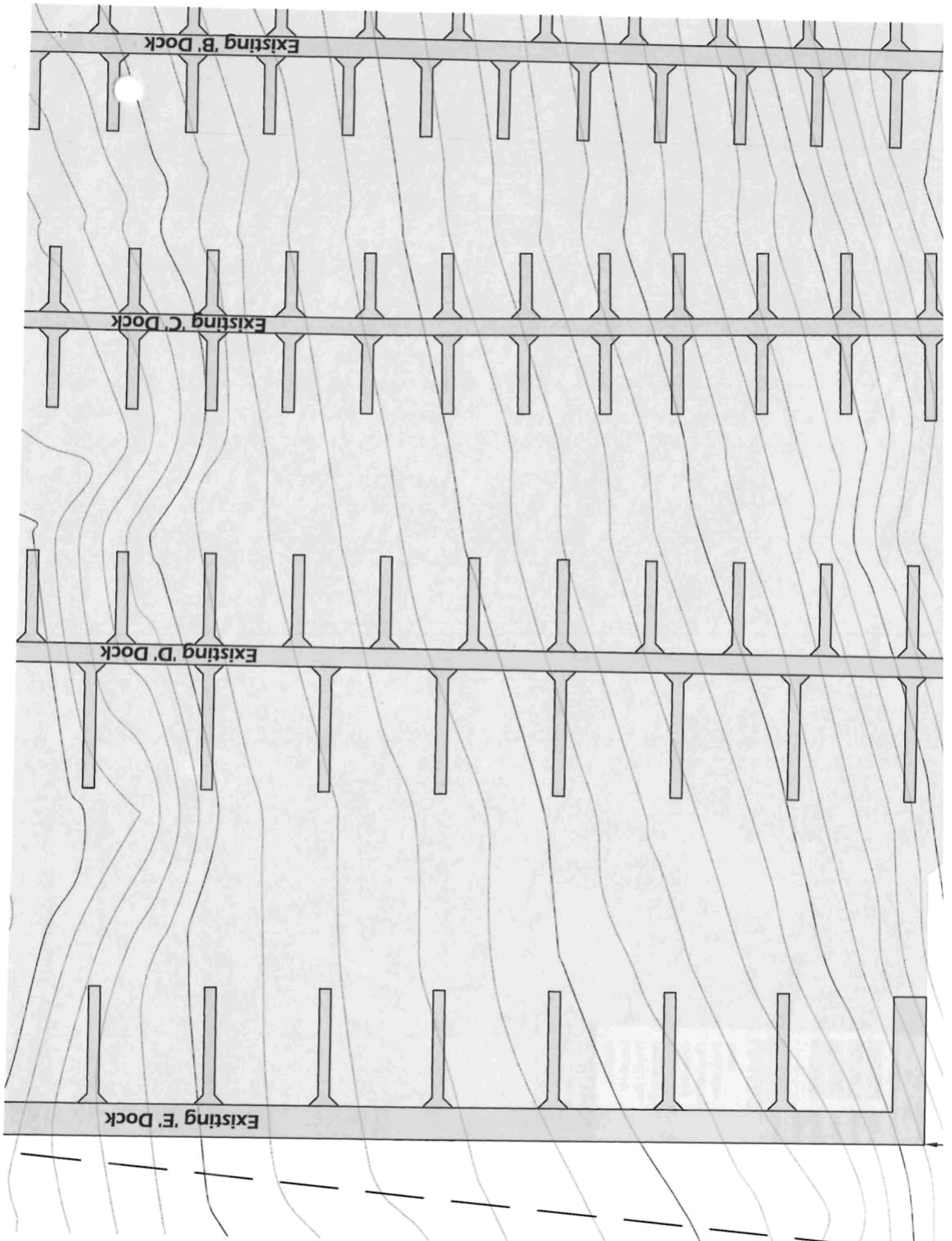


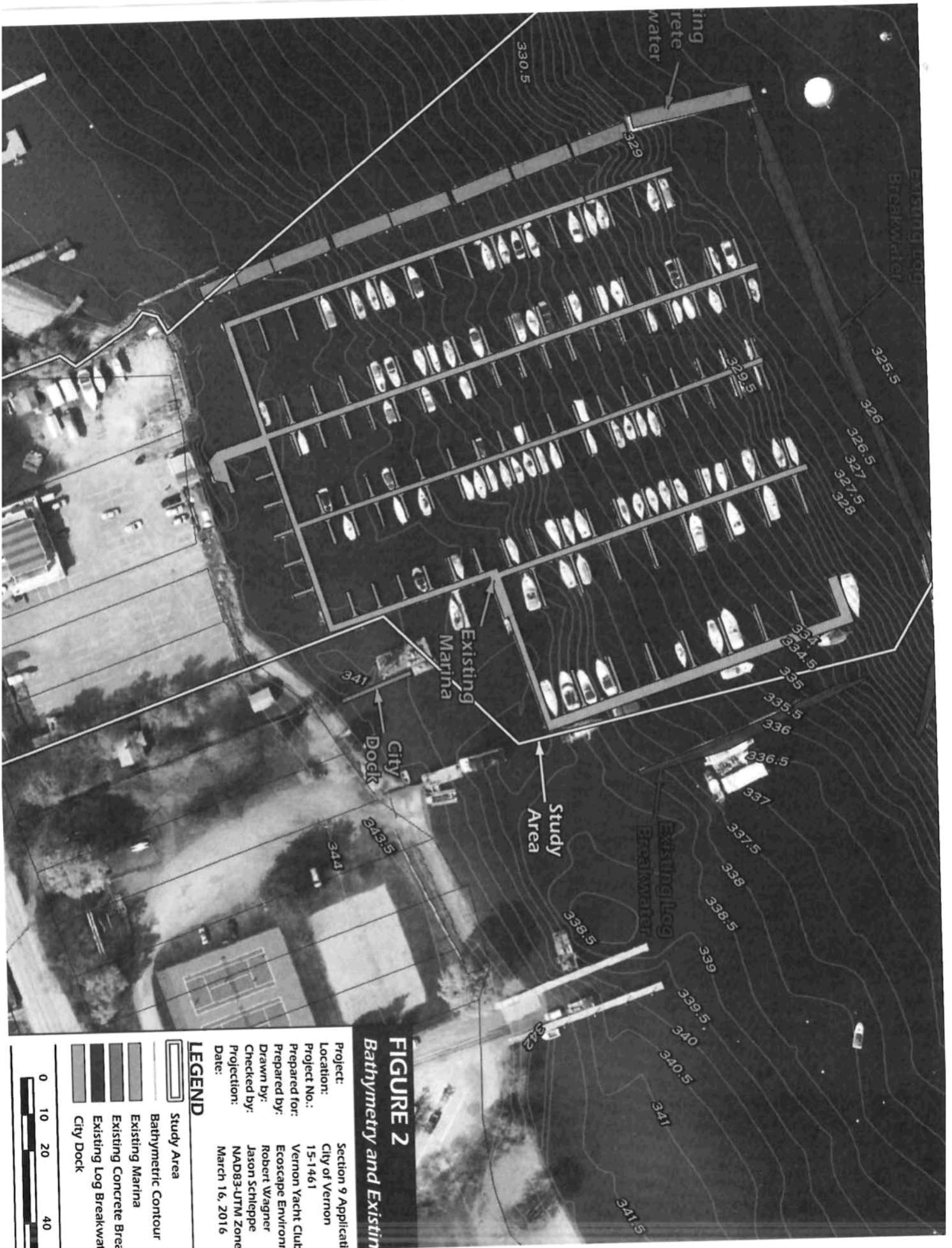
ROCKY MOUNTAIN RIDGE MUSSEL SURVEY SUMMARY



APPENDICES







SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE ASTM C136



July 7, 2006

WESTMAR CONSULTANTS INC.
400 - 233 West 1st Street
North Vancouver, BC V7M 1B3

JOB NUMBER: 06-1416-071
SAMPLE NUMBER: 1

ATTENTION: Holly Monaghan, EIT

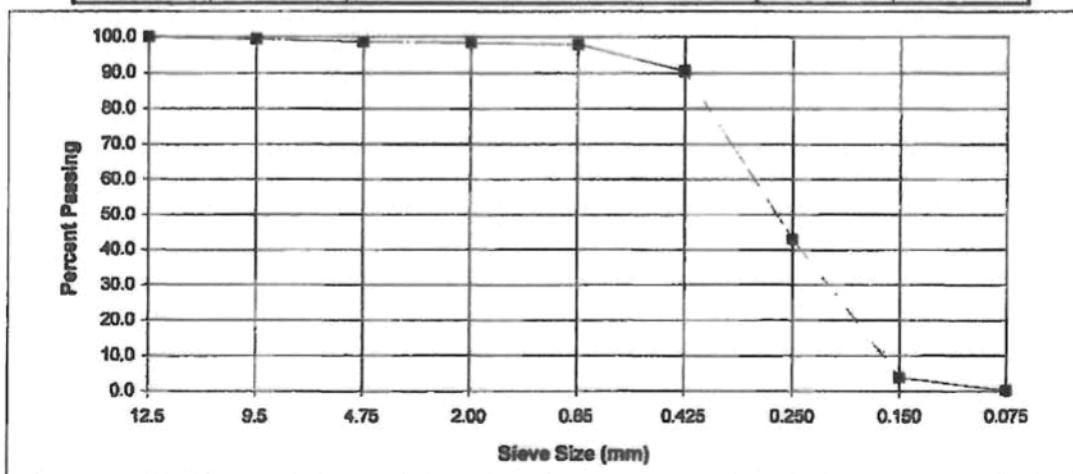
PROJECT: Grain Size Analysis

Sample:	Vernon Yacht Club #1
---------	----------------------

DATE SAMPLED: June 1, 2006

SAMPLED BY: Client

SIEVE ANALYSIS				
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)	
			+ 4.75	- 4.75
75	0.0	100.0	0.0	
50	0.0	100.0	0.0	
37.5	0.0	100.0	0.0	
25	0.0	100.0	0.0	
19	0.0	100.0	0.0	
12.5	0.0	100.0	0.0	
9.5	0.5	99.5	40.6	
4.75	0.8	98.6	59.4	
2.00	0.4	98.3		0.4
0.85	0.4	97.9		0.4
0.425	7.4	90.5		7.5
0.250	47.4	43.1		48.1
0.150	39.3	3.8		39.8
0.075	3.6	0.2		3.6
PAN	0.2			0.2
Total	100.0			



Remarks:

Fineness Modulus : 1.62

Reported by:

AS
AS

Reviewed by:

OSO
OSO

Notice: The test data given herein pertain to the sample provided and may not be applicable to material from other production zones. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE ASTM C136



July 7, 2006

WESTMAR CONSULTANTS INC.
400 - 233 West 1st Street
North Vancouver, BC V7M 1B3

JOB NUMBER: 06-1416-071
SAMPLE NUMBER: 2

ATTENTION: Holly Monaghan, EIT

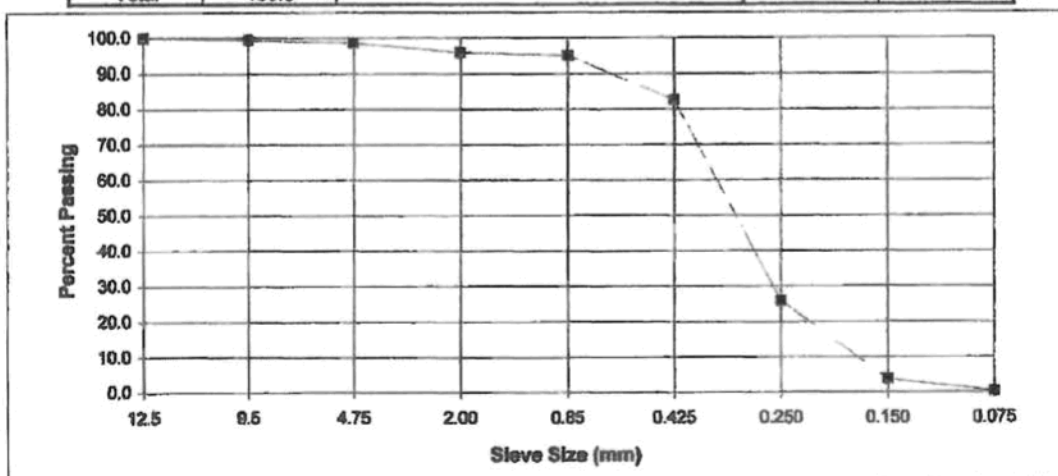
PROJECT: Grain Size Analysis

Sample:	Vernon Yacht Club #2
---------	----------------------

DATE SAMPLED: June 1, 2006

SAMPLED BY: Client

SIEVE ANALYSIS				
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)	
			+ 4.75	- 4.75
75	0.0	100.0	0.0	
50	0.0	100.0	0.0	
37.5	0.0	100.0	0.0	
25	0.0	100.0	0.0	
19	0.0	100.0	0.0	
12.5	0.0	100.0	0.0	
9.5	0.5	99.5	38.5	
4.75	0.9	98.6	61.5	
2.00	2.7	95.9		2.8
0.85	0.9	95.0		0.9
0.425	12.4	82.6		12.5
0.250	56.8	25.9		57.6
0.150	22.1	3.8		22.4
0.075	3.5	0.3		3.6
PAN	0.3			0.3
Total	100.0			



Remarks:

Fineness Modulus : 1.92

Reported by:

AS
AS

Reviewed by:

OSO
OSO

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**SIEVE ANALYSIS OF
FINE AND COARSE AGGREGATE
ASTM C136**



July 7, 2006

WESTMAR CONSULTANTS INC.
400 - 233 West 1st Street
North Vancouver, BC V7M 1B3

JOB NUMBER: 06-1416-071
SAMPLE NUMBER: 3

ATTENTION: Holly Monaghan, EIT

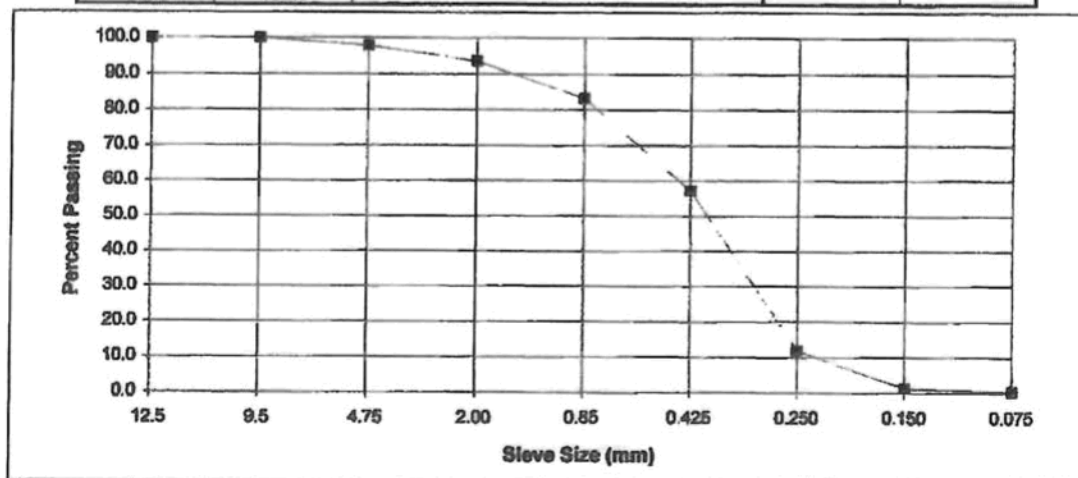
PROJECT: Grain Size Analysis

Sample:	Vernon Yacht Club #3
---------	----------------------

DATE SAMPLED: June 1, 2006

SAMPLED BY: Client

SIEVE ANALYSIS				
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)	
			+ 4.75	- 4.75
75	0.0	100.0	0.0	
50	0.0	100.0	0.0	
37.5	0.0	100.0	0.0	
25	0.0	100.0	0.0	
19	0.0	100.0	0.0	
12.5	0.0	100.0	0.0	
9.5	0.0	100.0	0.0	
4.75	2.2	97.8	100.0	
2.00	4.3	93.5		4.4
0.85	10.2	83.3		10.4
0.425	26.1	57.2		26.6
0.250	45.4	11.8		46.4
0.150	10.4	1.4		10.7
0.075	1.1	0.3		1.1
PAN	0.3			0.3
Total	100.0			



Remarks:

Fineness Modulus : 2.47

Reported by:

AS
AS

Reviewed by:

OSO
OSO

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SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE ASTM C136



July 7, 2006

WESTMAR CONSULTANTS INC.
400 - 233 West 1st Street
North Vancouver, BC V7M 1B3

JOB NUMBER: 06-1418-071
SAMPLE NUMBER: 4

ATTENTION: Holly Monaghan, EIT

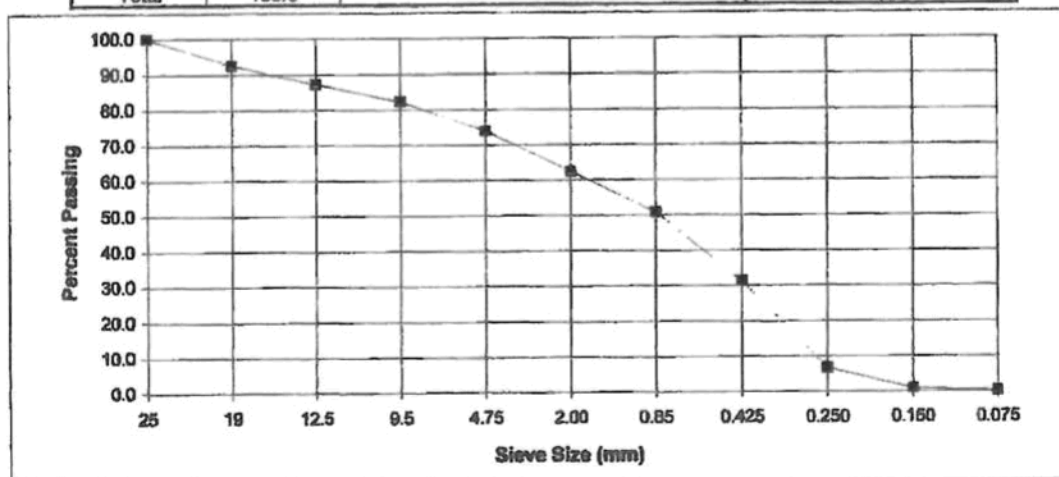
PROJECT: Grain Size Analysis

Sample:	Vernon Yacht Club #4
---------	----------------------

DATE SAMPLED: June 1, 2006

SAMPLED BY: Client

SIEVE ANALYSIS				
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)	
			+ 4.75	- 4.75
75	0.0	100.0	0.0	
50	0.0	100.0	0.0	
37.5	0.0	100.0	0.0	
25	0.0	100.0	0.0	
19	7.5	92.5	28.9	
12.5	5.1	87.3	19.7	
9.5	5.0	82.3	19.2	
4.75	8.4	73.9	32.2	
2.00	11.4	62.5		15.5
0.85	11.8	50.8		15.7
0.425	19.5	31.3		28.4
0.250	24.6	6.7		33.2
0.150	5.8	1.0		7.8
0.075	0.7	0.3		0.9
PAN	0.3			0.4
Total	100.0			



Remarks:

Fineness Modulus: 2.94

Reported by:

AS
AS

Reviewed by:

OSO
OSO

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SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE ASTM C136



July 7, 2006

WESTMAR CONSULTANTS INC.
400 - 233 West 1st Street
North Vancouver, BC V7M 1B3

JOB NUMBER: 06-1416-071
SAMPLE NUMBER: 5

ATTENTION: Holly Monaghan, EIT

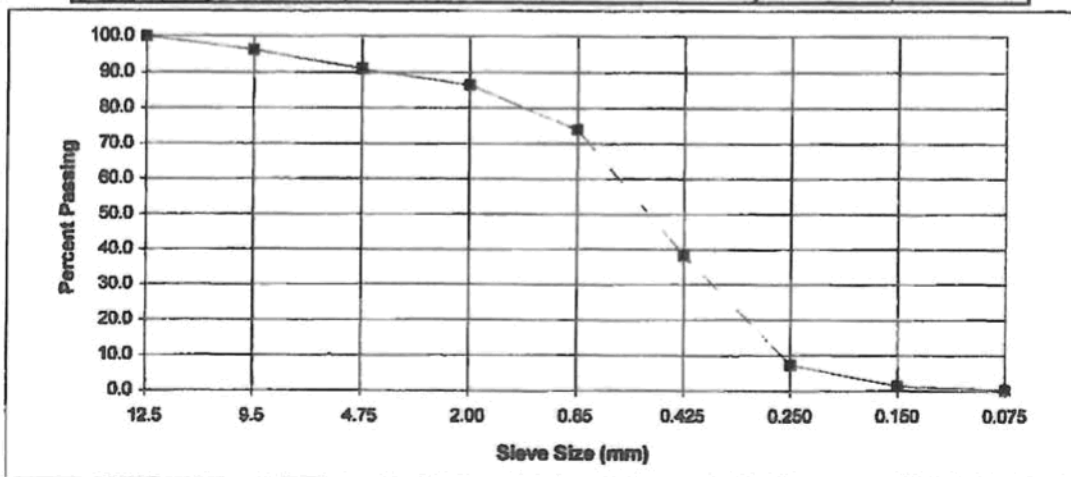
PROJECT: Grain Size Analysis

Sample:	Vernon Yacht Club #5
---------	----------------------

DATE SAMPLED: June 1, 2006

SAMPLED BY: Client

SIEVE ANALYSIS						
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)			
			+ 4.75	- 4.75		
75	0.0	100.0	0.0			
50	0.0	100.0	0.0			
37.5	0.0	100.0	0.0			
25	0.0	100.0	0.0			
19	0.0	100.0	0.0			
12.5	0.0	100.0	0.0			
9.5	3.9	96.1	43.1			
4.75	5.2	90.9	56.9			
2.00	4.5	86.5		4.9		
0.85	12.5	73.9		13.8		
0.425	35.5	38.4		39.1		
0.250	31.1	7.3		34.2		
0.150	5.8	1.4		6.4		
0.075	1.2	0.3		1.3		
PAN	0.2			0.3		
Total	100.0					



Remarks:

Fineness Modulus : 2.72

Reported by:

AS
AS

Reviewed by:

OSO
OSO

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SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE ASTM C136



July 7, 2006

WESTMAR CONSULTANTS INC.
400 - 233 West 1st Street
North Vancouver, BC V7M 1B3

JOB NUMBER: 06-1416-071
SAMPLE NUMBER: 6

ATTENTION: Holly Monaghan, EIT

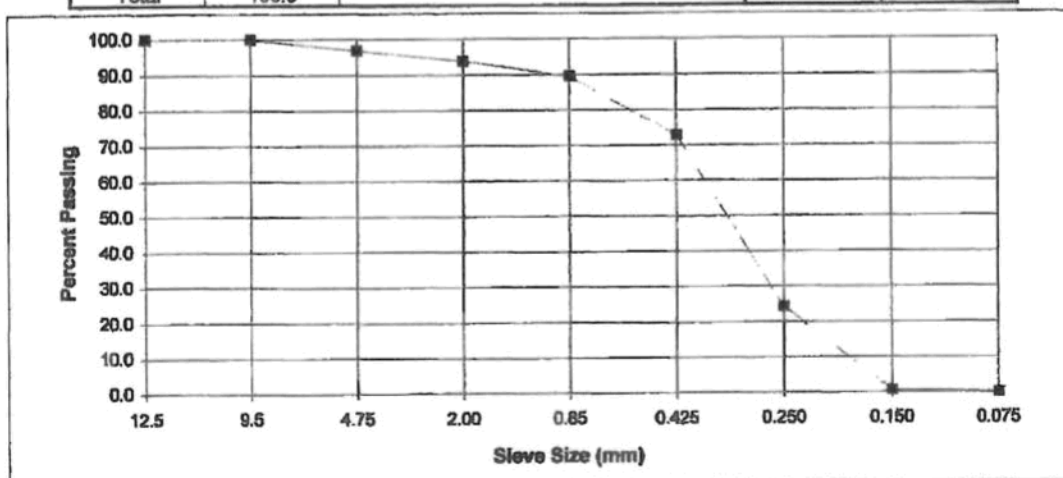
PROJECT: Grain Size Analysis

Sample:	Vernon Yacht Club #6
---------	----------------------

DATE SAMPLED: June 1, 2006

SAMPLED BY: Client

SIEVE ANALYSIS				
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)	
			+ 4.75	- 4.75
75	0.0	100.0	0.0	
50	0.0	100.0	0.0	
37.5	0.0	100.0	0.0	
25	0.0	100.0	0.0	
19	0.0	100.0	0.0	
12.5	0.0	100.0	0.0	
9.5	0.0	100.0	0.0	
4.75	3.3	96.7	100.0	
2.00	3.0	93.7		3.1
0.85	4.3	89.5		4.4
0.425	16.6	72.8		17.2
0.250	48.8	24.2		50.3
0.150	23.6	0.6		24.4
0.075	0.6	0.1		0.6
PAN	0.1			0.1
Total	100.0			



Remarks:

Fineness Modulus: 2.10

Reported by:

AS
AS

Reviewed by:

OSO
OSO

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SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE ASTM C136 & C117



July 7, 2006

WESTMAR CONSULTANTS INC.
400 - 233 West 1st Street
North Vancouver, BC V7M 1B3

JOB NUMBER: 06-1416-071
SAMPLE NUMBER: 7

ATTENTION: Holly Monaghan, EIT

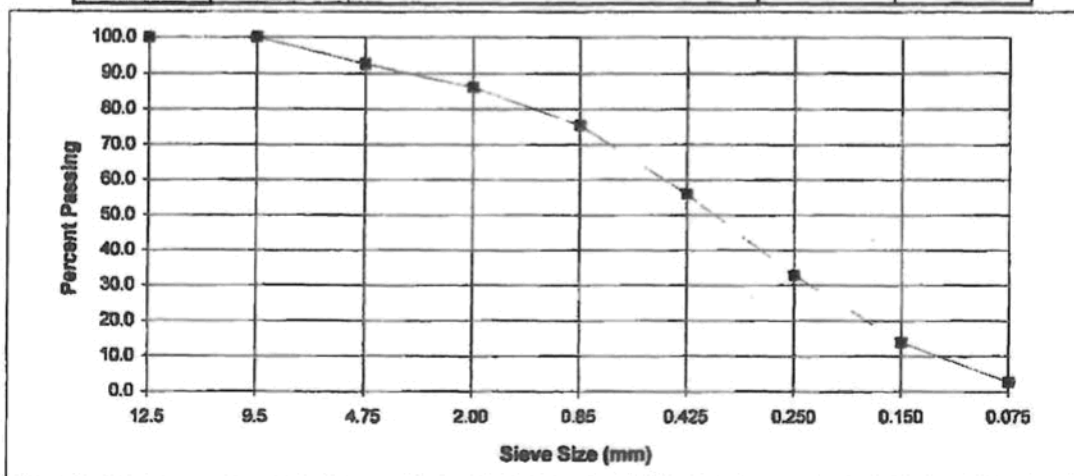
PROJECT: Grain Size Analysis

Sample:	Vernon Yacht Club #7
---------	----------------------

DATE SAMPLED: June 1, 2006

SAMPLED BY: Client

SIEVE ANALYSIS				
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)	
			+ 4.75	- 4.75
75	0.0	100.0	0.0	
50	0.0	100.0	0.0	
37.5	0.0	100.0	0.0	
25	0.0	100.0	0.0	
19	0.0	100.0	0.0	
12.5	0.0	100.0	0.0	
9.5	0.0	100.0	0.0	
4.75	7.4	92.6	100.0	
2.00	6.5	88.1		7.0
0.85	10.7	75.5		11.5
0.425	19.5	55.9		21.1
0.250	23.1	32.8		25.0
0.150	19.0	13.8		20.6
0.075	11.0	2.8		11.9
PAN	2.8			3.0
Total	100.0			



Remarks:

Fineness Modulus: 2.15

Reported by:

AS
AS

Reviewed by:

OSO
OSO

Notice: The test data given herein pertain to the sample provided and may not be applicable to material from other production zones. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE ASTM C136



July 7, 2006

WESTMAR CONSULTANTS INC.
400 - 233 West 1st Street
North Vancouver, BC V7M 1B3

JOB NUMBER: 08-1416-071
SAMPLE NUMBER: 8

ATTENTION: Holly Monaghan, EIT

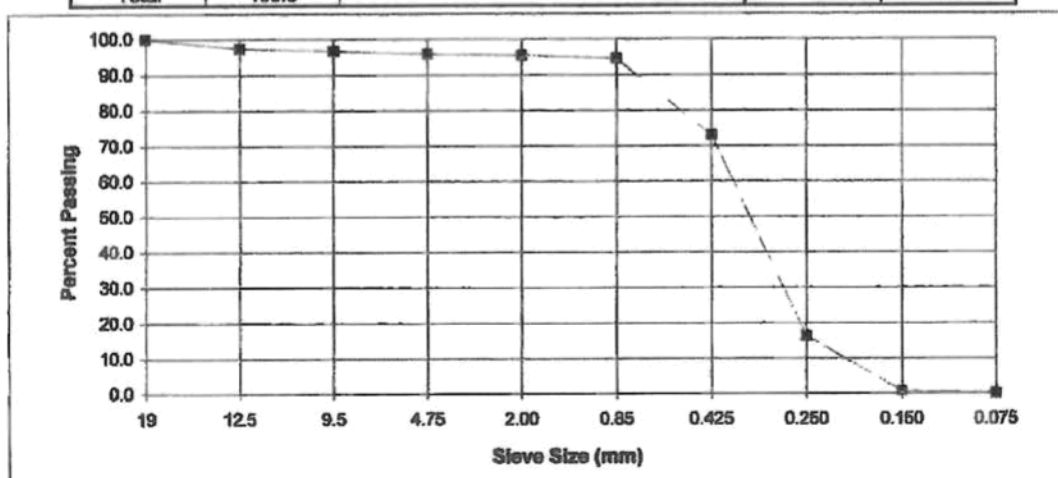
PROJECT: Grain Size Analysis

Sample:	Vernon Yacht Club #8
---------	----------------------

DATE SAMPLED: June 1, 2006

SAMPLED BY: Client

SIEVE ANALYSIS						
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)			
			+ 4.75	- 4.75		
75	0.0	100.0	0.0			
50	0.0	100.0	0.0			
37.5	0.0	100.0	0.0			
25	0.0	100.0	0.0			
19	0.0	100.0	0.0			
12.5	2.6	97.4	62.7			
9.5	0.7	99.7	16.6			
4.75	0.9	99.8	20.7			
2.00	0.3	99.4		0.4		
0.85	0.9	94.6		0.9		
0.425	21.5	73.0		22.5		
0.250	56.8	16.3		59.3		
0.150	15.5	0.7		16.2		
0.075	0.6	0.1		0.7		
PAN	0.1			0.1		
Total	100.0					



Remarks:

Fineness Modulus: 2.08

Reported by:

AS
AS

Reviewed by:

OSO
OSO

Notice: The test data given herein pertain to the sample provided and may not be applicable to material from other production zones. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

APPENDIX E

WESTMAR 1997 KILLINEY BEACH

**WAVES AND FORCING FOR VERNON YACHT CLUB BREAKWATER.
LOCATION OF THE STUDY IS NOT REPRESENTATIVE OF THE SITE.**

SEPT 15, 2014

CRAIG WILLIAMS

FAX: 250-558-1100

CRAIG, THIS IS ALL THE INFORMATION I CAN FIND.
THIS MAY GIVE YOU AN IDEA OF THE INFORMATION
REQUESTED.

REGARDS,

BRENT

Dock Construction, Rebuild & Repairs - Piles, Timber, Concrete & Steel
Exclusive Dynast Dock Flotation Systems - Permit Services & Project Design
Consultation, Survey & Engineering Services - Retaining Wall & Bulkhead Construction



WESTMAR CONSULTANTS INC.

$$\text{in 20 year, } V_c = .036 \text{ m/s} = .86 \text{ m/s}, f = \frac{1}{2} \rho C_D A V^2 = \frac{1}{2} \times \frac{1000 \text{ kg/m}^3}{1000 \text{ kg/m}^3} \times 1.4 \times 1 \times .86^2$$

$$= .78 \text{ kN/m} = \underline{93 \text{ lb/ft.}}$$

$$\text{in 100 year, } f = \left(\frac{117}{103}\right)^2 \times 93 = \underline{68 \text{ lb/ft.}}$$

Wave Drift

$$\text{in 20 year, } H_s = 2 \text{ m, } 10' \text{ W.D., } \lambda = 70.5', f = \underline{229 \text{ lb/ft.}}$$

$$\text{in 100 year, } H_s = 2.4 \text{ m, } \lambda = 76.5', f = \underline{325 \text{ lb/ft.}}$$

Total Static Load

$$\text{in 20 year, } f_{s,20} = 29 + 93 + 229 = \underline{311 \text{ lb/ft.}}$$

$$\text{in 100 year, } f_{s,100} = 37 + 68 + 325 = \underline{430 \text{ lb/ft.}}$$

Take Dynamic Loads as $\pm 50\%$ of Static Load

$$\text{in 20 year, } f_{d,20} = \underline{156 \text{ lb/ft.}}$$

$$\text{in 100 year, } f_{d,100} = \underline{215 \text{ lb/ft.}}$$

Sum of Static + Dynamic

$$\text{in 20 year, } f_{T,20} = \underline{467 \text{ lb/ft.}}$$

$$\text{in 100 year, } f_{T,100} = \underline{645 \text{ lb/ft.}}$$


Westmar Consultants Inc.

Project	Killiney Beach	By	N.A.	Date	Oct 15/14	Page	of
Subject	Wave & Surge	Ckd		Date		Job No.	97627

From wave report, scale factor
on winds = 1.0 (conservative for 1 in 20 year
condition)

Assume that the 'E' wave comes out of
Vernon (Kusman Beach Park)

Fetch = 12.5 km.

Spreadsheet Verne.wk1

Killiney Beach:

Return Period	Direction	Fetch	V _h	H _s	H _{max} = 1.8 H _s	T _p	λ
20 years	ENE*	12.5 km	70 kph	1.10 m (3.6')	2 m (6.6')	3.5 sec	19 m
100 years	ENE*	12.5 km	81 kph	1.37 m (4.5')	2.5 m (8.2')	3.8 sec	22 m
20 year	S	27 km	103 kph	2 m (6.6')	3.6 m (11.8')	4.4 sec	30 m
100 years	S	27 km	117 kph	2.4 m (8')	4.3 m (14')	4.7 sec	35 m

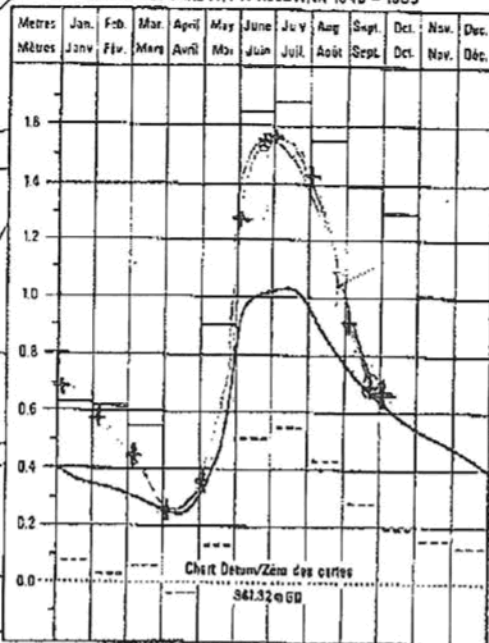
* E direction winds used.

Vernon: calc. W & SW winds & waves at Vernon are 11.5 km fetch

Vernon W. brk	20 years	W	12.5 km	88 kph	1.56 m	2.8 m	4 sec.	25 m.
	100 years	W	"	101 kph	1.97 m	3.5 m	4.3 sec.	29 m
Vernon SW brk	20 years	SW	"	90 kph	1.62 m	2.9 m	4 sec.	25 m.
	100 years	SW	"	107 kph	1.96 m	3.5 m	4.4 sec.	30 m

↓ ↓
→ H_{max} = 5' H_{max} = 7' →
→ h_{max} = 6' h_{max} = 11' →

OKANAGAN LAKE AT / À KELOWNA 1943 - 1985

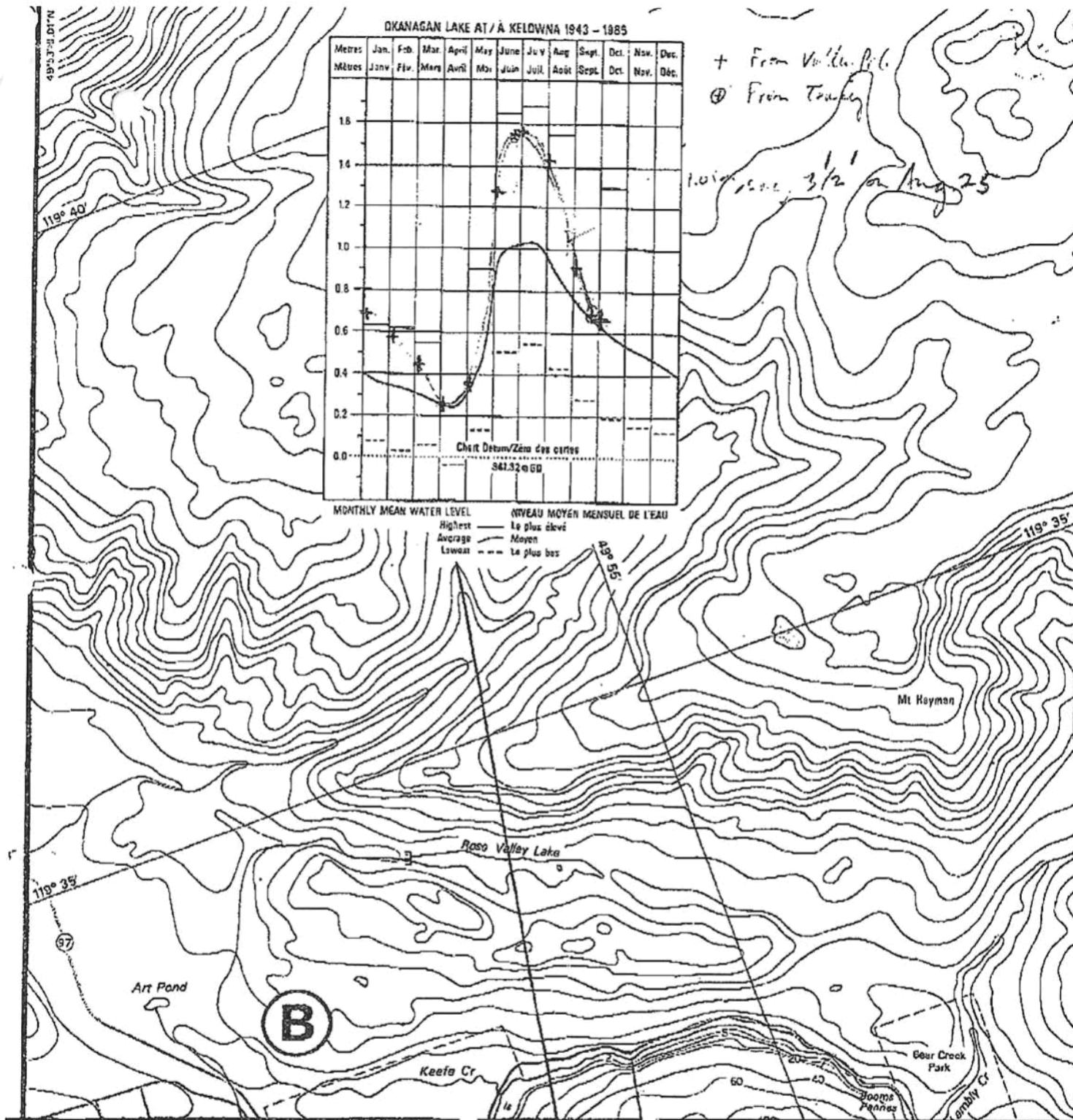


MONTHLY MEAN WATER LEVEL / NIVEAU MOYEN MENSUEL DE L'EAU

Highest / Le plus élevé
Average / Moyen
Lowest / Le plus bas

+ From V.I.L. P. 6.
④ From Traction

1.01 m, 3 1/2' on Aug 25



PROGRAM / PROGRAMME : GRP105

PROJECT NUMBER / NUMÉRO DU PROJET : 12345

STATION: VERNON
B.C. / C.B.
1128551

FOR / POUR: VRS/ANNÉES
1971-1979

WIND SPEED LIMIT / LIMITE LA VITESSE:

PERCENTAGE OF OCCURRENCES BY SPEED DIRECTION / % D'OC-CURRENCES PAR VITESSE DIRECTION

MEAN

PERCENTAGE DES OCCURRENCES SELON LA DIRECTION / % DE VITESSE DIRECTION

WIND DIRECTION / DIRECTION DU VENT

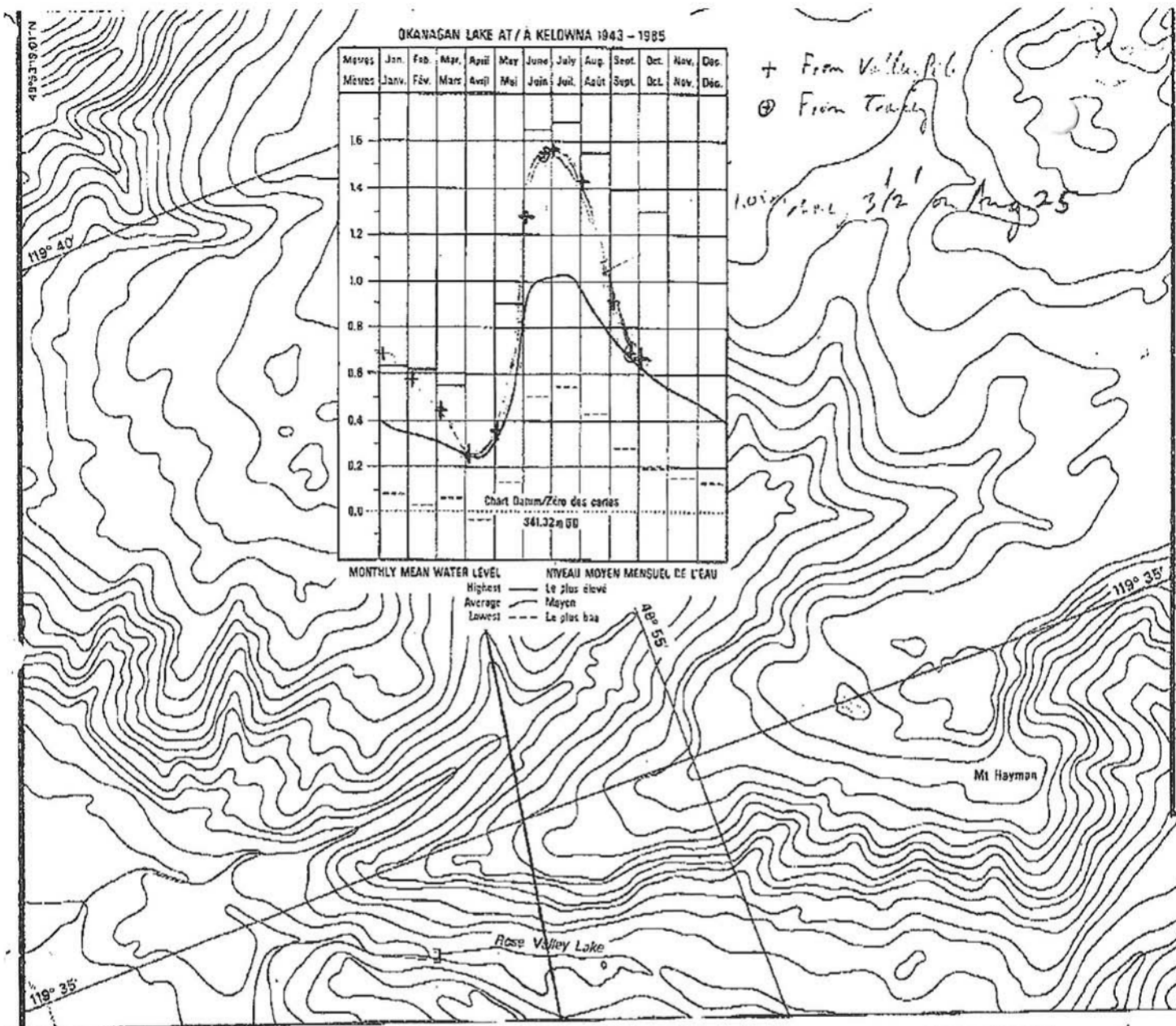
WIND SPEED CLASSES / CLASSES DES VITESSES DE VENT

	1- 9	10- 19	20- 30	31- 42	43- 55	56- 69	70- 84	85-100	101-117	118-999
NE	1,089	6.25	1.45	.84	.02					
E	1,023	5.14	1.76	.68	.25	.03				
SE	3,332	10.47	13.92	1.27	.11	.01				

MOYENNE

5.6
10.0
11.1

7.8
7.9
21.8



PROGRAM / PROGRAMME : GRU125

PROJECT NUMBER

NUMERO DU PROJET: 12345

STATION: VERNON

B.C. / C.B.

1128551

FOR / POUR: YRS/ANNÉES

1971-1979

WIND SPEED LIMIT
LIMITE LA VITESSE:

PERCENTAGE OF
OCCURRENCES BY
DIRECTION) LIM

MEAN

PERCENTAGE DES
OCCURRENCES
SELON LA
DIRECTION) LIM

MOYENNE

WIND SPEED CLASSES / CLASSES DES VITESSES DE VENT (KM/H)

DIRECTION DU VENT	1- 9	10- 19	20- 29	30- 39	40- 49	50- 59	60- 69	70- 79	80- 89	90- 99	100- 109	110- 119	120- 129
NE	1,089	6.25	1.45	.84	.02								
E	1,023	5.14	1.76	.63	.25	.03							
SE	3,352	10.47	13.92	1.27	.11	.01							
S	2,389	7.57	6.91	1.83	1.87	.29	.07	.02					
SW	1,397	2.61	3.59	2.78	1.43	.27	.36						
W	1,312	5.11	3.25	1.83	.52	.14	.83						
NW	534	2.87	1.45	.43	.48	.05	.83						
N	1,358	5.71	3.91	.69	.12	.01	.02						
CALM/ CALME	562												

TOTAL 13,806 44.92 36.24 8.74 3.91 .83 .22 .81

11.48

1188.84

5.0

APPENDIX F

RESPONSES FROM VERNON YACHT CLUB ANECDOTAL INFORMATION

tara@watersedgelt.ca

From: craignwilliams56@gmail.com on behalf of Craig Williams <craig@telus.net>
Sent: Monday, August 24, 2015 3:52 PM
To: Tara Hirsekorn
Cc: Jason Schleppe; Lawrence and Candace Johnson
Subject: Re: Vernon YC - List of Questions

Flag Status: Flagged

Hey Tara,

Responses below in red.

See you Thursday 9:00 am.

Craig Williams
Okanagan Approval Corp. and
Sierra Mortgage Fund Ltd.
3300 - 34th Avenue
Vernon, BC V1T 2P7

Off: [\(250\) 558-1111](tel:2505581111)
Cell: [\(250\) 503-8993](tel:2505038993)

On Thu, Aug 20, 2015 at 9:34 PM, Tara Hirsekorn <Tara@watersedgelt.ca> wrote:

Hi Craig,

It would be helpful to have input from some long-time users of the Yacht Club that are familiar with the breakwater, wave climate and sediment patterns in the area to provide a background. This will assist me to effectively develop options to address the issues with the breakwater. A list of the items that I am looking for input follows:

1. What are the specific issue whit the current breakwater? Details would be helpful.

Breakwater is positioned perpendicular to the prevailing weather; Scope of anchors to steep, in some cases as little as 2 to 1, allowing too much sideways movement of sections in the deepest water causing them to beat themselves against the piles that were installed in an attempt to prevent or reduce sideways movement and dragging of anchors.

2. What are the Club's priorities for replacing or upgrading the current breakwater? i.e. budget, performance, expansion, preference of a style of breakwater or ability to walk on it?

Priority for replacement is high so as to not render the existing breakwater useless from on-going damage as the intention is to use the existing sections for replacement of the north log bundle breakwater; realigning the breakwater to follow our westerly lease line is anticipated to break the predominant wave action and allow the north breakwater to move further north into our lease area and an eventual extension of each of the docks for future addition of more slips; the realignment is also expected to allow the addition of slips on the west side of A dock and possibly the ability for side-tying on the inside of the new breakwater which would require the ability to walk on and access from shore; would like to give consideration for the addition of a future fuel dock and repositioning of the W dock mains further out from shore.

3. What direction do the most damaging storms come from? (incident wave direction for large storms)

Southwest. There is at least a 7 mile fetch from Killiney Beach to the southwest

4. What incident wave directions are problematic for the club? (more than 1 direction to consider?)

Southwest produces the most damaging due to the fetch, north and northwest would be the next most problematic.

5. What are the largest waves ever seen at the Club (wave height) and over what period of observation (i.e. a member of 25 years saw waves of x metres)?

Of the few Members I have been ab

le

to speak with about their observations of the maximum wave height witnessed by them there seems to be a consensus of 3' - 4' in the area around our marina with greater heights occurring in the main lake.

One Member I spoke with is 60 years old and was raised on the Lake in the general area of our marina, the other two have been Members for approximately 20 years and 10 years respectively.

6. Is the sediment along the shoreline affected by longshore drift (moving along the shore)? If so, what is the predominant direction of movement?

From south southwest to east northeast

7. Is sediment an issue near the club? Erosion or accretion? Is dredging ever required?

Sediment has accumulated over the years along the shore, building up a deep, soft layer of silty type material. Dredging would allow only a slightly greater use of our boat launch and allow only slightly larger boats to occupy W dock (shallow depth in these areas is a hindrance) due to the close proximity of W dock running perpendicular to shore.

8. Any other tidbits of information that may be helpful to the project?

Our neighbour adjacent to our west boundary has concerns about sedimentation build-up they say they feel is created by a small log bundle breakwater we have extending from close to shore inside a sort of peninsula between us to the existing concrete breakwater. The purpose of this small log bundle is to break wave action that would otherwise prevent us from mooring the west half of W dock. Though the log bundle may trap some surface material inside the peninsula, it is more likely the peninsula itself creates the sediment build-up created by the longshore drift moving from southwest to northeast they are concerned about.

Some of these items may be obvious when I do the site visit, but this background will give me a good idea what to look for while I'm there and will serve as a check on the validity of the available data.

Thank you kindly.

I look forward to meeting you at 9:00 on the 27th.

Sincerely,

Waters Edge Engineering Ltd.

per: Tara Hirsekorn, P.Eng.

cell: (250) 300-3479

~~ Shore Protection ~~ Marinas ~~ Parks ~~ Stormwater ~~

<http://www.WatersEdgeLTD.ca/>



September 27, 2016

Project No: 15-1461

Craig Williams
c/o Vernon Yacht Club
7919 Okanagan Landing Road
Vernon, BC V1H 1H1

Subject: Survey for Rocky Mountain Ridged Mussels

Ecoscape Environmental Consultants Ltd. (Ecoscape) was retained by Mr. Williams with the Vernon Yacht Club to complete an inventory assessment to determine presence of Rocky Mountain ridged mussels (RMRM) (*Gonidea angulata*) at the Vernon Yacht Club, in relation to the proposed marina extension. The Vernon Yacht Club submitted a Section 11 Water Sustainability Act application to extend the existing marina, permitting is still ongoing for this project. The Ministry had requested a survey for RMRM at the site prior to approval.

The mussel survey was undertaken in the afternoon of September 13th, 2016. The survey methodology was based upon email correspondence with Laura Patterson from the Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) on September 1st, 2016. The search area was defined as the prescribed search area (PSA), composed of a zone of influence, risk zone, and an activity zone (Figure 1). The monitoring survey area focused on the breakwater located on the west side of the existing marina (Photo 1), the proposed extension area, the shoreline in front of the existing marina, as well as the shoreline to the west of existing marina. Surveys were conducted by a two-person crew; one person snorkeled while the other crew member reviewed transect locations onshore and undertook the shallow water survey and shoreline survey for RMRM or mussel shells. The in-water snorkel survey (to wetted depths of approximately 3.0 m) was conducted over a period of 1.5 hours, transects were run perpendicular to the shoreline from the HWM to the end of the PSA spaced 2 m apart (Figure 1). The weather was sunny with calm conditions, water was relatively clear due to minimal wind and wave action during the survey. The lake water temperature was approximately 16.3°C during the survey, as per the MFLNRO survey methods, surveys should be conducted when water temperatures are >16°C.

Substrates within the PSA largely consisted of 30% silt fines, 70% detritus/aquatic organics (Photo 2). These substrates were very loose and deep. Along the foreshore located west of the existing breakwater the substrates changed to 50% silt fines and 50% sand. Other substrate material



observed within the PSA include cobbles and pebbles, derived from previous beach grooming and development.

Eurasian watermilfoil (*Myriophyllum spicatum*), Richardson's pondweed (*Potamogeton richardsonii*), pondweed sp. (*Potamogeton* sp.), Canadian waterweed (*Elodea Canadensis*) and Chara (*Chara* sp.) provide dense cover in the fine-textured substrates within the PSA (Photo 3, 4 & 5). Redside shiners (*Richardsonius balteatus*), northern pikeminnow (*Ptychocheilus oregonensis*), yellow perch (*Perca flavescens*) and pumpkinseed (*Lepomis gibbosus*) were also documented with the PSA (Photo 5).

Based on the in-water findings, the proposed marina extension will be confined to areas of very loose silty detritus/aquatic organics where conditions are typically not suitable for mussels. No RMRM were found within the proximity of the marina, the proposed extension area or beyond the extension area. There were also no mussel shells found along the shoreline. Two Western Floater Mussel (*Anodonta kennerlyi/oregonensis*) shells were pulled from the water from the fine substrates that occurred within the PSA (Photo 6). Further survey through SCUBA diving was deemed unnecessary given that no live RMRM or shells were observed and the composition of substrate observed within the PSA.

In summary, no RMRM were observed within the PSA and the proposed marina expansion is not expected to cause impacts to the RMRM provided that best management practices are followed to limit the impact of works within the proposed marina footprint extension.

Please feel free to contact the undersigned with any questions or comments.

Prepared by:

Reviewed by:



Courtney Barr, B.Sc.
Junior Biologist
Direct Line: (250) 491-7337 ext. 214



Kyle Hawes, R.P.Bio.
Natural Resource Biologist
Direct Line: (250) 491-7337 ext.203

Attachments: Photos

estimated monetary value of the infrastructure that could be wiped out substantially if not entirely:

- Replacement Cost of existing concrete breakwater \$ 700,000
- Replacement cost of existing marina \$ 2,533,725
- Replacement cost of the 274 vessels within the marina \$ 9,016,000
- Total value \$12,249,725

Please note these figures do not take into account the cost of disposing of the existing concrete sections forming our current breakwater that would be rendered unusable once they have failed and sustained irreparable damage.

I know I am simply "preaching to the choir" by writing this summary on the present state of affairs of our existing floating concrete breakwater to you but I feel I must express these concerns in writing given the time that has already transpired since we started down this path, the time I fear it may yet take before we obtain approval to proceed with the proposed breakwater and then the time that follows after that to construct and install the breakwater itself and the number of severe storms we are likely to experience between then and completion.

Sincerely,

Craig Williams
Rear Commodore
Vernon Yacht Club
7919 Okanagan Landing Road
Vernon, BC V1H 1H1

Off: (250) 545-5518
Cell: (250) 503-8993
Email: rear-commodore@vernonyachtclub.com



Weir, with FLNR:EX

From: Jason Schleppe <jschleppe@ecoscapeltd.com>
Sent: Tuesday, October 10, 2017 9:56 AM
To: Mackie, John
Cc: 'craig@telus.net'; Weir, Keith FLNR:EX
Subject: RE: VYC maintence and expansion - our file 2006-501059
Attachments: 15-1461 - Environmental Assessment Report - Floating BW Re-Submission_Fi....pdf

Hi John,

We have now finalized the design for the Vernon Yacht Club maintenance project associated with the breakwaters. Let me know if I need to submit anything else. Note that the breakwaters have not transitioned from pile supported to a floating breakwater. Aside from that, the application is nearly identical. If you want the wave attenuation report by the engineer, please advise and I will send along.

Thanks
Jason

JASON SCHLEPPE, M.SC., R.P.BIO
SENIOR NATURAL RESOURCES BIOLOGIST
ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.

Phone: 250.491.7337 ext. 202 / Fax: 250.491.7772 / Cell: 250.808.3474

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-----Original Message-----

From: Mackie, John [mailto:John.Mackie@tc.gc.ca]
Sent: Wednesday, November 16, 2016 11:45 AM
To: Katrina Black <kblack@ecoscapeltd.com>
Cc: Jason Schleppe <jschleppe@ecoscapeltd.com>; 'craig@telus.net' <craig@telus.net>; 'Weir, Keith FLNR:EX' <Keith.Weir@gov.bc.ca>
Subject: RE: VYC maintence and expansion - our file 2006-501059

Hello Katrina,

I have not heard from the neighbours or interested parties lately.

Will the proposal be subject to the municipal process? I would expect you might get an earful at that time. John

-----Original Message-----

From: Katrina Black [mailto:kblack@ecoscapeltd.com]
Sent: Wednesday, November 16, 2016 10:10 AM
To: Mackie, John <John.Mackie@tc.gc.ca>

Cc: Jason Schleppe <jschleppe@ecoscapeltd.com>; 'craig@telus.net' <craig@telus.net>; 'Weir, Keith FLNR:EX' <Keith.Weir@gov.bc.ca>
Subject: RE: VYC maintence and expansion - our file 2006-501059

Hi John,

I am following up on the Vernon Yacht Club on behalf of Jason, I know he was corresponding with you back in September (see below).

