Denman and Hornby

Connectivity Research

and

Public Consultation

Part One of the Two-Part
Digital Roadmap & Implementation Plan

Prepared for:
Comox Valley Regional District

By:
Hornby Island Community Economic Enhancement Corporation
Denman Island Residents' Association Internet Committee
with the assistance of Baylink Networks Inc.

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EXECUTIVE SUMMARY – OVERARCHING PART 1 AND 2

This paper discusses digital connectivity in the Denman Island/Hornby Island communities. Denman and Hornby Islands are neighbouring islands in the Salish Sea, and are part of the Comox Valley Regional District.

This connectivity project began because of deep dis-satisfaction with inadequate broadband services. Funding was provided by ICET, NDIT, Denman Works and HICEEC to allow the hiring of an experienced telecommunications contractor to develop a Digital Roadmap and Implementation/Business plan. Information was gathered within the community through an extensive consultation and engagement process.

The federal regulatory authority, the CRTC, has declared that a basic Internet service providing a minimum download speed of 50 Mbps and an upload speed of 10 Mbps, should be available to all Canadians. Neither of the internet services, Telus or Xplornet, offered on Hornby and Denman Islands come close to meeting this recommended minimum level of service.

The poor internet service on Hornby and Denman Islands hampers economic prosperity, resident satisfaction, educational opportunities, public safety, the provision of services and economic development. Public input on the Islands demands improved connectivity for the Islands.

Over the last 18 months committees on the two islands have engaged with the community in an intensive consultation process. Surveys were conducted on each island with unusually high response rates. They documented the inadequacy of the internet, disclosed problems this causes for groups within the community and economy and demonstrated hopes for options that would be possible with better connectivity. The committees informed the community of the internet situation and opportunities for improvement with articles and letters in the popular weekly newspapers and three widely used local Facebook groups. Other consultation measures included radio interviews and presentations at well-attended public events. The main events were two public Open Houses (each drawing over 70 attendees) and four other public meetings (each drawing over 30 attendees).

This process has established that the community is dis-satisfied with its present poor connectivity, that it does not favour wireless-based improvement, and that it supports the concept of a fibre-optic based service. The community is moving to improve its digital connectivity by selecting the best, feasible option.

INTRODUCTION

This section provides essential facts about Denman and Hornby islands, our community, and the project to improve our connectivity.

Context

Denman and Hornby are northern Gulf Islands in the Salish Sea, in British Columbia. They are considered rural and remote, as they are 'boat access only'. No airport or bridge serves them - access is provided from Vancouver Island by the British Columbia Ferry Corporation. To access Hornby, one takes the ferry from Vancouver Island to Denman Island, and then drives across Denman to take a second ferry to Hornby.

Denman and Hornby are within the jurisdiction of the Comox Valley Regional District and they are part of the Islands Trust, which controls land use and encourages conservation in the Gulf Islands. The islands have local, volunteer quasi-governmental organizations called the Hornby Island Residents and Ratepayers' Association (HIRRA) and the Denman Island Residents Association (DIRA) that assist in defining priorities and public operations.

There are limited internet services available on Denman and Hornby Islands. The only wired internet is the Asymmetric Digital Subscriber Line (ADSL) service provided by Telus. A few other Internet Service Providers (ISPs), such as Uniserve and Lightspeed offer products that make use of the Telus wires. Satellite internet is available from Xplornet. Telus and Bell offer plans that access the internet using their cellular systems. These plans are only available in specific areas, and only to a few residents. Some 'tether' their computers to cellular telephones or use cellular phones to browse. These methods have high costs and limited service. The islands rank among the bottom 10 percent in Canada for speed, reliability, and availability in internet service.

Population

Following are some key characteristics of the populations of these islands, as revealed in the 2016 Census of Canada.

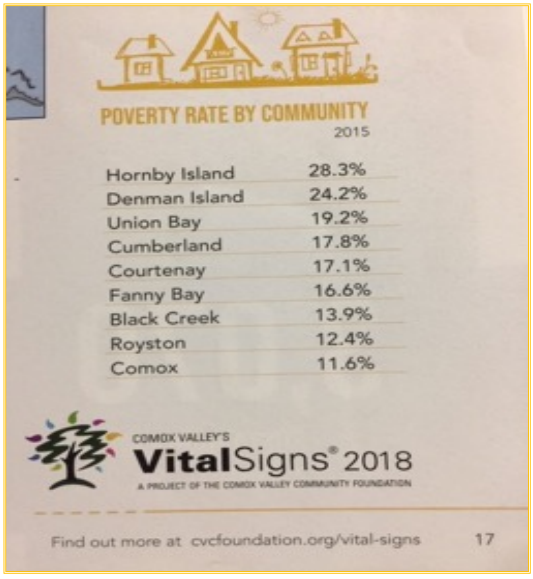
Denman In an area of 51.03 km² (19.7 sq.mi.), Denman's population includes:

- 1165 residents in 590 households;
- 125 children aged 0-19 years (11% of all);
- 595 people of working age - 20-64 years (51% of all);
- 440 people aged 65 years and older (38% of all).
- Denman grew 14 percent from 2011 to 2016.

Hornby In an area of 29.97 sq. km. (11.57 sq. mi.), Hornby's population includes:

- 1016 residents, living in 560 households;
- 105 children aged 0-19 years (10% of all);
- 515 people aged 20-64 years (51% of all);
- 395 people aged 65 years and older (39% of all).
- Hornby grew 6 percent from 2011 to 2016.

The islands' populations differ from most BC communities in some characteristics which are relevant to their relationship with the internet. The Comox Valley Community Foundation's 2018 report "Vital Signs" found that Hornby had the highest poverty rate in the CVRD, with Denman Island in second place. Hornby's median household income was $35,328, while the BC average was $69,995. Denman is growing faster than most BC communities (BC average growth was 5.6%). The proportions of seniors on both islands are greater than the British Columbia norm (19%), and there are fewer children than the provincial average (20%). The populace is more highly educated than the BC norm, with 70% of Denman and 68% of Hornby possessing a post-secondary certificate, diploma or degree (BC average is 55%). Many residents are self-employed or work more than one job.



These Denman and Hornby characteristics have implications for connectivity:

- The population is widely dispersed through the Islands, so internet services must cover large areas. In many rural, remote and northern communities service can be concentrated at a central community area or along a few roadways. On Denman and Hornby this is not feasible.
- Educational achievement correlates with internet access. Children require solid internet connections to study, learn and recreate, just as children do in Canada's large urban centres.
- The population is more educated. Educated people use the internet more.
- Island businesses are usually dependent on the internet for banking, billing, marketing, scheduling, etc. 'Bricks and Mortar' alternatives are not available on either island. There is only one banking institution, no big box stores or franchises. The commercial sector is small in scale, much of it home studio based, and mostly with individual entrepreneurs.
- Seniors find the internet brings entertainment and services they desire and provides the ability to maintain family contacts through tele-conferencing programs like Skype.
- There are many seasonal residences, and their owners expect to access the internet. If good internet is not available to them, seasonal residents will seek properties elsewhere, or visit less and stay for shorter periods. They will spend less on the islands, reducing the economic sustainability of the islands.
- Young people want good internet access and choose not to locate on these islands because it isn't available.

Broader Context

These communities take pride in their hospitality, their arts community and their legacy of creativity. Dates and details of festivals, fairs, shows, exhibitions, music, recreation and special events can be seen at www.hornbyisland.com/EVENTS or www.visitdenmanisland.ca. The communities are committed to environmental protection and are very appreciative of like-minded visitors.

- Hornby is blessed to have approximately 1/3 of its land mass in parks and most of the ocean foreshore is accessible. Tribune Bay Provincial Park boasts one of the finest sandy swimming beaches in B.C. Helliwell Provincial Park offers a 5 km. walk that circles along spectacular bluffs and through old-growth forest and Garry Oak meadows. The Mt. Geoffrey Parks have an extensive trail system for hiking and mountain biking. These features contribute to a tourist-based economy, resulting in needs to provide services that tourists expect.

- Denman Island offers a beautiful, natural environment with opportunities for active recreation or restful recreation. Boyle Point Provincial Park is on a breathtaking 125-hectare waterfront parcel at the south end, affording eagle watching, especially during the spring herring run. Sandy Island Marine Provincial Park is a rare niche of sand dunes, fragile vegetation, diverse animal species, and a home to a variety of birds. Fillongley Provincial Park's 23 hectares feature some of the largest remaining stands of Douglas Firs and Cedars in the region, with walking trails around the Beadnell Creek salmon-spawning habitat.

This discussion of the characteristics of the community has demonstrated that Denman and Hornby have fundamental qualities that lead to needs and interests in improving connectivity.

Project Chronology

The Denman-Hornby internet improvement project emerged over the last few years.

In late 2015, the Hornby Island Community Economic Enhancement Corporation (HICEEC) collaborated with Telus to investigate ways to improve service on Hornby Island. This led to an upgrade of the ADSL infrastructure on the SE corner, bringing internet service to unserved properties and providing improved speeds to others. This project was completed in March, 2018. Telus then informed HICEEC that there would be no further improvements because Telus would no longer install or add to this old ADSL service.

The Denman Island Internet Committee (DIIC) was formed on June 28, 2018 as a committee of DIRA. Over the next month it notified the community of its existence with articles in the weekly newspaper The Grapevine (delivered to all mailboxes on both Denman and Hornby Islands), as well as by postings on the Denman Island Facebook Bulletin Board.

In August, 2018, DIIC conducted an online and paper survey that produced 185 responses from Denman's 592 households. It published the survey findings, including producing a 21-page survey report that was made available online. This survey, and a 13-response 2019 addendum, is attached as Appendix A

On September 20, 2018 DIIC met with HICEEC and the two committees realized they have common goals and should work together to improve connectivity. The committees learned that funding was available from both the Federal and Provincial Governments to assist remote and rural communities to obtain better internet. There were challenges in learning how to qualify for some of this money. Investigations included:

- learning how other communities had approached similar problems and achieved success;
- many conference calls with management of our current primary service provider, Telus;
- attending presentations by the Provincial Government;
- asking for and receiving support from our MP, our MLA, and our representative at the CVRD.

The committees learned about the federal/provincial Connected Coast project that will bring fibre-optic capacity up both sides of Vancouver Island, discovered that Hornby and Denman were not on the list of communities to be served, and held discussions with the project's manager, the Strathcona Regional District.

With assistance from the BC Ministry of Citizen's Services, the committees learned how to apply to senior levels of government for funding to allow them, in conjunction with an experienced technical contractor, to plan for the installation of a new, state-of-the-art, fibre-optic infrastructure on the islands. An application would have to include an experienced ISP to operate the new fibre system. They learned that they should hire professional assistance to produce a Digital Roadmap and Implementation Plan. This plan would identify

what directions the community wishes to take in relation to digital connectivity, and would contain a financially-feasible technical design by telecommunications engineers that would deliver on those aspirations.

The committees identified two sources of funding that could enable the required planning phase. These were: the Island Coastal Economic Trust (ICET) and the Northern Development Initiative Trust (NDIT). The committees began preparations to apply to these trusts for planning support grants. A consultant was sought who could undertake the demanding Digital Roadmap and Implementation/Business Plan task. The committees secured a few proposals and selected Baylink Networks Inc., a company with a 30-year track record in the telecommunications field. The committees began active promotion of the project within the community, including obtaining letters of support from:

- The Comox Valley Regional District
- Hornby Island Trust, local council
- Island Trust Chair, Peter Luckham
- Denman Island Trust, local council
- Denman Island Residents Association (DIRA)
- Hornby Island Residents and Ratepayers Association (HIRRA)
- MLA Scott Fraser
- Member of Parliament Gord Johns
- School Trustee, School District 71, Sheila McDonnell
- Hornby Island Community Economic Enhancement Corporation
- Denman Island Works (economic enhancement)

With excellent guidance from ICET and NDIT grants totaling approximately $35,000 were secured from these trusts by September 2019, and $15,000 was raised locally from Denman Works and HICEC. Baylink Networks was contracted to complete the Digital Roadmap and Implementation/Business Plan.

THE DIGITAL ROADMAP

The committees learned of an initiative within the BC Ministry of Citizens Services, entitled Connected Communities BC that has provided guidance on the development of the digital roadmap. This is important because the Denman-Hornby project will apply to this Ministry for the funding to enable our community to improve its connectivity.

The Ministry has provided a model of the roadmap, a framework tool that supports communities to establish their own digital roadmap for future development and advancement. With this tool, and this knowledge, and the funding support from ICET and NDIT and others, and the skills and knowledge available from Baylink Networks, the committees moved forward with a program to consult the community about digital connectivity.

CONSULTATION IN THE PROJECT

A concerted consultation program to inform the community and discuss connectivity, both now and in the future, and to explore the community's views began in early September, under the guidance of the committees and Baylink. This section describes the consultation program.

An online survey was developed for Hornby Island to parallel and improve on the survey conducted in 2018 on Denman. Based on the Denman survey, the new survey was improved to better bring out the community's digital needs and aspirations. HICEEC staff distributed the survey, on paper and online, from September 26 to November 12 of 2019. The survey was advertised by a social media campaign, and by sandwich boards that were placed strategically in the community. HICEEC delegation reports were made at community groups' meetings, which had average attendance in the 30 person range. When it closed on November 12, the survey had attracted 229 responses from among Hornby's 560 households. Both the Denman and Hornby surveys achieved high rates of response.

The report on Hornby's survey is attached as Appendix B.

A public campaign to better inform the community about the project was designed, and began by mid-September. A series of six informative articles were prepared and published in the Denman/Hornby weekly newspaper, The Grapevine. These were:

Sept 12 - Ty Runkle's notice of the coming series of articles
Sept 19 - Ty Runkle's article about Telus's ADSL service, its capabilities and shortcomings
Oct 3 - Ty Runkle's article about minor ways of accessing the internet (SmartHubs and Satellites)
Oct 10 - Peter Spurr's article about a future life with improved internet
Oct 20 - Ty Runkle's article about the context for improving connectivity
Oct 30 - Peter Spurr's article summarizing the situation, advertising the Open Houses

These articles are available at: www.hornbydenmaninternet.com.
After consultation with the experienced Baylink staff, personal contact was sought with representatives of all sectors of the economy on both Denman and Hornby Islands to ask about their current digital situation, their future aspirations for digital connectivity, and any limitations they experience. Inquiries were made to these groups: businesses, arts & culture organizations, tourist services, retail, education providers, clubs, research organizations, affordable housing projects, medical, emergency services, health providers, banking, library, B.C. Ferries, and local government.
After committee representatives attended the Vancouver Island Economic Summit, additional questions arose. Questions were taken from a card deck supplied by the Ministry regarding digital aspirations at the community level. A questionnaire was developed with 19 talking points. This questionnaire was distributed to the 30 attendees at the HICEEC Fall '19 Business Mixer & Business of the Year Award Presentation, the

Hornby Ferry Advisory Committee (which represents 6 sectors of the economy), and was posted online, using Survey Monkey.
Appendix C is a report in tabular form, entitled "Connectivity on Denman & Hornby - Current State and Future Needs". It combines the input obtained from the personal contacts and the feedback from the 19-point questionnaire.
A representative of HICEEC, Karen Ross, gave an interview on CHFR-FM - Hornby Radio - FM 91.5. (This interview is available at www.hornbydenmaninternet.com)

A social media campaign was undertaken to encourage individuals to provide their thoughts about the state of the internet and their needs and aspirations for future connectivity. The platform used was "Hornby Island Community Connections", a Facebook group with over 1600 members. The dialogue was shared on the "Denman Open Bulletin Board (Taystayic)", another Facebook group with 1574 members. Professions of respondents include: farmer, senior management/manufacturing, medical doctor, ESL teacher, website developer, Conservancy Hornby Island, politician & management consultant, dance studio owner, music booking agent, Federal Job Shop contractor, photographer, engineer, medical journal editor, B.C. Arts Council adviser, artist, architect, graphic artist, mortgage lender, landscape designer, online book store, homeschooling parent, architect, ferry crew, entrepreneur, software developer, mixed media artist, research librarian, artist & educator, virtual reality testing and production, instructor of Business & Marketing, work from home Mom, movie industry product placement, educator, and videographer.

Appendix D provides a listing of these respondents with quotations they offered. The Appendix is structured to demonstrate the community response to each of the five strong foundational elements identified in the Ministry's Digital Roadmap model. By examining the wide coverage of each foundational element by the community, it is possible to observe the communities position along the four stages of digital development (also provided by the Ministry's model). These stages of digital development are:

Digital Inclusion - Basic communication provides inclusion and access to vital services such as first responders. Limited connectivity restricts a community's ability to benefit from a digital economy.

> The Denman/Hornby community is clearly at this stage, with some basic communication but restricted by limited connectivity.

Digital Integration - Moderate connectivity supports most business and community needs, fostering greater integration and access to improved services

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> The Denman/Hornby community achieves integration in a few respects, but integration and access to services clearly need improvement.

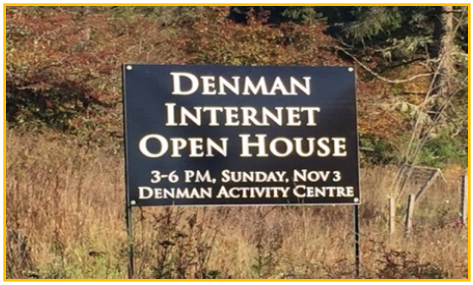
Digital Innovation -Good connectivity and digital capability supports a knowledge workforce and attracts talent that drives innovation and growth opportunities.

> The Denman/Hornby community is aware of these possibilities and aspires to advance itself into this stage.

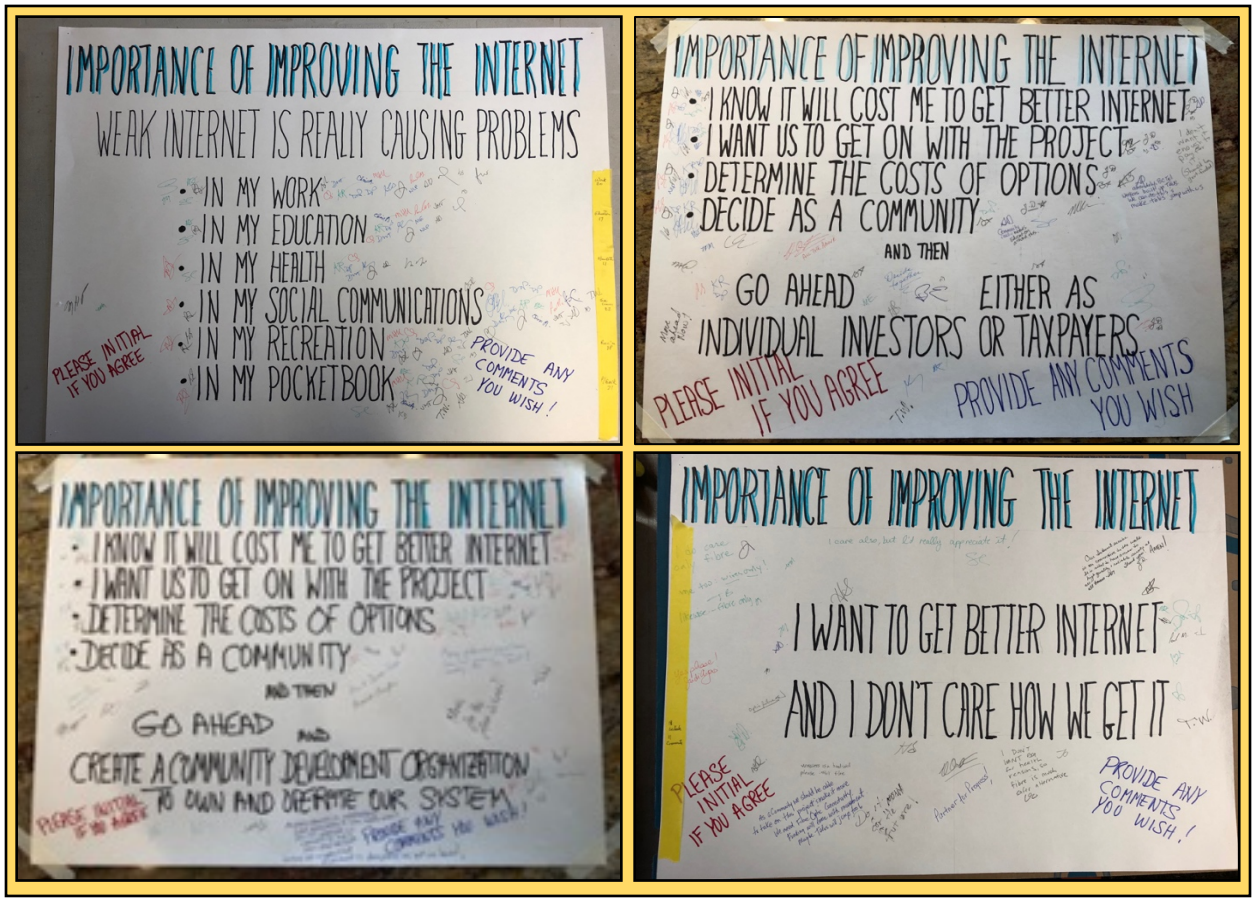
Connected Communities -The community has differentiated itself; it is at or near the forefront of a sector or area of expertise due to how it has adapted to enable and support digital innovation. It is known for its innovative and entrepreneurial culture.

> The Denman/Hornby community can achieve this level once it has advanced to, and consolidated itself within, the innovation stage.

The main component of the consultation program was a pair of widely-publicized Open House meetings, held on Denman and Hornby on November 3. The meetings were advertised with notices in The Grapevine weekly newspaper, The Hornby Tribune weekly advertising flyer, and both islands' monthly newspapers. Large billboards advertising the events were placed in key locations on each island. Each meeting was attended by about 70 people who showed strong interest in the subject and held active conversations.



The meeting rooms had display posters and maps, and attendees were invited to write on the posters to display their opinions.



Attendees signing the boards and wrote comments demonstrating their interest in these "Importance of Improving the Internet" exhibit boards.

On the board that said "Weak Internet is Really Causing Problems" there were a total of 109 entries, divided evenly between the categories:

- in my social communications;
- in my pocketbook;
- in my work;
- in my recreation and
- in my education

The category "in my health" produced slightly lower entries.

The board that introduced a community development organization as an option for improvement attracted 55 entries, of which 13 were specifically for community development organization. The matching board that introduced individual investment or a local tax as an option for improvement attracted 71 entries, of which 19 were specifically for individual investment or a local tax.

Twenty-nine wrote on the board that said "I Want to Get Better Internet and I Don't Care How We Get It".

Following the opening period when people reviewed these exhibits, each meeting moved to a presentation phase led by a moderator. The presentations began with a committee member describing the overall project, key aspects of what it has learned and what it proposes to do. The committee explained the Telus proposal to provide Fibre To The Home to the two islands if the islands provide a base payment and partner with Telus to apply to the senior governments for funding. Next, Baylink Networks was introduced and gave a presentation on fibre-optic internet, its capabilities, and the manner in which it could be installed. The meetings were opened for questions and at both meetings there were lively discussions about the connectivity situation and how to remedy it. There was interest in the Telus proposal and a general feeling of dis-satisfaction with Telus' record of providing service that did not live up to Telus' promises. At the Hornby meeting there was an expectation among the attendees that the committee might advocate a wireless solution, and the crowd was delighted to learn that this was not true. In both meetings there was a clear consensus that a fibre-optic distribution system throughout the islands would move our community towards many of its personal and group objectives.

The meetings ended with the committees undertaking to produce options for connectivity improvement for the community to consider and decide upon, early in 2020.

CONCLUSION

The Denman-Hornby Internet Improvement Project has engaged in a thorough process of consultation. It has sought to learn about options and encourage the community to form opinions about its digital connectivity. This process has established that the community is dis-satisfied with its present, poor connectivity, that it does not favour wireless-based improvement, and that it supports the concept of a fibre-optic based service. This consultation is part of the project to produce a digital roadmap and implementation/business plan. The next step in this consultation process will be to present options to the community and seek the communities' views about their preference among these options.

APPENDIX A
DENMAN ISLAND INTERNET SURVEY

Denman Island Internet Committee

October 8, 2018

Executive Summary

This reports on the survey conducted on Denman Island during August of 2018 by the Internet Committee (DIIC) of the Denman Island Residents' Association. It collected information from residents about their use of, needs for and satisfaction with current internet services. The "Denman Island Internet Survey" is available on the internet in a public folder at https://tinyurl.com/yaxqxpyt.

The survey closed after Labour Day with 185 completed questionnaires.

Denman's population is growing quickly with key groups that require good quality, reliable internet (seniors, school-age children, businesses). Also, good internet attracts seasonal residents, who are important to Denman's economy.

Only 5% of Island households do not use the internet. Users access the internet via ADSL (copper cable) from Telus (126 of 185 responses), satellite from Xplornet (34 of 185), or tethered cellphones offered by various providers (12 of 185).

Telus service comes from two points which it calls Central Offices, located at Kirk and Northwest Roads, and on East Road at McFarlane. The speed of users' access declines with distance from these offices, until no reliable service occurs at about 5 kms. This causes service gaps in (1) the East/Corrigal/Jemima area; (2) south of Fillongley (Balkie/Dalziel/Swan/ Schmidt); (3) northern Denman (Komas, etc) and (4) southwestern Denman (Lacon/Reginald/Dusty).

The satellite service provided by Xplornet can usually be accessed anywhere, but it can be blocked by terrain or heavily forested areas. People can tether computers to cellphones to access the internet, but this requires a strong cellular signal (which is scarce on Denman), and the user must have an adequate and affordable data plan (which is not common among cellphone users).

Availability notwithstanding, significant problems were found with internet service on Denman.

- Nearly 40 percent of respondents indicated their internet speed or capacity is inadequate for their enjoyment, and one-half of these respondents also said it is inadequate for their business.
- 33 respondents said their enjoyment or business would improve with better internet.
- One-half of the 19 seasonal residents who responded said if better internet was available they would acquire it, and one-third of them reported their internet was inadequate for either their enjoyment or their business.
- Seniors' views about their internet service were varied, with one-quarter reporting satisfaction, one quarter finding their service inadequate at certain times, and one in six reporting it is inadequate for their enjoyment.

- About one-half of the 30 responding households that had school-age children, said they would acquire better internet if it was available, and about one-third said it is inadequate at certain times. Five of the households said they would consider leaving Denman because of the internet.
- None of the business respondents indicated they are satisfied with their internet service.
- 32 percent of respondents said the price of the internet is too high.

Only one in three respondents indicated they are satisfied with their internet services.

According to the CRTC, the regulator of Canada's telecoms, 82 percent of Canadians enjoyed a download speed of 50 Mbps and 10 Mbps for uploads as of 2015. That is far faster than the level of service obtained by any Denman user. The CRTC target is for all Canadians to experience this level of service by 2021.

- 95 percent of the 462 speed tests reported in the Denman survey were below 25 Mbps (half of the CRTC standard).
- 54 percent of users' download speeds were below 6 Mbps.
- As is characteristic of copper cable internet service, download speeds fall when the number of internet users is high.
- Four geographic areas have low internet speeds, and they generally correspond with the gaps in Telus service.

Comparisons of survey findings in relation to the two main ISPs did not produce findings, but differences were evident in the firms' service characteristics.

This response constitutes a random sample, accurately representing the situation and opinions of Denman Island households. It should be valuable to begin conversation with service providers and regulators in pursuit of better internet services.

Introduction

This reports on the survey of internet services conducted on Denman Island during August of 2018. It is primarily an information piece, informing Denman Islanders of the internet services they receive, and their views about it.

Denman is a thriving island community with a 2016 population of 1,165 persons living in 595 households,[1] in an area of 52 square kilometres. Population characteristics have implications for Denman's requirements for internet services, and Denman's population differs from typical characteristics seen in British Columbia.

Denman grew 14 percent from 2011 to 2016 while the population of British Columbia grew by 5.6 percent. Denman's 2016 population includes:

125 children aged 0-19 years (11% of all);

595 people of working age - 20-64 years (51% of all);

440 people aged 65 years and older (38% of all).

The proportion of seniors is greater than the British Columbia norm (19%), and there are fewer children than the provincial average (20%)[2]. About one-half of its population is considered to be "in the labour force" (515 people), and of these workers, 210 are classified "self-employed". Denman Islanders are more highly educated than the BC norm, with 70 percent possessing a post-secondary certificate, diploma or degree (BC average is 55%), and 40 percent have a university degree (compared to 25 percent overall in BC). The 3.4 percent who have doctorates (35 people) are nearly 4 times BC's rate of PhD's per capita.

Denman's characteristics give rise to a few issues concerning internet services. Its population is spread throughout the Island, so widely dispersed internet services are required. This differs from the internet situation in many rural, remote and northern communities where service can be concentrated at a central community area or along a few roadways. Educational achievement correlates with internet access. Denman children require solid internet connections to study and learn (and recreate) just as children do in Canada's larger urban centres. Denman's households that are more educated have greater needs for good internet facilities. Island businesses, particularly self-employment, are usually quite dependent on the internet for functions like banking, billing,

[1] Data for Denman Island Trust Area from Census Profile, 2016 Census of Canada. These are private households occupied by usual residents.
[2] In the next decade, 70 children should advance to the working age group, increasing it slightly, while 290 people should move from the working age to swell the senior age group.

marketing, scheduling, etc. Denman's seniors increasingly find the internet brings them entertainment and services they desire, and the ability to maintain family contacts through tele-conferencing programs like Skype. A particular requirement on Denman arises from the sizeable component of seasonal residences, as these inhabitants increasingly expect to be able to access the internet. If good internet is not available to them, seasonal residents will seek out more suitable properties elsewhere. And finally, the large working age group finds the internet has important entertainment and informational functions that are a regular part of their daily lives.

There are limited internet services available on Denman Island. The only wired internet is ADSL service (Asymmetric Digital Subscriber Line) provided by Telus. A few other ISPs (Internet Service Providers) offer products that make use of the Telus wires (the survey found Uniserve and Lightspeed). Wireless internet is available from one ISP, Xplornet. Several telephone companies sell programs that allow users to access the internet using their cellular phones (e.g.: Telus Mobility's Smart Hub, Bell Mobility's Turbo Hub, Rogers' Rocket Hub). All of these methods of accessing the internet are sold by ISPs with claims about the speed and capacity that they provide, and with varied contractual arrangements and prices. There are also a few less-formal methods of accessing the internet, including "tethering" computers to cellular telephones, or just using cellular phones to browse. These alternative methods usually entail higher costs and diminished qualities of service.

In this context of Denman's characteristics, issues and limited internet services, Denman Island's Internet Committee (DIIC) was created in June 2018. The Denman community had learned that Hornby Island's community association had recently undertaken activities that had resulted in improvements to some of their internet service. A committee formed to find ways to improve internet service on Denman Island, and this became an affiliate of The Denman Island Residents Association (DIRA). The new DIIC committee developed a survey in order to obtain accurate information and resident's views about current internet use, as well as the demand for internet services and the degree of satisfaction with the present services. The Committee plans to use this information to make the case to ISPs and regulatory authorities that Denman's internet requires improvement.

The DIIC survey was designed as a universal study of Denman Island's internet situation. After pre-testing, the survey was launched August 9, making use of several channels. When the survey closed on September 5th, 185 completed questionnaires had been accumulated[3].

[3] One completed questionnaire came from a household on Hornby Island, so it was put aside.

Coverage of Denman's Survey Response

This section examines the representativeness of the response to the survey. The survey was designed to be universally available and appealing so people would be encouraged to respond to it.

- It had a minimal geographic identifier, three "tick the box" choice questions, and a simple speed test.
- The survey instructions required that each household submit only one survey for each ISP. The completed surveys were checked to ensure this instruction was followed[4].
- The administration of the survey was aimed to reach the entire population. Paper questionnaires were delivered: to all Island mailboxes on August 9 within "The Grapevine" weekly newsletter (Denman Island circulation - 675); available from August 9 in a box within The Denman Store; and on August 18 at the popular Saturday Market. An online version employing SurveyMonkey was provided 24/7 for 27 days, and a PDF version was distributed via e-mail to DIRA's entire address list on August 9, and was also available on a public web folder. Articles were printed in "The Grapevine" to introduce the survey and describe its availability, and notices were placed on Denman's Facebook bulletin boards. Later reminders to complete the questionnaire were published in both locations. These arrangements were augmented by some door-to-door delivery/reminders within three districts (Komas, Fillongley and southern Lacon Road). A prominent sign reminding people about the survey was placed for several consecutive days on each of the three roads that lead into Denman Island from the Denman West ferry terminal.

No significant biases are identified in the survey design and administration that limit it as a random representation of Denman households.

The return of 185 completed questionnaires is a strong representation[5] of Denman's 595 private households (31% sample). Questionnaires were received from addresses on 37 different roads, which is most of the roads on the Island. When plotted on a map, this distribution is clearly representative of the entire Island geography.

The response also represents vital groups within Denman's population that are significant parts of the communities' structure, and important to the goals of the Committee. The survey's coverage of seniors is exceptionally strong. While the Census reported 38 percent of Denman's population was over 65 years, 129 of the responding households reported seniors present (70% of the survey response). Thirty households reported having school-age children present, while the 2016 Census revealed that Denman has 120 private households with children (25% sample). The survey represents Denman's SMEs (Small to Medium Enterprises) – 44 questionnaires contained specific

[4] In two cases questionnaires were completed showing two ISPs, and follow-up contacts refined the responses so each questionnaire only dealt with a single provider.

[5] There is considerable variability in response rates to surveys. A typical response for a self-administered paper survey is in the 7-10 percent range, while online surveys seldom achieve 5%. Surveys administered by an employer within a workplace, where people are motivated to respond, often achieve returns in the 30-50% range.

business perspectives (35% of all responses). Nineteen responses (10% of all responses) came from households reporting as primarily seasonal residences. Seasonal residents are vital components of Denman's economy, adding purchasing power and supporting considerable work in construction, gardening and services. Each of these groups has particular needs for internet services that are important, particularly from the perspectives of regulatory agencies seeking to foster strong economies and equitable services, within provincial or national communities.

It is concluded that this survey response constitutes a random sample of Denman Island households, and a solid representation of key groups that are important from the perspective of internet regulatory policy.

Internet Access and Satisfaction

The most obvious finding of the survey is that Denman Islanders are strong users of the internet. Ninety-five percent of the survey respondents use the internet somehow, and only 9 respondents did not.

Internet Access on Denman Island, All Respondents and Key Groups
(as reported in the Denman Internet Survey)

	All Households		Households with One or More Seniors Present		Households with One or More Children Present	
	No. of Responses	***% of Responses***	**No. of Responses**	***% of Responses***	**No. of Responses**	***% of Responses***
All responses	185	*100%*	129	*100%*	30	*100%*
No internet	9	*5%*	5	*4%*	1	*3%*
ISP is Telus	126	*68%*	86	*67%*	22	*73%*
ISP in Xplornet	34	*18%*	27	*21%*	5	*17%*
Employ tethering	12	*6%*	9	*7%*	1	*3%*
Satisfied with Service	49	*26%*	39	*30%*	6	*17%*

Telus ASDL is the predominant source of the internet for Islanders, with some variety for the balance. Of the 185 survey responses, 87 percent access the internet from Telus (126 responses)

and Xplornet (34 responses). Twelve tether their cellphones, while others use cellphones as their only means of access.

Nine respondents (5 percent of all respondents), do not access the internet. Five of these report that no Telus is available to them, four say they would buy better service if it available, and three say the price is too high.

Forty-nine respondents indicated they are satisfied with their internet service, and of these, 84 percent access the internet through Telus (39) or Xplornet (6).

Seniors and Satisfaction

A less clear finding is that Denman seniors use the internet but they have mixed views about how satisfactory it is.

Seventy percent of all responses to the survey came from 129 households that have seniors present. These included 86 respondents who access the internet using Telus and 27 who use Xplornet. Nine others tether their cellphones, three just use cellphones for internet access, while one "camps out" on a neighbouring household's network.

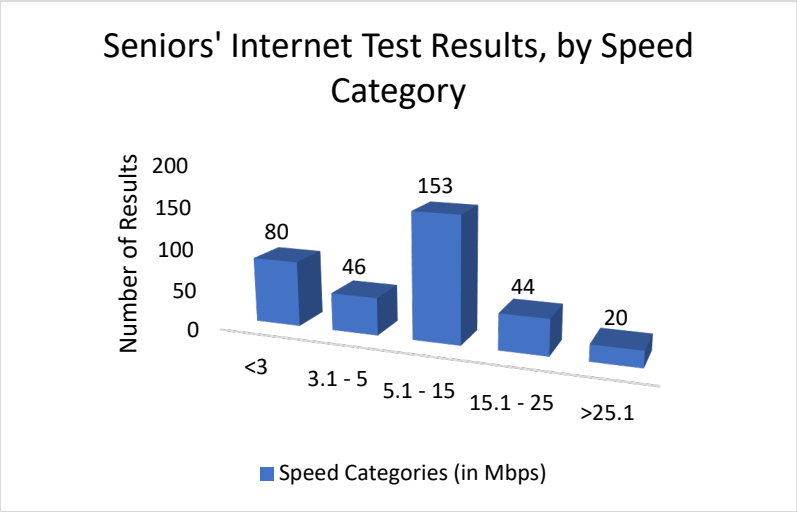
Five responses came from seniors households that do not use the internet. Three of these have no Telus available, three would buy better service if it was available, and three find the price too high.

Thirty of the seniors who responded were satisfied with the internet (23%), and they comprised 61 percent of all Islanders who indicated satisfaction. Among these satisfied seniors, nearly one-third (9 respondents) would buy better service if it was available, and nearly one-quarter (7 respondents) consider the price is too high.

The survey found that 49 of the responding seniors (40%) consider the speed[6] or capacity of their internet inadequate for enjoyment. These views concerning inadequacy were quite consistent with seniors' views about whether their internet service is satisfactory, as only two of the 49 respondents said both that their internet is inadequate for enjoyment and that it is satisfactory.

[6] Internet speed will be discussed further, below.

It is hypothesized that seniors use the internet for enjoyment, perhaps to view Netflix or YouTube, or Skype with family members and friends. Netflix recommends a minimum speed of 3 Mbps[7] for streaming video, and 5 Mbps for high definition video. While most seniors households did not report inadequate speeds (80 of 129 households) the following chart illustrates that nearly one-quarter of their speed test reports were below the Netflix guideline for reception, and 36 percent of all seniors reported speeds that were inadequate to view high definition video.



Thirty-four seniors households (26%) report that the internet speed was inadequate at certain times or certain days. These households included 14 who also reported their internet was inadequate for enjoyment. Two of the seniors households reported the temporal problems with the internet, but also indicated they are satisfied with their service.

A check at the Denman Seniors' Centre found download speeds of 7.6 Mbps[8] in the Lounge area, and 1.9 and 1.7 Mbps in the upper and lower gyms, respectively.

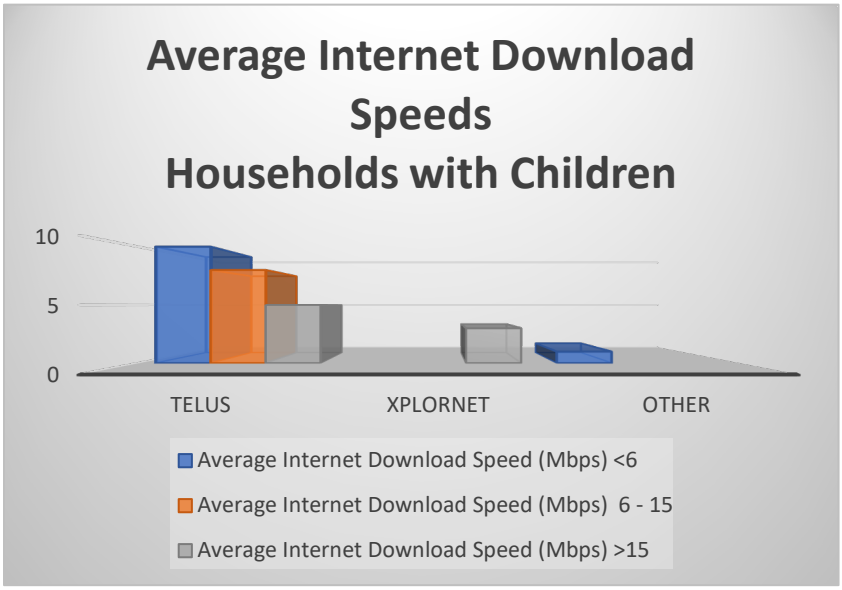
It may be concluded that seniors have mixed views about their internet service, with the majority finding it is inadequate. Some seniors were satisfied with their internet even though they had relatively low average download speeds.

School-age Children and Internet Adequacy

Denman's school-age children need to have access to good internet. The survey found, of the 30 households that have children present, 29 use the internet but only six of these reported they are satisfied with it. Nine indicated they have temporal issues with their internet service. Sixteen (53%)

[7] Mbps is the abbreviation of megabits per second. Downloading is data coming from the internet to the user. Uploads travel from the user to the internet.
[8] Mbps is the abbreviation of megabits per second. Downloading is data coming from the internet to the user. Uploads travel from the user to the internet.

said they would buy better service if it was available, and five said they would consider leaving Denman because of internet inadequacy. Five reported that Telus was not available to them, and three of these respondents use Xplornet.



Twenty-eight of the households with children reported their internet speed tests, and 11 of them (39%) had average download speeds under 6 Mbps. A test of download speed at Denman Community School (in the CAPS facility) found a speed of 9.6 Mbps, while the nearby Denman Library was slightly higher at 10.3 Mbps.

The survey suggests that, with the exception of Xplornet, Denman's internet service may be weak in relation to its capacity to support children's education.

Inadequacy for Business

The survey found Denman's businesses (SMEs) consider the internet service has significant inadequacies. Forty-four respondents said the internet is inadequate to conduct their business, and of these, thirty-three said their business or interest in Denman would improve with better internet. None of them indicated they are satisfied with their internet service. Seven of these respondents indicated the poor internet makes them consider leaving Denman. The internet services used by the business respondents were Telus (27), Xplornet (10) and tethering (6).

It is interesting to observe the internet speeds associated with these unsatisfied business interests. Thirty-eight of the respondents who said their internet is inadequate for business, reported their speeds. The average speed they reported, after three downloads, was 8.7 Mbps. Nineteen of them had average speeds below 6.0 Mbps. The sub-6.0 Mbps speeds were from Telus (16) and tethering (3).