At this stage, the design is still being finalized with an aim to submit the finalized design by late November/early December. Are you able to send along any comments you have received from neighbours/interested parties as the owner would like to see if they can address any concerns?

Thanks for your time.

Regards

Katrina Black, BSc, BIT
Natural Resource Biologist

ECOSCAPE Environmental Consultants Ltd.
#102 – 450 Neave Court
Kelowna, BC V1V 2M2
Tel: 250.491.7337 ext. 215
Email: kblack@ecoscapeltd.com

-----Original Message-----

From: Mackie, John [mailto:John.Mackie@tc.gc.ca]
Sent: Wednesday, September 14, 2016 6:59 AM
To: Jason Schleppe <jschleppe@ecoscapeltd.com>; 'craig@telus.net' <craig@telus.net>; 'Weir, Keith FLNR:EX' <Keith.Weir@gov.bc.ca>
Cc: Katrina Black <kblack@ecoscapeltd.com>
Subject: Re: VYC maintence and expansion - our file 2006-501059

Thanks Jason.

This will do for now.

The breakwater is of particular interest to neighbours. John

Sent from my BlackBerry 10 smartphone on the Rogers network.
From: Jason Schleppe
Sent: Tuesday, September 13, 2016 5:39 PM
To: Mackie, John; 'craig@telus.net'; 'Weir, Keith FLNR:EX'
Cc: Katrina Black
Subject: Re: VYC maintence and expansion - our file 2006-501059

Hi John

Currently we are looking at breakwater alternatives due to the required depth of piles. At this point we have nothing new to submit. The application is preceeding but finer points in engineering are being finalized.

I am out in the fielderly for a bit. Does this suffice for now? I can elaborate more later on or in phone call.

Thanks
Jason

Sent from my Samsung device

----- Original message -----

From: "Mackie, John" <John.Mackie@tc.gc.ca>
Date: 2016-09-13 2:23 PM (GMT-08:00)
To: "Mackie, John" <John.Mackie@tc.gc.ca>, Jason Schleppe <jschleppe@ecoscapeltd.com>, "craig@telus.net" <craig@telus.net>, "Weir, Keith FLNR:EX" <Keith.Weir@gov.bc.ca>
Cc: Katrina Black <kblack@ecoscapeltd.com>
Subject: RE: VYC maintence and expansion - our file 2006-501059

Hello Jason,

We are receiving comments from members of the community concerned with the YC proposal. Can you give me an update on the expansion? John Mackie

From: Mackie, John
Sent: Thursday, May 12, 2016 11:04 AM
To: 'Jason Schleppe'; 'craig@telus.net'; Weir, Keith FLNR:EX
Cc: Katrina Black
Subject: RE: VYC maintence and expansion - our file 2006-501059

Thanks Jason,

- 1) Regarding a breakwater; we will need general arrangement drawings that show plan and profiles (piles, chains, mooring lines, etc.) of the works within the provincial license area.
- 2) Not likely. The greatest impact on the review will be the expansion of the works. The current suggested proposal shows the expansion primarily to the south and not toward the middle of the lake. We should be able to deal with this in terms and conditions of and approval. We are however, interested in what the adjacent property owner has to say.
- 3) No. We will still need to approve any change / maintenance to the marina.
- 4) If the adjacent neighbor is not supportive, our interest is navigation only, so narrow. We are also interested in potential impacts on the neighbor's riparian access to his property (provincial).

Hope this helps. I will wait for further info. John

From: Jason Schleppe [mailto:jSchleppe@ecoscapeltd.com]
Sent: Thursday, May 12, 2016 10:21 AM

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Sent: Thursday, May 12, 2016 9:44 AM
To: Jason Schleppe <jschleppe@ecoscapeltd.com<mailto:jschleppe@ecoscapeltd.com>>; 'craig@telus.net'
<craig@telus.net<mailto:craig@telus.net>>
Subject: RE: VYC maintence and expansion - our file 2006-501059

Hello Jason and Craig,

Any word from the adjacent property owner regarding the expansion? John Mackie

From: Jason Schleppe [mailto:jschleppe@ecoscapeltd.com]
Sent: Tuesday, April 19, 2016 12:14 PM
To: Mackie, John
Cc: 'craig@telus.net'
Subject: RE: VYC maintence and expansion - our file 2006-501059

Hi John,

While there is a little expansion on this side, it all falls within the existing Crown Land tenure.

The VYC is actively discussing with the adjacent property owner, but I do not think anything has been formalized. I will ask Craig (CCd) to provide a brief summary to me for submission to you regarding efforts to discuss things with that owner.

Thanks
Jason

Jason Schleppe, M.Sc., R.P.Bio
Senior Natural Resources Biologist
Ecoscape Environmental Consultants Ltd.

Phone: 250.491.7337 ext. 202 / Fax: 250.491.7772 / Cell: 250.808.3474

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P Please consider the environment before printing this e-mail

From: Mackie, John [mailto:John.Mackie@tc.gc.ca]
Sent: Tuesday, April 19, 2016 12:07 PM
To: Jason Schleppe <jschleppe@ecoscapeltd.com<mailto:jschleppe@ecoscapeltd.com>>
Subject: VYC maintence and expansion - our file 2006-501059

Hello Jason.

I will be reviewing this application pursuant to the NPA.

I note the expansion of the existing yacht club, primarily at the western side. I recall that there is a property owner on that side of the club, have they be approached about the expansion? John

John Mackie

Navigation Protection Officer, Navigation Protection Program Transport Canada | Government of Canada Agente de protection de la navigation, Programme de protection de la navigation Transports Canada | Gouvernement du Canada
john.mackie@tc.gc.ca<mailto:john.mackie@tc.gc.ca> / 604-775-8890

Visit our website @ <https://www.tc.gc.ca/eng/programs-624.html>

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Weir with FLNR:EX

From: Jason Schleppe <jschleppe@ecoscapeltd.com>
Sent: Friday, September 29, 2017 3:40 PM
To: Weir, Keith FLNR:EX
Cc: 'Craig Williams'; Tara Hirsekorn
Subject: RE: Vernon yacht club
Attachments: 15-1461 - Environmental Assessment Report - Floating BW Re-Submission_Final.pdf

Hi Keith,

As per our discussion below, please find attached the revised version of the proposed breakwater repairs at the VYC. Note that I will be sending along another report from the engineer for the breakwaters as well. This report has more detail no those requirements.

What we currently need to know is if this triggers any Crown Lands applications. Once I received word about this, which based on the information below, I am hoping it doesn't, we will then upload to the previous Section 11 application which is on Yi's desk.

Alternatively, I would let you ensure these reports get to where they need for the application process. Please advise. I am basically acting on our last discussion, where it was deemed best to email them to you for initial review, and await further instruction. Since the flooding, the need for repair is obviously greater. We have taken the time to really sort out engineering concerns, and believe this is a good solution that balances the needs of VYC and many of the other concerns.

Give me a phone call this afternoon or on Monday to go over, and then we can plot a pathway forward. Note you will receive one more email with the engineering report in a minute as well.

Thanks
Jason

JASON SCHLEPPE, M.Sc., R.P.BIO
SENIOR NATURAL RESOURCES BIOLOGIST
ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.

Phone: 250.491.7337 ext. 202 / Fax: 250.491.7772 / Cell: 250.808.3474

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Please consider the environment before printing this e-mail

From: Weir, Keith FLNR:EX [<mailto:Keith.Weir@gov.bc.ca>]
Sent: Thursday, February 2, 2017 7:56 AM
To: Jason Schleppe <jschleppe@ecoscapeltd.com>
Subject: Vernon vacht club

Hi Jason

As per our phone conversation on Tuesday, I looked at the current agreement for the lease. We will consider minor changes to the current dock layout, and may not need to amend the tenure....in other words if it is within the existing lease boundary, the number of slips stays the same (or close) and it is just a reconfiguration, we may be able to review it very quickly, and provide some direction for the upcoming boating season. And, of course, the club will need to submit, and obtain approval under the *Water Sustainability Act*.

Keith

EMAIL CORRESPONDANCE FROM REAR COMMODORE

Received August 17, 2017



Hey Jason,

You must forgive me but as time continues to quickly slip past while we work toward gaining approval from the Ministry of Forests, Lands and Natural Resource Operations for the desperately needed replacement of our existing floating concrete breakwater, I am compelled to express the already obvious and dire need to keep moving the process forward toward resolution just as quickly as is physically possible.

As you are already well aware, the existing floating concrete breakwater protecting our marina basin is seriously inadequate to attenuate the most severe storm waves we are exposed to from the WSW to a transmitted wave height that is acceptable practically, let alone one that meets the Ministry's criteria. You will recall that Tara Hirsekorn, our Marine Engineer consultant, has stated that in an ideal world the floating breakwater would have to be at least 50 feet in width for optimal performance but unfortunately both space and money limitations preclude this size of structure as an option for us. Though the proposed 300 foot wide floating concrete breakwater is narrower than the deemed optimal size it is nonetheless considerably wider than the 14 foot wide existing floating breakwater and it will comprise only two separate sections of 356 feet and 120 feet in length, compared to the 10 separate sections of roughly 55 feet in length each our present breakwater is comprised of.

Not only will the 30 foot width of the proposed floating concrete breakwater attenuate the most severe storm waves to a height 50% below what our existing breakwater is generating but the proposed angling of the new breakwater along our westerly lease line takes it off-angle from being perpendicular to the prevailing weather, such as our existing floating concrete breakwater is aligned, thereby greatly reducing the stresses put upon it as the entire length of it will no longer be beam on to the prevailing weather.

With each passing storm the condition of our existing floating concrete breakwater continues to worsen at an alarming pace and is closer than ever to the point where I believe a failure to be imminent. During the last severe storm we experienced at the end of May this year many of the 10 sections forming our existing floating concrete breakwater suffered even more damage from smashing into each other and the piles attempting to hold them in place by being tossed around by the . In addition, the intense wave action generated by the storm was enough to skew one of the floating sections out of align with the other sections of our existing breakwater by forcing the piles holding that end in place to lean toward the east (see photo attached).

Once one or more of these existing breakwater sections fail, such as what happened to the Kelowna Yacht Club in late August of last year, the damage to our marina infrastructure and the vessels secured within it will be catastrophic especially considering the long fetch of over 8 kms we have from the WSW. In order to give you an idea of the potential magnitude of destruction we could be faced with when one or more of the existing breakwater sections fail, I provide the following outline of the



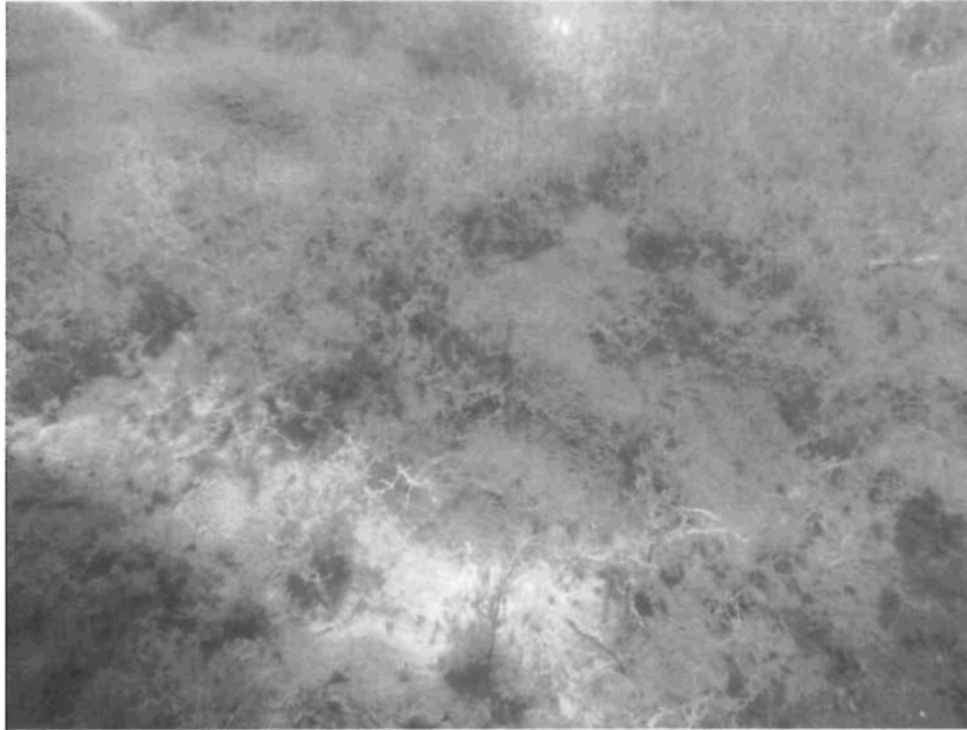


Photo 3. View of substrate found on the western boundary of the prescribed search area.



Photo 4. View of aquatic vegetation observed within the prescribed search area.

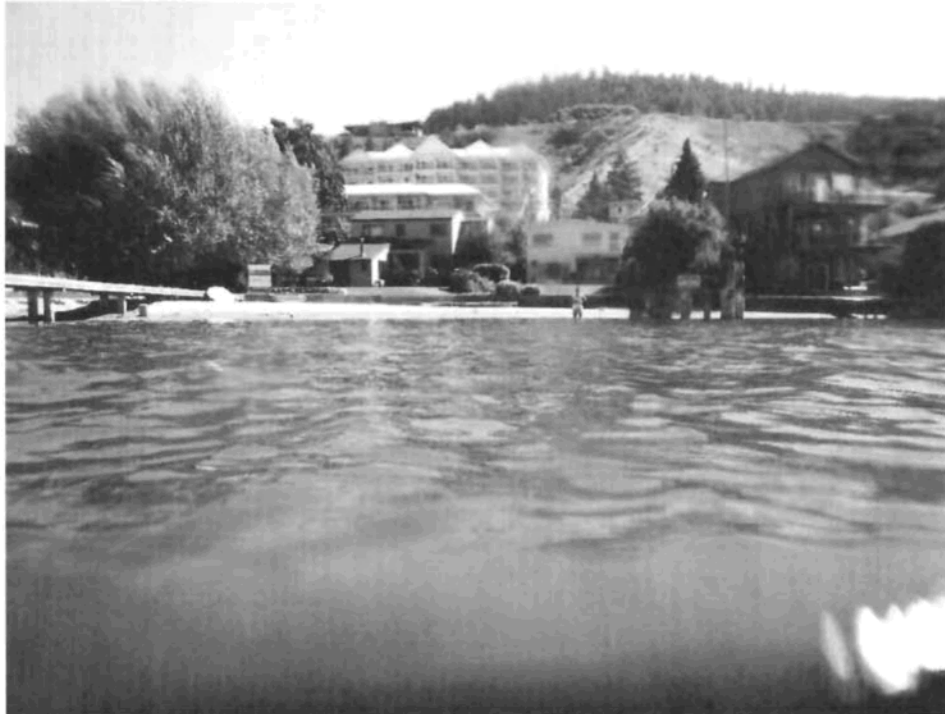


Photo 1. View of a portion of the prescribed search area, looking south east towards foreshore (all photos taken September 13, 2016).



Photo 2. View of silty-very loose aquatic organic substrates observed throughout the prescribed search area.



Photo 5. View of red side shiner and aquatic vegetation observed within the prescribed search area.



Photo 6. View of Western Floater Mussel shell found within the prescribed search area.



Weir, Keith FLNR:EX

From: Jason Schleppe <jschleppe@ecoscapeltd.com>
Sent: Friday, August 11, 2017 10:31 AM
To: Weir, Keith FLNR:EX
Cc: Craig Williams; steve@burtonpiledriving.com; Tara Hirsekorn
Subject: Vernon Yacht Club Application

Hi Keith,

Just want to touch base on this application. We have now finalized a design and engineering for the breakwater repair only. I am reaching out to see what is the most expeditious way to permit this. Do we amend the existing application with Crown Land tenure or do we submit a separate Section 11. I am hoping we can use the consultation side from the existing Crown Land file to keep it moving.

The biggest issue right now is getting the repairs permitted to construct ASAP. Given the high water, things are pretty rough and the Club needs to get it moving.

I am in today and on Monday. Please give me a call so that we can determine what is best and get it submitted. We are hoping to submit later next week.

Thanks
Jason

JASON SCHLEPPE, M.Sc., R.P.BIO
SENIOR NATURAL RESOURCES BIOLOGIST
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V1V 2M2
Email: jschleppe@ecoscapeltd.com
Check Out Our New Website: <http://ecoscapeltd.com>
Twitter: <https://twitter.com/#!/EcoscapeEnv>
Facebook: <http://www.facebook.com/Ecoscape.Environmental.Consultants.Ltd>

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Weir, Keith FLNR:EX

From: Katrina Black <kblack@ecoscapeltd.com>
Sent: Sunday, February 19, 2017 11:11 AM
To: Weir, Keith FLNR:EX
Cc: Jason Schleppe
Subject: RE: Vernon yacht club
Attachments: 15-1461 - EMP_Repairs_Feb_2017.pdf; Change Approval and Notification (Changes In and About a Stream) 100198767.pdf

Hi Keith,

I am working with Jason on the permitting for the minor change to the Vernon Yacht Club (refer to your email below). The changes will remain within the existing lease boundary and the slips will be reduced by one (from 279 to 278). I have attached the EMP, the figures attached detail the existing lease area and proposed reconfiguration. We have also submitted the Section 11 notification to the Province, I have attached the application.

Are you able to review and let me know if we need to amend the existing tenure? I appreciate your help.

Regards

Katrina Black, BSc, BIT
Natural Resource Biologist

ECOSCAPE Environmental Consultants Ltd.
#102 – 450 Neave Court
Kelowna, BC V1V 2M2
Tel: 250.491.7337 ext. 215
Email: kblack@ecoscapeltd.com



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Keith

Weir, Keith FLNR:EX

From: Mackie, John <John.Mackie@tc.gc.ca>
Sent: Wednesday, November 16, 2016 11:45 AM
To: 'Katrina Black'
Cc: Jason Schleppe; 'craig@telus.net'; Weir, Keith FLNR:EX
Subject: RE: VYC maintenance and expansion - our file 2006-501059

Hello Katrina,

I have not heard from the neighbours or interested parties lately.

Will the proposal be subject to the municipal process? I would expect you might get an earful at that time. John

-----Original Message-----

From: Katrina Black [mailto:kblack@ecoscapeltd.com]
Sent: Wednesday, November 16, 2016 10:10 AM
To: Mackie, John <John.Mackie@tc.gc.ca>
Cc: Jason Schleppe <jschleppe@ecoscapeltd.com>; 'craig@telus.net' <craig@telus.net>; 'Weir, Keith FLNR:EX' <Keith.Weir@gov.bc.ca>
Subject: RE: VYC maintenance and expansion - our file 2006-501059

Hi John,

I am following up on the Vernon Yacht Club on behalf of Jason, I know he was corresponding with you back in September (see below).

At this stage, the design is still being finalized with an aim to submit the finalized design by late November/early December. Are you able to send along any comments you have received from neighbours/interested parties as the owner would like to see if they can address any concerns?

Thanks for your time.

Regards

Katrina Black, BSc, BIT
Natural Resource Biologist

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Tel: 250.491.7337 ext. 215
Email: kblack@ecoscapeltd.com

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Sent: Wednesday, September 14, 2016 6:59 AM

To: Jason Schleppe <jschleppe@ecoscapeltd.com>; 'craig@telus.net' <craig@telus.net>; 'Weir, Keith FLNR:EX' <Keith.Weir@gov.bc.ca>
Cc: Katrina Black <kblack@ecoscapeltd.com>
Subject: Re: VYC maintenance and expansion - our file 2006-501059

Thanks Jason.

This will do for now.

The breakwater is of particular interest to neighbours. John

Sent from my BlackBerry 10 smartphone on the Rogers network.

From: Jason Schleppe

Sent: Tuesday, September 13, 2016 5:39 PM

To: Mackie, John; 'craig@telus.net'; 'Weir, Keith FLNR:EX'

Cc: Katrina Black

Subject: Re: VYC maintenance and expansion - our file 2006-501059

Hi John

Currently we are looking at breakwater alternatives due to the required depth of piles. At this point we have nothing new to submit. The application is proceeding but finer points in engineering are being finalized.

I am out in the field for a bit. Does this suffice for now? I can elaborate more later on or in phone call.

Thanks
Jason

Sent from my Samsung device

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Date: 2016-09-13 2:23 PM (GMT-08:00)

To: "Mackie, John" <John.Mackie@tc.gc.ca>, Jason Schleppe <jschleppe@ecoscapeltd.com>, "'craig@telus.net'" <craig@telus.net>, "'Weir, Keith FLNR:EX'" <Keith.Weir@gov.bc.ca>

Cc: Katrina Black <kblack@ecoscapeltd.com>

Subject: RE: VYC maintenance and expansion - our file 2006-501059

Hello Jason,

We are receiving comments from members of the community concerned with the YC proposal. Can you give me an update on the expansion? John Mackie

From: Mackie, John

Sent: Thursday, May 12, 2016 11:04 AM

To: 'Jason Schleppe'; 'craig@telus.net'; Weir, Keith FLNR:EX

Cc: Katrina Black

Subject: RE: VYC maintenance and expansion - our file 2006-501059

Thank you, Jason,

- 1) Regarding a breakwater; we will need general arrangement drawings that show plan and profiles (piles, chains, mooring lines, etc.) of the works within the provincial license area.
- 2) Not likely. The greatest impact on the review will be the expansion of the works. The current suggested proposal shows the expansion primarily to the south and not toward the middle of the lake. We should be able to deal with this in terms and conditions of and approval. We are however, interested in what the adjacent property owner has to say.
- 3) No. We will still need to approve any change / maintenance to the marina.
- 4) If the adjacent neighbor is not supportive, our interest is navigation only, so narrow. We are also interested in potential impacts on the neighbor's riparian access to his property (provincial).

Hope this helps. I will wait for further info. John

From: Jason Schleppe [mailto:jschleppe@ecoscapeltd.com]
Sent: Thursday, May 12, 2016 10:21 AM
To: Mackie, John; 'craig@telus.net'; Weir, Keith FLNR:EX
Cc: Katrina Black
Subject: RE: VYC maintence and expansion - our file 2006-501059

Hi John,

We are currently working with Keith Weir of Crown Lands (CCd) to decide the best path forward for this project. We need to discern what Crown Lands requirements are (specifically what the triggers are for addition of new slips, and what results in only a minor amendment to the Crown Land Lease versus that of a major amendment which is more similar to a new tenure as I understand), and may adjust what has been presented. These adjustments would likely only be a reduction in slips, if any, with the breakwater aspects remaining the same.

Key information for us from you includes:

- 1) If we propose only a breakwater, does this affect your review?
- 2) If we proposed a breakwater with fewer slips, does this affect your review?
- 3) If we trigger only a minor Crown Land Lease amendment, does this affect your review?
- 4) What happens if the adjacent neighbor is not supportive, but this infrastructure is needed to protect vessels in an operational facility? What is the pathway forward for the VYC?

The key to this application is that the current breakwater is failing, is not 100% consistent with the existing lease boundary, and that the proposed design is optimal based upon the engineering reviews to date. Further, the proposed full design moves the first rows of slips into deeper water to be more consistent with current BMP's. Given that the proposed works will bring the breakwater and slips into better compliance with the existing tenure and BMP's, it should presumably be better for the adjacent neighbor that what is currently onsite. Amending the designs back to a floating structure are not optimal, and not likely to stand the tests of time, given past experience with a similar type of structure.

Thanks for following up. We are working on the file, but sorting out stuff with Provincial agencies currently is the critical pathway. Once these issues are resolved, we will then have a look to see where we stand.

Jason Schleppe, M.Sc., R.P.Bio
Senior Natural Resources Biologist
Ecoscape Environmental Consultants Ltd.

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>0>

P Please consider the environment before printing this e-mail

Hello Jason and Craig,

From: Jason Schleppe [mailto:jrschleppe@ecoscapeltd.com]
Sent: Tuesday, April 19, 2016 12:14 PM
To: Mackie, John
Cc: 'craig@telus.net'
Subject: RE: VYC maintence and expansion - our file 2006-501059

While there is a little expansion on this side, it all falls within the existing Crown Land tenure.

Thanks
Jason

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Sent: Tuesday, April 19, 2016 12:07 PM

To: Jason Schleppe <jschleppe@ecoscapeltd.com<mailto:jschleppe@ecoscapeltd.com>>

Subject: VYC maintenance and expansion - our file 2006-501059

Hello Jason.

I will be reviewing this application pursuant to the NPA.

I note the expansion of the existing yacht club, primarily at the western side. I recall that there is a property owner on that side of the club, have they be approached about the expansion? John

John Mackie

Navigation Protection Officer, Navigation Protection Program Transport Canada | Government of Canada Agente de protection de la navigation, Programme de protection de la navigation Transports Canada | Gouvernement du Canada
john.mackie@tc.gc.ca<mailto:john.mackie@tc.gc.ca> / 604-775-8890

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Weir, Keith FLNR:EX

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Thanks for your time.

Regards

Katrina Black, BSc, BIT
Natural Resource Biologist

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Subject: Re: VYC maintenance and expansion - our file 2006-501059

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I am out in the fielderly for a bit. Does this suffice for now? I can elaborate more later on or in phone call.

Thanks
Jason

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Subject: RE: VYC maintence and expansion - our file 2006-501059

Hello Jason and Craig,

Any word from the adjacent property owner regarding the expansion? John Mackie

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Sent: Tuesday, April 19, 2016 12:14 PM

To: Mackie, John

Cc: 'craig@telus.net'

Subject: RE: VYC maintence and expansion - our file 2006-501059

Hi John,

While there is a little expansion on this side, it all falls within the existing Crown Land tenure.

The VYC is actively discussing with the adjacent property owner, but I do not think anything has been formalized. I will ask Craig (CCd) to provide a brief summary to me for submission to you regarding efforts to discuss things with that owner.

Thanks

Jason

Jason Schleppe, M.Sc., R.P.Bio

Senior Natural Resources Biologist

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Weir with FLNR:EX

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Cc: Katrina Black
Subject: Re: VYC maintence and expansion - our file 2006-501059

Thanks John. We are aware. Can you Sen along comments as the owner would like to understand and see if they can address any of them? Thanks.

Sent from my Samsung device

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We are currently working with Keith Weir of Crown Lands (CCd) to decide the best path forward for this project. We need to discern what Crown Lands requirements are (specifically what the triggers are for addition of new slips, and what results in only a minor amendment to the Crown Land Lease versus that of a major amendment which is more similar to a new tenure as I understand), and may adjust what has been presented. These adjustments would likely only be a reduction in slips, if any, with the breakwater aspects remaining the same.

Key information for us from you includes:

- 1) If we propose only a breakwater, does this affect your review?
- 2) If we proposed a breakwater with fewer slips, does this affect your review?
- 3) If we trigger only a minor Crown Land Lease amendment, does this affect your review?
- 4) What happens if the adjacent neighbor is not supportive, but this infrastructure is needed to protect vessels in an operational facility? What is the pathway forward for the VYC?

Sent: Tuesday, April 19, 2016 12:07 PM
To: Jason Schleppe <jschleppe@ecoscapeltd.com<mailto:jschleppe@ecoscapeltd.com>>
Subject: VYC maintence and expansion - our file 2006-501059

Hello Jason.

I will be reviewing this application pursuant to the NPA.

I note the expansion of the existing yacht club, primarily at the western side. I recall that there is a property owner on that side of the club, have they be approached about the expansion? John

John Mackie
Navigation Protection Officer, Navigation Protection Program
Transport Canada | Government of Canada
Agente de protection de la navigation, Programme de protection de la navigation
Transports Canada | Gouvernement du Canada
john.mackie@tc.gc.ca<mailto:john.mackie@tc.gc.ca> / 604-775-8890

Visit our website @ <https://www.tc.gc.ca/eng/programs-624.html>

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Weir.

From: Jason Schleppe <jschleppe@ecoscapeltd.com>

Sent: Thursday, June 9, 2016 8:25 AM

To: 'craig@telus.net'; Weir, Keith FLNR:EX; Aura, Bernadette FLNR:EX

Cc: steve@burtonpiledriving.com; Tara Hirsekorn; Katrina Black

Subject: FW: Vernon Yacht Club

Thanks Keith.

Can you provide us with any information so we can facilitate review as best as possible. Note the following:

- 1) Test piles are driven and results will be submitted shortly
- 2) Will we need to complete public consultation? If so, can instructions be sent?
- 3) Will First Nations review occur? If so, should we contact Judith Zwickel or Laverne Cormier to confirm any ways we can facilitate, determine which FN Bands are most appropriate to consult with, etc.?
- 4) Is there any outstanding information that you require for your review?
- 5) If we need temporary structures to address immediate repairs due to large storm events, can these be placed in short order? The hope is to avoid spending any extra money, but if an emergency arises, it will be good for us to understand the exact process to get them done?

I think this is it from my end, but the information requested above will help us ensure we facilitate the process for an expeditious review.

Tara / Steve, this is all just for your information.

Thanks
Jason

JASON SCHLEPPE, M.Sc., R.P.BIO
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Please consider the environment before printing this e-mail

From: Weir, Keith FLNR:EX [mailto:Keith.Weir@gov.bc.ca]
Sent: Thursday, June 9, 2016 7:21 AM
To: Jason Schleppe <jschleppe@ecoscapeltd.com>
Subject: FW: Vernon Yacht Club



From: Weir, Keith FLNR:EX [mailto:Keith.Weir@gov.bc.ca]
Sent: Monday, May 16, 2016 2:24 PM
To: Jason Schleppe <jschleppe@ecoscapeltd.com>
Subject: RE: Vernon Yacht Club

Hi Jason

I talked it over with Don Meeks. We felt that the changes are significant, so the application would be treated and reviewed as new. He said anything more than 3 new slips would trigger a full review. The proposed relocation of the western breakwater is also significant in that it will be much closer to the lease boundary, and could affect neighboring properties.

The existing design is already approved, so if a new breakwater is needed immediately, you can replace them in their current location. (some minor changes would be OK)

Keith

From: Jason Schleppe [mailto:jSchleppe@ecoscapeltd.com]
Sent: Wednesday, May 11, 2016 11:14 AM
To: Weir, Keith FLNR:EX
Cc: Craig Williams
Subject: RE: Vernon Yacht Club

Hi Keith,

Thanks for the discussion. As I understand, you are going to carefully review this and provide us with guidance regarding the following:

- 1) Does this truly open up the Crown Land Tenure, or can it fall within an amendment. Again, since we are staying within the existing tenure, preference would be to stick with a minor amendment.
- 2) If it is a major amendment (i.e, basically a new application), how many slips would they have to drop to keep it at a minor amendment for the time being.

I think this is the key for now. As I said, the critical pathway is the Section 9 Notification for the test piles, which allows us to complete engineering. We will keep on this aspect, but if you could get back to me on the other parts, I can then try and guide VYC through.

Thanks
Jason

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From: Jason Schleppe
Sent: Wednesday, May 11, 2016 10:48 AM
To: Weir, Keith FLNR:EX <Keith.Weir@gov.bc.ca>
Cc: 'Craig Williams' <craig@telus.net>
Subject: Vernon Yacht Club

Hi Keith,

I have left a few messages with you a few times over the last few days and would like to chat about this file, noting Cathy Jenkins also left me a message last week, and I have phoned her a few times as well to no avail.. The breakwater must be repaired, and is considered a priority. What I need to understand is how best to stage the application(s) to make sure that the priority happens ASAP, and then how to facilitate the remainder of project (both short term and long term).

After our initial discussion in early January, I was under the impression that if we were bringing the breakwater into compliance, and then keeping within the existing Crown Land Tenure / Lease area, this would not trigger a tenure review. However, as I understand, by adding the proposed slips, this opens the tenure up, and Cathy has indicated that a **new** tenure is needed for the small addition. If this is the case, the VYC may wish to alter the application to only include the breakwater repairs. I presume this wouldn't trigger a new Crown Land tenure, is this the case?. They do not wish to open the Crown Land tenure process multiple times (as they have other future plans, as we discussed). What this all means is that I need to understand what the different options are, and how best to guide them through the Section 11 (formerly Section 9) process, and what expectations and triggers are for different permitting paths.

On another note, we are still actively trying to get the Section 9 / 11 Notification for the test piles, this is holding up the process as we cant completed detailed designs on the breakwater until we have this. As I understand, Danika in Vernon has this file, and is away. If there anything that you can do to help out this aspect. With the potential for larger storms coming, and a breakwater in a state of disrepair, we need to move these files along to ensure safety of vessels in the facility.

Please give me a call ASAP such that I can figure out how best to guide VYC.

Thanks
Jason

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#102 – 450 Neave Court
Kelowna, BC
V1V 2M2
Email: jschleppe@ecoscapeltd.com
Check Out Our New Website: <http://ecoscapeltd.com>
Twitter: <https://twitter.com/#!/EcoscapeEnv>
Facebook: <http://www.facebook.com/Ecoscape.Environmental.Consultants.Ltd>

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Weir, Keith FLNR:EX

From: Jason Schleppe <jschleppe@ecoscapeltd.com>
Sent: Friday, June 3, 2016 10:09 AM
To: Weir, Keith FLNR:EX
Cc: 'craig@telus.net'
Subject: RE: Vernon Yacht Club

Hi Keith,

At this point, I think that we would like to either meet with you in Kamloops, or in Vernon, and go over this application. I think that where we are concerned is that the lease is an existing tenure, and that, in essence, infers that the VYC could buildout within this boundary. I have reviewed the tenure agreements, and it does not have wording that reflects specific reference to number of slips, etc. While I am not a lawyer, it would appear as though, this means they have rights to build within the lease boundary. However, if any change in configuration (i.e., replacement of a breakwater) occurs, and it triggers a new lease (or major amendment, which is similar to a new lease), then the lease agreement loses relevance because what is constructed is all that matters (i.e., the lease boundary is only applicable to paper space, but the boundary actually only exists based upon what is constructed in the field.

At this point, we just need to know what is triggering the major amendment. The site currently has a breakwater, all we are proposing to do, is construct an improved breakwater along the existing lease boundary. In discussions with VYC, the lease boundary was adjusted in 2006 to better comply with the neighbours riparian rights (which to me means, in the last lease round, they adjusted it so that it was appropriate). There is an existing breakwater onsite, and, theoretically, could have been placed on that boundary at that time. However, it wasn't because it wasn't needed there. Presumably, with a Section 9, they could move this floating breakwater to the boundary, with no trigger for a new lease (because they would just be moving infrastructure.). Is this the case? Now, again, I am not a lawyer, and only trying to confirm what the specific triggers are that are driving the major versus minor amendment (i.e., is it First Nations Consultation, is it the neighbour's riparian rights, , etc.). Once we understand the specific triggers, we can then present information for the application accordingly.

Finally, the big concern here is that the breakwater is not in good shape. Opening up a large, long process, presents risks to the existing infrastructure (i.e., what if it fails in the meantime?). At this point, the VYC has approval to obtain money to construct a new breakwater that is most appropriate, but does not have sufficient funds to repair the existing breakwater, while they wait to navigate through a process to construct a new one. We just need to get a firm understanding of what is driving the trigger, and how best to proceed to ensure the infrastructure is protected, and that we address any concerns.

Thanks for any input. I am not trying to be difficult with this, I am just concerned. Further, when I reached out early in the process to discuss the path, in discussions with you, I was under the interpretation, that if we stayed in the existing lease boundary, that it would be a minor amendment (during that conversation, we discussed Mabel, VYC, and I think one other, but we only followed up via email on Mabel. Note, I also spoke to Yi Li at that time to, to confirm the requirements for the Section 11(formerly 9) Approval). Based upon this initial dialogue, we worked to develop a plan that addressed engineering and environmental concerns, that would be the most expeditious path to permit, given the condition of the breakwater. The change in permit path is just one we are grappling with because we do not fully understand the drivers for why.

Have a good weekend. I tried to phone (but didn't leave a message) to chat verbally about this, and then follow up with email, but you weren't around.

Cheers

Jason

JASON SCHLEPPE, M.Sc., R.P.BIO
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From: Weir, Keith FLNR:EX [mailto:Keith.Weir@gov.bc.ca]
Sent: Tuesday, May 17, 2016 1:28 PM
To: Jason Schleppe <jschleppe@ecoscapeltd.com>
Subject: RE: Vernon Yacht Club

Thanks for being patient....we will figure this one out eventually.

From: Jason Schleppe [mailto:jschleppe@ecoscapeltd.com]
Sent: Tuesday, May 17, 2016 9:49 AM
To: Weir, Keith FLNR:EX
Cc: 'craig@telus.net'
Subject: RE: Vernon Yacht Club

Hi Keith,

Thanks. Please hold tight for now. We are going to dig up some old correspondence from 2006 when the lease boundary and issues with the neighbor were addressed. As I understand from talking to Craig, the boundary was shifted in that year to better accommodate the neighbor. Also, as I understand, the neighbor just built their dock, and this was built to accommodate VYC lease. Anyway, we will dig this up, and then come armed with a few more questions, and proceed from there.

Thanks
Jason

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Sent: Monday, May 16, 2016 2:24 PM
To: Jason Schleppe <jschleppe@ecoscapeltd.com>
Subject: RE: Vernon Yacht Club

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Cc: Craig Williams
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Cc: 'Craig Williams' <craig@telus.net>
Subject: Vernon Yacht Club

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Twitter: <https://twitter.com/#!/EcoscapeEnv>
Facebook: <http://www.facebook.com/EcoscapeEnvironmentalConsultantsLtd>

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Weir, Keith FLNR:EX

From: Jason Schleppe <jschleppe@ecoscapeltd.com>
Sent: Thursday, May 12, 2016 10:21 AM
To: Mackie, John; 'craig@telus.net'; Weir, Keith FLNR:EX
Cc: Katrina Black
Subject: RE: VYC maintenance and expansion - our file 2006-501059

Hi John,

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- 2) If we proposed a breakwater with fewer slips, does this affect your review?
- 3) If we trigger only a minor Crown Land Lease amendment, does this affect your review?
- 4) What happens if the adjacent neighbor is not supportive, but this infrastructure is needed to protect vessels in an operational facility? What is the pathway forward for the VYC?

The key to this application is that the current breakwater is failing, is not 100% consistent with the existing lease boundary, and that the proposed design is optimal based upon the engineering reviews to date. Further, the proposed full design moves the first rows of slips into deeper water to be more consistent with current BMP's. Given that the proposed works will bring the breakwater and slips into better compliance with the existing tenure and BMP's, it should presumably be better for the adjacent neighbor that what is currently onsite. Amending the designs back to a floating structure are not optimal, and not likely to stand the tests of time, given past experience with a similar type of structure.

Craig and I will pass along any correspondence from the neighbor we get through dialogue.

Thanks for following up. We are working on the file, but sorting out stuff with Provincial agencies currently is the critical pathway. Once these issues are resolved, we will then have a look to see where we stand.

Jason

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John Mackie

Navigation Protection Officer, Navigation Protection Program
Transport Canada | Government of Canada

Agente de protection de la navigation, Programme de protection de la navigation
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john.mackie@tc.gc.ca / 604-775-8890

Visit our website @ <https://www.tc.gc.ca/eng/programs-624.html>

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From: Jason Schleppe <jschleppe@ecoscapeltd.com>
Sent: Wednesday, May 11, 2016 10:48 AM
To: Weir, Keith FLNR:EX
Cc: Craig Williams
Subject: Vernon Yacht Club



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August 22, 2017

Special Meeting at VYC

Call to Order: 7pm.

Present: Lawrence Johnson-Commodore, Craig Williams-Rear Commodore, Betty Day-Executive Secretary, Lisa Salt, Gord Fowler representing 7959 & 7965 Okanagan Landing Road, John & Heather Sharpe representing 7953 Okanagan Landing Road. Via phone Marcus & Michelle Boyle representing 7941 Okanagan Landing Road.

The meeting was held at the request of the neighbors of the VYC to discuss the breakwater replacement project and how it may affect the neighboring properties.

The most current diagrams and concepts were presented by Craig and Lawrence as well as the time lines followed for announcing plans to the neighbors and the community at large. The diagrams displayed at the meeting are attached.

Concerns of the neighbors were presented:

1. Their property values will decrease as a result of the project.
2. Erosion may occur to their properties as a result of the wave action and backwash created by the project, would like independent engineer report as well as a wave analysis report.
3. The view from their properties will be impeded by the project.
4. Lights from the project will shine on their properties and into their homes.
5. More debris will be deposited on their properties.
6. Docking difficulties that will be created for their properties.
7. Noise levels will be increased on their properties due to increased activity.
8. Will boats be docked stern forward or bow?
9. Concerns about interpretation of property line.
10. More meetings will be held after information has been received and reviewed.
11. A request for the drawings of the proposed navigation and walkway lighting was made.

The VYC will send to the neighbors the following documents:

Drawings of the breakwater and marina as presented at the meeting.

The Minutes of the Meeting.

Meeting adjourned at 7:19pm.

).

JASON SCHLEPPE, M.Sc., R.P.BIO
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Hi Yi,

Note that I have run this by Keith Weir (CCd) in regards to Land's concerns. As I understand, since the proposed works only include breakwater repair, and not the addition of new slips, it will be considered as an updated management plan only, not a full tenure review.

Thanks
Jason

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Page 139 of 317



Yi

Hi Laura,

Please see the response to your questions below, in green. I will follow this up with a phone call, please just let me know when may work best for you. Note, I have also included other members of the project team on this response to keep them posted.

On another note, Yi, please be advised that detailed engineering designs for the pile supported breakwater are undergoing. At this point, there is consideration being given to transition back to a floating breakwater, due to the engineering requirements (i.e., depths, pile size requirements, angles needed for supports and construction challenges as examples). These details are not sorted yet, and revisions to the submitted plan may occur, once sorted out. Once they are finalized, Ecoscape will provide a revised plan in conjunction with the team. It is important to note, this is not 100% certain at this time, and our timing on delivery of details was delayed because the Section 9 (now Section 11) notification to place the temporary piles took more time than anticipated to attain.

Thanks,
Jason

JASON SCHLEPPE, M.Sc., R.P.BIO
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From: Patterson, Laura FLNR:EX [mailto:Laura.Patterson@gov.bc.ca]
Sent: Thursday, September 1, 2016 11:09 AM
To: Jason Schleppe <jschleppe@ecoscapeltd.com>
Cc: 'craig@telus.net' <craig@telus.net>; Lacey, Cathy M ENV:EX <Cathy.Lacey@gov.bc.ca>; Li, Yi FLNR:EX <Yi.Li@gov.bc.ca>
Subject: Vernon Yacht Club Marina Expansion Approval Application #8003608

Hi Jason

The Ecosystems Section is in the process of reviewing the Water Sustainability Act Section 11 application to expand the Vernon Yacht Club Marina. Could you please clarify the following pertaining to this application:

- 1) Was a survey specifically targeting Rocky Mountain Ridged Mussel performed at the project site? If so, could you please provide the survey methodology and results of the survey. Please note that if a survey was not performed for Rocky Mountain Ridged Mussel, this work will be required prior to Ecosystems approval of the project as Rocky Mountain Ridged Mussels have recently been observed very near the marina. I can provide survey methodology if this work has not yet been completed. No, this survey has not been conducted. I am sure we have the methods, but please provide and we will conduct one shortly and get the results back to you in a separate memo. During our field visits, we did not document shells, but having said that, this does not constitute a survey.
- 2) The environmental assessment states that the row of slips closest to the shoreline will be removed, but these structures do not appear to be removed (not highlighted in yellow) in the schematic provided. Can you please confirm that these slips will be removed and provide the expected water depth (at low water) at the shallowest boat bay. Removed is maybe not the best choice of words. Rather, they will be moved to deeper water. Some are removed, some are added, etc., as per the presented plan. The intent was to move the first row of slips deeper to reduce littoral zone coverage and improve current site conditions from what is currently operating. The contour ranges from 341 to 340.5 or so. These slips would be close, but maybe not quite attaining the 1.5 m depth at low water requirement, but are a substantial improvement over what is currently present, which currently sits at 341.5 or so. Given the fact that the contours are not matching with the alignment of the first dock, this would be a challenge to accommodate within the current lease area, a key design criteria (as we had initially tried to avoid a Major Crown Land Tenure amendment in discussions with Keith Weir). To attain the 1.5 m depth, the whole marina would need to be shifted out 5 to 10 m. as the depths do not increase rapidly at this location. Thus, this design attempted to trade off benefits by shifting slips deeper, while still working within the existing lease of a larger facility.
- 3) The mitigation for silt management states that silt curtains will be used if turbidity becomes a significant concern. Given the high number of piles being installed for this project and nature of the substrate could you please provide further information on how turbidity levels will be quantified on site and/or provide more detailed mitigation measures for this environmental effect. Turbidity would be measured in situ using a van Dorn to get water at depth and a handheld Hack Turbidity meter most likely if needed. Visual observation would also be used to assess if plumes were present. In our experience, pile driving does not typically result in significant sediment disruption, with the exception of a very localized effect (i.e., usually within 1 m of the pile placement itself). Our observations have been that sediment disruption is somewhat independent of the number of piles and more so dependent upon method. Ultimately, the effects of sediment disruption are related mostly to how piles are placed (i.e., are they dragged or lifted into place). This means that one poorly placed pile could disrupt substantially more sediment than 10 well placed piles. Burton Marina has extensive experience placing piles, in even more sensitive habitats (i.e., Mabel Lake Marina), meaning we have a high level of confidence that placement will occur with efficiency and diligence, and risks of poor pile placement are low. If sediment was a concern, mitigation would likely be to amend methods to avoid sediment mobilization. If necessary, silt curtains could be established, noting that this would be a last resort given the

difficulties with containing piles, the barge, etc. Personally, I have yet to see significant sediment disruption from placement of piles on numerous marinas or docks, and therefore, I would categorize risks of significant sediment disruption to be very low. I have not yet seen sediment curtains deployed for placement of piles, except in cases when they needed for other aspects of instream works associated with piles.

Note that if the designs transition to a floating breakwater, the quantity of piles will be reduced. Thus, while I have provided a response, further information may change this response.

- 4) Please provide a rationale for the need for the expanded landing adjacent to the shoreline, as this expansion is not consistent with what Ecosystems would recommend for a walkway leading to the marina. This is for storage of life jackets, etc., as indicated on the figures. The relocation is to replace the previously existing landing that occurs (shown in grey on Figure 3, white CAD file). If we consider what is removed, and slips shifted to deeper water, etc., the overall footprint in the littoral zone is reduced. If this area is a significant sticking point, we could consider relocation. I will need to liaise with VYC to confirm a different location.
- 5) Lastly, as the timeframe for works listed in the application is no longer feasible, could you please provide a new timeline for these works. Timeframe is dependent upon receipt of Crown Land Tenure and Section 11. Given the status of the marina, and state of repair, works would likely begin immediately. The marina is in dire need of repair, and significant risks exists to internal infrastructure, boats, etc.

Note that our hydrologist is also in the process of review and may have further questions in addition to the above. Understood.

Please feel free to contact me if you have any questions or concerns.

Thanks,

Laura Patterson, M.Sc., R.P.Bio.

Ecosystems Biologist

Ministry of Forests, Lands and Natural Resource Operations

Thompson-Okanagan Region

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September 22, 2017

Vernon Yacht Club
7919 Okanagan Landing Road
Vernon, BC, V1H 1H1

Rev. 0
WEEL File #: 1522
Sent Via Email: craig@telus.net

Attention: Mr. Craig Williams

Subject: Vernon Yacht Club – Hydrotechnical Study of the Wave Attenuator Performance

I.0 INTRODUCTION

Waters Edge Engineering Ltd. (Waters Edge) has been retained by the Vernon Yacht Club (VYC) to study the wave attenuation performance of the proposed floating and fixed breakwaters for the marina expansion on the west side. Appendix A shows the proposed layout of the new wave attenuation system provided by the VYC via Ecoscape Environmental Ltd. (Ecoscape) and through discussion with Burton Pile Driving (Burton). This letter addresses only the wave attenuation performance of the proposed western breakwaters and is intended to assist in regulatory permitting requirements and to evaluate if the proposed breakwaters are likely to provide an acceptable level of protection to the VYC marina.

I.1 BACKGROUND

The VYC is located on the south shore of the north inlet of Okanagan Lake at 7919 Okanagan Landing Road. An aerial image of the site and surrounding shoreline is in Figure 1.
Copyright

Figure 1: Aerial Overview of the Project Area (2013 imagery, Google Earth)

The floating concrete western breakwater is in poor condition and needs replacement. This is the primary wave protection system for the VYC. Concept design work on the modifications to the west breakwater has been ongoing since 2015. The VYC worked closely with Burton to develop a concept (originally piled) and then retained Ecoscape for environmental permitting and Waters Edge for the breakwater assessment to support the permitting application.

1.2 EXISTING WAVE ATTENUATION SYSTEM

The VYC is currently protected by a floating wave attenuation system consisting of log bundles on the northern and eastern sides of the marina and a concrete caisson breakwater on the south-western side, which is exposed to the largest waves. A small log breakwater closes the gap between the south-west corner of the caissons and the shore. The existing system is shown in light grey on Appendix A.

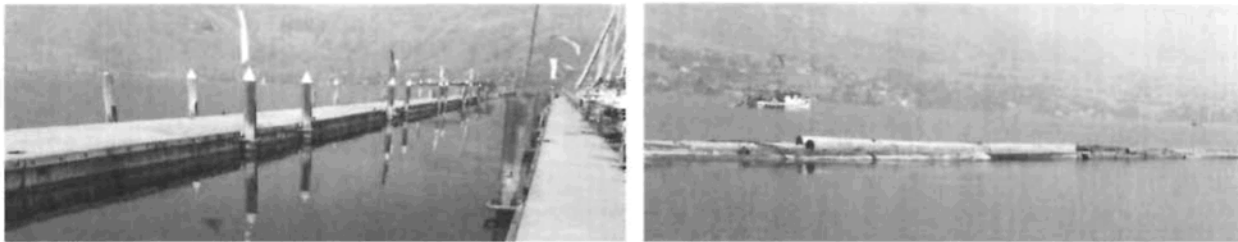


Figure 2: Existing Wave Attenuation Systems (August 27, 2015)

The concrete caissons are 14' (4.3m) wide (beam) and are positioned such that the west-south-west waves are incident nearly beam-on. The caissons in deep water are being damaged and the moorings are failing. Their failure has been accelerated by this year's flood levels and storms leaving the caissons and moorings now in dire need of replacement.

The existing wave attenuation system does not attenuate the waves adequately on the north and west sides according to interview with the VYC. The log bundle on the east side reportedly performs adequately.

1.3 PROPOSED WAVE ATTENUATION SYSTEM

The proposed breakwater system is illustrated in in Appendix A. There will be no change to the log bundles on the east side. The existing concrete caissons will be repaired and relocated to the north side of the marina to improve wave attenuation from the north.

Wave attenuation on the west side is with a new 9.14m (30') wide floating concrete breakwater with "wing-walls" and will be aligned with the lease boundary. A short piled breakwall overlaps a portion of the existing breakwater to allow access to the boat launch (see Figure 3). The nearshore area retains the existing concrete caissons and small log bundle. These are rotated to respect the lease boundary, but otherwise are unchanged, keeping attenuation unchanged nearshore.

The proposed entry channel for access to the private boat launch is narrower than recommended by guidelines and is not ideal for navigation. However, the VYC understands the associated risks and will use this access rarely, and only in calm conditions. The VYC assumes liability for the navigability of the access.

The proposed wave attenuation system to be designed by others is presently at a conceptual level. The attenuation will be improved over the existing condition to meet current guidelines.

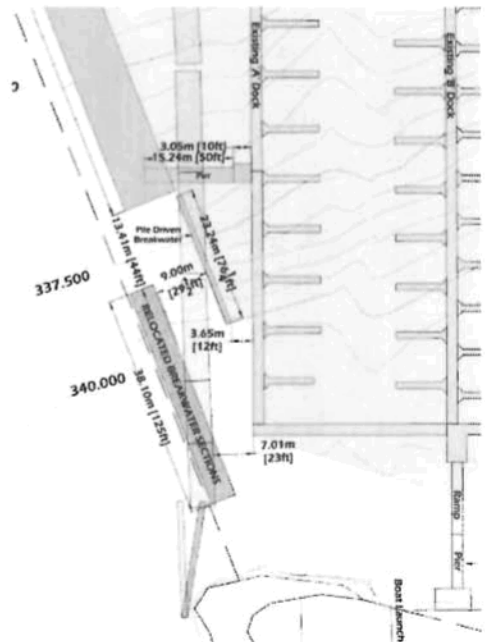


Figure 3: Proposed Nearshore Configuration

The floating wave attenuator proposed by Burton is shown in Appendix B. The fixed vertical breakwater (breakwall) proposed by Burton is generally as shown in Appendix C. These breakwaters have different characteristics and require separate analyses. The wave study completed by Westmar in the “Sediment Transport Study” of August 2, 2006 (included in Appendix D) is used as the input to the analysis and for determining the wave criteria; no additional wave study was completed.

2.0 DESIGN CRITERIA FOR HARBOUR TRANQUILITY

The light blue shaded area on the figure in Appendix A designates the mooring area that is required to meet the berthing tranquility criteria. The Planning and Design Guidelines for Small Craft Harbors¹, published by the ASCE in 2012, has been used as the basis for the wave attenuation criteria. The acceptable wave climate inside a marina are based on:

- published engineering guidelines,
- orientation of the boats relative to the incident waves,
- level of performance required for the type of marina designed as “excellent”, “good” or “moderate” and
- level of risk that is acceptable to the stakeholders.

The head seas² condition is derived from the orientation of the moorage slips and is used for establishing the allowable wave climate inside the VYC’s marina; the deep-water berths are only 4.5 degrees off the dominant west-southwest (WSW) incident wave direction of 247.5 degrees.

Table 1: ASCE 2012 Wave Criteria for “Good” Wave Conditions Inside the Marina¹

Incident Wave Direction	WSW	W	WNW	NW	NNW
Incident Wave Bearing	247.5	270	292.5	315	337.5
Incident Angle relative to Head Seas	-4.5	18	40.5	63	85.5
x = Angle in Radians (absolute value)	0.079	0.314	0.707	1.100	1.492
50-Year Design Wave Hc50 *	0.580	0.492	0.362	0.270	0.230
1-Year Design Wave Hc1 *	0.293	0.258	0.206	0.169	0.153

* Values for wave periods between 2 and 6 seconds. From Table 2-5 in the ASCE 2012 guideline.

$H_{c50} = 0.3048 (2 - 1.25 \sin x) = \text{Max sig. wave height allowable in a marina for 50-year storm}$

$H_{c1} = 0.3048 (1 - 0.5 \sin x) = \text{Max sig. wave height allowable in a marina for yearly storm}$

Head Seas (Boat Orientation) = 252 Degrees

Although only the “Good” conditions are shown here, there is also allowance for “Moderate” conditions in the ASCE Guideline. Criteria for a “moderate” wave climate is 1.25 times the values shown in Table 1.

For the purposes of this study, the 30-year wave was used to satisfy the 50-year criteria since it is the longest return period wave that was available and has been found not to differ significantly from the 50-year value within reasonable error margins for the purposes of the analysis.

¹ Planning and Design Guidelines for Small Craft Harbors, Third Edition, Prepared by the Task Committee on Marinas 2020 of the Coasts, Oceans, Ports and Rivers Institute of the American Society of Civil Engineers, 2012.

² Head seas refers to the boat orientation being aligned with the incident wave direction. i.e. waves hit the boat bow-on.

Note that the guidelines relate to a small boat that is moored. Motions and forces on the docks, piers and other structures or mechanical systems must be considered during their design. A floating system of boats and docks on moorings may respond less favourably under these conditions. The design waves inside the marina are likely to cause damage to such a system despite being allowable for individual moored boats.

3.0 ENVIRONMENTAL CONDITIONS

Environmental conditions are the natural processes that affect the project site and the area around it. These include wind, waves, ice and seasonal water levels. Littoral sediment transport patterns are generated by the environmental conditions.

3.1 WATER LEVELS AND BATHYMETRY

Bathymetry at the project site was surveyed by Ecoscape on August 29, 2015 and is shown by the contours in Appendix A, which shows the existing and proposed marina plans.

Water levels on Okanagan Lake correspond to a regulated system and so are well documented. However, flooding this past Spring reached an elevation of 343.266 m Geodetic Datum (GD) on June 8, 2017³, which exceeded the published value of the 200-year flood level of 343.05m GD⁵. New water levels for design are likely to be published in the future, but for the purposes of this analysis the following water levels have been used:

- Low Water Level (LWL) = 341.32 m⁴ GD, typically occurring in March or April;
- High Water Mark (HWM) = 342.52 m GD⁵, assumed to approximate average annual high water level (HWL), typically occurring in June;
- 200-year flood level is assumed to be approximately 343.27 m³ GD (2017 flood level).

There are many published water levels that differ in centimetres. The values listed above are representative of Okanagan Lake conditions and the accuracy is suitable for the purposes of this study.

Water depths at 3 primary locations were used in the assessment of the western wave attenuation system's performance. These 3 locations are shown in Figure 4 and they represent: (1) the deep, offshore sections of floating breakwater, (2) the transition point from floating to fixed breakwater and (3) the shallow end of the fixed breakwater respectively.

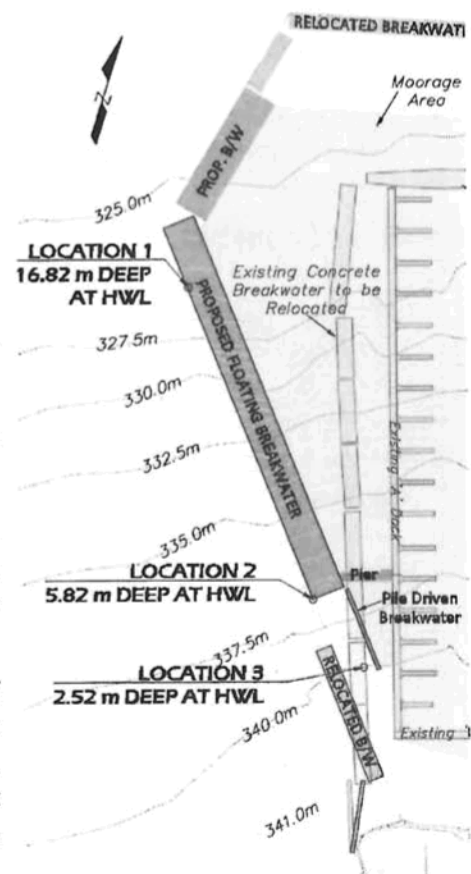


Figure 4: Locations Used in Assessment

³ Real-Time Hydrometric Data Graph for Okanagan Lake at Kelowna (station 08NM083) from Environment Canada.

⁴ Fisheries and Oceans Canada, Hydrographic Chart 3052, Okanagan Lake, 1994 (Chart Datum = 341.32 m GD).

⁵ Okanagan Lake Water Level Management Review of Past Trends with Recommendations, Ward and Associates Ltd., March 2000 (Figure 3 notes Max. normal and Min. normal operating range as well as other levels).

3.2 WAVE STUDY

Waves at the project site are primarily generated by wind. A wind and wave study and sediment transport study was completed in 2006 for the Vernon Yacht Club by Westmar Consultants Inc. (Westmar)⁶. This study is attached in Appendix D and was completed in support of the marina expansion at that time and includes a table of the design wave conditions as well as the sediments at the site. This study is used as the wind and wave study to support the proposed design.

The deep water incident waves are needed as input to the wave attenuation assessment. These incident waves are taken from Table 1 of the Westmar study. Based on this study, the most severe storm waves are from west-south-west (WSW), which has the longest fetch length; significant wave height (Hs) is **1.29m** and peak period (Tp) is **3.9s** for the 30-year storm. Waves from the north-north-west (NNW) are also significant, especially since they are nearly beam-on to the direction of moorage, with a 30-year Hs of 0.73m and Tp of 2.5s.

Waves from the southwest (SW) may be larger than those from the WSW as they enter Vernon Arm from the main lake, corresponding to the strongest wind and wave direction. The marina is largely sheltered from these waves due to the coastline configuration to the SW of the site. (SW waves were not analysed in the Westmar 2006 report.) Even so, 30-year waves from the SW may result in slightly more severe conditions at the offshore end of the marina, and this has been brought to the attention of the client.

Figure 5: Location on Okanagan Lake (Google Earth)

Design wave calculations for a project entitled "Killiney Beach" were also undertaken by Westmar in 1997, attached in Appendix E, and it has been reported that this document was used as the basis of wave and loading calculations for the concrete breakwater at VYC. A review of the document indicates that the calculated wave conditions were in fact obtained for Killiney Beach and presumably for Kin Beach [the document refers erroneously to "Vernon (Kinsman Beach Park)"]. However, both these sites experience a different wave climate to that at the VYC. Killiney Beach is not at all exposed to waves from the NW and SW sectors, as are relevant to the VYC; and Kin Beach, which lies NE of the site at the end of the Vernon Arm, is exposed to longer-fetch SW waves. Therefore, this reference is not relevant to the present study and is not considered further.

Accuracy of the Westmar studies was out of scope and was not reviewed by Waters Edge.

⁶ Project Memorandum: Sediment Transport Study for Vernon Yacht Club, Westmar Consultants Inc., August 2, 2006.

Table 2 on the following page shows a summary of the results of the current wave study, deriving from Westmar (2006) for the 3 locations of interest as indicated in Figure 4. Thus, key deep water wave conditions were extracted from the Westmar 2006 wave study; these were used as input to all calculations. Wave transformations were calculated for the effects of shoaling and refraction for several incident wave directions for each location. The design tranquility criteria are also shown for each location and direction as well as what transmission coefficient (K_t) would be needed to achieve the tranquility criteria based on the tranquility values in Table 1 above. [The transmission coefficient K_t is the ratio of the wave height transmitted past the attenuator to the incident wave height approaching the attenuator and is elaborated upon shortly.]

Further information about the waves at the project site is available in Appendix F. This corresponds to anecdotal information provided by VYC in response to a series of questions about the breakwater and site conditions, and provides an anecdotal check to the 2006 study and the existing breakwater performance.

3.3 ICE

In the Okanagan, ice has historically damaged structures in the water near-shore. Therefore, ice loading should be considered during the detailed design of the structures. However, for the purposes of wave and sediment transport conditions, ice is not anticipated to have any impacts on the processes and has not been considered in this assessment.

Table 2: Incident Design Waves with Transformations (Depth at HWL)

Location 1: Floating Breakwater - Deep End			30- Year Return Period					Annual Return Period				
			WSW-30	W-30	WNW-30	NW-30	NNW-30	WSW-1	W-1	WNW-1	NW-1	NNW-1
Deep Water Incident Wave:		Units										
Compass Bearing	qo	Degrees	247.5	270	292.5	315	337.5	247.5	270	292.5	315	337.5
Deep Wave Height	Ho	m	1.29	0.88	0.84	0.61	0.73	0.72	0.54	0.49	0.39	0.39
Peak Period	Tp	s	3.9	2.8	2.6	2.3	2.5	3.2	2.4	2.2	1.99	1.98
Deep Wave Length	Lo	m	23.75	12.24	10.55	8.26	9.76	15.99	8.99	7.56	6.18	6.12
At Location 1:		Units										
Depth at Site	d	m	16.82	16.82	16.82	16.82	16.82	16.82	16.82	16.82	16.82	16.82
Depth Condition is -->			DEEP	DEEP	DEEP	DEEP	DEEP	DEEP	DEEP	DEEP	DEEP	DEEP
Wave Length	L1	m	23.75	12.24	10.55	8.26	9.76	15.99	8.99	7.56	6.18	6.12
Wave Ray Bearing	θ1	Degrees	247.50	270.00	292.50	315.00	309.50	247.50	270.00	292.50	315.00	309.50
Angle Relative to Lakebed		Degrees	76.0	53.5	31.0	8.5	14.0	76.0	53.5	31.0	8.5	14.0
Angle Relative to Breakwater		Degrees	-36.0	-13.5	9.0	31.5	26.0	-36.0	-13.5	9.0	31.5	26.0
Refraction Coefficient	Kr	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Shoaling Coefficient	Ks	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Wave Height	H1	m	1.29	0.88	0.84	0.61	0.73	0.72	0.54	0.49	0.39	0.39
Wave Transmission Criteria		m	0.58	0.49	0.36	0.27	0.23	0.29	0.26	0.21	0.17	0.15
Kt Required		-	0.45	0.56	0.43	0.44	0.31	0.41	0.48	0.42	0.43	0.39
Location 2: Transition Floating to Fixed Breakwater			30- Year Return Period				Annual Return Period					
			WSW-30	W-30	WNW-30	NW-30	WSW-1	W-1	WNW-1	NW-1		
Deep Water Incident Wave:		Units										
Compass Bearing	qo	Degrees	247.5	270	292.5	315	247.5	270	292.5	315		
Deep Wave Height	Ho	m	1.29	0.88	0.84	0.61	0.72	0.54	0.49	0.39		
Peak Period	Tp	s	3.9	2.8	2.6	2.3	3.2	2.4	2.2	1.99		
Deep Wave Length	Lo	m	23.75	12.24	10.55	8.26	15.99	8.99	7.56	6.18		
At Location 2:		Units										
Depth at Site	d	m	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82		
Depth Condition is -->			INTERM.	INTERM.	DEEP	DEEP	INTERM.	DEEP	DEEP	DEEP		
Wave Length	L1	m	22.08	12.18	10.55	8.26	15.69	8.99	7.56	6.18		
Wave Ray Bearing	θ1	Degrees	259.06	270.38	292.50	315.00	251.28	270.00	292.50	315.00		
Angle Relative to Lakebed		Degrees	64.4	53.1	31.0	8.5	72.2	53.5	31.0	8.5		
Angle Relative to Breakwater		Degrees	25.6	36.9	59.0	81.5	17.8	36.5	59.0	81.5		
Refraction Coefficient	Kr	-	0.75	1.00	1.00	1.00	0.89	1.00	1.00	1.00		
Shoaling Coefficient	Ks	-	0.93	0.99	0.99	1.00	0.97	1.00	1.00	1.00		
Wave Height	H1	m	0.90	0.87	0.83	0.61	0.62	0.54	0.49	0.39		
Wave Transmission Criteria		m	0.56	0.49	0.36	0.27	0.29	0.26	0.21	0.17		
Kt Required		-	0.63	0.57	0.43	0.44	0.46	0.48	0.42	0.43		
Location 3: Fixed Breakwater - Shallow End			30- Year Return Period				Annual Return Period					
			WSW-30	W-30	WNW-30	NW-30	WSW-1	W-1	WNW-1	NW-1		
Deep Water Incident Wave:		Units										
Compass Bearing	qo	Degrees	247.5	270	292.5	315	247.5	270	292.5	315		
Deep Wave Height	Ho	m	1.29	0.88	0.84	0.61	0.72	0.54	0.49	0.39		
Peak Period	Tp	s	3.9	2.8	2.6	2.3	3.2	2.4	2.2	1.99		
Deep Wave Length	Lo	m	23.75	12.24	10.55	8.26	15.99	8.99	7.56	6.18		
At Location 3:		Units										
Depth at Site	d	m	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52		
Depth Condition is -->			INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.		
Wave Length	L1	m	17.23	10.95	9.76	7.96	13.29	8.56	7.36	6.11		
Wave Ray Bearing	θ1	Degrees	278.75	277.52	295.06	315.31	269.74	273.58	293.39	315.10		
Angle Relative to Lakebed		Degrees	44.7	46.0	28.4	8.2	53.8	49.9	30.1	8.4		
Angle Relative to Breakwater		Degrees	45.3	44.0	61.6	81.8	36.2	40.1	59.9	81.6		
Refraction Coefficient	Kr	-	0.58	0.93	0.99	1.00	0.64	0.96	1.00	1.00		
Shoaling Coefficient	Ks	-	0.93	0.92	0.93	0.95	0.91	0.94	0.96	0.98		
Wave Height	H1	m	0.70	0.75	0.77	0.58	0.42	0.49	0.47	0.38		
Wave Transmission Criteria		m	0.44	0.45	0.35	0.27	0.26	0.25	0.20	0.17		
Kt Required		-	0.63	0.59	0.45	0.47	0.61	0.51	0.44	0.44		

4.0 WAVE ATTENUATION

While the tranquility criteria in Table 2 is the goal, the analysis provides only an approximation of the performance for comparison purposes. Fundamentally, the wave attenuation post-construction should be the same or better than the wave attenuation in the existing condition which has lasted several years.

The efficiency of the wave attenuator is calculated as a transmission coefficient value (K_t) which represents ratio of the transmitted wave height entering the marina to the incident wave height approaching the marina. The transmitted wave height (H_t) is simply the incident wave height (H_i) times the transmission coefficient (K_t):

$$H_t = H_i \times K_t.$$

The K_t value required to meet the wave transmission criteria for each location and condition is shown on the bottom of the tables in Table 2. Floating and fixed breakwaters are assessed separately below.

Floating breakwaters are not effective for long period waves, like those on Okanagan Lake, due to several limitations. There are inherent risks with using a floating breakwater as has been explained to the Vernon Yacht Club. The size of the breakwater becomes costly and impractical as the wave period approaches 4 seconds; note the WSW 30-year design wave period is 3.9s according to the Westmar 2006 study. A fixed breakwater was originally investigated by VYC but the lakebed was found to be unsuitable for piling. The proposed attenuation system is a marked improvement over the existing floating wave attenuation system but it may not be adequate in all storms at the site due to various dynamics.

It is noted that attenuators generally result in some wave reflection. However, in the present study wave reflection is only discussed in the context of navigation adjacent to the wall.

4.1 FLOATING WAVE ATTENUATORS

The transmission coefficient for a floating wave attenuator is based on physical properties such as the beam, draft and shape relative to the incident wave properties and site conditions, such as the incident wave angle, wavelength and the depth of water at the location of interest. K_t was calculated using formulae published by Carr⁷, Macagno⁸ and Kreibel⁹ for rectangular cross sections. These references are based on different simplifying assumptions so that there can be significant variation in the calculated values; therefore, the K_t values were then averaged for each case. This methodology was applied consistently to both the existing and proposed breakwater sections for comparison.

4.1.1 Existing Floating Wave Attenuators

The VYC is currently protected by floating concrete caisson breakwater segments on the west side, which is exposed to the largest waves. The seven (7) existing segments in deep water will be repaired and re-used on the north side to replace a portion of the log-bundle breakwater. These segments are 14' wide by 6' in height with a freeboard of roughly 1.75'. These sections were analysed for comparison to the proposed breakwater performance.

⁷ J.H. Carr, (1950). Mobile Breakwater Studies. Hydrodynamics Laboratory Report No. N-64.2, California Institute of Technology, Pasadena, California.

⁸ E. Macagno (1954). Wave action in a flume containing a submerged culvert. La Houille Blanch.

⁹ L. Kriebel and C.A. Bollmann. (1996). Wave transmission past vertical wave barriers. In Proceedings of Coastal Engineering Conference, Vol. 2, , pp. 2470–2483. ASCE.

The three (3) existing segments closest to shore are retained, although slightly rotated to respect the lease boundary. The segment closest to shore is only 4' in height while the other 2 segments are 6' in height; all of them have 1.75' of freeboard. These segments were not analysed since there is no significant change in this area. The north and east sides, currently protected by log breakwaters, are not in the scope of this study.

4.1.2 Proposed Floating Wave Attenuators

The proposed floating wave attenuators (breakwaters) are concrete caissons with overall dimensions of 9.14 m (30') wide by 1.52 m (5') in height with 12' "wing walls" added as illustrated in the concept section from Burton in Figure 6. The wing walls increase the effective draft and effective mass of the breakwater as they trap the water below the breakwater and improve its performance.

The new wave attenuators will be aligned with the lease boundary on the west side, as shown in the layout in Appendix A, to protect from the strongest waves from the west-south west (WSW). The structural integrity of the breakwater and its mooring system consisting of anchors and mooring lines are to be designed by others.

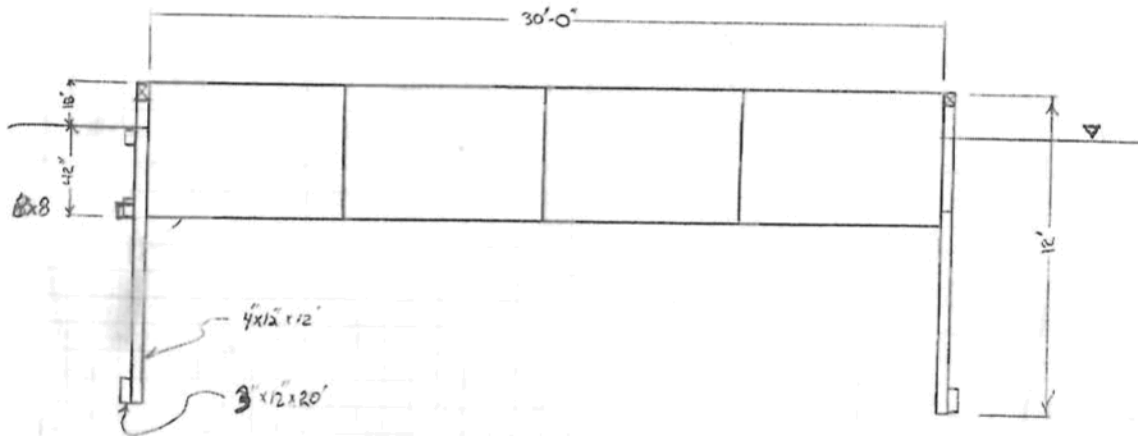


Figure 6: Proposed Floating Wave Attenuator Cross-Section by Burton

For calculating performance of the proposed section, the wing walls are assumed to generate an added mass to the structure as they trap the water below the breakwater. The proposed cross-sectional shape is more complex than typical rectangular-section breakwaters and has not been as well studied. Therefore, for determining the transmission coefficient of the proposed section, the shape was approximated as a rectangular cross section of 9.14 m x 5.12 m (30' x 12') which is easily compared to the existing rectangular breakwater performance.

4.1.3 Performance of the Floating Wave Attenuators

The equations and methodologies available to determine the performance of various floating wave attenuators rely on a range of assumptions and are applicable over certain ranges of conditions, so that there is a great deal of variability in the results between them. Since predicted attenuation levels are only approximate, the best way to compare the existing and proposed breakwater sections is to show their relative performance. The goal is to attain "Good" tranquility conditions (as defined by ASCE 2012) in the mooring area of the marina as defined by the shaded blue in Appendix A.

Although numerical values are presented below for transmitted waves, these should be read with an understanding of the large margin of error inherent in the calculations. The actual values of the transmission coefficients determined by the 3 different equations are also presented for an appreciation of the variability in the potential results.

Table 3 and Table 4 present the analysis of the floating wave attenuators in the proposed reconfiguration shown in Appendix A. Specifically, the tables compare the performance of the new 30' beam breakwater subjected to WSW waves with the existing 14' beam breakwater at its current location and exposed to waves ranging from WSW to NNW. The grey shaded cells represent the proposed breakwater performance in the WSW direction.

The existing attenuators are expected to perform satisfactorily for most wave conditions but not for the waves from the WSW direction. Although the "Location 1" 30-year NNW did not meet the "Good" criteria, it meets the "Moderate" criteria and is the existing condition for the VYC in that direction; therefore, it is deemed acceptable.

Since the analysis was not sensitive to the incident wave angle the results shown in the tables are applicable regardless of the breakwater orientation which allows the results to be applied to both existing and proposed orientations along the western side for comparison purposes.

Table 3 is labeled Location 1, but it applies to all deep-water locations. The incident angle relative to the breakwater that is shown in the table is for the shorter 36.6m section farthest from shore. Table 4 applies specifically at Location 2; the shallow end of the floating breakwater. Incident wave properties change as the depth of water reduces. The NNW direction does not apply in this location and therefore was omitted.

Table 3: Wave Attenuation at Location 1 – Deep Water

Location 1 - Deep Water		30-yr Return Period						1-yr Return Period					
		WSW	WSW	W	WNW	NW	NNW	WSW	WSW	W	WNW	NW	NNW
		New	Existing	Existing	Existing	Existing	Existing	New	Existing	Existing	Existing	Existing	Existing
Beam, B	ft	30.0	14.0	14.0	14.0	14.0	14.0	30.0	14.0	14.0	14.0	14.0	14.0
Total height (incl wall, freeboard)	ft	12.00	6.00	6.00	6.00	6.00	6.00	12.00	6.00	6.00	6.00	6.00	6.00
Freeboard:	ft	1.5	1.75	1.75	1.75	1.75	1.75	1.5	1.75	1.75	1.75	1.75	1.75
Draft (incl. walls), h	ft	10.50	4.25	4.25	4.25	4.25	4.25	10.50	4.25	4.25	4.25	4.25	4.25
Wave Length, L	ft	77.5	77.5	38.8	33.2	25.6	30.6	51.4	51.4	28.0	23.3	18.8	18.6
Depth at Location, d	ft	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2	55.2
Deep water approximations:	ave:	0.43	0.77	0.49	0.42	0.31	0.38	0.26	0.62	0.34	0.27	0.20	0.20
Kt Carr		0.64	0.87	0.66	0.60	0.50	0.57	0.48	0.76	0.54	0.47	0.39	0.39
Kt Macagno		0.33	0.78	0.41	0.32	0.20	0.28	0.15	0.57	0.24	0.17	0.10	0.10
Kt Kreibel		0.31	0.67	0.40	0.33	0.22	0.30	0.14	0.52	0.26	0.18	0.11	0.11
Incident angle relative to BW:	deg	-36.0	-36.0	-13.5	9.0	31.5	26.0	-36.0	-36.0	-13.5	9.0	31.5	26.0
Incident Wave, H _i	m	1.29	1.29	0.88	0.84	0.61	0.73	0.72	0.72	0.54	0.49	0.39	0.39
Kt Selected		0.43	0.77	0.49	0.42	0.31	0.38	0.26	0.62	0.34	0.27	0.20	0.20
Transmitted Wave, H_t	m	0.55	1.00	0.43	0.35	0.19	0.28	0.19	0.45	0.19	0.13	0.08	0.08
Criteria for Good Conditions	m		0.58	0.49	0.36	0.27	0.23		0.29	0.28	0.23	0.17	0.15
Criteria for Moderate Conditions	m		0.72	0.61	0.45	0.34	0.29		0.37	0.32	0.26	0.21	0.19
Passes "Good" Criteria?			NO	YES	YES	YES	NO		NO	YES	YES	YES	YES

Table 4: Wave Attenuation at Location 2

Location 2 - Near-Shore End		30-yr Return Period					1-yr Return Period				
		WSW	WSW	W	WNW	NW	WSW	WSW	W	WNW	NW
		New	Existing	Existing	Existing	Existing	New	Existing	Existing	Existing	Existing
Beam, B	ft	30.0	14.0	14.0	14.0	14.0	30.0	14.0	14.0	14.0	14.0
Total height (incl wall, freeboard)	ft	12.00	6.00	6.00	6.00	6.00	12.00	6.00	6.00	6.00	6.00
Freeboard:	ft	1.5	1.75	1.75	1.75	1.75	1.5	1.75	1.75	1.75	1.75
Draft (incl. walls), h	ft	10.50	4.25	4.25	4.25	4.25	10.50	4.25	4.25	4.25	4.25
Wave Length, L	ft	72.4	72.4	40.0	34.6	27.1	51.5	51.5	29.5	24.8	20.3
Depth at Location, d	ft	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1
Finite depth approximations:	ave	0.39	0.76	0.49	0.42	0.31	0.23	0.61	0.34	0.27	0.20
Kt Carr		0.44	0.80	0.60	0.54	0.45	0.33	0.69	0.48	0.42	0.35
Kt Macagno		0.37	0.79	0.43	0.34	0.22	0.17	0.59	0.26	0.19	0.12
Kt Kreibel		0.35	0.70	0.43	0.36	0.25	0.19	0.56	0.29	0.21	0.13
Incident angel relative to BW:	deg	25.6	25.6	36.9	59.0	81.5	17.8	17.8	36.5	59.0	81.5
Kt corrected for beta		0.39	0.76	0.49	0.42	0.23	0.23	0.61	0.34	0.27	0.15
Incident Wave, H _i	m	0.90	0.90	0.87	0.83	0.61	0.62	0.62	0.54	0.49	0.39
Kt Selected		0.39	0.76	0.49	0.42	0.23	0.23	0.61	0.34	0.27	0.15
Transmitted Wave, H_t	m	0.35	0.69	0.42	0.35	0.14	0.14	0.38	0.18	0.13	0.06
Criteria for Good Conditions	m		0.56	0.49	0.36	0.27		0.29	0.26	0.21	0.17
Criteria for Moderate Conditions	m		0.70	0.61	0.45	0.34		0.36	0.32	0.26	0.21
Passes "Good" Criteria?			NO	YES	YES	Yes		NO	YES	YES	YES

The existing breakwater performance is shown in all columns since it is valuable for comparison and the existing sections remain, although relocated. In all cases the proposed breakwater preforms much better than the existing breakwater. In the WSW direction, it offers a 45% - 62% improvement in wave attenuation beyond the current condition. The existing breakwater is replaced with the proposed breakwater in all locations requiring protection from the WSW.

The small gaps in the breakwaters will transmit some wave energy by diffraction (values were not quantified). The gap should be kept as small as possible to reduce the transmission in this area and boats should not be moored near the gap. Detailed design of the system should also address the gap size and potential for the breakwater segments to impact with differential motions during storms. Breakwater motions also present risks to pedestrian safety if used as a walkway and to boats and infrastructure if used for moorage.

4.1.4 Natural Periods

Natural periods of the proposed floating wave attenuator in heave and roll have been assessed with respect to the various incident wave conditions reported. The natural period of the structure should not be too close to the incident wave period. Otherwise, this can result in harmonic oscillations of the structure that can be damaging and can reduce the level of attenuation; this could lead to damaging waves entering the marina.

Estimates of the natural periods require an assessment of the stiffness and effective mass of the breakwater with respect to heave and roll in turn, with the "effective mass" accounting for the movement of water adjacent to and below the breakwater. However, for the case of large draft wing-walls, as in the proposed design, estimates without the use of a sophisticated numerical model become relatively uncertain and require judgement in the assumptions made. Bearing in mind such uncertainties, the heave natural period

has been estimated to be 4.1 - 4.6 s (compared with 3.2 - 3.3 s for the existing design) and the roll natural period has been estimated to be 4.3 - 5.0 sec (compared with 4.0 - 4.1 s for the existing design).

The largest reported wave period from the Westmar 2006 wave study is 3.9 s for the 30-year return period wave from the WSW direction. Thus, the proposed breakwater offers a significant improvement relative to the existing breakwater with respect to heave motions and a modest improvement with respect to roll motions; such that the natural periods for the proposed design are considered acceptable even for the 30-year wave condition. More generally, floating breakwaters are not effective for wave periods over about 4 s due to several limitations, and there are inherent risks with using a floating breakwater for such waves, as has been explained to the Vernon Yacht Club. However, the proposed system is an improvement over the existing floating wave attenuation system.

4.2 PROPOSED FIXED BREAKWALL

The 23m long piled breakwall proposed at the nearshore opening for access to the boat launch is based on the design that was used by Burton at the Okanagan Safe Harbour in Lake Country (Appendix C and Figure 7). The key difference is the bottom of the breakwall will be kept a minimum of 1.0 m above the lakebed to avoid interruption to sediment transport processes and to maintain circulation in the marina. This clearance requirement will be accommodated by stepping the concrete panels down as the depth increases to a maximum depth of 340.0 m, roughly equivalent to the bottom of the existing breakwater at low water, thereby maintaining the wave attenuation properties similar to the existing floating breakwater in this “gap” in the floating breakwater.

The bottom of the breakwall in the shallowest section is set to elevation 341.0 m (0.3m lower than LWL) in order to provide some attenuation for waves aligned with the opening for all water levels and all directions.

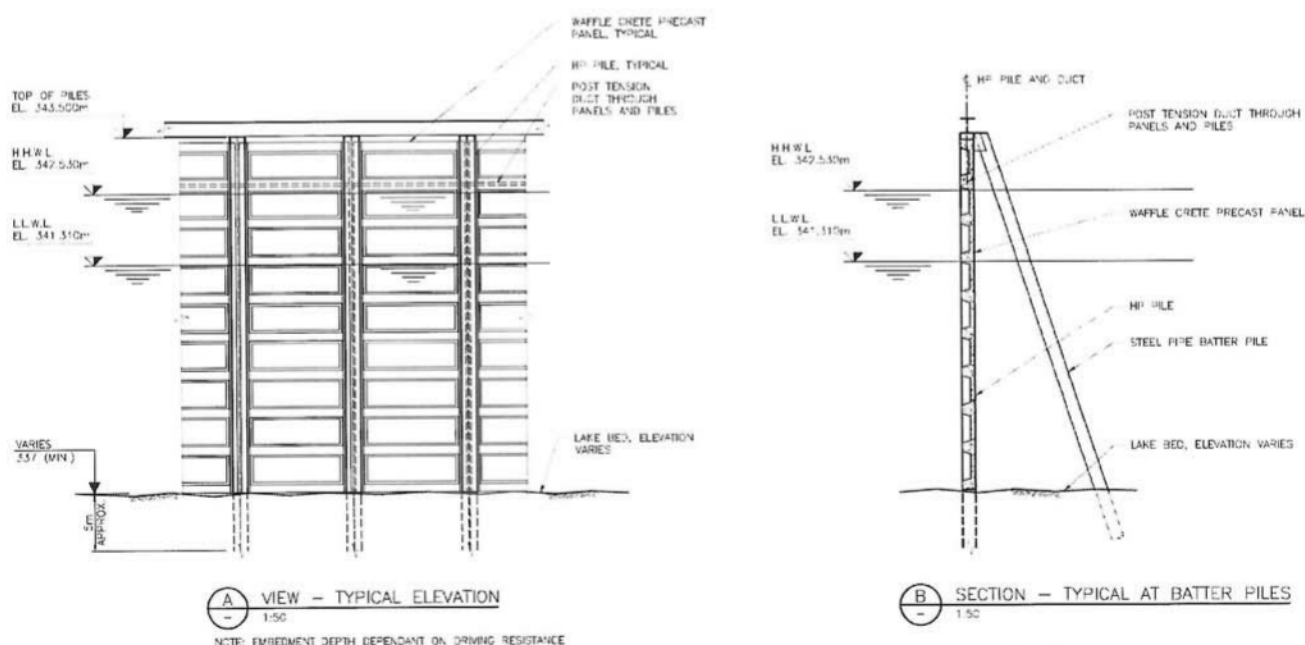


Figure 7: Example Breakwall Used at Okanagan Centre Safe Harbour by Burton

The breakwall structure will give rise to some wave reflection in its immediate vicinity, similar to the existing floating breakwater. This could make it challenging to navigate the narrow boat launch access channel between the breakwaters under some wave conditions. The VYC understands this and accepts the associated risks of using this private access.

4.2.1 Performance of the Fixed Breakwall

The objective of this study with respect to the nearshore area is to maintain the existing wave attenuation conditions. Therefore, the draft of the proposed breakwall is based on the existing floating breakwater at high and low water levels (HWL and LWL). The Kreibel equation is used to estimate the wave transmission since that equation is not dependent on beam. These results are shown in Tables 5 and 6 on the following page. Fundamentally, this simplifies the assessment to a comparison of draft values, with equivalent draft providing equivalent wave transmission.

Figure 8 shows the incident wave condition, post wave transformations, at Location 2 for the HWL condition. The NW direction is such that it does not enter the gap, therefore was omitted from this assessment.

The breakwall protects a small number of slips nearshore due to the angle of attack in the shallow water. The deep end of the wall (Location 2) meets all criteria for a “good” wave condition in a marina except for being just shy on the annual WSW direction at LWL, as shown in Table 5, which is equivalent to the existing condition. The corner of “W” and “A” docks is partially exposed to waves from the channel.

The shallow end of the wall (Location 3) meets all criteria for a “good” wave condition in a marina at HWL but does not meet the criteria at LWL as shown in Table 6. The shallow end of the wall is sheltered by the floating breakwaters, which reduces the incident wave beyond what is used in the breakwall calculations; incident waves are calculated outside the existing breakwater. At LWL the relocated existing floating breakwater reduces the vast majority of the wave energy and therefore the wall is only needed for the waves aligned through the gap, which will have been diminished by diffraction. The slips nearshore on Dock A are at a greater risk of damage if a poorly-aligned storm blows through the gap. However, the depth of the wall is limited to avoid impacts on existing conditions in the nearshore.

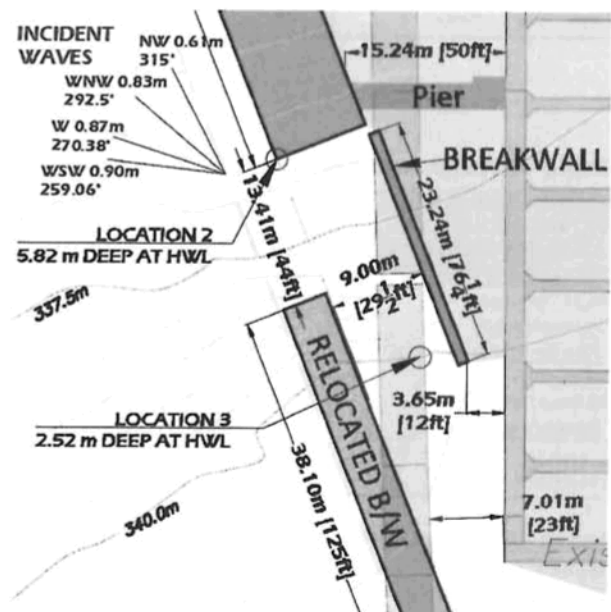


Figure 8: Layout of the Breakwall Area with Incident Waves Shown at Location 2

Table 5: Wave Attenuation at Location 2 (Deep End of Wall)

Location 2 (DEEP END) - HWL, Depth = 5.82m

Constant Condition:		30-Year Return Period						Annual Return Period					
		WSW-30		W-30		WNW-30		WSW-1		W-1		WNW-1	
		Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
Draft of Existing Float (m) = 1.30		INTERM.	INTERM.	INTERM.	INTERM.	DEEP	DEEP	INTERM.	INTERM.	DEEP	DEEP	DEEP	DEEP
Draft of Breakwall (m) = 2.52		Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
Depth Condition is -->		INTERM.	INTERM.	INTERM.	INTERM.	DEEP	DEEP	INTERM.	INTERM.	DEEP	DEEP	DEEP	DEEP
Wave Length (m)	L1	22.1	22.1	12.2	12.2	10.6	10.6	15.7	15.7	9.0	9.0	7.6	7.6
Wave Ray Bearing (degrees)	θ1	259.1	259.1	270.4	270.4	292.5	292.5	251.3	251.3	270.0	270.0	292.5	292.5
Incident Hs	m	0.90	0.90	0.87	0.87	0.83	0.83	0.62	0.62	0.54	0.54	0.49	0.49
Kt Selected		0.70	0.46	0.43	0.16	0.36	0.11	0.56	0.29	0.28	0.06	0.21	0.03
Transmitted Wave Hs	m	0.63	0.41	0.37	0.14	0.30	0.09	0.35	0.18	0.15	0.03	0.10	0.02
Criteria for Good Conditions		0.56	0.56	0.49	0.49	0.26	0.26	0.29	0.29	0.25	0.25	0.21	0.21
Passes "Good" Criteria?		NO	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES

Location 2 (DEEP END) - LWL, Depth = 4.61m

Constant Condition:		30-Year Return Period						Annual Return Period					
		WSW-30		W-30		WNW-30		WSW-1		W-1		WNW-1	
		Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
Draft of Existing Float (m) = 1.30		INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	DEEP	DEEP	DEEP	DEEP
Draft of Breakwall (m) = 1.31		Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
Depth Condition is -->		INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	DEEP	DEEP	DEEP	DEEP
Wave Length (m)	L1	20.9	20.9	12.0	12.0	10.5	10.5	15.3	15.3	9.0	9.0	7.6	7.6
Wave Ray Bearing (degrees)	θ1	264.7	264.7	271.3	271.3	292.8	292.8	255.5	255.5	270.0	270.0	292.5	292.5
Incident Hs	m	0.81	0.81	0.84	0.84	0.82	0.82	0.55	0.55	0.53	0.53	0.49	0.49
Kt Selected		0.68	0.68	0.45	0.45	0.38	0.37	0.57	0.57	0.30	0.29	0.21	0.21
Transmitted Wave Hs	m	0.55	0.55	0.38	0.38	0.31	0.31	0.31	0.31	0.16	0.16	0.10	0.10
Criteria for Good Conditions		0.56	0.56	0.49	0.49	0.35	0.35	0.29	0.29	0.25	0.25	0.21	0.21
Passes "Good" Criteria?		YES	YES	YES	YES	YES	YES	NO	NO	YES	YES	YES	YES

Table 6: Wave Attenuation at Location 3 (Shallow End of Wall)

Location 3 (SHALLOW END) - HWL, Depth = 2.52m

Constant Condition:		30-Year Return Period						Annual Return Period					
		WSW-30		W-30		WNW-30		WSW-1		W-1		WNW-1	
		Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
Draft of Existing Float (m) = 1.30		INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.
Draft of Breakwall (m) = 1.52		Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
Depth Condition is -->		INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.
Wave Length (m)	L1	17.2	17.2	11.0	11.0	9.8	9.8	13.3	13.3	8.6	8.6	7.4	7.4
Wave Ray Bearing (degrees)	θ1	278.8	278.8	277.5	277.5	295.1	295.1	269.7	269.7	273.6	273.6	293.4	293.4
Incident Hs	m	0.70	0.70	0.75	0.75	0.77	0.77	0.42	0.42	0.49	0.49	0.47	0.47
Kt Selected		0.56	0.47	0.44	0.36	0.39	0.31	0.50	0.42	0.33	0.26	0.26	0.19
Transmitted Wave Hs	m	0.39	0.33	0.33	0.27	0.30	0.24	0.21	0.18	0.16	0.13	0.12	0.09
Criteria for Good Conditions		0.44	0.44	0.45	0.45	0.35	0.35	0.26	0.26	0.25	0.25	0.20	0.20
Passes "Good" Criteria?		YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Location 3 (SHALLOW END) - LWL, Depth = 1.31m

Constant Condition:		30-Year Return Period						Annual Return Period					
		WSW-30		W-30		WNW-30		WSW-1		W-1		WNW-1	
		Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
Draft of Existing Float (m) = 1.30		INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.
Draft of Breakwall (m) = 0.31		Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
Depth Condition is -->		INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.	INTERM.
Wave Length (m)	L1	13.2	13.2	8.9	8.9	8.1	8.1	10.5	10.5	7.3	7.3	6.5	6.5
Wave Ray Bearing (degrees)	θ1	290.9	290.9	287.7	287.7	300.2	300.2	284.0	284.0	282.8	282.8	297.4	297.4
Incident Hs	m	0.70	0.70	0.70	0.70	0.75	0.75	0.38	0.38	0.44	0.44	0.44	0.44
Kt Selected		0.01	0.84	0.01	0.81	0.01	0.79	0.01	0.82	0.01	0.78	0.01	0.75
Transmitted Wave Hs	m	0.01	0.58	0.01	0.56	0.01	0.59	0.00	0.32	0.00	0.34	0.00	0.33
Criteria for Good Conditions		0.44	0.44	0.45	0.45	0.35	0.35	0.26	0.26	0.25	0.25	0.2	0.2
Passes "Good" Criteria?		YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO

5.0 RELATIVE WAVE AND SEDIMENT IMPACTS

Waters Edge was retained by Ecoscape on behalf of the VYC to provide an opinion regarding anticipated impacts to waves and sediment transport processes due to the changes to the western breakwater in support of the permitting process and the Environmental Assessment (EA) completed by Ecoscape.

The Sediment Transport Study completed by Westmar in 2006, in Appendix D, covers the majority of information required for background and analysis of sediment processes near the site as well as sediment sizes and littoral drift processes. Waters Edge provides a general overview, without analysis, to supplement the Westmar 2006 study for the proposed changes to the western wave attenuation system.

In general, changes in deep water conditions have minimal impact on nearshore and sediment transport processes, while changes to nearshore conditions can have much greater potential to impact the shoreline and littoral processes. Since the proposed nearshore system is essentially unchanged, there is no anticipated change to the sediment transport patterns.

The nearshore objective is to have no impact on existing wave and sediment processes while correcting compliance with the western lease line boundary. The nearshore area (littoral zone) retains the existing concrete caissons (125' long) and small log bundle to close the gap to shore. In the existing orientation, the floating breakwater end closest to shore trespasses beyond the lease line. Therefore, in the proposed layout, it is rotated to respect the lease boundary, but otherwise unchanged.

5.1 SEDIMENT TRANSPORT DISCUSSION

General littoral transport processes in the vicinity west of the VYC are toward the east as shown in Figure 9. Sediment accretion is reported west of the VYC and inside the VYC. This process has also been confirmed by Westmar 2006 and the VYC in Appendix F. Sediment erodes and accretes generally associated with the few largest storms each year with significant variability from one year to the next.

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Figure 9: Sediment Deposits Due to Eastward Littoral Drift, Google Earth

Images of the 2004 and 2013 shoreline are shown in Figure 10 and 11 respectively. 2017 produced irregular sediment patterns due to rainfall (addition of sediment to the lake), flood waters previously unseen on Okanagan Lake, and irregular storms during the food event; climate change impacts are not yet fully realized. However, the general sediment processes, including the accretion west of the VYC and inside the VYC marina and localized scour, are anticipated to continue after construction of the proposed breakwater system.

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Figure 10: Shoreline on December 30, 2004 – Google Earth

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Figure 11: Shoreline on May 4, 2013 – Google Earth

5.2 IMPACTS WITH EXISTING SYSTEM

Accretion and erosion have been observed in and around the VYC as described briefly below:

- Inside the VYC, accretion has reduced the water depth nearshore and limits use of the boat launch and the inner slips. The “W-Dock” and moorage slips were recently moved further offshore due to depth restrictions.
- The retaining wall shown in Figure 12 protects the point of land from erosion and will eventually require repair.
- The small log breakwater assists in erosion control at this point of land and provides minimal wave attenuation for the inner slips.



Figure 12: Boat Launch Area and Nearshore

- Accretion has been noted west of the VYC, likely due to the historic protrusion of land fronting the marina interacting with the littoral drift toward the east.
- Wave energy inside the marina is adequate to carry coarse sandy sediments onto the boat launch.
- Waves are partially reflected by the breakwaters with some reflected wave energy directed towards shore. Figure 13 shows an example of wave reflection off the existing breakwater; however the image shows very short-period waves from boat wake whereas longer period waves will have reduced reflection.

Figure 13: Existing Breakwater Reflecting Boat Waves (Google Earth 2016)

5.3 IMPACTS WITH PROPOSED SYSTEM

The proposed breakwater layout is illustrated in Appendix A by Ecoscape and the potential impacts of the components of the proposed system on the west side have been summarized below. Note that the east side of the marina is unchanged and the minor changes to the north side are in deep water.

- New 9.14 m (30') Beam Floating Breakwater. The proposed breakwater orientation is altered and it is wider and deeper than existing in order to adequately attenuate waves with a westerly component to meet the ASCE 2012 guidelines as described above. The deeper draft is anticipated to increase wave reflection. However, this is not expected to impact the sediment transport processes in a noticeable way since this breakwater is in deep water and therefore has minimal impact on the nearshore area.

- New 23.2 m (76') Breakwall Structure. In the deep end of the littoral zone, the piled breakwall structure at the boat launch access will be designed to maintain the littoral zone essentially unchanged. It will be built offshore of the 340m elevation contour as shown in Figure 8 and will be a minimum of 1 m above the lakebed to reduce risks of scour and allow sediment passage. At low water the proposed breakwall has only 0.3m of draft, leaving the existing floating concrete breakwater as the primary attenuator.
- Existing Floating Breakwater Re-Oriented. The three (3) existing concrete caissons closest to shore will be rotated so as to be aligned within the lease boundary but are otherwise unchanged. The depth profile in the rotated location is similar to the existing orientation and given that there would be no change in the amount of reflection, this small shift in direction is not anticipated to generate changes to the existing sediment transport patterns in a noticeable way.
- Existing Log Bundle. The log bundle partially protects the point from erosion. Rotation of the log bundle relative to its existing configuration should not lead to any changes in sediment transport processes.

The nearshore littoral area is unchanged other than the orientation of the existing floating breakwaters. On the west side, the existing concrete caissons and small log breakwater are remaining, although rotated to respect the lease boundary. This small shift is not anticipated to generate changes to the sediment transport patterns since they are very close to their existing locations.

Overall, the proposed western breakwater system is not expected to cause any noticeable change to the sediment transport patterns around the marina relative to current conditions in the nearshore area.

6.0 SUMMARY

The Vernon Yacht Club (VYC) proposes to replace its damaged western breakwater with an improved wave attenuation system to protect their marina as illustrated in Appendix A. Although floating breakwaters are not ideal in long-period wave environments, such as Okanagan Lake, the proposed system offers significant improvement over the existing floating breakwater for wave attack from westerly directions.

Results presented are approximations of the wave attenuation performance for comparison to the ASCE 2012 guidelines and for relative comparison of the existing and proposed wave attenuation systems.

Waves from the Westmar 2006 study, used as input to the analysis, indicate the west-southwest (WSW) direction is the most severe wave attack at the site and have been used in the analysis. Waves from the southwest (SW) could result in slightly more severe conditions at the offshore end of the marina, and this has been brought to the attention of the client.

The existing attenuators are expected to perform satisfactorily for most wave conditions but not for the waves from the WSW direction. In the WSW direction, the proposed 30' wide attenuator with wing-walls provides a 45% - 62% improvement in wave attenuation beyond the current condition and satisfies the ASCE 2012 criteria. The proposed attenuator is aligned with the lease boundary.

The wave attenuation system in the nearshore littoral area is unchanged other than the orientation of the existing floating breakwaters and the addition of a short breakwall. The proposed breakwall covers the gap in the floating wave attenuators to allow a narrow access to the private boat launch. The breakwall is open at the bottom and aims to approximate the existing floating wave attenuator performance over the gap. Although the orientation of the proposed western wave attenuation system will be somewhat different than the existing orientation as it relates to respecting the lease boundary, the nearshore conditions remain otherwise unchanged. Therefore, nearshore wave and sediment process are anticipated to be generally the

same as existing, bearing in mind the complications of climate change and the irregularity of storms and water levels in a natural system.

The existing floating breakwater is in poor condition and should be replaced prior to the winter storms to reduce the risk of significant losses in the marina.

7.0 LIMITATIONS AND CLOSURE

This document has been prepared for the Vernon Yacht Club in support of their provincial permitting application for breakwater repairs. It is intended for their exclusive use on this project and may not be relied upon by any other party or for any other project. Waters Edge provides opinions in this document based on the historical information available and provided by others and provides no warranty on this information. Climate change may impact the estimated return period events of storms and water levels as well and sediment trends. All project guidance, estimations and correspondence are bound by the terms in the Services Agreement.

Waters Edge Engineering trusts this meets your present requirements. If you require additional information please do not hesitate to contact us.

Sincerely,
Waters Edge Engineering Ltd.



Tara Hirsekorn, P.Eng.
Principal, Hydrotechnical Engineer
Tara@WatersEdgeLTD.ca
(250) 300-3479

Reviewed by:

Michael Isaacson, Ph.D., P.Eng.
Senior Coastal Engineer

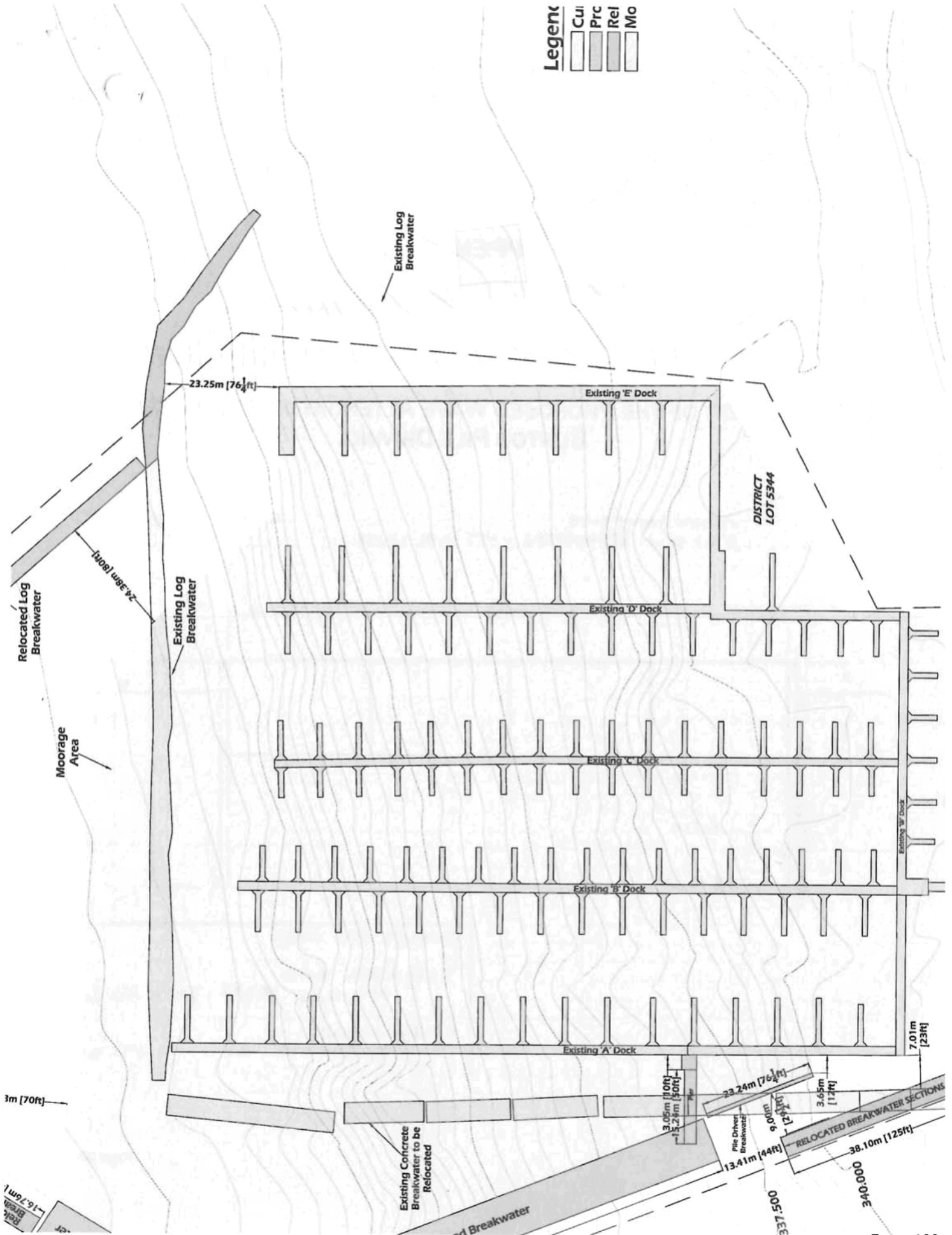
Appendices:

- A – Figure of Marina Layout - Ecoscape
- B - Floating Breakwater Concept Section - Burton
- C - Piled Breakwall Concept - Burton
- D - Westmar Memorandum 2006
- E - Westmar 1997 Killiney Beach
- F - Responses from Vernon Yacht Club

APPENDIX A

FIGURE OF MARINA LAYOUT - ECOSCAPE

FIGURE 3 FROM THE E.A. FOR THIS APPLICATION BY ECOSCAPE ENVIRONMENTAL LTD. SHOWS THE EXISTING AND PROPOSED WAVE ATTENUATION SYSTEMS AND THE MOORING AREA



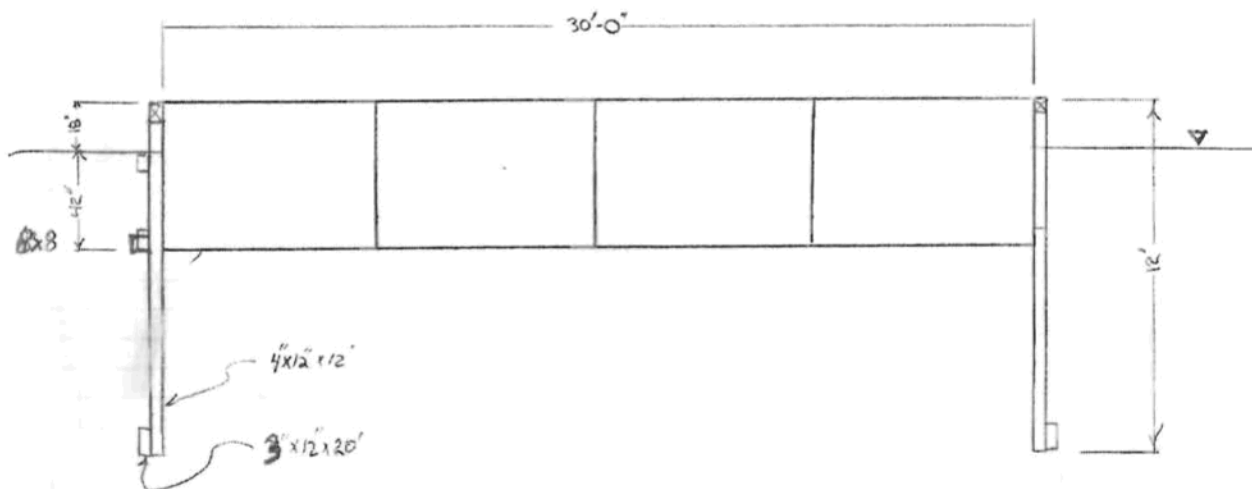
APPENDIX B

FLOATING BREAKWATER CONCEPT SECTION – BURTON

CONCEPT OF THE PROPOSED WAVE ATTENUATOR PROVIDED BY BURTON PILE DRIVING.

VERNON YACHT CLUB
 5' D x 30' W BREAKWATER - 455' TOTAL LENGTH

JAN 16, 2016



BOUANCY PER BOARD

1) WEIGHT PER BOARD

$$4" \times 12 \times 12 / 12 = 48 \text{ board ft} \times 3.25 = 156 \text{ lbs}$$

2) DISPLACEMENT

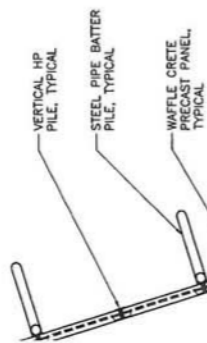
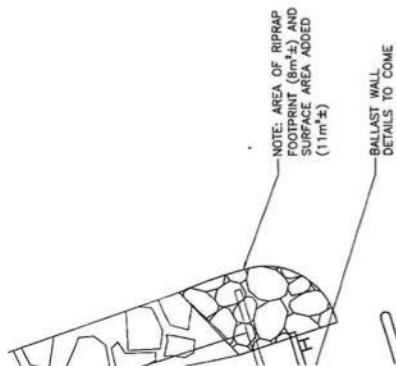
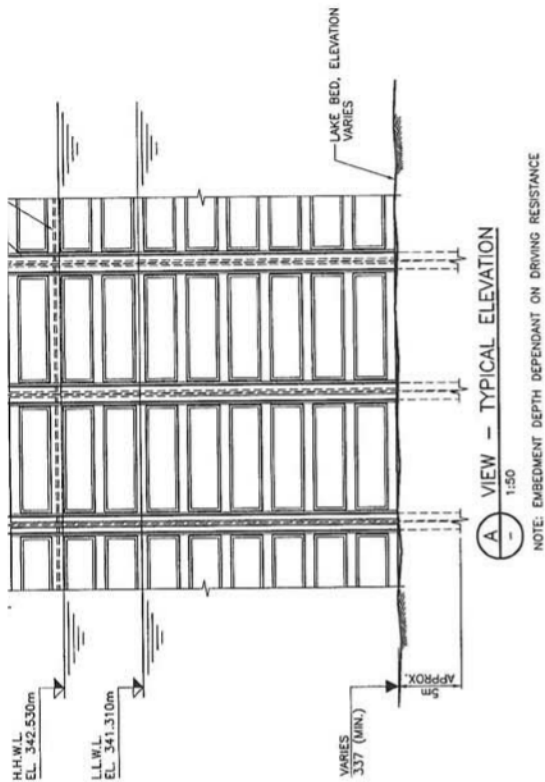
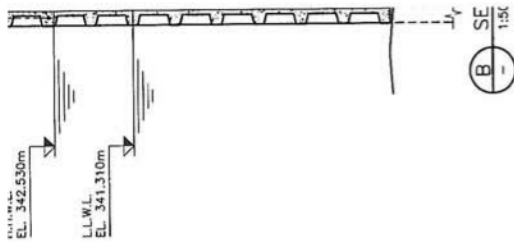
$$3.5" \times 11.5" \times 10' \times 61 = 171 \text{ lbs}$$

APPENDIX C

PILED BREAKWALL CONCEPT – BURTON PILE DRIVING

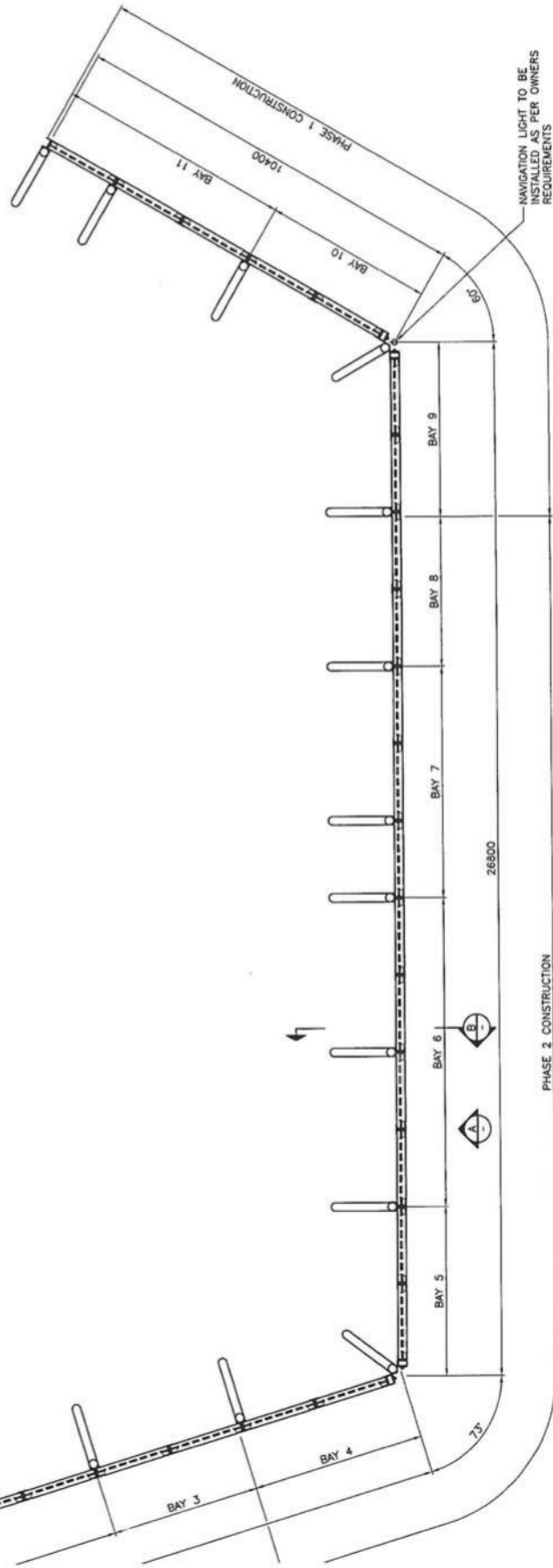
**DRAWING FROM THE OKANAGAN SAFE HARBOUR BREAKWALL IS
SIMILAR TO THE PROPOSED BREAKWALL.**

INCLUDED AS A REPRESENTATION OF THE CONCEPT.