It seems clear that internet services are inhibiting Denman Island's businesses, particularly the internet provided by Telus or by tethering.

Inadequacy for Seasonal Residents

Nineteen households indicated they are primarily seasonal residents. Seven of these households had seniors present, and of these, three had school-age children. Fifteen of the households access the internet, while three responded that they don't, and one didn't respond.

A higher proportion of seasonal households than fulltime residents use informal methods to access the internet. While eight seasonals use Telus and one uses Xplornet, four tether their cellphones and one just uses a cellphone for browsing. One accesses the internet at a nearby property. Two of the households that were tethering their cellphones said that Telus was not available to them.

The seasonal households that use the internet are not satisfied with it. Eight report that if faster internet were available they would acquire it (53% of users). Four report their internet is inadequate for their enjoyment, and two find it inadequate for their business. Three report their enjoyment or business would improve with better internet. Four said the price is too high. Four households indicated that they are satisfied.

The three seasonal households that don't use the internet include two who said they would sign up if faster services were available. One said the price is too high.

It is clear that seasonal residents find a lot of shortcomings with the internet on Denman Island.

The Price Question

The second most common opinion revealed by survey responses is that the price of internet services is too high. Fifty-nine respondents reported this, about one of every three respondents (see table overleaf).

This proportion is quite consistent among the various groups of respondents identified in the survey. Households with children, and households using Xplornet, have slightly higher proportions of reporting "too high prices" (40% and 47% respectively). The group of households that access the internet by other means, mainly by tethering, has a slightly lower proportion reporting high prices (23%).

Survey Respondents Reporting the Internet Price is Too High					
Groupings of Respondents	**All Respondents**		**Respondents Reporting Prices Too High**		
	No.	***% of All***	**No.**	***% of All***	***% of Class***
All Respondents	185	*100%*	59	32%	*32%*
Seniors Present	129	*70%*	40	22%	*31%*
Children Present	30	*16%*	12	6%	*40%*
Primarily Seasonal	19	*10%*	6	3%	*32%*
Satisfied with Internet	49	*26%*	13	7%	*27%*
Would Buy If Better	96	*52%*	31	17%	*32%*
ISP is Telus	127	*69%*	35	19%	*28%*
ISP is Xplornet	34	*18%*	16	9%	*47%*
Other Internet Access	17	*9%*	4	2%	*23%*
Don't Use Internet	9	*5%*	3	2%	*33%*

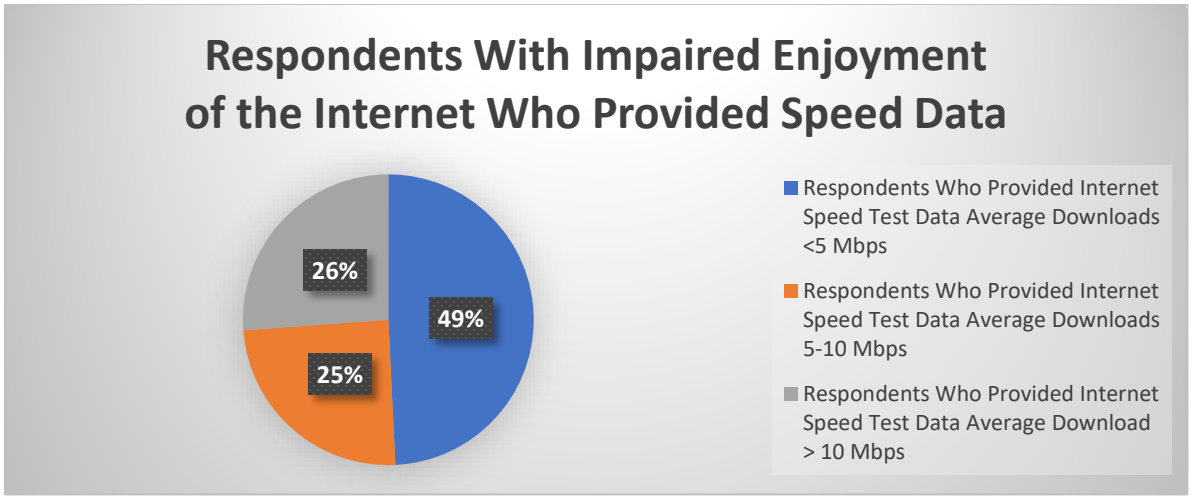
The survey doesn't afford much additional examination of the meaning of this widespread view about high prices. The consistency of the proportions, and the higher price sensitivity expressed by households with children, and households using Xplornet, all suggest that the "price too high" judgements are well-considered opinions within the Denman community. However, it is also noteworthy that one-half of all respondents to the survey said they would buy faster internet if it was available, and one-third of these respondents are the same households who report the present price is too high.

Inadequacy for Enjoyment

The opinion expressed most commonly by survey respondents is that the internet speed or capacity is inadequate for their enjoyment. Seventy-three (39% of all respondents) expressed this view, and 34 of these respondents also reported the internet is inadequate for their business. Thirty-nine of these respondents (53% of them) said their interest or business would improve with better internet, and 43 (59% of them) said if it was available they would acquire better internet.

Two factors that were covered in the survey may aid in understanding why so many users find their enjoyment impeded. Twenty-two respondents, thirty percent of those who weren't enjoying their internet, said the problems occur at certain times, and certain days.

The following chart provides some insight into what causes these temporal problems. It shows the distribution among three speed categories, of the averaged data from sixty-five respondents who reported their internet speed tests.



Three-quarters of these respondents had average download speeds under 10 Mbps, and one half of them had speeds below 5 Mbps. Slow internet speeds result in interruptions in the transmission of larger data files including images, in video data such as Netflix and YouTube, in live streaming and in games – all examples that would impair enjoyment of the internet.

Internet Speed

This section of the report conveys the survey findings about a complicated subject, internet speed.

The federal agency responsible for regulation of the internet in Canada, the Canadian Radio Television Commission (CRTC), publishes information for consumers about the use of the internet and internet standards[9]. It advises that internet speeds are affected by many factors, both within and outside the home. Inside factors include the modem, the router, the number of devices being used

[9] Information summarized from CRTC website at https://crtc.gc.ca/eng/internet/performance.htm.

(computers, tablets, cellphones on Wi-Fi settings), the distance and materials between the router and the device being used, and the speed of the device being used (older devices are usually slower). Outside factors include the house connection to ISP services, the quality of the ISP service at that location, and the traffic on the website being accessed. Internet speeds found by users are the outcome of all of these factors, as well as the capabilities of the test that produced the speed finding.

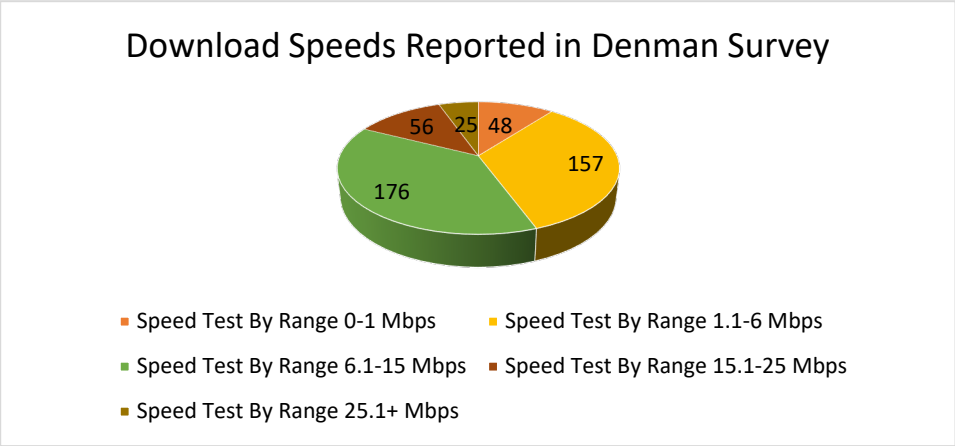
Denman Islanders should be aware that in December 2016 the CRTC issued a regulatory target as follows:

> *In 2015, 82% of Canadians had access to speeds of 50 Mbps download/10 Mbps upload for fixed broadband services. We recognize that a well-developed broadband infrastructure is essential for Canadians to participate in the digital economy. That is why we set new targets for Internet speeds. We want all Canadian homes and businesses to have access to broadband Internet speeds of at least 50 Mbps for downloads and 10 Mbps for uploads.*
>
> *While most Canadians today have access to these minimum service levels, many rural and remote regions in Canada lack the infrastructure needed. As part of its effort to support such an infrastructure, we are setting up a fund to help ensure minimum service levels for broadband Internet access across Canada. By the end of 2021, we expect 90% of Canadian homes and businesses will have access to broadband speeds of at least 50 Mbps for downloads and 10 Mbps for uploads.*

This CRTC statement demonstrates what experts view to be reasonable, necessary internet targets. It also attests that regulators understand that rural infrastructure needs improvement to reach these levels.

Our survey asked respondents to report their internet speed using a particular speed test, the "Combined" test at www.testmy.net. This is one of many good tests available, and it had the useful feature of immediately providing users with contextual information about their test scores. Using one test has the advantage of producing consistent information, suitable for comparison. The speed testing in the survey provides comparative information about a lot of Denman internet users, and affords some understanding of relative speeds and trends on the Island.

The survey asked respondents to perform and report on three tests of internet speed, with each test covering both downloads and uploads. The examinations that follow only concern the download results, that is, the speeds at which data is delivered from the internet to users on Denman Island. Ignoring the uploads makes the examinations more manageable, and is the conventional manner of considering speed.



This chart illustrates the distribution of 462 download speed test results, among five classes of download speeds.

While most of the results were above 6 Mbps, there were 205 of 462 tests (44%) at a lower level of service. The average speed of the 157 reports between 1.1Mbps and 6 Mbps was 3.57 Mbps, which is enough for a standard Netflix video, but not adequate for a high definition video. There were 176 results (38%) between 6.1 and 15 Mbps, and 56 results (12%) between 15.1 and 25 Mbps. Taken together, 95 percent of the internet tests on Denman Island were below 25 Mbps, which is less than one-half of the CRTC target speed for Canada.

Speed and Temporal Inadequacy

The survey found that 52 respondents, 28 percent of all respondents, found the internet inadequate at some times, and some days.

The large number of speed readings, taken by many households over about a month, affords the ability to look at these temporal aspects of the internet service. The table below reports the 447 internet speed test results that identified the day of the week that they were obtained. There is day to day variation in the number of speed tests performed. From Sundays to Thursdays inclusive there were 40-64 reports daily, while on Fridays and Saturdays there were 101 and 90 reports, respectively. This pattern of distribution is generally consistent within the five download speed ranges. The proportions in the higher download speeds are slightly greater on Fridays and Saturdays than on other days. Whereas many survey respondents found temporal problems in their internet service, the survey does not reveal a daily inadequacy.

Internet Speeds Reported by Speed Range and Day of Week							
Speed Ranges	**Weekdays**						
	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**	**Sunday**
< 1 Mbps	4	3	7	8	13	7	5
1.1 – 6 Mbps	13	20	17	26	30	29	12
6.1 – 15 Mbps	16	21	15	22	40	33	25
15.1 – 25 Mbps	6	5	13	4	12	8	8
> 25.1 Mbps	1	1	0	4	6	13	
Subtotals	40	50	52	64	101	90	50

The second table, below, provides insight into the “time of day” aspect of the temporal inadequacy issue. It shows the distribution of the 419 speed test results that identified the time when the test was carried out, with time organized into five groups.

Internet Speeds Reported by Speed Range and Time of Day					
Speed Ranges	**Time Periods During Day**				
	06:01- 11:00 (morning)	**11:01 - 14:00 (noon)**	**14:01 - 17:00 (afternoon)**	**17:01 - 22:00 (evening)**	**22:01 -06:00 (night)**
< 1 Mbps	19	8	6	11	3
1.1 – 6 Mbps	48	29	26	29	5
6.1 – 15 Mbps	43	30	30	50	8
15.1 – 25 Mbps	17	7	4	16	6
> 25.1 Mbps	7	4	5	8	0
Subtotals	134	78	71	114	22

Fifty-nine percent of all test reports (248 reports) come from two five-hour periods, morning and evening. During the morning sixty-seven reports are from the lowest speed classes (below 1.0 Mbps, and 1.1-6 Mbps). This is a notably greater number, and proportion of low speed than occurs in any other time period. During the evening there were 40 reports from the two lower speed ranges. It appears that during the periods when the number of internet users is high (mornings and evenings), there is a disproportionate rise in low speed test results. That relationship would cause users whose speed drops, to consider their internet inadequate at those times.

Speed and Geography

The survey provided some rough geographic information about the distribution of internet speeds across Denman Island. The table overleaf shows, for six classes of internet speeds below 6.0 Mbps, the streets where speeds within these ranges were reported. The table does not show all speeds reported on these streets, just the streets where all sub 6.0 Mbps speed tests were reported.

Listing of Streets Where Internet Speeds <6.0 Were Reported					
Speed Ranges					
<1 Mbps	1.1-2.0 Mbps	2.1 -3.0 Mbps	3.1-4.0 Mbps	4.1-5.0 Mbps	5.1-6.0 Mbps
Baikie	Baikie				
	Chrisman Rd		Chrisman Rd		
			Cokley Rd	Cokley Rd	
Corrigal Rd		Corrigal Rd		Corrigal Rd	Corrigal Rd
Crescent					
Dalziel Rd		Dalziel Rd	Dalziel Rd		Dalziel Rd
Denman Rd	Denman Rd	Denman Rd		Denman Rd	
Dusty Road	Dusty Road	Dusty Road			
Eaglecrest Rd	Eaglecrest Rd	Eaglecrest Rd	Eaglecrest Rd		
East Rd	East Rd		East Rd	East Rd	East Rd
				Greenhill Rd	Greenhill Rd
				Hilberry Lane	Hilberry Lane
				Jemima Rd	Jemima Rd
			Keith Wagner Way	Keith Wagner Way	Keith Wagner Way
					Kelsey Rd
Lacon Rd	Lacon Rd	Lacon Rd	Lacon Rd	Lacon Rd	Lacon Rd
Lake Road		Lake Road	Lake Road		
					Marcus Rd.
					McFarlane Rd
		Nixon Rd	Nixon Rd		Nixon Rd
Northwest Rd	Northwest Rd	Northwest Rd	Northwest Rd	Northwest Rd	Northwest Rd
		Owl Crescent	Owl Crescent		
					Park
Reginald	Reginald	Reginald	Reginald		
Schmidt Rd		Schmidt Rd	Schmidt Rd		
Scott Rd			Scott Rd	Scott Rd	
Swan Rd	Swan Rd	Swan Rd	Swan Rd		
				Triple Rock Rd	Triple Rock Rd
				Trueman	
	Wren	Wren			

There are a four recognizable geographic patterns in this table. For instance, the sector of East Road (northern end), Corrigal, Marcus, Jemima is not served by Telus. Telus service is also minimal to unavailable in much of the area south of Fillongley Park (Balkie, Dalziel, Schmidt, Swan). Telus service is weak at the southern end of Lacon Road, including Dusty and Reginald. It is also weak towards the northern end of the island (Northwest, Lake, Wren, Nixon, Scott, Chrisman).

There is a relationship between these patterns of low speed, and characteristics of Telus' ASDL service. Telus internet service speeds reduce with distance from its two Central Offices (COs). These COs are located on Kirk Road, and at the corner of East Road and McFarlane Road.

There is clearly a weakness in the availability of adequate speeds in internet service to particular parts of the Island.

Service Providers

This final section conveys information about the internet service providers serving Denman Island.

Telus

The Island's predominant ISP is Telus, which has a valuable but dated ASDL service network that evolved out of its wired telephone facilities and previous generation of cable television infrastructure.

Telus service arrives on Denman via fibre-optic cable near the Denman West ferry. The fibre goes to Telus' CO on Kirk Road, then continues out along two routes. One goes out Lacon Road and across McFarlane to Telus's other CO at the corner of McFarlane and East Road. The other fibre optic cable goes across Denman Road to Cable Beach, where it crosses Lambert Channel to bring internet to Hornby Island. In the COs, the fibre-optic cable is connected, by means of ports, to cables that run out to distribute service to customers. Each customer connects to a port in the CO through a pair of twisted copper wires, contained within the cables. The quality of internet services declines with distance from the CO, with 5 kms being the approximate limit for service. To account for the resulting variations in the speeds it can provide, Telus undertakes with individual customers to provide service at one of

the following speed levels: 1 Mbps, 6 Mbps, 15 Mbps and 25 Mbps. Its prices are approximately as follows[10]:

- For service up to 15 Mbps, the charge is $71 per month, with the first 3 months at $55 for term contracts, the first 6 months at $50 for a 2-year contract;
- For service up to 25 Mbps, where available, $76 per month;
- For service above 50 Mbps, where available, $80 per month.

Xplornet Xplornet provides rural internet service across Canada, and is the only satellite internet provider that was identified in the survey[11]. It mounts its dish on a customer's property, facing the southern sky, providing service at prices approximately as follows[12]:

- For up to 10 GB of data, speed up to 5 Mbps, $50 per month;
- For up to 20 GB of data, speed up to 5 Mbps, $60 per month;
- For up to 50 GB of data, speed up to 10 Mbps, $80 per month;
- For up to 300 GB of data, speed up to 25 Mbps, $120 per month (with a $20 per month discount for the first 12 months)

Survey Data About These ISPs

The survey found some differences in Denman Islanders' use and opinions about the two main ISPs (see following table). Overall, the survey indicates that over two-thirds use Telus and just less than twenty percent use Xplornet.

Comparison of the shares each ISP received for each particular "Type of Data", with that ISP's overall shares of the completed questionnaires, reveals whether the ISP has a notable characteristic on Denman. To illustrate, both ISPs have shares of two Types of Data, "households with seniors" and "households with children", that are very close to their overall shares of Denman households, so these are not notable. Both ISPs have lower proportions of the seasonal residents than their overall shares of the Island's internet, so this reveals that seasonal residents are more likely to avoid these ISPs

when accessing the internet. Telus received more than its share of households that consider it inadequate on certain days or times of the day, and people who would consider leaving because of internet inadequacies, so these stand out as negative

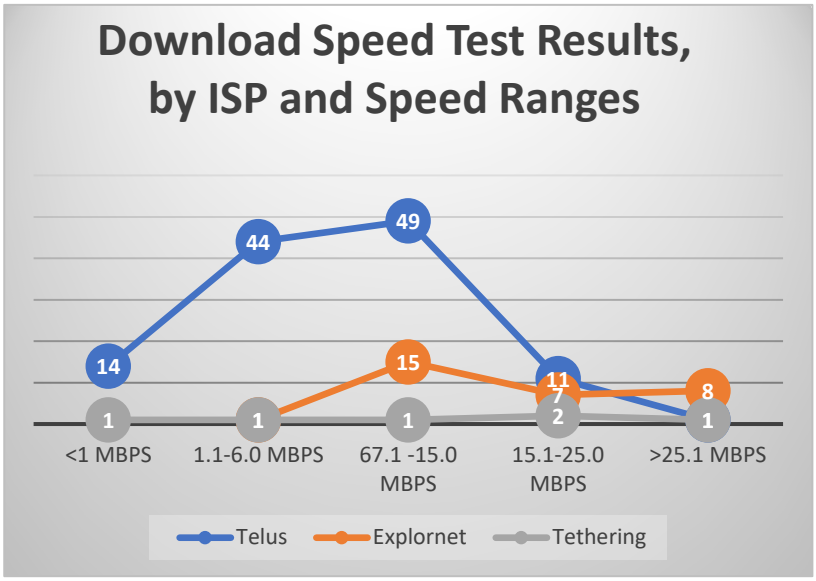
[10] This pricing information was provided by a Telus sales agent on a generalized basis, for illustrative purposes. Actual price quotations are only made for individual locations.
[11] Other Canadian or even global satellite internet providers may also be in use, such as Bell or Shaw, but none were reported in the survey.
[12] Pricing information from Xplornet website at https://www.xplornet.com/shop/our-internet-packages/.

characteristics. On the positive side, Telus users reported less than its share of households that feel better internet would improve their enjoyment or business, and of households that said they would acquire better internet if it was available. Xplornet's negative characteristics are that it received more than its share of households that said it was inadequate for enjoyment, and those that said its price is too high. In terms of user satisfaction, Telus received more than its share, and Xplornet received less than its share.

Comparison of Telus and Xplornet as Seen in Denman Survey

Type of Data	Telus		Xplornet		All Responses	
	No.	*% of All*	No.	*% of All*	No.	*% of All*
Households that completed questionnaires	127	*69%*	34	*18%*	185	*100%*
Households having seniors present	86	*67%*	27	*21%*	129	*100%*
Households having school-age children present	22	*73%*	5	*17%*	30	*100%*
Seasonal residents	8	*42%*	1	*5%*	19	*100%*
Telus not available			15	*54%*	28	*100%*
Internet inadequate for enjoyment	44	*60%*	20	*27%*	73	*100%*
Internet inadequate for business	27	*61%*	10	*23%*	44	*100%*
Internet inadequate at certain times, some days	38	*73%*	10	*19%*	52	*100%*
Internet price too high	35	*59%*	16	*26%*	59	*100%*
Internet makes household consider leaving Denman	11	*73%*			15	*100%*
Better internet would improve enjoyment or business	37	*58%*	16	*25%*	64	*100%*
Would acquire better internet, if available	57	*58%*	25	*25%*	98	*100%*
Satisfied with internet	41	*80%*	6	*12%*	49	*100%*

Finally, this chart shows the results of the speed tests reported by Denman users, organized as five classes of download speed, and grouped by ISP. It also includes the few results from people who tether their cellphones. Most Telus users are in the lower speed ranges, while Xplornet users are primarily at higher speeds. This is not surprising, as the pattern of Telus users' speeds mainly reflects the fact that most users are located some distance from the COs, so they cannot acquire the higher speed service. Xplornet users have their choice of speeds, so the chart merely demonstrates their choices.



Summary of Findings

This report has provided information about the internet services received on Denman Island, and Islanders' views about many aspects of this service.

Denman has particular needs for internet services. It is growing quickly and has key population groups that, for different reasons, require good quality, reliable internet (seniors, school-age children, businesses). Also, seasonal residents are an important component of Denman's economy, and good internet is vital to attracting these people.

In August, the new Denman Island Internet Committee conducted a survey to learn what internet services are received here and what Islanders think about the service. The survey closed after Labour Day with 185 completed questionnaires, and examination of this response found it constitutes a random sample, representative of the Island.

The internet is widely used on Denman. Of the 185 survey responses, 87 percent access the internet from Telus (126 responses) and Xplornet (34 responses). Twelve tether their cellphones, while others use cellphones as their only means of access. Perhaps 5% of Islanders do not use the internet.

The dominant provider, Telus, distributes its service via twisted copper pairs in cables coming from two central offices (located on Kirk at Northwest, and on East at McFarlane). The greater the distance between an internet users' house and one of these offices, the slower their internet service. At a distance of about 5 kms, no reliable service occurs. Also, there are service gaps in Telus' distribution, notably: (1) the East/Corrigal/Jemima area; (2) south of Fillongley (Balkie/Dalziel/Swan/Schmidt); (3) Northern Denman (Komas); and (4) Southwestern Denman (Lacon/Reginald/Dusty).

The satellite service provided by Xplornet can usually locate anywhere, but it can be blocked by terrain or heavily forested areas. People can tether computers to cellphones to access the internet, but this requires a strong cellular signals (which are scarce on Denman), and the user must have an adequate and affordable data plan (which is not common among cellphone users).

Availability notwithstanding, significant problems were found with internet service on Denman.

- Nearly 40% of all respondents indicated their internet speed or capacity is inadequate for their enjoyment, and one-half of these respondents also said it is inadequate for their business.
- 33 respondents said their enjoyment or business would improve with better internet.
- One-half of the 19 seasonal residents who responded said if better internet was available they would acquire it, and one-third of them reported their internet was inadequate for either their enjoyment or their business.
- Seniors' views about their internet service were varied, with one-quarter reporting satisfaction, one quarter finding their service inadequate at certain times, and one in six reporting it is inadequate for their enjoyment.
- About one-half of the 30 responding households that had school-age children, said they would acquire better internet if it was available, and about one-third said it is inadequate at certain times. Five of the households said they would consider leaving Denman because of the internet.
- 32% of respondents said the price of the internet is too high.

Notwithstanding these problems, it is also notable that nearly one in three respondents indicated they are satisfied with their internet services.

The speed of internet services on Denman Island is far below the service received by most Canadians. The federal agency that regulates internet in Canada, the CRTC, has established a target that all Canadians have access to broadband internet speeds of at least 50 Mbps for downloads and 10 Mbps for uploads, by the end of 2021. It states that 82% of Canadians were obtaining these levels in 2015. Ninety-five percent of the 462 speed tests reported in the Denman survey were below 25 Mbps, and that is only one-half of the national standard. Fifty-four percent of

Denman speeds were below 6 Mbps. Examination of the speeds reported at different times of the day showed that during periods when the number of internet users is high, there is a disproportionate rise in the low-speed test results. The geographic distribution of the lower speed results was examined, and four areas of lower speed were observed, matching the Telus service gaps described above.

Some comparisons were made, of survey findings in relation to the two main ISPs. This did not produce findings, other than to observe that the services provided by these two firms have different characteristics.

The information gathered from this survey should be valuable to Denman Island as it begins conversation with service providers and regulators in seeking to improve internet services.

Addendum

(13 months later)

Denman Island Internet Survey

Denman Island Internet Committee

November 21, 2019

Summary

The 13 responses by Denman households to the recent HICEEC online internet survey added somewhat to the findings of the Denman survey conducted in 2018.

The total survey response from Denman was increased to 198 (34% of all households).

Some additional information was obtained:

- There is an overwhelming preference for a fibre-optic option to improve the internet;
- There is an interest in keeping the user charges to the $60-$90 per month range; and
- There is an understanding that weak connectivity limits the quality of life in the community.

Introduction

During the period September 15 - November 15, 2019, the Hornby Island Community Economic Enhancement Corporation (HICEEC) conducted a 14-question online survey of internet services which produced thirteen responses from Denman Island residents. These responses are additions to the August-September 2018 survey on Denman Island (survey findings published October 8, 2018).

This Addendum provides summary information from the thirteen added responses, highlighting new findings. The structure of the Addendum follows the order of the 14 questions posed in the HICEEC survey questionnaire.

Total Sample

The additional responses add to the strength of the survey response, bringing the total response to 198, which is 34 percent of all Denman households.

Distribution of Responses (Q3)

The additional responses came mainly from the east side of Denman Island. Streets included were Denman (2), East (4), Fillongley (2), Hilberry, Lacon, McFarlane, Owl, Schmidt and Yule. This adds two streets to bring the total geographic coverage of survey responses to 39 different roads, almost all the roads on Denman Island.

Household Types (Q4)(Q7)

The new responses included 11 year-around residences, 2 seasonal residences and a home business. This information is not fully additive to the original survey as the latter did not ask respondents specifically whether they were a business, or a home business. The composition of the households was similar to that found in the original survey.

COMPOSITION OF HOUSEHOLDS FOUND IN ADDITIONAL SURVEY RESPONSES		
Household Members by Type	**Responses**	
	Number	**% of Total**
Residents		
School-age children (3-18 yrs)	2	12%
Young adults (19-25 yrs)		
Adults (26-64 yrs)	6	35%
Seniors (65+ yrs)	6	35%
ST	**14**	**82%**
Frequent Visitors		
School-age children (3-18 yrs)		
Young adults (19-25 yrs)	1	6%
Adults (26-64 yrs)	2	12%
Seniors (65+ yrs)		
ST	**3**	**18%**
TOTALS	**17**	**100%**

Sources of Internet (Q5)

The sources of internet were similar to those found in the original survey. The Xplornet users supplied a slightly higher proportion of these respondents' internet, and there were fewer SmartHub users. Both of these findings are reflective of the respondents' dominant location on the east side of Denman, where Telus' services are weaker.

SOURCES OF INTERNET (ISPs) FOUND IN ADDITIONAL SURVEY RESPONSES		
Internet Provided By	**Responses**	
	Number	**% of Total**
Telus	8	61%
Xplornet	4	31%
SmartHub	1	8%
ST	**13**	**100%**
No Telus Available	2	

Use of the Internet (Q6)

The Hornby survey questionnaire improved on the original Denman survey by asking how respondents use the internet. The following table shows usage by the 13 Denman respondents:

USES OF THE INTERNET FOUND IN ADDITIONAL SURVEY RESPONSES		
Uses	**Responses**	
	Number	**% of Responses**
Basic uses (email, texting, browsing, Facetime/Skype)	13	100%
Streaming (Netflix etc, sports, gaming, news/documentary/events/conferences	7	54%
Basic business (till and billing, bookkeeping, credit cards, accounting, banking, inventory, research, ordering, sales, promotion/advertising	6	46%
Interactive learning (teleconferences, group modelling, data base projects, interactive gaming)	5	38%
Educational access (home school, post-secondary, distance learning courses, work-related courses)	3	23%
Advanced business (data base modelling, digital graphics, multi-media collaborations)	2	15%
Medical (health monitoring, online diagnosis, treatment)	0	
Household mechanics (smart electronics, controls, monitoring, security)	0	
TOTAL	**36**	

Nearly one-half of respondents employ the internet for basic business, while 15 percent use it for more advanced business functions. There are indications it is widely used for education (23 percent using it for educational access, 38 percent using it for interactive learning).

Satisfaction With the Internet (Q11)

As seen in the original survey, most Denmaners are not satisfied with their internet service. The 13 added responses were:

- Not satisfied with my internet service 10 (77%)
- Satisfied with my internet service now 2 (15%)
- Satisfied for the foreseeable future 1 (8%)

The Inadequacy of the Internet (Q12)

The Hornby survey asked about the specific impacts of the inadequacy of their internet. These responses provide direct evidence of what is meant when respondents describe the internet as being inadequate.

FUNCTIONS AND ACTIVITIES THE PRESENT INTERNET IS INADQUATE FOR, BECAUSE OF SPEED/CAPACITY/RELIABILITY		
Functions/Activities Where Internet is Inadequate	**Responses**	
	Number	**% of Responses**
My enjoyment/entertainment	11	85%
My learning/education functions	8	61%
My household's functions (smart equipment, security)	4	31%
Reducing the cost of travel, by accessing services via the internet	4	31%
Reducing my carbon footprint from travelling to access services, in a vehicle, and on the ferry (or ferries)	4	31%
Connecting with my community, alleviating isolation	4	31%
Safety and accessing emergency services into the future	3	23%
My business functions	3	23%
Attracting young families	3	23%
My desire to live here for the long term	2	15%
Accessing healthcare services	1	8%
TOTAL	**47**	

The most common "inadequacy" is fact that poor internet limits enjoyment and entertainment. Perhaps more importantly, nearly two-thirds of respondents observed that it weakens their learning and education. One-third of respondents observed problems in connecting with the community, reducing carbon footprint and money spent on travel, and employing smart equipment. About one in four identified that weak internet makes it difficult: to attract young families to our islands; to perform business functions; and increasingly, that it will limit safety and access to emergency services. These detailed responses, and the frequencies of the responses, demonstrate the communities' interest in achieving better quality of life through improved connectivity.

Pricing and the Internet (Q9, Q10)

The Hornby questionnaire yielded some insight into people's thoughts about the pricing of connectivity. As seen in the table below, most respondents would like to keep their internet payments in the $60 - $90 per month range. The responses provide slight, but only slight, evidence that some respondents would pay more for better service.

PRICING AND THE INTERNET				
Price Range (per month)	**Paying at Present**		**Would Pay for Fast, Reliable, High Capacity Internet**	
	Number of Responses	**% of All Responses**	**Number of Responses**	**% of All Responses**
Less than $60	2	20%	2	15%
Between $60 - $90	5	50%	7	54%
Between $90 - $120	3	30%	3	23%
More than $120	0		1	8%
TOTAL	**10**	**100%**	**13**	**100%**

How Should the Internet Be Improved (Q13)

The Hornby questionnaire asked respondents to select their preference between four descriptions of possible methods of improving their internet. Twelve of the thirteen Denman respondents answered this question, and one of these respondents selected two options, so a total of 13 options were selected by twelve respondents.

The overwhelming choice, made by 85 percent of respondents, was as follows:

> *"the principal solution for the islands should be to secure universal "fibre to the home". A fibre optic (glass) cable emits no radiation, will last for decades, and can always be kept up to date. In opting for this solution, it is recognized that it may have a higher minimum cost, and may be unavailable or have added costs for homes in the more remote locations, or homes with very long driveways."*

A different option was selected by three respondents. One respondent preferred "*Any source of internet with speeds of at least 25 Mbps".* One selected a wireless-based service with towers of varying heights. One selected a hybrid option with fibre where financially and physically possible, and with wireless, copper wire and satellite-based service as other sources.

Summary

The 13 responses by Denman households to the recent HICEEC online internet survey added somewhat to the findings of the Denman survey conducted in 2018.

The total survey response from Denman was increased to 198 (34% of all households).

APPENDIX B
HORNBY ISLAND SURVEY

Baylink Networks

&

Hornby Island Community Economic Enhancement Corporation

November 13, 2019

Introduction

The Hornby Island survey was designed as a universal study of Hornby Island's digital connectivity situation. After development, consultation, and pre-testing, the survey was launched September 26, 2019. When the survey closed on November 12th, 229 completed questionnaires had been accumulated.

Coverage of Hornby's Survey Response

This section examines the representativeness of the response to the survey. The survey was designed to be universally available and appealing so people would be encouraged to respond to it.

- It was comprised of only 14 questions.
- The first was whether the service was on Denman or Hornby, in order to allow both islands to use the survey, if desired. Of the 244 surveys received, 229 were from Hornby and only those were considered in the analysis. Information from the Denman responses was provided to the DIIC.
- Use and satisfaction questions were developed for information on needs and aspirations.
- A speed test was requested, but not mandatory, and an app. to use for the test was recommended.
- Providing contact information was an optional field
- An address, or neighbourhood description, was requested in order to assure a wide geographic representation was included in the results
- Respondents were asked to identify whether they were full time residents, or seasonal residents, in order to assess uptake on a future economic model.
- Business usage was isolated in order to review the economic impact of inadequate internet service.
- Demographic questions were used to identify respondents by age, family status, interests and needs.
- The survey allowed only one response from each I.P. address, so that households would be singularly represented.
- The administration of the survey was aimed to reach the entire population. Paper copies were made available at the "Free Post", with the easier to complete digital copy online. The website link to the survey was widely advertised in flyers and newspapers, and on the Hornby Community Connections Facebook page (over 1600 members). Delegates also attended Island meetings, influencers in the community were asked to spread the word, sandwich boards were strategically placed for attention.
- No significant biases are identified in the survey design and administration that would limit it as a random representation of Hornby households.

Connectivity, Access and Satisfaction

Number of respondents 229

- Total number of households on Hornby, 2016 Census: 560
- 75% of respondents live/work on the island year-round, the other 25% have secondary homes on the island, and a principle residence in another centre.

The return of 229 completed surveys is a strong representation of Hornby's 560 private households.

- Questionnaires were received from all geographic areas on the island.
- The responses were representative of the age groups residing on the island.

  2016 Census data showed 53% of the population was over 60, and 54% of the 2019 survey respondents were seniors. 10% of the survey respondents were family households vs. 16% of the Census identified families.

- The survey had 127 respondents reporting using the internet for business purposes which corresponds to the high number of independent, self-employed people who live on Hornby. Hornby is considered a rural, remote island, without any significant major employers or industries. In the 2018 Vital Signs report done by the Comox Valley Foundation, Hornby had a poverty rate of 28.3%, the highest in the catchment area.
- Seasonal residents are vital components of Hornby's economy, adding purchasing power, support for the Arts Community, and all the service-oriented businesses. Hornby has a very seasonal, tourism-based economy. Each of these groups has particular needs for internet services that are important, particularly from the perspectives of regulatory agencies seeking to foster strong economies and equitable services, within provincial or national communities.
- It is concluded that this survey response constitutes a random sample of Hornby Island households, and a solid representation of key groups that are important from the perspective of internet regulatory policy.

What about Wireless Cell Service?

In 2015/16 Hornby residents vocally turned down a Telus tower installation on the island. There was a common concern regarding Electro Magnetic Frequencies emitted by wireless devices, and a lack of proven safety for the technology. This recent experience has created an ongoing concern in looking to the future of digital connectivity, and created the desire to bring islanders together as we looked to the future of digital capability.

Therefore, a key consideration, in this survey, was to monitor where the resident appetite currently lies regarding connectivity. A question was crafted to outline three connectivity choices:

i. The principal solution for the islands should be to secure universal “fibre to the home”. A fibre optic (glass) cable emits no radiation, will last for decades, and can always be kept up to date. In opting for this solution, it is recognized that it may have a higher minimum cost, and may be unavailable or have added cost for homes in the more remote locations, or homes with very long driveways.

ii. The principal solution for the islands should be towers of varying heights, providing wireless-based service to reach all locations, costs may be lower, and it will possess greater capacity to evolve into 5G applications in the future.

iii. The principal solution for the islands should be a hybrid service employing fibre where financially and physically possible, and for other areas wireless service beamed to shoreline areas, limited copper service, private satellite service, and a minimum number of areas where service is unavailable. It is understood that this option may not meet the 50/10 Canadian standard for 100% of properties.

155 respondents, representing 71.8% of the 216 that completed this question in the survey, wanted Option 1, Fibre to the Home, despite the potential for having higher user levies. A further 16.7% would be amenable to Option 3, which is preferably fibre but could employ a wireless strategy if it was more feasible. Option 2, the less expensive choice, was chosen by 11.6% of respondents.

By significant majority, people on Hornby are extremely concerned about the safety of wireless infrastructure, and do not want to go in that direction, even if it means better cell service and cheaper internet rates.

A vision has been developed for a Fibre to the Home project, encompassing all properties, on both islands. This will allow better cell service by way of wifi calling, and will dramatically improve the delivery of both cell and internet services.

Using Internet

The most obvious finding of the survey is that Hornby Islanders are strong users of the internet. One hundred percent of the survey respondents use the internet somehow.

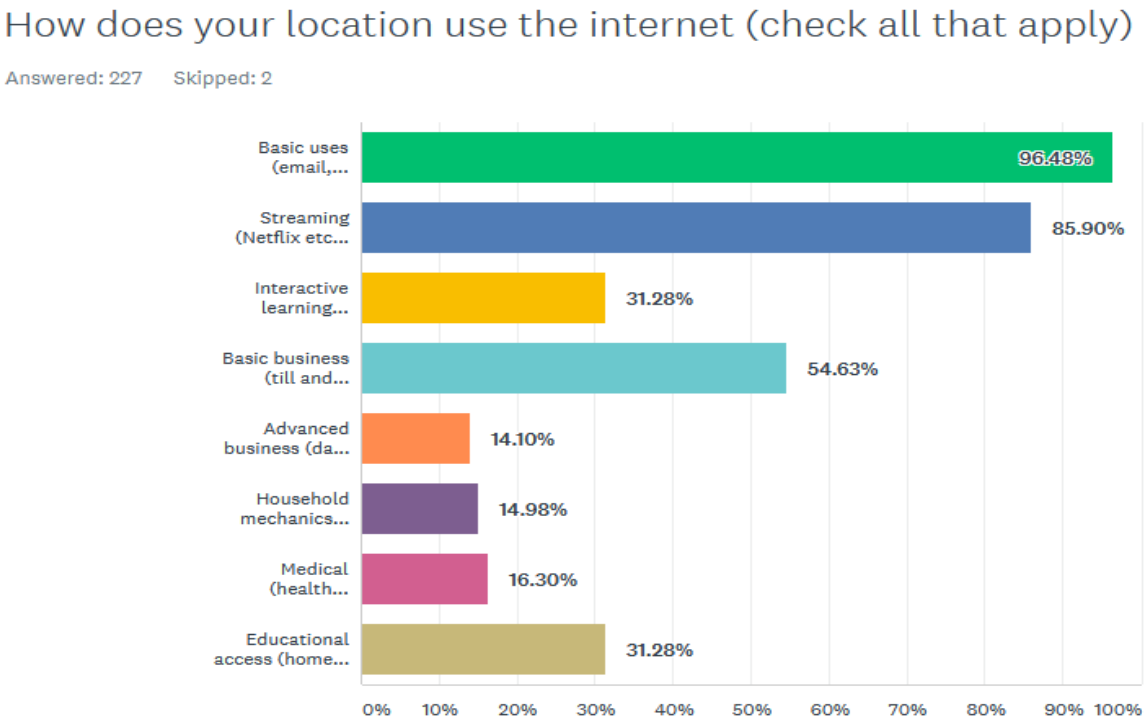
Hornby's population growth has stalled, with significant challenges faced on the transportation, housing, and connectivity fronts. Connectivity has been identified as having potential to be a key economic driver, to help diversify and strengthen the Hornby economy. Key groups that require good quality, reliable internet are businesses, remote workers, institutions, transportation providers, young families, seniors, school-age children, and life-long learners. Also, seasonal residents have reported that good internet attracts them to visit more often, and to stay for longer periods of time.

Of the respondents, representing 41% of Island households, 84% of users access the internet via ADSL (copper cable) from Telus. The remainder, statistically get satellite from Xplornet, Smart Hubs from Telus cellular with line of sight service to off-island towers, or tethered cellphones offered by various providers. (although cell service is intermittent on the island).

Telus service is distributed from three points which it calls Central Offices: Shingle Spit and Mount Road, the main office on Central Road near the Coop Store, and at the intersection of Central Road and Sandpiper Drive. Several residents living close to the CO's have been offered bonded wire service, which increases their service dramatically. The downside of this is that it takes two ports, which means that with growth in the population another individual may not get any service. With copper wiring infrastructure the speed of users' access declines with distance from these offices, until no reliable service occurs at about 5 kms. This causes service gaps and increasingly poor internet, especially in two of our major subdivisions – Galleon Beach and Whaling Station Bay. Service levels further decline in the summer months, when the population increases with summer visitors.

The satellite service provided by Xplornet cannot be easily accessed everywhere, as it can be blocked by terrain or heavily forested areas. People can tether computers to cellphones to access the internet, but this requires a strong cellular signal (which is scarce on Hornby), and the user must have an adequate and affordable data plan (which is not common among cellphone users). Telus is promoting their new Smart Hub service, but only a few of the wealthier residents, living on the waterfront, are able to access service in that manner.