EX
 1C
 FILL
 SL
 RI
 MI
 EL

SUGG	BAY
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11



PLAN
 1:75

APPENDIX D

WESTMAR MEMORANDUM 2006

SEDIMENT TRANSPORT STUDY FOR VERNON YACHT CLUB'S MOST RECENT EXPANSION

Client: VERNON YACHT CLUB**Date: August 2, 2006****Project: MARINA EXPANSION****Project No.: 06150****Subject: SEDIMENT TRANSPORT STUDY****Page 1 of 7**

1 Introduction

The Vernon Yacht Club (VYC) is located on the north end of Okanagan Lake (as shown in *Figure 1* in *Appendix A*). The VYC is planning on expanding and replacing the existing marina. The drawing of the planned expansion as provided by the client is contained in *Figure 2* in *Appendix A*.

Littoral transport of sediment is produced by waves approaching the shoreline at Oblique Angle A (as indicated in *Figure 3* in *Appendix A*). If Angle A is large, the breaking waves will have two effects as follows:

- The waves will put fine sand into suspension and as well as cause a longshore current. These suspended sediments will be transported along the shore.
- Waves are also capable of moving fine gravel. Coarse gravel requires much larger wave heights than would be generated in this area of Okanagan Lake.

A bathymetric survey was carried out by Kerr Wood Leidel (KWL) on July 4, 2006, and the results are provided in *Appendix C* of this project memorandum.

In the Okanagan Lake, wave action is limited by the moderate wind climate and the limited extent of lake over which the wind can blow. This length of open water is referred to as the fetch. The estimated wave climate for the Vernon Yacht Club Marina site is presented in *Table 1* on the following page. The extreme waves are represented by the 1 in 30 year return period, while wave erosion is determined by the 1 in 1 year return period storm, where return period is defined as the average length of time between occurrences of storms of a given magnitude or greater.

In this project memorandum, we are asked to evaluate any changes to the littoral transport of sediment that will be caused by the proposed changes to the marina breakwater and float system. These changes can be observed in *Figure 2* in *Appendix A*.

TABLE 1: Wave Heights and Periods (Based on Vernon Airport Wind Data - All Year Scaled 0.88 from NBCC 2005 (Vernon))

North - 1.5 km		North-North-East - 1.6 km		North-East - 1.2 km		West-South-West - 8.8 km		West - 2.8 km		West-North-West - 2.1 km		North-Wes
Wave Height (m)	Wave Period (s)	Wave Height (m)	Wave Period (s)	Wave Height (m)	Wave Period (s)	Wave Height (m)	Wave Period (s)	Wave Height (m)	Wave Period (s)	Wave Height (m)	Wave Period (s)	Wave Height (m)
0.10	1.2	0.07	1.1	0.04	0.9	0.13	1.7	0.19	1.7	0.14	1.5	0.17
0.16	1.4	0.12	1.3	0.07	1.1	0.35	2.5	0.31	2.0	0.26	1.8	0.25
0.27	1.7	0.21	1.6	0.14	1.3	0.72	3.2	0.54	2.4	0.49	2.2	0.39
0.38	1.9	0.31	1.8	0.21	1.5	1.10	3.7	0.76	2.7	0.72	2.5	0.54
0.41	2.0	0.33	1.9	0.23	1.6	1.22	3.8	0.83	2.8	0.80	2.6	0.58
0.43	2.0	0.35	1.9	0.24	1.6	1.29	3.9	0.88	2.8	0.84	2.6	0.61

8.8 km is based on the longest fetch length (248° from north).
have fetch lengths equal to zero.

2 Existing Conditions

The client has informed us that the marina is currently under expansion in areas indicated as D and E in *Figure 2* in *Appendix A*. The expected changes are labelled Phases 3 through 5 or Docks A, B and C. This previous and proposed arrangement can be viewed in *Figure 2* in *Appendix A*.

A sounding survey was completed by KWL on June 5 2006, and this drawing is provided in *Appendix C*.

Based on the photographs provided for the VYC marina site and included in *Appendix B* herein, there is no indication of any significant erosion, either in the south-west or the north-east of the marina, under the existing marina configuration.

3 Proposed Conditions

The current configuration is outlined in black, with the expansions highlighted in gray. The proposed development consists of the increase of length of the western portion of the walkway (Dock A) with an added breakwater along the north section. Also expected are the increase in length and amount of fingers to the three inner walkways (Docks B, C and D). The eastern dock, labelled Dock E, is to be constructed. Another modification to the existing marina is the construction of a floating "Social Deck". This deck is to be located in the southern portion of the marina. The existing southern fingers and floats are to be removed and replaced.

4 Wind and Wave Study

Wind speeds for 16 compass directions were calculated using Environment Canada Model B wind data from Vernon Airport. The wind data was collected between the years 1864 and 2006. These values were calibrated to the National Building Code of Canada (2005) for Vernon, BC. A summary of design wind speeds for various return periods are given in *Table 2* on the following page. A wind rose for the area was also made and can be found in *Figure 4* in *Appendix A*.

TABLE 2: Design Wind Speeds for Vernon Airport 1864 to 2004 (km/h)

Wind Direction	Occurrence Interval				
	1 Week	1 Month	1 Year	10 Years	30 Years
North	18.6	27.3	39.7	52.2	58.1
North-North-East	13.6	21.2	32.1	42.9	48.1
North-East	9.2	15.9	25.5	35.1	39.7
East-North-East	5.7	11.9	20.7	29.5	33.7
East	9.1	17.3	29.0	40.7	46.3
East-South-East	21.6	35.3	54.9	74.4	83.8
South-East	19.8	26.9	37.1	47.2	52.1
South-South-East	16.5	21.6	28.9	36.2	39.7
South	18.6	26.0	36.6	47.1	52.2
South-South-West	31.1	44.0	62.6	81.1	89.9
South-West	33.4	44.9	61.2	77.6	85.4
West-South-West	18.2	30.5	48.2	65.9	74.3
West	23.5	36.1	54.0	71.9	80.5
West-North-West	20.8	35.4	56.3	77.2	87.2
North-West	79.5	79.5	79.5	79.5	79.5
North-North-West	10.9	26.8	49.5	72.2	83.0
All	40.2	50.9	66.2	81.6	88.9

Using the wind speeds for the 16 sectors given above, wind generated design waves were calculated based on the methodology outline in the Shore Protection Manual (1984) and Coastal Engineering Design Manual, Draft Edition (2001). *Table 1* summarizes the design wave heights at the YVC marina site.

5 Grain Size Analysis

Soil samples were supplied by the client, and were taken from the locations labelled Site 1-8, which are indicated *Figure 2* in *Appendix A*. The samples were then analyzed for grain size distribution. The results are located in the *Appendix D* of this report. In general, the sand sizes (gravelly sand to sand) are quite similar for all the sites. Slightly finer sediments occur within the yacht club basin. Coarser grains are located to the west of the marina. This coarseness is due to the large wave action from the south-west direction. The wave action moves the fines along the shoreline into the yacht club basin. A summary of the D_{50} is given in *Table 3* on the following page. The definition of D_{50} is the diameter of particle that comprises 50% of the sample.

TABLE 3: D_{50} of Samples

Site	D_{50} (mm)
1	0.275
2	0.324
3	0.397
4	0.833
5	0.564
6	0.343
7	0.380
8	0.354

6 Littoral Drift

6.1 Wave Attack from the South-West to North-West

The shoreline to the west of the existing marina lies in the direction of 230° from north. This allows waves to approach from the south-west to the north-west directions. The breakwater on this western side is not being changed. Therefore, the proposed changes to the marina do not alter this westerly wave attack. No change to the littoral drift processes are expected on the south-west side of the marina.

6.2 Wave Attack from the North-West to North-North-East

The proposed new floating breakwater along the north-north-west boundary of the marina will be more effective in reducing wave attack from this direction. The existing log boom breakwater would probably generate no significant reduction in waves greater than a two second period (the time it takes for wave crests to pass a fixed point). The new floating breakwater is assumed to reduce the 1 to 1.3 m waves to 0.25 m. This new breakwater will reduce wave attack approaching from the north-west to north-north-east. The waves that travel in this direction approach approximately perpendicular to the shoreline. Even with no breakwater in this area, these waves would produce limited alongshore sediment transport. The reduction of waves by the new breakwater will not significantly change the present sediment regime.

6.3 Wave Attack from the North-North-East to East-North-East

The shoreline on the City of Vernon side of the marina lies in the east-north-east direction. Wave action from the north-north-west to east-north-east will not be changed by the proposed new breakwater and floats. The wave attack from these directions is moderate and is expected to be unchanged from the present conditions. Photographs of this region do not indicate any ongoing erosion, and therefore it is concluded that the proposed changes to the marina will not change the existing sediment regime in the area.

7 Conclusion

The main wave attack is from the south-west to south-south-west direction. From this direction, there is no proposed change to the breakwater system and therefore, there will be no change to the existing littoral transport regime on either side of the marina due to waves from these wind directions.

A new breakwater is proposed for the north-north-west side of the marina. This breakwater replaces an existing floating log boom. The new breakwater will reduce the waves from the north-west to north sector, such that a 1 m wave approaching the shoreline will be of the order of 0.25 m.

The wave attack under the existing conditions, as with the proposed new breakwater, is almost perpendicular to the shoreline. This type of wave attack induces very little littoral transport. The expansion of the marina is not expected to produce any significant change to the longshore transport inshore to the existing marina.

The wave attack from the north-east side of the marina is mild, because of the limited fetch length. Wave attack from this direction will not be changed by the proposed development of north breakwater and floats. Thus, the littoral transport adjacent to the marina will not be changed by the modifications.

There will be a benign effect on the littoral drift effect from the Vernon Yacht Club expansion plan.

End of Project Memorandum

Prepared by:

[Original signed by Holly Monaghan]

Holly Monaghan, E.I.T.

Approved by:

[Original signed by Dr. Michael Quick]

Dr. Michael Quick
Professor Emeritus, UBC

HAM/tmw
Encl. 4

cc: John Mackie, Department of Fisheries and Oceans
Norman Allyn, Westmar Consultants Inc.

APPENDIX A

Figures

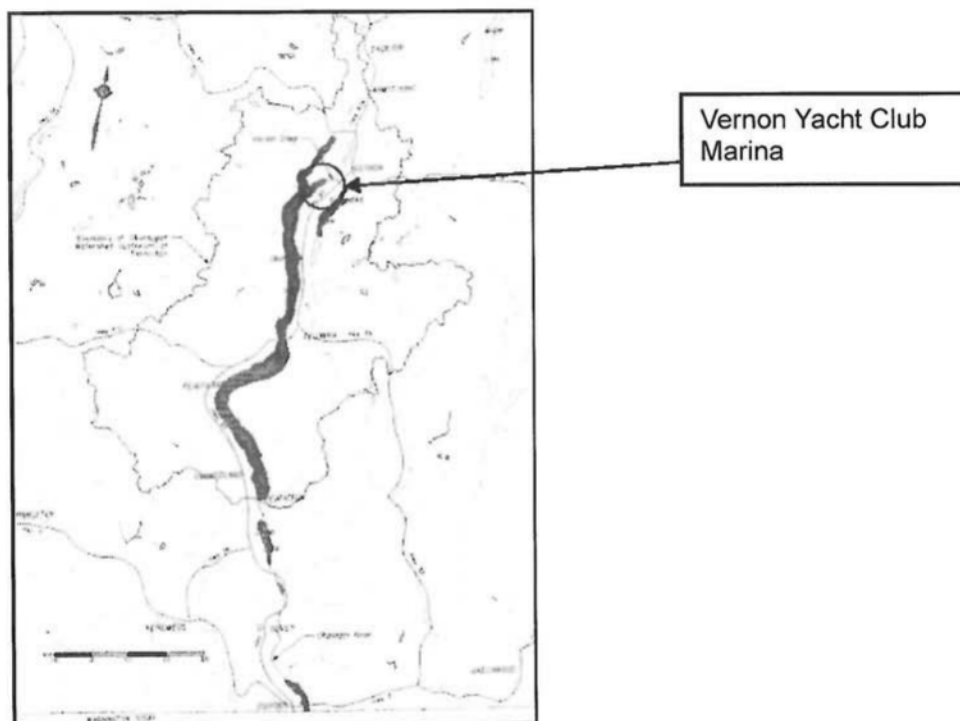


Figure 1: Vernon Yacht Club - Location Map

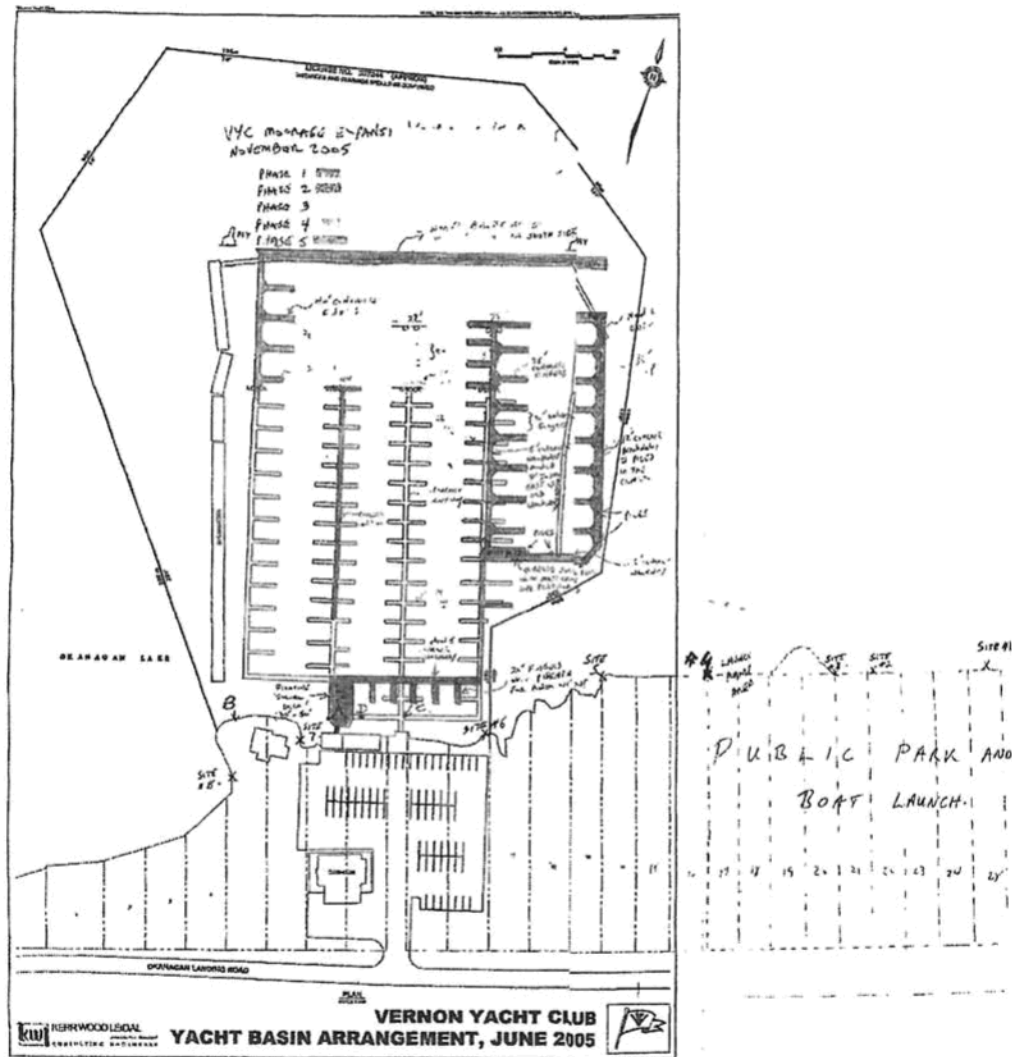


Figure 2: Vernon Yacht Club - Yacht Basin Arrangement

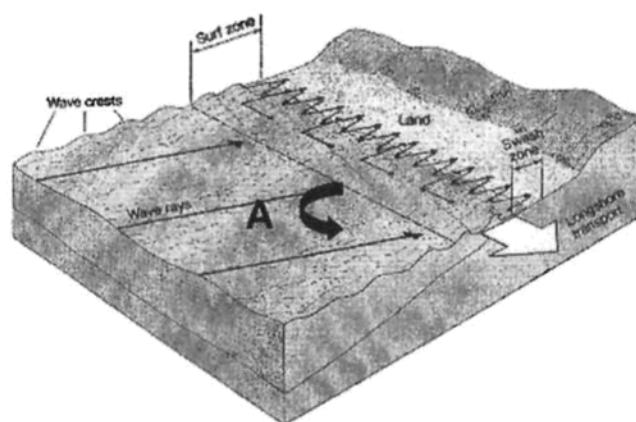


Figure 3: Littoral Drift Process (Note Wave Rays are Perpendicular to the Wave Crests)

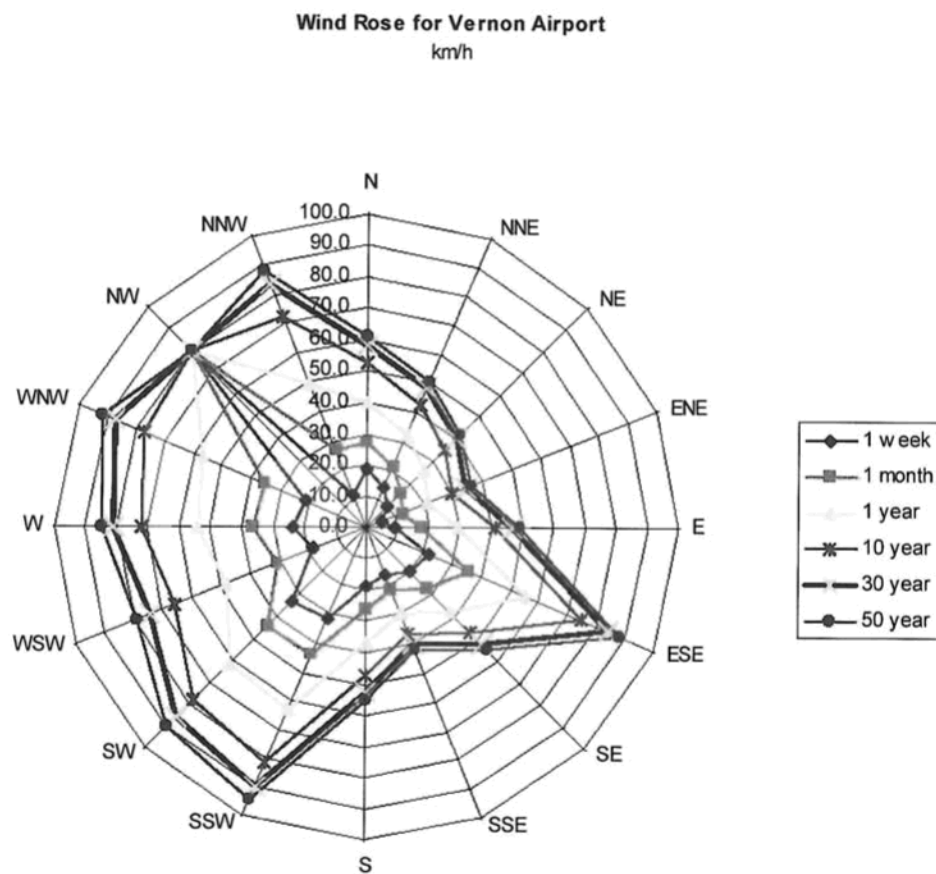
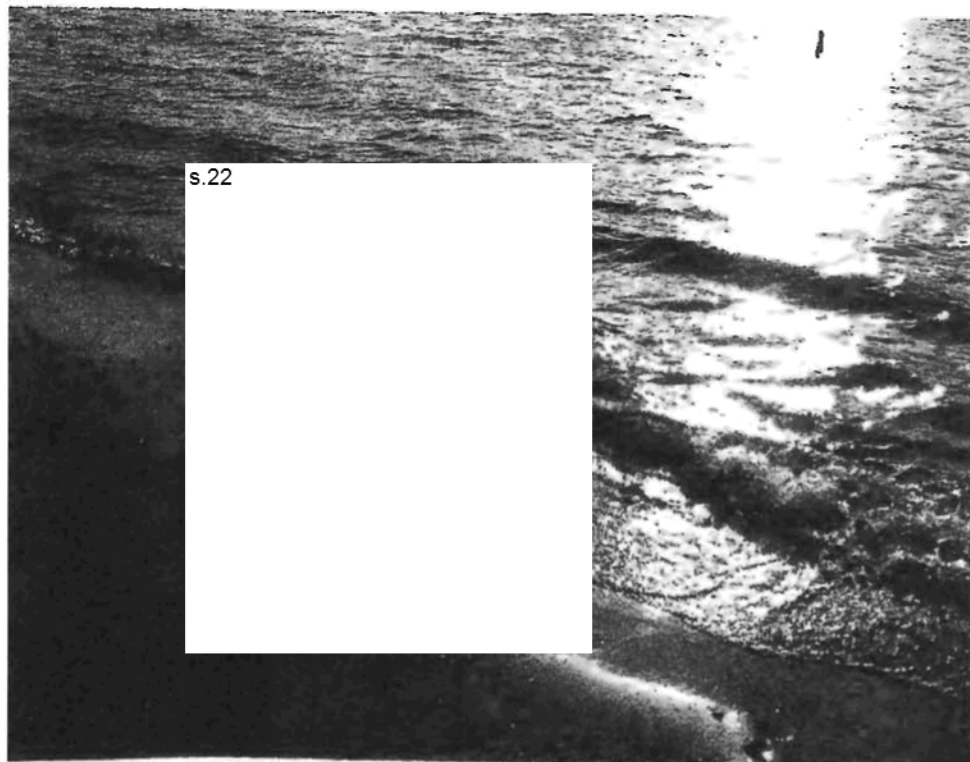


Figure 4: Wind Rose for Vernon Airport

APPENDIX B

Photographs

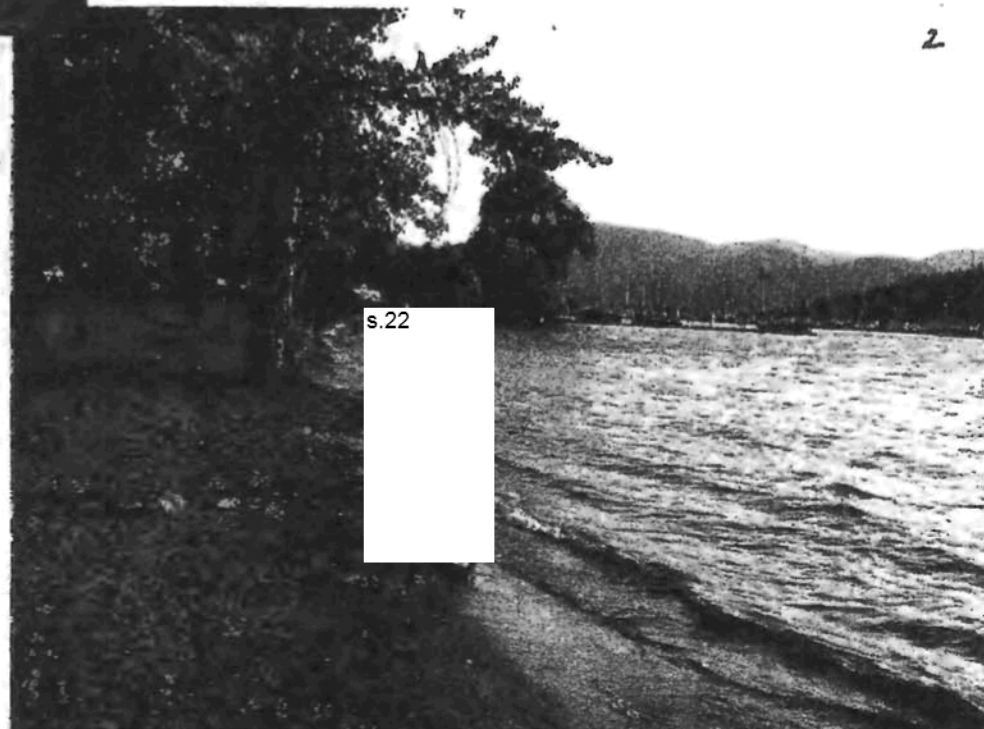


s.22

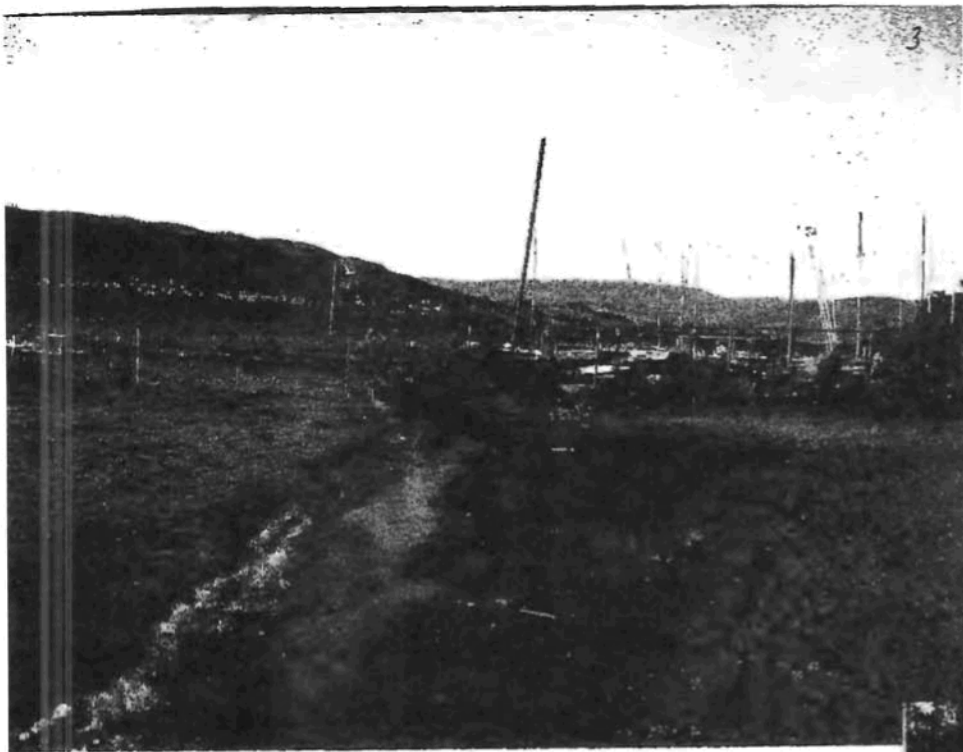
SITE #1. SANDY BEACH IN A PUBLIC
PARK. SAND IS CLEANED AND
← GROOMED DAILY IN THE SPRING,
SUMMER AND FALL (APRIL-OCTOBER)

SITE #1 LOOKING S. WEST →
ALONG THE BEACH.

IN THE BACKGROUND BEYOND
THE TREES IS A PUBLIC
BOAT LAUNCH AND THE
VERNON YACHT CLUB.

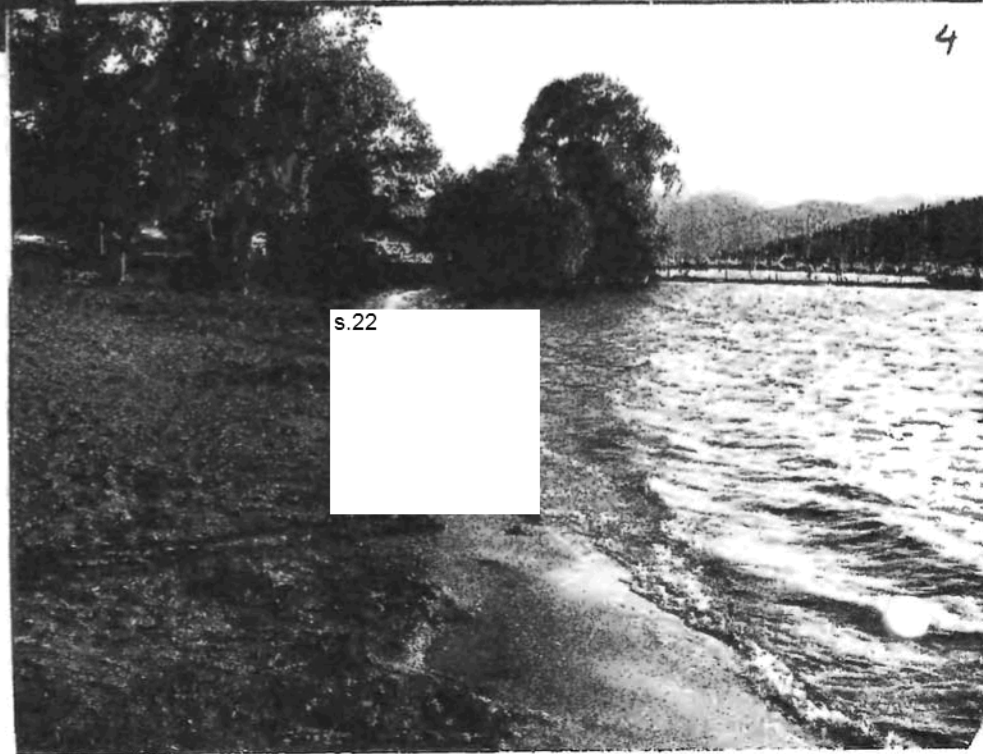


s.22



← SITE #1. LOOKING N. EAST
ALONG THE BEACH TOWARD THE
N. OKANAGAN SAILING ASSOC.
COMPOUND. NOTICE THAT THE
BEACH HAS BEEN GROOMED.

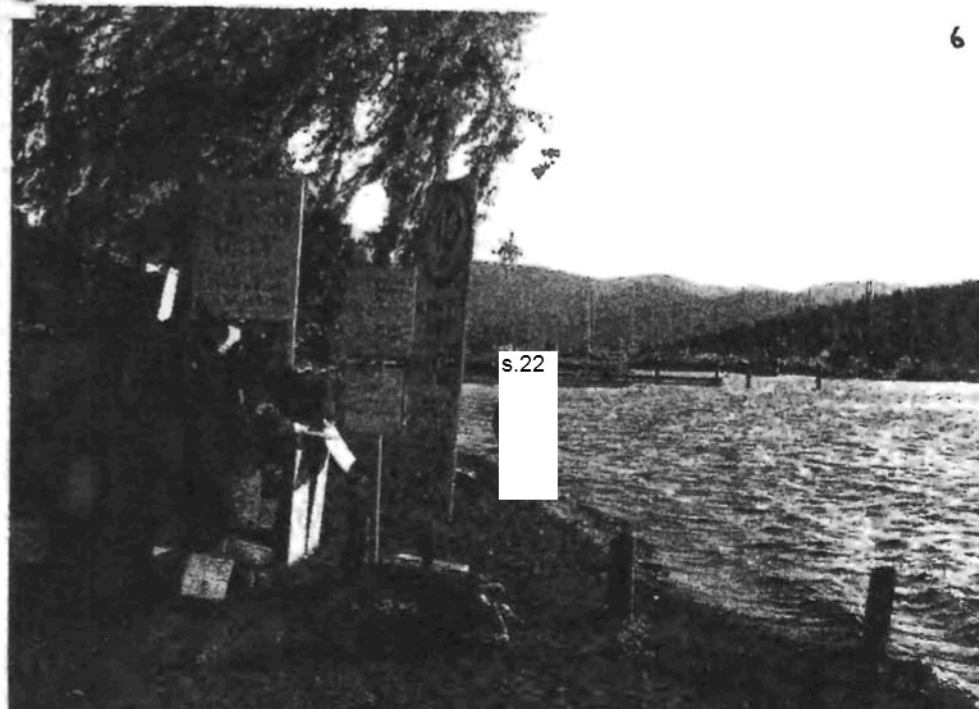
SITE #2



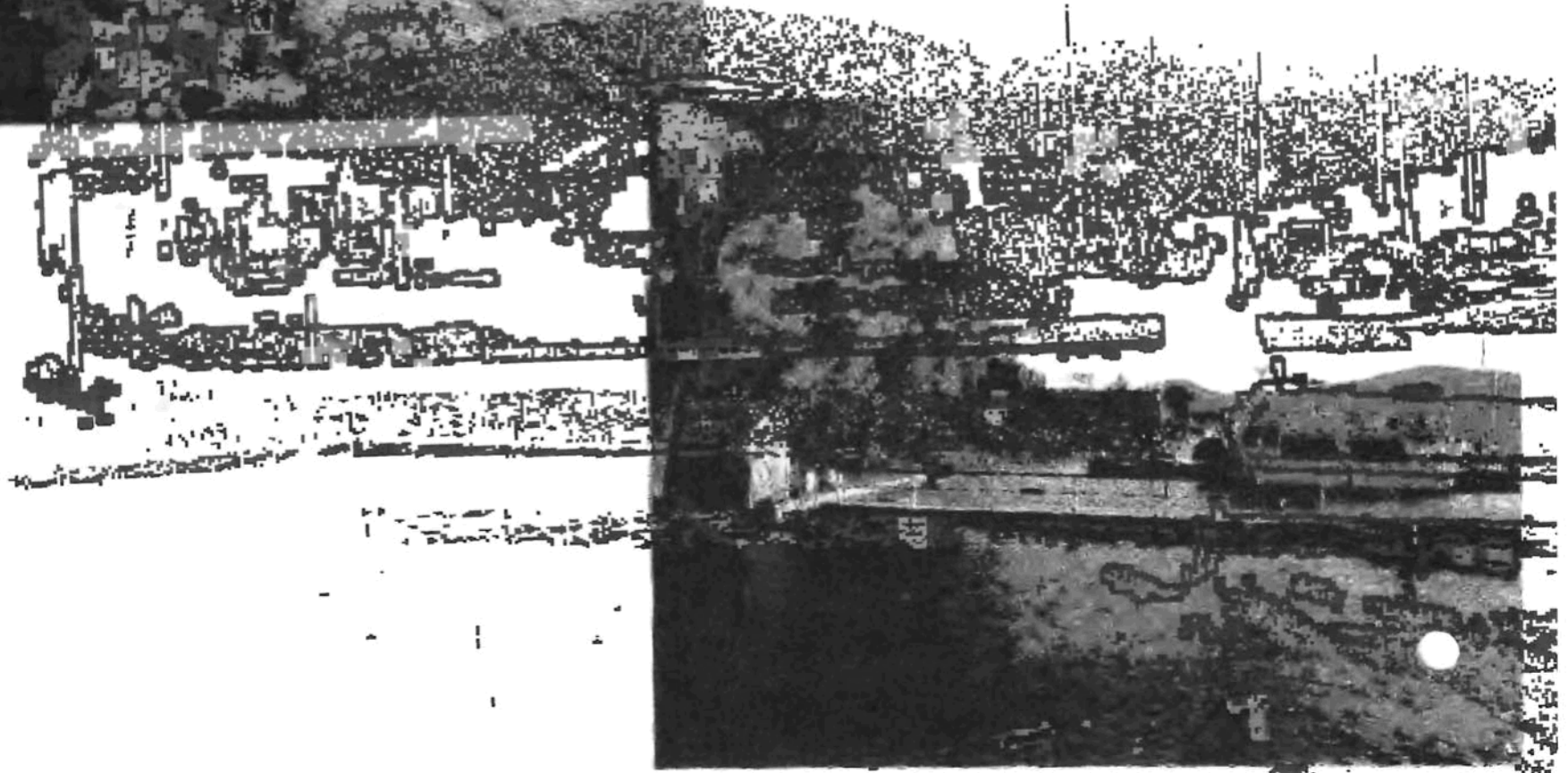
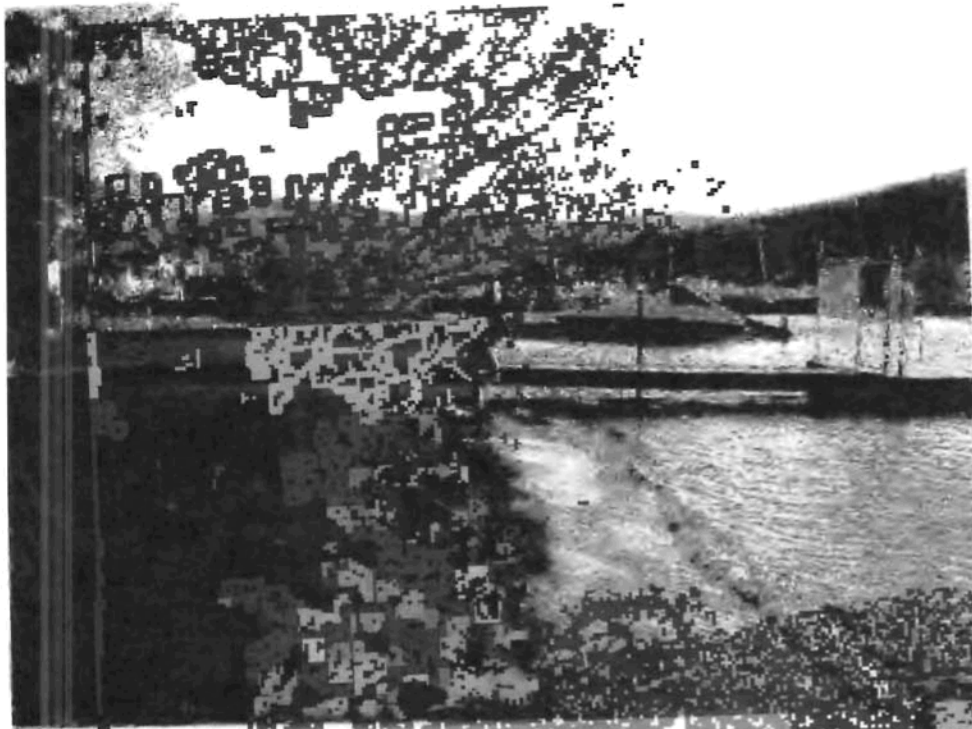


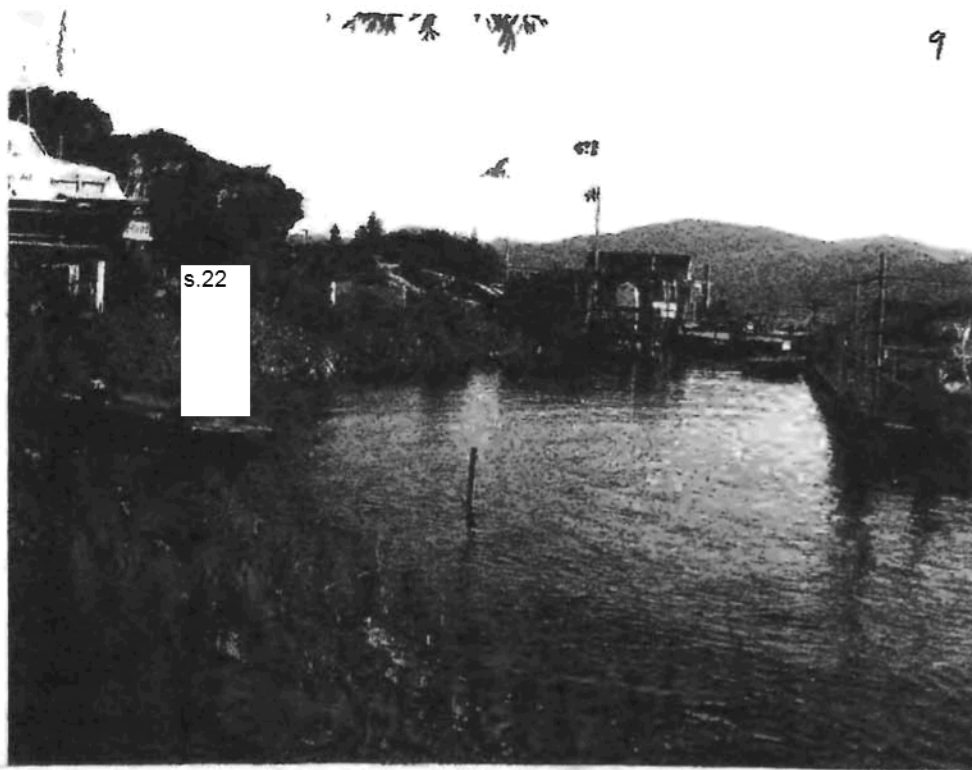
5 SITE #3. - THE S. WEST END OF
THE PUBLIC BEACH. THE FORESHORE
IS RIP RAPPED TO PROTECT THE
BOAT LAUNCH CAR PARK AND STORM
DRAIN: THE OUTFALL OF THE
STORM DRAIN CULVERT IS VISIBLE
AS A METAL CRATING UNDER
THE TREES.

SITE #4 THE OTHER SIDE OF THE
BOAT LAUNCH FROM SITE #3



6





9 SITE 6. N. EAST CORNER OF THE VERNON
YACHT CLUB PROPERTY.

VIEW TO THE N EAST FROM SITE 6
YOU CAN SEE THE GATED DOCK
VISIBLE IN SITE 5.



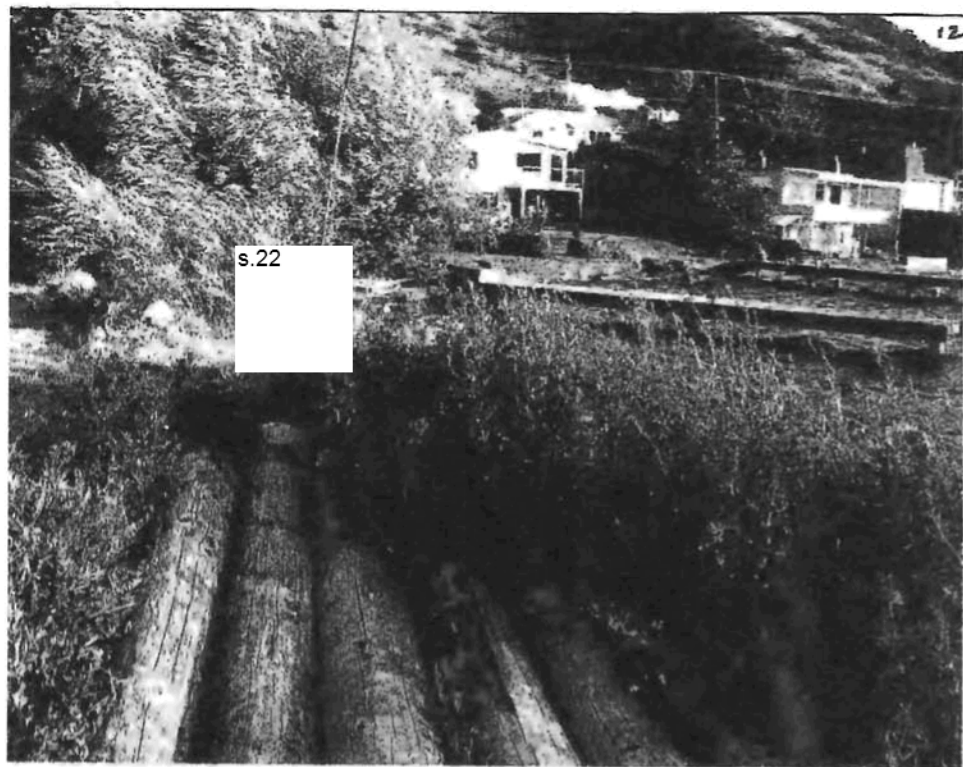


SITE #7. PHOTO TAKEN FROM POINT
'A' ON THE PLAN OF THE YACHT
CLUB'S DOCKS.

SITE #7 ~~WAS~~ IS THE OLD YACHT
CLUB BOAT LAUNCH RAMP.

VIEW FROM POINT 'B' LOOKING
NEAST ALONG THE FORESHORE IN
FRONT OF THE OLD BUILDING

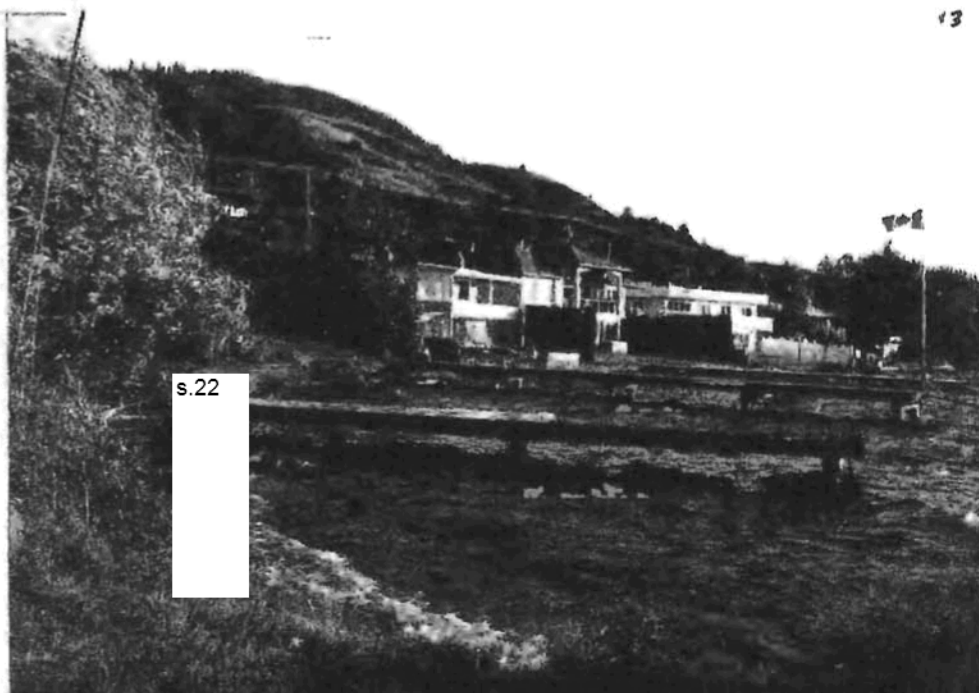




VIEW OF SITE #8 FROM POINT 'B'

SITE #8' S. WEST EDGE OF THE
YACHT CLUB'S FORESHORE.

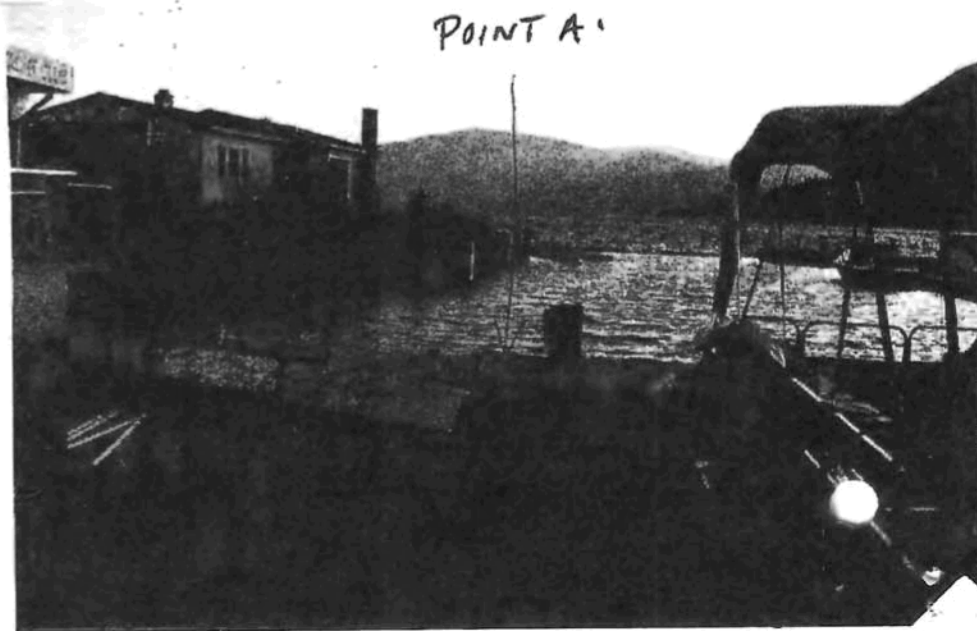
ALL THE PROPERTIES S. WEST OF
THE CLUB HAVE CONSTRUCTED
RETAINING WALLS AND DOCKS





R VIEW OF THE FORESHORE WITHIN
THE YACHT CLUB LOOKING TOWARD
THE ENTRANCE. TAKEN FROM POINT 'C'
LOOKING S.WEST'

VIEW OF THE FORESHORE IN FRONT
OF THE OLD BUILDING. TAKEN
FROM POINT D.



POINT A'



15

VIEW FROM SITE 8 LOOKING
S.WEST

THE PREVAILING WINDS ARE
FROM THE WEST SOUTH WEST
AND THE FORESHORE DRIFT IS
FROM THE S.WEST .

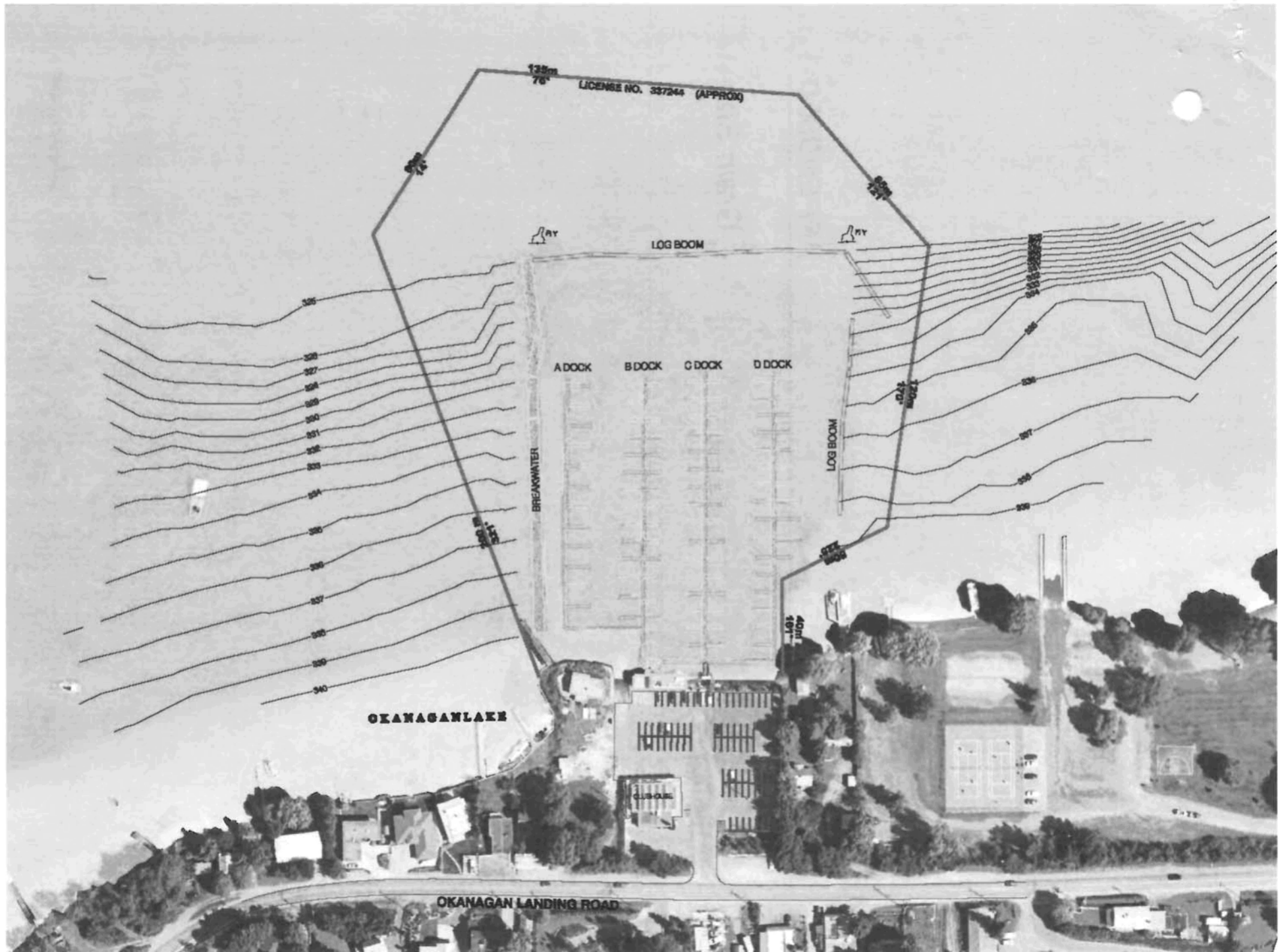
VIEW OF SITE A6 FROM THE
YACHT CLUB DOCKS. VIEW
TAKEN FROM POINT 'C'.
LOOKING N. EAST.



16

APPENDIX C

Sounding Survey



APPENDIX D

Grain Size

Aura, Bernadette FLNR:EX

From: Craig Williams <craig@telus.net>
Sent: Thursday, August 25, 2016 5:56 PM
To: Aura, Bernadette FLNR:EX; 'Jason Schleppe'
Cc: Weir, Keith FLNR:EX; Lawrence Johnson
Subject: RE: Tracking Numbers: 100172388 and 100161276 Vernon Yacht Club Marina Application
Attachments: Newspaper ad (Aug.07-16).pdf; Newspaper ad (Aug.14-16).pdf; Staking (1).jpg; Staking (2).jpg
Importance: High

Hi Bernadette,

Please find attached a copy of each advertisement of our application that ran in the Vernon Morning Star newspaper on Sunday August 7th and Sunday August 14th along with 2 photos taken August 16th of the staking notice that was placed on-site as required.

I trust this is satisfactory for your purposes and completed in a manner to meet the requirements of your acceptance letter of July 18, 2016. You are no doubt aware of the destruction suffered by the Kelowna Yacht Club this past Sunday August 22nd, including the breaking apart of sections of their west breakwater, after winds to 90km/hour tore through the Okanagan (follow this link for a report from CBC <http://www.cbc.ca/news/canada/british-columbia/kelowna-yacht-club-damage-1.3731563>).

Luckily the Vernon Yacht Club suffered only minor damage to our west breakwater, the one which is the subject of our application for replacement, from this most recent storm and we would just like to emphasize the urgency of this necessary work to avoid a catastrophe that could be worse than that endured by the Kelowna Yacht Club due to our unsheltered location such as theirs due to the 8.8 km fetch to the west south west, the direction of the most severe storm waves.

If you have any questions or require us to do anything further, especially anything that may expedite the review of our application, please let me know at your earliest possible convenience.

Cheers,

Craig Williams
Rear Commodore
Vernon Yacht Club
7919 Okanagan Landing Road
Vernon, BC V1H 1H1

Off: (250) 545-5518
Cell: (250) 503-8993
Email: craig@telus.net

From: Aura, Bernadette FLNR:EX [<mailto:Bernadette.Aura@gov.bc.ca>]
Sent: Monday, July 18, 2016 5:02 PM
To: 'Jason Schleppe' <jshleppe@ecoscapeltd.com>; 'craig@telus.net' <craig@telus.net>
Subject: Tracking Numbers: 100172388 and 100161276 Vernon Yacht Club Marina Application

Hi Jason and Craig, here is you acceptance letter with advertising and staking instructions.

Bernadette Aura
Natural Resource Specialist
FrontCounter BC
Ministry of Forests, Lands and Natural Resource Operations
441 Columbia Street
Kamloops BC V2C 2T3
250 828 4210
Fax: 250 828 4442
Toll Free: 1 877 855 3222

Page 195 to/à Page 196

Withheld pursuant to/removed as

Copyright



Tracking Numbers: 100172388 and 100161276
FCBC Project Number: 213872
Lands File: 3404262
Water: 8003608

July 18, 2016

Vernon Yacht Club
7919 Okanagan Landing Road
Vernon, BC V1H 1H1

Dear Craig Williams:

RE: Application for a Major Amendment to a Crown Land Tenure under the
Commercial Marina Policy; and Section 11 – Changes in and About a Stream
Approval

Thank you for your applications covering District Lot 5344 and District Lot 5343, ODYD
for Commercial Marina purposes in the vicinity of Vernon.

FrontCounter BC (FCBC) has accepted your applications on behalf of the Ministry of
Forests, Lands and Natural Resource Operations (MFLNRO). Your project has been
assigned to Keith Weir who will review your proposal and make a recommendation to
approve or disallow the project.

**This letter does not imply tenure will be offered nor does it give you any
authorization to occupy or use the Crown land under application.**

During the application review, your application will be referred for comment to:

- First Nations;
- other government agencies having statutory responsibilities related to your
application;
- local governments; and

FrontCounter BC

Mailing Address:
441 Columbia Street
Kamloops BC V2C 2T3

Phone: (250) 828-4131
Fax: (250) 828-4442
Toll Free: 1-877-855-3222
Website: www.frontcounterbc.gov.bc.ca

- the general public.

As directed in the Commercial Marina Policy, you are required to:

1. Advertise your application by August 8, 2016.

Please find attached an advertising requirement checklist with an example. The "Comment Closure Date" to be indicated in the advertisement is September 7, 2016.

2. Stake your application by August 29, 2016.

Enclosed is a blank staking notice with instructions.

Please provide proof of advertising and staking to this office by August 29, 2016.