Availability notwithstanding, significant problems were found with internet service on Hornby. Only 6.67% of respondents indicated their internet speed or capacity is adequate for the foreseeable future. The rest are dissatisfied with the status quo in the long term. Respondents use the internet for a wide range of activities, from business to entertainment, from health to education, and everything in between.



According to the CRTC, the regulator of Canada's telecoms, online November, 2019, at current Canadian standards, 85.7% percent of Canadians enjoyed a download speed of 50 Mbps and 10 Mbps for uploads.

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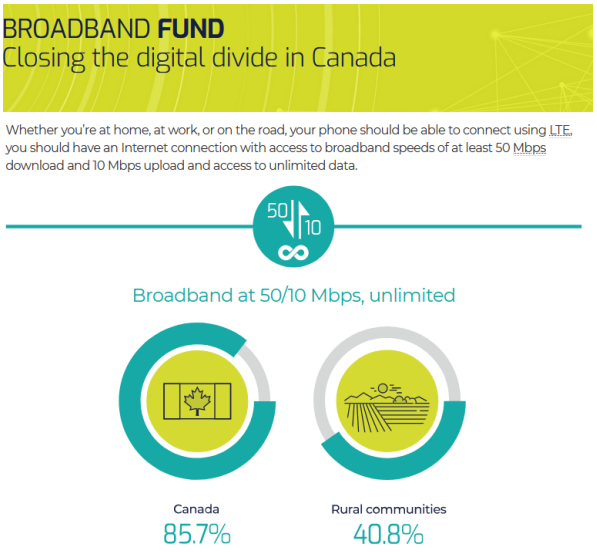
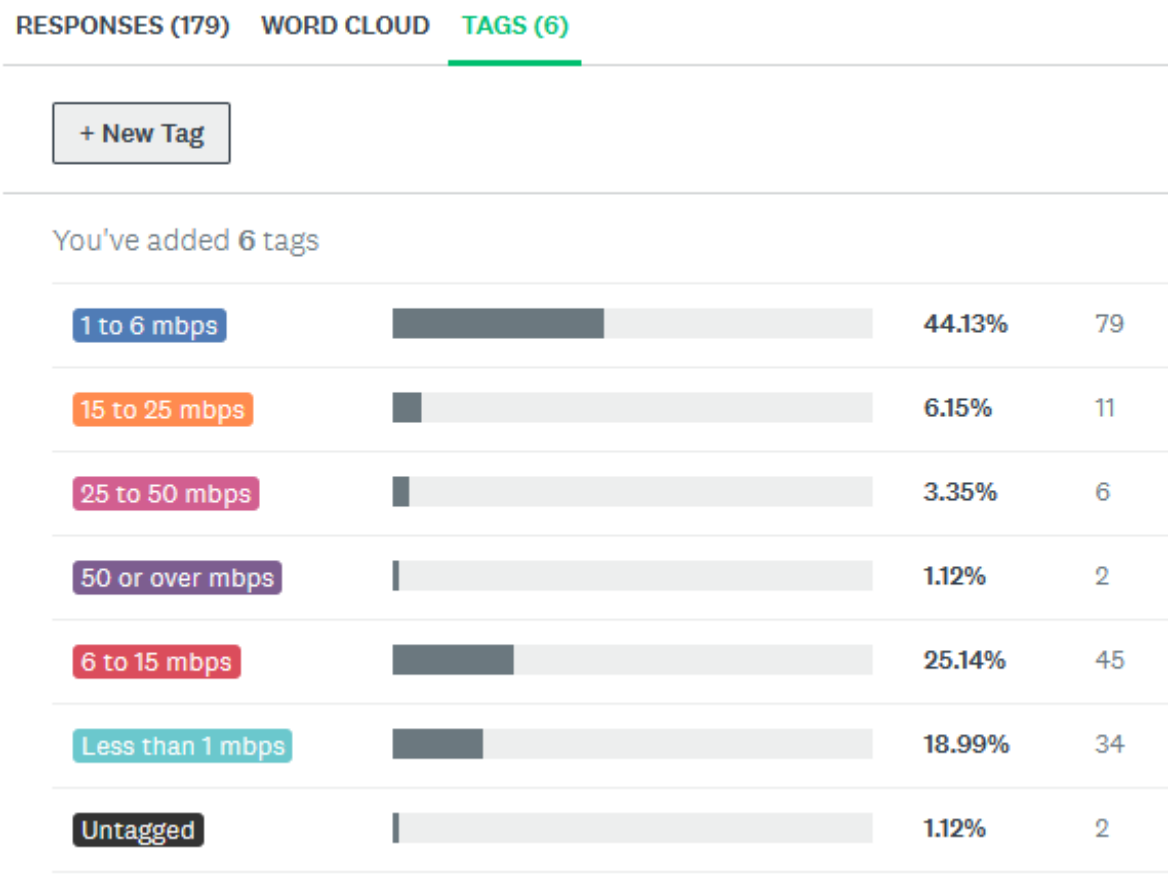


The CRTC website (https://crtc.gc.ca/eng/internet/performance.htm) states *"by the end of 2021, we expect 90% of Canadian homes and businesses will have access to broadband speeds of at least 50 Mbps for downloads and 10 Mbps for uploads."*

Hornby Island's service is a far cry from the National Standard, with a reported 95% of users experiencing less than half the Canadian Standard!



It should be valuable to continue the conversation with service providers and regulators in pursuit of better internet services on both Hornby and Denman Islands.

Analyzing the Numbers

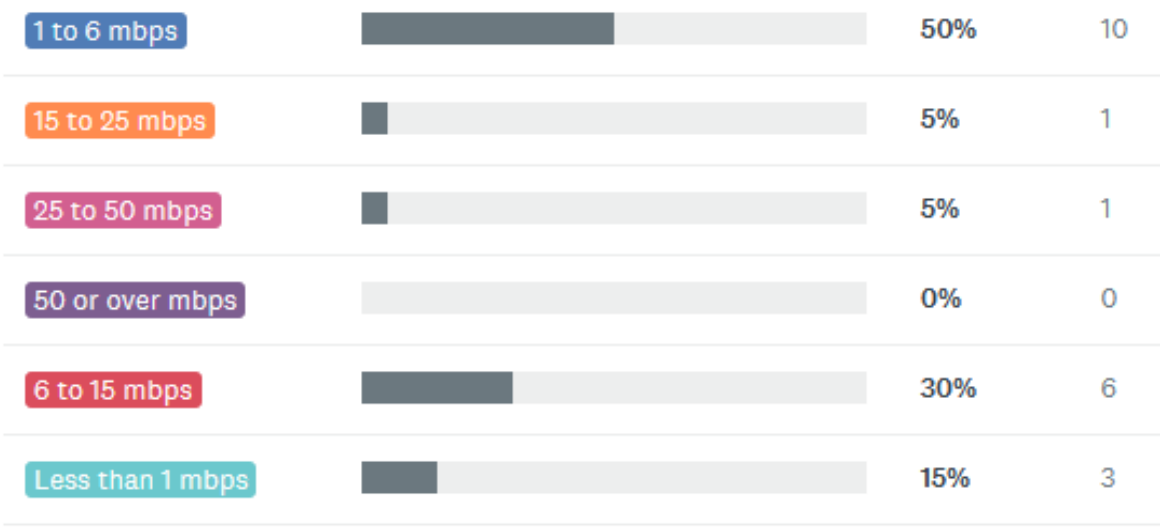
Families with School-age Children, and Internet Inadequacy

Hornby's school-age children need to have access to good internet.

The survey found, of the 22 responding households that have children age 3 - 18, all use the internet, with none of them satisfied with their service looking into the foreseeable future. 91% of these families use Telus copper wiring internet, resulting in 90% of these families with download speeds of under 15 Mbps and a whopping 65% with service speeds under 6 Mbps download.

The educators at the Hornby Community School reported that many children had challenges with homework assignments due to poor home internet, and that parents that choose to home school their children face serious difficulties. The survey suggests that Hornby's internet service may be weak in relation to its capacity to support children's education.

Families with school aged children may subscribe to less expensive service plans, and their results are somewhat lower that the overall picture, with 95% of them reporting less than 15 Mbps.



On the economic front, 1/2 of these families also reported operating a home based business (with from 1 – 10 people working at that location), with these poor levels of internet service

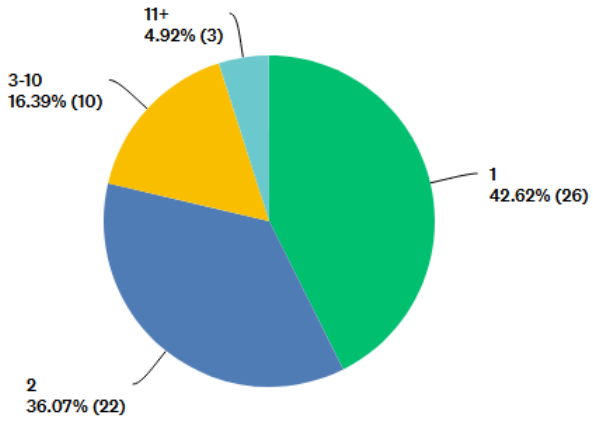
Inadequacy for Business

The survey found Hornby's businesses consider the current internet service has significant inadequacies. 127 respondents said they use the internet for business purposes and 79% declared the internet is inadequate to conduct their business effectively. 86% have Telus copper wiring infrastructure internet that delivers under 15 Mbps download speed to 90% of respondents. The most dire reports were from 21 of these respondents download speeds below 1 Mbps.

These business respondents represent the livelihoods of upwards of 150 people, as indicated in the graph below.

If you are a business, enter the number of owners/operators and employees who work at the location.

Answered: 61 Skipped: 66



It seems clear that poor internet services are inhibiting Hornby Island's businesses' performance, and impeding Island economic sustainability.

Inadequacy for Seasonal Residents

25% of the respondents, or 57 households, indicated they are primarily seasonal residents on Hornby. Approx. half of these households had seniors present, and about half were younger than 65, couples and families.

63% have Telus internet accounts, while most of the rest are using some form of cellular service to access the web. 80% of the seasonal households have indicated they are not satisfied with Hornby's internet options.

While 53% of this sector currently pays less than $60/mo. for their internet, 67% state they are willing to pay more than $60. for higher speeds. And very interestingly, this sector has much less aversion to a cellular component than the resident population. 65% of the seasonal residents are open to using some form of wireless or hybrid system to deliver better internet.

This sector also identified inadequate internet on Hornby as impeding population growth, with it's resulting economic and social growth. 50% of the seasonal residents stated that the poor internet is affecting their ability to migrate from being a seasonal resident household to full-time residency, and to live on Hornby for the long term.

It is clear that seasonal residents find a lot of shortcomings with the internet on Hornby Island.

Inadequacy for Seniors and Their Satisfaction

125 households that have seniors present responded to the survey, representing 54% of the total 229 responses to the survey.

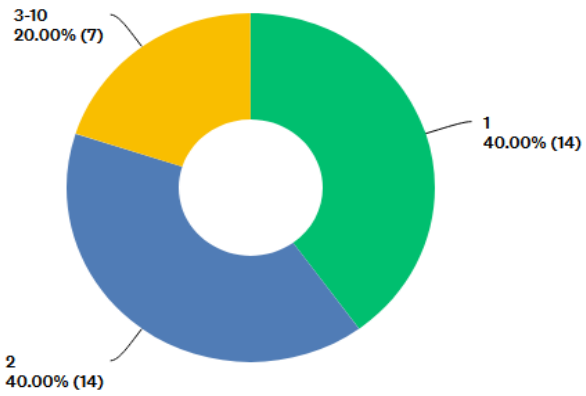
These included 88% who access the internet using Telus plus another 6 who subscribe to internet with other companies (who would be using the Telus lines); 6 who use satellite service; and the remaining handful using some kind of limited cellular option.

Common concerns, expressed by at least 1/3 of the respondents include the impact of poor service on educational opportunities, safety and emergency services, business functions, enjoyment/entertainment, alleviating isolation, reducing costs/carbon footprint of travelling, and attracting young families. The concern around attracting young families is two-fold, one that they enhance diversity in the community, and two they are necessary as a workforce to provide services for the aging population.

A clear finding in reviewing this sector is that Hornby Island has a very active senior population, as many are still choosing, or need to, continue working. 35 of the 125 senior respondents indicated that they use the internet for business purposes, with upward of 80 people working at their locations. Our active arts community accounts for part of this number

If you are a business, enter the number of owners/operators and employees who work at the location.

Answered: 35 Skipped: 90



A high percentage of the population, including seniors, use the internet for enjoyment, perhaps to view Netflix or YouTube, or Skype with family members and friends. Netflix recommends a minimum speed of 3 Mbps[7] for streaming video, and 5 Mbps for high definition video. 62% of Hornby's reporting seniors have speeds under 6 mbps, with fluctuations. Especially in the summer months, with increased usage of the service by visitors, dips and drains occur. 70% of reporting seniors are dissatisfied with their current options for accessing the world wide web.

The New Horizon's Seniors Centre on Hornby has not subscribed to internet, as service in the neighbourhood where it is located, is poor

Inadequacy for Enjoyment

The opinion expressed most commonly by survey respondents is that the internet speed or capacity is inadequate for their enjoyment. One hundred and fifty three (82% of all respondents) expressed this view.

- Reasons for this displeasure are related to the capacity of providing internet with either copper wiring infrastructure and/or satellite. The download and upload speeds of the plan are important factors in determining your actual Internet speeds. Some people may not be able to afford the more robust plans, even if they were available.

- Number of devices being used. If other family members are using the internet on a computer, tablet, or smart phone it impedes performance of them all. Many devices using the Internet at the same time compete for the same speeds and can slow things down. This is particularly important for families and small businesses.
- With 28.3% poverty, people are probably not upgrading their computers and equipment regularly, like some more wealthy people would. An older computer will struggle to keep up with the demands of new applications.
- Heavy traffic in the neighbourhood, or even on a popular website, will affect speeds. If thousands of other people are trying to access the same website, it may affect how quickly you can access that site. This can be impacted by time of day, and even day of the week.
- Technical factors like latency (the time it takes for data to travel from a source to a destination) and packet loss (the number of data packets sent to or from your home that don't get to their destination) can slow your Internet speeds. This is identified as one of the drawbacks of satellite internet, along with inclement weather.

Two factors that were covered in the survey may aid in understanding why so many users find their enjoyment impeded. Twenty-two respondents, thirty percent of those who weren't enjoying their internet, said the problems occur at certain times, and certain days.

Major areas of entertainment/enjoyment are video data such as Netflix and YouTube, live streaming and online games – low internet speeds result in interruptions in the transmission of larger data files including images, which would impair enjoyment of the internet.

What else?

Three questions were directed at the concerns over being a remote community, dependent of ferry service to access many services, that aren't available locally.

The first is mainly an economic question, that would allow a marginalized population more affordable living: 37% of respondents indicated that they would reduce their cost of travel by accessing services via the internet, that they currently travel to use.

The second is a question of the GNH index – Gross National Happiness. On a remote island, where it may be difficult for your family to visit, and your nearest neighbour lives down the road on acreage, people can feel disconnected:

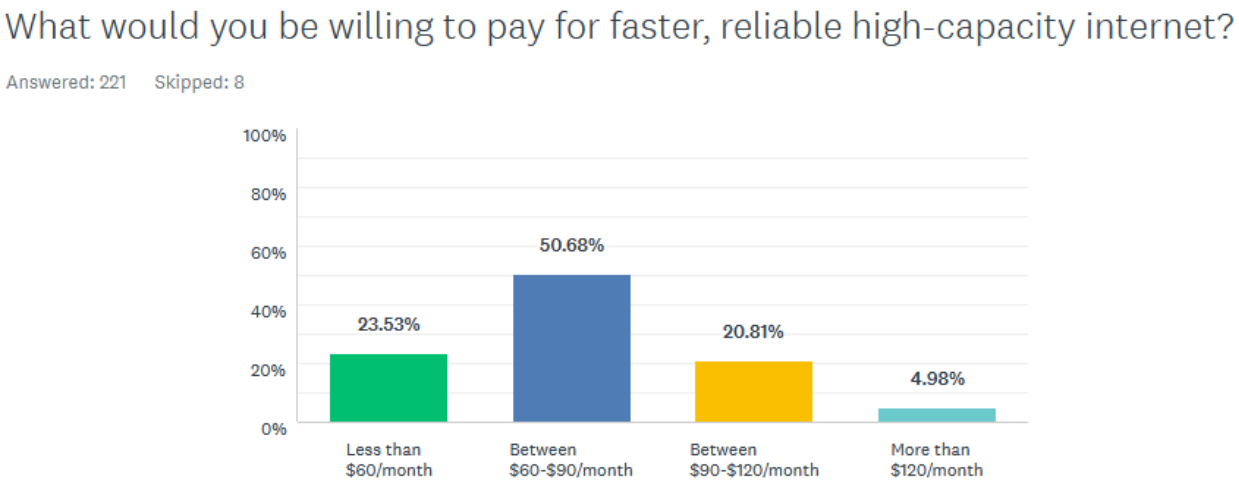
- 84 people (45% of respondents) said that they count on using the internet to help alleviate isolation, and to connect with their community.

The third is a conscious concern for the environment. Hornby Island prides itself on being environmentally aware, with residents as stewards of the land. Climate change mitigation is a challenge that we are facing head-on:

- 39% or respondents indicated that the internet would alleviate the necessity, thereby reducing their carbon footprint, of travelling in a vehicle, and then on two ferries (each way), and driving to their off-island appointments or to shop and purchase services on Vancouver.

The Price Question

The second most common opinion revealed by survey responses is that respondents do not believe they are getting value on their internet service. The numbers are fairly consistent between what people are paying now, and what they are willing to pay. However, the survey clearly depicts their dissatisfaction, it lies not in the price, but rather on what they receive for that payment.



The amounts that households/home businesses are currently paying:

- 22.07% of people currently paying less than $60./month.
- 56.81% paying between $60 - $90/mo
- 13.62% paying between $90 - $120./mo
- And 7.51% paying more than $120./mo.

Comparing the monthly payments actually paid, to the amount people are willing to pay, a monthly cost of $60-$90. Seems to be realistic, if the service was dramatically improved.

Summary of Findings

This report has provided information about the internet services received on Hornby Island, and Islanders' views about many aspects of this service.

Hornby has particular needs for internet services. The population is growing, with significant seasonal/summer spikes in the population. It has key population groups that, for different reasons, require good quality, reliable internet (seniors, school-age children, businesses). Also, seasonal residents are an important component of Hornby's economy, and good internet is vital to attracting, and servicing the needs, of these people.

The speed of internet services on Hornby Island is far below the service received by most Canadians. The federal agency that regulates internet in Canada, the CRTC, has established a target that 90% of all Canadians have access to broadband internet speeds of at least 50 Mbps for downloads and 10 Mbps for uploads, by the end of 2021. It states that 82% of Canadians were obtaining these levels in 2015.

Ninety-five percent of the 173 speed tests reported in the Hornby survey were below 25 Mbps, and that is only one-half of the national standard. Sixty three percent of Hornby speeds were below 6 Mbps. Examination of the speeds reported at different times of the day showed that during periods when the number of internet users is high, there is a disproportionate rise in the low-speed test results. The geographic distribution of the lower speed results was examined, and over half of the Island is affected by the very slowest of speeds. One of our major concerns is that the "last mile" infrastructure is outdated copper wiring. Telus has told the community that this type of set-up has a finite expected life. Unfortunately, due to our low population density, replacing it is not economic for Telus, as the Return on Investment is insufficient to warrant investment. If we don't work towards improving this utility, we may end up with more and more bandaids on a failing, outdated, white elephant.

Hornby and Denman Islands would benefit economically, socially, and environmentally from receiving internet to the standards that have been set by the Federal Government. As meeting the definition of "rural, and remote, communities", the Islands should be eligible for funding to invest in infrastructure upgrades from Senior Levels of Government.

This survey offers resounding evidence that the population is together on this project, that we are a community looking to "get connected". We need to push forward the conversation with service providers and regulators in seeking to improve our connectivity.

APPENDIX C
SECTORAL CONSULTATIONS
CONNECTIVITY ON DENMAN & HORNBY - CURRENT STATE AND FUTURE NEEDS

Denman Island Internet Committee
and
Hornby Island Community Economic Enhancement Corporation

November 25, 2019

CONNECTIVITY ON DENMAN & HORNBY– CURRENT STATE AND FUTURE NEEDS			
Socio/Economic Factors	**Current Situation**	**Anticipated Future**	**Limitations in Current Situation**
INTRODUCTION	Denman (DI) has 592 occupied HHs, Hornby (HI) has 560(Census). **DIIC survey** (responses 185/592 HHs) showed 95% of respondents use internet. Mainly Telus, 10-15 % Xplornet, some smart hubs and tethering. **Hornby survey** (225 of 560) showed 100% use the internet, with 87% using Telus. 62% of respondents reported download speeds of 6 mbps, or less. Only 1% reported speeds at the Canadian standard, and they have special services set up. 94% of Hornby residents reported that they are not satisfied with their current internet for the foreseeable future.	According to the 2016 census: DI 5-yr growth rate 14%, HI 6%, BC rate 11.6%	High growth on islands, esp DI, requires growth of many services, including internet. Current residents, on both islands have identified economic impediments from poor internet. Telus policy obstructs our future. (Stated no future spending on copper wiring infrastructure, which provides last mile service on Hornby and Denman)
GENERAL Overall attractiveness of our communities	Northern Gulf Islands gradually becoming better known as a destination to visit, a place to live, retire.	As costs grow in urban BC, and environmental conditions deteriorate there, there will be increasing interest in re-locating to Gulf Islands. Internet access will be an important quality in the future of our islands.	Telus' ADSL impedes success of our islands. We need wider distribution of hi-speed internet, more capacity, at affordable prices.
GENERAL Scale of internet activity	At present the internet is largely seen as separate from telephone and television	In a connected world with fibre service, telephone, television and internet can be combined, if the ISP is capable of realizing these full potentials	Telus' ADSL impedes success of our islands. We need wider distribution of hi-speed internet, more capacity, at affordable prices.

CONNECTIVITY ON DENMAN & HORNBY– CURRENT STATE AND FUTURE NEEDS

Socio/Economic Factors	Current Situation	Anticipated Future	Limitations in Current Situation
GENERAL Household Shopping	Internet shopping is increasing.	Online shopping will continue increasing. There is much concern about climate change, and many people will choose to order over the Internet to minimize travel, especially on ferries and in private vehicles.	Telus' weaknesses impede our islands' capacity into future.
GENERAL Communications	Email and texting widely used, especially by young. Some VOIP, FaceTime/Skype etc, teleconferencing. There is currently no internet at the Hornby Radio, CHFR 96.5	Importance of HH communications willincrease with better familiarity with Information Technology Communications (ITC). Provides an alternative to transportation (fossil fuel use) that allows a lower carbon footprint and less expense. Hornbyradio.com is considering internet streaming and an island-wide internet upgrade would improve the likelihood of the Radio being able to stream radio. This would be significant for emergency services use, public announcements, news sharing, and public entertainment.	Our islands need wider distribution of hi-speed internet, more capacity, at affordable prices, to allow expansion of internet uses.
GENERAL Entertainment	Internet used for NetFlix,etc, online gaming, networked musical "jamming". NetFlix functions at 3 Mbps (44% of HHs in DI survey below 6 Mbps). Music is a very important entertainment sector on our islands, with a multitude of Festivals & Happenings.	Expect more use of smart tv, streamed entertainment, networked activities. As musicians work together, they will need more access to digital uploads to market their work. Non-profit organizers of Festivals & Events will need increasing access for day-to-day operations, online Box Offices, logistical planning, grant applications, content sharing, social media exposure, collaborations within the industry and access to clients, and research.	Telus' ADSL impedes digital entertainment of our Islands. We need wider distribution of hi-speed internet, more capacity, at affordable prices. Current infrastructure has a significant impact on this sector's ability to function organizationally, as employers and entertainers, and providers of programming in our communities.

CONNECTIVITY ON DENMAN & HORNBY– CURRENT STATE AND FUTURE NEEDS

Socio/Economic Factors	Current Situation	Anticipated Future	Limitations in Current Situation
GENERAL Sustainability • Conservation: • Research • Data Analytics	Conservancy Hornby Island reports frequent disconnection from internet. When connected, slow data retrieval. No ability to upgrade to a faster plan. This makes research slow and tedious.	Expect high speed internet to alleviate these issues and enable the Conservancy organizations on both islands to more effectively collect, and record, data for scientific purposes.	Telus preventing fast and efficient collection of research for our study on a herring recovery plan, sharing info with our affiliates.
GENERAL Recreation, family visits	Especially as new residents locate on the Islands, their friends and families will be checking out what to do when they come to visit.	Visitors will increasingly require good internet to make decisions, pre-trip, and also while they are visiting. Many residents report that their grandchildren, and working children, are less likely to visit if they don't have access to high quality internet.	Telus' capacity to improve or grow service is limited to locations near its COs
GENERAL Seniors centre	DI Activity Centre current speed 2.0 -7.6 MBps Hornby Island New Horizons Sr. Centre does not have internet	Membership is growing annually, demand for the use of the Centres is also in growing. The Centres rent meeting hall space to help subsidize Senior activities and operational expenses.More and more renters want high quality, reliable WiFi.	Very poor service
EDUCATION General	DI survey showed only 21% of HHs w/internet and w/children are satisfied with internet, 18% are considering leaving. HI survey showed 37% of respondents felt that the poor internet is an impediment to attracting young families to live on the Island. 40.7% indicated it impedes adult education.	Role of internet growing (distance education, lifelong learning). More courses use more internet for group workshops, hands-on interaction with teachers, fellow students. Home schooling is now entirely dependent on internet usage.	Telus' ADSL impedes educational success on our islands. We need wider distribution of hi-speed internet, more capacity, at affordable prices.

CONNECTIVITY ON DENMAN & HORNBY– CURRENT STATE AND FUTURE NEEDS			
Socio/Economic Factors	**Current Situation**	**Anticipated Future**	**Limitations in Current Situation**
EDUCATION From Home	Education very important. DI population has 64% post secondary, HI has 66%, BC average 47% Education increasingly occurs at home. Students have assignments needing internet. All residents engaged in distance learning, esp seniors in lifetime learning.	Online learning increasingly needs bandwidth. More streaming, more interactive learning, teleconferences. Lifetime learning and distance learning are increasing steadily. Population aging. DI 38% seniors, HI 39% vs BC average 18%. More lifetime learners.	Telus' ADSL impedes success of our islands. We need wider distribution of hi-speed internet, more capacity, at affordable prices
EDUCATION Community School	Telus "managed fibre connection", very expensive. Hornby School reports the island has "Varying coverage for internet, depending on the area of the island, leading to an inequality of access for students in a rural and remote area to complete course work (e.g. video streaming for research from research databases, downloading/uploading and accessing Distributed Learning courses/resources as part of a 4 day Blended Learning model. Uploading/downloading to e-portfolios to demonstrate learning, etc.	Need high calibre of service, reasonable cost. Increased bandwidth is needed for school systems. Teachers report that "Homework for secondary students, as well as Wednesday School access (not located at the school), and home learning being assigned will require increased access to technology and internet access. We currently experience interruptions to operations several times per year due to ferries unable to sail (weather/mechanical issues), power outages and snow. Having technology to support missed school time at home is key for our learners in having equal access to resources. "	No less expensive option. Many families do not have reliable access to internet, or internet strong enough for streaming/large uploads/downloads.

CONNECTIVITY ON DENMAN & HORNBY– CURRENT STATE AND FUTURE NEEDS

Socio/Economic Factors	Current Situation	Anticipated Future	Limitations in Current Situation
MEDICAL **OVERVIEW**	Little use of the internet for medicine at present. Some personal alarms use telephone, but not widely used on our islands. Tele-Health available (2019). The Hornby/Denman Health Care Society uses internet access for operations and service provision. They also make access available to health care providers and groups that use their boardroom.	Expect health care system to move to a greater reliance on technology to deliver health services including virtual access and tele-health services (medical diagnosis and consults), monitoring, booking doctor appointments, group interactions, as well as a transition to electronic medical records. These will require improved speed and reliability.	Limited capacity for reliable online equipment Telus' ADSL impedes capacity of our islands to participate in medical progress. We need wider distribution of hi-speed internet, more capacity.
MEDICAL Doctors, dentists, physios, therapists	Several doctors, dentists practicing or retired, many yoga, fitness facilities	Online medical equipment, patient monitoring, doctor appointments, specialist consultations, interactive exercise session. Dr. training, mandatory Continuing Medical Education will be online.	Limited capacity for reliable streaming sessions
INSTITUTIONAL Fire, first response and lifeline	Communications problems on both islands. Responders must use pagers. Secondary alerts for incident call-outs. Download dispatch logs to add to incident reports after every call. Mapping apps for addresses - Training materials - Training evaluations, online exams Webinars save significant dollars vs. sending someone off island for a day of training. Public messaging through web site, social media	Improved connectivity for pagers, lifelines. More health conditions needing direct connection. Online training, online property monitoring.Increased use of web-based training in the form of webinars 5G microcells in central transportation corridor would improve public safety by enabling communications Increase service levels would allow for better mapping apps on apparatus which would help us get to emergency scenes more quickly	Need reliable service with minimal vulnerability The existing internet Copper infrastructure is maxed out and exhibiting dropouts when under heavy use. This causes loss of use and i.p. address changes which require us to reset login credentials On Hornby Island the lack of cell coverage in central corridor becoming a public safety hazard.

CONNECTIVITY ON DENMAN & HORNBY– CURRENT STATE AND FUTURE NEEDS

Socio/Economic Factors	Current Situation	Anticipated Future	Limitations in Current Situation
INSTITUTIONAL Ambulance (Denman only)	Little use of internet	Online training, online patient monitoring	Telus' capacity to improve or grow service is limited to locations near its COs
INSTITUTIONAL Community Internet portal	Denman free portal has very poor service	Service should be expanded as welfare measure	Telus' capacity to improve or grow service is limited to locations near its COs
INSTITUTIONAL Museum	DI. Part of senior's centre. No online presence	Expect online (virtual) museum	Limited capacity for reliable streaming sessions
INSTITUTIONAL Parks, trails	3 on DI, 5 on HI. Parks largely without attendants or information provided	Parks could be more interactive, offer WiFi to campers, digital displays for educational purposes, online bookings for overnight camping, etc.	Limited capacity for WiFi
INSTITUTIONAL Public Transportation: Bus	Hornby Bus, has a website and a Facebook page	The bus could be tracked similar to the bus on Gabriola Island, using a cellular network: https://wheresgertie.ca/ Additionaly it could have an onboard surveillance system and the ability to be in constant communication - High frequency radio on the bus and a dispatcher	No cellular service in the centre of Hornby Island.
INSTITUTIONAL Public Transportation: Ferries	Internet access via fibre optic lines at Buckley.Bay and Gravelly.Bay, and via line of sight, at Denman.West and Shingle Spit Terminals. For the terminals (booths and signage -vessels have connectivity via XX (Source: Darin Guenette Strategy & Community Engagement British Columbia Ferry Services Inc.)	BCF is researching wi-fi capabilities at all terminals; using digital signage as hotspots -planning to cease printing sailing schedules in 2020 -new BCF website to launch soon, providing customers with new capabilities and functionality for travel planning -would like to have improved connectivity for ships/terminal, ideally via XX (Source: Darin Guenette)	Some customers on islands have no internet access (or very limited/slow), so BCF aim to encourage online info/planning/booking, etc is hampered. Difficult to get timely info (breakdowns, schedule changes, etc) to customers if they are not all online in real-time. (Source: Darin Guenette)

CONNECTIVITY ON DENMAN & HORNBY– CURRENT STATE AND FUTURE NEEDS

Socio/Economic Factors	Current Situation	Anticipated Future	Limitations in Current Situation
INSTITUTIONAL **Local Government:** • Denman Island Ratepayers Assoc. (DIRA) • Hornby Island Residents & Ratepayers Assoc. (HIRRA) • Islands Trust • CVRD	Peter Luckham Chair, Islands Trust Council pluckham@islandstrust.bc.ca September 5, 2019 In a letter to: (Provincial) Minister of Citizens Services & (federal) Minister of Innovation, Science and Economic Development Canada Expressed the need for Gulf Islands improved internet. The Hornby local government, HIRRA, reports very poor Operational internet: PING: 21ms DOWLOAD 5.96Mbps UPLOAD 0.81Mbps	"That Trust Council, by a letter signed by the Chair, request the appropriate agencies of Canada and the Province of British Columbia to take steps to facilitate and fund the safe and reliable improvement of internet connectivity throughout the Trust Area" (Source: Peter Luckham) HIRRA anticipates continued and expanded need for internet access to support office work and meetings, potentially also video-conferencing with off-island agencies.	"Improved, high-speed broadband internet connections for residents in rural and remote communities will in turn help to improve their quality of life. Improved connectivity can help community members to reduce their greenhouse gas emissions via reduced travel, access education and health services, participate in economic opportunities that are compatible with the conservation of island resources, and better participate in the decision-making processes of all levels of government." (Source: Peter Luckham)
INSTITUTIONAL Library	Denman library no internet The Hornby library does have internet, not robust, but the V.I. Regional Library has a tech. staff and is looking at ways to improve client experience via digital connectivity.	Internet would encourage library use. Jason Kuffler Sales and Marketing Officer Vancouver Island Regional Library Phone: 1.250.753.1154 x 246 Mobile: 1.250.327.1291 Email: jkuffler@virl.bc.ca Web: virl.bc.ca Jason states: "support for the creation of local infrastructures so that library customers can enjoy the benefits of our digital resources.	Limited capacity for reliable streaming sessions.

CONNECTIVITY ON DENMAN & HORNBY– CURRENT STATE AND FUTURE NEEDS			
Socio/Economic Factors	**Current Situation**	**Anticipated Future**	**Limitations in Current Situation**
COMMERCE Employment – High Tech	Some online technical workers now, some telecommuting. Known examples include a geo (runs 8-hr computer models), engineer (who can't leave Vancouver because of weak Denman internet), computer graphics (who finds her Denman connectivity is at the margins, may have to leave). On Hornby 13% of the survey respondents need advanced business capabilities (data base modelling, digital graphics, multi-media collaborations). These include Software & website developers, music recording studio, digital artists, videotography, photography, engineering, architecture, etc. Further, consultation indicated that many professionals are limited in the time they can spend on Hornby due to the poor digital infrastructure in place.	Much more of what is seen now. Younger "tech"people are increasingly footloose, are fleeing big cities, high property values, excess consumption of energy, and with good connectivity are making the lifestyle choice to live on Hornby and Denman Islands. Additionally, many baby boomers are easing into retirement by working part-time, and living on the Islands around a limited work schedule.	Telus' ADSL impedes success on our islands. We need wider distribution of hi-speed internet, more capacity, at affordable prices. High technology applications have limited ability to fully participate in the digital economy.
COMMERCE Employment – High Tech Banking	The Union Bay Credit Union is the banking institution serving Hornby and Denman Islands. They use Telus internet to provide access to our banking system and servers in addition to free public WiFi service.	"With a greater focus on technology, we will continue to require improved internet speed and service. The branch will eventually be getting an ATM machine which requires further connections. Ultimately, we would like to be able to provide enhanced banking services such as lending and financial advising which are completed in an office via video conference to employees which are off-island. "	The current internet speed is just barely adequate to operate a banking system and connect to our servers, any further enhancements to the service at the Hornby/Denman branch will require improved internet infrastructure.

CONNECTIVITY ON DENMAN & HORNBY– CURRENT STATE AND FUTURE NEEDS			
Socio/Economic Factors	**Current Situation**	**Anticipated Future**	**Limitations in Current Situation**
COMMERCE Employment – Low Tech	Some use of internet for secondary work activity (such as selling on eBay, Kijiji,). Some interaction with regulators, benefits providers. Minority younger population have websites, some work-at-home.Hornby survey, 54.7% of respondents use internet for basic business (till and billing, bookkeeping, credit cards, sales, accounting, banking, inventory, research, ordering, promotion, advertising). Remote workers are self-identified in the fields of art, music, tourism, teaching, business consulting, counselling, farming, medical practitioners, manufacturing, business management, law, and research.	Work at home will be much more common, across the age ranges (especially tele-commuting). Feedback during this consultation has been very vocal from our remote workers – we need better internet for equal opportunities in our industries. With improved digital connectivity more people will be able to do business on the islands, helping to alleviate the cycle of poverty for many working residents.	Telus' ADSL is a significant impediment to success on our islands. We need wider distribution of hi-speed internet, more capacity, at affordable prices.
COMMERCE Business Start-up	Island Stars Observatory makes all it's customer contacts via the internet not to mention the need to remain current on weather, astronomical news and the ability to perform online banking.	Improvements in service would allow this business to operate with greater efficiencies. Fast, direct link video to major world observatories would enhance the experience for clients. -Uploading of music and merchandising opportunities.	Current service is slow, and inefficient
COMMERCE Accommodation: Lodging, B & Bs, Resorts, Campgrounds	14 on DI Hornby has an estimated 150 vacation rentals, 4 Resorts, 4 campgrounds, 2 glamping businesses, and a handful of B n B's. (Online till, book-keeping, inventory, credit cards, ordering, administration, social media, and training)	Visits will grow, particularly as the summer season is reaching capacity and other ten months are ready for expansion. Businesses use basic business internet, and increasingly sophisticated social media marketing. Collaborations with Destination B.C., Tourism Vancouver Island, and other such organizations increasingly require more digital sophistication.	Telus' capacity to improve or grow service is limited to locations near its Cos. Demand from both the proprietors and the clients, is very high in this sector, resulting in dissatisfaction.

CONNECTIVITY ON DENMAN & HORNBY– CURRENT STATE AND FUTURE NEEDS			
Socio/Economic Factors	**Current Situation**	**Anticipated Future**	**Limitations in Current Situation**
COMMERCE Artisans, Galleries	About 12 on DI, 40 on HI. (hubs for 15-20 Potters and many home studios, galleries) (Online till, book-keeping, inventory, credit cards, ordering, sales, social media, etc.)	We are able to function with the current speed but improvements in speed and reliability would undoubtedly make us more efficient and effective in our work. The Hornby Island Arts Council is part of a large digital arts partnership grant that will rely on connectivity if funded. As the Arts Centre grows into a regional association of arts organizations and infrastructure, it will work in partnership with other institutions to leverage attention to our position as a place in which to seek out the arts in Canada as a whole. We cannot be part of this network with poor connectivity. We see our studio tour and map going online for real-time interaction through app development. We also see that the digital arts are a fast-growing medium of expression and that real-time interactive installations that interface through the internet are already happening in arts spaces and doubtlessly will be important in the Arts Centre. Many of the pedagogical futures of the Arts Centre will rely on internet connectivity. We already see speakers coming to present material and having panic experiences with their presentations when they realize there is little or no internet available to them. Another example includes filmmakers at our film fest: we have been lucky to see them attend their films in person so far, however, things can change, and being able to skype in a filmmaker when conditions prevent an in-person delivery would be a critical relief for the festival.	Telus' capacity to improve or grow service is limited to locations near its Cos For out non-profit arts organizations, almost all Arts granting systems have moved online. Financial transactions are increasingly moving online as well: artists expect and need to be paid more promptly and transactions are taking place through a variety of connected technologies. Failing to keep up with efficiencies that allow our staff and board to focus on what matters puts us in a poor competitive position.

CONNECTIVITY ON DENMAN & HORNBY– CURRENT STATE AND FUTURE NEEDS			
Socio/Economic Factors	**Current Situation**	**Anticipated Future**	**Limitations in Current Situation**
COMMERCE Recreational business	3 on DI, 11 on HI. (Kayak/board rentals, fishing charters, water taxi, bikes, boards, horse riding, etc). Hornby is home to Tribune Bay Outdoor Education facility, operated by two School Districts. Over 3000 children/year attend the facility, needing strong broadband capacity for both clients and businesses. The centre completely relies on internet to secure bookings, communicate with current and potential guests, submit reports, statements, grants, conduct video interviews, and other integral business admin. Guests rely on internet access for work, training workshops, student online courses, and general communication due to limited cellular service.	Growth likely. More guiding, fishing, diving, cycling, kayaking, and instructed outdoor experiences especially as related to the ocean. As islands we are surrounded by water, and many recreational opportunities present. The Outdoor Ed. Facility foresees: “Site-wide internet access to better facilitate the needs of specialty groups and academies (Ocean literacy academy, Search and Rescue Academy, Deaf Youth Today, etc.). Proper infrastructure would open opportunities for school academies to study and connect with others while on location. It would allow shoulder season expansion for groups looking to use TBOEC as a mobile office/retreat. Wifi calling would also alleviate communication issues within the staff.”	Telus' capacity to improve or grow service is limited to locations near its COs The Outdoor Ed. Facility is a strong proponent of improved internet. “Internet is only used in two buildings due to low speeds and cannot support the annual 3000 guests per year. Large areas around the centre do not have cellular service or wifi, meaning no means of communication in an emergency. Slow productivity in the office due to the ongoing need for uploading and downloading documents.”
COMMERCE Retail Stores	9 on DI, 17 on HI (Online till, book-keeping, inventory, credit cards, debit cards, ordering, advertising on social media, training.). The largest retailer, the Hornby Coop Store, has their book-keeping system, equity and membership tracking; much of our business records are centralized through FCL on a mainframe in Saskatchewan.	More small stores and vendors, more online transactions. Sales and traffic have grown steadily over the last 5 years. If this trend continues, improved internet connectivity will support parallel business function growth.	Telus' capacity to improve or grow service is limited to locations near its COs. The current underservicing limits growth and stability in the retail sector.Internet slows with high use on the island. Essential business services and systems become unreliably erratic or stop working altogether.