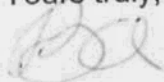
Once your advertisement has been published, clip it out, ensuring that the date portion of the newspaper banner is included and submit the clipping to us by email.

Your application may be subject to further requirements under the federal Fisheries Act. Please refer to Fisheries and Oceans Canada's "Projects Near Water" webpage (<http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html>) for information on how to ensure your project complies with the Fisheries Act.

If you require any further information or clarification, please contact Keith Weir at (250) 828 4419 or email to: keith.weir@gov.bc.ca, quoting the above file number.

The application turn-around time is 140 days. This is the general turnaround time for a decision. The decision may take less or more time depending on the completeness, accuracy and complexity of a given application. Once the application process is complete, you will be advised whether or not your application has been approved or declined.

Yours truly,



Bernadette Aura
Natural Resource Specialist
FrontCounter BC

pc: Ecoscape Environmental Consultants Ltd. 102 450 Neave Court, Kelowna, BC V1V 2M2 Attn: Jason Schleppe

CROWN LAND ADVERTISING REQUIREMENTS NEWSPAPER

Ministry of Forests, Lands and Natural Resource Operations

These Requirements are part of the application and each item must be met.

1. Advertise once a week for two consecutive weeks in a newspaper circulating in the community in which the Crown land is situated.
 - a) File number must be noted in the advertisement (ad)
 - b) The newspaper ad must include a map of your application area that will give a clear indication of where the land is that you are applying for. The scale should not be so large that the area is too vague, and the scale should not be so small that the site cannot be physically oriented to the surrounding lands.
 - c) There is no size requirement on the ad, however, the map **MUST** be legible
2. The first ad must appear in the publications within 21 days from the date of this letter.
3. The ad must be headed "Land Act: Notice of Intention to Apply for a Disposition of Crown Land".
4. Indicate the Ministry of Forests, Lands and Natural Resource Operations, _____ Office, applicant's name, address, and occupation as well as the legal description and purpose for which the disposition is required. (The legal description and purpose can be found on the acknowledgement letter that was sent when the application was accepted for review.)
5. At the end of the ad, state the following:

"Comments concerning this application should be directed to the Senior Land Officer at _____. Comments will be received by the Ministry of Forests, Lands and Natural Resource Operations until (insert the Comment Closure Date as per your Letter of Acceptance). Ministry of Forests, Lands and Natural Resource Operations may not consider comments received after this date. Please visit the Applications and Reasons for Decision Database website at www.arfd.gov.bc.ca/ApplicationPosting/index.jsp for more information."
6. When you have finished your advertising, you must return copies of the advertisements covering a two-week period, confirming that your application has been advertised. The copies from the newspaper must be of the whole page including the date.

FAILURE TO ADVERTISE AS REQUESTED WILL RESULT IN THE DISALLOWANCE OF YOUR APPLICATION

**SAMPLE NEWSPAPER ADVERTISEMENT
LAND ACT**



**Land Act:
Notice of Intention to Apply for a
Disposition of Crown Land**

Take notice that Vernon Yacht Club from Vernon, BC has applied to the Ministry of Forests, Lands and Natural Resource Operations (MFLNRO), Thompson-Okanagan, for a major amendment to an existing lease for Commercial Marina purposes situated on Provincial Crown land located at District Lot 5344 and District Lot 5343, ODYD.

The Lands File for this application is 3404262. Comments on this application may be submitted by one of two options:

Option 1: Online via the Applications and Reasons for Decision website at:

<http://www.arfd.gov.bc.ca/ApplicationPosting/index.jsp> where details of the application and maps can be found.

Option 2: by mail to Senior Land Officer, Thompson-Okanagan, MFLNRO, at 441 Columbia Street Kamloops BC V2C 2T3.

Comments will be received by MFLNRO up to September 7, 2016. MFLNRO may not be able to consider comments received after this date. Please visit our website

<http://arfd.gov.bc.ca/ApplicationPosting/index.jsp> for more information.

Be advised that any response to this advertisement will be considered part of the public record. For information, contact the Freedom of Information Advisor at Ministry of Forests, Lands and Natural Resource Operations' Office in Thompson-Okanagan.

MAP REQUIRED

(The scale should not be so large that the area is too vague, and the scale should not be so small that the site cannot be physically oriented to the surrounding lands.)

Jorgensen, Catherine J FLNR:EX

From: Aura, Bernadette FLNR:EX
Sent: Monday, July 4, 2016 12:48 PM
To: Jorgensen, Catherine J FLNR:EX
Cc: Harvey, Danalee FLNR:EX; Jenkins, Kathy M FLNR:EX
Subject: FW: Vernon Yacht Club
Attachments: ApplicationFormReport_CL Tenure.pdf; Section 9 Application Form Report.pdf

Hi Catherine, make sure you put Tracking 100172388 under same project (213872). And locate the Section 11 application to put it with this one. (I thought Kathy had it or Danalee). Berny

From: Katrina Black [mailto:kblack@ecoscapeltd.com]
Sent: Friday, June 17, 2016 1:40 PM
To: Aura, Bernadette FLNR:EX
Cc: Jason Schleppe; Tara Hirsekorn; Craig Williams; Weir, Keith FLNR:EX; steve@burtonpiledriving.com
Subject: RE: Vernon Yacht Club

Hi Bernadette,

We have submitted the Crown Land Tenure application (tracking number:100172388). The Section 11 application has already been submitted and is tracking number 100161276, both applications are attached. The existing lease for the marina is lease number: 343750 (File no. 3404262).

Please get in touch with Jason or myself if you need anything else.

Regards

Katrina Black, BSc, BIT
Natural Resource Biologist

ECOSCAPE Environmental Consultants Ltd.
#102 – 450 Neave Court
Kelowna, BC V1V 2M2
Tel: 250.491.7337 ext. 215
Email: kblack@ecoscapeltd.com

From: Jason Schleppe
Sent: Tuesday, June 14, 2016 2:17 PM
To: Aura, Bernadette FLNR:EX <Bernadette.Aura@gov.bc.ca>
Cc: Katrina Black <kblack@ecoscapeltd.com>
Subject: RE: Vernon Yacht Club

Hi Bernadette,

Once we submit the Crown Land tenure, Katrina will send along the original tracking file number, etc.

Hold tight, should be today or tomorrow.

Thanks
jason

Phone: 250.491.7337 ext. 202 / Fax: 250.491.7772 / Cell: 250.808.3474

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Sent: Tuesday, June 14, 2016 2:12 PM

To: Jason Schleppe <jschleppe@ecoscapeltd.com>

Subject: RE: Vernon Yacht Club

What was the Tracking number again?

From: Jason Schleppe [<mailto:jschleppe@ecoscapeltd.com>]

Sent: Tuesday, June 14, 2016 1:29 PM

To: Aura, Bernadette FLNR:EX; 'craig@telus.net'; Weir, Keith FLNR:EX

Cc: steve@burtonpiledriving.com; Tara Hirsekorn; Katrina Black

Subject: RE: Vernon Yacht Club

Thanks Bernadette, we will.

Once done, can you please link the existing Section 11 (Section 9 application) to it. This ensure that the tracking and files numbers we have don't get lost, etc., and saves us an hour or so.

Thanks,
Jason

JASON SCHLEPPE, M.Sc., R.P.BIO
SENIOR NATURAL RESOURCES BIOLOGIST
ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.

Phone: 250.491.7337 ext. 202 / Fax: 250.491.7772 / Cell: 250.808.3474

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From: Aura, Bernadette FLNR:EX [mailto:Bernadette.Aura@gov.bc.ca]

Sent: Tuesday, June 14, 2016 12:24 PM

To: Jason Schleppe <jshleppe@ecoscapeltd.com>; 'craig@telus.net' <craig@telus.net>; Weir, Keith FLNR:EX <Keith.Weir@gov.bc.ca>

Cc: steve@burtonpiledriving.com; Tara Hirsekorn <Tara@WatersEdgeLTD.ca>; Katrina Black <kblack@ecoscapeltd.com>
Subject: RE: Vernon Yacht Club

Hi Jason, here is the link to apply. <http://www.frontcounterbc.gov.bc.ca/>
You can apply under New Application (for the major amendment). Thanks.

From: Jason Schleppe [<mailto:jschleppe@ecoscapeltd.com>]
Sent: Thursday, June 9, 2016 8:25 AM
To: 'craig@telus.net'; Weir, Keith FLNR:EX; Aura, Bernadette FLNR:EX
Cc: steve@burtonpiledriving.com; Tara Hirsekorn; Katrina Black
Subject: FW: Vernon Yacht Club

Thanks Keith.

Can you provide us with any information so we can facilitate review as best as possible. Note the following:

- 1) Test piles are driven and results will be submitted shortly
- 2) Will we need to complete public consultation? Is so, can instructions be sent?
- 3) Will First Nations review occur? If so, should we contact Judith Zwickel or Laverne Cormier to confirm any ways we can facilitate, determine which FN Bands are most appropriate to consult with, etc.?
- 4) Is there any outstanding information that you require for your review?
- 5) If we need temporary structures to address immediate repairs due to large storm events, can these be placed in short order? The hope is to avoid spending any extra money, but if an emergency arises, it will be good for us to understand the exact process to get them done?

I think this is it from my end, but the information requested above will help us ensure we facilitate the process for an expeditious review.

Tara / Steve, this is all just for your information.

Thanks
Jason

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SENIOR NATURAL RESOURCES BIOLOGIST
ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.

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From: Weir, Keith FLNR:EX [<mailto:Keith.Weir@gov.bc.ca>]
Sent: Thursday, June 9, 2016 7:21 AM
To: Jason Schleppe <jschleppe@ecoscapeltd.com>
Subject: FW: Vernon Yacht Club

—

Whether we call this a minor or major amendment, we will still send referrals, and conduct a fairly thorough review process. You are correct that the changes are all within the existing lease boundary, and that fact will likely make or review quicker, but the change is fairly significant and we are already getting expressions of concern from the neighbor; we will err on the side of caution and treat it as a major amendment. We will do our best to expedite the review.

From: Weir, Keith FLNR:EX
Sent: Tuesday, May 17, 2016 1:28 PM
To: 'Jason Schleppe'
Subject: RE: Vernon Yacht Club

From: Jason Schleppe [<mailto:jschleppe@ecoscapeltd.com>]
Sent: Tuesday, May 17, 2016 9:49 AM
To: Weir, Keith FLNR:EX
Cc: 'craig@telus.net'
Subject: RE: Vernon Yacht Club

Thanks. Please hold tight for now. We are going to dig up some old correspondence from 2006 when the lease boundary and issues with the neighbor were addressed. As I understand from talking to Craig, the boundary was shifted in that year to better accommodate the neighbor. Also, as I understand, the neighbor just built their dock, and this was built to accommodate VYC lease. Anyway, we will dig this up, and then come armed with a few more questions, and proceed from there.

JASON SCHLEPPE, M.Sc., R.P.BIO
SENIOR NATURAL RESOURCES BIOLOGIST
ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.

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Page 205 of 317



Keith

Hi Keith,

Thanks for the discussion. As I understand, you are going to carefully review this and provide us with guidance regarding the following:

- 1) Does this truly open up the Crown Land Tenure, or can it fall within an amendment. Again, since we are staying within the existing tenure, preference would be to stick with a minor amendment.
- 2) If it is a major amendment (i.e, basically a new application), how many slips would they have to drop to keep it at a minor amendment for the time being.

I think this is the key for now. As I said, the critical pathway is the Section 9 Notification for the test piles, which allows us to complete engineering. We will keep on this aspect, but if you could get back to me on the other parts, I can then try and guide VYC through.

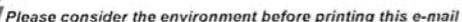
Thanks
Jason

JASON SCHLEPPE, M.Sc., R.P.BIO
SENIOR NATURAL RESOURCES BIOLOGIST
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Phone: 250.491.7337 ext. 202 / Fax: 250.491.7772 / Cell: 250.808.3474

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From: Jason Schleppe
Sent: Wednesday, May 11, 2016 10:48 AM
To: Weir, Keith FLNR:EX <Keith.Weir@gov.bc.ca>
Cc: 'Craig Williams' <craig@telus.net>
Subject: Vernon Yacht Club

Hi Keith,

I have left a few messages with you a few times over the last few days and would like to chat about this file, noting Cathy Jenkins also left me a message last week, and I have phoned her a few times as well to no avail.. The breakwater must be repaired, and is considered a priority. What I need to understand is how best to stage the application(s) to make sure that the priority happens ASAP, and then how to facilitate the remainder of project (both short term and long term).

After our initial discussion in early January, I was under the impression that if we were bringing the breakwater into compliance, and then keeping within the existing Crown Land Tenure / Lease area, this would not trigger a tenure review. However, as I understand, by adding the proposed slips, this opens the tenure up, and Cathy has indicated that a **new** tenure is needed for the small addition. If this is the case, the VYC may wish to alter the application to only include the breakwater repairs. I presume this wouldn't trigger a new Crown Land tenure, is this the case?. They do not wish to open the Crown Land tenure process multiple times (as they have other future plans, as we discussed). What this all means is that I need to understand what the different options are, and how best to guide them through the Section 11 (formerly Section 9) process, and what expectations and triggers are for different permitting paths.

On another note, we are still actively trying to get the Section 9 / 11 Notification for the test piles, this is holding up the process as we cant completed detailed designs on the breakwater until we have this. As I understand, Danika in Vernon has this file, and is away. If there anything that you can do to help out this aspect. With the potential for larger storms coming, and a breakwater in a state of disrepair, we need to move these files along to ensure safety of vessels in the facility.

Please give me a call ASAP such that I can figure out how best to guide VYC.


Thanks
Jason

JASON SCHLEPPE, M.Sc., R.P.BIO
SENIOR NATURAL RESOURCES BIOLOGIST
ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.

Phone: 250.491.7337 ext. 202 / Fax: 250.491.7772 / Cell: 250.808.3474
#102 – 450 Neave Court
Kelowna, BC
V1V 2M2
Email: jschleppe@ecoscapeltd.com
Check Out Our New Website: <http://ecoscapeltd.com>
Twitter: <https://twitter.com/#!/EcoscapeEnv>
Facebook: <http://www.facebook.com/Ecoscape.Environmental.Consultants.Ltd>

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Aura

From: Katrina Black <kblack@ecoscapeltd.com>
Sent: Friday, June 17, 2016 1:40 PM
To: Aura, Bernadette FLNR:EX
Cc: Jason Schleppe; Tara Hirsekorn; Craig Williams; Weir, Keith FLNR:EX;
steve@burtonpiledriving.com
Subject: RE: Vernon Yacht Club
Attachments: ApplicationFormReport_CL Tenure.pdf; Section 9 Application Form Report.pdf

Hi Bernadette,

We have submitted the Crown Land Tenure application (tracking number:100172388). The Section 11 application has already been submitted and is tracking number 100161276, both applications are attached. The existing lease for the marina is lease number: 343750 (File no. 3404262).

Please get in touch with Jason or myself if you need anything else.

Regards

Katrina Black, BSc, BIT
Natural Resource Biologist

ECOSCAPE Environmental Consultants Ltd.
 #102 – 450 Neave Court
 Kelowna, BC V1V 2M2
 Tel: 250.491.7337 ext. 215
 Email: kblack@ecoscapeltd.com

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Cc: Katrina Black <kblack@ecoscapeltd.com>
Subject: RE: Vernon Yacht Club

Hi Bernadette,

Once we submit the Crown Land tenure, Katrina will send along the original tracking file number, etc.

Hold tight, should be today or tomorrow.

Thanks
jason

JASON SCHLEPPE, M.Sc., R.P.BIO
SENIOR NATURAL RESOURCES BIOLOGIST
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Thanks Bernadette, we will.

Once done, can you please link the existing Section 11 (Section 9 application) to it. This ensure that the tracking and files numbers we have don't get lost, etc., and saves us an hour or so.

Thanks,
Jason

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Thanks Keith.

Can you provide us with any information so we can facilitate review as best as possible. Note the following:

- 1) Test piles are driven and results will be submitted shortly
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Tara / Steve, this is all just for your information.

Thanks
Jason

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Sent: Thursday, June 9, 2016 7:21 AM
To: Jason Schleppe <jschleppe@ecoscapeltd.com>
Subject: FW: Vernon Yacht Club

From: Weir, Keith FLNR:EX
Sent: Thursday, June 9, 2016 7:20 AM
To: Weir, Keith FLNR:EX
Cc: Aura, Bernadette FLNR:EX
Subject: RE: Vernon Yacht Club

Hi Jason

From: Weir, Keith FLNR:EX [mailto:Keith.Weir@gov.bc.ca]
Sent: Friday, May 16, 2016 2:24 PM
To: Jason Schleppe <jschleppe@ecoscapeltd.com>
Subject: RE: Vernon Yacht Club

Hi Jason

I talked it over with Don Meeks. We felt that the changes are significant, so the application would be treated and reviewed as new. He said anything more than 3 new slips would trigger a full review. The proposed relocation of the western breakwater is also significant in that it will be much closer to the lease boundary, and could affect neighboring properties.

The existing design is already approved, so if a new breakwater is needed immediately, you can replace them in their current location. (some minor changes would be OK)

Keith

From: Jason Schleppe [mailto:jSchleppe@ecoscapeltd.com]
Sent: Wednesday, May 11, 2016 11:14 AM
To: Weir, Keith FLNR:EX
Cc: Craig Williams
Subject: RE: Vernon Yacht Club

Hi Keith,

Thanks for the discussion. As I understand, you are going to carefully review this and provide us with guidance regarding the following:

- 1) Does this truly open up the Crown Land Tenure, or can it fall within an amendment. Again, since we are staying within the existing tenure, preference would be to stick with a minor amendment.
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I think this is the key for now. As I said, the critical pathway is the Section 9 Notification for the test piles, which allows us to complete engineering. We will keep on this aspect, but if you could get back to me on the other parts, I can then try and guide VYC through.

Thanks
Jason

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Cc: 'Craig Williams' <craig@telus.net>
Subject: Vernon Yacht Club

Hi Keith,

I have left a few messages with you a few times over the last few days and would like to chat about this file, noting Cathy Jenkins also left me a message last week, and I have phoned her a few times as well to no avail.. The breakwater must be repaired, and is considered a priority. What I need to understand is how best to stage the application(s) to make sure that the priority happens ASAP, and then how to facilitate the remainder of project (both short term and long term).

After our initial discussion in early January, I was under the impression that if we were bringing the breakwater into compliance, and then keeping within the existing Crown Land Tenure / Lease area, this would not trigger a tenure review. However, as I understand, by adding the proposed slips, this opens the tenure up, and Cathy has indicated that a **new** tenure is needed for the small addition. If this is the case, the VYC may wish to alter the application to only include the breakwater repairs. I presume this wouldn't trigger a new Crown Land tenure, is this the case?. They do not wish to open the Crown Land tenure process multiple times (as they have other future plans, as we discussed). What this all means is that I need to understand what the different options are, and how best to guide them through the Section 11 (formerly Section 9) process, and what expectations and triggers are for different permitting paths.

On another note, we are still actively trying to get the Section 9 / 11 Notification for the test piles, this is holding up the process as we cant completed detailed designs on the breakwater until we have this. As I understand, Danika in Vernon has this file, and is away. If there anything that you can do to help out this aspect. With the potential for larger storms coming, and a breakwater in a state of disrepair, we need to move these files along to ensure safety of vessels in the facility.

Please give me a call ASAP such that I can figure out how best to guide VYC.

Thanks
Jason

JASON SCHLEPPE, M.Sc., R.P.BIO
SENIOR NATURAL RESOURCES BIOLOGIST
ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.

Phone: 250.491.7337 ext. 202 / Fax: 250.491.7772 / Cell: 250.808.3474
#102 – 450 Neave Court
Kelowna, BC
V1V 2M2
Email: jschleppe@ecoscapeltd.com
Check Out Our New Website: <http://ecoscapeltd.com>
Twitter: <https://twitter.com/#!/EcoscapeEnv>
Facebook: <http://www.facebook.com/Ecoscape.Environmental.Consultants.Ltd>

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This email, and any files transmitted, are confidential and may contain privileged information. Any unauthorized dissemination or copying is strictly prohibited. If you have received this email in error, please notify the sender immediately and delete the email.





Crown Land Tenure Application

Tracking Number: 100172388

APPLICANT INFORMATION

If approved, will the authorization be issued to an Individual or Company/Organization? Company/Organization
What is your relationship to the company/organization? Consultant

APPLICANT COMPANY/ORGANIZATION CONTACT INFORMATION

Applicant is an Individual or an Organization to whom this authorization Permit/Tenure/Licence will be issued, if approved.

Name: Vernon Yacht Club
Doing Business As:
Phone: 250-545-5518
Fax:
Email: craig@telus.net
BC Incorporation Number:
Extra Provincial Inc. No:
Society Number:
GST Registration Number:
Contact Name: Craig Williams
Mailing Address: 7919 Okanagan Landing Road
Vernon BC V1H1H1

CONSULTANT INFORMATION

Please enter the contact information of the Individual/Organization who is acting on behalf of the applicant.

Name: ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.
Doing Business As: ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.
Phone: 250-491-7337 ext. 202
Fax: 250-491-7772
Email: jschleppe@ecoscapeltd.com
BC Incorporation Number: BC0754281
Extra Provincial Inc. No:
Society Number:
GST Registration Number:
Contact Name: Jason Schleppe
Mailing Address: 102-450 Neave Crt
kelowna BC V1V 2M2
Letter(s) Attached: Yes (Letter of Agency (Ecoscape).pdf)

CORRESPONDENCE E-MAIL ADDRESS

If you would like to receive correspondence at a different email address than shown above, please provide the correspondence email address here. If left blank, all correspondence will be sent to the above given email address.

Email:
Contact Name: Jason Schleppe

ELIGIBILITY

Question	Answer	Warning
Do all applicants and co-applicants meet the eligibility criteria for the appropriate category as listed below?	Yes	

Applicants and/or co-applicants who are Individuals must:

1. be 19 years of age or older and
2. must be Canadian citizens or permanent residents of

Canada. (Except if you are applying for a Private Moorage)

Applicants and/or co-applicants who are Organizations must either:

1. be incorporated or registered in British Columbia (Corporations also include registered partnerships, cooperatives, and non-profit societies which are formed under the relevant Provincial statutes) or
2. First Nations who can apply through Band corporations or Indian Band and Tribal Councils (Band or Tribal Councils require a Band Council Resolution).

TECHNICAL INFORMATION

Please provide us with the following general information about you and your application:

EXISTING TENURE DETAILS

Do you hold another Crown Land Tenure?

Yes

Please specify your file number:

343750

If you have several file numbers, please make a note of at least one of them above. Example numbers: 1234567, 153245, others

ALL SEASONS RESORTS

The All Seasons Resorts Program serves to support the development of Alpine Ski and non-ski resorts on Crown land. For more detailed information on this program please see the operational policy and if you have further questions please contact FrontCounter BC.

Are you applying within an alpine ski resort? No

WHAT IS YOUR INTENDED USE OF CROWN LAND?

Use the "Add Purpose" button to select a proposed land use from the drop down menu.

If you wish to use Crown land for a Short Term, low impact activity YOU MAY NOT NEED TO APPLY for a tenure as you may be authorized under the Permissions policy. To determine if your use is permissible under the Land Act please refer to the Land Use Policy - Permissions

If your purpose can not be found in the list or if your intended use or term does not meet the terms and conditions of the policy, please contact FrontCounter BC.

Purpose	Tenure	Period
Marina The marina is for the use of the Vernon Yacht Club, the current works include reconfiguring and adding slips to the existing marina, relocating and repairing the existing concrete and log breakwaters, installing a new steel/concrete breakwater and dock and installing a new ramped pier for marina access.	Lease	More than thirty years

ACCESS TO CROWN LAND

Please describe how you plan to access your proposed crown land from the closest public road:

The marina is existing and has access through the Vernon Yacht Club off Okanagan Landing Road in Vernon.

MARINA

Marinas and Yacht Clubs can be established on Foreshore and/or Aquatic Crown land through tenures available from the Province of British Columbia. Marinas and Yacht Clubs are tenured through the Commercial General program. Click here to review the policy. You may also require a Section 9 Water Act authorization

Specific Purpose:

The marina is for the use of the Vernon Yacht Club, the current works include reconfiguring and adding slips to the existing marina, relocating and repairing the existing concrete and log breakwaters, installing a new steel/concrete breakwater and dock and installing a new ramped pier for marina access.

Period:

More than thirty years

Tenure:

Lease

TOTAL APPLICATION AREA

Please give us some information on the size of the area you are applying for.

Please specify the area:

3.7 hectares

PROJECT DETAILS**Are you the waterfront upland owner?**

Yes

Are you planning to sell gas at the proposed marina?

Yes

ALL SEASONS RESORT

If your activities include more than one million dollar in the Recreational Infrastructure and more than 100 Commercial Bed Units, your activities may fall under the All Seasons Resort Policy.

Are you applying to build an all season resort as defined under the All Seasons Resort Policy, including more than one million dollars in Recreational Infrastructure and more than 100 Commercial Bed Units? No

IMPORTANT CONSIDERATIONS

Selecting yes to any of the following questions may indicate that you will require further or additional authorizations under the Land Act or other legislation.

Is your proposed activity within the Okanagan, Kalamalka and Wood Lakes, Skaha Lake, Vaseux Lake, or Christina Lake areas? Yes

Please review the Okanagan Large Lake foreshore protocol. Please ensure that an Environmental Impact Assessment is included with your application.

Is your proposed activity within the Shuswap, Mara, Mable, or Little Shuswap Lake areas? No

ADDITIONAL QUESTIONS

In many cases you might require other authorizations or permits in order to complete your project. In order to make that determination and point you in the right direction please answer the questions below. In addition, your application may be referred to other agencies for comments.

Is the Applicant or any Co-Applicant or their Spouse(s) an employee of the Provincial Government of British Columbia? No

Are you planning to cut timber on the Crown Land you are applying for? No

Are you planning to use an open fire to burn timber or other materials? No

Do you want to transport heavy equipment or materials on an existing forest road? No

Are you planning to work in or around water? Yes

1. If you will be working in or around fresh water, you will require a Water Sustainability Act Change Approval or Notification from the Province. 2. The federal Department of Fisheries and Oceans might need to review your project. 3. Review the Transport Canada website if the Navigation Protection Act applies.

Does your operation fall within a park area? No

LOCATION INFORMATION

Please provide information on the location and shape of your Crown land application area. You can use one or more of the tools provided.

☒ I will upload a PDF, JPG or other digital file(s)

MAP FILES

Your PDF, JPG or other digital file must show your application area in relation to nearby communities, highways, railways or other land marks.

Description	Filename	Purpose
Figure 1 - Site Location	Figure 1 - Site Location.pdf	Marina
Figure 2 - Bathymetry and Existing Marina Structures	Figure 2- Bathymetry annd E...	Marina
Figure 3 - Proposed Marina Configuration	Figure 3 - Proposed Marina ...	Marina

ATTACHED DOCUMENTS

Document Type	Description	Filename
General Location Map	Figure 1 - Site Location	Figure 1 - Site Location.pdf
Management Plan	Management Plan - Vernon Yacht Club	Vernon Yacht Club Managemen...
Other	Change Approval and Notification Application (Changes IN and About a Stream) - Tracking #100161276	Section 9 Application Form ...
Other	Environmental Assessment (Ecoscape Environmental Consultants Ltd.)	15-1461 - Environmental Ass...
Other	Wave and Sediments Impacts Letter (Waters Edge Engineering Ltd.)	1504-Letter Wave and Sedime...
Shoreline Photographs	Photo 1: View to the west	20150623_145635.jpg
Shoreline Photographs	Photo 2: View to the north	20150623_145648.jpg
Shoreline Photographs	Photo 3: View to the east	20150623_150039.jpg
Site Plan	Site Plan - Figure 3 (Proposed Marina Reconfiguration)	Figure 3 - Proposed Marina ...

PRIVACY DECLARATION

☒ Check here to indicate that you have read and agree to the privacy declaration stated above.

REFERRAL INFORMATION

Some applications may also be passed on to other agencies, ministries or other affected parties for referral or consultation purposes. A referral notification is necessary when the approval of your application might affect someone else's rights or resources or those of the citizens of BC. An example of someone who could receive your application for referral purposes is a habitat officer who looks after the fish and wildlife in the area of your application. This does not apply to all applications and is done only when required.

Company / Organization: Vernon Yacht Club
Contact Name: Craig Williams
Contact Address: 7919 Okanagan Landing Road
Vernon BC V1H1H1
Contact Phone: 250-545-5518
Contact Email: craig@telus.net

☒ I hereby grant permission for the public release of the information provided above. This information will be used to fulfill, if required, the referral and advertising requirements of my application.

IMPORTANT NOTICES

- Once you click 'Next' the application will be locked down and you will NOT be able to edit it any more.

DECLARATION

☒ By submitting this application form, I, declare that the information contained on this form is complete and accurate.

OTHER INFORMATION

Is there any other information you would like us to know?

A Section 11 application has already been applied for (tracking number: 100161276), please link these applications. Keith Weir and Bernadette Aura have been working on the applications.

APPLICATION FEES

Item	Amount	Taxes	Total	Outstanding Balance
Crown Land Tenure Application Fee	\$500.00	GST @ 5%: \$25.00	\$525.00	\$0.00

OFFICE

Office to submit application to: Kamloops

PROJECT INFORMATION

Is this application for an activity or project which requires more than one natural resource authorization from the Province of BC? Yes

What is the name of your project? Vernon Yacht Club

Please provide any of the following: reference number(s), project number(s), tracking number(s), or other descriptive information which would allow us to group these applications together: Section 11 - tracking number: 100161276)

APPLICANT SIGNATURE

Applicant Signature

Date

OFFICE USE ONLY

Office Kamloops	File Number	Project Number
	Disposition ID	Client Number

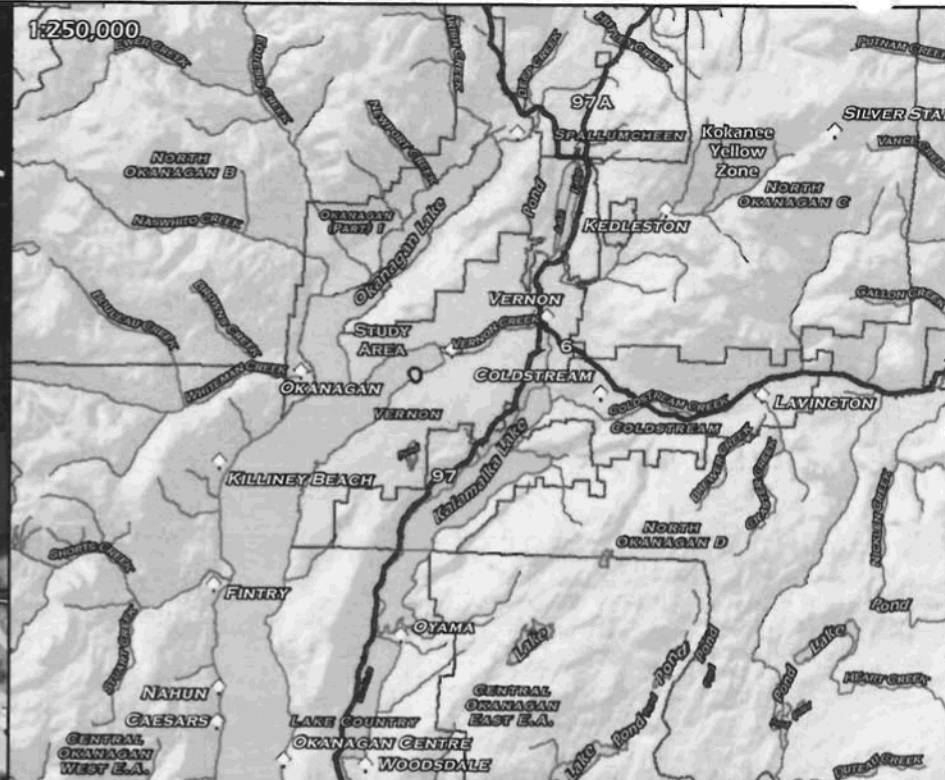
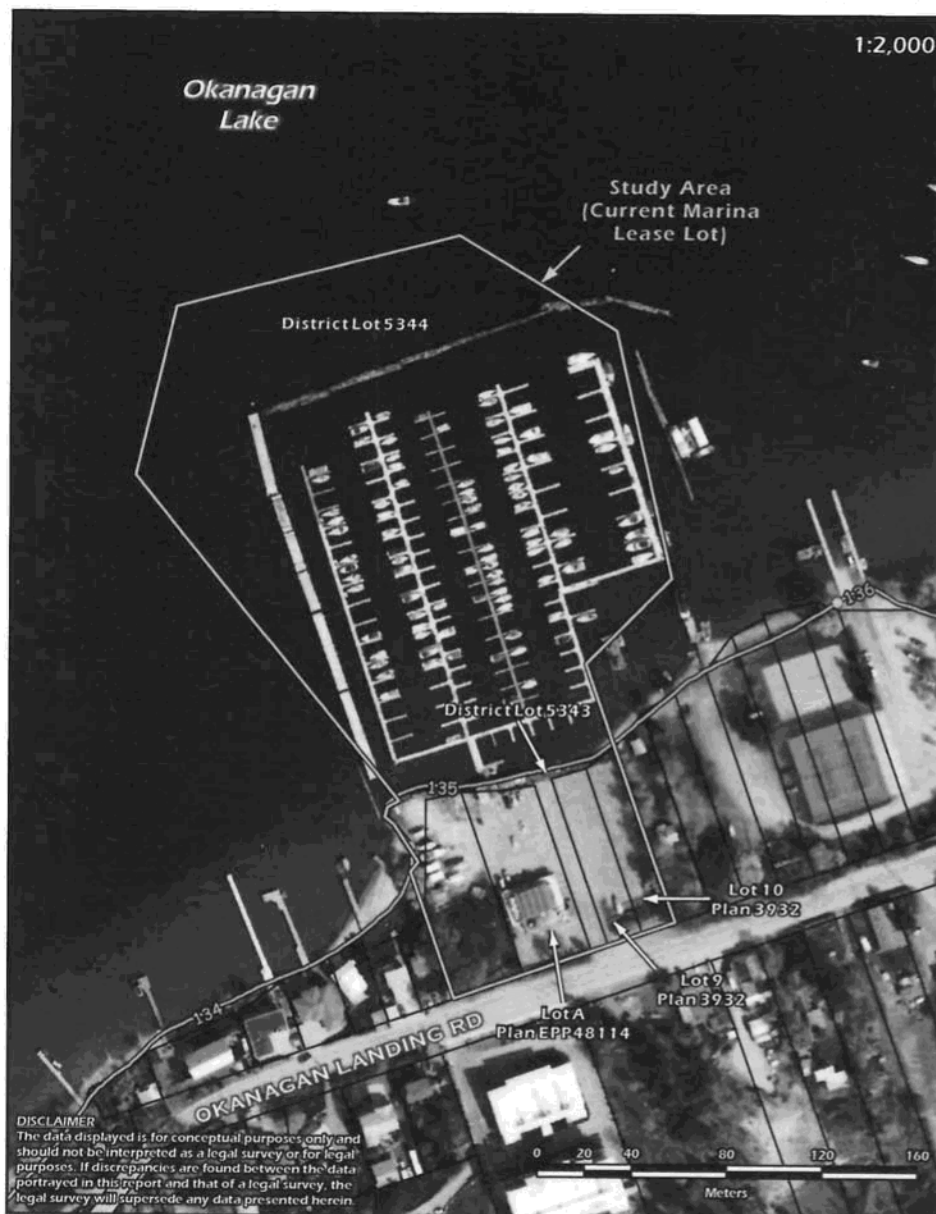


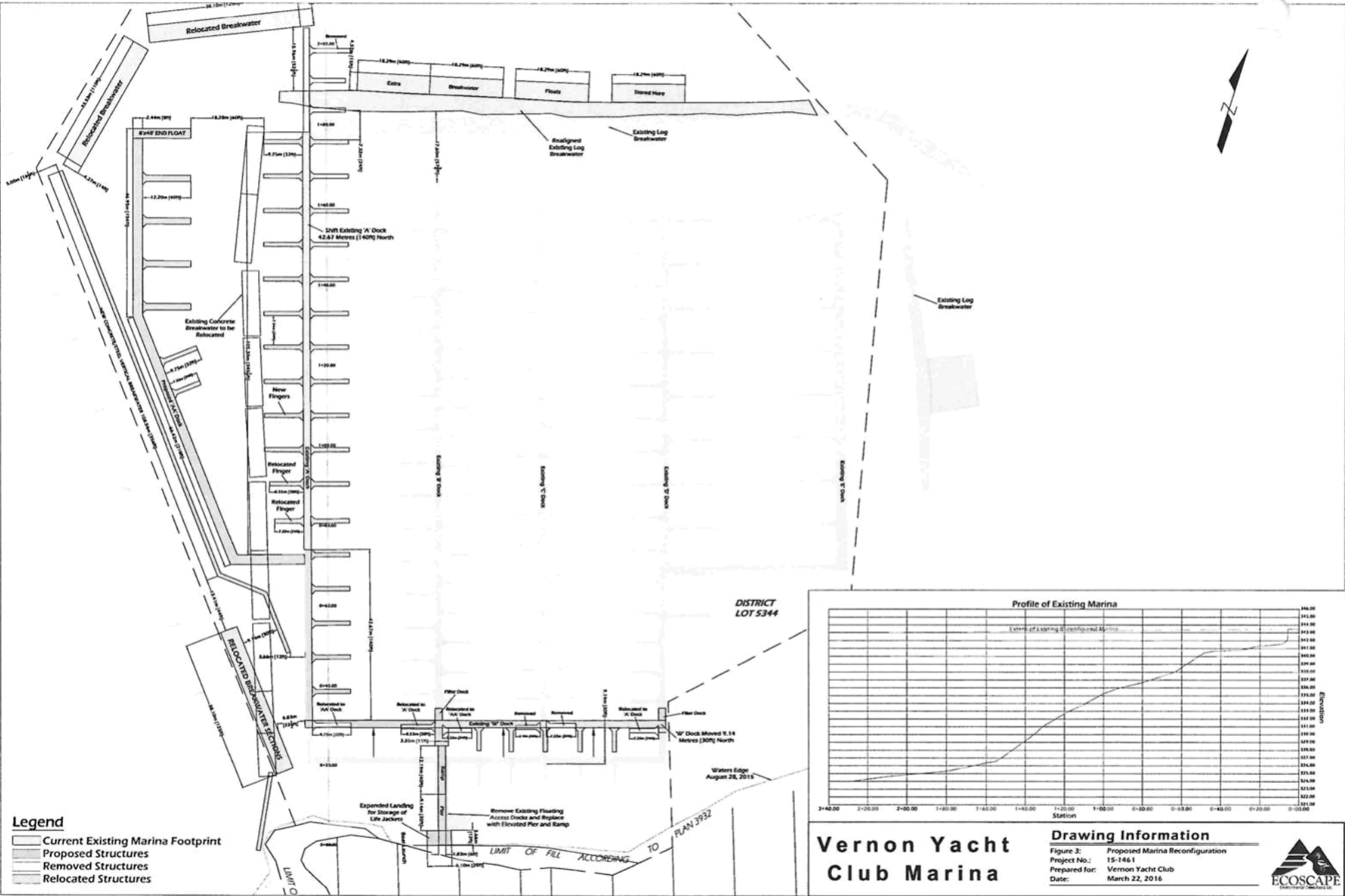
FIGURE 1
Site Location

Project: Section 9 Application
Location: City of Vernon
Project No.: 15-1461
Prepared for: Vernon Yacht Club
Prepared by: Ecoscape Environmental Consultants Ltd.
Drawn by: Robert Wagner
Checked by: Jason Schleppe
Projection: NAD83-UTM Zone 11
Date: March 16, 2016



LEGEND

- | | | |
|---------------------------------------|--------------------|---|
| Places | Study Area | Segment Break |
| Regional Location of Subject Property | Municipal Boundary | Foreshore Inventory and Mapping (FIM) |
| Cadastre | City of Vernon | Kokanee Historical Spawning Record |
| Major Highway | Lake | Ministry of Environment - Kokanee Yellow Zone |
| | Streams and Rivers | Ministry of Environment - Kokanee Red Zone |
| | | Ministry of Environment - Kokanee Black Zone |



Management Plan for Vernon Yacht Club

Prepared: June 2016

1.0 BACKGROUND

1.1 PROPOSED USE AND RATIONALE

The Vernon Yacht Club has an existing marina which currently has approximately 285 slips, proposed upgrades will include approximately 32 additional slips, relocating and repairing the existing concrete and log breakwaters, installing a new steel/concrete breakwater and dock and installing a new ramped pier for marina access. The existing marina will be shifted approximately 7.6 metre north, away from the foreshore to better comply with current marina guidelines.

There is an existing lease for commercial marina and yacht purposes, for a 30 year term commencing September 18, 2007 (Licence No.: 343750, File No.:3404262). Given the proposed reconfiguration, a new lease is being applied for, this Management Plan will accompany the new lease application.

1.2 PRELIMINARY INVESTIGATIVE WORK

Ecoscape Environmental Consultants Ltd (Ecoscape) has submitted the following applications associated with this project: Transport Canada (Notice of Work) and Provincial Section 11 Changes in and About a Stream Approval application. To satisfy the requirements of permitting applications Ecoscape completed an Environmental Assessment (EA) for the marina expansion and breakwater repairs in March, 2016. Waters Edge Engineering Ltd. (Waters Edge) complete a Wave and Sediments Impacts Letter for the breakwater repairs in March, 2016.

1.3 ZONING

Tourist Commercial (C10)

2.0 LOCATION

2.1 GENERAL DESCRIPTION

The property is located at 7919 Okanagan Landing Road, along the south arm of Okanagan Lake in Vernon, BC.

The legal description is Lot 9, Plan KAP3932, PID 009-367-136 (Figure 1).

Geographic coordinates for the property are:

Latitude: 50° 14' 02.63"

Longitude: 119° 21' 49.37"

2.2 ACCESS PLANS

The proponent is the owner of the upland property which can be accessed via Okanagan Landing Road.

2.3 TRAFFIC

Traffic volume is expected to slightly increase with the increase in number of slips.

2.4 SEASONAL EXPECTATIONS OF USE

The highest use months for boating season are typically from late April or early May through to late September/ early October.

2.5 LAND USE

The current land use of the upland property is the Vernon Yacht Club with the club building and parking.

2.6 SURROUNDING AREA

The surrounding land to the west is residential lots and to the east is parkland.

2.7 SAFETY PLAN

No safety plan has been prepared for this project. The contractor will have a safety plan in place.

3.0 INFRASTRUCTURE**3.1 EXISTING INFRASTRUCTURE AND ROADS**

The marina facility is existing. Existing foreshore modifications along the upland property include the marina, breakwater, docks, buildings, retaining walls and parking facility. A number of adjacent properties have existing moorage structures.

No waste disposal is proposed for the marina. The marina has a sanitary sewer pump out for use by members and non-members. Fuelling is not currently undertaken at the marina, however, it may be proposed in the future.

4.0 FIRST NATIONS

No consultation has been completed with First Nations.

5.0 ENVIRONMENTAL

A detailed Environmental Assessment entitled "Vernon Yacht Club Marina Expansion and Breakwater Repairs - Environmental Assessment" was prepared by Ecoscape in March, 2016. The EA was attached to the Crown Land Tenure application and relevant permitting applications.

5.1 LAND IMPACTS

5.1.1 General

No vegetation cutting, riparian encroachment and/or pesticide application is proposed.

5.1.2 Construction Methods and Materials Used

The existing marina includes approximately 285 slips with a plan to expand by up to 32 slips. The main walkout pier will be fixed and elevated. The pier will be approximately 2 m wide and approximately 20 m long, with a ramp connected to the end of the pier will transition to the main floating portion of the moorage. This platform is connected to a perpendicular concrete main.

The breakwater system surrounding the marina is currently made up of logs on the north and east side of the marina, and consists of concrete floats on the west side. The west end of the existing log breakwater located north of the marina will be moved deeper such that it is ~14 m and ~18 m from the ends of the A and B Docks, respectively. A new steel/concrete breakwater will extend to the northwest from the south end of the A Dock. The new breakwater will be ~140 m long and ~2 m wide. A new dock will be constructed parallel to the A to E Docks, and will extend off the north end of the new steel/concrete breakwater. This new dock will be ~45 m long and ~2.6 m wide. The concrete breakwater floats that currently run along the west side of the marina will be relocated such that two (2) of them provide a continuation of the new steel/concrete breakwater in a southwest to northeast orientation and east to west orientation, respectively. The remaining concrete floats from the west side of the marina will be placed north of the log breakwater located at the north end of the marina. The new and relocated sections of the breakwater system will be supported by a combination of untreated Douglas-fir piles and concrete anchors with chain.

The fixed elevation access pier and connecting ramp that leads from the floating portion of the marina will be made with an aluminum frame and either concrete or wood decking. The additions to the A dock (including fingers and main extension), as well as the new breakwater and dock structures will be built with concrete reinforced with rebar, steel and fiber mesh, and styrofoam core for flotation. Anchors used for the moorages and breakwater system will include galvanized chain connected to polypropylene rope that leads to a concrete anchor, and pilings will be untreated Douglas-fir.

Most of the marina components will be constructed off site, transported to the site and assembled at the development site. Piles will be installed via a floating barge. The walkways will be assembled via floating barge and towed to the site.

5.2 ATMOSPHERIC IMPACTS

5.2.1 Sound

No atmospheric impacts including noise and emissions are not expected to change substantially with the increase in number of slips. Some increase in noise is likely during construction. The Vernon Yacht Club should encourage marina users to limit idling with signs and other information, set guidelines for operational hours for the marina and adhere to local bylaws and guidelines for noise.

5.3 WATER OR LAND COVERED BY IMPACTS

5.3.1 Drainage

The marina is not expected to affect upland drainage.

5.3.2 Sedimentation

Westmar completed a sediment transport study for the site in August 2006. Waters Edge Engineering Ltd. completed a Wave and Sediments Impact Letter in March, 2016, the conclusions of this study were as follows;

'The east side of the marina is unchanged and the minor changes to the north side are insignificant to sediment transport processes. The vertical structure that will be built on the west side of the marina will be designed to allow sediment to pass below the structure. It will be built offshore of the 340m elevation contour and will be designed to perform similar to the floating concrete caissons in terms of sediment passage. There will be some reflection off the vertical structure, but it will be disbursed horizontally through detailed design of the face so that the reflected wave does not create scour beyond the existing condition.

The nearshore area is unchanged from a sediment transport perspective. On the west side, the existing concrete caissons and small log breakwater are remaining, although rotated to respect the lease boundary. This small shift is not anticipated to generate changes to the sediment transport patterns since they are very close to their existing locations.'

5.3.3 Water Diversion

No water diversion is proposed as part of this project.

5.3.4 Water Quality

Provided recommendations included in the Environmental Assessment prepared for the project are followed, water quality impacts should be avoided during construction and operation.

5.3.5 Public Access

The marina is for members of the Vernon Yacht Club and access is restricted by a locked gate, there is no public access through the upland property.

5.3.6 Flood Potential

Flood potential is considered to be not applicable.

5.4 FISH AND WILDLIFE HABITAT

5.4.1 Current Status of Fish and Wildlife

This is discussed in great detail in the EA prepared for the site that has been included with the tenure and Section 11 (formally Section 9) applications.

5.4.2 Disturbance to Wildlife Habitat

None proposed.

5.4.3 Disturbance to Fish Habitat

See detailed information in EA that has been included with the tenure and Section 11 applications. Provided mitigation measures in the EA report are adhered to, impacts to fish habitat should be minimized.

5.4.4 Threatened or Endangered Species in the Area

The BC Conservation Data Centre Mapped Known Locations online mapping application was queried for mapped records of species at risk¹. There were no species at risk known to occur within the lake at the site. Species at risk within the upland property and surrounding area are listed in the EA prepared for this project.

5.4.5 Seasonal Considerations

The peak use of the marina is considered to be May through September. There are no other seasonal considerations that are considered to be noteworthy.

6.0 SOCIO-COMMUNITY

6.1 LAND USE

Existing and proposed land and water use are not expected to change materially as a result of this project.

6.2 PUBLIC RECREATION AREAS

There are no known public recreation areas associated with the upland property.

6.3 FIRE PROTECTION OR EMERGENCY SERVICES

The proposed marina is existing with an additional 32 slips proposed, overall the proposed changes are not anticipated to change the demand on fire protection or emergency services.

¹ B.C. Conservation Data Centre. 2016. Species Summaries. Available: <http://a100.gov.bc.ca/pub/eswp/> (accessed June 16, 2016).

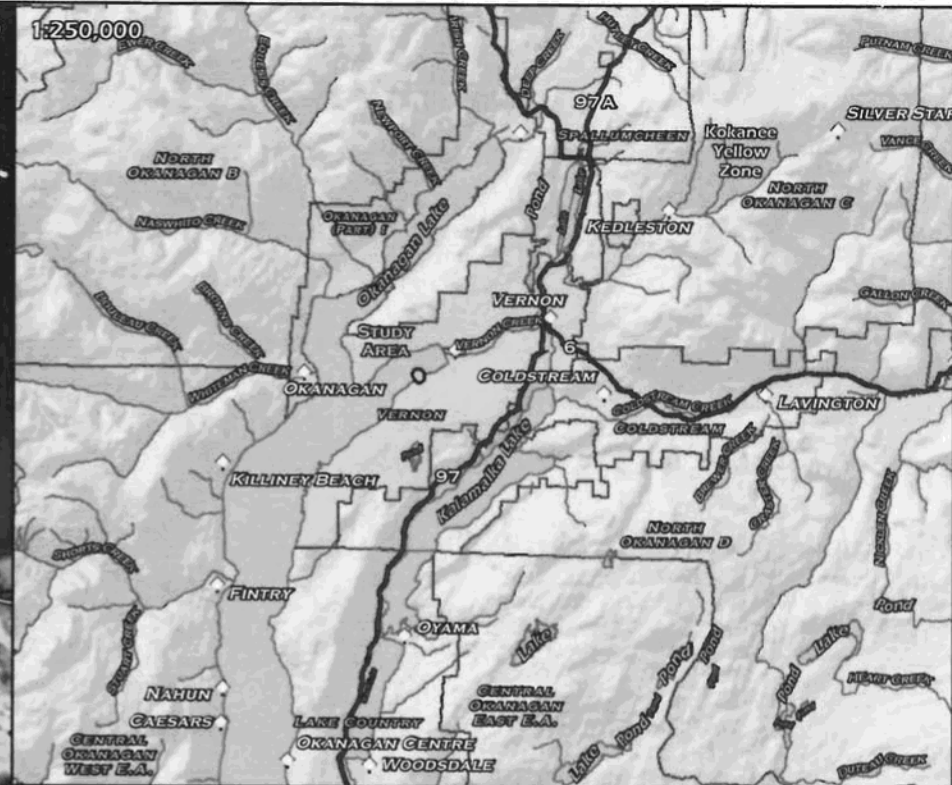
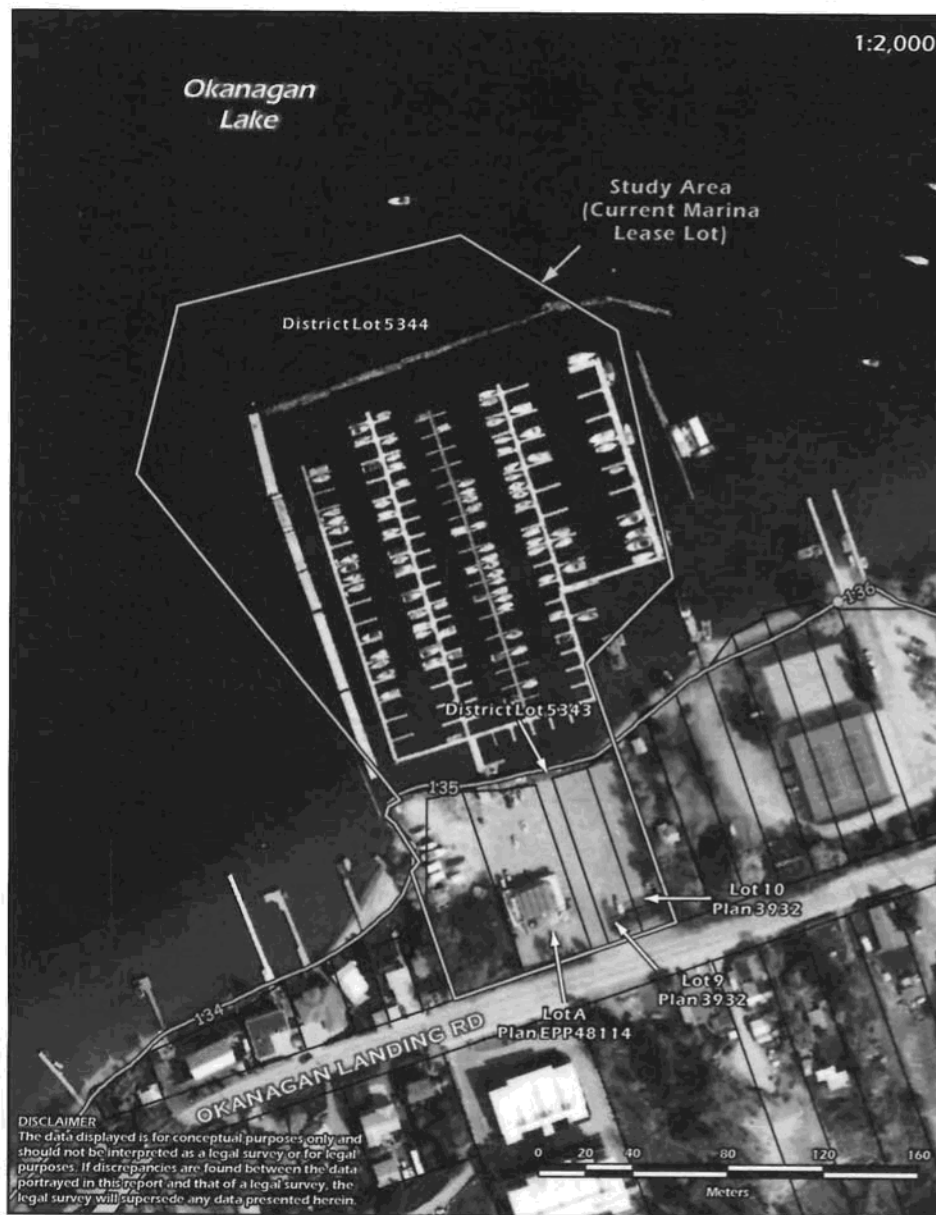


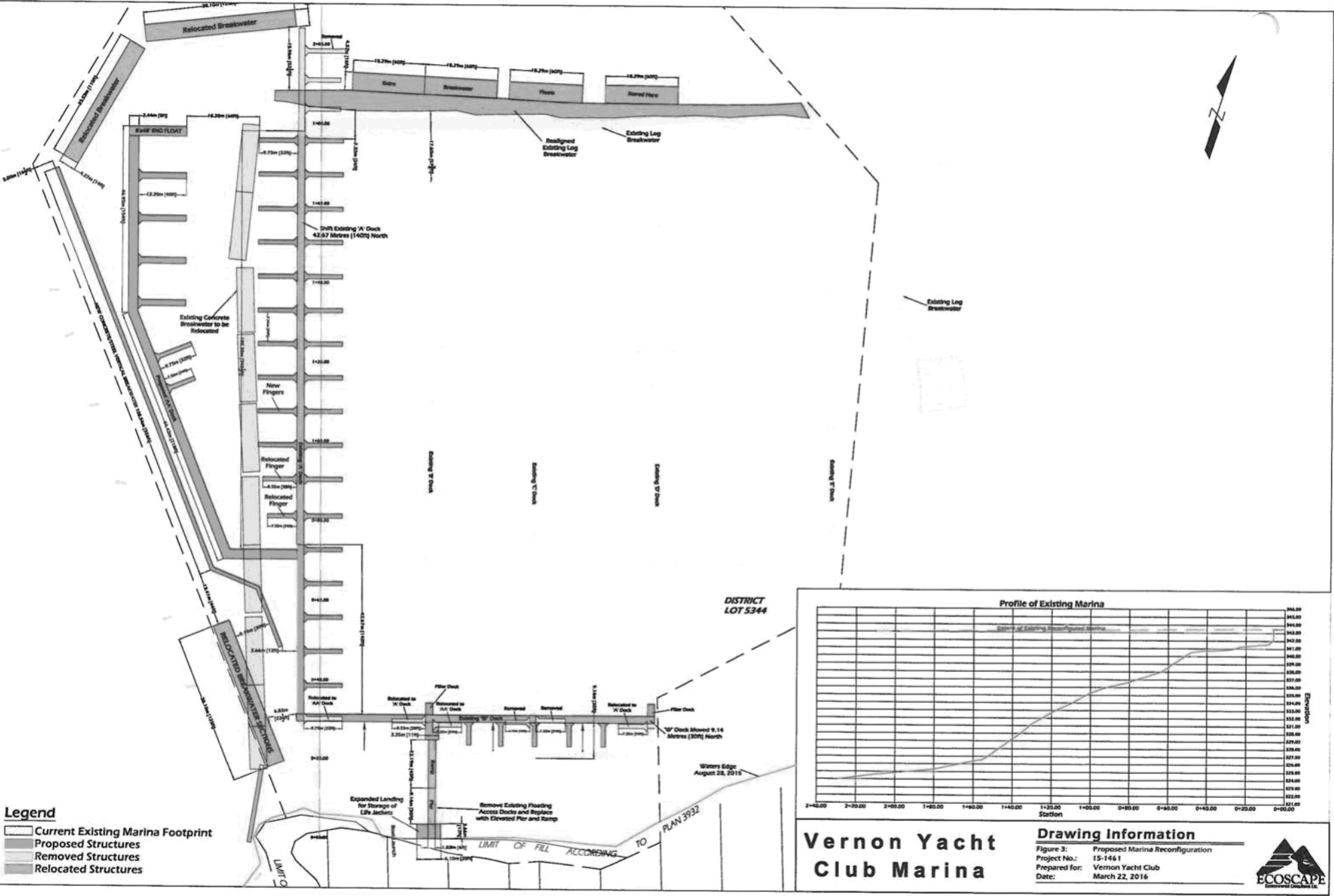
FIGURE 1
Site Location

Project: Section 9 Application
Location: City of Vernon
Project No.: 15-1461
Prepared for: Vernon Yacht Club
Prepared by: Ecoscape Environmental Consultants Ltd.
Drawn by: Robert Wagner
Checked by: Jason Schleppe
Projection: NAD83-UTM Zone 11
Date: March 16, 2016



LEGEND

- | | | | | | |
|--|---------------------------------------|--|--------------------|--|---|
| | Places | | Study Area | | Segment Break |
| | Regional Location of Subject Property | | Municipal Boundary | | Foreshore Inventory and Mapping (FIM) |
| | Cadastre | | City of Vernon | | Kokanee Historical Spawning Record |
| | Major Highway | | Lake | | Ministry of Environment - Kokanee Yellow Zone |
| | | | Streams and Rivers | | Ministry of Environment - Kokanee Red Zone |
| | | | | | Ministry of Environment - Kokanee Black Zone |



Letter of Agency

March 17, 2016

Ministry of Forests, Lands and Natural Resource Operations
c/o Front Counter BC Okanagan Shuswap
2501-14 Avenue,
Vernon BC V1T8H2

To Whom It May Concern:

Re: Authorization to Allow Ecoscape Environmental Consultants Ltd. to Act on Behalf of Vernon Yacht Club

Craig Williams
I, Rear-Commodore of the, owner of the property located at 7919 Okanagan Landing Road, Vernon, BC have retained the following agent to act on our behalf for the *Water Act* Notification / Authorization and/or, Fisheries and Oceans Canada Project Review and/or Transport Canada Notice of Works applications for repairs to an existing marina at the above referenced property.