CONNECTIVITY ON DENMAN & HORNBY– CURRENT STATE AND FUTURE NEEDS

Socio/Economic Factors	Current Situation	Anticipated Future	Limitations in Current Situation
COMMERCE Industrial, fabrication, production	5 on DI, 9 on HI. (BC Ferries, Denman Chocolate, Corlan Vineyard, HI Estate Winery, Island Spirits Distillery, Middle Mountain Meadery, Sushi Snax, Hornby Energy Balls, Hornby Isl. Brewing, Lerena Vineyard, East Cider Orchard, The Hornby Spark, Maker's Space, etc. The current levels of internet are adequate for emails, and limited use.	Agricultural product market is growing. Market for pottery expanding. Individual industries may require specialised, private internet capacity. For the Maker's Space on Hornby, of particular importance is video streaming, like You Tube, in order to hold offering trainings to a wider audience and also in selling on sites like ebay. This is particularly important for specialized fabrication projects. E.g. Training others on how to make widgets, and selling your widgets to others.	Telus' capacity to improve or grow service is limited to locations near its Cos Insufficient for participating in the global economy. For training and product distribution limitations exist in accessing social media – Twitter, Facebook, You Tube, etc. Difficult to do business without high speed access.
HOUSING Affordable Housing	Not at present, but growing interest	Affordable housing project(s) will need good internet to meet current market expectations.	Telus' capacity to improve or grow service is limited to locations near its COs
HOUSING Seasonal residences, long term rentals	Seasonal and long-term rentals use internet to advertise, attract customers.	Seasonal residents, and new residents, will decide whether to locate to our islands, partially based on the availability, quality and utility of internet	Telus' ADSL impedes success of our islands. We need wider distribution of hi-speed internet, more capacity, at affordable prices.
HOUSING Smart House	Minority of HHs make use of "smart house" capabilities.	HHs will use some smart capabilities for control of HVAC systems, appliances, lighting, security. Key driver will be to minimize energy use.	We need wider distribution of hi-speed internet, more capacity, at affordable prices, to allow expansion of internet uses

APPENDIX D
CONSULTATIONS WITH INDIVIDUALS ON THE DIGITAL ROADMAP

Denman Island Internet Committee
and
Hornby Island Community Economic Enhancement Corporation

November 27, 2019

Introduction

This Appendix is an examination of the relationship between one component of the community consultation in the Denman Hornby Internet Improvement Project and the "Digital Roadmap" provided by the Connected Communities BC Program. The component being examined is the wide range of interviews and other input the project received, apart from the input obtained from formal surveys and public meetings. The Appendix provides the findings of this program of consultation with important community actors (businesses, institutions, and certain representative households).

Consideration of this content in relation to the Digital Roadmap yields evidence of the strength of our community over the five inter-related foundational elements for digital transformation provided in the roadmap model. This assessment adds to the understanding of our communities' needs and aspiration for improved connectivity revealed by other aspects of our project, our surveys, public events and other interactions, and our sectoral analysis.

The five foundational elements defined in the Ministry of Citizens' Services' Digital Roadmap are the following:

- **Leadership & Support**
- **Connectivity**
- **Digital Capability**
- **Sustainability**
- **Community well-being**

Leadership & Support

(description from the BC Ministry of Citizens Services “Digital Roadmap”)

> *“ Successful communities need strong leadership to drive forward the digital agenda: digital champions serve as leaders and catalysts for change. Communities indicate leadership and support is critical to rally the community around its history and identity and engage residents to reimagine what the community can become in a digital world. “*

Our community has come together to express its desire to have improved connectivity. This project has been led by the Hornby Island Community Economic Enhancement Corporation HICEEC), in conjunction with the Denman Island Internet Committee (DIIC). An extensive program of studying the problem and potential solutions, informing the public, and soliciting and developing public option, has been conducted.

A vision has been developed for a Fibre to the Home project, encompassing all properties on both islands. This will allow better cell service by way of WiFi calling, and will dramatically improve the delivery of both cell and internet services. The communities of Hornby and Denman Island are extremely concerned about the safety of wireless infrastructure, and do not want to go in that direction, even if it means better cell service and cheaper internet rates.

The committees conducted formal surveys on both islands over a 12-14 month period that achieved remarkably high response rates, documenting the communities present internet services, views about these services, and opinions about needs for improvement.

The project secured grant support from both local and provincial sources. Grants have been obtained from HICEEC, Denman Works, and the Province of British Columbia’s ICET program, and its NDIT Connecting British Columbia program. The grants fund have been used to contract the services of a skilled, experienced technical contractor, Baylink Networks, to develop a detailed, feasible, and economically practical strategy for implementation of the community’s vision, including resources & funding. Technically, this project support is referred to as a Digital Roadmap and Implementation Plan.

The community has strongly expressed its aspiration for the functions and activities that will be enabled by improved internet, specifically by achieving the Canadian Standard of 50 Mbps of download speed, and 10 Mbps of upload. The existing copper wire infrastructure is out-dated and incapable of serving most residents with anything but the lowest of speeds. The whole “last mile” infrastructure for delivery will need to be rebuilt.

In order to create direct dialogue with a wide cross section of users for digital connectivity, additional activities were undertaken.

- An approach was made to individuals via a 1600 person “Hornby Community Connections” Facebook page, as well as by direct phone calls and emails. Nearly 50 people responded, identifying unique needs and aspirations for digital needs when working from home. (Much of this feedback can also be seen in Appendix C).
- Direct contact was made with businesses, institutions, and some individual associations on both islands.
- Questionnaires were handed out at the Hornby Island Community Economic Enhancement Corporation annual Fall Business Mixer and the 6 person Ferry Advisory Committee meeting. From the feedback regarding ease of completion, this survey was put online. A Facebook posting was then made to invite others to also respond. This resulted in 42 questionnaires being completed.
- Public meetings were held on both islands on November 3. These were widely advertised in both print and social media, as well as on three roadside billboards. About 70 people attended each meeting.
- Caroline Sneath from HICEEC, and Tony Gregson from DIIC attended the Rural & Remote Islands Forum on Pender Island, Nov. 7 th & 8th, to connect with other B.C. Island communities. A primary purpose of attending was to dialogue with other Island communities regarding their internet initiatives and to discern whether there was any new information that would beneficially be included in the work being done by the Hornby and Denman communities.

Connectivity

(description from the BC Ministry of Citizens Services “Digital Roadmap”)

> *“ Being digitally connected is the cornerstone of connected communities – unlocking the benefits that come with connectivity and transforming the way residents in rural areas live their day-to-day lives. Speed, access and affordability are fundamental connectivity factors that can help transform local economics and in unprecedented ways, strongly position rural communities to attract renowned talent and drive sustainable growth and development. “*

Through comprehensive discussions with people in leadership roles and also with any citizen in the community who chose to engage, a clear picture has formed that the community’s needs and aspirations are to become a “Connected Community”. This section quotes findings from direct community consultation that underpins this observation.

Lori Nawrot, Hornby Denman Health Care Society:

We anticipate a greater reliance on technology to deliver health services including virtual access and tele-health services as well as a transition to electronic medical records. These will require improved speed and reliability. Internet speed and reliability has limited our ability to participate in video-conference meetings and trainings.

David Critchley, Denman Trustee, Islands Trust:

My current provider is Explornet, so the service is satellite based. As such it is expensive and “laggy”. So far it has been basically reliable although it shuts down from time to time and the system needs to be rebooted. Also, the connection tends to shut down for video display during electronic meetings. These meetings can be four or five hours duration and during that time the video will disappear perhaps three or four times. Furthermore, these meetings are conducted using separate telephone connections for the audio component. This is on the recommendation of Island Trust technical people who advise that there is generally not sufficient bandwidth for most Trustees on the islands to have a steady connection.

Etienne de Villiers, Architect/Builder, Denman Island:

We are using the internet constantly throughout our workday. We upload and store all our documents & construction drawings online so that they might be accessed by contractors/clients and us regardless of where we are in the world. We use the internet to host online meetings with clients or groups of professionals involved in a project. This allows us to reach a much bigger client base, besides serving the needs of the community here. It allows us to stay in business.

If the internet fails we usually have to stop work for the duration of the outage and our contractor in the office has to go home, which costs us both financially and timewise. During online meetings, we're unable to share our webcam with any clients, we're also unable to effectively hold a meeting with more than one person at a time. The internet is just too slow and the lagging caused prevents clear communication.

Cath Gray, Administrator, Conservancy Hornby Island:

Current service provides constant disconnection from the internet. When connected, slow data retrieval. No ability to upgrade to a faster plan. This makes research slow and tedious. Telus service is preventing fast and efficient collection of research for our study on a herring recovery plan, and sharing info with our affiliates. Looking to the future, expect high speed internet to alleviate these issues.

Darin Guenette, Strategy & Community Engagement, British Columbia Ferry Services Inc:

The terminals (booths and signage) at Buckley.Bay and Gravelly.Bay, have dedicated internet access via fibre optic lines, the terminals at Denman .West and Shingle Spit have line-of-sight connections to their sister connected terminal. BCF is "researching wi-fi capabilities at all terminals; using digital signage as hotspots

- *planning to cease printing sailing schedules in 2020*
- *new BCF website to launch soon, providing customers with new capabilities and functionality for travel planning*
- *would like to have improved connectivity for ships/terminals".*

Some customers on islands have no internet access (or very limited/slow), so our goal of encouraging them to be online for info/planning/booking, etc is hampered. It is also difficult to get timely info (breakdowns, schedule changes, etc) to customers if they are not all online in real-time.

Rachelle Chinnery, Educator/Artist, Hornby Island:

I did a graduate degree part-time online and it was very difficult uploading multi-page documents, as well as downloading multi-page research and library listings. That was three years ago. This spring I'm hoping to take more graduate courses and am somewhat dreading the download times. For anyone teaching or studying through distance education, much better Internet is needed on our island, studying online, too.

Pat Jones, Owner, Corlan Vineyard and Winery, Denman Island:

We need strong internet for our email, online banking, ability to take credit cards, sourcing materials and contacting suppliers. Liquor control requires that all licence reporting, renewal etc is online - this is very important for our business.

John Nemy, Island Stars Observatory, Hornby Island:

Island Stars Observatory makes all it's customer contacts via the internet not to mention our need to remain current on weather, astronomical news and the ability to perform online banking. Improvements in service would allow this business to operate with greater efficiencies. Fast, direct link video to major world observatories would enhance the experience for our clients. Uploading of our music and merchandising opportunities is slow, and inefficient.

Marc Atkinson, The Barn Recording Studio, Hornby Island:

It is very important to my biz to have fast speed both up and down. I'm constantly sharing files back and forth with other musicians and producers. I have had to stop teaching by Skype for the most part, as it was to unreliable. Living in a remote area can be fantastic when the internet is up to standards with the folks of the city. There is no reason why a professional can't work from home here on Hornby if the internet is solid.

John Heinegg, Medical Editor for Medscape, a subsidiary of WebMD, Hornby Island:

I spend a great deal of time during the workday waiting for downloads and uploads to complete. Bringing speeds up to the Canadian standard would help my efficiency (and reduce the annoyance factor). I also have a side business that involves video conferences with clients; the connection is often poor.

Karen Elder, Bent Tree Studio, Hornby Island:

Doing marketing and exposure online as an artist through websites, google search, fb page, ordering supplies, using square and e-transfers, ordering prints, keeping up-to-date with art happenings on island and off, and on and on. Definitely helpful to have better internet!

Dominique Husereau, Contractor, Job Shop, www.ceas.ca, Hornby Island:

Poor island internet makes job searching online from home difficult. Everything is online.

Digital Capability

(description from the BC Ministry of Citizens Services "Digital Roadmap")

> *" Digital capability is the key to participating in a knowledge-based world. Greater capability at the community level drives business opportunities and improves livability. A focus on digital literacy, adoption and skills development for personal and business benefit is fundamental to building capability. From distance learning programs to local training and college partnerships, it goes beyond simply training and developing skillsets, but extends to supporting and fostering innovation and tapping into the opportunities that come with it. "*

Alissa Pratt, Vice-Principal, Hornby Elementary School and member of the Hornby Island Education Society:

Students access to internet: Varying coverage for internet, depending on the area of the island, leading to an inequality of access for students in a rural and remote area to complete course work (e.g. video streaming for research from research databases, downloading/uploading and accessing Distributed Learning courses/resources as part of a 4 day Blended Learning model. Uploading/downloading to e-portfolios to demonstrate learning, etc. We currently experience interruptions to operations several times per year due to ferries unable to sail (weather/mechanical issues), power outages and snow. Having technology to support missed school time at home is key for our learners in having equal access to resources.

Daryl McLoughlin, Owner, Denman General Store:

We have both a business and a residence. We require high speed internet for the business to operate our Point Of Sale devices, our ATM as well as the computers for communications. For our residence we use the internet for emails and for television (our residence is not satellite accessible). My residence is about 2 kilometres away from the store (business).

For the business we have very fast and reliable internet service. We are very happy with the service we get and Telus does meet it's commitment to be up over 99% of the time. For our residence the download speeds are very slow and they are not fast enough to get full television service. The television service stops and starts. I would be constrained in my ability to run a business out of my home due to the slow internet speeds.

Mark Jones, Manager, Union Bay Credit Union (Hornby):

We are using Telus internet to provide access to our banking system and servers in addition to free public wifi service. With a greater focus on technology, we will continue to require improved internet speed and service. The branch will eventually be getting an ATM machine which requires further connections. Ultimately, we would like to be able to provide enhanced banking services such as lending and financial advising which are completed in an office via video conference to employees which are off-island. The current internet speed is just barely adequate to operate our banking system and connect to our servers, any further enhancements to the service on Hornby will require improved internet infrastructure.

Lisha Scott, Team Manager, Co-op Store/Gas Bar and adjacent Ringside Retail & Food Market, Hornby Island:

We use internet for Point of Sale systems, credit/debit card transactions, ATM, online communications (email, FB, website, web meetings), training, much of our wholesale supplier ordering, and our essential business systems rely on internet connectivity. Our book-keeping system, equity and membership tracking, much of our business records are centralized through FCL on a mainframe in Saskatchewan. Internet connections slow with high use on the island. Our essential business services and systems become unreliably erratic or stop working altogether.

Looking to the future, we need improved connectivity. Sales and traffic have grown steadily over the last 5 years. If this trend continues, improved internet connectivity will support parallel business function growth.

Alex Ortwein, Manager, Tribune Bay Outdoor Education Centre, (3000 students/year from School Districts 69 & 71):

The centre completely relies on internet services to secure bookings, communicate with current and potential guests, submit reports, statements, grants, conduct video interviews, and other integral business admin. Guests also rely on internet access for work, training workshops, student online courses, and general communication due to limited cellular service. Site-wide internet access to better facilitate the needs of specialty groups and academies (Ocean literacy academy, Search and Rescue Academy, Deaf Youth Today, etc.). Proper infrastructure would open opportunities for school academies to study and connect with others while on location. It would allow shoulder season expansion for groups looking to use TBOEC as a mobile office/retreat. Wifi calling would also alleviate communication issues within the staff. Internet is only used in two buildings due to low speeds and cannot support the annual 3000 guests per year. Large areas around the centre do not have cellular service or wifi, meaning no means of communication in an emergency. Slow productivity in the office due to the ongoing need for uploading and downloading documents.

Steve Carballeira, Hydro-Geologist, Owner – H2O Environmental, Denman Island

My internet needs are the ability to run an efficient business. I currently have difficulty loading maps, databases and figures which I require for my hydrogeologic business. This increases my time spent on each project. Webinars are very hard to attend as are video conference calls. Additionally, streaming basic Netflix or Prime Video is challenging.

Quana Parker, Spark, Maker's Space, Hornby Island:

Current internet is adequate for emails, and limited use. It does not allow the Centre to make full use of the potential. Of particular importance is video streaming, like You Tube, in order to hold offering trainings to a wider audience and also in selling on sites like eBay. This is particularly important for specialized fabrication projects. E.g. Training others on how to make widgets and selling your widgets to others. Insufficient for participating in the global economy. For training and product distribution limitations exist in accessing social media – Twitter, Facebook, You Tube, etc. Difficult to do business without high speed access.

Don Peterson, Don Peterson Photography, Hornby Island:

Better internet would certainly make uploading large files (photographs) for clients or printers much easier. Some days here it is simply not possible and on good days it is just very slow.

Henry Touwslager, Touwslager Engineering, Hornby Island:

I cannot get good enough speed and reception to log into my work computer and work remotely. It is possible to login sometimes but it is extremely slow and extremely unproductive.

Kim Lake, Graphic Artist, Hornby Island:

I thought I'd contribute to why better internet is of benefit to me as a Hornby island resident and artist. I'm primarily a digital illustrator and graphic art practitioner. I don't work at this full time or even part-time as I'm limited to a local clientele due to upload issues. I can't send large files that my industry requires. Clients have to physically pick up the work. Also sending wip to people is hard for the above reasons and lower quality files need to stand in. Most of my income is derived from other means that don't require internet. I'm severely limited by what is available. I would love to expand and participate in my art community online in a more professional and profitable manner that would allow me to contribute to my community in a more economically abundant way.

Wendy Burton, Lecturer, University of the Fraser Valley, Hornby Island:

I am a remote worker. I teach courses online for my university. I have done so since 1999. Back in 1999, the technology of the courses and the internet capability (dial up) worked quite well. Since then, and since I am on the ""slow"" end of the island, the courses have become more graphics heavy and more interactive, so the lack of speed is creating a problem for those teaching and learning online. Many universities and colleges offer fully online courses, often with live chat features. Remote workers also include remote learners.

Sustainability

(description from the BC Ministry of Citizens Services "Digital Roadmap")

> *" A healthy, sustainable community is rooted in a diversified, green, resilient economy. Connectivity is having a transformational impact across BC, enabling communities to re-envision and reinvent themselves, to diversify their economies in ways that respect, support and leverage community values. This leads communities to relevancy and competitive advantage. The need to adapt and innovate requires workforce attraction, support structures and programs for entrepreneurs and sensitivity to the pristine environments and responsible lifestyles that many entrepreneurs seek. "*

Doug Chinnery, Chief, Hornby Island Fire Department:

We currently use the internet for public messaging through web site, social media, mapping apps for addresses, training materials, training evaluations and online exams, secondary alerts for incident call-outs, we download dispatch logs to add to our incident reports after every call, webinars save significant dollars vs. sending someone off island for a day. We currently experience copper infrastructure maxed out and exhibiting dropouts when under heavy use. This causes loss of use and ip address changes which require us to reset login credentials. Lack of cell coverage in central corridor becoming a public safety hazard. The current infrastructure is unable to meet the uses we need, in the near future we anticipate increased use of web-based training in the form of webinars. 5G microcells in central transportation corridor would improve public safety by enabling communications, increase service levels would allow for better mapping apps on apparatus which would help us get to emergency scenes more quickly.

David Critchley, Denman Trustee, Islands Trust

Employment and economic activity opportunities are inherently limited on islands and my view is that these would be much improved if fast and reliable internet was broadly available. Telecommuting and small home-based businesses are a way of life on islands, including Denman. The modern importance of highspeed internet in these endeavours is self-evident.

Rebecca Raworth, Research Librarian, University of Victoria, Hornby Island:

I tried to do a 6-month sabbatical from Grassy Point a few years ago but as an academic I was unable to download all the articles I needed and do the online research required for my project (I work at UVic). I had to leave Hornby after the first month and do most of my sabbatical work back in Victoria. I had so looked forward to being able to work and live on Hornby for 6 continuous months so was very disappointed that the slow Internet speed was inadequate for my needs. This was after installing a $1500 satellite dish. Every time there was wind or rain there'd be no service at all.

Paul Marmion, Engineer, Denman Island

I'm a semi-retired/ still practicing Professional Engineer who needs to use the internet for uploading and down loading large files, video/ cloud conferencing etc. The internet on Denman is unreliable, it goes down on a regular basis, this is frustrating and for me and costly in terms of lost time etc. Presently, we have to go back to our apartment in Vancouver or to my office in Vancouver to do any work that needs a usable internet service. This is expensive, time consuming and basically unworkable in the long term. I probably will have to make a choice of either leaving the Island or stop doing Island based consulting work.

Natalie Coupar, Digital Graphics Artist, Denman Island

I could get more work, have a more stable client base, I could have less stress and not have a risk of losing clients due to poor internet. Often clients need me to download their files and games, however with the current connection I can't do that, so I am losing work and experiencing business instability every day that passes. With each lost opportunity the thought of moving is growing, which means Denman loses a working class person.

Sue Hargrave, Employment Agent, Hornby Island:

From a part time resident point of view, at least 20 homes on Cape Gurney (furthest point of Whaling Station) are not able to receive Telus ADSL internet. They tell us the signal is not strong enough. I have tried to run my business from Hornby, & have home schooled my daughter from there (we are required to have Internet for home schooling in B.C.). I have tried to install satellite at the cost of $150/mo. Which is well beyond the norm. We welcome any changes that would help us stay on the Island for more duration.

Community Well-being

(description from the BC Ministry of Citizens Services “Digital Roadmap”)

“ Healthy and sustainable communities support quality of life. Citizen and business engagement are critical to shaping and building community wellbeing. Connected communities enable social inclusion and interconnectivity, and help citizens work together to shape a future identity. Building the social fabric that underpins connected communities requires a citizen-centric approach. “

Michael Rapati, President, Arts Denman

As President of Arts Denman I would like to shed some light on our internet needs and woes on Denman Island. We use the internet to host our various websites, vet performers and presenters, receive payments, and communicate for the various committees; Denman Readers and Writers Festival, Concerts Denman, Summer Gallery, Denman Audio Arts Collective, Creative Threads Conspiracy, and Denman Early Music Festival

Managing and downloading content with our internet speed of 5.8 Mbps on a good moment is tiresome and often fails. Researching performers and presenters, reviewing their web sites and watching their videos is most often done with pauses waiting for rebuffing. A lot of volunteer time is wasted due to wait time and is a source of frustration and volunteer burnout.

Andrew Mark, Executive Director, Hornby Island Arts Council:

Connectivity is critical to the work of HIAC. It facilitates our day-to-day operations, logistical planning, artist communications and research. I’ll add promotions (and increasingly so). We lost power to the trailer for an unplanned month this season and it created chaos: having no internet at the trailer was part of this.

We are part of a large digital arts partnership grant that will rely on connectivity if funded. As the Arts Centre grows into a regional association of arts organizations and infrastructure, it will work in partnership with other institutions to leverage attention to our position as a place in which to seek out the arts in Canada as a whole. We cannot be part of this network with poor connectivity. We see our studio tour (40 artists) and map going online for real-time interaction through app development. We also see that the digital arts are a fast-growing medium of expression and that real-time interactive installations that interface through the internet are already happening in arts spaces and doubtlessly will be important in the Arts Centre. Many of the pedagogical futures of the Arts Centre will rely on internet connectivity. We already see speakers coming to present material and having panic experiences with their presentations when they realize there is little or no internet available to them. Another example includes filmmakers at our film fest: we have been lucky to see them attend their films in person so far, however, things can change, and being able to skype in a filmmaker when conditions prevent an in-person delivery would be a critical relief for the festival. If current infrastructure is not going to be maintained, this would have a significant impact on our ability to function an organization, employer and provider of programming in our community.

Almost all our grant systems have moved online. Financial transactions are increasingly moving online as well: artists expect and need to be paid more promptly and transactions are taking place through a variety of connected technologies. Failing to keep up with efficiencies that allow our staff and board to focus on what matters will put us in a poor competitive position.

Peter Luckham, Chair, Islands Trust Council:

Improved, high-speed broadband internet connections for residents in rural and remote communities will in turn help to improve their quality of life. Improved connectivity can help community members to reduce their greenhouse gas emissions via reduced travel, access education and health services, participate in economic opportunities that are compatible with the conservation of island resources, and better participate in the decision-making processes of all levels of government.

Paul Marmion, Engineer, Denman Island:

I believe that the present internet situation on Denman is unsustainable and in itself is creating a 'have and have-not' situation (some people on the island have relatively fast service other people/ families have no service). This situation is especially harmful for young Denman'ites who want to have equal learning opportunities as their peers in Vancouver. And also, for people like us who may want to make a productive life for themselves on Denman.

CHFR 96.5, hornbyradio.com, Hornby Island:

Currently there's no internet at the Radio Studio. The Radio Society is considering internet streaming and an island-wide internet upgrade would improve the likelihood of the Radio being able stream radio. This would be significant for emergency services use, public announcements, news sharing, and public entertainment.

Etienne de Villiers, Architect/Builder, Denman Island:

For islanders with family & friends elsewhere in Canada and the world, faster internet would enable people to stay in touch using video calls. It's currently quite difficult to do so without lag here. It would be really nice for more isolated or housebound residents to be able to communicate reliably and easily with their support network.

Questions Posed and Community Responses, During Consultations

As part of the consultation program, questions were posed through Facebook forums, and many citizens responded. Following are some observations of these responses:

Q. As community members, what should we be paying attention to when it comes to connectivity?

A. 66% of the respondents to the questionnaire felt that “parity of access” was the most important. This is parity with other Canadians, and also parity with other properties on the Islands. A close second, with 60% feeling it is of priority was “speed”. Clearly the respondents are supportive of working to have the Canadian standard of 50 Mbps download and 10 Mbps upload as the Hornby standard, as well.

- **How important is social media when communicating information to the public?**

- 87% of respondents replied important or very important to this question. The Hornby Community Connections Facebook page has 1600 members, making it a key communication tool for events, items of interest, and airing debate.

What role can connectivity play in building economic resiliency or driving investment in our local economy?

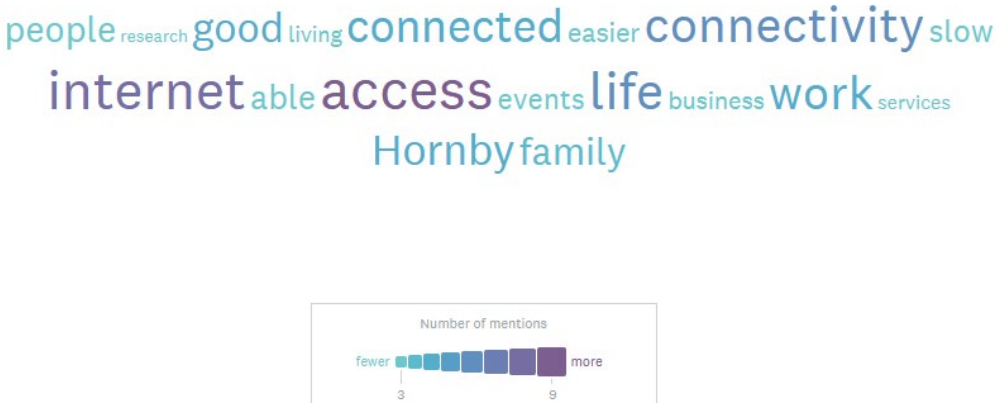
- Generally, connectivity is essential in building economic resiliency and encouraging a more diverse economy. The specifics included generating self-employment, attracting young families, education and skills development, accessing customers online, and helping money stay in the community.

What role does connectivity play in our community well-being?

(A word cloud, from community members, when asked that question)

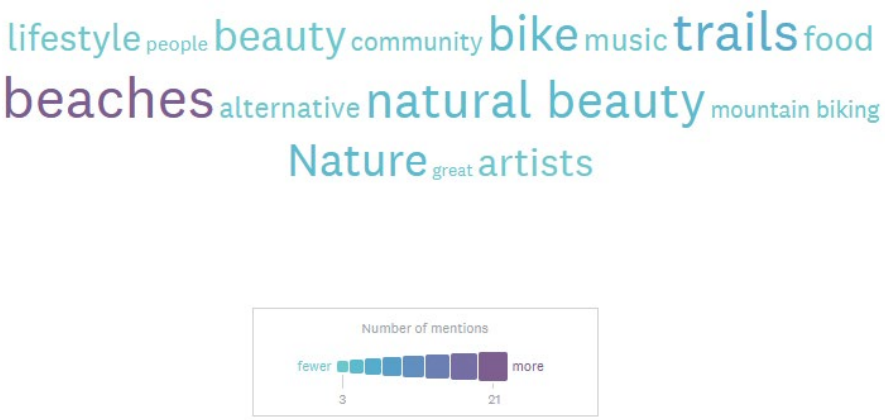
How has our community and your life changed with access to connectivity?

(A word cloud, from community members, when asked that question)



What attracts visitors to our community?

(A word cloud, from community members, when asked that question)



APPENDIX E
COMMUNITY COMMENTS ABOUT THE INTERNET OBTAINED BY FACEBOOK CONSULTATIONS ON HORNBY ISLAND

Hornby Island Community Economic Enhancement Corporation

December 3, 2019

HORNBY ISLAND FACEBOOK CONSULTATION			
Commentor		**Occupation**	**Comment**
First Name	**Surname**	**Profession**	
Jesse	Berg	ocean adventures tour operator	"It would help me for sure!"
Alsoon	Brine	commuting medical doctor	"The electronic medical files of all my patients are on-line. I do a couple of hours of work remotely every day that I'm not in the office in Courtenay. The speed is frustratingly slow, and I often lose everything I've recorded when the internet crashes."
Wendy	Burton	Educator	"I am a remote worker. I teach courses online for my university. I have done so since 1999. Back in 1999, the technology of the courses and the internet capability (dial up) worked quite well. Since then, and since I am on the "slow" end of the island, the courses have become more graphics heavy and more interactive, sothe lack of speed is creating a problem for those teaching and learning online." "Many universities and colleges offer fully online courses, often with live chat features. Remote workers also includes remote learners."
Rachelle	Chinnery	mixed media artist	"I did a graduate degree part-time online and it was very difficult uploading multi-page documents, as well as downloading multi-page research and library listings. That was three years ago. This spring I'm hoping to take more graduate courses and am somewhat dreading the download times." "For anyone teaching or studying through distance education, much better Internet is needed on our island. Studying online, too."
Paula	Courteau	Ferry crew	"I do some food ordering online for work, about twice a month. It goes very slowly and I would spend only half the hours with proper high-speed internet."
Al	Dickie	Senior management /manufacturing	"I'm a business owner and have to use the internet and phone to interact with my employees and customers. I currently use satellite internet as the existing TELUS internet does not reach my home. Hi speed internet was promised to all households in Canada in the last federal election. Another of the many promises not kept."

HORNBY ISLAND FACEBOOK CONSULTATION			
Commentor		**Occupation**	**Comment**
First Name	**Surname**	**Profession**	
Karen	Elder	Artist	"Doing marketing and exposure online as an artist through websites, google search, fb page, ordering supplies, using square and e-transfers, ordering prints, keeping up-to-date with art happenings on island and off, and on and on. Definitely helpful to have better internet!"
Aileen	Fearman	Farm/glamping	"I communicate with guests 99 percent through email, instagram, Facebook and our website booking app. From Jan to August about 4 hours per day. I need to be able to transfer large files and it's impossible through the current internet I use my phone as a hot spot!"
Catherine	Gray	Administrator, CHI	"My job as administrator at Conservancy Hornby Island requires me to use internet for research (many hours a week), newsletters, communicating with partner non-profits and board members, planning events such as our annual HerringFest, creating posters (I do this with an online tool), managing our website, posting Facebook news, etc, etc. The past few months I have wasted a lot of time rebooting my router several times per session due to the slow connection, and it often takes a long time for pages to load. I (and by extension our marine ecosystem) would truly benefit from improved internet connectivity and speed."
Susan	Hargrave	work from home Mom	"From a part time resident point of view.At least 20 homes on Cape Gurney (furthest point of Whaling Station) are not able to receive telus ADSL internet. They tell us the signal is not strong enough. I have tried to run my business from Hornby, & have home schooled my daughter from there (we are required to have Internet for home schooling in B.C.). I have tried to install satellite at the cost of $150/mo. Which is well beyond the norm. We welcome any changes that would help us stay on the Island for more duration."
John	Humphrey	Entrepreneur	"I'd like to hear a discussion about hot spots... Wondering what brands, and costs and if there are any issues I might not be aware of such as downtime or lack of customer service. I checked out a couple that people in the RV community are using and they didn't seem that much more expensive than what we're paying Telus."

HORNBY ISLAND FACEBOOK CONSULTATION			
Commentor		**Occupation**	**Comment**
First Name	**Surname**	**Profession**	
Dominique	Husereau	Job Shop	"Job searching online from home. Everything is online."
Ann	Kelly	ESL teacher	"I teach English as a second language on line 6 hrs a week.(China, Ontario, BC). Sometimes the connection is weak.. meaning the students miss part of the conversation. I would really benefit from improved WIFI speed and cell coverage as there is often a need to discuss things on the phone besides teaching over wifi. I know of four others who are educators who either work or teach online from Hornby part time. Three have struggled with the wifi speed." Difficulty of access to emergency health services via cell phone...I tried to call the clinic on call line and could not get cell call connection where I was living and had to drive to the Coop Store to get a cell signal. Not good if you are bleeding! Don't know about 911 calls."
Kim	Lake	Graphic artist	I thought I'd contribute to why better internet is of benefit to me as a hornby island resident and artist. I'm primarily a digital illustrator and graphic art practitioner. I don't work at this full time or even part-time as I'm limited to a local clientele due to upload issues. I can't send large files that my industry requires. Clients have to physically pick up the work. Also sending wip to people is hard for the above reasons and lower quality files need to stand in. Most of my income is derived from other means that don't require internet. I'm severely limited by what is available. I would love to expand and participate in my art community online in a more professional and profitable manner that would allow me to contribute to my community in a more economically abundant way. I hope this helps.
Sasha	LeBaron	virtual reality testing and production	Do we need improved internet? "Yes Yes Yes! And I would pay up to $60/mo. for it"
John	McLachlan	musician & B.C.Arts Council adviser	Recording and performing artist. "Improved internet would be very helpful. It's an essential part of being able to make a living here."

HORNBY ISLAND FACEBOOK CONSULTATION			
Commentor		**Occupation**	**Comment**
First Name	**Surname**	**Profession**	
Peter	Panjoyah	Entrepreneur	"Yes, we work online professionally across several different service offerings. And although our speed is good atm, we won't always be living here.
Shawn	Pederson	Entrepreneur	Live on Anderson Drive. "My desire to convert from part-time to fulltime residency"
Don	Pederson	photographer	"Better internet would certainly make uploading large files (photographs) for clients or printers much easier. Some days here it is simply not possible and on good days it is just very slow."
Mark	Phillips	Business Development for a mortgage lender	However, my wife is a landscape designer and she requires almost constant connectivity. If she starts working from there next summer we might just be in need of a strong internet connection, so in her case better internet would allow her to be there more often for sure."
Rebecca D.	Raworth	Research Librarian /U.Vic.	"I tried to do a 6 month sabbatical from Grassy Point a few years ago but as an academic I was unable to download all the articles I needed and do the online research required for my project. (I work at UVic.) I had to leave Hornby after the first month and do most of my sabbatical work back in Victoria. I had so looked forward to being able to work and live on Hornby for 6 continuous months so was very disappointed that the slow Internet speed was inadequate for my needs.This was after installing a $1500 satellite dish. Every time there was wind or rain there'd be no service at all."
Stacey	Reynauld	Instructor of Business & Marketing at BCIT and SFU. Also, a student doing a Masters of Education.	"I work 100% online. I'm an instructor. And I'm doing graduate studies 100% online. I teach business and marketing at B.C.I.T. and S.F.U. online. I'm doing my MEd in mindfulness-based teaching and learning. I use wi-fi calling on my cell phone. I use Virgin mobile, and Telus internet. I live at Grassy Point. No cell coverage until around the Credit Union.
Katherine	Ronan	Architect	"My internet is very slow. Download around 3 Mbps, upload around .5 mbps, slow internet speed interferes with my architectural work"
Zsofin	Sheehy	videotographer	Wandering Eye Mediahas to go to a friend's house to upload any content needing sending.

HORNBY ISLAND FACEBOOK CONSULTATION			
Commentor		**Occupation**	**Comment**
First Name	**Surname**	**Profession**	
Susie		movie industry product placement advertising	Download (mbps)Telus - 3.44 / Xplornet 25 for Business - 18.86 - note these flux down in the evening Upload (mbps)Telus - 0.54 / Xplornet 25 for Business - 1.32 - note these flux down in the evening
Michael John	Thompson	Online book store & homeschooling parent	"100% online; working on-line full-time, supporting a family of 5." "Along with our on-line business, we have 2 remote learners. Our older children take ASL courses on-line, as well as doing mathematics programs; also, one is partially home schooled and we do on-line filing of learning reports; another is in high school and does many writing projects, etc on-line for her regular high school classes. One can likely consider all the kids who go to Vanier as being remote learners due to having to access course content on-line." Also we home schooled Ursula, Emily and Arwen for many years; and we will be home-schooling Ronja in a few years. On-line access, and fast on-line access, is vital to the learning environment today.
Henry	Towslanger	Engineering	Poor internet on Anderson Drive."I work 1-2 days a week from home in the winter, and 3-4 days week in the summer. Better connection would improve my performance and connect to colleagues."
Sara	Vipond	artist & educator	Poor internet on Anderson Drive. "I work 1-2 days a week from home in the winter, and 3-4 days week in the summer. Better connection would improve my performance and connect to colleagues."
Jeff	Zamluk	Contract manufacturer	manufactures unique marketing materials

Denman and Hornby

Broadband

Feasibility Study

Part Two of the Two-Part
Digital Roadmap & Implementation Plan

Prepared for:
Hornby Island Community Economic Enhancement Corporation (HICEEC)
&
Denman Island Residents Association (DIRA)

BAYLINK networks

December 2019

DOCUMENT CONTROL SHEET

For Revisions and Proposed Changes Contract:

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Issue	Date	Reason
0.1	December 20, 2019	1st Internal Draft
0.2	December 22, 2019	2nd Internal Draft
0.3	January 09, 2020	3rd Internal Draft
1.0	January 10, 2020	Draft Report to DIRA & HICEEC
1.1	January 13, 2020	4th Draft Review
1.2	January 14, 2020	5th Draft Review
2.0	January 17, 2020	Revision Report to DIRA & HICEEC
2.1	January 20, 2020	6th Draft Review
2.2	January 22, 2020	7th Draft Review
3.0	January 24, 2020	Revision Report to DIRA & HICEEC
4.0	January 29, 2020	Final Report

TABLE OF ACRONYMS

Acronym	Description
ACAD	AutoCAD
CDC	Community Development Company
CO	Central Office
CRTC	Canadian Radio-television and Telecommunications Commission
DHCP	Denman Hornby Connectivity Project
DIRA	Denman Island Residents Association
FDH	Fibre Distribution Hub
FTTP	Fibre to the Premise
Gbps	Gigabits Per Second
GIS	Geographic Information System
GLB	Ground Level Box
GPON	Gigabit Passive Optical Network
HICEEC	Hornby Island Community Economic Enhancement Corporation
ISP	Internet Service Provider
Mbps	Megabits Per Second
MoTi	Ministry of Transportation and Infrastructure
MTTR	Mean time to Repair
NIU	Network Interface Unit
NOC	Network Operations Center
ODN	Optical Distribution Network

OLT	Optical Line Terminal
ONT	Optical Network Terminal
OSP	Outside Plant
OTDR	Optical Time-Domain Reflectometer
PON	Passive Optical Network
POP	Point of Presence
SLL	Shore Landing Location
USN	Undersea Network

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EXECUTIVE SUMMARY – OVERARCHING PART 1 AND 2

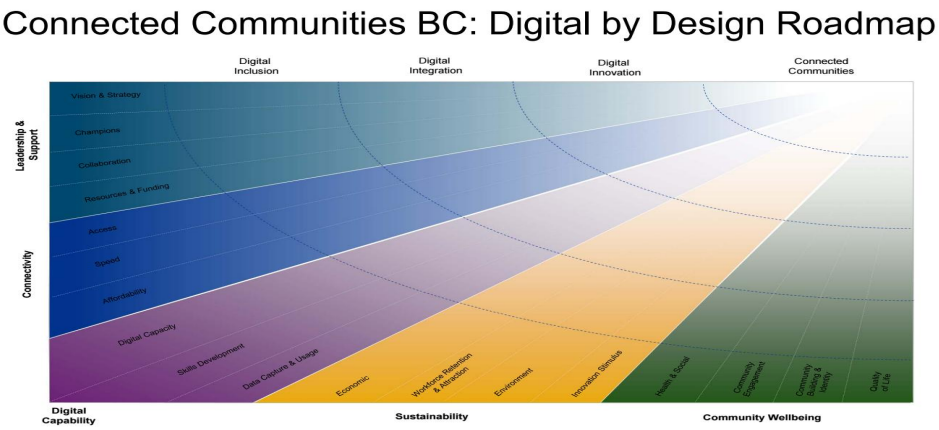
This paper develops a strategic intervention to improve the digital connectivity of the under-served communities of Denman Island and Hornby Island.

This project to improve connectivity emerged because of the deep dis-satisfaction with inadequate broadband services on these neighbouring islands in the Salish Sea, part of the Comox Valley Regional District. The substandard internet service on these islands is based on obsolete ADSL technology that is uneconomic to upgrade. The community will have to either partner with an experienced service provider to replace the ADSL with modern telecommunications infrastructure or build this itself.

Over the last 18 months committees formed on each island, then joined forces to engage the entire community in an intensive consultation process. The committees set out to better understand local connectivity possibilities and better inform the community. They learned of the connectivity guidance and funding available from British Columbia's Information Communication Technologies Directorate and the federal Broadband Fund, and determined to seek their assistance. British Columbia's Connected Communities program defines a "connected community" as:

"Applies a digital mindset to reimagine itself in today's interconnected world. Digitally empowered connected communities purposefully integrate technology into all aspects of community development to improve livability, workability and sustainability, while leverage existing resources in new ways to achieve greater economic, social and environmental outcomes."

The Ministry has depicted the route to connectivity in the following graph:



With guidance provided by the Ministry of Citizen's Services in direct communications and in this definition and chart, the Denman and Hornby community has considered all aspects of the route to digital connectivity. This examination is presented in our attached, comprehensive, two-part report. Surveys were conducted with unusually high response rates, documenting the inadequacy of the internet in the community, disclosing problems this causes for individuals, groups and the economy, and demonstrating the many aspirations within the islands for a better future with advanced digital connectivity. Funding was obtained from ICET, NDIT, Denman Works and HICEEC which allowed the committees to hire experienced telecommunications expertise and develop a Digital Roadmap, Implementation and Business Plan.

The Current Situation

The rural, remote communities of Denman and Hornby need strong connectivity. Their populations (Denman – 1,165; Hornby 1,016) are growing faster than the BC average, raising the need for services. They have key groups with particular requirements for good quality, reliable broadband (seniors, school-age children, businesses). Seasonal residents are of central importance to the economy of these islands; this sector has critical needs for strong internet. Better connectivity is closely linked to objectives for improvement in public safety and services, for the expansion of individual firms, shops and studios, and for enabling skilled residents to build their vocations from home.

Through its two surveys, the committees learned of the depth of the internet problems on the two islands, and the dimensions of the market for improved service. Both surveys attained response rates exceeding 30 percent. They found no islanders receiving broadband at the level of service established by the federal government as a standard (that all Canadians should have broadband providing a minimum download speed of 50 Mbps and an upload speed of 10 Mbps). Speed testing from the surveys revealed that on each island, over 95 percent of respondents recorded download speeds below 25 Mbps, and nearly one-half were below 6 Mbps.

- On Hornby, with 560 occupied households:
    - 127 of 229 survey respondents use the internet for business, and 79 percent say it is inadequate to conduct their business effectively;
    - 54 percent of respondents include seniors, who are major internet users for social, health, business and entertainment purposes;
    - 22 percent include school-age children, and none are satisfied that their internet supports children's education as a study and research tool. Ninety-five percent report speeds below 15 Mbps.
    - 25 percent are primarily seasonal residents, and one-half said poor internet stops them from becoming full-time residents or spending more time on the island.

- On Denman, with 592 occupied households:
    - 135 of 198 survey respondents involved seniors, and 40 percent of them say the internet is inadequate;
    - 16 percent of respondents include school-age children, and 82 percent are not satisfied with their internet service;

- 10 percent are primarily seasonal, and 79 percent of them are dis-satisfied with the internet;
- All business respondents are dis-satisfied with their internet;

The committees informed the community of these findings and began discussions of potentials for improvement. Articles and letters were published in the locally-popular weekly newspapers and three widely-used local Facebook groups. Individual mini-interviews were conducted with all institutions and most businesses in the community to learn of their needs and aspirations concerning connectivity. Other consultation measures included radio interviews and presentations at well-attended public events. The main events were two public Open Houses (each drawing over 70 attendees) and four other public meetings (each drawing over 30).

Three other key findings emerged from this extensive consultation:

- The community is proud of its attentiveness to the environment. It sees improved connectivity as means of replacing travel, which would reduce its carbon footprint as well as lowering its expenditure on travel;
- The community has a vision of universal Fibre to the Premise (FTTP) on both islands advancing the social and economic lives, health, safety and enjoyment of all residents;
- The community is deeply concerned about electro-magnetic frequencies emitted by wireless devices and is prepared to expend more to obtain FTTP service. The interest in obtaining improved cellular service was discussed but is not as strong a concern as the interest in FTTP.

The surveys and consultation process have developed the communities' objectives and identified the market for better broadband. All these factual components and process findings contribute to a strategic plan to improve Denman/Hornby connectivity.

Design of an Improved System

The technical assessment of the situation is contained in the Feasibility Study, including a design to build an appropriate fibre-optic network and a study of the financial feasibility of approaches to the realization of this construction design. This research was undertaken by Baylink Networks which designed, costed and assessed likely business plans for a broadband network that would efficiently meet the communities' current and future needs.

Baylink developed a network plan for universal coverage linking the islands' 1600 homes and businesses. The plan development included a detailed study using large-scale Google Earth digital mapping plus ground truthing, considerable reference to other projects, specialist suppliers and contractors, many regulators, and the development of multiple spreadsheets that created and tested several construction/business alternatives.

The network design contains two main components, Backbone or Backhaul, and Last Mile or Fibre to the Premise.

- Two methods of securing backbone are presented: purchasing from Telus at the Denman Island CO; or purchasing from Shaw at Buckley Bay and then bringing it by submarine cable to this CO. Telus' very high quote for selling the capacity made the more complicated Vancouver Island purchase more economic.
- From this CO high-count fibre optic cable would go southeast across Denman Island to make another submarine crossing near Gravelly Bay to Hornby Island. On Hornby the cabling would extend to a second CO near the Co-op store. These COs or POPs, would have minimum capacity of 10 Gbps, capable of expansion to serve all needs for several generations.
- Two methods of building the Last Mile were considered, aerial (involving 2079 poles and 137 kms of backbone routing) and underground (requiring three crews each installing about 200 meters per day). Many implications of both methods were assessed, including timings, regulatory processes and ongoing maintenance.
- Two technical systems for the FTTP connectivity were examined, Passive Optical Network and Active Ethernet System. Either would accommodate multiple applications simultaneously (internet, telephone, television, other).
- Permitting, construction, maintenance and servicing requirements (involving time, staff, equipment and modalities) were all examined in detail and incorporated in spreadsheets and Gantt charts as part of the analysis of feasibility and viability.

Underground deployment and a PON network were recommended because of community characteristics (although an ethernet hybrid might be considered in a few sectors).

- Total construction costs are estimated at $10.289 M.
- Once constructed, monthly operating costs (gateway, staff and overhead, maintenance and equipment, insurance, others) would sum to $58,116.40
- This valuable broadband network design would be profitable to operate. Estimated monthly revenue would range from a conservative $77,000 (1,100 subscribers averaging $70 fees) to an aggressive $154,000 (1,400 subscribers averaging $110 fees).

Alternative Plans

Assessments were made of financial implications for four alternative modes of organizing the implementation/ownership of the proposed underground fibre broadband network. The implementation/ownership models all involve Denman/Hornby participating with the "owner" in securing government funding of 75% of project costs, and this would require active island involvement in the project construction/start-up for approximately three years. The models are:

1. Owner builds and operates, in some kind of relationship to Denman/Hornby group;

2. Owner operates, but hires out the construction. Has some kind of relationship to Denman/Hornby group;
3. Owner is a community development corporation, successor to Denman/Hornby group. Owner is in a joint venture with a builder/owner/operator (as in 1. above), receiving 10% of profits above a threshold and 10% of any sale proceeds, and with a specific arrangement that it could influence rates and service levels,
4. Owner and operator would be Telus, and the network would be to its design, primarily aerial on existing poles, with a Telus-defined project cost of $11,565,000. Denman/Hornby (with CVRD assistance) would make a significant contribution to the actual build costs (perhaps $300 -500,000), and would partner with Telus in applying for government funding.

It was observed that in all models except 4. (Telus), Denman/Hornby would have an ongoing critical role requiring managerial/financial skill and perhaps involving liability.

Conclusion

Denman and Hornby Islands need better internet and want to develop their community with better connectivity. The islands' committees have conducted an intensive, thorough consultation process that developed these findings in depth and helped inform the community. All of these factors are described in detail in Part One of this comprehensive report, inspired by British Columbia's "digital roadmap" model.

Part Two of this report is an examination of the feasibility of building a broadband network on Denman and Hornby that would meet the community's needs, and provide the capacity to serve all aspirations for their future. The examination was conducted by Baylink Networks, an experienced telecommunications engineering firm, under a contract made possible by grants obtained from ICET, NDIT, Denman Works and HICEEC.

A quality, low-maintenance, underground fibre optic network that would meet and exceed the bandwidth needs of the community for the foreseeable future, can be built on the Islands. It would serve every home/business on the islands with fibre optics (no wireless infrastructure), and can supply internet, phone, TV and any other telecommunications services. It could be built for a total construction/installation budget of $10,289,668.

It would be possible to construct an aerial network less expensively, but because of known risks associated with implementation and costs, aerial infrastructure is only viable, financially, for Telus.

The construction and start-up of a high-capacity fibre-optic network service is greatly needed on Denman and Hornby Islands, and this will require a complicated, lengthy, and expensive project.

OBJECTIVES OF THE FEASIBILITY STUDY

In February of 2019, Hornby Island Community Economic Enhancement Corporation (HICEEC) and Denman Island Residents Association (DIRA) entered discussions with Baylink Networks (BN) regarding development of a Digital Road Map and Execution Plan for the islands. In September of 2019, BN was contracted to complete this study investigating how to bring a Fibre-to-the-Premise (FTTP) network to both Denman and Hornby Islands. Various options are available for a region of this size and density. The early sections of the study review why a fibre system is important and the existing market conditions, while subsequent sections address network designs, organizational structures, cost estimates and financial analyses. The end objective is to recommend a project design and estimated costs to construct and operate a quality FTTP system. A key objective is to deliver a Digital Roadmap and Implementation/Business Plan which meets the criteria defined by senior governments to whom applications for project funding will be filed. This study is intended to be used for grant application, survey and construction planning, budget and economic modelling and hazard identification and risk management for the eventual construction of such a cable system to serve the telecommunication needs of the islands for the foreseeable future.

The feasibility report is structured as follows:

Executive Summary – provides an outline to the content of the report;

Section 1.0: **Introduction** – outlines what the project entails;

Section 2.0: **Project Background –**provides an overview of both Denman and Hornby current broadband availability;

Section 3.0: **System Design** – outlines a high-level network design and other options;

Section 4.0: **Operations and Maintenance** – provides the required operation and maintenance of an access network;

Section 5.0: **Project Permitting and Environmental Assessments** – provides example of the permitting process and contracts required;

Section 6.0: **Risk Assessment and Project Planning** – outlines the potential project risk of building a fibre to the premise network;

Section 7.0: **Cost Analysis** – provides a cost estimate for the proposed network;

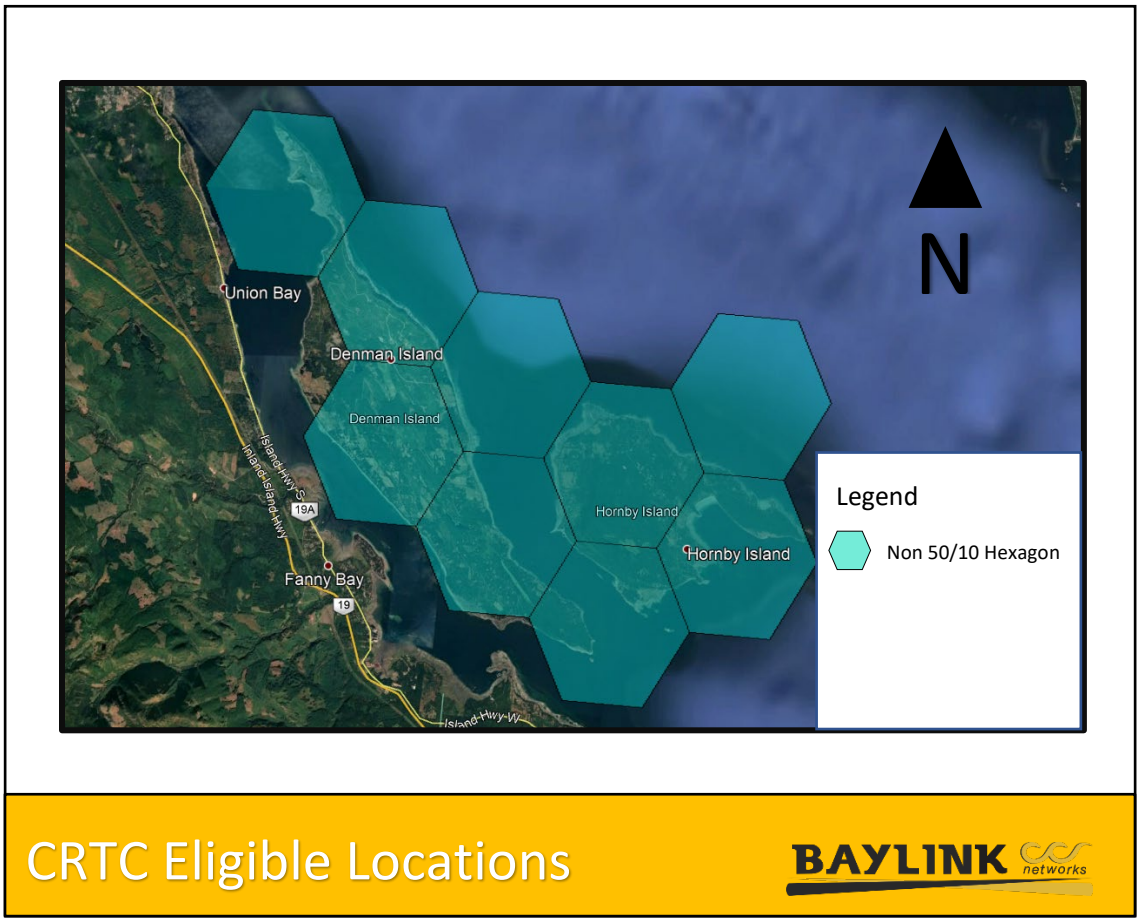
Section 8.0: **Ownership Options** – describes different options of owning and operating the system;

Section 9.0: **Conclusions and Recommendations** – outlines closing comments and recommendations for this network.

1.0 INTRODUCTION

Connectivity is the ability to affordably access quality internet services that citizens need to fully participate in the growing digital economy. Responding to a global transition to knowledge-based economies, governments at all levels have identified access to information communication technologies as a cornerstone to support future sustainable economic development and serve as a cornerstone to maintain a high standard of living and quality of life. The definition of broadband has evolved rapidly over the past five years as governments and regulatory bodies have closely examined the service characteristics of internet services that allow consumers and businesses to take advantage of these services.

Residents and businesses continue to have increased dependency on reliable high-speed connectivity. In December 15, 2016, the Canadian Radio and Telecommunications Commission (CRTC) established that broadband internet was a basic service and set target service objectives of (50 Mb/s download and 10 Mb/s upload) to be available in 90% of Canadian premises by 2021. Reliance on internet-based services for both residential and commercial customers continues to grow as internet-based communications, entertainment, computing applications and services expand. As shown below on CRTC's mapping, Denman and Hornby Islands are both eligible for the federal and provincial funding programs.



Some benefits of access to high-speed internet include:

Building the economy

Responding to climate change

Delivering health services

Providing education

Ensure public safety

While public policy objectives now include making broadband available to most Canadians, the reality for residents in many rural and remote areas is that such quality services are still not available or adequate, and solutions to remedy that situation are not readily apparent. Hornby and Denman Islands will need to work towards ensuring that broadband services on both islands keep pace to continue to attract residents, visitors, and businesses which will allow for sustainable growth and diversification.

Hornby and Denman Islands are studying the feasibility of a complete last-mile fibre optic system connecting the islands to long haul fibre and back on the Lower Mainland. Over 1600 homes and business will be served by this system. The planned system will link the regions with connectivity to existing terrestrial or planned subsea broadband fibre optic infrastructure.

2.0 PROJECT BACKGROUND

Overview of System

Baylink Networks was selected by the Denman Hornby Connectivity Project (DHCP) to provide community consultations, network design, site visit and feasibility study to provide evidence of support for the proposed backhaul and last-mile fibre build.

The study supports a proposed backhaul and last-mile fibre build for DHCP. DHCP is a planned fibre cable system with six fibre distribution hubs in the 2 communities on both island regions. The DHCP fibre cable system has an initial Ready For Service (RFS) of late 2021 which is approximately 22 months after funding approvals. This study has a budgetary level pricing estimate for a turnkey telecommunication cable construction company. A significant part of the study was concentrated on the technical design and feasibility of the terrestrial installation of the fibre cable and two associated submarine backhaul systems, with landings in each of the specified regions to connect to pre-existing network endpoints at Buckley Bay on Vancouver Island.

The planned, 308km DHCP system will link approximately 1,600 homes on both islands with connectivity to either existing or planned submarine broadband fibre optic infrastructure on Vancouver Island. The basic system is a main trunk fibre cable coming from Vancouver Island then reaching Denman Island central office where it spurs to each community.

Scope of Work

The study incorporates all activities necessary to evaluate the potential network and provides Denman and Hornby island with the information required to move ahead with the project; effectively delineating both technical and commercial risk; and options to successfully operate the system to meet or exceed capacity and/or revenue targets.

The study provides a report with possible business plan options to be considered.
Main inclusions are listed below:

Community Engagement
Route Deployment Analysis
Choice of Technologies
3rd Party Options
High Level Engineering and Design Plans
Market Analysis
Estimate Construction Costs
Ideal Operational Models and Cost
Risk Management

The final deliverables are:

- To prepare a digital roadmap for the two islands that addresses federal and provincial requirements for broadband funding;
- To examine the broadband situation and the detailed physical environment on the two islands and produce a technical implementation plan and appropriate business plan to bring quality connectivity to the islands, to at least the federal 50/10 standard, and including consideration of at least three ownership structural options;
- To conduct a thorough community consultation that informs the communities on both islands about their broadband situations, explores needs and aspirations for improvement, discusses options for improvement, develops a consensus and identifies support and opposition;
- To provide a thorough, integrated final report for the project.

Methodology

The study incorporates all activities necessary to design and evaluate the fibre build on both Denman and Hornby Islands.

The timeline and key activities for each stage were identified and are shown below:

September	**Project Start-Up** DIIC and HICEEC to develop consultation plan, develop survey(s), develop consultation paper, develop communications plan for the consultation process BN to undertake an in-depth desktop analysis/production to a first draft stage of digital roadmap (including DIIC and HICEEC as needed)
October	**Main Project Development** DIIC and HICEEC to complete survey, consultation planning and communications activities including widespread distribution of consultation paper, preparation for coordinated public open house consultations on both islands. Open houses to include: displays (by BN, Telus, others); speakers (DIIC/HICEEC, BN, Telus, Networks BC, Island Health, others); survey/poll material directed to developing consensus and identifying opposition. BN to provide technical support BN to continue roadmap and implementation/business plan production covering at least three structural options identified by DIIC/HICEEC, with site examinations, preparation for participation in consultation
November	**Public Consultation** DIIC/HICEEC and BN to hold public, open house consultations on each island, conduct post-consultation reviews, move to either: consolidation of all material into draft final report; OR review problems uncovered in public consultation, revise and perform additional work including additional consultation if necessary, then draft final report
December	**Project Finalization** DIIC/HICEEC and BN to complete draft final report which integrates the consultation, digital roadmap and implementation plan, circulate the draft(s) for review, and finalize. The final report will be under BN covers Close-out of project, final accounting

Based on this plan, a five-phase approach was adopted:

Phase 1: Data Gathering
Phase 2: Data Assimilation and Consolidation
Phase 3: High Level System/Service Requirements Design
Phase 4: Complete Last-Mile Fibre System Design
Phase 5: Report Delivery and Recommendations

The current existing state of broadband on both islands was reviewed and analyzed and the need for an upgrade to the existing system confirmed. This was further confirmed through the community consultation process. All existing and potential sites, routes, point of presences (POPs) and vaults on both islands were reviewed in accordance with industry standards. The objective of the site visits was to determine the suitability and collect data necessary for conceptual design and reporting. Based on the collected data, the final fibre design was prepared. It is a thorough and accurate fibre rollout plan. This represents a significant portion of a ready for construction telecommunications project. An initial route plan and review produced a series of alternative initial route plans.

A high-level review of the regulatory and permitting requirements for the system summarizes the requirements for the project and estimated timeframes to complete those requirements for the proposed system.

The project system costs have been estimated to a ± 20% range of accuracy utilizing an experienced-based cost estimating system. The costs of permitting, outsourced engineering and project management services, and system supply, installation/construction costs for fibre systems. The collected data was analyzed to identify project risks, enabling evaluation and risk elimination related to the system. The data collected and analyzed is based on experience and a variety of public, commercial and scientific sources to best analyze and project market conditions and cost.

Site Visit

Site surveys were conducted on Hornby and Denman Islands in the fall of 2019. Site visit reporting was completed, and the data collected was compiled and presented. The site visit report assessed the suitability of the landing sites and confirmed the ability to construct terrestrial infrastructure that reaches the landing sites and all homes and business. Any concerns with the nature of the landings, terrain, environment, local issues, etc., were noted. The Site Visit Report serves as a reference for the Cable Route Desktop Study and permitting activity.

Cable Route Desktop Study

The following map and table below outline a list/data of all possible fibre distribution hubs (FDH) that will potentially be part of the network. The Shore Landing Locations (SLLs) that connect both islands and the main feeder line on Vancouver Island and their approximate coordinates of locations are provided. A detailed Cable Route Desktop Study was produced to provide a cable route and installation methodology of sufficient accuracy to produce a cost estimate for the system within the ± 20%. The study involved a thorough review

of all available public domain data and the survey data, drawings, maps, plans photographs, and reports that were made available to produce a Cable Route Desktop Study report. The Cable Route Desktop Study optimized the cable type, route, and installation methodology by ensuring the physical security of the system from natural and man-made hazards through route selection, slack allocation, cable type (including armor) choice, and the use of industry-standard cable burial and protection practices.

SUMMARY

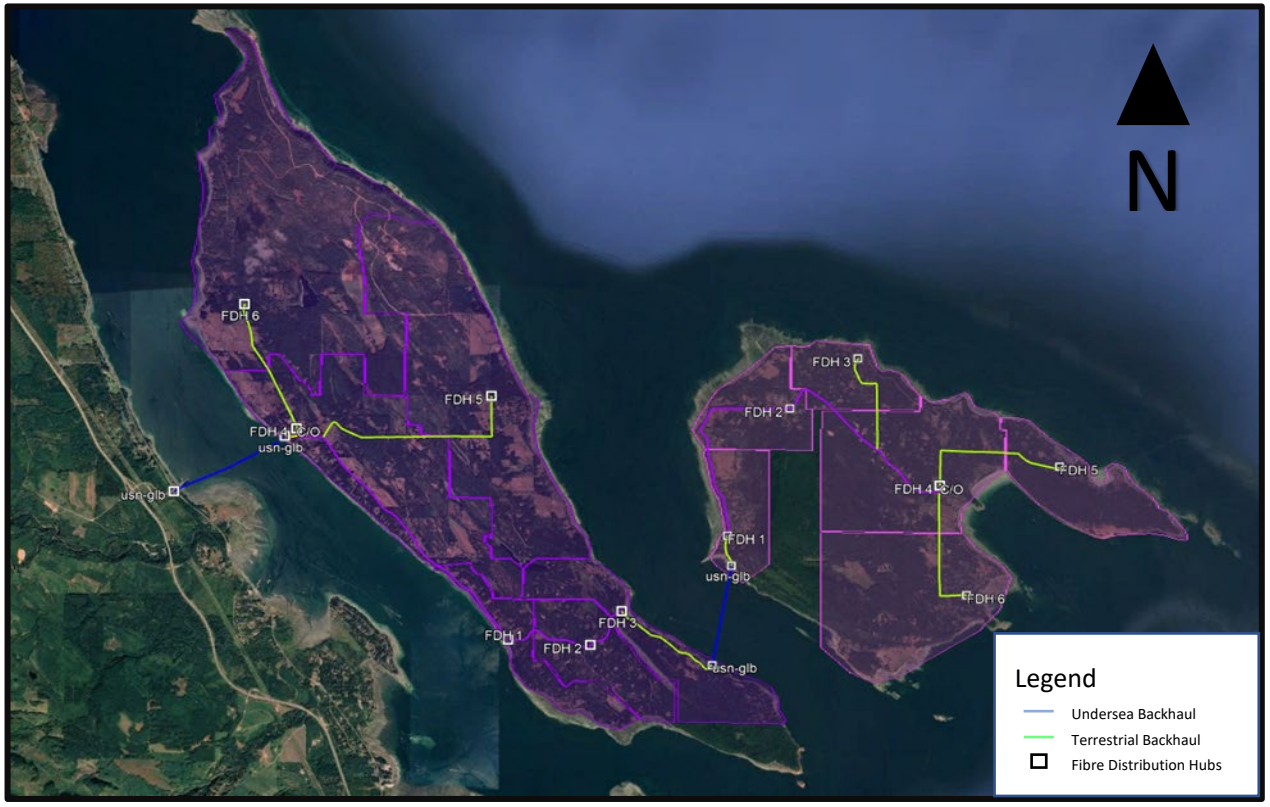
Baylink Networks developed fibre and electronics conceptual network designs to provide fibre to the premise. The goal is to provide a concept architecture for fibre and network electronics that would support the telecom requirements, as well as provide an opportunity to support both business and residential broadband services to the community.

The proposed network architecture is comprised of two components:

- Fibre and conduit infrastructure
- Network electronic design

Each of the design components are based on providing the ability to service the islands current and future network requirements, as well as provide the ability to provide connectivity to both residential and commercial customers.

With this project start-up and planning completed, the project is able to move to detailed study that will be described in the next section.



Hornby and Denman Fibre Distribution Network

BAYLINK networks

	Item	Longitude	Latitude
Denman	FDH 1	-124.7617047	49.49804883
	FDH 2	-124.7400942	49.49710515
	FDH 3	-124.7318375	49.50316526
	FDH 4	-124.8173665	49.53592643
	FDH 5	-124.7661418	49.54176189
	FDH 6	-124.8310926	49.55818643
	C/O	-124.8173626	49.53588354
Hornby	FDH 1	-124.7041319	49.51670604
	FDH 2	-124.6877014	49.53954379
	FDH 3	-124.6698289	49.54850676
	FDH 4	-124.648329	49.52572584
	FDH 5	-124.6168112	49.52905605
	FDH 6	-124.641287	49.50600062
	C/O	-124.6483282	49.52569673
Undersea	usn-glb 1	-124.7030735	49.51131005
	usn-glb 2	-124.7081138	49.49342982
	usn-glb 3	-124.8495562	49.52457414
	usn-glb 4	-124.8204126	49.53453897

3.0 SYSTEM DESIGN

System Overview

The planned, 308km system will link 1,600 homes on both Denman and Hornby Island with connectivity to existing or planned submarine broadband fibre optic infrastructure on Vancouver Island. The basic system is a main trunk fibre cable coming from Vancouver Island then reaching Denman Island central office where it branches to each community. There will be 12 fibre pairs (24 fibres) in the trunk cable. The trunk cable will continue off Denman Island Central Office and travel towards (Gravelly Bay ferry terminal) south-east of the island, where it becomes a submarine cable joining the two islands. Once on Hornby Island, the trunk cable will make its way towards the Hornby Island Central Office as shown on the previous map. One pair will be used for traffic to each central office, the remaining pairs are spares for future backhaul and expansion. Throughout the system design, additional vaults and points of presence (POP) are included for future expansion/homes. The fibre design system is based upon current fibre systems carrying multiple optical wavelengths (λs), (e.g. 100 λs x 10Gbps). Each community fibre distribution hub (FDH) would be provided with sets of wavelengths. Most of the FDH's have relatively small populations, (ie, several hundred people). At this time, no community is forecast to need more than 2Gbps of traffic for the foreseeable future.

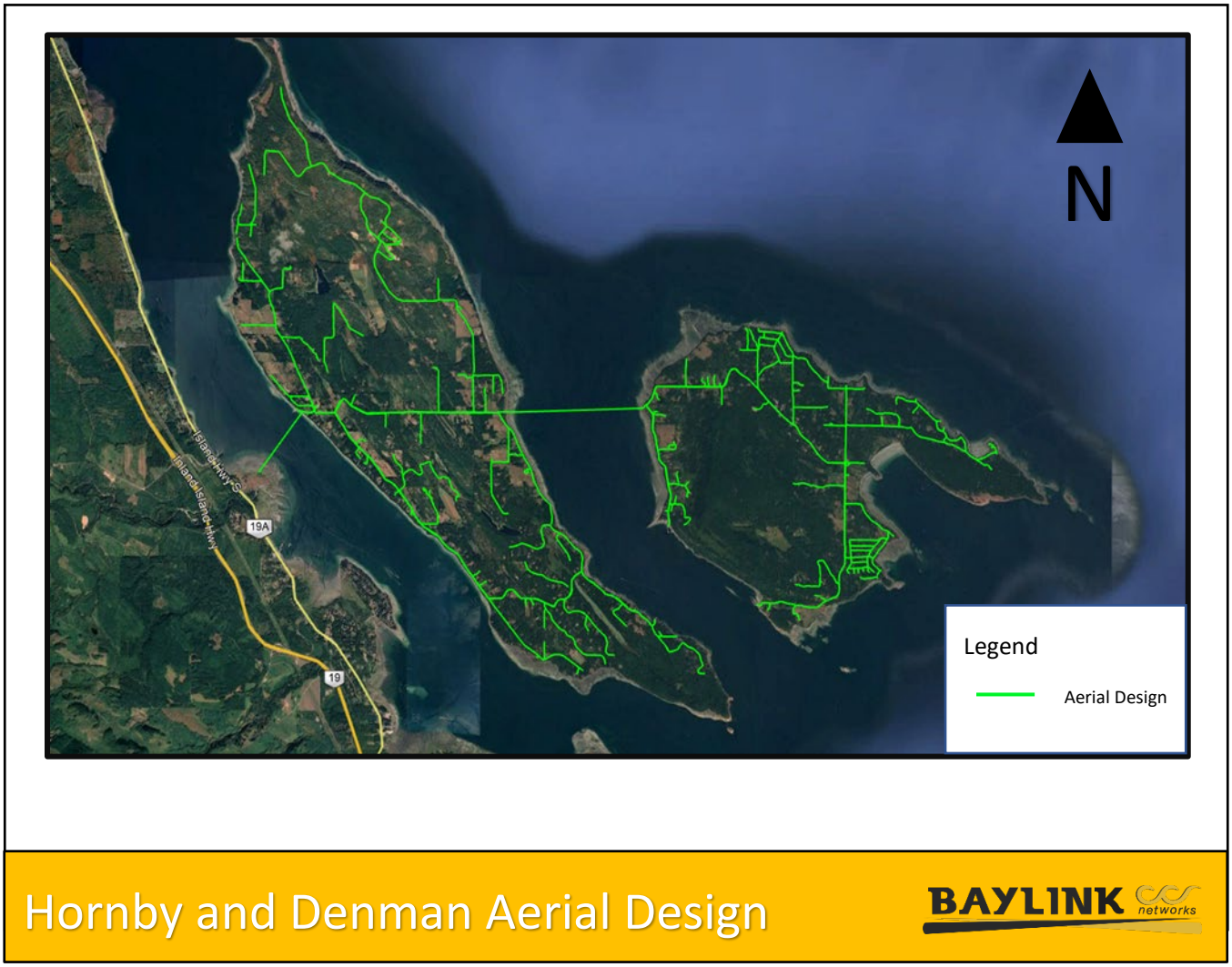
This section also examines the engineering considerations and the implementation requirements that must be considered with respect to the general feasibility of constructing this fibre optic network on the islands.

The construction phase of any fibre optic network is often the single most costly capital expense for the entire project. Thus, it is essential to have accurate planning and engineering in order to minimize risk while ensuring that the end product will support current and future requirements.

Aerial

Aerial construction consists of installing the supporting strand, lashing fibre optic cable to the strand, splicing the fibre optic cable, distribution center placement and activation testing of the outside plant installation. Before any construction can be done on the existing pole infrastructure, make-ready work must be completed. The make-ready work consists of preforming aerial attachment (other fibre, telephone, and cable) relocation, sometimes pole extension or replacement. It must be done to ensure minimum clearance codes are met. Aerial make-ready costs are typically about $12,500 per kilometer excluding the incremental aerial construction material cost (fibre cable, splice enclosures, fibre taps for individual subscriber drop connects, strand, and pole attachment hardware). The make-ready costs only include the cost to make the poles ready for construction, this excludes any material and labour costs to put up new fibre cable.

Below is a map of the potential aerial design based on existing pole infrastructure on both Hornby and Denman Islands.



Hornby and Denman Aerial Design

Underground

Underground construction can be accomplished in many ways. The following are the predominant methods of construction for underground outside plant installation.

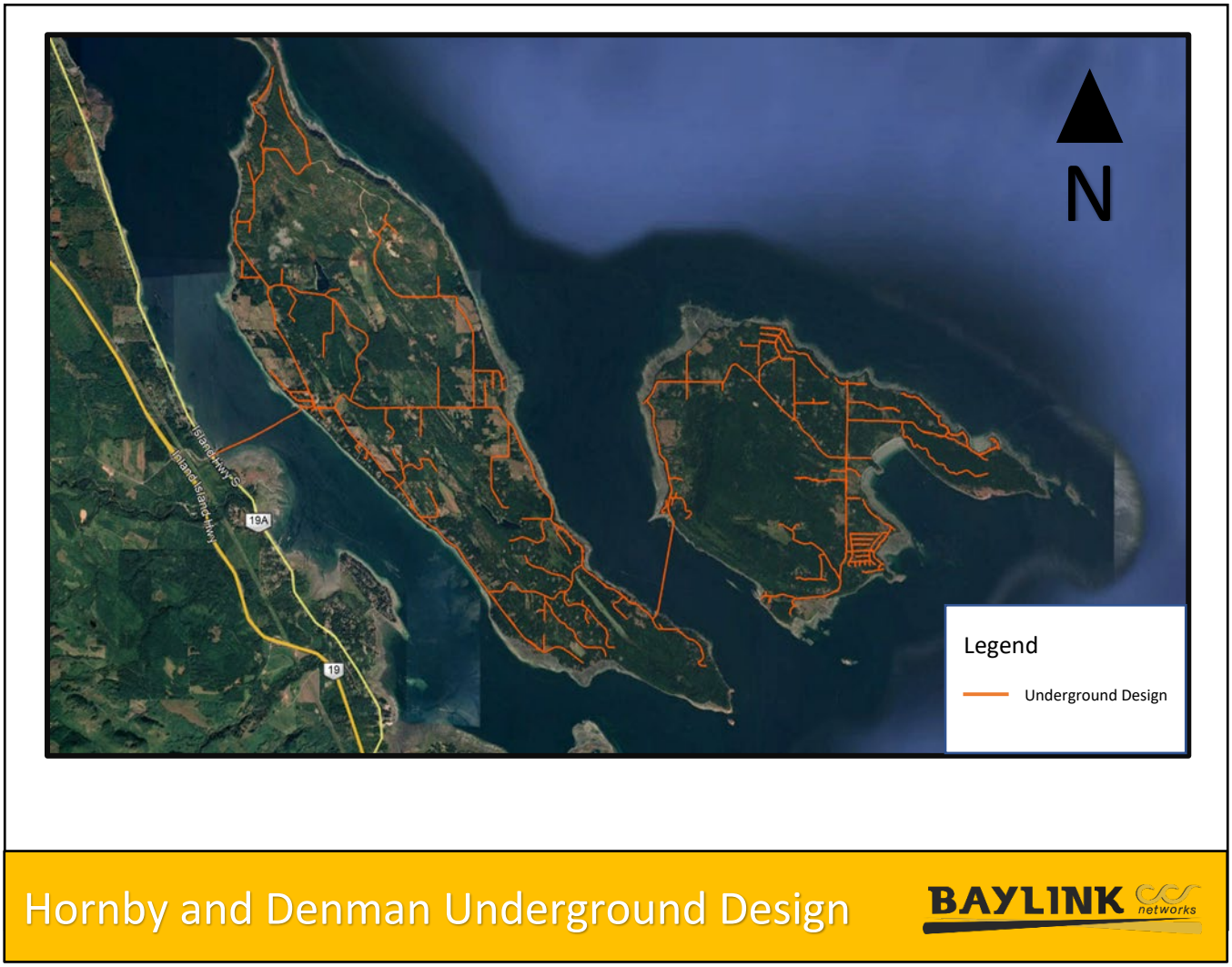
Plowing: If a cable route is unpaved, an ideal method of construction is the use of a vibratory plow to insert the cable into the ground. A cable plow has a vibrating blade that feeds cable or conduit down its chute into the ground. An advantage of using a plow is not having to backfill any trench or holes as material is not removed from the ground. In a single step, the plow generally opens a narrow trench, places the conduit or cable and closes the trench. Plowing is the most productive method of the three methods. It is ideal for direct burial of cable or small amount of flexible conduit but is not suitable for large numbers of conduits in one pass.

Trenching: When paved areas are encountered and cannot be plowed, trenching may be required. Trenching is a technique where a blade is used to cut or dig out a section of the ground and then backfilled after the conduit or cable is placed. It will first be cut and trenched, then cable placed, back filled, then patched. This method is suitable for installing large amounts of cable or conduit in a fibre route section. However, the drawback of this method is the need to backfill and repair road conditions. Trenching can also leave permanent cosmetic and/or structural damage to right of ways or roadways.

Directional Boring: Sometimes, pavement cuts are not allowed in certain sections and it may necessary to bore under the asphalt. There are different techniques for boring including the use of auger, water pressure, and pneumatic devices. Each method requires a pit to be dug on each side of the section to be drilled. The boring device is placed on one side of the pit and bores its way to the other open pit creating a pathway underground. Upon reaching the other pit, the cable or conduit is attached and pulled back through the same hole on retraction.

Underground construction costs can vary significantly depending up the construction methodology used and ground surface conditions. While the direct material costs for the underground construction are very similar with that of aerial construction, the labour and equipment costs are generally greater. The costs for underground construction can range from $15,000 to $150,000 per kilometer with the higher end being in dense urban areas. However, due to the lower density of both islands compared to that of an urban environment, the cost will be lower due to not having to deal with many concrete sidewalks or asphalted streets. Another advantage on the islands is the lack of constant traffic reducing the need for heavy traffic control. The estimated average for both islands is approximately $20,000 per kilometer mostly done with plowing and including some sectional trenching. This cost estimate only includes labour and equipment.

Below is a map of the planned underground network for Denman and Hornby Islands.



Hybrid

As mentioned above, the system does not require that it be one or the other. Both an aerial and underground mixture can be used (hybrid). There are many factors that can contribute to the decision of what infrastructure is to be used in different scenarios. The factors can be cost, ground conditions, length of segment, last mile or transport, environmental impact etc. During the construction phase of this project, the builder will decide on a case by case depending on the mentioned factors.

Top Level Requirements

The fundamental aspect which network architecture follows must satisfy capacity, speed, reliability and availability. The Future State Network must be capable of offering a suite of products and services that address the needs of its customers and users within the network. In addition to services, users require scalable solution as their business needs grow. Users require services that are intelligent and can differentiate between best effort traffic, Voice over IP, Video, and critical business applications that are both reliable and dependable. The network must have the necessary redundancy and resiliency to ensure high availability, meaning that the system is available in every instance and instantly when the users need it.

Bandwidth Capacity

In order to meet most funding programs, there are set speeds and bandwidth capacity that must be met. CRTC's Broadband Fund for example require all access project (last-mile) have a minimum of 25/5 Mbps to be funded but the targeted universal service objective-level is 50/10 Mbps. Transport projects for new builds must offer a minimum capacity of 1 Gbps, and projects that would upgrade transport infrastructure must offer a minimum capacity of 10 Gbps, to support the speed and capacity levels set out in the universal service objective.

Reliability and Availability

The system will need to provide industry standard levels of availability services uptime of 99.99% with a mean time to repair of 24 hours. (The network must be in operation for a minimum five-year period following the project completion date. The system is required to have an overall design life of 30 years.)

Cable Routing and Protection

The network routing needs to take into consideration the weather and terrain on the islands. The Comox Valley can regularly get up to 90km/h winds during storms. Certain sections of both islands are steep and narrow for utility right of way. Redundancy of the network where it is possible should be applied to maintain availability. This system will be designed such that faults affecting one section of the network will not impair the operation of the rest of the system.

Maintenance and Support

The proposed network must have acceptable level of service during network failures in the course of normal operations and unforeseen circumstances. These circumstances may include physical network failures, such as fibre cuts or equipment malfunctions, and natural disasters. The overall system design must consider the lack of technical expertise readily available on both Denman and Hornby Islands. Therefore, the system shall be designed with sufficient redundancy to minimize maintenance and maximize availability.

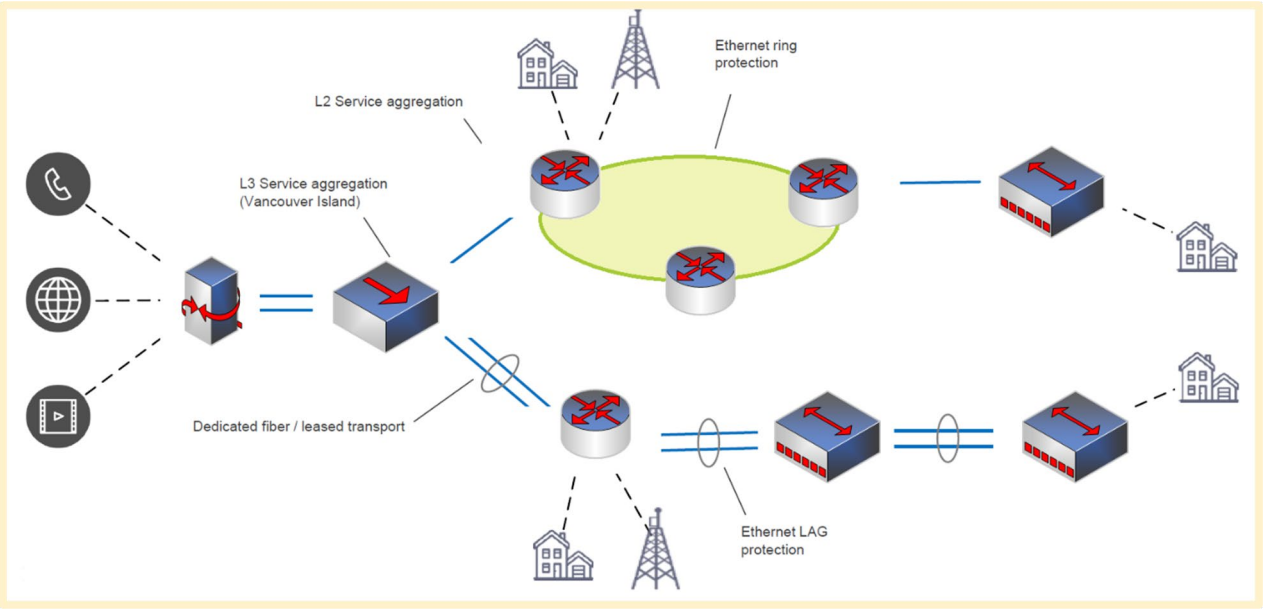
Network Expansion Capability

The network must demonstrate the ability to meet or exceed the universal service objective of 50/10 Mbps. The network must have the ability to serve more customers and/or provide more extensive coverage following the project completion.

System Design

The foundation of the network design is built upon a 10 Gbps fibre optic transport network inter-connecting all of the different community areas on both islands. This transport network is to be connected to the last mile aggregation points in each fibre distribution areas. Each access aggregation point is then connected to 1 Gbps access nodes in various spots around both islands to 100% feed every home in the region.

This design is not a static system and may require refinement through more detailed consultations with different service suppliers. The system designed is a modular chassis-based passive solution for the optical transport network, such that these electronics may be easily interchanged within the design.



The fibre network design is based on providing connectivity to the facilities and generally follows the road shoulder of the road right of ways to be deployed in a manner that would maximize the ability to extend to residential and commercial customers. The fibre network is comprised of the backbone system, providing the main transport systems, and the distribution system, providing the connection to the individual properties.

The fibre network will be deployed with conduit, direct buried, shadow conduits or a hybrid method sizing and fibre counts that allow for growth of services and connections as required. The fibre route is proposed with adequate breakout points and room to accommodate the deployment of additional fibre branches as future needs increase. The fibre network would have adequate fibres to accommodate an aggregated fibre to the premise network, dedicated point to point connections and support carrier/service provider connections

as required. The system will have capacity to enable island residents to take advantage of connectivity to support their internal services, both existing and planned.