The agent's contact information is as follows:

Jason Schleppe, M.Sc., R.P.Bio
Senior Aquatic Biologist, Principal
Ecoscape Environmental Consultants Ltd.
#102 – 450 Neave Court
Kelowna, BC V1V 2M2
Phone: 250.491.7337 ext. 202 Fax: 250.491.7772
email: jschleppe@ecoscapeltd.com

Term of Appointment:

From: March 1, 2016 until November 1, 2017

Signed,

Craig Williams
Rear-Commodore
Vernon Yacht Club

VERNON YACHT CLUB MARINA EXPANSION AND BREAKWATER REPAIRS

Environmental Assessment

Prepared For:
Vernon Yacht Club

Prepared By:

Ecoscape Environmental Consultants Ltd.
#102 – 450 Neave Court
Kelowna, B.C.
V1W 3A1



March, 2016
Project No. 15-1461



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Figure 1:	Site Location
Figure 2:	Bathymetry and Existing Marina Structures
Figure 3:	Proposed Marina Reconfiguration



1.0 INTRODUCTION

1.1 Background

Ecoscape Environmental Consultants Ltd. (Ecoscape) was retained by the Vernon Yacht Club to complete an environmental assessment and mitigation plan for a proposed marina expansion and breakwater repairs on Okanagan Lake, along the south shoreline of Vernon Arm in Okanagan Lake (Figure 1). The proposed works involve reconfiguring and adding slips at the marina, relocating and repairing existing concrete and log breakwaters, installing a new steel/concrete breakwater and dock and installing a new ramped pier for marina access. The existing marina will be shifted 7.6 m north, away from the foreshore, to better comply with current marina design guidelines.

Ecoscape understands that the proposed works will remain within the existing Crown Lands tenure. Amendments to the land tenure may be required to reflect the proposed upgrades to the marina, noting that the marina will not change the operational area, suggesting that only a new site plan addendum is likely most appropriate in this case. The requirements for any Tenures amendments are under to be decided by the Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) and Crown Lands. At this time, we are proposing only a Section 9 Water Act Notification for repairs, since the changes proposed are consistent with what is currently constructed under the existing Crown Land Tenure, and our review of the tenure documents indicates that there is no specific guidelines for number of slips, but rather, references that the total number must be reported annually and must occur within the existing lease area. This submission includes design specifications for wind and wave attenuation, and detailed design is ongoing and will be submitted once finalized.

This report documents the existing conditions present along the foreshore and riparian area at the site. The report also provides an assessment of the potential environmental impact associated with the proposed marina upgrades. The main focus of this report is to support the *Water Act* Section 9 notification permitting required for the proposed works.

1.2 Project Contacts

The following section details the main project contacts.



1.2.1 Vernon Yacht Club

The applicant is the Vernon Yacht Club, proponent and upland owner. The owner currently has a Crown Land tenure for the area (File #: 34750).

Main Contact: Craig Williams, Rear Commodore

Address: Vernon Yacht Club
7919 Okanagan Landing Road
Vernon, B.C. V1H 1H1

Phone: 250.558.1111

Email: craig@telus.net

1.2.2 Ecoscape Environmental Consultants Ltd.

The environmental professional overseeing this report is a Senior Aquatic Biologist from Ecoscape.

Main Contact: Jason Schleppe, M.Sc., RPBio – Senior Aquatic Biologist

Address: 102-450 Neave Court
Kelowna, BC V1V 2M2

Phone: 250.491.7337 x 202

Email: jschleppe@ecoscapeltd.com

An engineer has been retained to consider potential effects the proposed repairs will have on wind and wave patterns and subsequent sediment scour and deposition patterns within and proximal to the proposed marina. The engineer undertaking these works is:

Main Contact: Tara Hirsekorn, P.Eng.

Address: Kelowna, BC

Phone: 250.300.3479

Email: Tara@WatersEdgeLTD.ca

Structural engineering is being conducted by Craig Work, at Herold Engineering Ltd. The structural engineer is being engaged by the contractor completing the work, listed below. The detailed designs will be provided shortly, once finalized.



1.2.3 Burton Marine Pile Driving Inc.

The main contractor for the proposed marina construction is Burton Pile Driving Inc.

Main Contact: Steve Burton
Address: 1609 Munson Road
Kelowna, BC V1W 2G8
Phone: 778.478.9755
Email: info@burtonpiledriving.com

2.0 PROJECT IDENTIFICATION

Project Title/Type: Vernon Yacht Club
Project Location: Foreshore at 7919 Okanagan Landing Road, Vernon, BC

Figure 1 provides an overview of the site and project location.

3.0 PROJECT DESCRIPTION

The proposed repairs to the marina and breakwater system, as shown in Figure 3, are as follows:

- Remove the existing floating access docks and replace them with a fixed elevated pier and ramp.
- Shift the existing marina footprint approximately 9 m north, away from the foreshore and into deeper water.
- Shift the existing log breakwater located at the north end of the marina slightly towards the north, to facilitate the shifting of the marina structure.
- Install a new ~140 m long by ~2 m wide steel/concrete breakwater that extends northwest from the southwest corner of the marina. The breakwater is intended to replace the failing concrete floating breakwater along this edge.
- A new dock will be installed near the north end of the new breakwater, and will include nine (9) slips for larger vessels. These slips are intended to replace some of the shallow water slips, noting that there will be a small increase in the overall capacity of the marina facility.
- Three (3) of the five (5) concrete breakwater sections that are currently located along the west edge of the marina will be relocated to extend in a SW to NE, and E to W orientation off the end of the new steel/concrete breakwater. The remaining four (4) concrete breakwater sections will be stored along the north side of the log breakwater that exists at the north end of the marina.



- Eleven (11) new fingers will be installed on the west side and five (5) new fingers will be installed on the east side of the A Dock. One finger will be removed from the east side of the A Dock and will be relocated at the southeast end of the C Dock.

3.1 Location and Site Description

The property is located at 7919 Okanagan Landing Road, Vernon, BC.

The existing water lease number is 343750. The legal description of for the tenured area is DL 5344, ODYD.

Geographic coordinates for the property are:

Latitude: 50° 14' 2.5"

Longitude: 119° 21' 49.2"

The lease area is shown in Figure 2.

3.2 Overview

The intent of the proposed marina and breakwater repairs is to provide a permanent solution for recurring damage at the west end of the facility. The existing floating breakwater has a long history of needed repairs, with damage occurring as early as July, 1997 and as recent as July 2015.



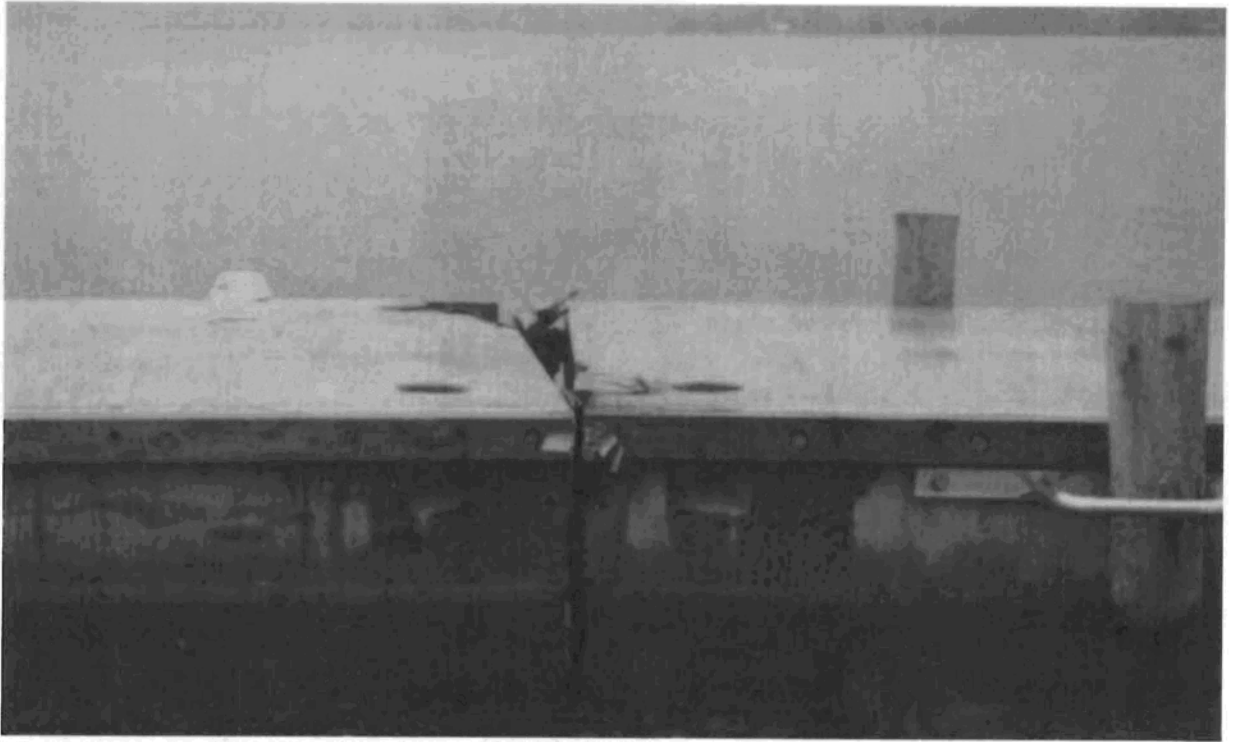


Photo 1: Image of breakwater damage in July, 1997.



Photo 2: Image of breakwater damage occurring in July, 2015.

The proposed breakwater upgrades will enhance protection from wave action and sediment deposition inside the marina. To help finance the needed repairs, a small addition of 32 new slips will occur, to support both the increasing demand for boat slips and the costs of the new marina configuration. The proponent has proposed a steel/concrete breakwater to ensure long term viability of the breakwater and to better comply with the existing Crown Land Tenure, since this style of breakwater uses less lake area to achieve the same level of wave protection. Coupled with this, some of the moorage in the current marina occurs in shallow water, and the extension/shift will help reduce near shore effects of marina operation by moving slips to deeper waters.

This report focuses on the foreshore and riparian area of Okanagan Lake as it relates to the subject property, and is intended to provide a summary of potential environmental effects with mitigation strategies for construction and operation to mitigate potential effects, noting that the focus of the impact statement is to address how the facility will affect biological conditions from the current condition, rather than from a pre disturbance condition because the facility currently operates under an existing Crown Lands lease.

3.3 Project Components and Structures

The current marina includes approximately 285 moorage slips (Figure 2), and the proposed upgrades will include approximately 36 additional slips (Figure 3). The main walkout pier will be fixed and elevated. The pier will be approximately 2 m wide and approximately 20 m long, with a ramp connected to the end of the pier will transition to the main floating portion of the moorage. This platform is connected to a perpendicular concrete main. This main, which runs parallel to the shoreline, as shown in Figure 3, is referred to as the W dock, and is ~90 m long with an additional setback section that is 45.45 m long. Five (5) concrete mains extend from the W dock, and are labelled in alphabetical order from west to east as A to E. The A Dock will extend ~140 m from the W Dock, while the B and C Docks will extend ~135 m and 135 m, respectively. The W Dock is setback away from the Okanagan foreshore adjacent the D and E Docks, which extend ~90 m and ~90 m from the W Dock, respectively. A pump out and gantry are located at the south end of the D Dock. No changes will be made to the existing D and E docks.

The breakwater system surrounding the marina is currently made up of logs on the north and east side of the marina, and consists of concrete floats on the west side. The west end of the existing log breakwater located north of the marina will be moved deeper such that it is ~14 m and ~18 m from the ends of the A and B Docks, respectively. A new steel/concrete breakwater will extend to the northwest from the south end of the A Dock. The new breakwater will be ~140 m long and ~2 m wide. A new dock will be constructed parallel to the A to E Docks, and will extend off the north end of the new steel/concrete breakwater. This new dock will be ~45 m long and ~2.6 m wide. The concrete breakwater floats that currently run along the west side of the marina will be relocated such that two (2) of them provide a continuation of the new steel/concrete breakwater in a southwest to northeast orientation and east to west orientation, respectively. The remaining concrete floats from the west side of the marina will be placed north of the log breakwater located at the north end of the marina. The new and relocated sections of the breakwater system will be supported by a combination of untreated Douglas-fir piles and concrete anchors with chain.

The following provides a summary of the total number of expected piles (by type and location), and anchors needed for the proposed works, noting that these numbers will adjust slightly depending upon detailed design:

- The total number of steel "H" piles for the pile driven breakwater is anticipated to be approximately 85.
- The total number of steel pipe batter piles is estimated to be 70.
- The total number of new wood piles for the floating infrastructure on "W" dock, "A" dock and "AA" dock is estimate to be 45.
- Piles for new pier and landing is approximately 4, made of either steel or wood
- Total number of new anchors for the repositioned breakwaters is 20, weighing 9000 pounds each.

- Total number of new anchors for "A" dock in deep water is 10 weighing 9000 pounds each.
- Total number of new anchors for "AA" dock in deep water is 6, weighing 4500 pounds

The fixed elevation access pier and connecting ramp that leads from the floating portion of the marina will be made with an aluminum frame and either concrete or wood decking. The additions to the A dock (including fingers and main extension), as well as the new breakwater and dock structures will be built with concrete reinforced with rebar, steel and fiber mesh, and styrofoam core for flotation. Anchors used for the moorages and breakwater system will include galvanized chain connected to polypropylene rope that leads to a concrete anchor, and pilings will be untreated Douglas-fir.

Figure 2 shows the bathymetry and depths associated with the proposed marina.

3.4 Project Activities

The following section briefly outlines the activities associated with marina construction, operation and decommissioning.

3.4.1 Construction

Most of the marina components will be constructed off site, transported to the Vernon Yacht club and assembled at the site. Any instream works will be from a floating barge with a smaller boat to assist. Concrete sections for the new fingers, mains and breakwater will be trucked to the site and launched from the existing boat launch or another industrial launching facility that is appropriate.

3.4.2 Operation

Activities likely to be associated with operation of the marina include launching, storage, fueling at the designated fueling area as allowed under the existing lease, and use of boats. Other activities associated with the marina will include maintenance of the marina structure. Maintenance activities like dredging are not likely needed, because the design has moved most infrastructure to deeper water to avoid environmental risks associated with dredging. No maintenance of boats is to occur within the marina.

3.4.3 Decommissioning or Expansion

The structure upgrades are expected to have a minimum 20 year lifespan (noting it could be longer depending upon site conditions), and decommissioning would likely only be required if the marina needed to be replaced by a new structure. Demand for moorage on Okanagan Lake is expected to continue into the future and as a result Ecoscape anticipates that the proposed moorage will not need to be decommissioned unless required by regulatory agencies. Upgrades to the structure in future are currently being considered,

with the proponent working through public consultation. Proposed future additions include components new mains/floats, slips, extension of the lease area, and associated breakwater structures. All infrastructure will require routine maintenance, typical of larger marine facilities, including occasional pile replacement, repairs or replacement of floating slips, etc.

3.5 Project Schedule

The study area is located along a section of Okanagan Lake which is not considered to be suitable kokanee spawning habitat. Furthermore, there are no known kokanee spawning creeks or shore spawning areas within 500 m of the proposed works. Because substrates are not exclusively mud or silts in the study area, the timing windows are June 1 to September 30. Since works to repair the facility are required immediately, works are proposed outside of the work window. It is important to note that there is not likely any salmonid spawning occurring on the larger substrates within the study area based upon habitat suitability. For this reason, works outside the window are not likely to pose significant risks to salmonids. In terms of non salmonids such as Cyprinids, risks are considered very low because these species are highly tolerant, very fecund, and are less affected by routine construction such as pile driving or overwater works.

3.6 Project Justification

In July 2014, a storm incurred damage on the concrete breakwater floats located on the west end of the marina. More specifically the two most northerly sections of the breakwater system detached, opening a significant portion of the breakwater exposing the marina. Prior to this most recent event, previous repairs have been attempted at various times, but have not been successful at providing a long terms solution. The ongoing repairs and maintenance have resulted in designing and installing a solution that will require less maintenance and help to reduce risks to the significant value of assets occurring within the marina. The new and relocated breakwater structures will improve mitigation against detrimental wind and wave action as well as sediment deposition.

The small marina expansion is required to help offset the costs of the infrastructure, and support the increasing demand for moorage slips in the area. Part of the design consideration was to allow for the existing facility to better operate under the existing Crown Land tenure by designing proposed infrastructure to fit within the existing lease boundary, where previously, some components possible extended past the lease. The new structure will be in deeper water which will alleviate some of the existing concerns with shading, grounding and propeller scour.

4.0 EXISTING BIOPHYSICAL CONDITIONS

The biophysical and socio-economic components relevant to the project are described in this section. A site assessment was completed on June 23 by Jason Schleppe, M.Sc., R.P.Bio. Photographs were taken to document field features and these have been included in the Photographs section at the end of this report. Most data for this report references previous works completed, such as the Foreshore Inventory and Mapping, or Sensitive Terrestrial Inventory and Mapping. Detailed wildlife or fisheries inventories were not conducted because of the temporal variation in habitat use, making firm conclusions difficult to determine from point surveys and inventories.

4.1 Vegetation and Wetlands

The Biogeoclimatic Ecosystem Classification (BEC) is a land classification system that groups similar terrestrial ecosystems based on climate, soils, and vegetation. This classification system was developed in British Columbia and is used as a framework for resource management. The property is located within the Okanagan Very Dry Hot Interior Douglas-fir variant (IDF_h1) Biogeoclimatic Zone (Ministry of Forests 1998). The IDF zone occurs at low to mid-elevations (400-1250m), typically above the Ponderosa Pine zone. It occurs in areas with a warm, dry climate with a relatively long growing season, in which moisture deficits are a regular occurrence. Tree species typical of climax stands include Douglas-fir, and some Ponderosa Pine. The IDF_h1 subzones are separated from the remaining IDF subzones by the absence of western larch and western red cedar. IDF understory is typically dominated by pinegrass. *Due to the extensive historic anthropogenic alterations at the site, it is currently considered urban in nature.*

The riparian area at the site is highly disturbed and includes a boat launch, a parking lot, the yacht club building, a lease exteand some rip-rap and retaining walls along the shoreline. Some native vegetation does exist within the riparian area and includes tall Oregon-grape (*Mahonia aquifolium*). There is very limited emergent vegetation present along the shore and submerged vegetation includes Eurasian watermilfoil (*Myriophyllum spicatum*), an invasive species.

No wetlands were observed in proximity to the proposed marina development.

4.2 Aquatic Resource Values

Kokanee (*Oncorhynchus nerka*) are the fish species of primary concern with respect to shoreline development and aquatic habitat alteration along Okanagan Lake. A review of Kokanee shore spawning zoning information for Okanagan Lake, as of April 2015, revealed that the subject property is located within a Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) Kokanee No Colour Zone (Figure 1).

The provincial No Colour Zone designation indicates that there has been no recent or historic observed Kokanee shore spawning activity within this area (BC MoE, 2009). The subject property is located approximately 1190 m to the southwest of the nearest kokanee

Yellow Zone. The Yellow Zone rating is applied to areas of shoreline recognized as providing moderate to high value habitat required for long-term maintenance of Kokanee productivity. Yellow Zone designation is given to areas where aggregations of 50 or fewer fish were observed in recent years (2001-present), historic shore spawning activity of less than 1000 fish has been documented, in proximity to mouths of streams, or locations with Rocky Mountain ridged mussel (*Gonidea angulata*) shells (BC MoE, 2009). There was no evidence of Rocky Mountain ridged mussel shells or live mussels during the June 2015 site assessment, but it is important to note that there are occurrences within the Vernon Arm of Okanagan Lake, meaning that non detect does not necessarily mean there are no individuals present at the site.

The Vernon Yacht Club occurs along Okanagan Lake Foreshore Inventory and Mapping (FIM) Segment 135, which is described as being 100% commercial, with 100% disturbance occurring over of the approximately 236 m segment (Schleppe, 2010). The shore type along the segment is described as being 100% "other" due to the extensive historical alterations, with substrates in the nearshore area being described as 80% gravel and 20% sand (Schleppe, 2010). The littoral zone width was described as moderate (10 - 50m). Moorages along the segment were documented at a density of 4.25 docks/km. This FIM segment description is generally consistent with the current state of the subject property. The Aquatic Habitat Index (AHI) criteria is currently Very Low for this segment of shoreline with juvenile rearing potential ranked as moderate (Schleppe, 2010). While shore spawning Kokanee have not previously been documented within 3.3 km of the subject property, substrates may provide suitable spawning, foraging and general living habitat for a number of mostly coarse fish species such as Cyprinids. Table 1 provides a list of native and non-native fish species documented to occur in Okanagan Lake.

Table 1. Species of fish found in Okanagan Lake (BC MFLNRO, 2015)

Common Name	Scientific Name
Eastern Brook Trout	<i>Salvelinus fontinalis</i>
Burbot	<i>Lota</i>
Carp	<i>Cyprinus carpio</i>
Chiselmouth	<i>Acrocheilus alutaceus</i>
Cutthroat Trout	<i>Oncorhynchus clarki lewisi</i>
Kokanee	<i>Oncorhynchus nerka</i>
Lake Trout	<i>Salvelinus namaycush</i>
Lake Whitefish	<i>Coregonus clupeaformis</i>
Largescale Sucker	<i>Catostomus macrocheilus</i>
Leopard Dace	<i>Rhinichthys falcatus</i>
Longnose Dace	<i>Rhinichthys cataractae</i>
Longnose Sucker	<i>Catostomus</i>
Mountain Whitefish	<i>Prosopium williamsoni</i>
Northern Pikeminnow	<i>Ptychocheilus oregonensis</i>
Peamouth Chub	<i>Mylocheilus caurinus</i>
Prickly Sculpin	<i>Cottus asper</i>
Pumpkinseed	<i>Lepomis gibbosus</i>
Pygmy Whitefish	<i>Prosopium coulteri</i>
Rainbow Trout	<i>Oncorhynchus mykiss</i>
Redside Shiner	<i>Richardsonius balteatus</i>

Slimy Sculpin
Yellow Perch*Cottus cognatus*
Perca flavescens

4.3 Wildlife/Habitat

Wildlife habitat at the site is limited because of the developed nature of the riparian area, however, some riparian habitat does exist. It is possible to find some bird species such as grouse, woodpecker and flycatcher. Eagles, osprey and other raptors also likely utilize neighbouring trees along the shoreline as habitat. There is the potential for small mammals such as beavers, muskrat and others to be present although the likelihood is considered to be low because of the developed nature of the shoreline. Some amphibians may also be present. No wildlife was observed during the field visit, likely due to timing of the assessment.

4.4 Species at Risk

The CDC Mapped Known Locations online mapping application was queried for mapped records of species at risk. Shape ID 74373, Occurrence ID 10214, which spans a vast area east of Okanagan Lake, is present on the subject property and represents a sighting of an American Badger (*Taxidea taxus*), last observed in 2012 (BC CDC 2015).

Shape ID 7892, Occurrence ID 1667, is present on the subject property, and represents observations of Blue Vervain (*Verbena hastata* var. *scabra*). Blue Vervain was not observed during the June, 2015 site visit.

Shape ID 47799, Occurrence ID 8098 is located immediately east of the subject property. This occurrence is related to observations of Western Screech Owl (*Megascops kennicottii macfarlanei*).

Shape ID 19093, Occurrence ID 6094 is located approximately 1.3 km east of the subject property, and is associated with observations of Grasshopper Sparrow (*Ammodramus savannarum*). The disturbed nature of the subject property has drastically reduced its suitability for Grasshopper Sparrow habitat.

Shape ID 8448, Occurrence ID 3735 is located approximately 1.7 km northeast of the subject property, and is associated with observations of Great Basin Spadefoot (*Spea intermontana*). The disturbed nature of the subject property has drastically reduced its suitability for Great Basin Spadefoot habitat.

No species at risk were observed during the field review at the subject property although formal rare wildlife and plant surveys were not within the scope of this assessment. The proposed development area was scanned for species presence at a reconnaissance level. The likelihood of encountering these species is not considered to be high because the habitats associated with the marina and adjacent areas are highly developed and disturbed and there is little opportunity for life history processes to occur. However, a non detect does not infer that use may occur at some point, but the probability of high use or permanent residence on the site is considered very low. Finally, because the work is primarily occurring at depth in the lake and not in nearshore or shoreline areas, there is a low probability of rare and endangered risks associated with the proposed works.

5.0 ENVIRONMENTAL EFFECTS AND MITIGATION

The following section outlines potential effects associated with the proposed marina and breakwater upgrades. For some of the components, no effects are anticipated. There is the potential for positive effects to occur also. The following components are unlikely to be affected by the proposed marina:

Terrain/Topography: No upland works are proposed as part of marina construction. As a result significant changes to the terrain and topography are not anticipated. Potential changes to sediment transport are covered under soil and sediment.

Wildlife Habitat: The proposed works are not anticipated to substantially change the overall character of the foreshore and riparian area associated with the subject property.

Species at Risk: No species at risk were encountered during the field surveys and additional impacts to potential habitat for species at risk are is not anticipated.

The following table outlines potential effects along with an assessment of the significance of the effect and proposed mitigation measures. Many of the operational effects are those that might take place during operation of the existing marina. For each potential effect Ecoscape has outlined measures to mitigate effects to the receiving environment. Many of these mitigation measures were sourced from common best management practices documents. The following are examples of some of the documents that were referenced:

- Alaska Best Management Practices for Harbor, Marina and Boat Operations. Prepared for State of Alaska, Office of the Governor. (Prepared by Neil Ross Consultants and Concepts Unlimited. 2004.)
- Best Management Practices for Wharf, Pier, Dock, Boathouse and Mooring (Ministry of Environment and Fisheries and Oceans Canada. Date Unknown).

- Habitat Officer's Terms and Conditions (Ministry of Environment Habitat Officers, Okanagan Region. April 2011).
- Land Development Guidelines for the Protection of Aquatic Habitat (Department of Fisheries and Oceans and Ministry of Environment, Lands and Parks 1992).
- Marina Development Guidelines for the Protection of Aquatic Habitat (Fisheries and Oceans Canada and Ministry of Environment, Lands and Parks 1995).
- Marine Guide to Small Boat Moorage Factsheet (Fisheries and Oceans Canada Habitat Enhancement Branch 2001).
- Operational Statement for Construction of Docks in Freshwater Systems (Department of Fisheries and Oceans 2007).
- Standards and Best Practices for Instream Works (Ministry of Water, Land and Air Protection 2004).

Table 2 provides an outline of potential effects associated with construction and operation of the marina. No mitigation is provided for decommissioning as there are no plans to decommission the proposed marina, future plans would likely include maintenance and replacement of degraded components over time only. Groundwater and surface water have been addressed together in the table as the impacts that are likely to affect surface water are likely to be the same as those that affect groundwater. There are also no groundwater wells mapped within close proximity to the marina (i.e. below the high water mark) although there is a water intake at depth.

Table 2: Potential Environmental Effects Analysis

Environmental Component	Description of Potential Environmental Effects	Significance of the Effect	Recommended Mitigation Measures and/or Best Management Practices	Residual Effect	Significance of Residual Effect
Surface Water and Groundwater Quality – (works are not expected to affect surface or groundwater quantity)	--Debris from removal of unused portions of the marina and/or breakwater system could be deposited in the lake and could impact water quality.	ME	--Existing piles that will not be reused should be cut or broken off as close to the lake bottom as possible if they cannot be safely and successfully pulled out (Ministry of Environment 2006). --All material from damaged or relocated structures that will not be used in the upgrades should be taken offsite and disposed of in an appropriate location. --Waste should be taken offsite as soon as possible and should not be stored within 15 m of the high water mark of Okanagan Lake. --Burning of piles and wooden dock components along the foreshore is not an acceptable form of disposal and must not occur (Ministry of Environment 2006). --Cutting of wood decking, steel or concrete over the water must not occur due to the potential release of toxins. Any cutting that is to occur on site should take place over a tarp or suitable containment area, and all cuttings/byproduct should be removed from the site and not disposed of in water.	If mitigation measures are followed, there are unlikely to be residual effects.	NA
Surface Water and Groundwater	--Construction activities such as pile driving and placement and securing of marina components has the potential to cause sedimentation and turbidity.	ME	--Prevent the release of silt, sediment, or sediment-laden water. If works are expected to significantly disrupt lake bottom substrates, then containment measures must be undertaken. --Sufficient water depths must be present to prevent the barge from grounding on the foreshore and the use of barge stabilizing spuds should be avoided (Fisheries and Oceans Canada and Ministry of Environment, date unknown). During construction, prop scour from the barge or tending vessels must not occur. --It may be necessary to install a floating/hanging silt curtain during pile driving and other construction activities if turbidity becomes a significant concern. The need for a silt curtain could be determined by the dock builder, proponent and environmental monitor based on the construction activities and associated turbidity concerns.	If mitigation measures are followed, there are unlikely to be residual effects.	NA
Surface Water and Groundwater	--Spills of various substances during construction such as fuels, concrete, lubricants, etc. have the potential to impact water quality. --Construction materials have the potential to impact water quality if they leach substances into the water.	ME	--No concrete pours should occur on site. All marina components should be pre-cast or a. --Ensure that onsite machinery is in good operating condition, clean and free of leaks, excess oil, or grease. --Operators should take care when fueling equipment to prevent spills. Fueling should occur over an impermeable surface so that incidental spills or drips can be cleaned up with the appropriate spill response materials. All of the construction crew should be familiar with the location and proper use of these materials and how to respond in the event of a spill or spill related emergency. --Any equipment left in proximity to water over night should be secure. Place a clean piece of cardboard or some sheeting underneath equipment parked overnight to detect incidental leaks or drips. --Any equipment working from a barge over the water should contain a spill kit with adequate response materials to clean up potential spills. --Equipment operating from the barge should be serviced with "environmentally friendly" hydraulic fluid. --No equipment is to sit within the wetted perimeter of Okanagan Lake during construction. --Lumber, if required during construction, should be treated with environmentally friendly stains. Cut, seal and stain all lumber away from the water using only environmentally-friendly stains (http://www.dfo-mpo.gc.ca/Library/245973.pdf). All sealed and stained lumber must be completely dry before being used near water. --Any spills of a deleterious substance of reportable quantities must be immediately reported to Emergency Management BC's 24 hour hotline at 1-800-663-3456 as well as Fisheries and Oceans Canada and Ministry of Environment. --Pads used for the boat launch extension should be pre-cast. No cast in place works are to occur during expansion of the boat launch.	If mitigation measures are followed, there are unlikely to be residual effects.	NA
Soils/Sediment	--Construction activities could result in changes to soils and sediment in the nearshore area. Piles have the potential to displace substrates.	ME	--No beach grooming, addition of sand or removal of cobbles/boulder below the high water mark must occur during construction. Similarly no dredging is permitted below high water mark.	If mitigation measures are followed, there are unlikely to be residual effects.	NA



	--Marina components including piles and anchors have the potential to displace substrates if they are dragged across the bottom.		--Cobbles and boulders occurring within the piling or anchor footprint must not be removed from the lake environment. If necessary, they should be relocated to an area immediately adjacent and of similar water depth following guidelines of the Department of Fisheries and Oceans Operational Statement for Construction of Docks in Freshwater Systems. --Sufficient water depths must be present to prevent the barge from grounding on the foreshore and the use of barge stabilizing spuds should be minimized (Fisheries and Oceans Canada and Ministry of Environment, date unknown). During construction, prop scour from the barge or tending vessels must not occur. --Marina components including piles and anchors must be towed or lifted into place and not dragged across the bottom of the lake. --Work on the proposed boat launch must be limited to the existing and proposed footprint and must not encroach beyond these limits. --Engineering review of the proposed facility has determined that the proposed repairs will not substantially alter shoreline processes. A letter under separate cover is provided in the application with design criteria that will be used to reach this determination. Detailed designs will be submitted once finalized.		
Air Quality and Climate Change	--Construction activities will likely result in a temporary increase in air emissions associated with construction and operation of equipment and machinery.	ME	--Limit idling of equipment. --Make sure equipment is serviced and in good working order.	If mitigation measures are followed, there are unlikely to be residual effects.	NA
Noise/vibration	--Construction activities will likely result in a temporary increase in noise associated with pile driving and operation of equipment and machinery.	ME	--Limit noise impacts to daytime activities only between 7 am and 7 pm.	No residual effects are anticipated after construction is complete.	NA
Vegetation and Wetlands <i>There are no wetlands associated with the project.</i>	--Construction activities have the potential to impact the existing riparian area.	ME	--No riparian vegetation should be removed during construction. Works should occur from the water and no work is to be completed within the vegetated riparian area other than restoration planting. This work is to be completed by hand. No heavy equipment is to be used along the beach.	If mitigation measures are followed, there are unlikely to be residual effects.	NA
Vegetation and Wetlands	--Construction activities have the potential to impact aquatic macrophytes.	ME	--Pilings and anchors should be positioned such that they are not impacting aquatic vegetation wherever possible. In the case of Eurasian watermilfoil, this is a non-native invasive species and disturbance with piling or anchor placement is not a concern. --Limit the width of walkways wherever possible, and thru flow decking should be used on the access pier to limit shade.	If mitigation measures are followed, there are unlikely to be residual effects.	NA
Fish and Fish Habitat	--Works completed outside the timing windows designated for Okanagan Lake have the potential to impact important life stages of fish populations in Okanagan Lake.	ME	--Works will be completed during the least risk timing window for Okanagan Lake which is June 1 – September 30. --No works can occur below the high water mark of Okanagan Lake without having a Provincial Water Act Section 9 Notification application submitted, approved and in the possession of the property owner and contractor prior to any instream works.	If mitigation measures are followed, there are unlikely to be residual effects.	NA
Fish and Fish Habitat	--Pile driving activities may impact fish during construction activities.	ME / M	--Both wood piles and steel piles will be used, where steel piles are known to have larger percussions than wood. --All percussions from pile driving should be within the limits provided within the guidelines for use of explosives near water (http://www.dfo-mpo.gc.ca/Library/232046.pdf) --If there is any evidence of impacts from piles affecting fish (i.e. observed mortality or other observable impacts) work should stop and a bubble curtain may need to be put in place. --Pile driving should begin with a few strikes followed by a pause to allow fish to swim out of the area. --Limit the number of piles that are put in each day where impacts to fish area a concern. --Push piles into substrates rather than pounding or driving piles where possible.	If mitigation measures are followed, there are unlikely to be residual effects.	NA



Transportation and Navigation	--Construction activities have the potential to interfere with boat traffic on Okanagan Lake.	ME	--Construction crews should adhere to all boating guidelines and should be clearly visible to boating traffic	If mitigation measures are followed, there are unlikely to be residual effects.	NA
Table Codes: S: Significant adverse environmental effect ME: Minor adverse effect/mitigable effect (not significant) NS: Not significant adverse environmental effect UN: Uncertain/unknown effect M: Monitoring required F: Follow up-required NA: Not required or not applicable					



6.0 ENVIRONMENTAL MONITORING

A suitably qualified environmental monitor should be retained to provide part time environmental monitoring during instream works. Monitoring should be completed on an as needed basis and depending upon risks. For works proposed outside of the standard work window, weekly visits are likely appropriate given anticipated risks of the project. For works within the work window, monthly or bi weekly visits are appropriate given the level of anticipated risk. The environmental monitor should document adherence to best management practices and provide guidance as necessary. It is the proponent's responsibility to retain an environmental monitor during construction.



7.0 CLOSURE

This report has been prepared by Ecoscape Environmental Consultants Ltd. (Ecoscape) for the Vernon Yacht Club and considers the existing and potential site conditions of the site with respect to aquatic and terrestrial ecosystems and intrinsic ecological values. Ecoscape has prepared this report with the understanding that all available information on the past, present, and proposed conditions of the property have been disclosed. The Vernon Yacht Club has acknowledged that in order for Ecoscape to properly provide the professional service, Ecoscape is relying upon full disclosure and accuracy of this information.

If you have any questions or comments, please contact the undersigned at your convenience.

Respectfully Submitted
ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.

Written By:



Mike Schutten, M.A.Sc
Environmental Scientist
Direct Line: (250) 491-7337 ext. 206

Reviewed By:



Jason Schleppe, M.Sc., RPBio
Senior Natural Resource Biologist
Direct Line: (250) 491-7337 ext. 202



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PHOTOS



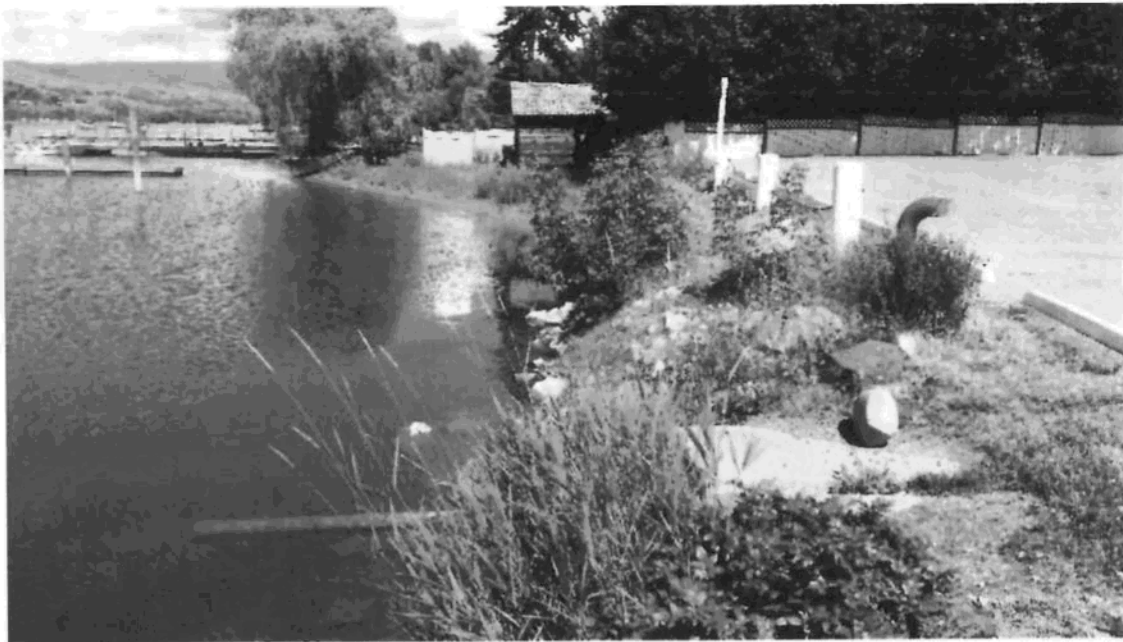


Photo 1. View of the existing shoreline near the north end of the site (all photos taken on June 23, 2015, unless otherwise specified).

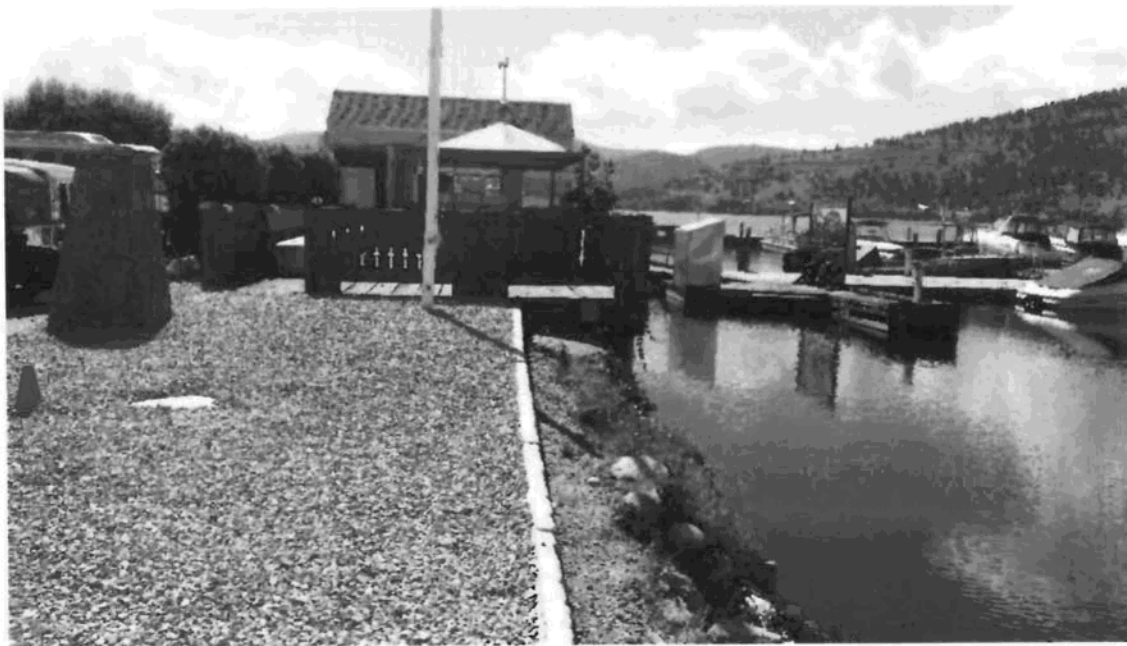


Photo 2. Looking south along the existing shoreline.



Photo 3. Looking northeast towards the log breakwater located north of the marina.



Photo 4. Looking at the damage done to the concrete breakwater floats west of the marina during the July 2014 storm (photo submitted by client)



Photo 5. A close look at damage done to the concrete breakwater floats west of the marina during the July 2014 storm.



Photo 6. A mix of concrete and wooden docks currently occupy the marina. All upgrades will be concrete.

FIGURES



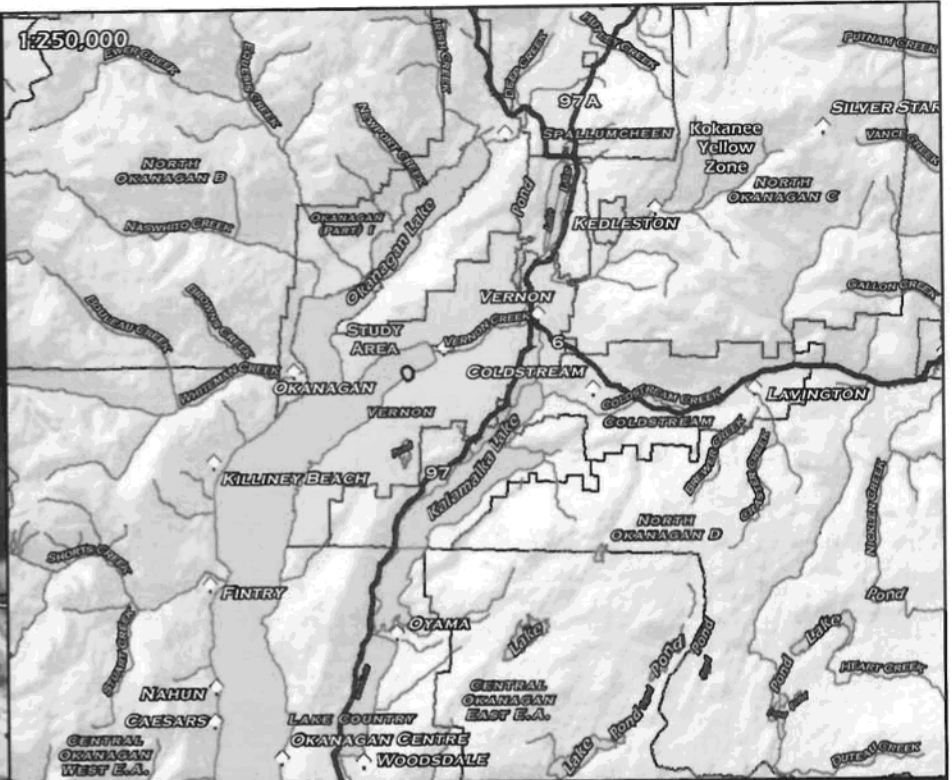


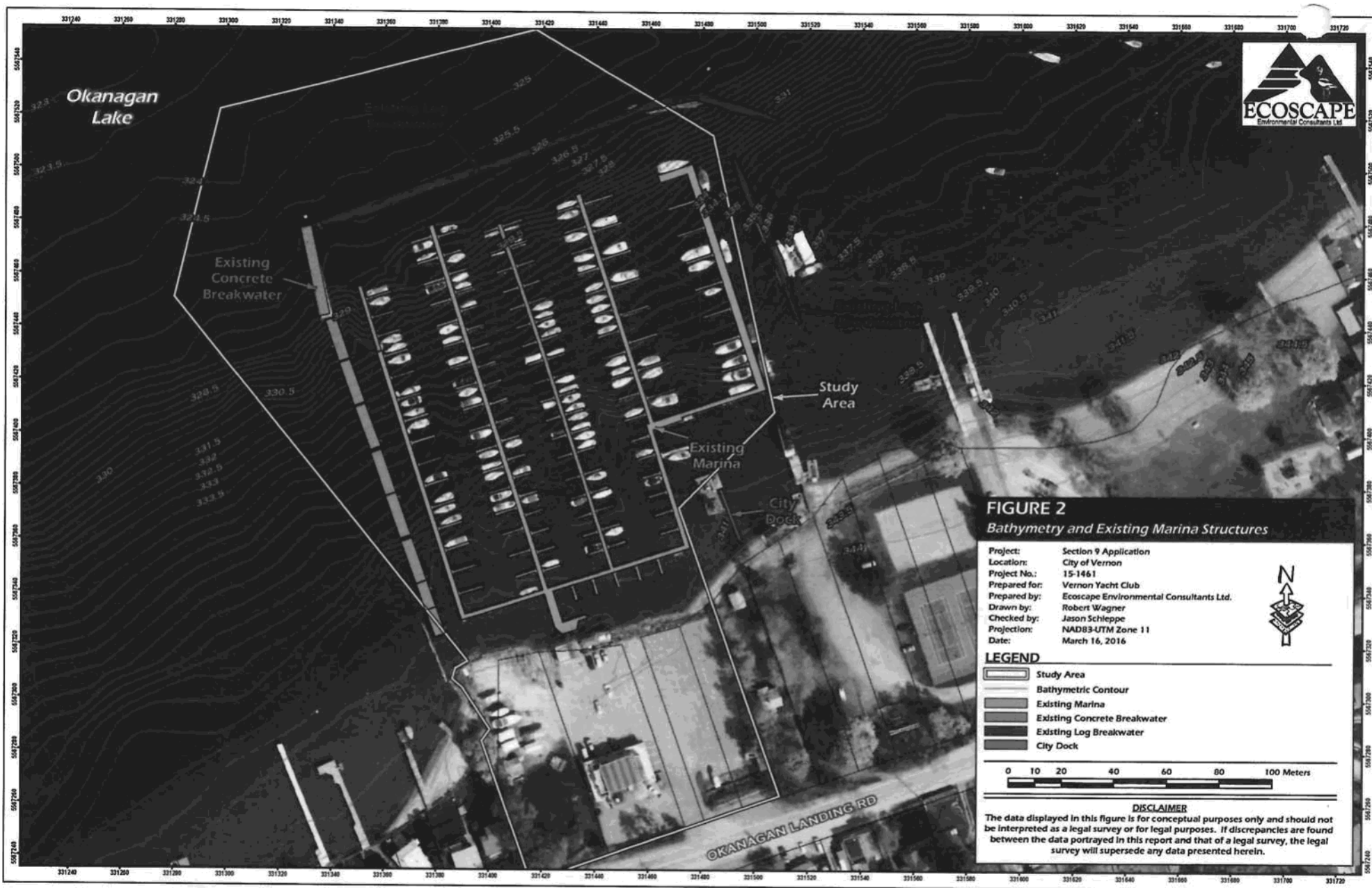
FIGURE 1
Site Location

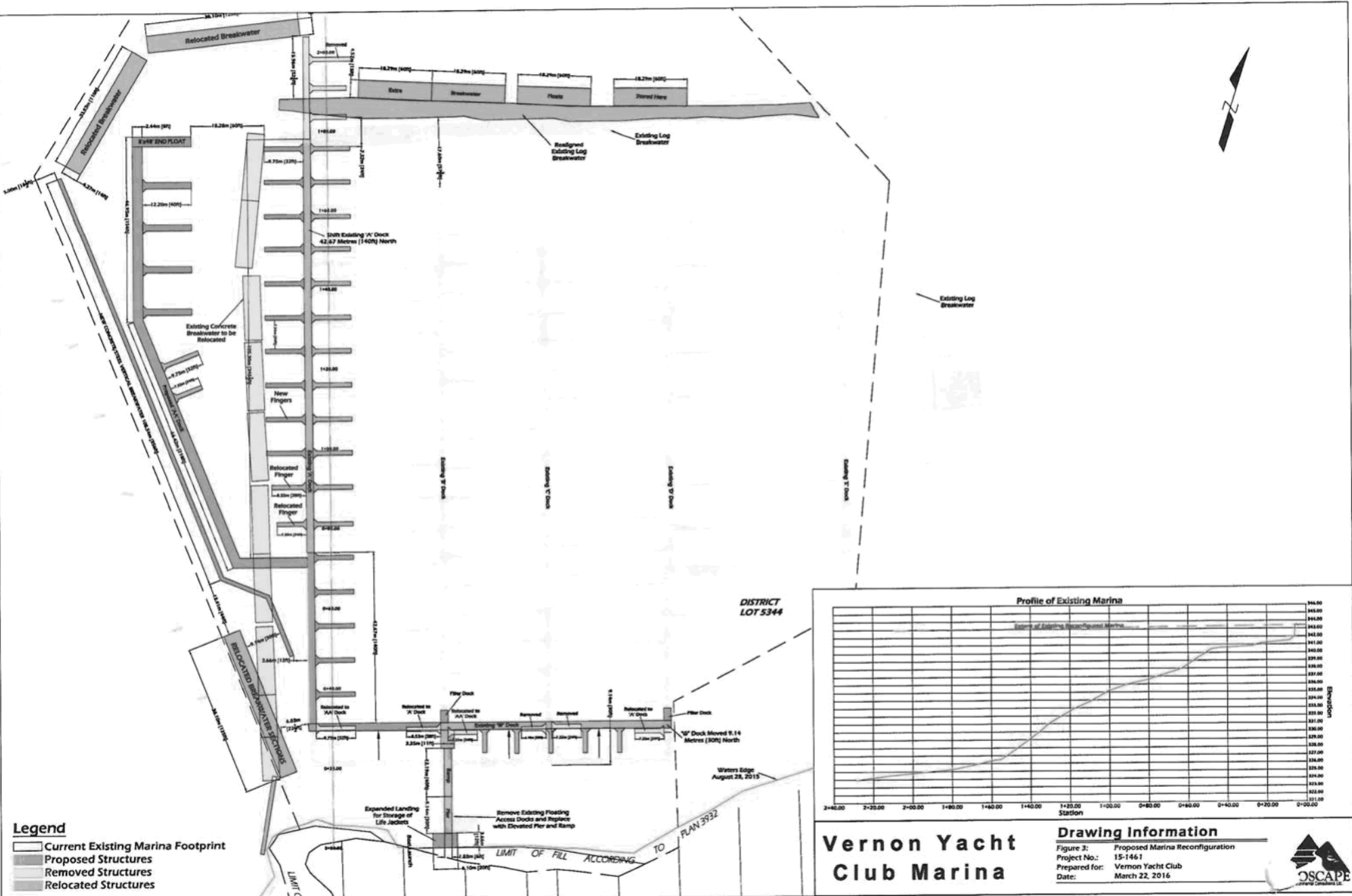
Project: Section 9 Application
Location: City of Vernon
Project No.: 15-1461
Prepared for: Vernon Yacht Club
Prepared by: Ecoscape Environmental Consultants Ltd.
Drawn by: Robert Wagner
Checked by: Jason Schleppe
Projection: NAD83-UTM Zone 11
Date: March 16, 2016



LEGEND

- | | | |
|---------------------------------------|--------------------|---|
| Places | Study Area | Segment Break |
| Regional Location of Subject Property | Municipal Boundary | Foreshore Inventory and Mapping (FIM) |
| Cadastre | City of Vernon | Kokanee Historical Spawning Record |
| Major Highway | Lake | Ministry of Environment - Kokanee Yellow Zone |
| | Streams and Rivers | Ministry of Environment - Kokanee Red Zone |
| | | Ministry of Environment - Kokanee Black Zone |





March 21, 2016

Vernon Yacht Club
7919 Okanagan Landing Road
Vernon, BC, V1H 1H1

Rev. 0
WEEL File #: 1504
Sent Via Email: craig@telus.net

Attention: Mr. Craig Williams

Subject: Vernon Yacht Club Breakwater Repairs – Wave and Sediment Impacts Letter

1.0 INTRODUCTION

Waters Edge Engineering Ltd. (Waters Edge) has been retained by Ecoscape Environmental Ltd. (Ecoscape) on behalf of the Vernon Yacht Club (VYC) to provide guidance to the conceptual plans for the VYC's marina breakwater repairs and to provide an opinion regarding the impacts to waves and sediment transport processes due to the changes to the breakwater in support of the permitting process.

This letter is provided in support of the Environmental Assessment (EA) completed by Ecoscape, project number 15-1461, dated March 2016, and may be read only as part of this document. The EA describes the project location, background and proposed overall changes to the marina. Therefore, these items have not been repeated in this letter. This letter focusses on the relative impacts to waves and sediment transport processes only.

The VYC is located on the south shore of the north inlet of Okanagan Lake at 7919 Okanagan Landing Road. An aerial image of the site and surrounding shoreline is in Figure 1.

Copyright

Figure 1: Aerial Overview of the Project Area (2013 imagery, Google Earth)

2.0 ENVIRONMENTAL CONDITIONS

Environmental conditions are the natural processes that affect the project site and the area around it. These include wind, waves, ice and seasonal water levels. Littoral sediment transport patterns are generated by the environmental conditions.

2.1 WATER LEVELS AND BATHYMETRY

Bathymetry at the project site was surveyed by Ecoscape on August 29, 2015 and is shown in the EA document on both Figure 2 and Figure 3, which show the existing and proposed marina plans respectively.

Water levels on Okanagan Lake are well documented since this is a regulated system. For the purposes of this analysis the following water levels have been used:

- Low Water Level (LWL) = 341.32m¹ Geodetic Datum (GD);
- High Water Mark (HWM)=342.53m GD², assumed to approximate the average annual high water level;
- 200-year flood level is assumed to be 343.05m GD² with flood construction level 0.6m above this.

There are many published water levels that differ in values of centimetres. The values listed above are representative of Okanagan Lake conditions and the accuracy is suitable for the purposes of this study.

2.2 WAVE STUDY

Wind is the primary generator of the waves at the project site. A wind and wave study and sediment transport study was completed in 2006 for the Vernon Yacht Club by Westmar Consultants Inc. (Westmar)³. This study is attached in Appendix A and was completed in support of the marina expansion at that time and includes a table of the design wave conditions as well as the sediments at the site. This study is used as the wind and wave study to support the proposed design.

The breakwater will be designed to attenuate the 30-year return period waves listed in Table 1 from the Westmar study. Based on this study, the most severe storm waves are from west-south-west, which has the longest fetch length; significant wave height (Hs) is 1.29m and peak period (Tp) is 3.9s for the 30-year storm. Waves from the north-north-west are also significant, especially since they are nearly beam-on to the direction of moorage, with a 30-year Hs of 0.73m and Tp of 2.5s.

Accuracy of the Westmar study was out of scope and was not reviewed by Waters Edge.

Figure 2: Site Location on Okanagan Lake (Google Earth)

¹ Fisheries and Oceans Canada, Hydrographic Chart 3052, Okanagan Lake, 1994 (Chart Datum = 341.32 m GD).