The proposed infrastructure provides the HICEEC and DIRA committees with high level design and cost estimates. The fibre backbone was designed to accommodate connectivity to six fibre distribution hub (FDH) service areas on each island. The network will connect all the facilities on both islands and extend into the various commercial and residential areas. This would consist of a high-count fibre optic cable. Breakout locations would be provided that would interconnect to local distribution vaults and access fibres to the various premises.

The network will consist of the backbone and last mile.

The **backbone** consists of very large capacity trunks that connect to multiple fibre-optic lines capable of transmitting large amounts of data. It provides a path for the exchange of information that local or regional networks can connect with for long distance data transmission.

The **last mile** brings the connection to residents' homes and small businesses within the internet service provider serving the area. Though all pieces of the broadband infrastructure are important, there is much focus on the availability (or lack thereof) of the last mile connectivity.

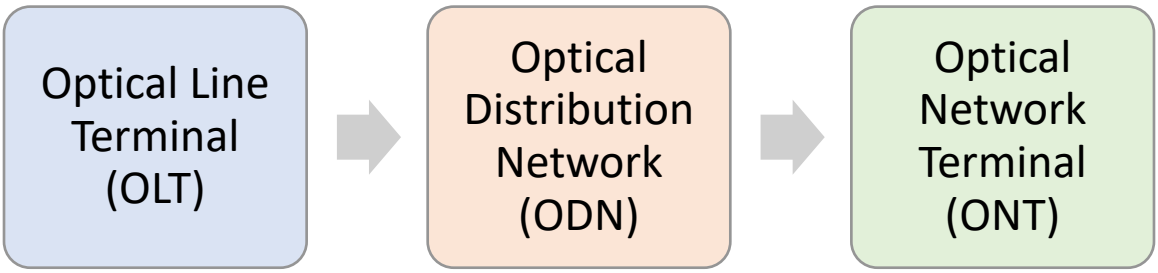
In this fibre optical network, the backbone will be the large capacity trunk fibre coming from Vancouver Island at Buckley Bay and the spurs to the C/O's. The last mile represents the majority of this network connecting the businesses and residential buildings.

The Distribution fibre network will provide last mile connectivity from specific backbone locations to the various premises, whether they be residential or commercial. Construction cost estimates per meter are based on previous network design and installation experiences.

The internet service provider (ISP) of broadband service requires several levels of network electronics, servers, and software in order to operate. These various levels are responsible for access, routing, activation, monitoring, management, and security. The service network provides the customer premise with electronics that connect back to the core network electronics located in the central office's (CO) network aggregation

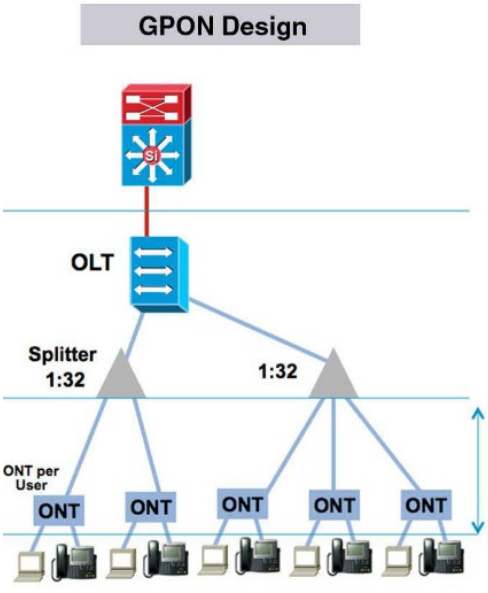
site. For the fibre network, there are two options as a deployment strategy, a Passive Optical Network (PON), or an Active Ethernet System.

The basic operation of this PON system is to deliver Internet broadband from the CO with the optical line terminal (OLT) device through the optical distribution network (ODN) with the splitter to the subscribers where the optical network terminals (ONT) are located.



Passive optical networks are fibre optic last mile technologies that are used in deploying FTTP architectures. They do not require any active element in between the Central office (CO) and the subscribers' premises. PON technology enables the optimization of fibre optic networks to the last miles in that the number of fibre optic cores required to connect many last mile users are significantly reduced. This is made possible as a result of a passive optical fibre component called the splitter. The splitter has the capacity to split a single fibre into 4, 8, 16, 32, 64, 128, etc. depending on the PON technology. The system can provide end users with Gigabit interfaces and the ability to provide varying levels of speeds and levels of service. The system is capable of 10 Gigabit capacity on the fibre. PON systems are efficient at creating a large shared pool of bandwidth, provides a feasible upgrade plan, and is an excellent technology for addressing residential and small business services.

The main components of PON are classified into three main divisions;



The Optical Line Terminal (OLT): This is located at the central office of the Internet Service Provider (ISP) or at the main Network Operating Centre (NOC) of an organization. It connects the PON to the core network.

Optical Distribution Network (ODN): This consists of the fibre optic, fibre distribution and the splitters. The splitter has the ability to split a single fibre optic core into several cores to the Optical Network Terminal

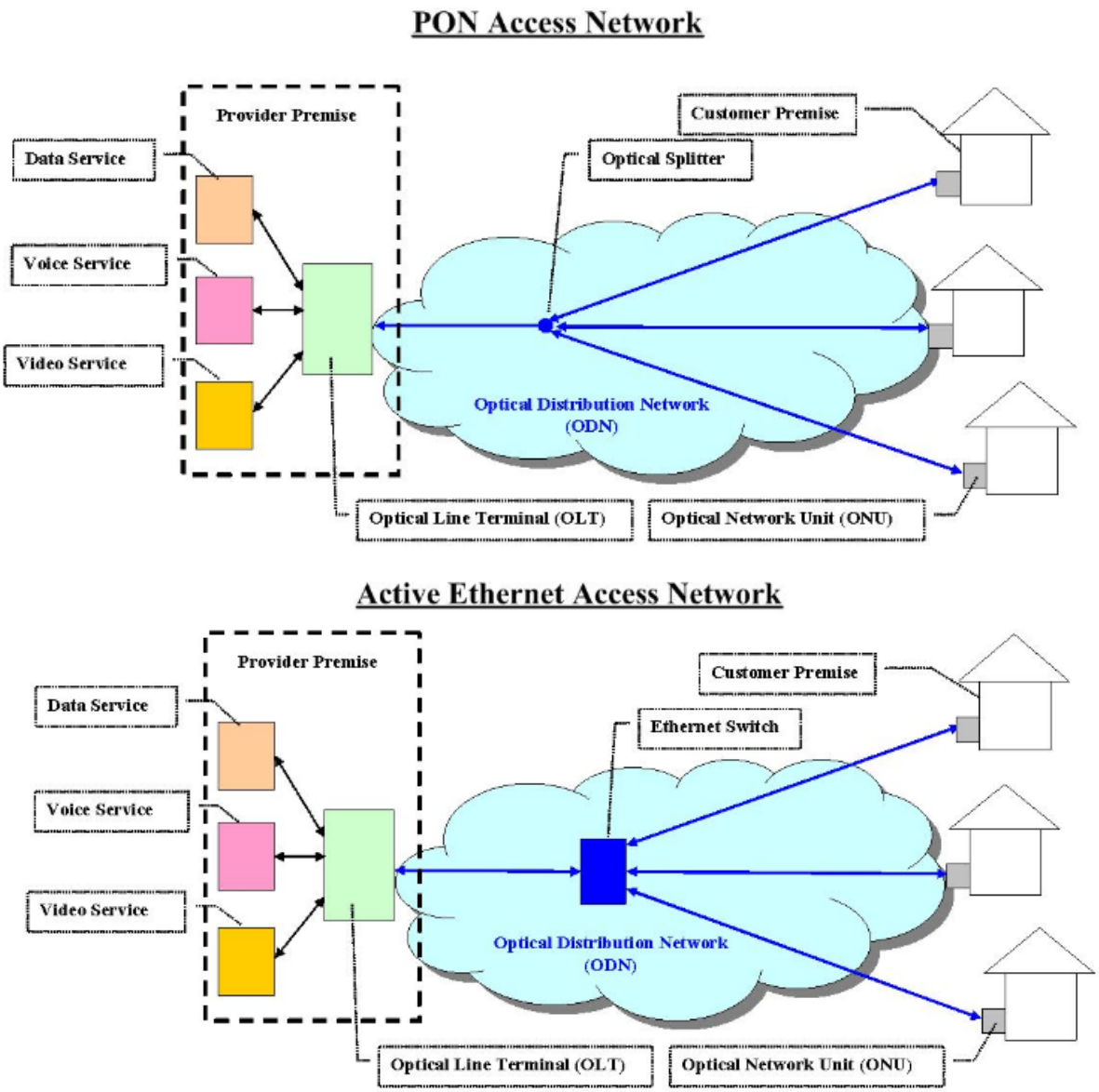
Optical Network Terminal (ONT): This is a device that connects the consumer (the last mile) to the passive optical network (PON). It is located at or very close to the user's location, depending on the FTTP configuration used.

The Active Ethernet System utilizes a dedicated fibre linking each premise to the aggregation site. The aggregation site has a fully redundant aggregation switch. This system can provide full symmetrical line rates in increments of 100 Megabits per second, 1 Gigabit per second, and 10 Gigabits per second. Generally, Active Ethernet Systems are deployed for commercial customers who require higher bandwidth than residential users. The customer premise electronics are generally higher in associated cost than PON.

Due to the low density and very limited number of high occupancy multi dwelling / business units with high occupancy on Hornby and Denman Islands, it is recommended that a Passive Optical Network architecture be utilized for the Hornby and Denman system requirements.

Below are graphic representations of the PON and Active Ethernet Systems

Attribute	G-PON	Active Ethernet
Type of Optical Distribution Network	Passive	Active
Capacity	32+ users per passive tree	
Reach	20km (28db) from OLT	10km (6db) from Active Node
Rates	Up to 2.4Gbps per PON	Up to 1.2Gbps per user
Bandwidth Efficiency	High	Low
Security	AES encryption	AES encryption
Scalability	Up to 32(64) users at 1.2(2.4) Gpbs on one PON tree and more users can be supported with more fibre and equipment	Higher capacities and more users can be supported with more equipment



Network Management

Network operations are critical to any network deployment. Systems must be monitored and maintained in order to protect the investment and ensure its success. The deployment of a network will require an operations component that provides the following for the network and customers:

- Network and customer activations
- Adds, moves and changes to the infrastructure as well as to the customer services
- Capacity management
- Maintenance and repair activities

- Customer management including billing
- Wholesale and carrier management

There are two main aspects of the network that require network management; the fibre infrastructure network and the service electronics network.

Fibre Network

After the deployment of the network resource, technical support is required for the fibre network. Engineering design and fibre installation, maintenance, adds, moves and changes can be contracted out after fibre deployment which would not require full time resource. Construction resources can both be contracted or in-house. Records management of the design and permits would be in-house functions.

There are multiple companies providing contract services for the fibre network. The overall recommendation would be to contract the specific fibre engineering, installation, maintenance, and adds/moves and changes to a single outsourced company (turnkey). However, this can be accomplished through the manpower of a contract with an existing or new ISP.

Service Electronics Network

The deployment and ongoing support of the Service Electronics will include access transport and distribution gear, customer premise electronics, management and activation servers, and routers and firewalls. Each of these components require differing technology skill sets, as well as varying levels of these skill sets. With a 24/7 operational environment, there is a level of personnel requirements to manage, and maintain this portion of the network. The estimated staff requirements for the network to support this are provided in below.

Resource	**Staff**
24/7 Network Operators	2-3
Network and Server Engineers	1-2
Technicians	1-2
Admin Staff/ Sales/ Payroll	1-2
Total	**5-9**

Some of these staff could serve dual purposes in addition to relying on vendors to supply support. The initial 6 months of operation could be done on a smaller scale.

A Network Operations Center (NOC) will be utilized to monitor and maintain the fibre optic system and its supporting equipment 365 days per day, 24 hours per day, 7 days per week as 365/24/7. This allows Mean-Time-to-Restore (MTTR)'s to be established with customers and carriers guaranteeing against failure. The NOC will also handle the management and provision of the fibre optic network connections and interconnections. The NOC will have monitoring system set in place to help identify anomalies, whether environmental, physical or electronic, and automatically initiate system alarms. Depending on the severity level of the issue, the system will alert the staff that maintenance is required at that site is immediate or not and a work order is created to service the site. The location of the NOC for both islands is yet to be determined, all future NOC locations can be done remotely or local to the island. The selected ISP will run the NOC.

SUMMARY OF SYSTEM DESIGN

The above high-level system design is intended to identify the appropriate configuration of the overall communication system design. The main factors including, the construction process of the network, the type of network (active or passive), the submarine cable plant, the top level requirements of the system, the interface requirements of the system, the location of the systems main components, and the management of the network. Having a high-level and basic understanding of the system design provides viable insight into creating cost estimates and project schedules.

4.0 MAINTENANCE

The network will require the following maintenance:

BC One Call – responding to locate requests – 10 locate requests per year – email response

BC One Call – painting the network to identify its location – 2 per year

Undersea landings inspections – 1 inspection every year

Repairs to the undersea network – possibly 1 every 30 years

General inspections of the network – 1 inspection every year

Emergency repairs on land network – possibly 1 per year

Construction site supervision to protect the network around construction activity – 1 event every year

Relocation of the network due to development and construction – 1 event every 10 years

Equipment and software upgrades – 1 upgrade every 2 years

Battery replacement – approximately every 7 years – there is possibly a battery backup unit in every home for the ONT – this will be a customer cost

Addressing technical issues from customers – 1 per day in the first few years – dropping off to 1 per week on the mature network

Backup power systems testing at the CO– 1 test per year

Removal of graffiti from cabinets – 1 event every 3 years

The team of 2 technicians will be able to support the maintenance activities required to maintain a healthy network on both islands. There may be a need to bring in support labour in the event of an emergency outage. During the initial build out phase when there are many new customers, the workload on the technicians will be high, and the technicians may need an additional support person to help. In general, underground networks in a rural setting will see very little disruptive activity.

5.0 PROJECT PERMITTING AND ENVIRONMENTAL ASSESSMENTS

Land Based Network

For the land-based fibre optic builds, the only permitting body is the Ministry of Transportation (MoTi). The proposed primary running line for the project will be in the roadway shoulders. Denman and Hornby Islands are managed by the MoTi office in Courtenay. The application process involves submitting a detailed set of drawings as well as forms. An environmental assessment is generally not required. A traffic management plan will be required. MoTi typically prefers the alignment for utilities to be at the far edge of the right of way. However, that is not feasible on Denman and Hornby due to encroaching trees and other obstacles. It will require some continued discussions, negotiations and escalations to get the road shoulder alignment approved. There are many precedent projects in the province that have been built in the road shoulder. The MoTi office has been contacted to request approval for the alignment but to date, has not received any significant feedback from the request. The first step contact for MoTi is found below:

Brendan Kelly
Senior Development Services Officer
Ministry of Transportation and Infrastructure
Vancouver Island District
Phone: 250-334-6967

Office:
Ministry of Transportation and Infrastructure British Columbia
550 Comox Rd, Courtenay, BC V9N 3P6, BC
Phone: (250) 334-6951

There are several housing co-ops on the islands which will require approval from the co-op management. This can typically be accomplished with a simple document. Also, approval is required from individual homeowners, and again this can be accomplished with a simple document.

The project will require the approval from the Islands Trust and such approval is presently in place for both islands.

Islands Trust
Northern Team
(Denman, Gabriola, Gambier, Hornby, Lasqueti, Thetis, Ballenas-Winchelsea)
Tel: 250-247-2063
http://www.islandstrust.bc.ca/

The preliminary survey and design work that has been completed represents a 95% accurate overall system design and can be used to produce ACAD construction/permit drawings. There is 14 weeks of additional work required to produce a set of construction/permit drawings.

Undersea Network Sections

For the undersea section of the network, applications for line assignment are made through Front Counter BC (Farming, Natural Resources & Industry). There is a well-defined application process, which will require a detailed set of drawing, letters of support, environmental management plans and archeological assessments. There is an application fee of approximately $1000. There will also be an ongoing fee to lease the line assignment, which is very small and sustainable within the operational budget of the network. The application process for the undersea network will typically take 6 months.

The preliminary survey and design work that has been completed represents a 95% accurate overall system design and can be used to produce a set of ACAD construction/permit drawings. There is 2 additional weeks of work required to produce a set of construction/permit drawings.

6.0 RISK ASSESSMENT AND PROJECT PLANNING

The network design and implementation plan has considered various project risks and potential mitigation. Some of the potentially critical aspects are considered below. Those with potential impact to cost and schedule are identified and discussed herein.

Preliminary Risk Analysis Considerations

The main construction risk at present involves the Ministry of Transport and Infrastructure approval. There is some risk that MoTi could potentially deny the request to use the shoulder of the roadway on the islands. A Right-of-Way alignment must be negotiated with MoTi. It will be the most economical pathway for the deployment of an underground fibre optic network.

The key financial risk factor on the revenue side is the penetration rate of the market (ie. subscribers). The rate of market share growth cannot be known until the project is well underway and significant amounts of capital are expended. However, considering that there is presently no premium broadband service available on either island and that the communities have overwhelmingly endorsed a desire for quality, affordable connectivity, the risk of low market penetration is considered to be minimal.

A small factor affecting the penetration rate on Denman and Hornby Islands is the seasonal aspect of some residents and their subscription rate. The potential maximum number of subscribers as of today is approximately 1600 total on the two islands. The following table compares service penetration rates of 30% vs 60% vs 90% as well as an aggressive triple play model. In telecommunications, triple play service is the ability of a telecommunications operator to supply voice, data, and video applications all at once. A typical example of a triple-play proposal would include phone lines, a high-speed Internet connection, and television/video services over a broadband connection to residential and business customers. The challenges in offering triple play are mostly associated with determining the right business model, backend processes, customer care support, and economic environment, rather than technology.

Residential ISP	**Take Rate**			
	30%	**60%**	**90%**	**Aggressive Triple Play @ 90%**
Average Monthly Billing	$70.00	$70.00	$70.00	$110.00
Number of Subscriber	480	960	1440	1440
Total Monthly Revenue	$33,600.00	$67,200.00	$100,800.00	$158,400.00
Total Annual Revenue	**$403,200.00**	**$806,400.00**	**$1,209,600.00**	**$1,900,800.00**

***The estimated cost to run this network annually is approximately $697,396.80, which means a take rate of a bit over 50% would be the break-even mark.**

At the same price that subscribers are currently paying for marginal bandwidth, it is likely that most people will subscribe to the upgraded service. This indicates that this is a low risk element.

If the subscription rate is worse than expected, another source of revenue can be the interest of the use of network as a cellular network. During the planning phase, several splices and or vault locations allows the breakout of the network along the route for Tier 1 cellular companies to invest in providing coverage. This is another potential revenue stream to the system owner/operator.

The risk factors on the cost side include, costing of production and installation of the network interface unit (NIU), or control box in the home, cost of building and installing the fibre network on both islands, and the required staffing levels. The costs of manufacturing and installing the control boxes and the FTTP network would be known before expending the capital required with proper design and project planning. These risk factors are manageable with proper contract ceilings, project planning, and other provisions to limit FTTP downside risks. Additionally, technology developments will tend to drive these costs downward, further limiting FTTP risks. Risk caused by not providing the level of service expected by the end users must be mitigated with the adequate staffing representatives. This is necessary to ensure excellent “word of mouth” advertising, which will be essential to maximizing market share early on during project roll out. However, it is noted that significantly increasing staffing levels can be costly. This risk can be limited by adding staff through outsourcing arrangements or temporary staffing for initial operations as opposed to adding full-time permanent staff.

Competitive risks from the technology standpoint do not appear to be significant at present. The table below identifies the existing services available on the islands. While the current incumbent internet provider has existing fibre to the backbone, their infrastructure does not extend out to the “last mile” connects from the backbone to the end users. The last mile portion in this project represents approximately 92% of the total fibre network and would remain a technological advantage of the FTTP system over the existing copper. The satellite internet system currently available on both islands also has its limitations. The upload and download speeds are about 50% of the CRTC prescribe rates at best and the service is dependent on weather and location with regards to topographical and timber/foliage interferences.

Internet Service Providers (ISPs) Serving Denman and Hornby Islands						
Carrier/ISP Name	**Plan Name**	**Download Speed**	**Upload Speed**	**Data Plan**	**Cost per month**	**Notes**
Xplornet	25 GB	up to 5 Mbps	unstated	25 GB	$59.99	slows significantly if data plan is exceeded
	unlimited 50	up to 10 Mbps	unstated	50 GB	$99.99	slows significantly if data plan is exceeded
	unlimited 100	up to 10 Mbps	unstated	100 GB	$119.99	slows significantly if data plan is exceeded
	unlimited 100	up to 25 Mbps	unstated	100 GB	$129.99	slows significantly if data plan is exceeded
Telus	Internet 25	up to 25 Mbps	5 Mbps	"unlimited"	$70.00 for 2 yrs. then $80.00	
	Internet 75	up to 75 Mbps*	15 Mbps	550 GB	$85	
	Legacy plans	existing plans	No data available	No data available	No data available	
	bonded pair	greater than 25Mbps	No data available	unknown	unknown	perhaps available if residence is within 500m of POP. Requires 2 land lines
Telus Mobility	Smarthub 100GB	up to 25 Mbps	up to 10 Mbps	100 GB	$60	+$10 per 5GB over
	Smarthub 500GB	up to 25 Mbps	up to 10 Mbps	500 GB	$75	+$10 per 5GB over
	Smarthub 1TB	up to 25 Mbps	up to 10 Mbps	1 TB	$110	+$10 per 5GB over
Lightspeed	Does not offer service on DI/HI. Not equipped for fibre optics					
Rogers Rocket Hub	N/A					no longer available
Bell Link Hub	N/A					not available to HI/DI
Tether to cell phone	**Tethering** is the use of cell **phone** as a **wireless** modem to connect to the **Internet** from your computer.					Expensive if data usage is significant

Installation

There is always some risk associated with the installation of a fibre network. In order to mitigate risk and challenges during installation, the following should be addressed for any new fibre optical network during initial design stage:

A clear understanding of the final design configuration of the network, and the final capacity requirements. This network architecture will determine the location of branching/splicing points, the configuration of the network distribution, the location of the different service area, the number passive cabinets etc. It is almost always more cost effective to install all future branching/splicing units during the initial installation than later in the life of the system.
The design then needs to consider the initial requirements, and the most cost-effective expansion strategy as the system grows.
Both the initial and final design configurations need to consider the interconnection points of the proposed system with either a local distribution network, or other operators' systems at the end terminal locations, together with a robust business and administrative operating model.
Accurate terrestrial data, and up to date geographic information system (GIS) mapping are then used to generate a "desktop" study to evaluate alternative network configurations. Key evaluation parameters are:

Feasible Route - usually performed an assessment on the potential routes to determine the possible existing infrastructure or new infrastructure would be used.
Network Reliability – an assessment of alternative routings (sometimes using alternative technologies) in the event of a fibre break.
Maintenance Strategy – how to deal with both land and undersea technical failures. This includes estimates of the expected "mean time between failures," access to both the land-based equipment and a strategy for dealing with undersea fibre breaks.

Environmental Review and Permitting – this activity generates a list of all the reviews and permits that are required to install, commission, and operate the system. An estimate of the cost and scheduling implications is then assigned to each environmental review and permit application.
Putting all the above considerations together to generate cost and schedule alternatives.

Taking these steps during the final design stage will minimize unforeseen risk or challenges. For this project, a high-level design and site survey for Denman and Hornby Islands has been completed to reduce installation risk for this project. The next step is to further generate an engineering report (for construction) for the permit approvals, with further refined cost and schedule estimates.

System Operation and Maintenance Failures

The support and operation of a network of this size is not trivial and has its challenges. The provider should have a lengthy track record passing traffic throughout a region of this size. Establishing the structure in a collaborative and consultative manner will be the key to success of the operating model.

A potential operating risk is not being able to deliver 24/7 customer service as required in the current digital world. Almost all service providers operate 24/7/365 today and have Network Operation Centres (NOC) to support their systems. The key will be to develop well defined technical service documents, marketing service

documents, master service agreements, and service level agreements and escalation policies for the network by drawing on their proven capabilities.

Having an active maintenance plan and a supporting NOC will help prevent any risk of a system fibre cut. In the event of a fibre optic cut, the network monitoring software signals the network operation center of the outage. The network monitoring staff alerts the operator of the section of outage and proceeds to follow the maintenance plan. The operator or technician then drives the fibre route to determine if a visible incident (such as road construction, fire or water main break) has caused the incident. If the incident can be located, an operator informs its splicers of the location and sends them out to repair the damaged fibre. If the location of the cut is not noticeable or found, technicians will test the fibre from the closest access location using specialized equipment (OTDR) to determine the approximate location.

Timely Project Completion and Project Schedule

The project plan provided must be based on a sensible timescale that are typical for the industry, potential suppliers, and turnkey and service suppliers. The major area of risk to be considered is the interaction between the design, procurement/delivery, construction, installation, and the commissioning of the network. Depending on the type of network to be designed, each has its own set of risks.

The comprehensive summary project schedule shown below details the early preconstruction activities through to project completion. The schedule is based on a buried fibre build including 2 submarine crossings.

The schedule assumes that applications for senior government funding will be submitted during the first quarter of 2020. Upon submission of funding applications, there is an up-front delay of approximately 14 months minimum while the applications are reviewed and funding is put into place. The funding time frame is based upon actual dates experienced in a number of previous projects supported by government funding. The project schedule anticipates funding arrangements to be completed by June of 2021.

The overall FTTP construction period of approximately 27 months commences in June of 2021 and completes in November of 2023. The construction force is planned to be 3 crews working between the 2 islands.

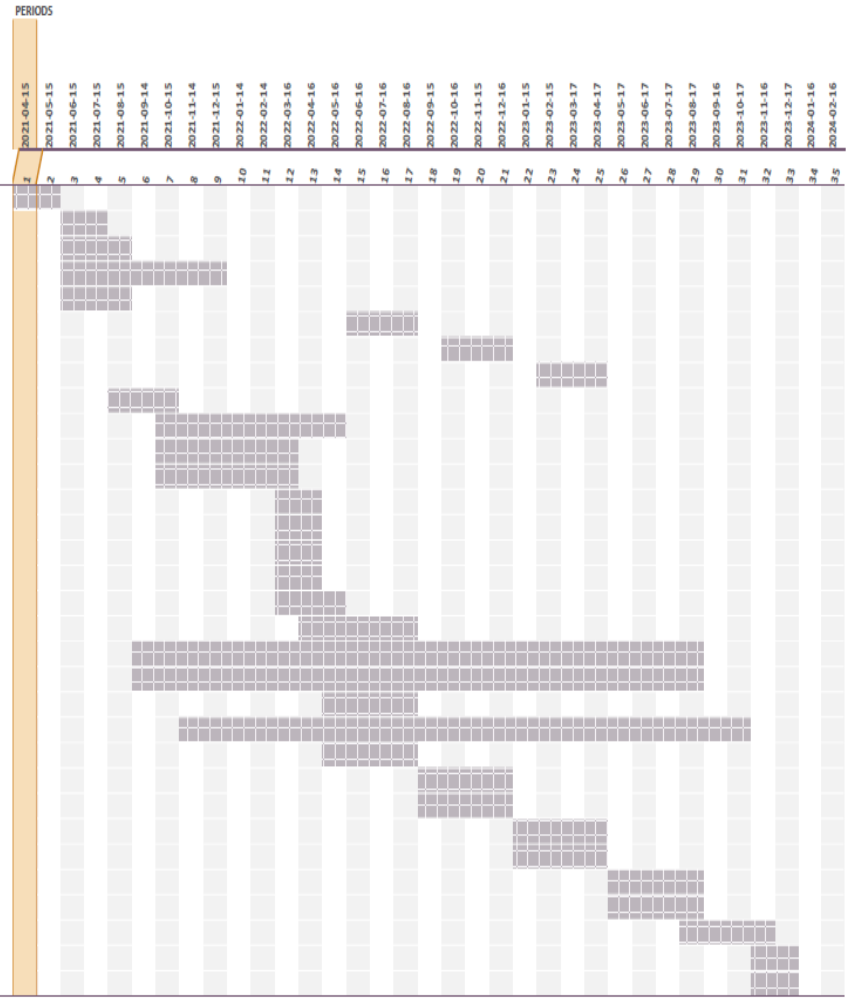
The plan includes the completion of engineering and procurement functions in a timely manner to support all permitting, procurement and construction needs. It is scheduled that the networks will become available for communications on a progressive basis as the various areas are completed. Within the overall schedule, the Vancouver Island backhaul is provided all the way back to downtown Vancouver.

Denman & Hornby FTTH Project Schedule

Select a period to highlight at right. A legend describing the charting follows.

Period Highlight: 1 | Plan Duration | Actual Start | % Complete | Actual (beyond plan) | % Complete (beyond plan)

ACTIVITY	PLAN START	PLAN DURATION	ACTUAL START	ACTUAL DURATION	PERCENT COMPLETE
Securing the project funds from the Provincial and Federal government.	1	2	0	0	0%
Completion of the construction level designs for the project.	3	2	0	0	0%
Permits and Approvals for the rights of way on the islands.	3	3	0	0	0%
Approval and construction of the Shaw interconnection point at Buckley Bay.	3	7	0	0	0%
Procurement of approximately 25% of the project materials at a time - including in home electronics.	3	3	0	0	0%
Procurement of approximately 25% of the project materials at a time - including in home electronics.	15	3	0	0	0%
Procurement of approximately 25% of the project materials at a time - including in home electronics.	19	3	0	0	0%
Procurement of approximately 25% of the project materials at a time - including in home electronics.	23	3	0	0	0%
Procurement of key construction equipment.	5	3	0	0	0%
Approval and construction of the undersea link between Buckley Bay and Denman and the undersea link between Denman and Hornby.	7	8	0	0	0%
Construction of the backbone section across Denman Island that will joint the undersea links together (not the complete backbone).	7	6	0	0	0%
Construction of a main backbone section through Hornby to reach several populated areas (not the complete backbone).	7	6	0	0	0%
Procurement of backbone and core electronics for the network - enough to make the network operational.	12	2	0	0	0%
Rental of space and power at the internet exchange at 1050 West Pender - Cologix.	12	2	0	0	0%
Order an internet feed from a service provider at Cologix.	12	2	0	0	0%
Order backhaul services from Shaw between Buckley Bay and Cologix.	12	2	0	0	0%
Start-up the ISP business or contract with the ISP (this means 2 technician, 3 admin people and 1 manager locally on the island or nearby).	12	3	0	0	0%
Launch an advertising and marketing campaign introducing the services and when they will be available.	13	5	0	0	0%
Perform Utility locates ahead of all underground construction.	6	24	0	0	0%
Testing and QC activities ongoing throughout the project.	6	24	0	0	0%
Phase 1H - Build out a geographic area of Hornby Island which includes a high density area and represents 25% of the homes.	14	4	0	0	0%
Submit as-built plans to BC-One Call.	8	24	0	0	0%
Phase 1D - Build out a geographic area of Denman Island which includes a high density area and represents 25% of the homes.	14	4	0	0	0%
Phase 2H - Build out a geographic area of Hornby Island which includes a high density area and represents 25% of the homes.	18	4	0	0	0%
Phase 2D - Build out a geographic area of Denman Island which includes a high density area and represents 25% of the homes.	18	4	0	0	0%
Phase 3H - Build out a geographic area of Hornby Island which includes a high density area and represents 25% of the homes.	22	4	0	0	0%
Phase 3D - Build out a geographic area of Denman Island which includes a high density area and represents 25% of the homes.	22	4	0	0	0%
Phase 4H - Build out a geographic area of Hornby Island which includes a high density area and represents 25% of the homes.	26	4	0	0	0%
Phase 4D - Build out a geographic area of Denman Island which includes a high density area and represents 25% of the homes.	26	4	0	0	0%
Construction wrap up activities.	29	4	0	0	0%
Documentation wrap up.	32	2	0	0	0%
Complete all funding contracts and payments.	32	2	0	0	0%



Order:	Project Elements:
10	Securing the project funds from the Provincial and Federal government.
20	Completion of the construction level designs for the project.
30	Permits and Approvals for the rights of way on the islands.
40	Approval and construction of the Shaw interconnection point at Buckley Bay.
50	Procurement of approximately 25% of the project materials at a time - including in home electronics.
55	Procurement of approximately 25% of the project materials at a time - including in home electronics.
60	Procurement of approximately 25% of the project materials at a time - including in home electronics.
65	Procurement of approximately 25% of the project materials at a time - including in home electronics.
68	Procurement of key construction equipment.
70	Approval and construction of the undersea link between Buckley Bay and Denman and the undersea link between Denman and Hornby.
80	Construction of the backbone section across Denman Island that will joint the undersea links together (not the complete backbone).
90	Construction of a main backbone section through Hornby to reach several populated areas (not the complete backbone).
100	Procurement of backbone and core electronics for the network - enough to make the network operational.
110	Rental of space and power at the internet exchange at 1050 West Pender - Cologix.
120	Order an internet feed from a service provider at Cologix.
130	Order backhaul services from Shaw between Buckley Bay and Cologix.
140	Start-up the ISP business or contract with the ISP (this means 2 technician, 3 admin people and 1 manager locally on the island or nearby).
150	Launch an advertising and marketing campaign introducing the services and when they will be available.
155	Perform Utility locates ahead of all underground construction.
157	Testing and QC activities ongoing throughout the project.
160	Phase 1H - Build out a geographic area of Hornby Island which includes a high density area and represents 25% of the homes.
165	Submit as-built plans to BC-One Call.
170	Phase 1D - Build out a geographic area of Denman Island which includes a high density area and represents 25% of the homes.
180	Phase 2H - Build out a geographic area of Hornby Island which includes a high density area and represents 25% of the homes.
190	Phase 2D - Build out a geographic area of Denman Island which includes a high density area and represents 25% of the homes.
200	Phase 3H - Build out a geographic area of Hornby Island which includes a high density area and represents 25% of the homes.
210	Phase 3D - Build out a geographic area of Denman Island which includes a high density area and represents 25% of the homes.
220	Phase 4H - Build out a geographic area of Hornby Island which includes a high density area and represents 25% of the homes.
230	Phase 4D - Build out a geographic area of Denman Island which includes a high density area and represents 25% of the homes.
240	Construction wrap up activities.
250	Documentation wrap up.
260	Complete all funding contracts and payments.

Aerial Network Considerations

There is considerable concern over the amount of time required to implement the Denman and Hornby network on the existing aerial infrastructure and its potential impact on project costs and schedule. There are 2079 poles and 137kms of backbone aerial route involved in the aerial network over the 2 islands.

Typically, when an installer/operator endeavours to utilize the existing pole facilities for additional aerial installations, a special application (P408 application) for pole access agreements must be filed. In the case of Denman and Hornby, this application for pole use is to be filed with BC Hydro/Telus. The application is then received and managed by Telus/Inceptra. It is conceivable that such an application from a non-Telus applicant such as Denman/Hornby can be delayed indefinitely thereby delaying the project and consequently driving the costs up.

As examples of this situation, two network operators (CityWest and Columbia Basin Broadband Corp.) have existing P408 applications into Telus for larger projects for pole access agreements. Both parties have been waiting for over one year with almost no feedback or progress. It will not be acceptable to funding groups, communities and investors to move forward with this level of uncertainty. Also, there is great uncertainty on the cost for the make-ready work required to prepare the existing aerial infrastructure for the new cables to be added on. There is no recourse to accelerate the P408 process or to argue/negotiate the make-ready costs, other than to actively lobby the CRTC with potential associated delays. The overall cost to implement the Denman and Hornby network on the existing aerial infrastructure has the potential to be less costly than building the network underground. However, the overall project risk in terms of unknown schedule delay and cost does not justify the potential savings. Senior government funding programs have deadlines for delivery which will likely not be achievable based on utilizing the aerial infrastructure.

Underground Network Considerations

There are time related risks in building underground telecom networks. The underground network will require approval from the Ministry of Transportation and Infrastructure (MOTI) which will take time. Historically, approval can be achieved in 3 to 6 months and there are channels and methods to escalate the approval process. The process of contacting the ministry for a preliminary approval in principal has already been initiated. Another risk in the underground network is the daily productivity rate for trenching/plowing/drilling the cable/conduit into the ground and that can vary greatly depending on ground conditions. There are some sections on both islands that have rocky conditions and other sections that have highly favourable conditions. The estimated average productivity is approximately 200 meters per day per crew and if concurrently running three crews, it will yield 600 meters per day for the complete network. These productivity numbers have been vetted by 3rd party contractors. Overall, the time risks to complete the underground build should be considered low risk and readily managed with many options for remedy if issues are encountered.

Mitigation of the overall project risk is to utilize well qualified and seasoned program and project management personnel who will ensure that all providers, resellers, and contractors are experienced in FTTP project works and operations. Further mitigation is achieved by ensuring rigorous, auditable, and enforceable master service and service level agreements with provider partners including performance metrics and performance milestones.

SUMMARY OF RISK MANAGEMENT AND SCHEDULE PLANNING

The risk factors and project schedule detailed above are based on the buried FTTP plan for the DHCP.

Mitigation of the overall project risk is to utilize well qualified and seasoned program and project management personnel to ensure that all permit applications are timely and that all material and equipment providers, resellers, and contractors are experienced in FTTP project works and operations. Further mitigation is achieved by ensuring rigorous, auditable, and enforceable master service and service level agreements with provider partners including performance metrics and performance milestones.

While this section has considered the risks and schedule, it is noted that there may be opportunity for the incumbent ISP (Telus) to offer schedule improvement and capital cost savings during the FTTP project development phase by utilizing the aerial option. However, as discussed above for non-Telus constructor/ISP's, the aerial option introduces further risks due to high pole access costs and the associated delays.

7.0 COST ANALYSIS

Construction Budget

The construction budget for this project based on an underground build with the construction contracted out as a turnkey project is shown in the table below.

Summary Budget:	
Construction Costs:	$5,722,974.77
Undersea Network Build:	$630,000.00
Hornby Island OSP materials:	$1,020,736.58
Hornby Island customer in building materials:	$430,677.20
Denman Island OSP materials:	$1,198,658.92
Denman Island customer in building materials:	$351,196.00
Total:	$9,354,243.48
Contingency %:	10.00%
Contingency $:	$935,424.35
Total Budget:	$10,289,667.82

Operating Budget

The table below is the operational budget for the network based on a staff of 2 technicians, 1 manager and 3 administrators. In the budget there are 2 vehicles for the technicians including the appropriate tools and an office. This team will service both islands.

General Monthly Expenditure:			
Description:	**Monthly Cost:**	**Description:**	**Monthly Cost:**
Gateway connection	$8,000.00	**Additional Vehicle allowance**	$400.00
One Call and Locates	$100.00	**New Equipment Accrual**	$1,666.00
Maintenance and Repairs	$625.00	**Insurance**	$2,966.00
Office Rental & Overheads	$3,000.00	**Software**	$200.00
Utilities	$400.00	**Staffing**	$37,859.40
Vehicles and Tools	$2,000.00		
Fuel	$600.00	**Total Monthly Expenditure:**	**$58,116.40**
Ferry Costs	$300.00	**Total Annual Expenditure:**	**$697,396.80**

Revenue and Profit

The tables below show a conservative and an aggressive revenue model. The models are missing loan repayments, cost of capital and interest. The different variables in the two models are the Average Monthly Billing rate and the Number of Subscribers.

Conservative Revenue:			**Aggressive Revenue:**	
Average Monthly Billing:	$70.00		**Average Monthly Billing:**	$110.00
Number of Subscribers:	1100		**Number of Subscribers:**	1400
Total Monthly Revenue:	**$77,000.00**		**Total Monthly Revenue:**	**$154,000.00**
Profit:			**Profit:**	
Total Monthly Expenditure:	$58,116.40		**Total Monthly Expenditure:**	$58,116.40
Total Monthly Revenue:	$77,000.00		**Total Monthly Revenue:**	$154,000.00
Gross Monthly Profit:	$18,883.60		**Gross Monthly Profit:**	$95,883.60
Annual Profit			**Annual Profit**	
Total Annual Revenue:	**$924,000.00**		**Total Annual Revenue:**	**$1,848,000.00**
Gross Annual Profit:	**$226,603.20**		**Gross Annual Profit:**	**$1,150,603.20**

SUMMARY OF COST ANALYSIS

The conservative and aggressive revenue models both show a profitable return for the ISP. The investment terms and model would need to be considered when known.

8.0 OWNERSHIP OPTIONS

This section describes the four options considered for ownership of the FTTP fibre systems on each island. Their respective summary budgets are projected and discussed.

The four options are;

1.0 Builder/Owner/Operator

The builder/owner/operator is a company highly experienced in building/operating fibre networks and providing telecommunications services to customers. The company will build, operate and then own the network.

2.0 Owner/Operator-Contracted out build cost

The Owner/Operator is a company experienced at owning/operating a fibre network but does not have the ability/structure to construct a network. The construction will therefore be contracted out.

3.0 The Owner is the Denman/Hornby Community Development Company

In this model, the Denman/Hornby broadband group (CDC – Community Development Company) is the owner of the network.

4.0 Telus is the Owner/Operator - Contracted out build cost.

As the Owner and Operator, Telus will contract out the construction work.

Option 1 - Builder/Owner/Operator

The builder/owner/operator is company highly experienced in building/operating fibre networks as well as providing telecommunications services to customers. In this model, the company will build, operate and the own the network. The company will fund 25% of the build cost, 100% of the in-building costs, and will provide the start-up funds for the operational (ISP) business that will run the network. The remaining build costs of 75% are covered by Federal and Provincial funding programs. The build is done at cost with no profit made on the construction of the network. The company invests $1,000,000 in cash and borrows the balance at favourable interest rates with a 25-year term. The loan is secured against the network asset. Higher loan amounts may be required to make this work. The lender is potentially the Comox Valley Regional District or possibly another institution. The three companies considering this opportunity are Canadian Fibre Optics, TeraSpan Networks Inc. and the former owners of Gwaii Communications. The opportunity offers the potential for a significant long-term recurring revenue stream. In this model, the funding application is submitted by the company, with the full support of the Denman/Hornby Broadband group. In the below table a conservative revenue is based on 1,100 subscribers while an aggressive revenue is based on 1,400 subscribers.