² Okanagan Lake Water Level Management Review of Past Trends with Recommendations, Ward and Associates Ltd., March 2000 (Figure 3 notes Max. normal and Min. normal operating range as well as other levels).

³ Project Memorandum: Sediment Transport Study for Vernon Yacht Club, Westmar Consultants Inc., August 2, 2006.

Wind, wave and forcing for the concrete breakwater was also provided by Westmar in 1997, attached in Appendix B. This document is challenging to read due to its age and resolution, but it appears to indicate that a different wave condition was used for design at that time. It is assumed that when Westmar provided the 2006 study that they completed a more comprehensive analysis and therefore the 1997 study is not being used in the design of the proposed breakwater.

Further information about the waves at the project site is available in Appendix C. The VYC responded to questions about the breakwater and site conditions, which provides an anecdotal check to the 2006 study.

2.3 ICE

In the Okanagan, ice has historically damaged structures in the water near-shore. Therefore, ice loading should be considered during the detailed design of the structures. However, for the purposes of wave and sediment transport conditions, ice is not anticipated to have any impacts on the processes and has not been considered in this assessment.

3.0 WAVE ATTENUATION

Fundamentally, the wave attenuation post-construction should be the same or better than the wave attenuation in the existing condition. Detailed design is not complete at the time of writing this letter.

3.1 EXISTING CONDITION

The VYC is currently protected by a floating wave attenuation system consisting of log bundles on the northern and eastern sides of the marina and a concrete caisson breakwater on the south-western side, which is exposed to the largest waves. A small log breakwater closes the gap between the south-west corner of the caissons and the shore.

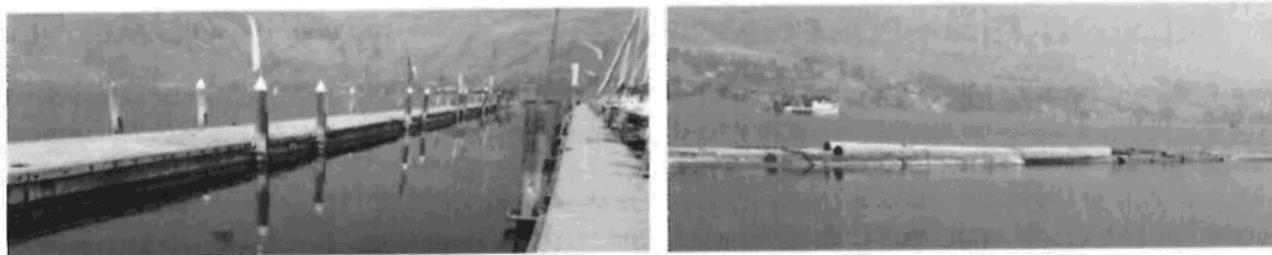


Figure 3: Existing Wave Attenuation Systems (August 27, 2015)

The concrete caissons are 14' (4.3m) wide in beam and are positioned such that the west-south-west waves are incident nearly beam-on, which is the least effective orientation. The caissons in deep water are being damaged and the moorings are failing.

The existing wave attenuation system does not attenuate the waves adequately on the north and west sides according to interview with the VYC. The log bundle on the east side reportedly performs adequately.

3.2 PROPOSED CONDITION

The proposed condition is illustrated in Figure 3 of the EA by Ecoscape. There will be no change to the log bundles on the east side. Segments of the existing concrete caissons will be repaired and rafted to the log bundles on the north side of the marina to improve wave attenuation from the north.

Wave attenuation on the west side is with a vertical piled structure aligned with the lease boundary and dog-legged to allow access to the boat launch near-shore. The existing concrete caissons will be repaired and used in locations and orientations that are more favourable for their performance in attenuating the waves. A new entrance will be accommodated on the north-west corner of the marina as well.

The nearshore area retains the existing concrete caissons and small log bundle. These are rotated to respect the lease boundary, but otherwise are unchanged. Attenuation is unchanged nearshore.

The proposed wave attenuation system will be designed by others to achieve acceptable wave agitation inside the marina based upon accepted marina design guidelines. The attenuation will be improved over the existing condition and is anticipated to be designed to transmit a 0.3m wave for the 30-year storm (to be determined).

The vertical structure will also be designed to minimize wave reflection by dispersing the wave energy horizontally. The existing concrete caissons reflect waves and the proposed system is anticipated to have a similar effect. However, the reflected waves will be more “choppy” and jumbled due to the shape of the face of the structure in order to disburse the energy.

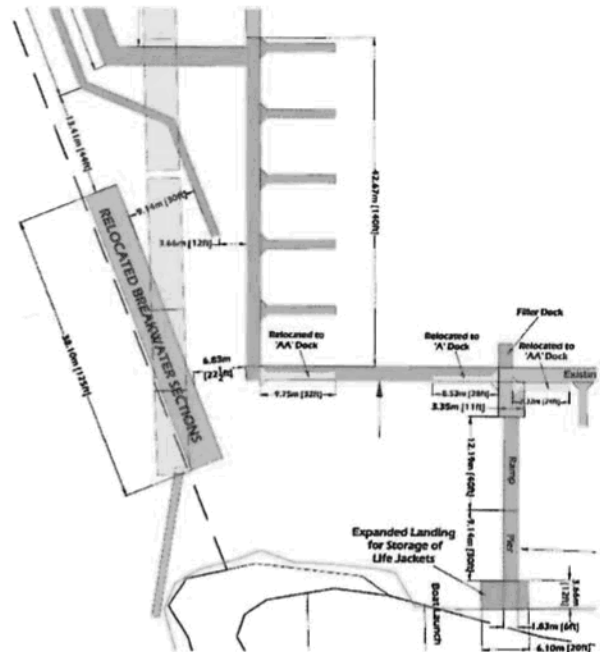


Figure 4: Proposed Nearshore Configuration

4.0 SEDIMENT TRANSPORT PROCESSES

Littoral transport processes in the vicinity of the VYC are driven by the strongest waves, which are from the west-south-west. Therefore, nearshore sediments are transported toward the east in the vicinity of the project area. This is evidenced by the Google Earth imagery in Figure 5 showing sediment accretion along the western side of the docks and other protrusions from shore near the VYC. This process has also been confirmed by the VYC in Appendix C. The Westmar 2006 memo in Appendix A describes sediment sizes and littoral drift processes. Images of the 2004 and 2013 shoreline are at the back of this document.

Sediment accretes at a slow rate in and around the VYC and is anticipated to continue at the same rate.

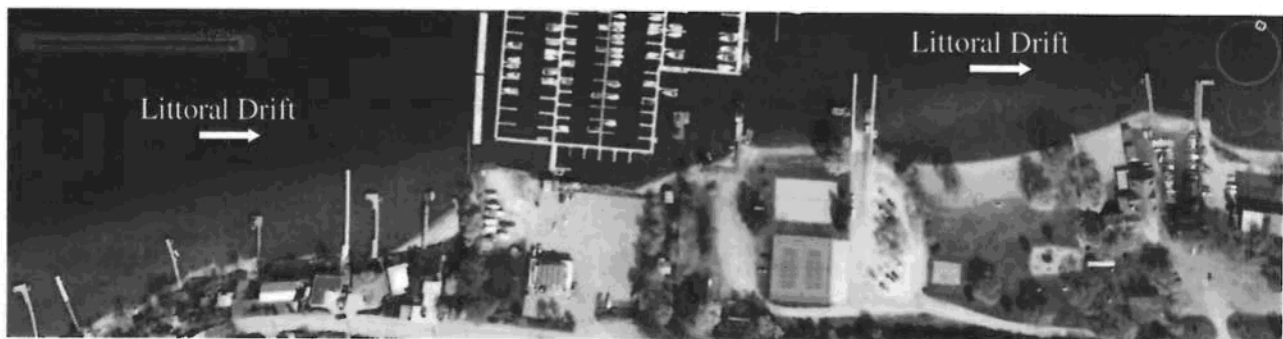


Figure 5: Sediment Deposits Due to Eastward Littoral Drift, Google Earth

4.1 EXISTING CONDITION

Inside the VYC, accretion has reduced the water depth nearshore and limits use of the boat launch and the inner slips. The retaining wall shown in Figure 6 protects the point of land from erosion and will eventually require repair. The small log breakwater assists in erosion control at this point of land and provides some wave attenuation for the inner slips. Wave energy inside the marina is adequate to carry coarse sandy sediments onto the boat launch.

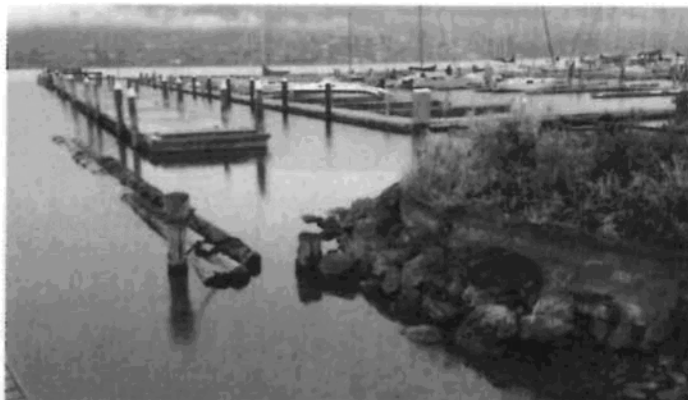


Figure 6: Boat Launch Area and Nearshore

4.2 PROPOSED CONDITION

The proposed condition is illustrated in Figure 3 of the EA by Ecoscape. The east side of the marina is unchanged and the minor changes to the north side are insignificant to sediment transport processes. The vertical structure that will be built on the west side of the marina will be designed to allow sediment to pass below the structure. It will be built offshore of the 340m elevation contour and will be designed to perform similar to the floating concrete caissons in terms of sediment passage. There will be some reflection off the vertical structure, but it will be disbursed horizontally through detailed design of the face so that the reflected wave does not create scour beyond the existing condition.

The nearshore area is unchanged from a sediment transport perspective. On the west side, the existing concrete caissons and small log breakwater are remaining, although rotated to respect the lease boundary. This small shift is not anticipated to generate changes to the sediment transport patterns since they are very close to their existing locations.

5.0 LIMITATIONS AND CLOSURE

This document has been prepared for the Vernon Yacht Club in support of their provincial permitting application for breakwater repairs. It is intended for their exclusive use on this project and may not be relied upon by any other party or for any other project. Waters Edge provides opinions in this document based on the information available and provided by others and provides no warranty on this information.

Waters Edge Engineering trusts this meets your present requirements. If any additional information would be helpful, please do not hesitate to contact us.

Sincerely,

Waters Edge Engineering Ltd.

Tara Hirsekorn, P.Eng.

Principal, Hydrotechnical Engineer

Tara@WatersEdgeLTD.ca

(250) 300-3479

APPENDIX A

WESTMAR MEMORANDUM 2006 SEDIMENT TRANSPORT STUDY FOR VERNON YACHT CLUB

Client: VERNON YACHT CLUB**Date: August 2, 2006****Project: MARINA EXPANSION****Project No.: 06150****Subject: SEDIMENT TRANSPORT STUDY****Page 1 of 7**

1 Introduction

The Vernon Yacht Club (VYC) is located on the north end of Okanagan Lake (as shown in *Figure 1 in Appendix A*). The VYC is planning on expanding and replacing the existing marina. The drawing of the planned expansion as provided by the client is contained in *Figure 2 in Appendix A*.

Littoral transport of sediment is produced by waves approaching the shoreline at Oblique Angle A (as indicated in *Figure 3 in Appendix A*). If Angle A is large, the breaking waves will have two effects as follows:

- The waves will put fine sand into suspension and as well as cause a longshore current. These suspended sediments will be transported along the shore.
- Waves are also capable of moving fine gravel. Coarse gravel requires much larger wave heights than would be generated in this area of Okanagan Lake.

A bathymetric survey was carried out by Kerr Wood Leidel (KWL) on July 4, 2006, and the results are provided in *Appendix C* of this project memorandum.

In the Okanagan Lake, wave action is limited by the moderate wind climate and the limited extent of lake over which the wind can blow. This length of open water is referred to as the fetch. The estimated wave climate for the Vernon Yacht Club Marina site is presented in *Table 1* on the following page. The extreme waves are represented by the 1 in 30 year return period, while wave erosion is determined by the 1 in 1 year return period storm, where return period is defined as the average length of time between occurrences of storms of a given magnitude or greater.

In this project memorandum, we are asked to evaluate any changes to the littoral transport of sediment that will be caused by the proposed changes to the marina breakwater and float system. These changes can be observed in *Figure 2 in Appendix A*.

TABLE 1: Wave Heights and Periods (Based on Vernon Airport Wind Data - All Year Scaled 0.88 from NBCC 2005 (Vernon))

Return Period	Probability of Occurrence (%)	North - 1.5 km		North-North-East - 1.6 km		North-East - 1.2 km		West-South-West - 8.8 km		West - 2.8 km		West-North-West - 2.1 km		North-West - 2.4 km		North-North-West - 1.8 km	
		Wave Height (m)	Wave Period (s)	Wave Height (m)	Wave Period (s)	Wave Height (m)	Wave Period (s)	Wave Height (m)	Wave Period (s)	Wave Height (m)	Wave Period (s)	Wave Height (m)	Wave Period (s)	Wave Height (m)	Wave Period (s)	Wave Height (m)	Wave Period (s)
1 in 1 Week	98.1	0.10	1.2	0.07	1.1	0.04	0.9	0.13	1.7	0.19	1.7	0.14	1.5	0.17	1.5	0.06	1.0
1 in 1 Month	92.3	0.16	1.4	0.12	1.3	0.07	1.1	0.35	2.5	0.31	2.0	0.26	1.8	0.25	1.70	0.17	1.5
1 in 1 Year	50.0	0.27	1.7	0.21	1.6	0.14	1.3	0.72	3.2	0.54	2.4	0.49	2.2	0.39	1.99	0.39	1.98
1 in 10 Years	9.1	0.38	1.9	0.31	1.8	0.21	1.5	1.10	3.7	0.76	2.7	0.72	2.5	0.54	2.2	0.62	2.3
1 in 20 Years	4.8	0.41	2.0	0.33	1.9	0.23	1.6	1.22	3.8	0.83	2.8	0.80	2.6	0.58	2.3	0.69	2.4
1 in 30 Years	3.2	0.43	2.0	0.35	1.9	0.24	1.6	1.29	3.9	0.88	2.8	0.84	2.6	0.61	2.3	0.73	2.5

Notes: West-South-West Fetch = 8.8 km is based on the longest fetch length (248° from north).
Wind directions not shown have fetch lengths equal to zero.

2 Existing Conditions

The client has informed us that the marina is currently under expansion in areas indicated as D and E in *Figure 2* in *Appendix A*. The expected changes are labelled Phases 3 through 5 or Docks A, B and C. This previous and proposed arrangement can be viewed in *Figure 2* in *Appendix A*.

A sounding survey was completed by KWL on June 5 2006, and this drawing is provided in *Appendix C*.

Based on the photographs provided for the VYC marina site and included in *Appendix B* herein, there is no indication of any significant erosion, either in the south-west or the north-east of the marina, under the existing marina configuration.

3 Proposed Conditions

The current configuration is outlined in black, with the expansions highlighted in gray. The proposed development consists of the increase of length of the western portion of the walkway (Dock A) with an added breakwater along the north section. Also expected are the increase in length and amount of fingers to the three inner walkways (Docks B, C and D). The eastern dock, labelled Dock E, is to be constructed. Another modification to the existing marina is the construction of a floating "Social Deck". This deck is to be located in the southern portion of the marina. The existing southern fingers and floats are to be removed and replaced.

4 Wind and Wave Study

Wind speeds for 16 compass directions were calculated using Environment Canada Model B wind data from Vernon Airport. The wind data was collected between the years 1864 and 2006. These values were calibrated to the National Building Code of Canada (2005) for Vernon, BC. A summary of design wind speeds for various return periods are given in *Table 2* on the following page. A wind rose for the area was also made and can be found in *Figure 4* in *Appendix A*.

TABLE 2: Design Wind Speeds for Vernon Airport 1864 to 2004 (km/h)

Wind Direction	Occurrence Interval				
	1 Week	1 Month	1 Year	10 Years	30 Years
North	18.6	27.3	39.7	52.2	58.1
North-North-East	13.6	21.2	32.1	42.9	48.1
North-East	9.2	15.9	25.5	35.1	39.7
East-North-East	5.7	11.9	20.7	29.5	33.7
East	9.1	17.3	29.0	40.7	46.3
East-South-East	21.6	35.3	54.9	74.4	83.8
South-East	19.8	26.9	37.1	47.2	52.1
South-South-East	16.5	21.6	28.9	36.2	39.7
South	18.6	26.0	36.6	47.1	52.2
South-South-West	31.1	44.0	62.6	81.1	89.9
South-West	33.4	44.9	61.2	77.6	85.4
West-South-West	18.2	30.5	48.2	65.9	74.3
West	23.5	36.1	54.0	71.9	80.5
West-North-West	20.8	35.4	56.3	77.2	87.2
North-West	79.5	79.5	79.5	79.5	79.5
North-North-West	10.9	26.8	49.5	72.2	83.0
All	40.2	50.9	66.2	81.6	88.9

Using the wind speeds for the 16 sectors given above, wind generated design waves were calculated based on the methodology outline in the Shore Protection Manual (1984) and Coastal Engineering Design Manual, Draft Edition (2001). *Table 1* summarizes the design wave heights at the YVC marina site.

5 Grain Size Analysis

Soil samples were supplied by the client, and were taken from the locations labelled Site 1-8, which are indicated *Figure 2* in *Appendix A*. The samples were then analyzed for grain size distribution. The results are located in the *Appendix D* of this report. In general, the sand sizes (gravelly sand to sand) are quite similar for all the sites. Slightly finer sediments occur within the yacht club basin. Coarser grains are located to the west of the marina. This coarseness is due to the large wave action from the south-west direction. The wave action moves the fines along the shoreline into the yacht club basin. A summary of the D_{50} is given in *Table 3* on the following page. The definition of D_{50} is the diameter of particle that comprises 50% of the sample.

TABLE 3: D_{50} of Samples

Site	D_{50} (mm)
1	0.275
2	0.324
3	0.397
4	0.833
5	0.564
6	0.343
7	0.380
8	0.354

6 Littoral Drift

6.1 Wave Attack from the South-West to North-West

The shoreline to the west of the existing marina lies in the direction of 230° from north. This allows waves to approach from the south-west to the north-west directions. The breakwater on this western side is not being changed. Therefore, the proposed changes to the marina do not alter this westerly wave attack. No change to the littoral drift processes are expected on the south-west side of the marina.

6.2 Wave Attack from the North-West to North-North-East

The proposed new floating breakwater along the north-north-west boundary of the marina will be more effective in reducing wave attack from this direction. The existing log boom breakwater would probably generate no significant reduction in waves greater than a two second period (the time it takes for wave crests to pass a fixed point). The new floating breakwater is assumed to reduce the 1 to 1.3 m waves to 0.25 m. This new breakwater will reduce wave attack approaching from the north-west to north-north-east. The waves that travel in this direction approach approximately perpendicular to the shoreline. Even with no breakwater in this area, these waves would produce limited alongshore sediment transport. The reduction of waves by the new breakwater will not significantly change the present sediment regime.

6.3 Wave Attack from the North-North-East to East-North-East

The shoreline on the City of Vernon side of the marina lies in the east-north-east direction. Wave action from the north-north-west to east-north-east will not be changed by the proposed new breakwater and floats. The wave attack from these directions is moderate and is expected to be unchanged from the present conditions. Photographs of this region do not indicate any ongoing erosion, and therefore it is concluded that the proposed changes to the marina will not change the existing sediment regime in the area.

7 Conclusion

The main wave attack is from the south-west to south-south-west direction. From this direction, there is no proposed change to the breakwater system and therefore, there will be no change to the existing littoral transport regime on either side of the marina due to waves from these wind directions.

A new breakwater is proposed for the north-north-west side of the marina. This breakwater replaces an existing floating log boom. The new breakwater will reduce the waves from the north-west to north sector, such that a 1 m wave approaching the shoreline will be of the order of 0.25 m.

The wave attack under the existing conditions, as with the proposed new breakwater, is almost perpendicular to the shoreline. This type of wave attack induces very little littoral transport. The expansion of the marina is not expected to produce any significant change to the longshore transport inshore to the existing marina.

The wave attack from the north-east side of the marina is mild, because of the limited fetch length. Wave attack from this direction will not be changed by the proposed development of north breakwater and floats. Thus, the littoral transport adjacent to the marina will not be changed by the modifications.

There will be a benign effect on the littoral drift effect from the Vernon Yacht Club expansion plan.

End of Project Memorandum

Prepared by:

[Original signed by Holly Monaghan]

Holly Monaghan, E.I.T.

Approved by:

[Original signed by Dr. Michael Quick]

Dr. Michael Quick
Professor Emeritus, UBC

HAM/tmw
Encl. 4

cc: John Mackie, Department of Fisheries and Oceans
Norman Allyn, Westmar Consultants Inc.

APPENDIX A

Figures

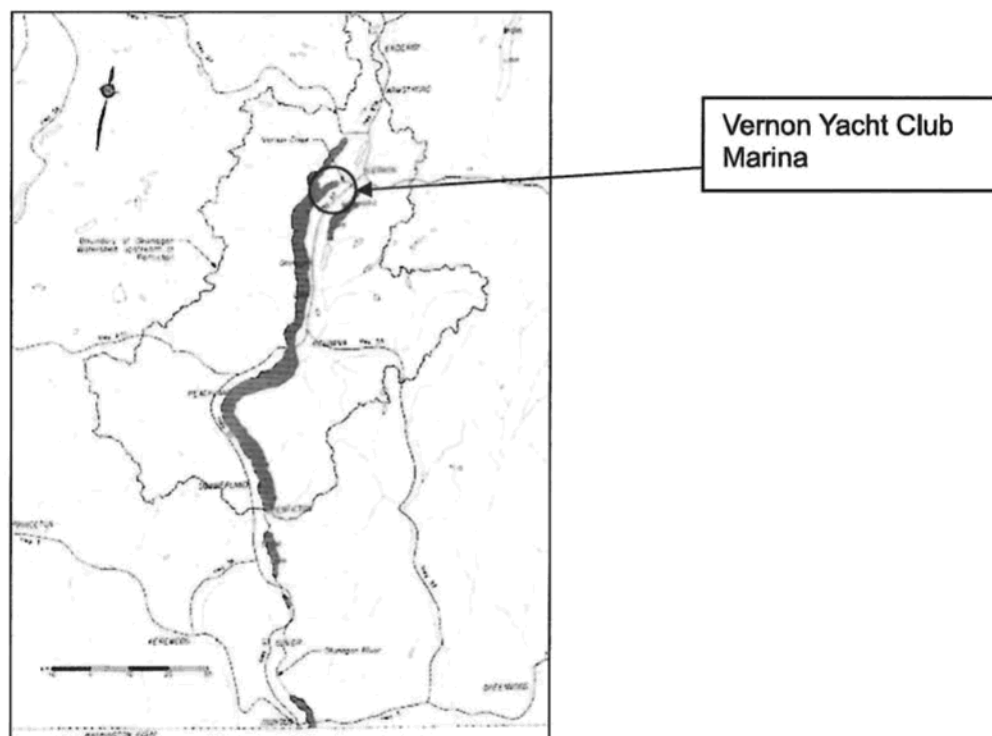


Figure 1: Vernon Yacht Club - Location Map

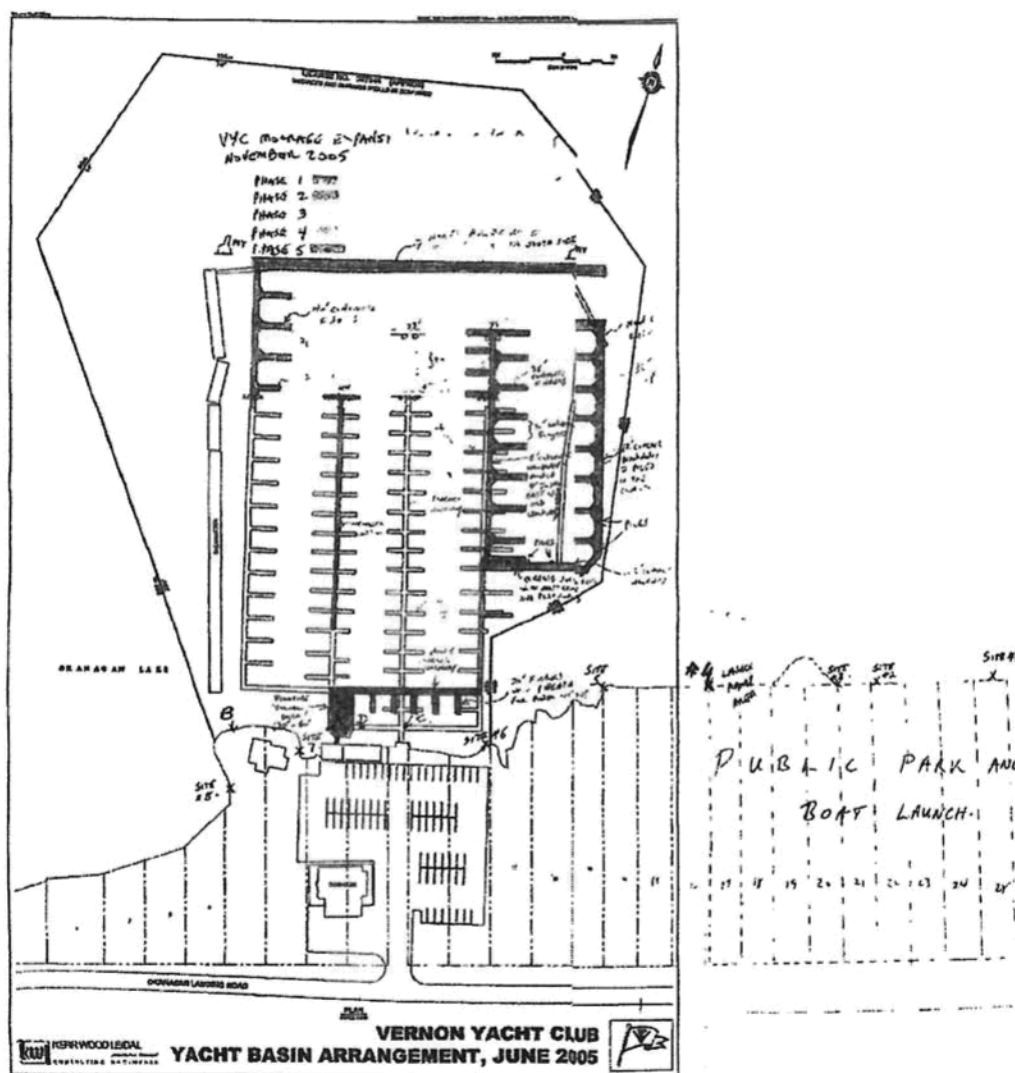


Figure 2: Vernon Yacht Club - Yacht Basin Arrangement

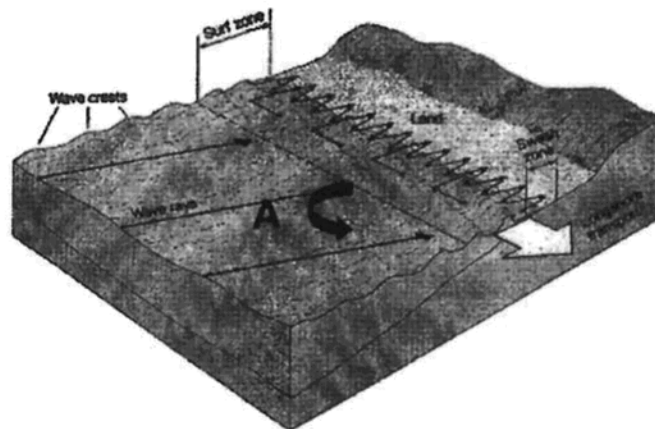


Figure 3: Littoral Drift Process (Note Wave Rays are Perpendicular to the Wave Crests)

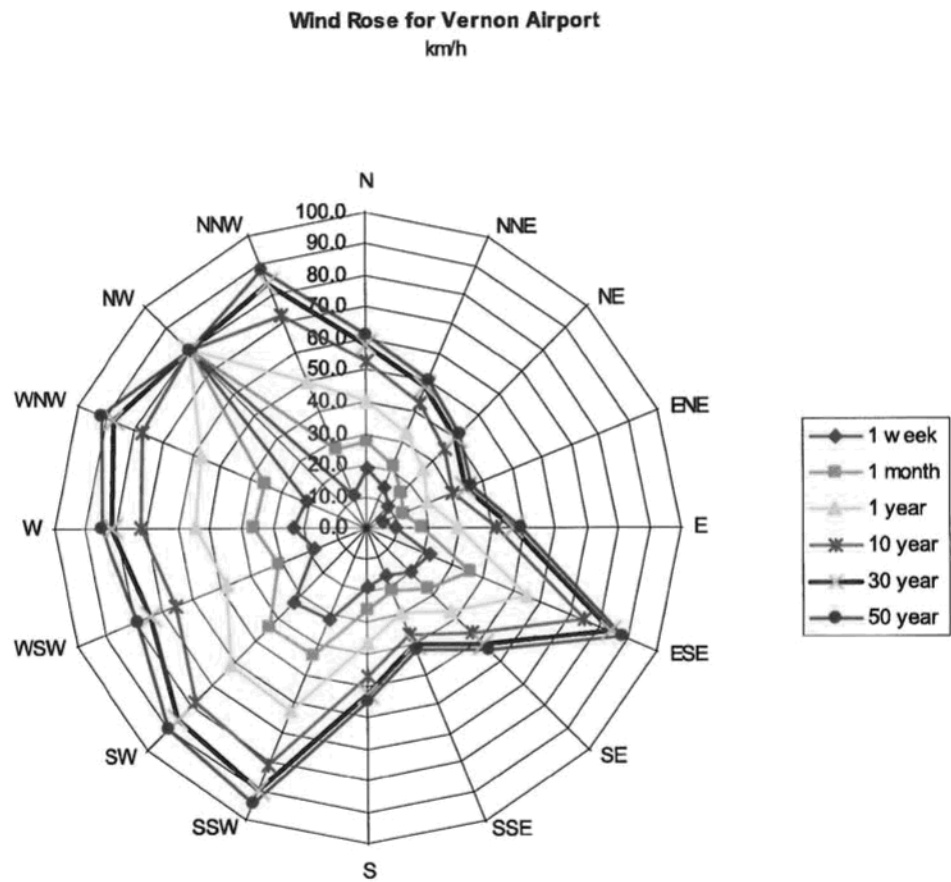


Figure 4: Wind Rose for Vernon Airport

APPENDIX B

Photographs

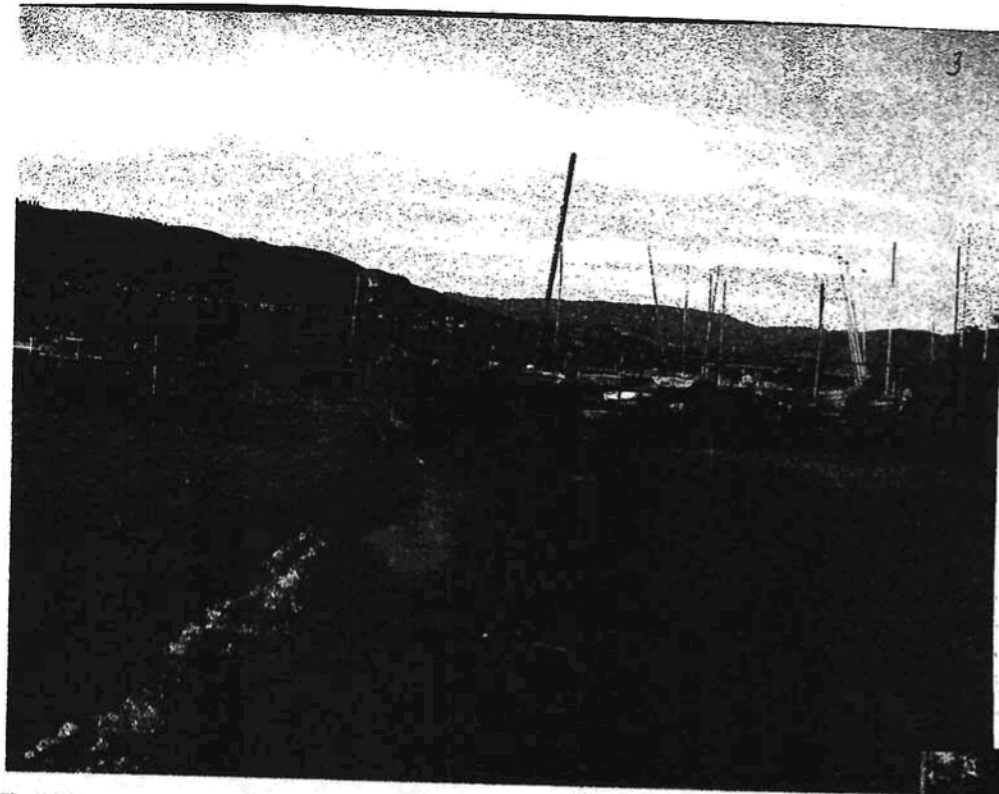
s.22

1
SITE #1. SANDY BEACH IN A PUBLIC
PARK. SAND IS CLEARED AND
← GROOMED DAILY IN THE SPRING,
SUMMER AND FALL (APRIL-OCTOBER)

SITE #1 LOOKING S. WEST →
ALONG THE BEACH.

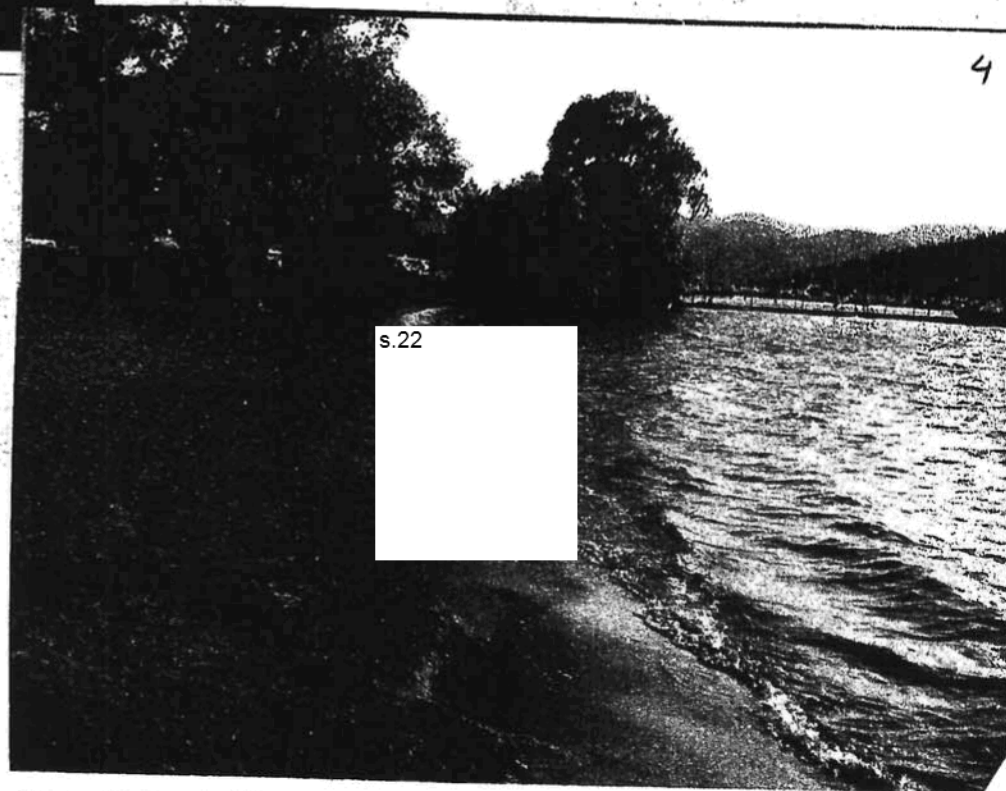
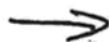
IN THE BACKGROUND BEYOND
THE TREES IS A PUBLIC
BOAT LAUNCH AND THE
VERNON YACHT CLUB.

2
s.22



← SITE #1. LOOKING N. EAST
ALONG THE BEACH TOWARD THE
N. OKANAGAN SAILING ASSOC.
COMPOUND. NOTICE THAT THE
BEACH HAS BEEN GROOMED.

SITE #2



5 SITE #3. - THE S. WEST END OF
THE PUBLIC BEACH. THE FORESHORE
IS RIP RAPPED TO PROTECT THE
BOAT LAUNCH CAR PARK AND STORM
DRAIN: THE OUTFALL OF THE
STORM DRAIN CULVERT IS VISIBLE
AS A METAL GRATING UNDER
THE TREES.



SITE #4 THE OTHER SIDE OF THE
BOAT LAUNCH FROM SITE #3





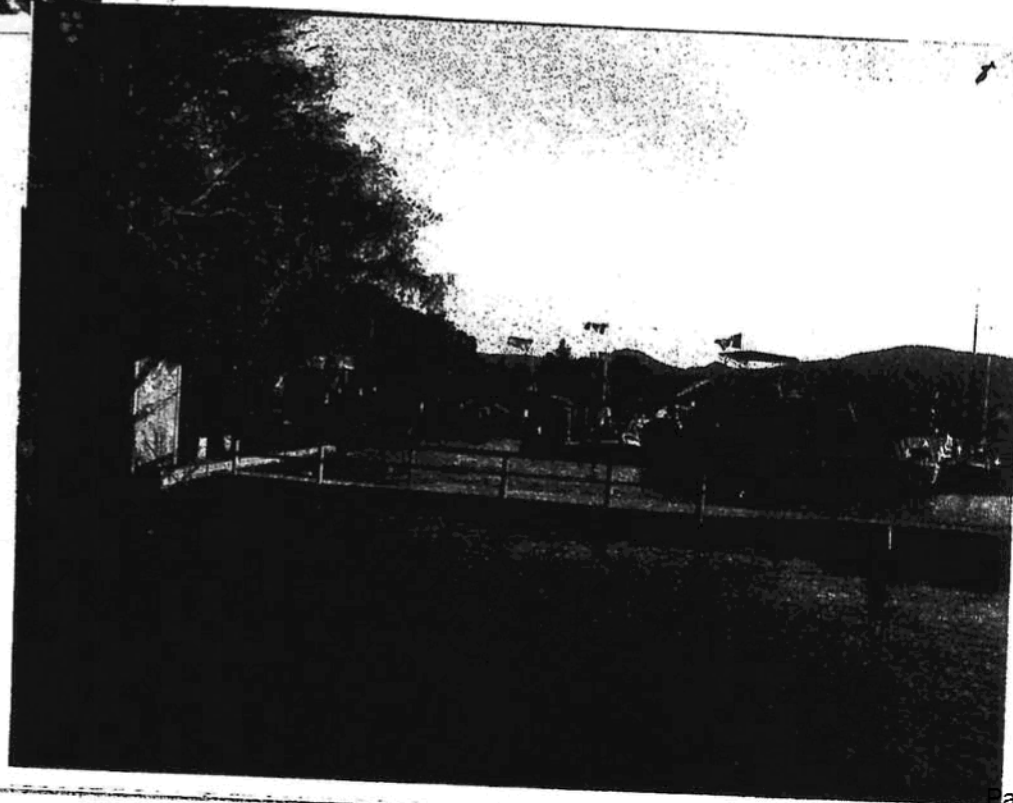
VIEW TOWARD THE YACHT CLUB
LOOKING S. WEST FROM THE
GATED DOCK IN SITE 5.

NOTE THE RETAINING WALL
ALONG FROM THE SHED. THIS IS
SHOWN AGAIN ON THE VIEW FROM
SITE 6.

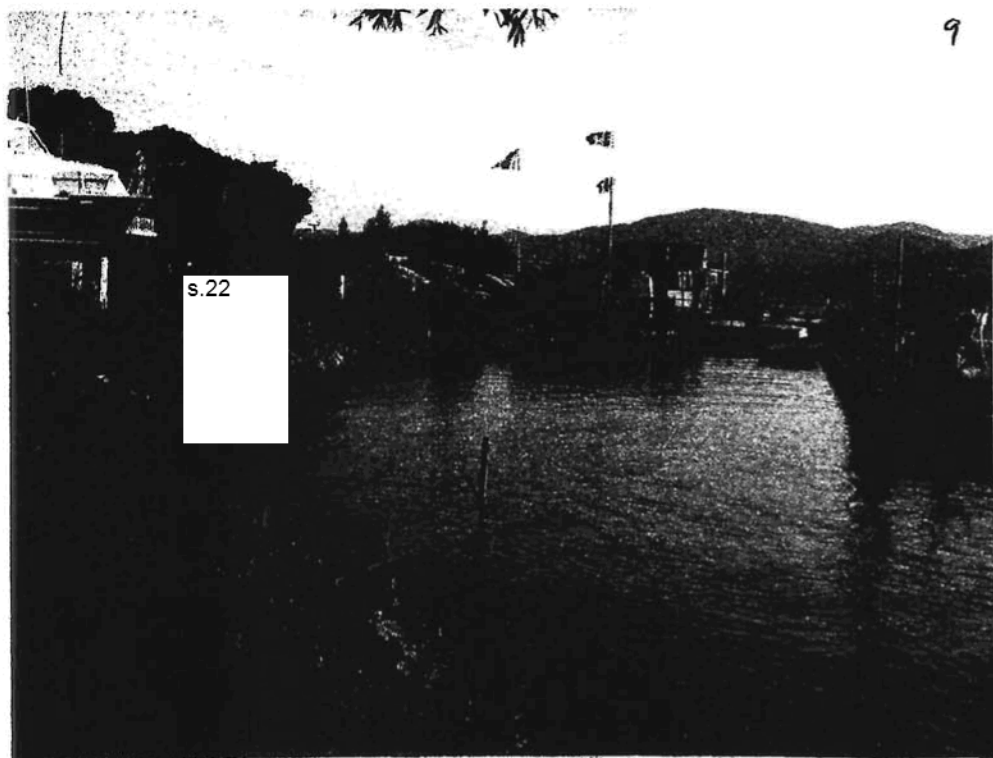
7

SITE 5. AT THE S. WEST END OF
THE FORESHORE BETWEEN THE
BOAT LAUNCH AND THE YACHT
CLUB. NOTE THE PRIVATE, GATED
DOCK.

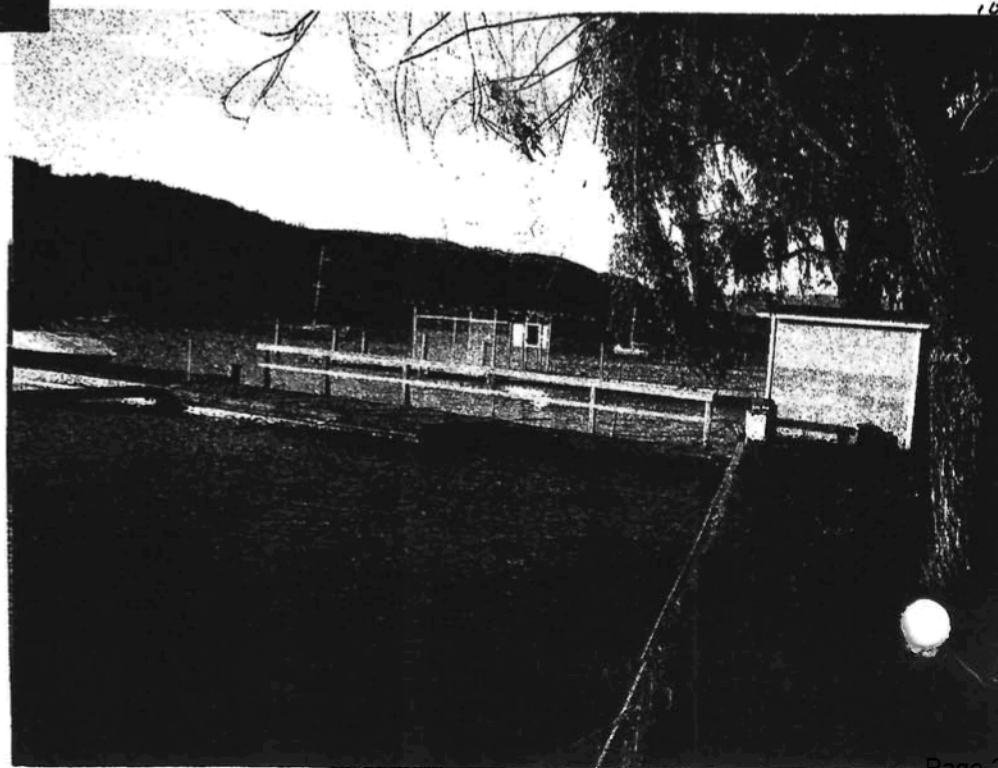
THIS FORESHORE IS PART OF THE
PARK AND IS USED TO LAUNCH
CANOES AND REFUEL FLOAT
PLANES.



9 SITE 6. N. EAST CORNER OF THE VERNON
YACHT CLUB PROPERTY.



VIEW TO THE N EAST FROM SITE 6
YOU CAN SEE THE GATED DOCK
VISIBLE IN SITE 5.



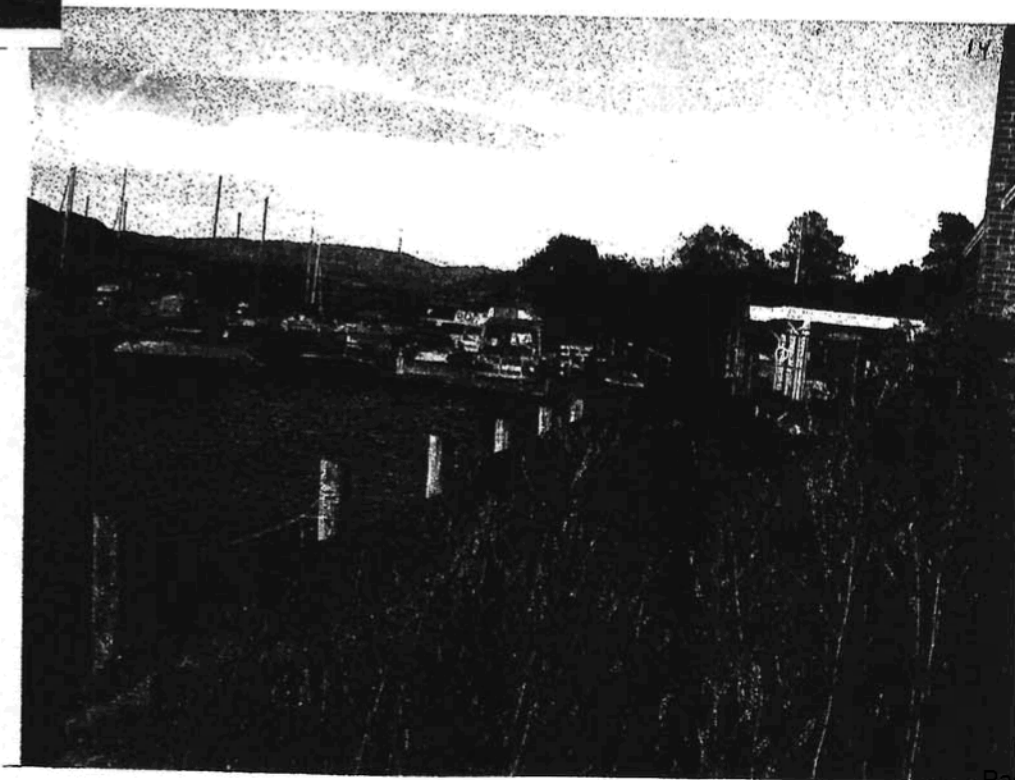
s.22

"

SITE #7. PHOTO TAKEN FROM POINT
'A' ON THE PLAN OF THE YACHT
CLUB'S DOCKS.

SITE #7 ~~WAS~~ IS THE OLD YACHT
CLUB BOAT LAUNCH RAMP.

VIEW FROM POINT 'B' LOOKING
N EAST ALONG THE FORESHORE IN
FRONT OF THE OLD BUILDING

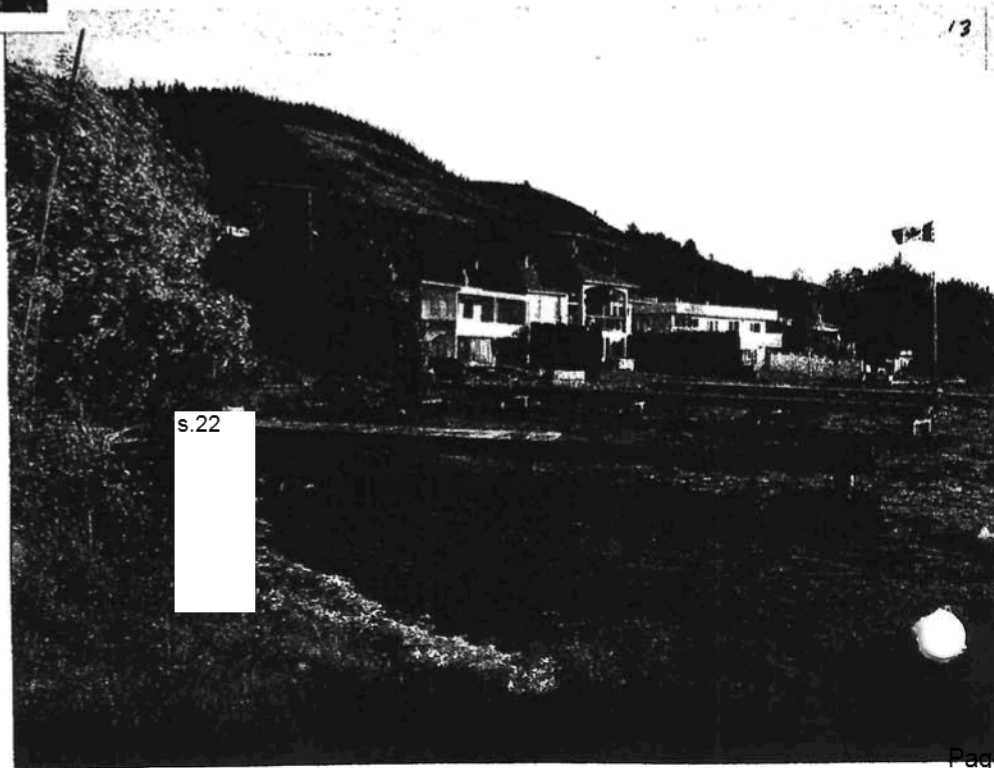




VIEW OF SITE #8 FROM POINT 'B'.

SITE #8' S. WEST EDGE OF THE
YACHT CLUB'S FORESHORE.

ALL THE PROPERTIES S. WEST OF
THE CLUB HAVE CONSTRUCTED
RETAINING WALLS AND DOCKS

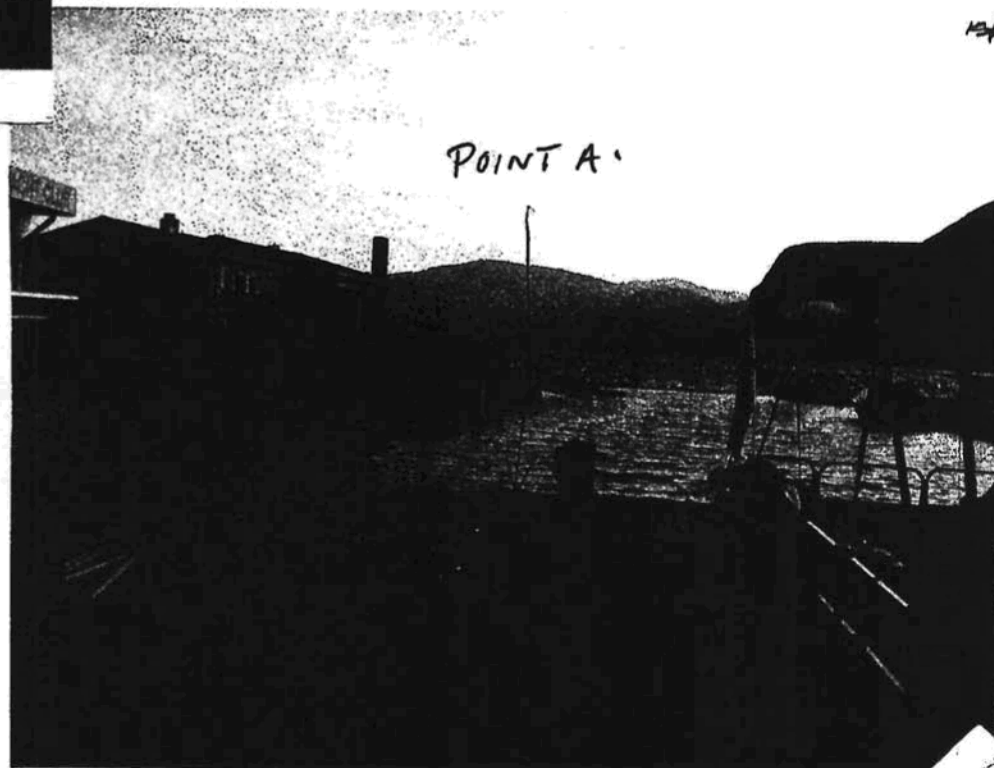




R

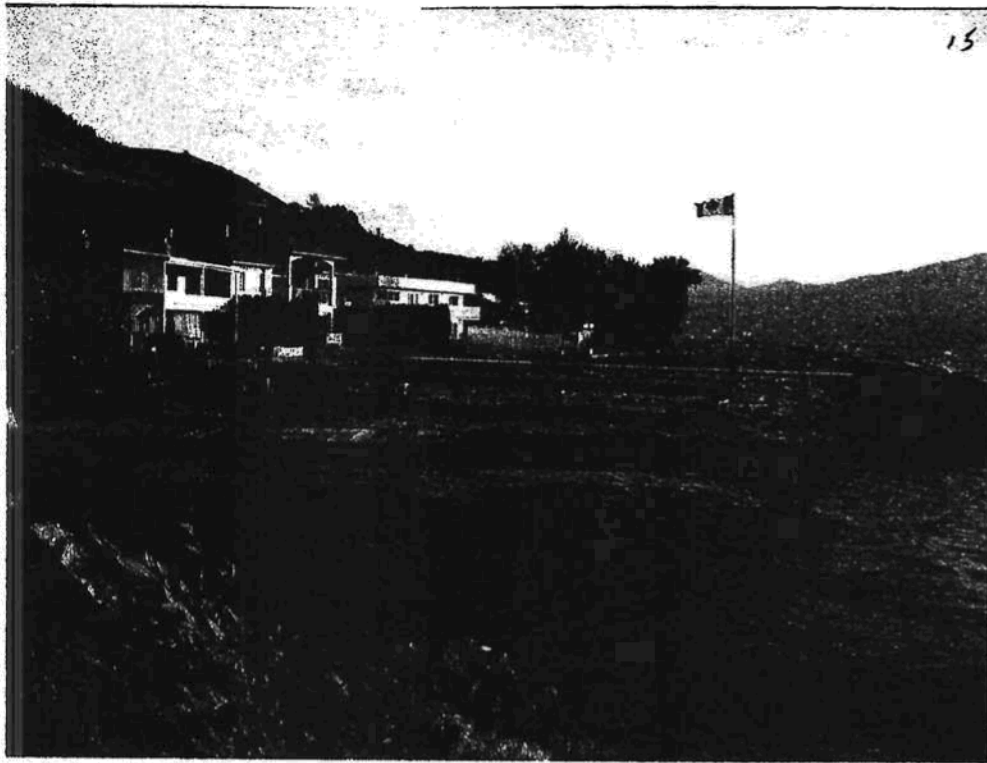
VIEW OF THE FORESHORE WITHIN
THE YACHT CLUB LOOKING TOWARD
THE ENTRANCE. TAKEN FROM POINT 'C'
LOOKING S. WEST

VIEW OF THE FORESHORE IN FRONT
OF THE OLD BUILDING. TAKEN
FROM POINT D.



POINT A.

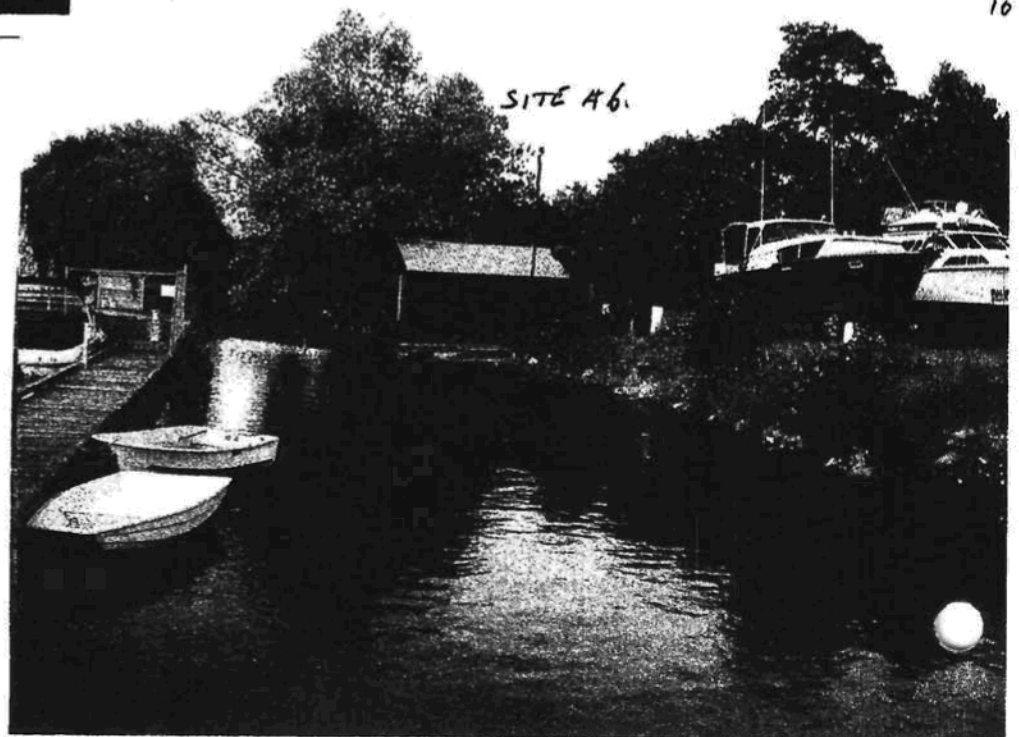
134



VIEW FROM SITE 8 LOOKING
S.WEST

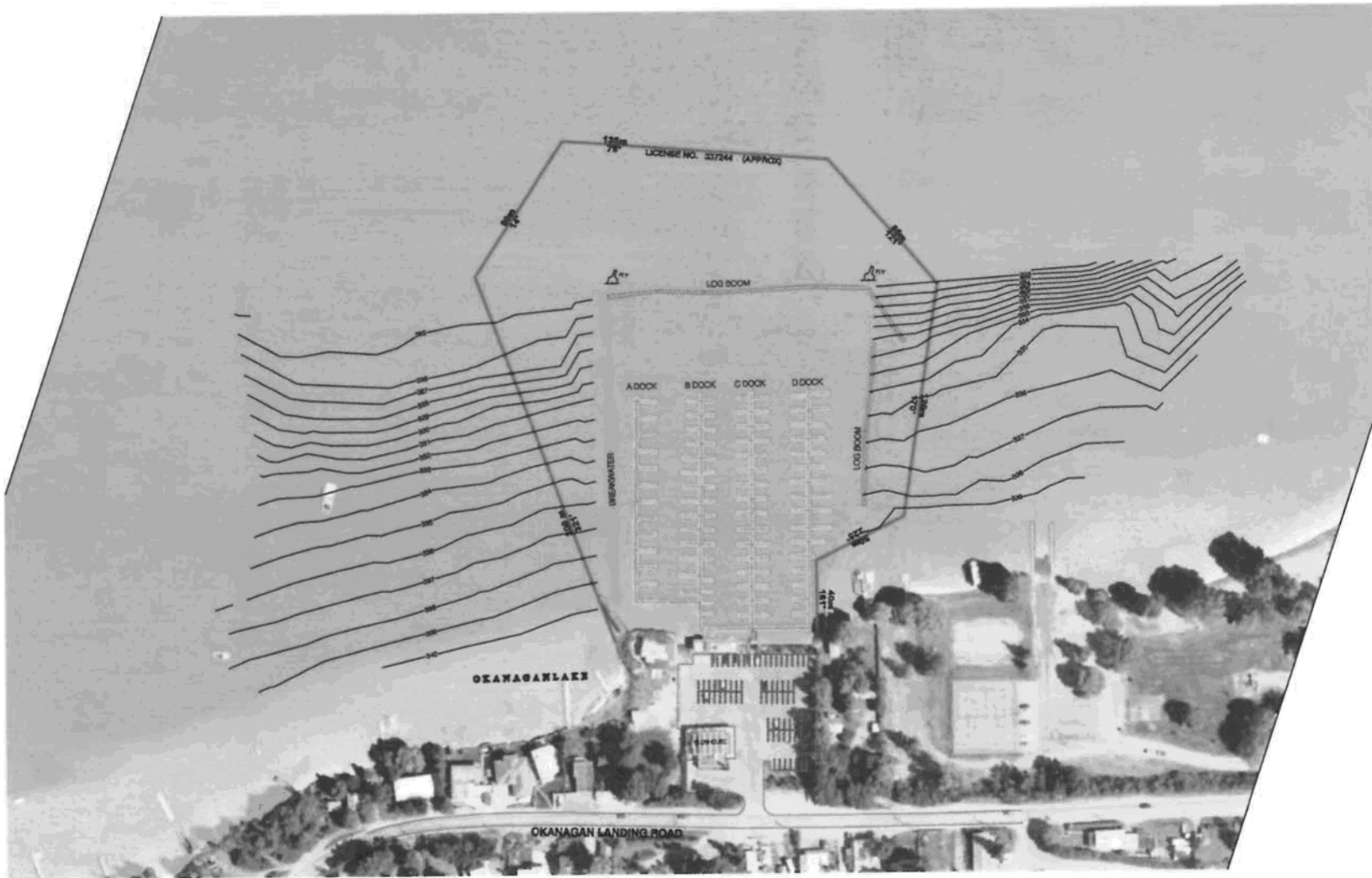
THE PREVAILING WINDS ARE
FROM THE WEST SOUTH WEST
AND THE FORESHORE DRIFT IS
FROM THE S.WEST

VIEW OF SITE #6 FROM THE
YACHT CLUB DOCKS. VIEW
TAKEN FROM POINT 'C'.
LOOKING N. EAST.



APPENDIX C

Sounding Survey



kwl KERR WOOD LEIDAL
associates limited
CONSULTING ENGINEERS

40 0 40
Scale in Metres

 **BATHYMETRIC SURVEY
VERNON YACHT CLUB**

APPENDIX D

Grain Size

SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE ASTM C136



July 7, 2006

WESTMAR CONSULTANTS INC.
400 - 233 West 1st Street
North Vancouver, BC V7M 1B3

JOB NUMBER: 06-1416-071
SAMPLE NUMBER: 1

ATTENTION: Holly Monaghan, EIT

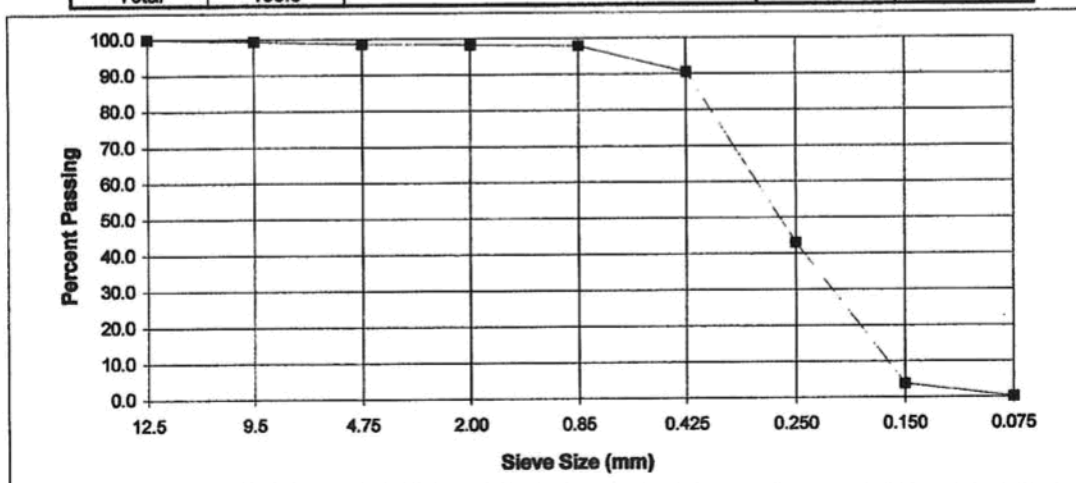
PROJECT: Grain Size Analysis

Sample:	Vernon Yacht Club #1
---------	----------------------

DATE SAMPLED: June 1, 2006

SAMPLED BY: Client

SIEVE ANALYSIS						
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)			
			+ 4.75	- 4.75		
75	0.0	100.0	0.0			
50	0.0	100.0	0.0			
37.5	0.0	100.0	0.0			
25	0.0	100.0	0.0			
19	0.0	100.0	0.0			
12.5	0.0	100.0	0.0			
9.5	0.5	99.5	40.6			
4.75	0.8	98.6	59.4			
2.00	0.4	98.3		0.4		
0.85	0.4	97.9		0.4		
0.425	7.4	90.5		7.5		
0.250	47.4	43.1		48.1		
0.150	39.3	3.8		39.8		
0.075	3.6	0.2		3.6		
PAN	0.2			0.2		
Total	100.0					



Remarks:

Fineness Modulus : 1.62

Reported by:

AS
AS

Reviewed by:

OSO
OSO

Notice: The test data given herein pertain to the sample provided and may not be applicable to material from other production zones. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE ASTM C136



July 7, 2006

WESTMAR CONSULTANTS INC.
400 - 233 West 1st Street
North Vancouver, BC V7M 1B3

JOB NUMBER: 06-1416-071
SAMPLE NUMBER: 2

ATTENTION: Holly Monaghan, EIT

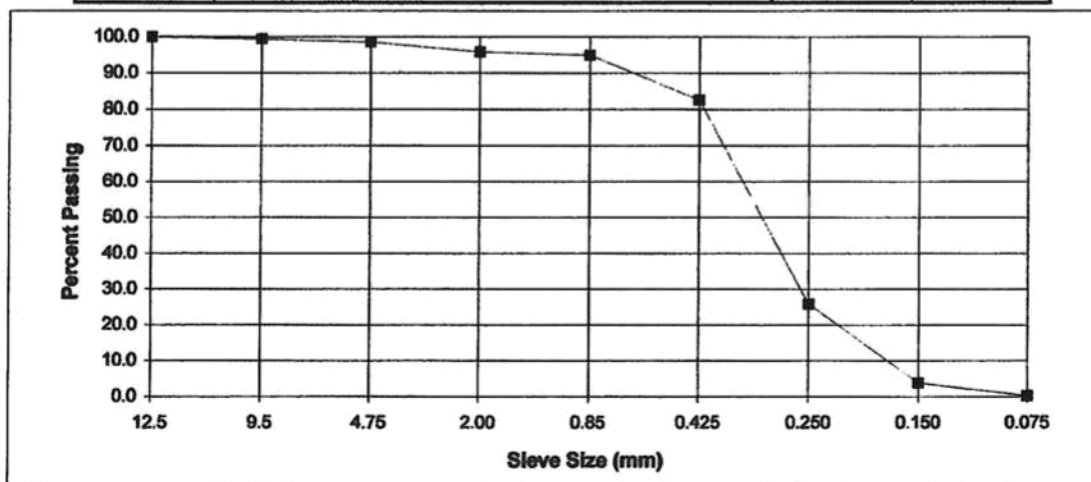
PROJECT: Grain Size Analysis

Sample:	Vernon Yacht Club #2
---------	----------------------

DATE SAMPLED: June 1, 2006

SAMPLED BY: Client

SIEVE ANALYSIS				
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)	
			+ 4.75	- 4.75
75	0.0	100.0	0.0	
50	0.0	100.0	0.0	
37.5	0.0	100.0	0.0	
25	0.0	100.0	0.0	
19	0.0	100.0	0.0	
12.5	0.0	100.0	0.0	
9.5	0.5	99.5	38.5	
4.75	0.9	98.6	61.5	
2.00	2.7	95.9		2.8
0.85	0.9	95.0		0.9
0.425	12.4	82.6		12.5
0.250	56.8	25.9		57.6
0.150	22.1	3.8		22.4
0.075	3.5	0.3		3.6
PAN	0.3			0.3
Total	100.0			



Remarks:

Fineness Modulus : 1.92

Reported by:

AS
AS

Reviewed by:

OSO
OSO

Notice: The test data given herein pertain to the sample provided and may not be applicable to material from other production zones. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE ASTM C136



July 7, 2006

WESTMAR CONSULTANTS INC.
400 - 233 West 1st Street
North Vancouver, BC V7M 1B3

JOB NUMBER: 06-1416-071
SAMPLE NUMBER: 3

ATTENTION: Holly Monaghan, EIT

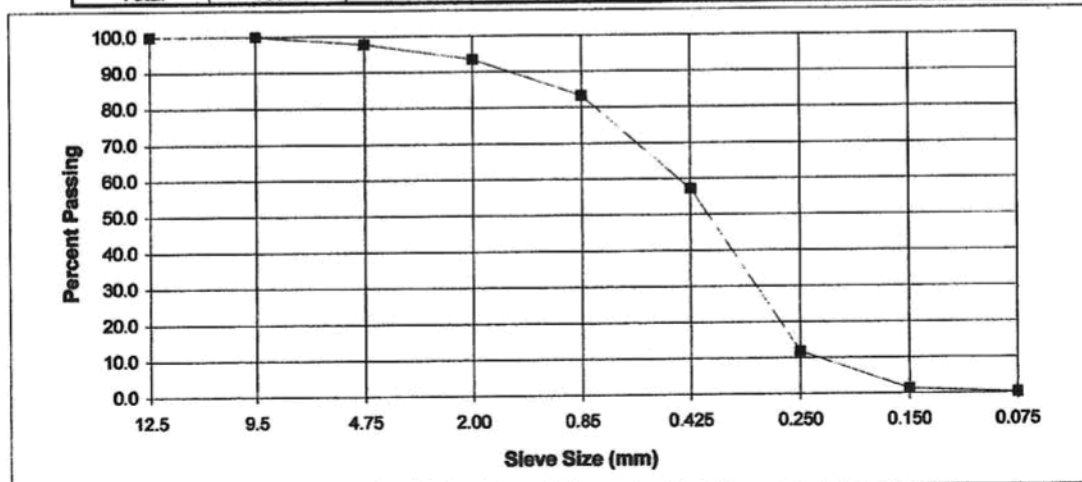
PROJECT: Grain Size Analysis

Sample:	Vernon Yacht Club #3
---------	----------------------

DATE SAMPLED: June 1, 2006

SAMPLED BY: Client

SIEVE ANALYSIS						
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)			
			+ 4.75	- 4.75		
75	0.0	100.0	0.0			
50	0.0	100.0	0.0			
37.5	0.0	100.0	0.0			
25	0.0	100.0	0.0			
19	0.0	100.0	0.0			
12.5	0.0	100.0	0.0			
9.5	0.0	100.0	0.0			
4.75	2.2	97.8	100.0			
2.00	4.3	93.5		4.4		
0.85	10.2	83.3		10.4		
0.425	26.1	57.2		26.6		
0.250	45.4	11.8		46.4		
0.150	10.4	1.4		10.7		
0.075	1.1	0.3		1.1		
PAN	0.3			0.3		
Total	100.0					



Remarks:

Fineness Modulus : 2.47

Reported by:

AS
AS

Reviewed by:

OSO
OSO

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SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE ASTM C136



July 7, 2006

WESTMAR CONSULTANTS INC.
400 - 233 West 1st Street
North Vancouver, BC V7M 1B3

JOB NUMBER: 06-1416-071
SAMPLE NUMBER: 4

ATTENTION: Holly Monaghan, EIT

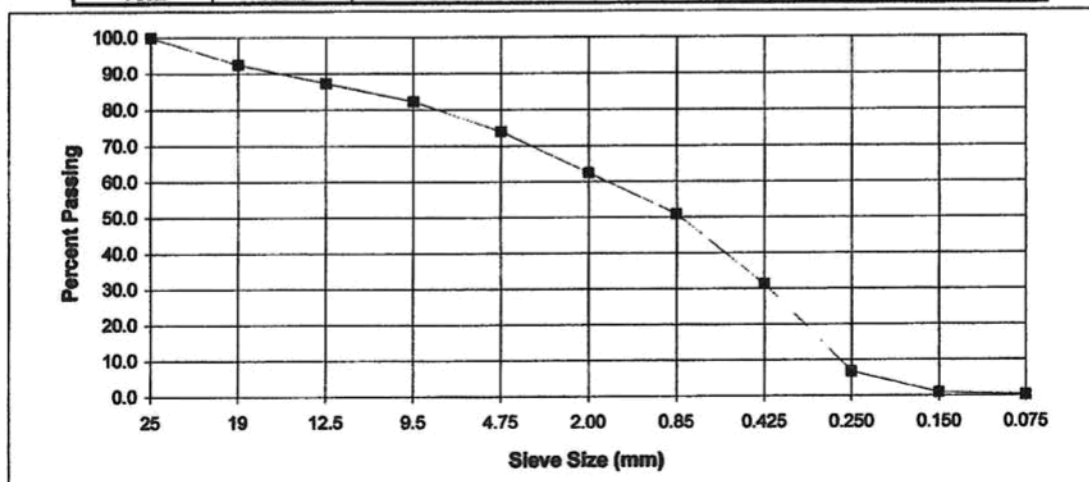
PROJECT: Grain Size Analysis

Sample:	Vernon Yacht Club #4
---------	----------------------

DATE SAMPLED: June 1, 2006

SAMPLED BY: Client

SIEVE ANALYSIS				
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)	
			+ 4.75	- 4.75
75	0.0	100.0	0.0	
50	0.0	100.0	0.0	
37.5	0.0	100.0	0.0	
25	0.0	100.0	0.0	
19	7.5	92.5	28.9	
12.5	5.1	87.3	19.7	
9.5	5.0	82.3	19.2	
4.75	8.4	73.9	32.2	
2.00	11.4	62.5		15.5
0.85	11.6	50.8		15.7
0.425	19.5	31.3		26.4
0.250	24.6	6.7		33.2
0.150	5.8	1.0		7.8
0.075	0.7	0.3		0.9
PAN	0.3			0.4
Total	100.0			



Remarks:

Fineness Modulus : 2.94

Reported by:

AS
AS

Reviewed by:

OSO
OSO

Notice: The test data given herein pertain to the sample provided and may not be applicable to material from other production zones. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE ASTM C136



July 7, 2006

WESTMAR CONSULTANTS INC.
400 - 233 West 1st Street
North Vancouver, BC V7M 1B3

JOB NUMBER: 06-1416-071
SAMPLE NUMBER: 5

ATTENTION: Holly Monaghan, EIT

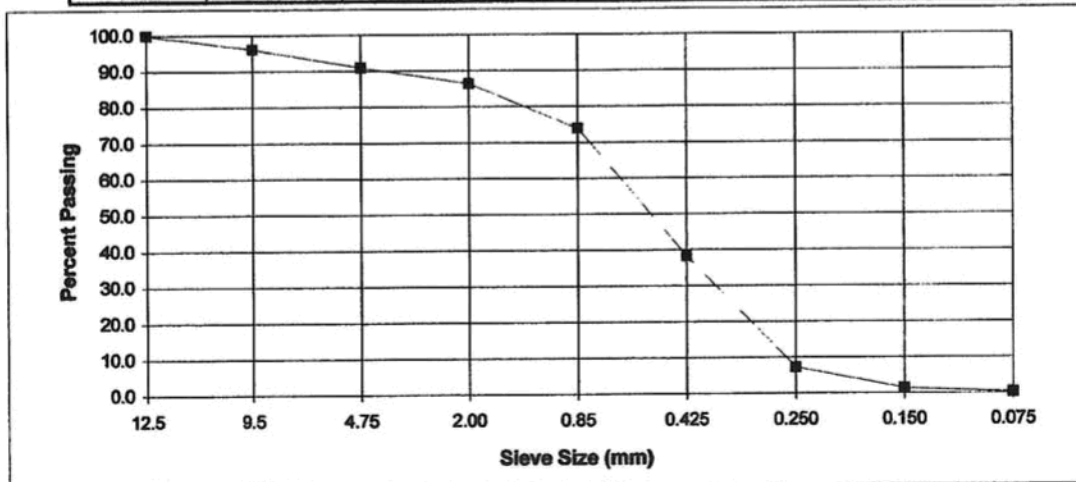
PROJECT: Grain Size Analysis

Sample:	Vernon Yacht Club #5
---------	----------------------

DATE SAMPLED: June 1, 2006

SAMPLED BY: Client

SIEVE ANALYSIS				
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)	
			+ 4.75	- 4.75
75	0.0	100.0	0.0	
50	0.0	100.0	0.0	
37.5	0.0	100.0	0.0	
25	0.0	100.0	0.0	
19	0.0	100.0	0.0	
12.5	0.0	100.0	0.0	
9.5	3.9	96.1	43.1	
4.75	5.2	90.9	56.9	
2.00	4.5	86.5		4.9
0.85	12.5	73.9		13.8
0.425	35.5	38.4		39.1
0.250	31.1	7.3		34.2
0.150	5.8	1.4		6.4
0.075	1.2	0.3		1.3
PAN	0.2			0.3
Total	100.0			



Remarks:

Fineness Modulus : 2.72

Reported by:

AS

Reviewed by:

OSO

Notice: The test data given herein pertain to the sample provided and may not be applicable to material from other production zones. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE ASTM C136



July 7, 2006

WESTMAR CONSULTANTS INC.
400 - 233 West 1st Street
North Vancouver, BC V7M 1B3

JOB NUMBER: 06-1416-071
SAMPLE NUMBER: 6

ATTENTION: Holly Monaghan, EIT

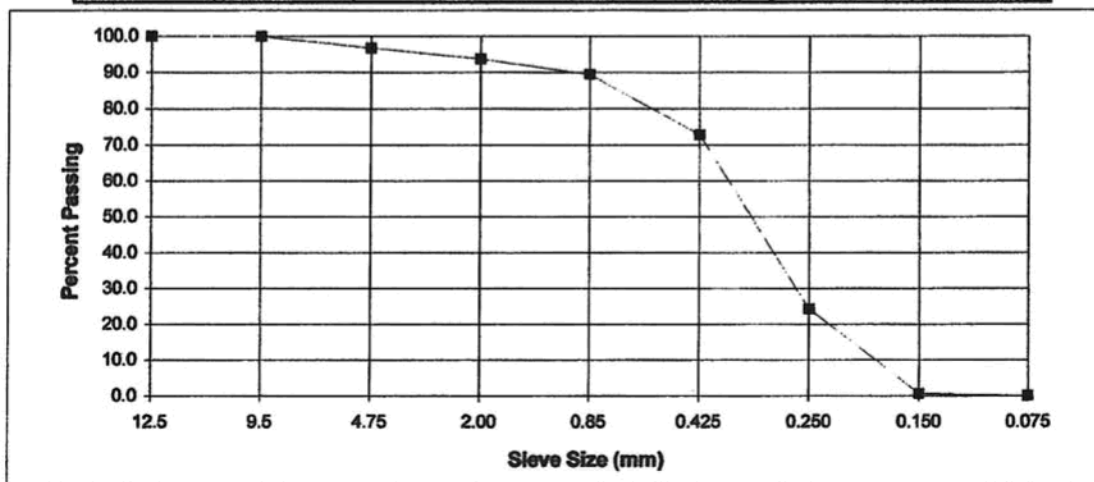
PROJECT: Grain Size Analysis

Sample:	Vernon Yacht Club #6
---------	----------------------

DATE SAMPLED: June 1, 2006

SAMPLED BY: Client

SIEVE ANALYSIS				
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)	
			+ 4.75	- 4.75
75	0.0	100.0	0.0	
50	0.0	100.0	0.0	
37.5	0.0	100.0	0.0	
25	0.0	100.0	0.0	
19	0.0	100.0	0.0	
12.5	0.0	100.0	0.0	
9.5	0.0	100.0	0.0	
4.75	3.3	96.7	100.0	
2.00	3.0	93.7		3.1
0.85	4.3	89.5		4.4
0.425	16.6	72.8		17.2
0.250	48.6	24.2		50.3
0.150	23.6	0.6		24.4
0.075	0.6	0.1		0.6
PAN	0.1			0.1
Total	100.0			



Remarks:

Fineness Modulus : 2.10

Reported by:

AS
AS

Reviewed by:

OSO
OSO

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SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE ASTM C136 & C117



July 7, 2006

WESTMAR CONSULTANTS INC.
400 - 233 West 1st Street
North Vancouver, BC V7M 1B3

JOB NUMBER: 06-1416-071
SAMPLE NUMBER: 7

ATTENTION: Holly Monaghan, EIT

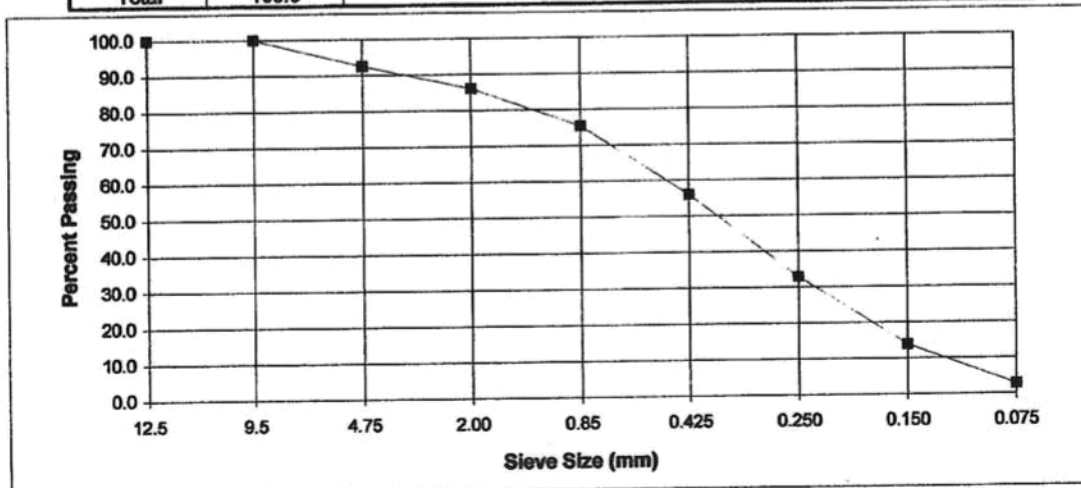
PROJECT: Grain Size Analysis

Sample:	Vernon Yacht Club #7
---------	----------------------

DATE SAMPLED: June 1, 2006

SAMPLED BY: Client

SIEVE ANALYSIS				
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)	
			+ 4.75	- 4.75
75	0.0	100.0	0.0	
50	0.0	100.0	0.0	
37.5	0.0	100.0	0.0	
25	0.0	100.0	0.0	
19	0.0	100.0	0.0	
12.5	0.0	100.0	0.0	
9.5	0.0	100.0	0.0	
4.75	7.4	92.6	100.0	
2.00	6.5	86.1		7.0
0.85	10.7	75.5		11.5
0.425	19.5	55.9		21.1
0.250	23.1	32.8		25.0
0.150	19.0	13.8		20.6
0.075	11.0	2.8		11.9
PAN	2.8			3.0
Total	100.0			



Remarks:

Fineness Modulus : 2.15

Reported by:

AS
AS

Reviewed by:

OSO
OSO

Notice: The test data given herein pertain to the sample provided and may not be applicable to material from other production zones. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE ASTM C136



July 7, 2006

WESTMAR CONSULTANTS INC.
400 - 233 West 1st Street
North Vancouver, BC V7M 1B3

JOB NUMBER: 06-1416-071
SAMPLE NUMBER: 8

ATTENTION: Holly Monaghan, EIT

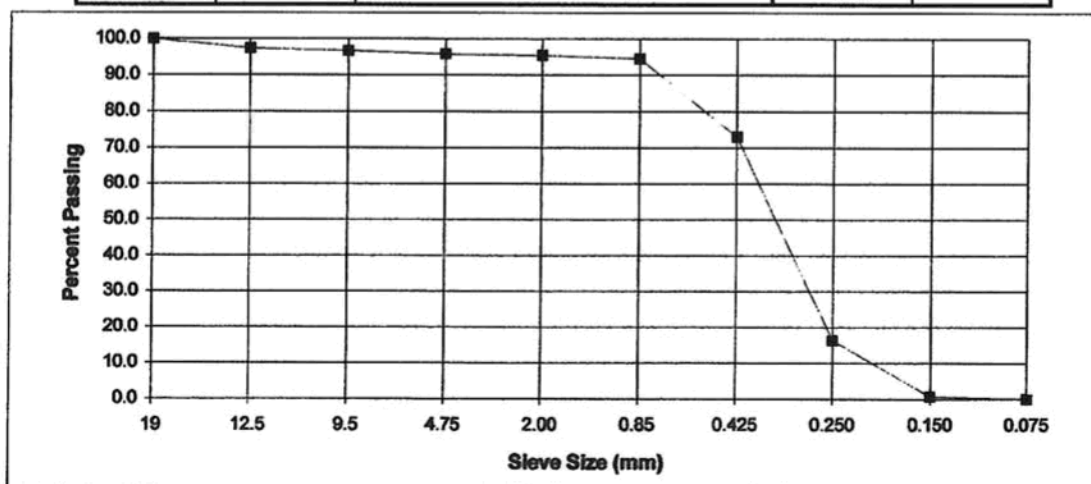
PROJECT: Grain Size Analysis

Sample:	Vernon Yacht Club #8
---------	----------------------

DATE SAMPLED: June 1, 2006

SAMPLED BY: Client

SIEVE ANALYSIS				
Sieve Size (mm)	% Retained	% Passing	Individual % Retained (Split values)	
			+ 4.75	- 4.75
75	0.0	100.0	0.0	
50	0.0	100.0	0.0	
37.5	0.0	100.0	0.0	
25	0.0	100.0	0.0	
19	0.0	100.0	0.0	
12.5	2.6	97.4	62.7	
9.5	0.7	96.7	16.6	
4.75	0.9	95.8	20.7	
2.00	0.3	95.4		0.4
0.85	0.9	94.6		0.9
0.425	21.5	73.0		22.5
0.250	56.8	16.3		59.3
0.150	15.5	0.7		16.2
0.075	0.6	0.1		0.7
PAN	0.1			0.1
Total	100.0			



Remarks:

Fineness Modulus : 2.08

Reported by:

AS
AS

Reviewed by:

OSO
OSO

Notice: The test data given herein pertain to the sample provided and may not be applicable to material from other production zones. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.

APPENDIX B

WESTMAR 1997

WAVES AND FORCING FOR VERNON YACHT CLUB BREAKWATER

VALLEY PILE DRIVING & MARINE CONSTRUCTION

#431- 8104 36th Avenue, Vernon, BC V1T 9M9 Cell: 250-558-9454

Certified Commercial Diving Service

5 PAGES

SEPT 15, 2014

CRAIG WILLIAMS.

FAX: 250-558-1100

CRAIG, THIS IS ALL THE INFORMATION I CAN FIND.
THIS MAY GIVE YOU AN IDEA OF THE INFORMATION
REQUESTED.

REGARDS,

BRENT

Dock Construction, Rebuild & Repairs - Piles, Timber, Concrete & Steel
Exclusive Dynast Dock Flotation Systems - Permit Services & Project Design
Consultation, Survey & Engineering Services - Retaining Wall & Bulkhead Construction



WESTMAR CONSULTANTS INC.

Project	Killarney Beach	By	NH	Date	Oct 12/12	Page	of
Subject		Ckd		Date		Job No.	97627

Focus on Bundles Log Breakwater.

Wind

Wind

$$1 \text{ in } 20 \text{ years}, V = 103 \text{ mph}, p = .53 \text{ hpa} = 11 \text{ psf}, f = 1.3 \times 11 \times 2 \text{ hgt} = 29 \text{ lb/ft}$$

$$1 \text{ in } 100 \text{ years}, V = 117 \text{ mph}, f = \left(\frac{117}{103}\right)^2 \times 29 \text{ hpa} = 37 \text{ lb/ft}$$

Wind Driven Current

$$1 \text{ in } 20 \text{ year}, V_c = .036 \text{ m} = .86 \text{ m/s}, f = \frac{1}{2} \rho C_D A V^2 = \frac{1}{2} \times \frac{1000 \text{ kg/m}^3}{1000 \text{ kg/m}^3} \times 1.5 \times 1.4 \times 1 \times .86^2$$
$$= .78 \text{ kN/m} = 93 \text{ lb/ft}$$

$$1 \text{ in } 100 \text{ year}, f = \left(\frac{117}{103}\right)^2 \times 93 = 68 \text{ lb/ft}$$

Wave Drift

$$1 \text{ in } 20 \text{ year}, H_s = 2 \text{ m}, 10' \text{ W.D.}, \lambda = 70.5', f = 229 \text{ lb/ft}$$

$$1 \text{ in } 100 \text{ year}, H_s = 2.4 \text{ m}, \lambda = 76.5', f = 325 \text{ lb/ft}$$

Total Static Load

$$1 \text{ in } 20 \text{ year}, f_{s,20} = 29 + 93 + 229 = 311 \text{ lb/ft}$$

$$1 \text{ in } 100 \text{ year}, f_{s,100} = 37 + 68 + 325 = 430 \text{ lb/ft}$$

Take Dynamic Loads as $\pm 50\%$ of Static Load

$$1 \text{ in } 20 \text{ year}, f_{d,20} = 156 \text{ lb/ft}$$

$$1 \text{ in } 100 \text{ year}, f_{d,100} = 215 \text{ lb/ft}$$

Sum of Static + Dynamic

$$1 \text{ in } 20 \text{ year}, f_{T,20} = 467 \text{ lb/ft}$$

$$1 \text{ in } 100 \text{ year}, f_{T,100} = 645 \text{ lb/ft}$$



Westmar Consultants Inc.

Project	Killiney Beach	By	N.A.	Date	Oct 15/14	Page	of
Subject	WLDs & Dikes	Ckd		Date		Job No.	77627

From wave report, scale factor
on winds = 1.0 (conservative for 1 in 20 year
condition).

Assume that the 'E' wave comes out of
Vernon (Killiney Beach Park)

Fetch = 12.5 km.

Spreadsheet Verne.wrk1

Killiney Beach:

Return Period	Direction	Fetch	Vibe.	H _s	H _{max} = 1.8 H _s	Tp	λ
20 years	ENE*	12.5 km	70 kph	1.70m (5.6')	2.2m (6.6')	3.5 sec	19 m
100 years	ENE*	12.5 km	81 kph	1.37m (4.5')	2.5m (8.2')	3.8 sec	22 m
20 year	S	27 km	103 kph	2m (6.6')	3.6m (11.8')	4.4 sec	30 m
100 years	S	27 km	117 kph	2.4m (8.0')	4.3m (14.1')	4.7 sec	35 m

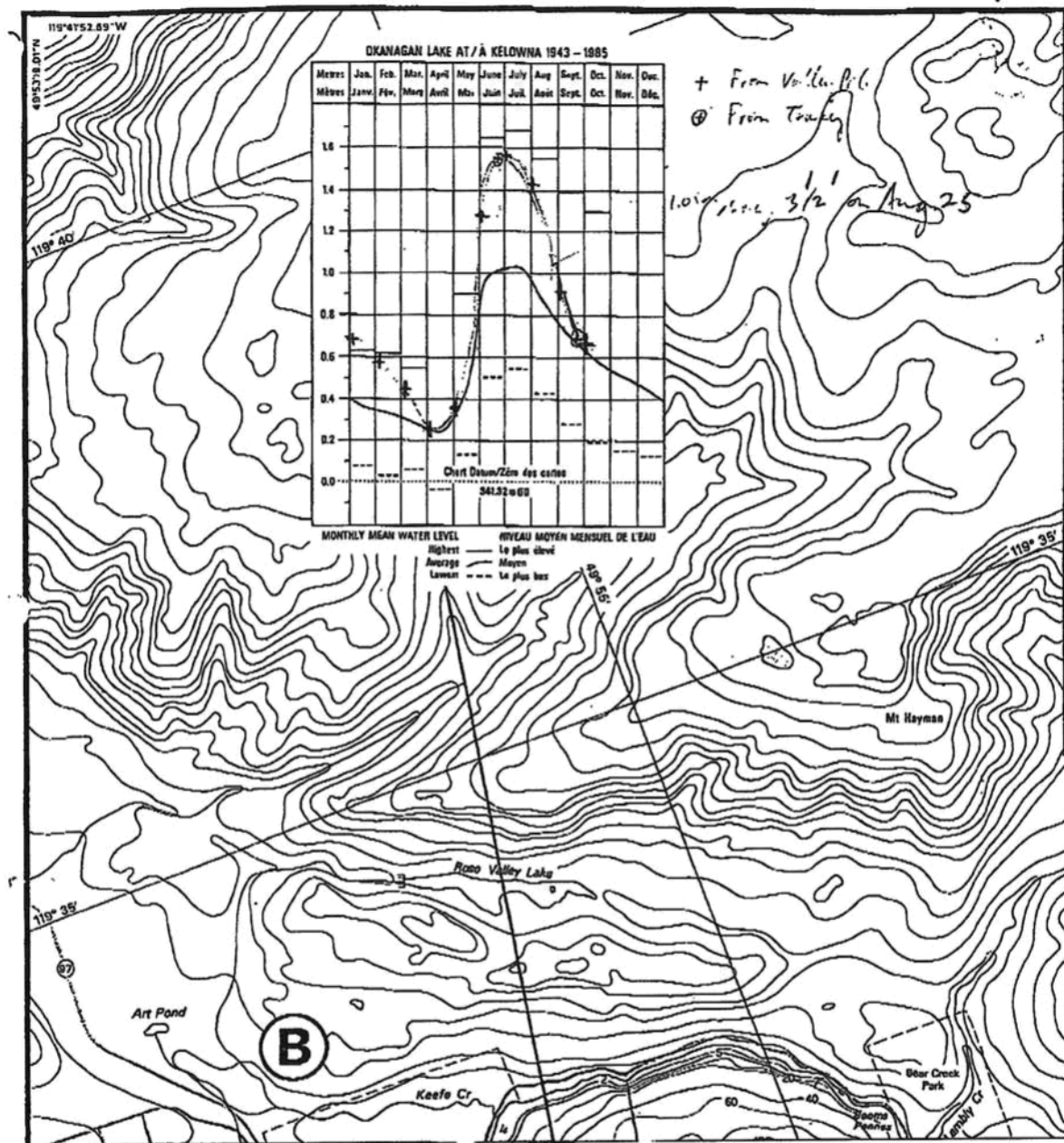
* E direction winds used.

Vernon: c.c. W & SW winds waves at Vernon are 11.5 km fetch

Vernon W. winds	20 years	W	12.5 km	88 kph	1.56m	2.8m	4 sec	25 m
	100 years	W	"	101 kph	1.92m	3.5m	4.3 sec	29 m
Vernon SW winds	20 years	SW	"	90 kph	1.62m	2.9m	4 sec	25 m
	100 years	SW	"	107 kph	1.96m	3.5m	4.4 sec	30 m

↓
→ H_s = 5' H_{max} = 9'
→ H_s = 6' H_{max} = 11'

Depths in m below 341.32



11.48 | =100.0% | 0.0%

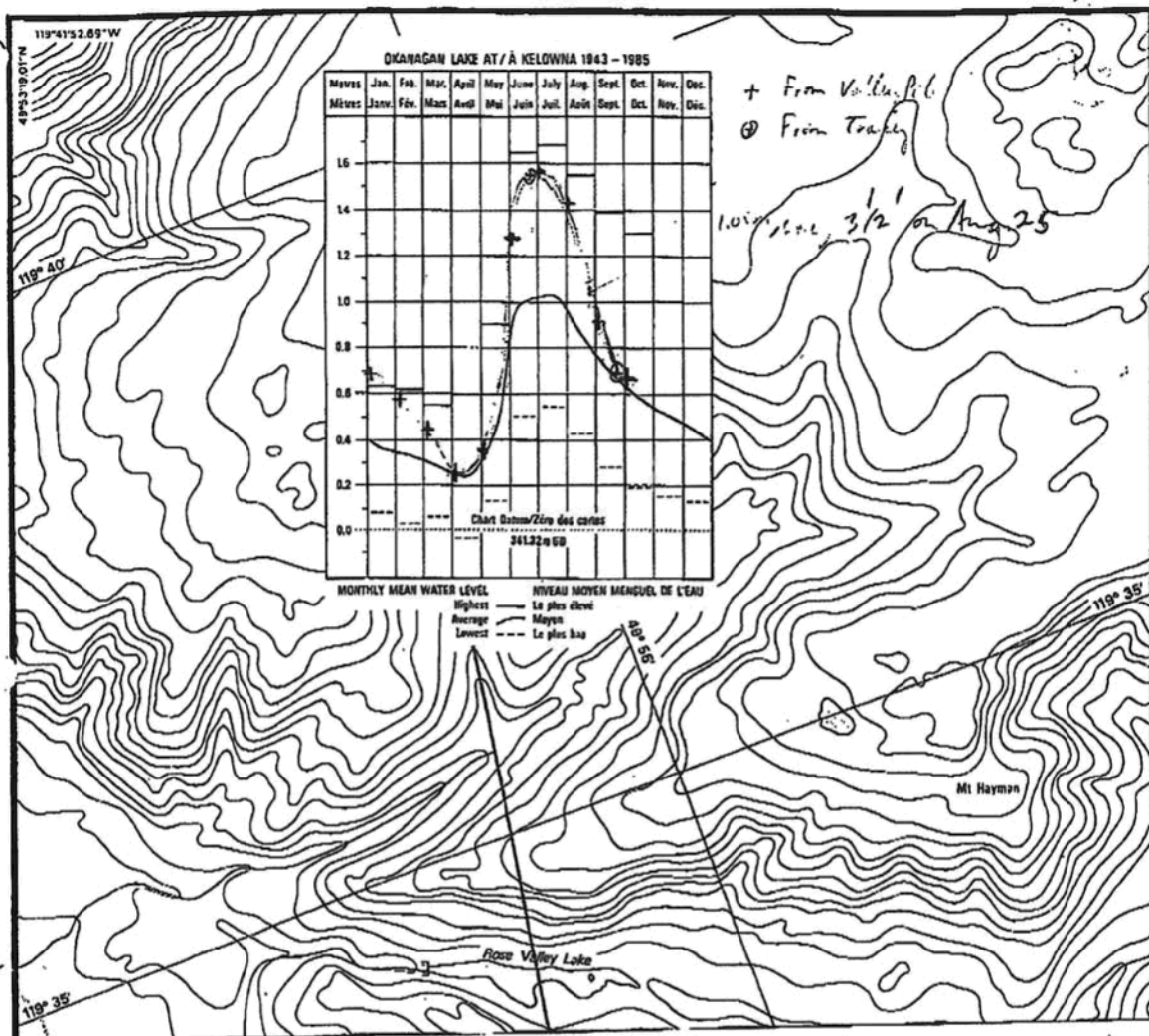
TOTAL 13,006 44.92 36.24 8.74 3.91 .83 .22 .01

11.48 180.02 0.01

* TOTAL NUMBER OF OCCURRENCES BEFORE SELECTION / NOMBRE TOTAL D OCCURRENCES AVANT SELECTION: 13,006 ✓

3052 KELOWNA TO/À VERNON

Depths in m below 341.32



PROGRAM / PROGRAMME : GROUPE

PROJECT NUMBER

NUMERO DU PROJET: 12345

STATION: VERNON

B.C. / C.B.
1128551

FOR / POUR: VRS/ANNÉES

1971-1979

WIND

DIRECTION

DIRECTION

DU VENT

NE

E

SE

S

SW

W

NW

N

CALM

CALME

WIND SPEED CLASSES / CLASSES DES VITESSES DE VENT

km/h

1- 9 10-19 20-30 31-42 43-55 56-69 70-84 85-100 101-117 118-999

DIRECTION	1- 9	10-19	20-30	31-42	43-55	56-69	70-84	85-100	101-117	118-999
NE	1,009	6.25	1.45	.84	.02					
E	1,023	5.14	1.76	.68	.25	.03				
SE	3,352	10.47	13.92	1.27	.11	.01				
S	2,389	7.57	6.91	1.83	1.07	.29	.07	.02		
SW	1,397	2.61	3.59	2.78	1.43	.27	.06			
W	1,312	5.11	3.25	1.03	.52	.14	.03			
NW	584	2.07	1.45	.43	.40	.09	.05			
N	1,350	5.71	3.91	.69	.12	.01	.02			
CALM	662									

TOTAL 13,006 44.92 36.24 8.74 3.91 .03 .22 .01

WIND SPEED LIMIT
LIMITE LA VITESSE:PERCENTAGE OF
OCCURRENCES BY SPEED
DIRECTION

%

MEAN

PERCENTAGE DES

OCCURRENCES

SELON LA

DIRECTION

MOYENNE

7.8

7.9

11.1

13.3

12.3

14.1

10.1

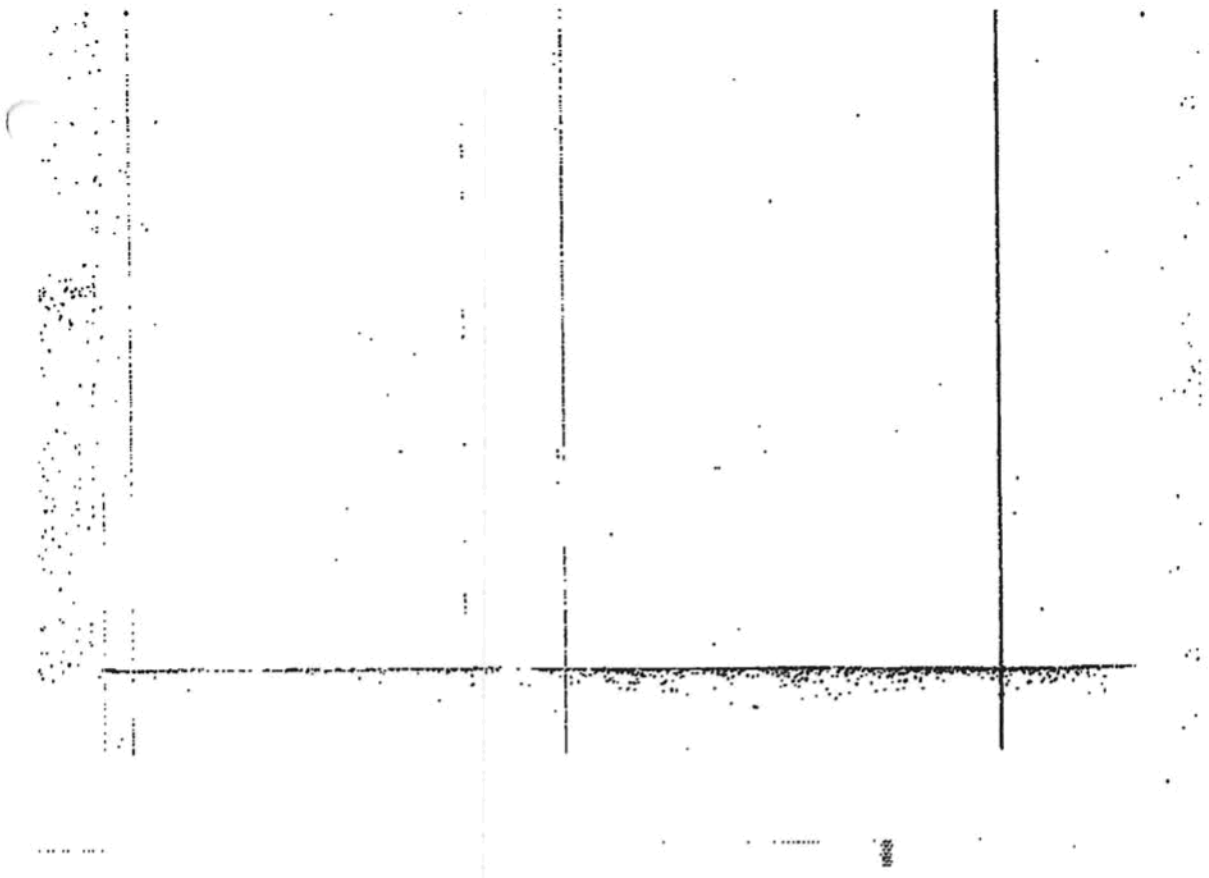
5.1

11.48

1180.02

8.6

* TOTAL NUMBER OF OCCURRENCES BEFORE SELECTION / NUMERO TOTAL D OCCURRENCES AVANT SELECTION: 13,006



APPENDIX C

INTERVIEW RESPONSES FROM VERNON YACHT CLUB ANECDOTAL INFORMATION

From: s.22 on behalf of Craig Williams <craig@telus.net>
Sent: Monday, August 24, 2015 3:52 PM
To: Tara Hirsekorn
Cc: Jason Schleppe; Lawrence and Candace Johnson
Subject: Re: Vernon YC - List of Questions

Flag Status: Flagged

Hey Tara,

Responses below in red.

See you Thursday 9:00 am.

Craig Williams
Okanagan Approval Corp. and
Sierra Mortgage Fund Ltd.
3300 - 34th Avenue
Vernon, BC V1T 2P7

Off: (250) 558-1111
Cell: (250) 503-8993

On Thu, Aug 20, 2015 at 9:34 PM, Tara Hirsekorn <Tara@watersedgelt.ca> wrote:

Hi Craig,

It would be helpful to have input from some long-time users of the Yacht Club that are familiar with the breakwater, wave climate and sediment patterns in the area to provide a background. This will assist me to effectively develop options to address the issues with the breakwater. A list of the items that I am looking for input follows:

1. What are the specific issue with the current breakwater? Details would be helpful.

Breakwater is positioned perpendicular to the prevailing weather; Scope of anchors too steep, in some cases as little as 2 to 1, allowing too much sideways movement of sections in the deepest water causing them to beat themselves against the piles that were installed in an attempt to prevent or reduce sideways movement and dragging of anchors.

2. What are the Club's priorities for replacing or upgrading the current breakwater? i.e. budget, performance, expansion, preference of a style of breakwater or ability to walk on it?

Priority for replacement is high so as to not render the existing breakwater useless from on-going damage as the intent is to use the existing sections for replacement of the north log bundle breakwater; realigning the breakwater to follow our westerly lease line is anticipated to break the predominant wave action and allow the north breakwater to moved further north into our lease area and an eventual extension of each of the docks for future addition of more slips; the realignment is also expected to allow the addition of slips on the west side of A dock and possibly the ability for side-tying on the inside of the new breakwater which would require the ability to walk on and access from shore; would like to give consideration for the addition of a future fuel dock and repositioning of the W dock mains further out from shore.

3. What direction do the most damaging storms come from? (incident wave direction for large storms)

Southwest. There is at least a 7 mile fetch from Killiney Beach to the southwest

4. What incident wave directions are problematic for the club? (more than 1 direction to consider?)

Southwest produces the most damaging due to the fetch, north and northwest would be the next most problematic.

5. What are the largest waves ever seen at the Club (wave height) and over what period of observation (i.e. a member of 25 years saw waves of x metres)?

Of the few Members I have been ab

le

to speak with about their observations of the maximum wave height witnessed by them there seems to be a consensus of 3' - 4' in the area around our marina with greater heights occurring in the main lake.

One Member I spoke with is 60 years old and was raised on the Lake in the general area of our marina, the other two have been Members for approximately 20 years and 10 years respectively.

6. Is the sediment along the shoreline affected by longshore drift (moving along the shore)? If so, what is the predominant direction of movement?

From south southwest to east northeast

7. Is sediment an issue near the club? Erosion or accretion? Is dredging ever required?

Sediment has accumulated over the years along the shore, building up a deep, soft layer of silty type material. Dredging would allow only a slightly greater use of our boat launch and allow only slightly larger boats to occupy W dock (shallow depth in these areas is a hindrance) due to the close proximity of W dock running perpendicular to shore.

8. Any other tidbits of information that may be helpful to the project?

Our neighbour adjacent to our west boundary has concerns about sedimentation build-up they say they feel is created by a small log bundle breakwater we have extending from close to shore inside a sort of peninsula between us to the existing concrete breakwater. The purpose of this small log bundle is to

break wave action that would otherwise prevent us from mooring the the west half of W dock. Though the log bundle may trap some surface material inside the peninsula, it is more likely the peninsula itself creates the sediment build-up created by the longshore drift moving from southwest to northeast they are concerned about.

Some of these items may be obvious when I do the site visit, but this background will give me a good idea what to look for while I'm there and will serve as a check on the validity of the available data.

Thank you kindly.

I look forward to meeting you at 9:00 on the 27th.

Sincerely,

Waters Edge Engineering Ltd.

per: Tara Hirsekorn, P.Eng.

cell: (250) 300-3479

~~ Shore Protection ~~ Marinas ~~ Parks ~~ Stormwater ~~

<http://www.WatersEdgeLTD.ca/>

PHOTOS

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Shoreline on December 30, 2004 – Google Earth

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Shoreline on May 4, 2013 – Google Earth



Weir, Keith FLNR:EX

From: Weir, Keith FLNR:EX
Sent: Thursday, June 9, 2016 7:21 AM
To: 'Jason Schleppe'
Subject: FW: Vernon Yacht Club

From: Weir, Keith FLNR:EX
Sent: Thursday, June 9, 2016 7:20 AM
To: Weir, Keith FLNR:EX
Cc: Aura, Bernadette FLNR:EX
Subject: RE: Vernon Yacht Club

Hi Jason

Whether we call this a minor or major amendment, we will still send referrals, and conduct a fairly thorough review process. You are correct that the changes are all within the existing lease boundary, and that fact will likely make or review quicker, but the change is fairly significant and we are already getting expressions of concern from the neighbor; we will err on the side of caution and treat it as a major amendment. We will do our best to expedite the review.

Keith Weir
Senior Land Officer
Ministry of Forests, Lands and Natural Resource Operations
441 Columbia Street
Kamloops BC V2C 2T3
Phone: (250)828-4419 Fax: 828-4442

From: Weir, Keith FLNR:EX
Sent: Tuesday, May 17, 2016 1:28 PM
To: 'Jason Schleppe'
Subject: RE: Vernon Yacht Club

Thanks for being patient....we will figure this one out eventually.

From: Jason Schleppe [<mailto:jschleppe@ecoscapeltd.com>]
Sent: Tuesday, May 17, 2016 9:49 AM
To: Weir, Keith FLNR:EX
Cc: 'craig@telus.net'
Subject: RE: Vernon Yacht Club

Hi Keith,

Thanks. Please hold tight for now. We are going to dig up some old correspondence from 2006 when the lease boundary and issues with the neighbor were addressed. As I understand from talking to Craig, the boundary was shifted in that year to better accommodate the neighbor. Also, as I understand, the neighbor just built their dock, and this was built to accommodate VYC lease. Anyway, we will dig this up, and then come armed with a few more questions, and proceed from there.

Thanks
Jason

JASON SCHLEPPE, M.Sc., R.P.BIO
SENIOR NATURAL RESOURCES BIOLOGIST
ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.

Phone: 250.491.7337 ext. 202 / Fax: 250.491.7772 / Cell: 250.808.3474

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Please consider the environment before printing this e-mail

From: Weir, Keith FLNR:EX [<mailto:Keith.Weir@gov.bc.ca>]
Sent: Monday, May 16, 2016 2:24 PM
To: Jason Schleppe <jschleppe@ecoscapeltd.com>
Subject: RE: Vernon Yacht Club

Hi Jason

I talked it over with Don Meeks. We felt that the changes are significant, so the application would be treated and reviewed as new. He said anything more than 3 new slips would trigger a full review. The proposed relocation of the western breakwater is also significant in that it will be much closer to the lease boundary, and could affect neighboring properties.

The existing design is already approved, so if a new breakwater is needed immediately, you can replace them in their current location. (some minor changes would be OK)

Keith

From: Jason Schleppe [<mailto:jschleppe@ecoscapeltd.com>]
Sent: Wednesday, May 11, 2016 11:14 AM
To: Weir, Keith FLNR:EX
Cc: Craig Williams
Subject: RE: Vernon Yacht Club

Hi Keith,

Thanks for the discussion. As I understand, you are going to carefully review this and provide us with guidance regarding the following:

- 1) Does this truly open up the Crown Land Tenure, or can it fall within an amendment. Again, since we are staying within the existing tenure, preference would be to stick with a minor amendment.
- 2) If it is a major amendment (i.e., basically a new application), how many slips would they have to drop to keep it at a minor amendment for the time being.

I think this is they key for now. As I said, the critical pathway is the Section 9 Notification for the test piles, which allows us to complete engineering. We will keep on this aspect, but if you could get back to me on the other parts, I can then try and guide VYC through.

Thanks

Jason

JASON SCHLEPPE, M.Sc., R.P.BIO
SENIOR NATURAL RESOURCES BIOLOGIST
ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.

Phone: 250.491.7337 ext. 202 / Fax: 250.491.7772 / Cell: 250.808.3474

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Please consider the environment before printing this e-mail

From: Jason Schleppe
Sent: Wednesday, May 11, 2016 10:48 AM
To: Weir, Keith FLNR:EX <Keith.Weir@gov.bc.ca>
Cc: 'Craig Williams' <craig@telus.net>
Subject: Vernon Yacht Club

Hi Keith,

I have left a few messages with you a few times over the last few days and would like to chat about this file, noting Cathy Jenkins also left me a message last week, and I have phoned her a few times as well to no avail.. The breakwater must be repaired, and is considered a priority. What I need to understand is how best to stage the application(s) to make sure that the priority happens ASAP, and then how to facilitate the remainder of project (both short term and long term).

After our initial discussion in early January, I was under the impression that if we were bringing the breakwater into compliance, and then keeping within the existing Crown Land Tenure / Lease area, this would not trigger a tenure review. However, as I understand, by adding the proposed slips, this opens the tenure up, and Cathy has indicated that a **new** tenure is needed for the small addition. If this is the case, the VYC may wish to alter the application to only include the breakwater repairs. I presume this wouldn't trigger a new Crown Land tenure, is this the case?. They do not wish to open the Crown Land tenure process multiple times (as they have other future plans, as we discussed). What this all means is that I need to understand what the different options are, and how best to guide them through the Section 11 (formerly Section 9) process, and what expectations and triggers are for different permitting paths.

On another note, we are still actively trying to get the Section 9 / 11 Notification for the test piles, this is holding up the process as we cant completed detailed designs on the breakwater until we have this. As I understand, Danika in Vernon has this file, and is away. If there anything that you can do to help out this aspect. With the potential for larger storms coming, and a breakwater in a state of disrepair, we need to move these files along to ensure safety of vessels in the facility.

Please give me a call ASAP such that I can figure out how best to guide VYC.

Thanks
Jason

JASON SCHLEPPE, M.Sc., R.P.BIO
SENIOR NATURAL RESOURCES BIOLOGIST
ECOSCAPE ENVIRONMENTAL CONSULTANTS LTD.

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