Builder/Owner/Operator Model - Summary Budget	
Construction Cost:	$4,006,514
OSP Material Cost:	$2,219,396
Undersea Network Cost:	$630,000
Total:	$6,855,909
Total + 10% Contingency	$7,541,500
75% of costs cover by funding agencies:	$5,656,125
Balance funded by Owner:	$1,885,375
In building costs not covered by funding agencies:	$781,873
In building costs + 10% contingency	$860,061
ISP start-up costs:	$150,000
Total funds required by owner:	$2,895,436
Cash:	$1,000,000
Loan:	$1,895,436
Interest rate:	5.00%
Term in years:	5
Amortization period years:	25
Monthly Payments:	$11,081
Sum of 300 payments:	$3,324,159
Total Interest:	$1,428,723
Conservative Revenue:	
Gross monthly profit before loan payment:	$18,884
Gross monthly profit after loan payment:	$7,803
Gross annual profit after loan payment:	$93,637
Aggressive Revenue:	
Gross monthly profit before loan payment:	$95,884
Gross monthly profit after loan payment:	$84,803
Gross annual profit after loan payment:	$1,017,637

Option 2 - Owner/Operator – Contracted out build cost

The Owner/Operator is a company that is experienced at owning/operating a fibre network, but does not have the ability/structure to construct a network and thus will contract out the construction. The company has the experience/infrastructure to provide telecommunications services to customers. The company will fund 25% of the build cost, 100% of the in-building costs, and will provide the start-up funds for the operational (ISP) business that will run the network. The remaining build costs of 75% are covered by Federal and Provincial funding programs. The build is done by an arms length contractor (who profits from the build). The company invests $1,000,000 in cash and borrows the balance at favourable interest rates and a 25-year term. Higher loan amounts may be required to make this work. The loan is secured against the network asset. The lender is potentially the Comox Valley Regional District or another institution. The opportunity offers the potential for a significant long-term recurring revenue stream. In this model, the funding application is submitted by the company, with the full support of the Denman/Hornby Broadband group. The potential Owner/Operator (the company) may be a larger telecom company such as Shaw. In the table below, a conservative revenue is based on 1,100 subscribers while an aggressive revenue is based on 1,400 subscribers.

Owner/Operator Model - Contracted out construction - Summary Budget	
Construction Cost:	$5,722,975
OSP Material Cost:	$2,219,396
Undersea Network Cost:	$630,000
Total:	$8,572,370
Total + 10% contingency	$9,429,607
75% of costs cover by funding agencies:	$7,072,205
Balance funded by Owner:	$2,357,402
In building costs not covered by funding agencies:	$781,873
In building costs + 10% contingency	$860,061
ISP start-up Costs:	$150,000
Total funds required by owner:	$3,367,462
Cash:	$1,000,000
Loan:	$2,367,462
Interest rate:	5.00%
Term in years:	5
Amortization period years:	25
Monthly Payments:	$13,840
Sum of 300 payments:	$4,151,984
Total Interest:	$1,784,522
Conservative Revenue:	
Gross monthly profit before loan payment:	$18,884
Gross monthly profit after loan payment:	$5,044
Gross annual profit after loan payment:	$60,524
Aggressive Revenue:	
Gross monthly profit before loan payment:	$95,884
Gross monthly profit after loan payment:	$82,044
Gross annual profit after loan payment:	$984,524

Option 3 – The Owner is the Denman/Hornby Community Development Company

In this model, the Denman/Hornby broadband group (CDC – community development company) is the owner of the network. The construction of the network is contracted out as a turnkey project. An independent project manager is hired by the CDC to oversee construction of the network. The operation of the network is basically contracted out to an existing ISP who will white label their existing services as the Denman/Hornby brand. The CDC will need two well equipped technicians (with vehicles and tools) and a manager on a full-time basis on the islands as well as an office. The budget for this model will look very similar to Option 2, however the loan amount will likely be higher.

Option 4 – Telus is the Owner/Operator – Contracted out build cost

In this option, Telus will apply for the funds with support of the Denman/Hornby Broadband Group (CDC) and Telus will build out the network (most likely on the existing aerial infrastructure). Telus will contract out the network build and will upgrade the customers to fibre services as the network is built out.

Telus's application will define the project's total contribution arrangements, including its own calculation of the "total build cost" of $11.565 M, and its contribution of $2.585 M. All other contribution amounts are variable. Funding agencies may approve up to 75 percent of the total build, but there is not enough detail in the Telus proposal to know if there are ineligible costs within their "Total Build Cost" numbers. Also, in order to obtain approval of these funding agencies, a community contribution of 5-10 percent of the total build cost will be required and are shown below.

Telus Model				
	Denman Island:		**Hornby Island:**	
UNITS	**Single family units:**	1043	**Single family units:**	1105
	Single family units adjusted:	592	**Single family units adjusted:**	560
	Single business units	24	**Single business units**	39
	Single business units adjusted:	24	**Single business units adjusted:**	36
	Multi-dwelling units	153	**Multi-dwelling units**	45
	Multi-dwelling units adjusted:	30	**Multi-dwelling units adjusted:**	45
	Total units:	1220	**Total units:**	1189
	Total units adjusted:	646	**Total units adjusted:**	641
FINANCIALS	**Access requirements:**	$5,502,000.00	**Access requirements:**	$5,332,000.00
	Transport & inside plant:	$360,000.00	**Transport & inside plant:**	$371,000.00
	Total build cost Denman:	$5,862,000.00	**Total build cost Hornby:**	$5,703,000.00

Telus Quote			
Funding Summary	**Total build cost both islands**	**$11,565,000.00**	
	Telus Contribution	2,585,000.00	
	Additional funds required	8,980,000.00	
Potential Government Funding	**75% max of eligible costs**	$8,673,750.00	
Potential Community Contribution Range		**10.0%**	**5%**
	5-10% community contribution	$1,156,500.00	$578,250.00

SUMMARY OF OWNERSHIP OPTIONS

The four options considered above will require community participation in varying degrees.

Options 1 and 4 require minimal community involvement. The community will participate in the planning and notification to island homeowners as the construction and network commissioning progresses. Depending upon the terms of contracts in Option 1, there is some potential for a higher degree of community activity than is anticipated in Option 4.

Options 2 and 3 will require a community management team of experienced personnel. The team personnel required will be knowledgeable in the areas of construction management; in the areas of optical fiber construction and commissioning including financial management. The team staffing level of Option 3 is higher than Option 2 as it requires the community development company to be fully mobilized in the areas of project, construction and financial management.

Note that in the above options, CDC project management costs are not included.

9.0 CONCLUSIONS AND RECOMMENDATIONS

A quality, low-maintenance, underground fibre optic network that would meet and exceed the bandwidth needs of the community for the foreseeable future, can be built on the Islands.

The network would serve every home/business on the islands with fibre optics (no wireless infrastructure). The network can supply internet, phone, TV and any other telecommunications services. It could be built for a total construction/installation budget of $10,289,668.

There is already good aerial infrastructure on the islands that could support an aerial fibre network. It is estimated that an aerial network would cost almost 50 percent less than a buried network. However, the risks of unmanageable delays and uncontrollable costs to gain access to more than 2000 poles, renders the aerial construction option unworkable for a non-Telus builder. Aerial infrastructure is only viable financially, for Telus.

In order to understand the viability of constructing and operating the preferred underground network, several business models were developed and tested. The models assumed that approximately 75% of the network construction costs will be paid by a combination of funding from the CRTC as well as from the Province of British Columbia. The remaining funds would come from whoever builds/owns and operates the network. The models anticipate that the owner would obtain some form of low-interest, long-term financing in order to make the business case more attractive. The testing found the models are attractive if the majority of the potential 1600 homes/businesses sign up for the new broadband service. However, if less than 1100 homes/businesses subscribe the business is at risk of losing money.

The construction and start-up of a broadband network service is a complicated, lengthy, and expensive project. In considering options to proceed, the community must ensure that in any ongoing joint venture with another owner, it has the managerial and financial skills to play a successful, central role.

APPENDIX A
SITE SURVEY
&
DESKTOP DESIGN

Baylink Networks

January 22, 2020

Denman and Hornby

Site Survey and Desktop Study

Report

Prepared for:
Hornby Island Community Economic Enhancement Corporation (HICEEC)
&
Denman Island Residents Association (DIRA)

BAYLINK networks

January 2020

DOCUMENT CONTROL SHEET

For Revisions and Proposed Changes Contract:

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Issue	Date	Reason
0.1	January 14, 2020	1st Internal Draft

TABLE OF CONTENTS

INTRODUCTION

This report summarizes the result of the site visit that was conducted and the desktop design for Hornby Island Community Economic Enhancement Corporation (HICEEC) and Denman Island Residents Association (DIRA), as part of preparation for the fibre optic network feasibility study. Site visits were conducted in the field 22-24 November 2019.

The network and configuration design for the planned fibre optic network system is shown in the figures below. The design has 12 potential fibre distribution hubs and two central office locations on the islands. There will be a main trunk fibre between Buckley Bay and Denman Island to service both islands. The main trunk runs to the two central offices on each island while it spurs into each of the distribution hub sites from the trunk. There are also blind end spurs planned off the main trunk on different locations on the islands to allow future system expansion.

The site visits started and finished on Denman Island with a client meeting in the afternoon of November 22, followed by Hornby site visits in the evening. The Baylink team, on November 23, visited the remaining entirety of Hornby Island and conducted ground condition sampling and review. On November 24, the Baylink team returned to visit the remaining portion of Denman Island and conducted additional ground sampling. The program ended by a wrap up meeting with DHCP and returning to Buckley Bay on November 24. The entire site survey of both Denman and Hornby Island was video recorded.

It was evident during the landing site visits that ground conditions were well suited for vibratory plowing a fibre cable along the road shoulders on both Denman and Hornby Islands. There were also suitable locations for a marine cable and shore landing locations on both islands. It was evident from the ground that linking these sites with a terrestrial network could readily be done.

Another objective of this desktop study is to propose and examine a provisional cable route for a fibre to the premise network/layout that provides the highest level of availability while minimizing total length. To meet this objective, parameters affecting the site survey, cable route engineering and installation of the system were all examined. Such factors included ground conditions, road material/base, pole conditions, shore landing locations, and landing site selection.

Resulting route recommendations made by Baylink Networks are based on the available information compiled during the production of the study and general route engineering experience. Prior to finalizing designs, it is recommended that a full survey to be conducted in review of the potential landing points and land routes followed by a detailed marine cable design. It would also finalize matters such as cable routing, cable lengths, armour type, burial, cable slack values and other protection requirements.

Routing

Cable route planning was completed with the aid of several software packages and the review and analysis of multiple databases. The following software was employed for the conversion of spatial data, chart construction and for the development of the provisional route:
ESRI ArcGIS
Spatial Manager
AutoCAD
Google Earth Pro

DESKTOP STUDY

Baylink Networks compiled the following desktop route design based on site findings.

The table below shows the geographic location of the potential fibre distribution hub, central offices, and undersea ground level vaults for both islands.

	Item	Longitude	Latitude
Denman	FDH 1	-124.7617	49.498049
	FDH 2	-124.74009	49.497105
	FDH 3	-124.73184	49.503165
	FDH 4	-124.81737	49.535926
	FDH 5	-124.76614	49.541762
	FDH 6	-124.83109	49.558186
	C/O	-124.81736	49.535884

	Item	Longitude	Latitude
Hornby	FDH 1	-124.70413	49.516706
	FDH 2	-124.6877	49.539544
	FDH 3	-124.66983	49.548507
	FDH 4	-124.64833	49.525726
	FDH 5	-124.61681	49.529056
	FDH 6	-124.64129	49.506001
	C/O	-124.64833	49.525697

	Item	Longitude	Latitude
Undersea	usn-glb 1	-124.70307	49.51131
	usn-glb 2	-124.70811	49.49343
	usn-glb 3	-124.84956	49.524574
	usn-glb 4	-124.82041	49.534539

The desktop study was used to generate the following route length table.

Statistical Data				
Denman Island	**Length**		**Hornby Island**	**Length**
Undersea Network Length	2,401		Undersea Network Length	2,024
Total Primary Route Length:	80,286		Total Primary Route Length:	67,753
Number of Residential & Commercial Units	760		Number of Residential & Commercial Units	932
Total Drop Trench:	95,137		Total Drop Trench:	79,596
Average Drop Cable Length:	211		Average Drop Cable Length:	156
Average Drop Trench Length:	125		Average Drop Trench Length:	85

The following map figures show the preliminary fibre network layout on both Denman and Hornby Islands. This includes the backbone and transport routes but excludes the drop routes into each individual premise. The network is broken down into six fibre distribution areas on each island for a total of 12 areas on both islands.

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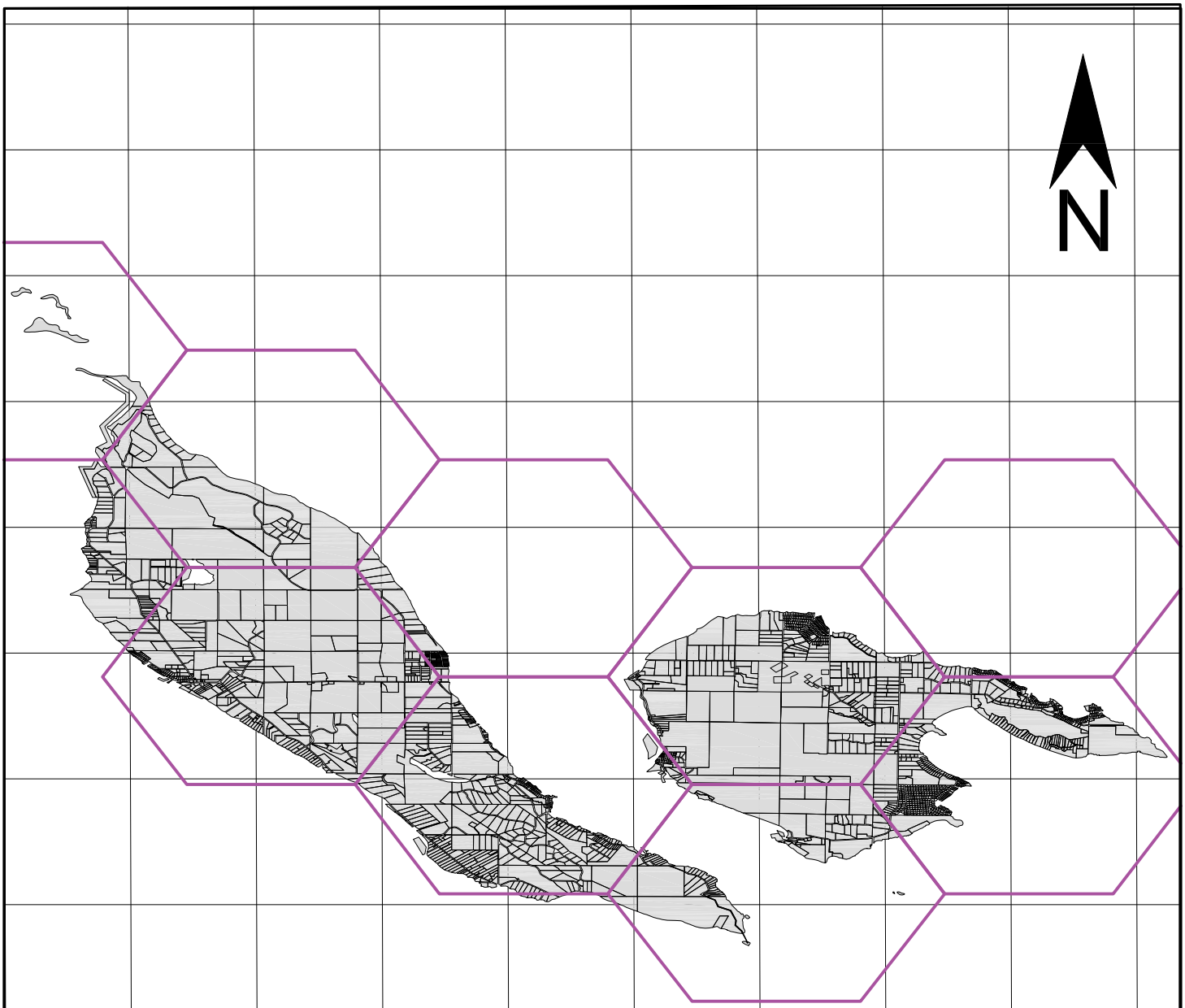


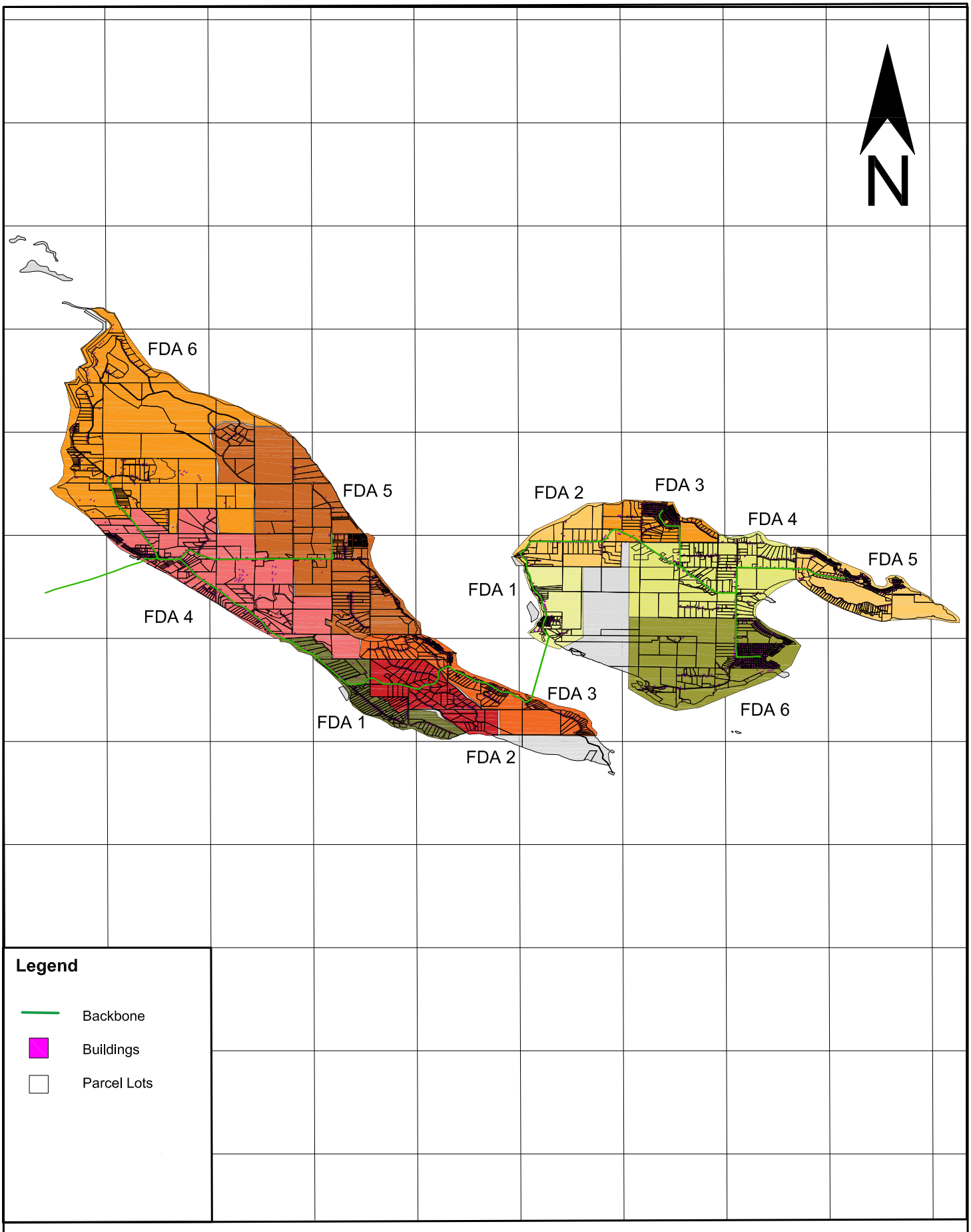
Legend

50 / 10 Mbps Upgradable

Parcel Lots

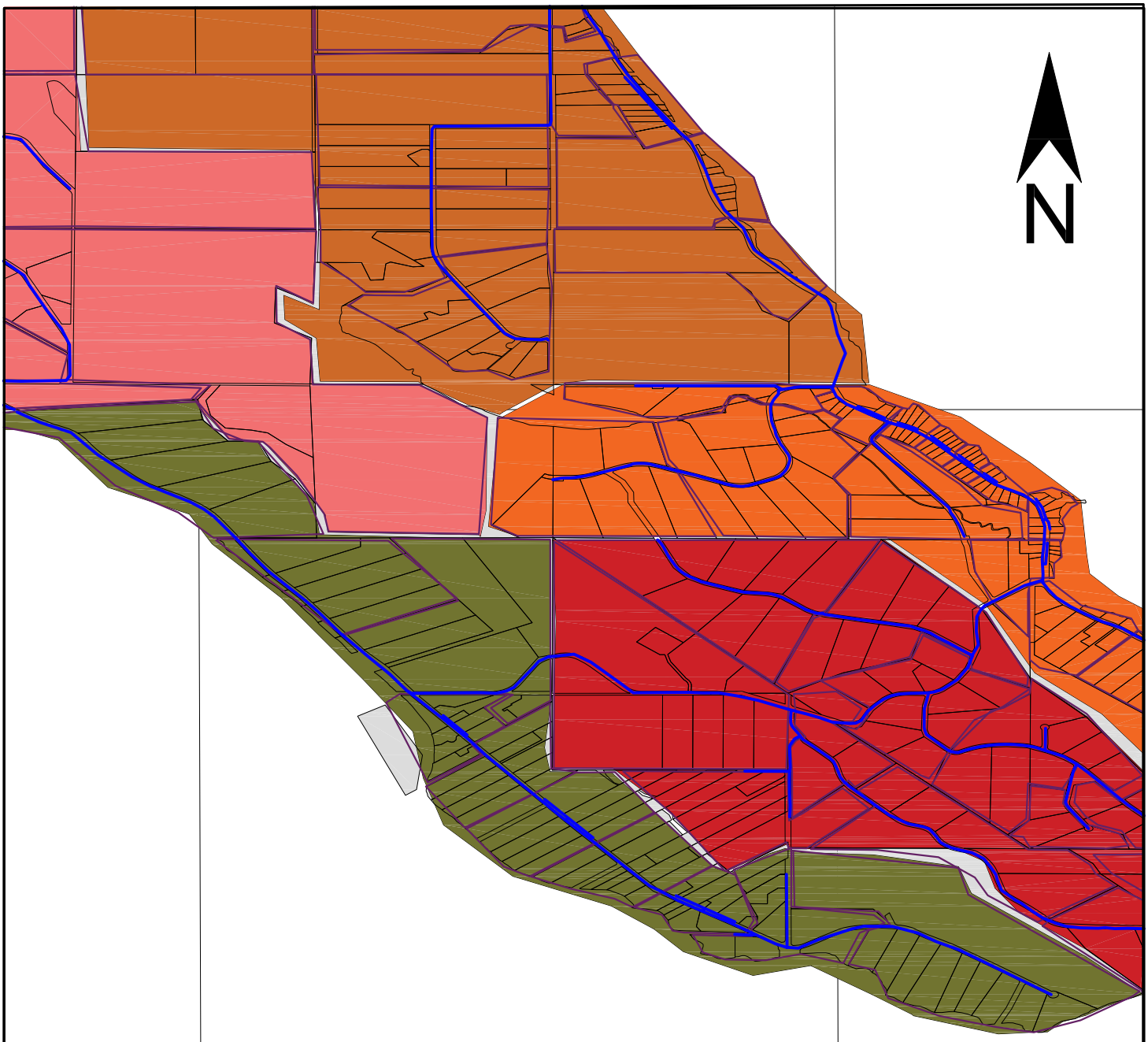
BAYLINK networks

DENMAN AND HORNBY ISLAND | CRTC HEXAGON 50 / 10 Mbps



BAYLINK networks

DENMAN AND HORNBY ISLAND | FIBRE DISTRIBUTION HUBS

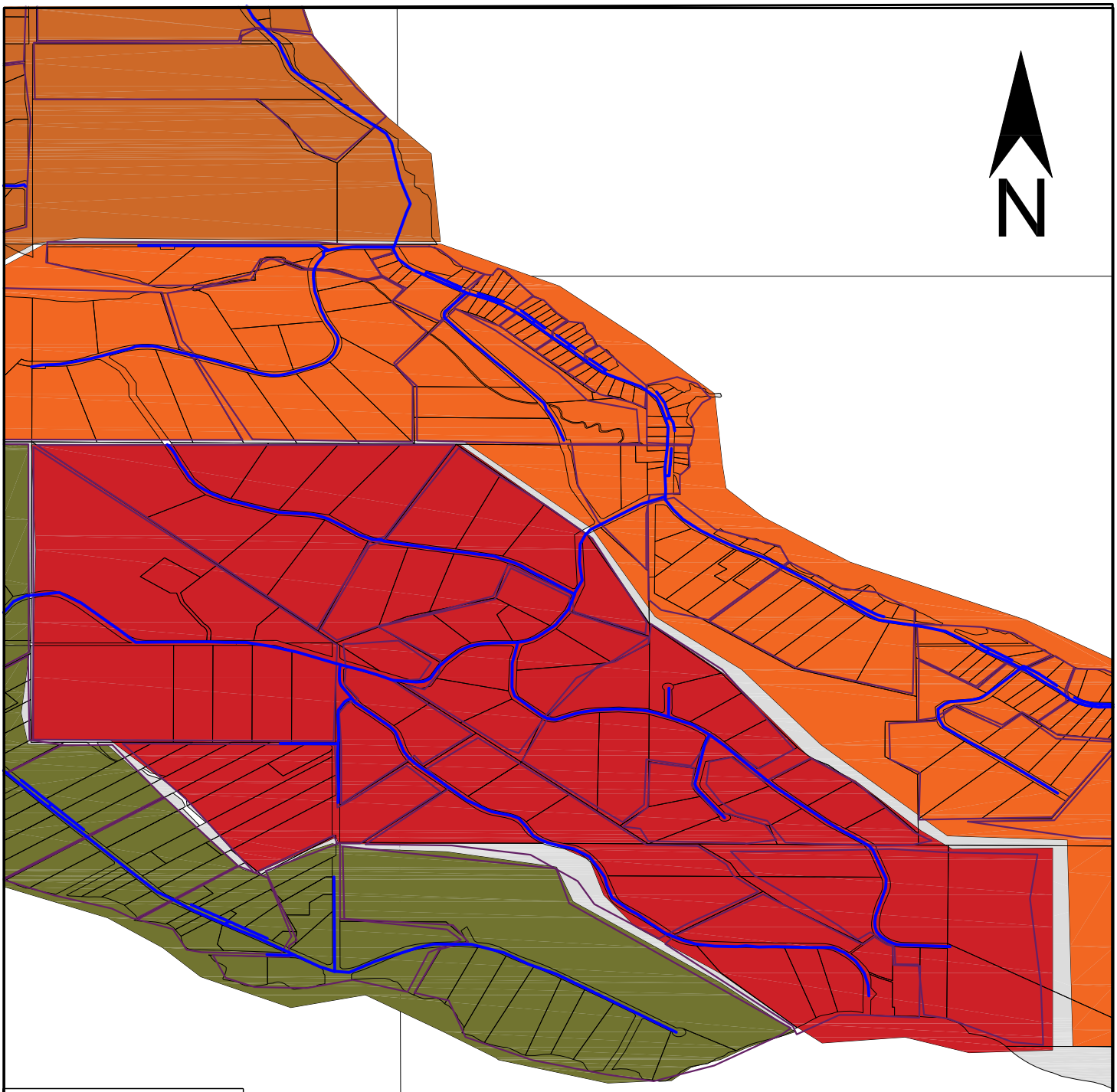


Legend

- Fibre Route
- Service Areas
- Parcel Lots

BAYLINK networks

DENMAN ISLAND | FIBRE DISTRIBUTION AREA 1

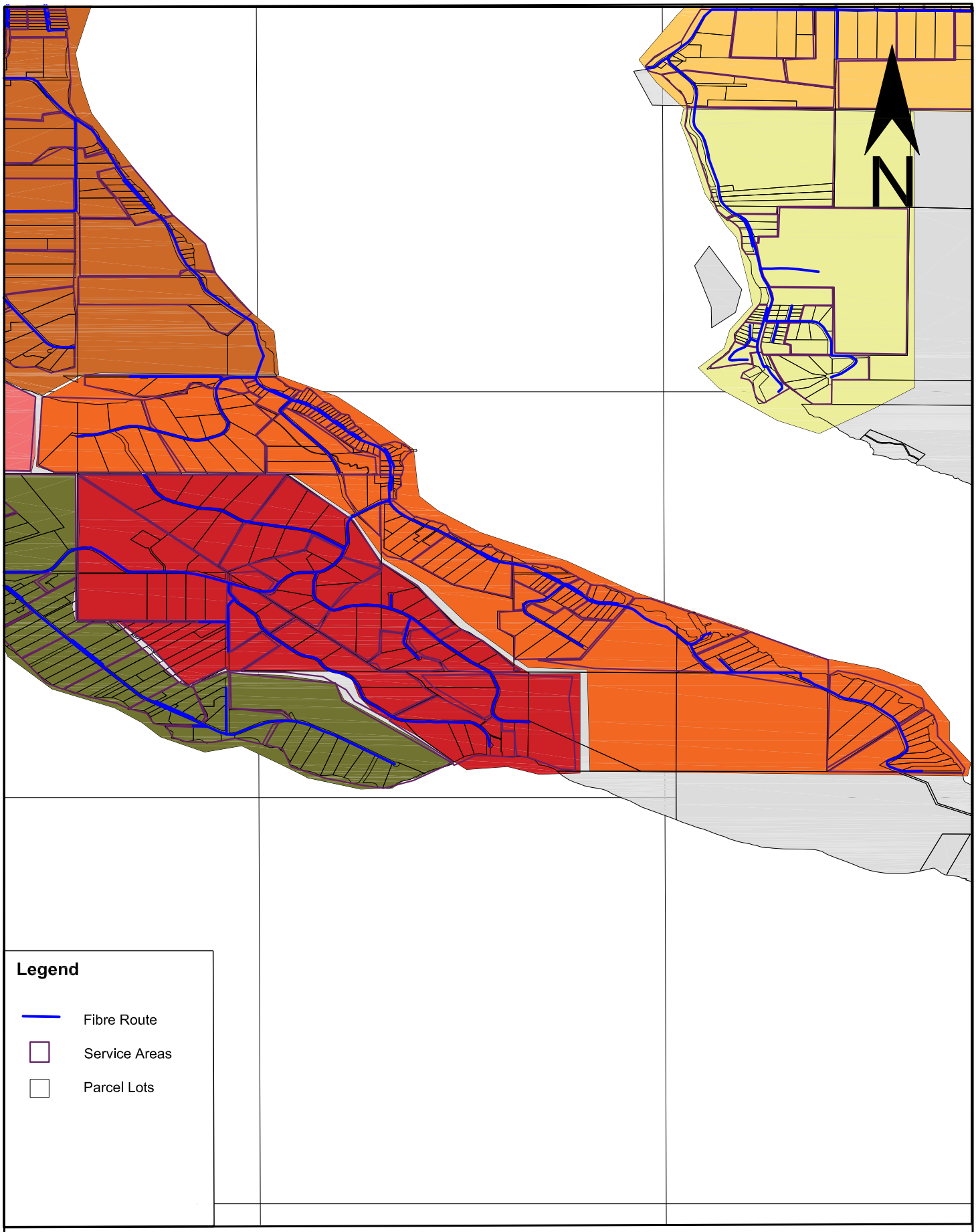


Legend

- Fibre Route
- Service Areas
- Parcel Lots

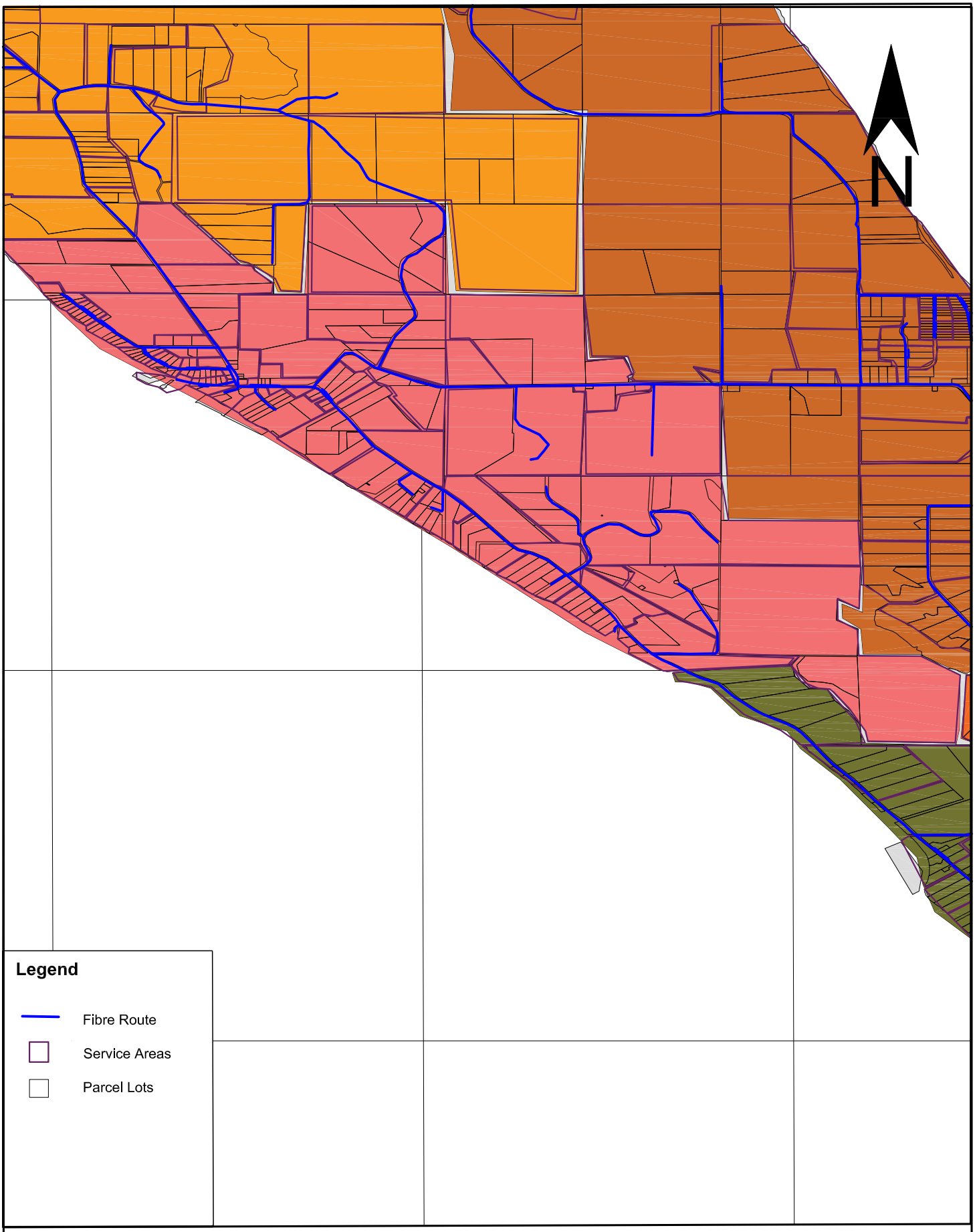
BAYLINK networks

DENMAN ISLAND | FIBRE DISTRIBUTION AREA 2



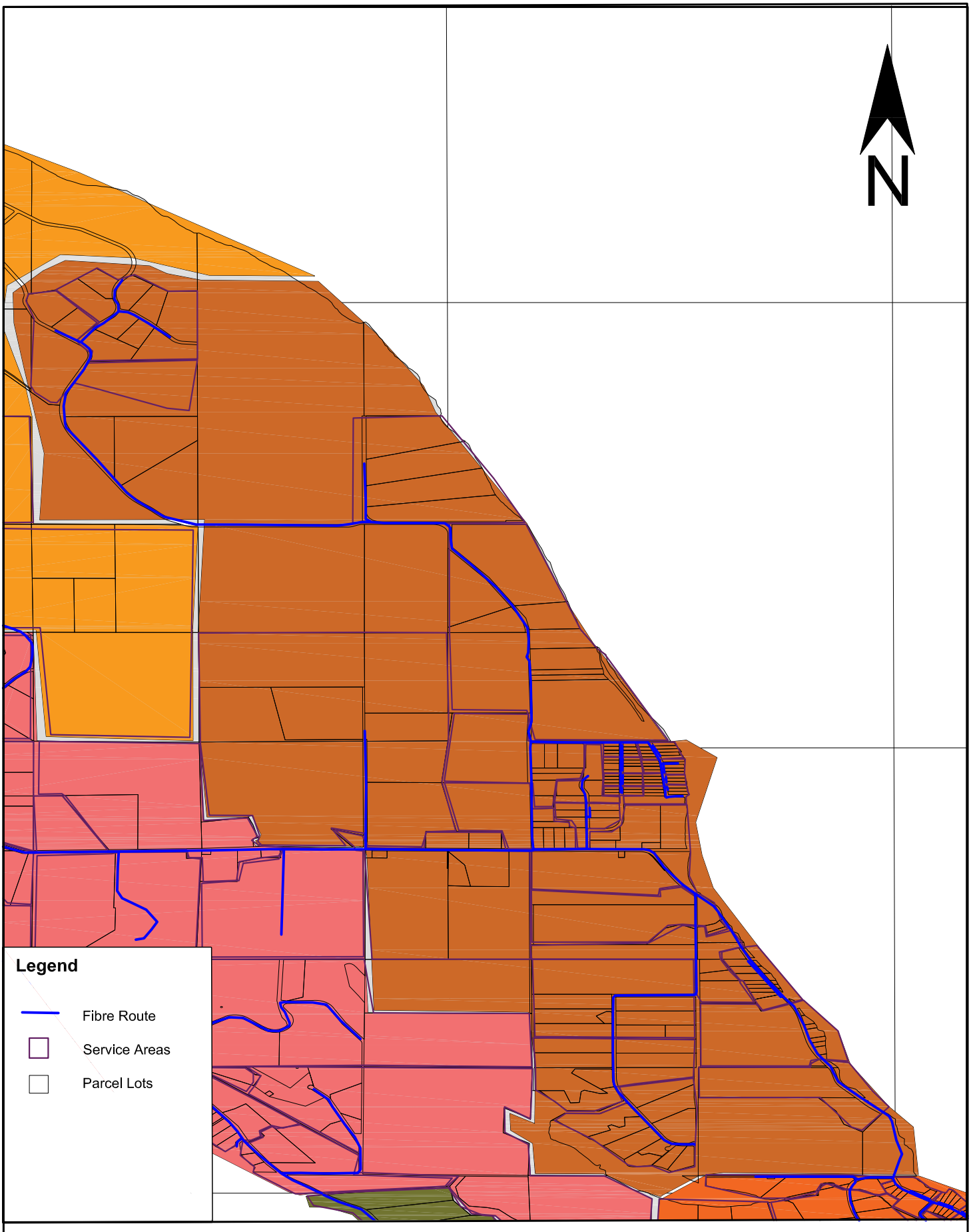
BAYLINK networks

DENMAN ISLAND | FIBRE DISTRIBUTION AREA 3



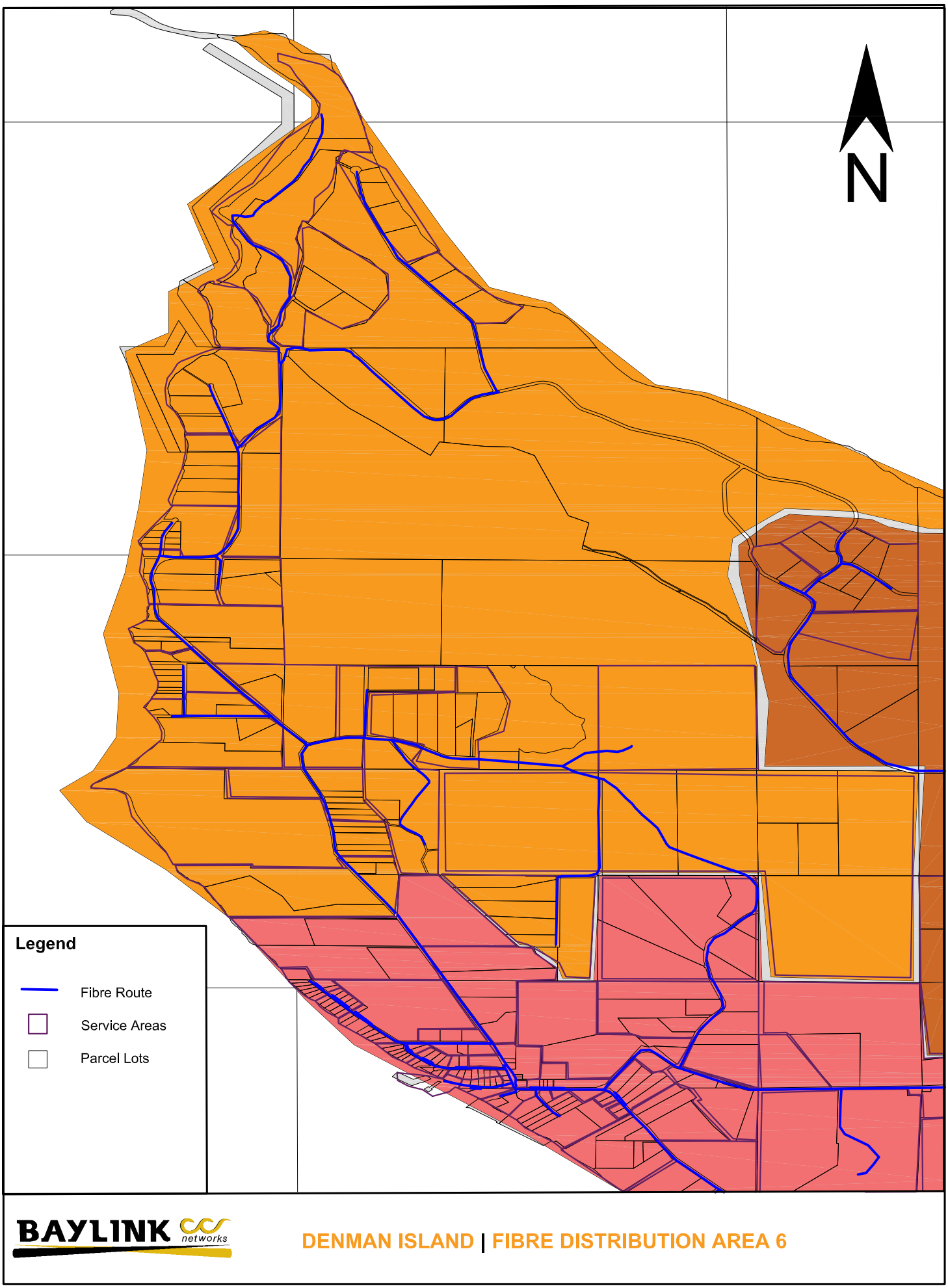
BAYLINK networks

DENMAN ISLAND | FIBRE DISTRIBUTION AREA 4



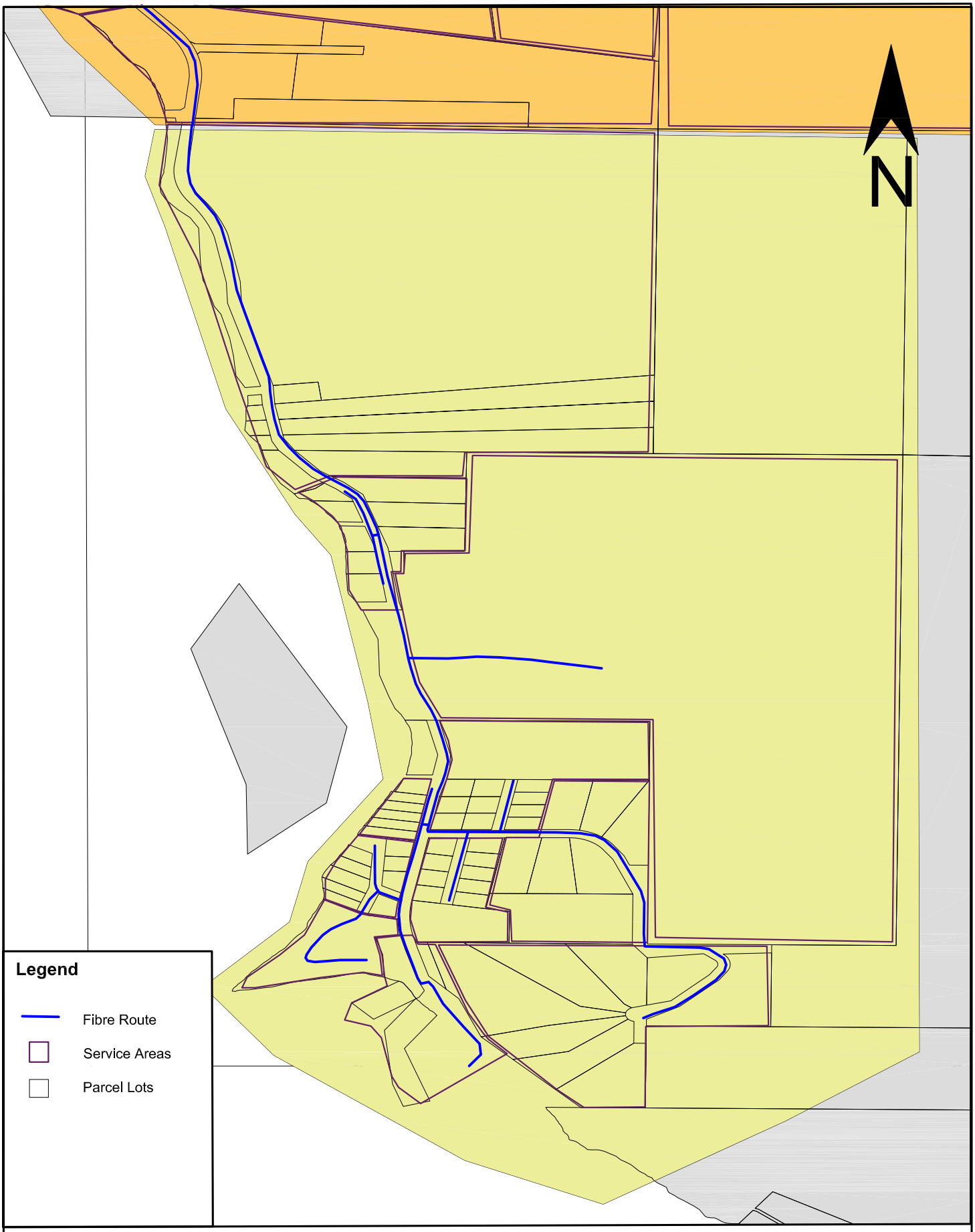
BAYLINK networks

DENMAN ISLAND | FIBRE DISTRIBUTION AREA 5



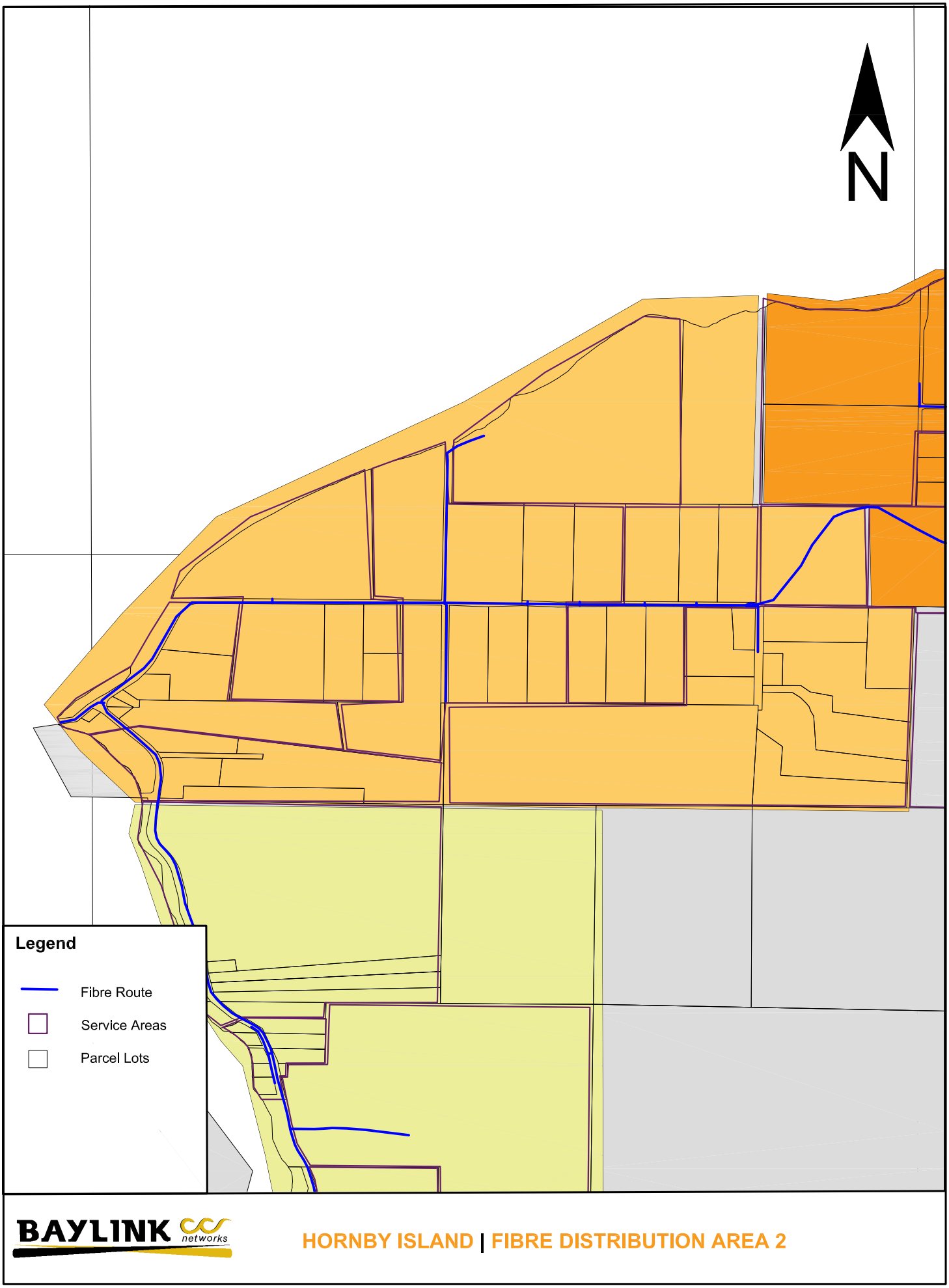
BAYLINK networks

DENMAN ISLAND | FIBRE DISTRIBUTION AREA 6



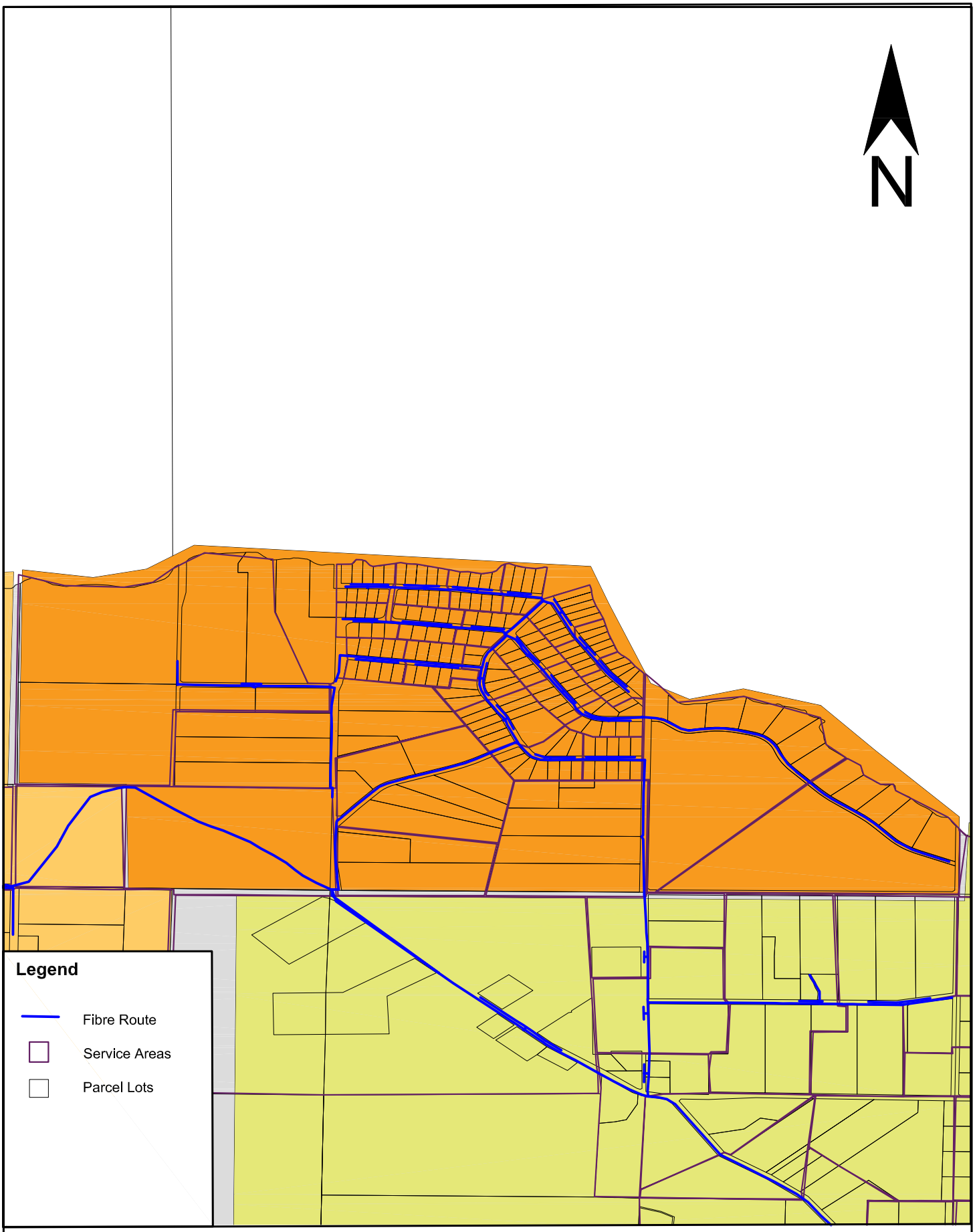
BAYLINK networks

HORNBY ISLAND | FIBRE DISTRIBUTION AREA 1



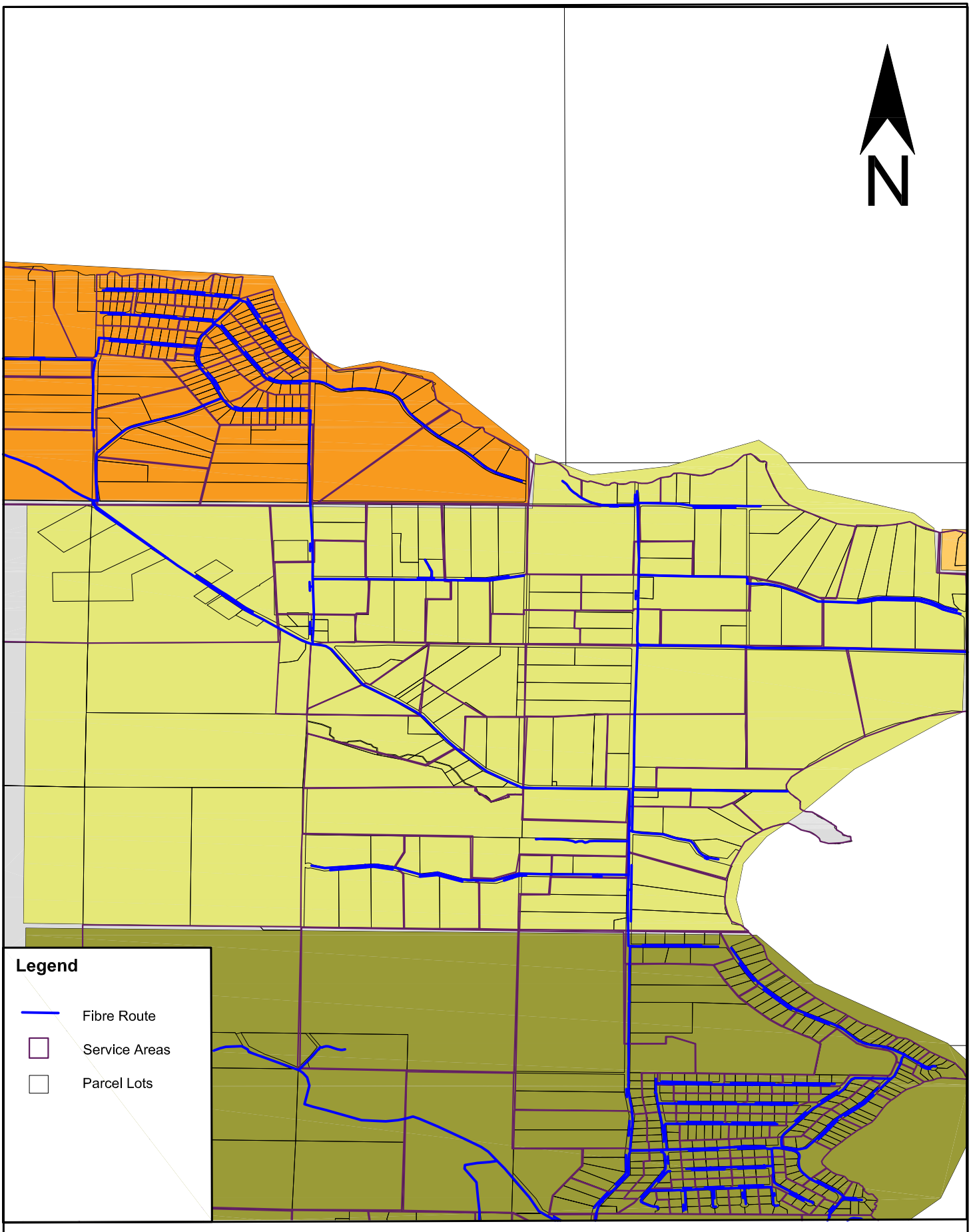
BAYLINK networks

HORNBY ISLAND | FIBRE DISTRIBUTION AREA 2



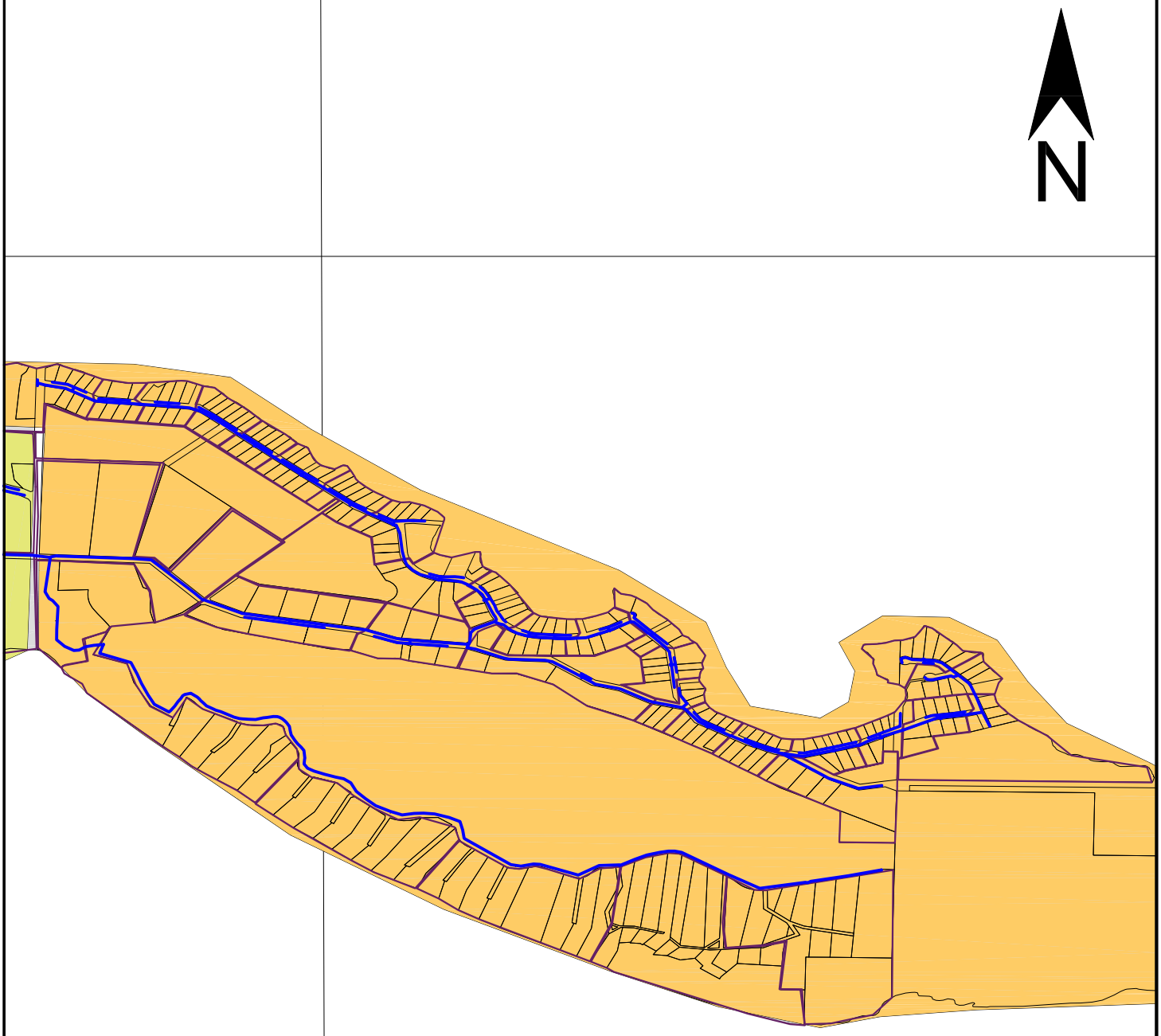
BAYLINK networks

HORNBY ISLAND | FIBRE DISTRIBUTION AREA 3



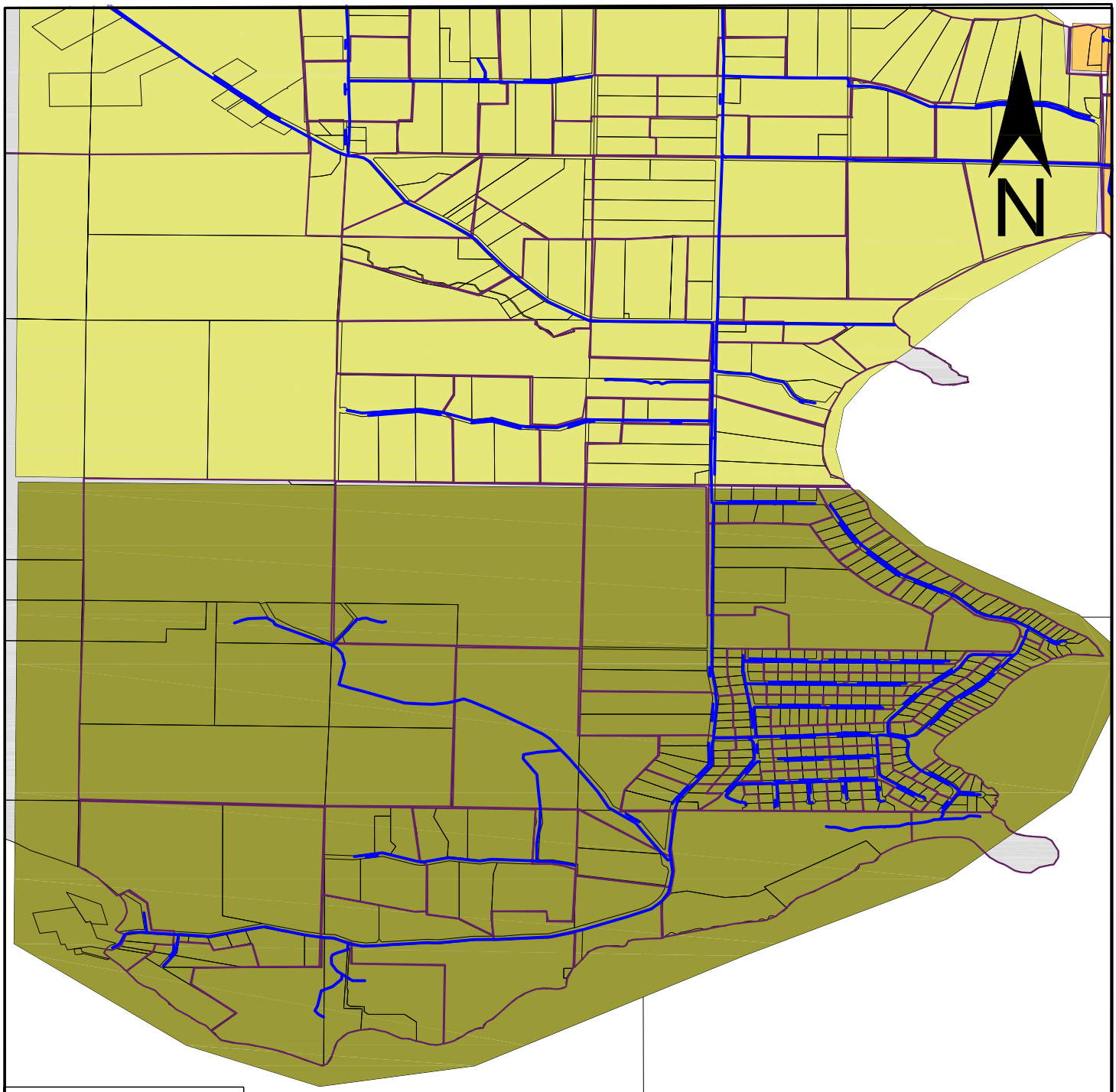
BAYLINK networks

HORNBY ISLAND | FIBRE DISTRIBUTION AREA 4



BAYLINK networks

HORNBY ISLAND | FIBRE DISTRIBUTION AREA 5



Legend

- Fibre Route
- Service Areas
- Parcel Lots

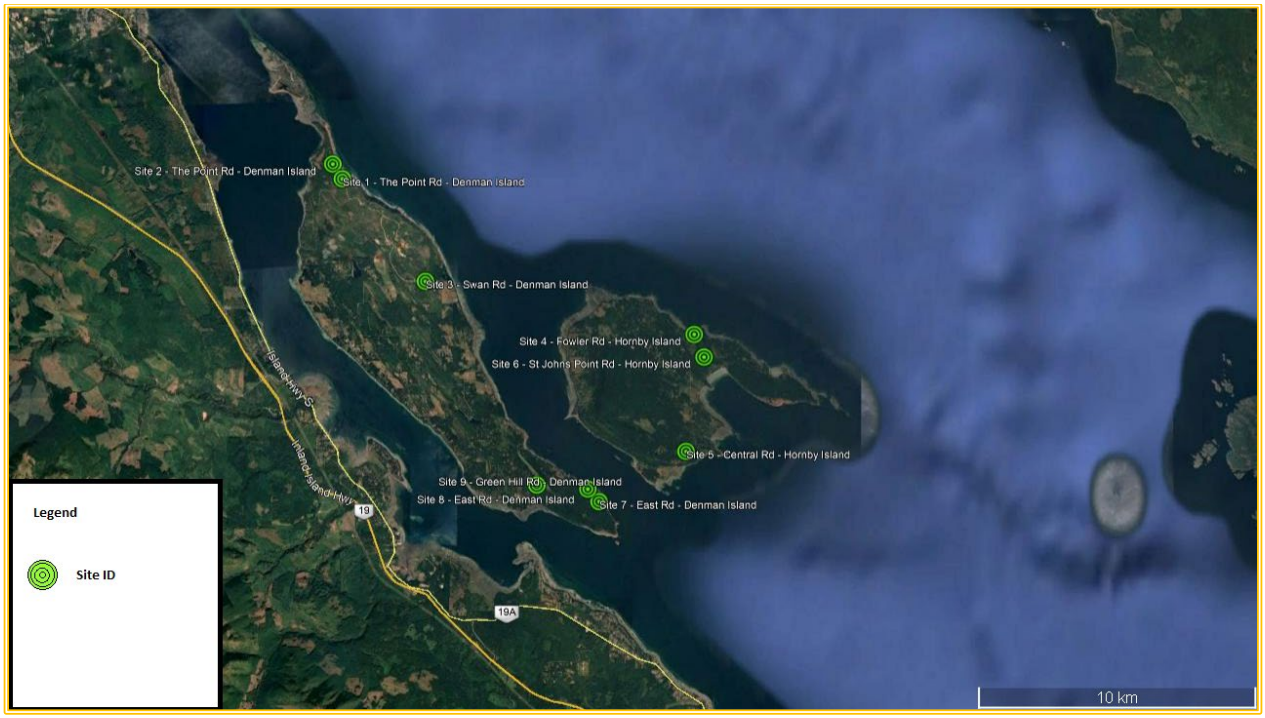
BAYLINK networks

HORNBY ISLAND | FIBRE DISTRIBUTION AREA 6

SITE SURVEY

During the site visits of 22-24 November 2019, both islands were driven in their entirety. Video footage is available. The table below summarizes the ground condition analysis that was assessed.

Site Location and Date					
#	**Site Name**	**Date**	**Longitude**	**Latitude**	**Comment**
1	The Point Rd - Denman Island	2019:11:22	-124.821	49.589233	Gravel, Loose Sand, Easy to Plow
2	The Point Rd - Denman Island	2019:11:23	-124.826	49.593997	Crushed Rocks, Loose Sand, Small Rocks, Easy to Plow
3	Swan Rd - Denman Island	2019:11:23	-124.78	49.556233	Crushed Rocks, Loose Sand, Easy to Plow
4	Fowler Rd - Hornby Island	2019:11:23	-124.646	49.539142	Loose Sand, Small Rock, Easy to Plow
5	Central Rd - Hornby Island	2019:11:23	-124.65	49.501472	Gravel, Medium Rocks, Easy to Trench
6	St Johns Point Rd - Hornby Island	2019:11:23	-124.641	49.531861	Loose Sand, Crushed Rocks, Small Rocks, Easy to Plow
7	East Rd - Denman Island	2019:11:24	-124.694	49.485292	Gravel, Medium Rocks, Rock Removal, Hard Landscape
8	East Rd - Denman Island	2019:11:24	-124.699	49.489328	Loose Sand, Medium Rocks, Rock Removal, Hard Landscape
9	Green Hill Rd - Denman Island	2019:11:24	-124.724	49.490617	Loose Sand, Small Rocks, Easy to Plow



The following observations and photographs were made during the site visits.

Site 1 – The Point Rd – Denman Island

Site 1 is located along The Point Road on Denman Island. The site ground conditions were as follows:

- Base - Gravel
- Sub-base - Loose Sand
- No potential problem for plowing/trenching


Site 2 – The Point Rd – Denman Island

Site 2 is located along The Point Road on Denman Island. The site ground conditions were as follows:

- Base – Crushed Rocks
- Sub-base - Loose Sand and Small Rocks
- No potential problems for plowing/trenching


Site 3 – Swan Rd – Denman Island

Site 3 is located along Swan Road on Denman Island. The site ground conditions were as follows:

- Base – Crushed Rocks
- Sub-base – Loose Sand
- No potential problems for plowing/trenching

Site 4 – Fowler Rd – Hornby Island

Site 4 is located along Fowler Road on Hornby Island. The site ground conditions were as follows:

- Base – Loose Sand
- Sub-base – Loose Sand and Small Rock
- No potential problems for plowing/trenching

Site 5 – Central Rd – Hornby Island

Site 5 is located along Central Road on Hornby Island. The site ground conditions were as follows:

- Base - Gravel
- Sub-base – Medium Rocks
- Harder Landscape, decent size rocks that may require a trench rather than plowing
- Rocks may be required to be pulled out

Site 6 – St Johns Point Rd – Hornby Island

Site 6 is located along St Johns Road on Hornby Island. The site ground conditions were as follows:

- Base – Loose Sand and Crushed Rocks
- Sub-base - Loose Sand and Small Rocks
- No potential problems for plowing/trenching


Site 7 – East Rd – Denman Island

Site 7 is located along East Road on Denman Island. The site ground conditions were as follows:

- Base - Gravel
- Sub-base – Medium Rocks
- Harder Landscape, decent size rocks that may require a trench rather than plowing
- Rocks may be required to be pulled out


Site 8 – East Rd – Denman Island

Site 8 is located along East Road on Denman Island. The site ground conditions were as follows:

- Base – Loose Sand
- Sub-base – Medium Rocks
- Harder Landscape, decent size rocks that may require a trench rather than plowing
- Rocks may be required to be pulled out

Site 9 – Green Hill Rd – Denman Island

Site 9 is located along Green Hill Road on Denman Island. The site ground conditions were as follows:

- Base – Loose Sand
- Sub-base - Loose Sand and Small Rocks
- No potential problems for plowing/trenching

Conclusion

In conclusion, it is clear that an underground network is viable and the method of construction using a vibratory plow along the road shoulder with Ministry of Transportation and Infrastructure approval is the most efficient and economical way to connect the sites. It was evident, that all of Hornby and the Northern side of Denman Island is ideal for plowing with the current ground conditions as of 4th quarter of 2019. The southern side of Denman Island may present some problems for vibratory plowing due to the harder landscape and bigger size rocks. The medium size rocks don't pose risk to the trenching method. The southern side can be trench where the vibrator plow is not a viable option. Overall, an underground fiber network on Hornby and Denman Islands is a viable option.

APPENDIX B
CAPITAL AND OPERATING COSTS ESTIMATES

Baylink Networks

January 22, 2020

Baylink Networks developed a detailed =/- 20% capital cost estimate and annual operating cost estimate for the Denman Hornby Connectivity Project (DHCP). The following tables summarize the estimated costs for the DCHP cable system based upon information from Requests for Information (RFI) responses and past Baylink Networks experience in fibre network construction.

Note that all dollars in the following tables are in fourth quarter 2019 Canadian Dollars.

Summary of Denman Island Underground FTTP Material

The tables below were used to generate the estimated material costs for the underground network. The quantities below were generated from the desktop design completed for Denman island.

Statistics:

Description:	Qt:	Units:	Slack:	Contingency:	Extended:
Undersea Network Length	2401	meters	300	10.00%	2,971
Total Primary Route Length:	80286	meters		0.00%	80286
Average Drop Trench Length	125	meters		0.00%	125
Average Drop Cable Length	211	meters		0.00%	211
Number of Homes	760	homes		0.00%	760
Total Drop Trench	95137	meters		10.00%	104650

Outside Plant Materials:

Description:	Qt:	Units:	Slack:	Contingency:	Extended:	Price:	Extended:
96 fiber cable	22111	meters	1000	10.00%	25422	$3.50	$88,978.10
48 fiber cable	28518	meters	2125	10.00%	33708	$1.80	$60,673.70
24 fiber cable	14617	meters	1950	10.00%	18223	$1.20	$21,867.86
144 fiber cable	18660	meters	1250	10.00%	21901	$4.50	$98,554.62
Total Drop Cable	160033	meters	38000	10.00%	217837	$0.50	$108,918.26
FDH Cabinets	6	cabinets		0.00%	6	$10,000.00	$60,000.00
Vaults	165	vaults		1.00%	167	$900.00	$149,985.00
FOSCs	165	foscs		1.00%	167	$300.00	$49,995.00
NIBS	760	nibs		2.00%	775	$25.00	$19,380.00
Connectors	760	connectors		5.00%	798	$15.00	$11,970.00
Tracer Wire	175422	meters		10.00%	192965	$0.33	$63,678.37
Ground plates	165	plates		1.00%	167	$25.00	$4,166.25
PVC Pipe	380	10 ft lengths		5.00%	399	$5.00	$1,995.00
Conduit	240857	meters		15.00%	276986	$0.90	$249,287.09
Warning Tape	175422	meters		5.00%	184194	$0.05	$9,209.68
CO Cabinet	1	cos		0.00%	1	$120,000.00	$120,000.00
Interconnect Cabinet	1	cabinets		0.00%	1	$80,000.00	$80,000.00
Total:							**$1,198,658.92**
Price per home:							**$1,577.18**

In-Building Materials:

Description:	Qt:	Units:	Slack:	Contingency:	Extended:	Price:	Extended:
In-Building Cables	760	cables		10.00%	836	$15.00	$12,540.00
Connectors in Home	1520	connectors		5.00%	1596	$15.00	$23,940.00
ONT	760	onts		1.00%	768	$350.00	$268,660.00
Power Bar	760	power bars		1.00%	768	$15.00	$11,514.00
Backup Power Supply	760	power supplies		1.00%	768	$45.00	$34,542.00
Total:							**$351,196.00**
Price per home:							**$462.10**

Summary of Hornby Island Underground FTTP Material

The tables below were used to generate the estimated material costs for the underground network. The quantities below were generated from the desktop design completed for Hornby island.

Statistics:

Description:	Qt:	Units:	Slack:	Contingency:	Extended:
Undersea Network Length	2024	meters	300	10.00%	2556
Total Primary Route Length:	67753	meters		0.00%	67753
Average Drop Trench Length	85	meters		0.00%	85
Average Drop Cable Length	156	meters		0.00%	156
Number of Homes	932	meters		0.00%	932
Total Drop Trench	79596	meters		10.00%	87555

Outside Plant Materials:

Description:	Qt:	Units:	Slack:	Contingency:	Extended:	Price:	Extended:
96 fiber cable	24763	meters	2600	10.00%	30099	$3.50	$105,347.55
48 fiber cable	24078	meters	2625	10.00%	29373	$1.80	$52,871.00
24 fiber cable	12522	meters	2250	10.00%	16249	$1.20	$19,499.04
144 fiber cable	1512	meters	250	10.00%	1938	$4.50	$8,721.90
Total Drop Cable	145208	meters	46600	10.00%	210989	$0.50	$105,494.43
FDH Cabinets	6	cabinets		0.00%	6	$10,000.00	$60,000.00
Vaults	191	vaults		1.00%	193	$900.00	$173,619.00
FOSCs	191	foscs		1.00%	193	$300.00	$57,873.00
NIBS	932	nibs		2.00%	951	$25.00	$23,766.00
Connectors	932	connectors		5.00%	979	$15.00	$14,679.00
Tracer Wire	147349	meters		10.00%	162083	$0.33	$53,487.55
Ground plates	191	plates		1.00%	193	$25.00	$4,822.75
PVC Pipe	466	10 ft lengths		5.00%	489	$5.00	$2,446.50
Conduit	203259	meters		15.00%	233748	$0.90	$210,373.07
Warning Tape	147349	meters		5.00%	154716	$0.05	$7,735.80
CO Cabinet	1	cos		0.00%	1	$120,000.00	$120,000.00
Interconnect Cabinet	0	cabinets		0.00%	0	$80,000.00	$0.00
Total:							**$1,020,736.58**
Price per home:							**$1,095.21**

In-Building Materials:

Description:	Qt:	Units:	Slack:	Contingency:	Extended:	Price:	Extended:
In-Building Cables	932	cables		10.00%	1025	$15.00	$15,378.00
Connectors in Home	1864	connectors		5.00%	1957	$15.00	$29,358.00
ONT	932	onts		1.00%	941	$350.00	$329,462.00
Power Bar	932	power bars		1.00%	941	$15.00	$14,119.80
Backup Power Supply	932	power supplies		1.00%	941	$45.00	$42,359.40
Total:							**$430,677.20**
Price per home:							**$462.10**

Underground Build Cost

The tables below provide an estimate of the construction cost utilizing plowing and trenching techniques.

Time Needed to Build:

Project Length in months:	24
Meters of network to build:	322,771.12
Meters per day:	640
Build price per meter:	$17.73

Construction Equipment Budget:

Description:	Qt:	Price:	Extended:
Trencher/Plow Combo - Small	2	$ 60,000.00	$120,000.00
Trencher/Plow Large	1	$ 120,000.00	$120,000.00
Pickup Truck	3	$ 50,000.00	$150,000.00
Landscape Trailer	2	$ 4,500.00	$9,000.00
Dump Trailer	1	$ 12,000.00	$12,000.00
Splicer	2	$ 15,000.00	$30,000.00
OTDR	2	$ 9,000.00	$18,000.00
Small directional Drill	1	$ 150,000.00	$150,000.00
Reel stands	3	$ 2,500.00	$7,500.00
Tech tools	3	$ 2,500.00	$7,500.00
Tech Vehicle	2	$ 50,000.00	$100,000.00
Mini Excavator	1	$ 80,000.00	$80,000.00
Hand Tools	8	$ 400.00	$3,200.00
Repair Tools	2	$ 800.00	$1,600.00
Generator	2	$ 1,500.00	$3,000.00
Compressor	1	$ 5,000.00	$5,000.00
Jack Hammer	1	$ 1,000.00	$1,000.00
Traffic Control Equipment	1	$ 1,000.00	$1,000.00
Total:			**$818,800.00**

Logistics, Fuel, LOA etc.:

Description:	Price:
Fuel	$60,000.00
LOA	$30,000.00
Travel	$80,000.00
Shipping	$80,000.00
Total:	**$250,000.00**

Manpower Cost:

Description:	Qt:	Hourly Wage:	Overhead Percentage:	Hourly Wage Extended:	Hours for Project:	Total Hours:	Total Cost for Project:
Construction Crew:	12	$25.00	35.00%	$33.75	4,032	48384	$1,632,960.00
Construction Lead:	1	$35.00	35.00%	$47.25	4,032	4032	$190,512.00
Admin:	1	$25.00	35.00%	$33.75	4,032	4032	$136,080.00
Project Manager:	1	$40.00	35.00%	$54.00	4,032	4032	$217,728.00
Technician:	2	$35.00	35.00%	$47.25	4,032	8064	$381,024.00
CAD Tech:	1	$28.00	35.00%	$37.80	4,032	4032	$152,409.60
Total:							**$2,710,713.60**

Other Overheads:

Description:	Price:
Insurance - general liability and errors and omissions:	$80,000.00
Vehicle Insurance:	$14,000.00
Staging Facility/Storage/Warehousing:	$28,000.00
Computer Equipment:	$16,000.00
Office Equipment/Furniture:	$5,000.00
Accounting and Legal:	$30,000.00
Utilities:	$4,000.00
Equipment Consumables:	$50,000.00
Total:	**$227,000.00**

Build Cost Summary:

Description:	Cost:	Contractor Margin:	Extended:
Construction Equipment Budget:	$818,800.00	0.00%	$818,800.00
Logistics, Fuel, LOA etc.:	$250,000.00	35.00%	$384,615.38
Manpower Cost:	$2,710,713.60	35.00%	$4,170,328.62
Other Overheads:	$227,000.00	35.00%	$349,230.77
Total:	**$4,006,513.60**		**$5,722,974.77**

Project Cost Summary

The tables above generate an estimated cost for an underground network that utilizes a plowing/trenching technique for construction. The table below summarizes the estimated project cost with an aggressive revenue model.

Summary Budget:	
Construction Costs:	$5,722,974.77
Undersea Network Build:	$630,000.00
Hornby Island OSP materials:	$1,020,736.58
Hornby Island customer in building materials:	$430,677.20
Denman Island OSP materials:	$1,198,658.92
Denman Island customer in building materials:	$351,196.00
Total:	$9,354,243.48
Contingency %:	10.00%
Contingency $:	$935,424.35
Total Build Cost:	**$10,289,667.82**
Total Homes:	1,692
Budget per Home:	$6,081.36
Public Funding %:	75.00%
Public Funding $:	$7,717,250.87
Private Funding $:	$2,572,416.96
Gross Annual Profit:	$226,603.20
Time to recover investment in years:	11.35
Simple Annual Return:	8.81%
Annual Revenue:	$924,000.00
Company valuation based on 5 times annual revenue:	$4,620,000.00
Aggressive Revenue Model:	
Gross Annual Profit:	$1,150,603.20
Time to recover investment in years:	2.24
Simple Annual Return:	44.73%
Annual Revenue:	$1,848,000.00
Company valuation based on 5 times annual revenue:	$9,240,000.00

Cashflow for ISP and Construction

The tables below analyze both a cashflow model for operating an ISP business and the estimated construction build cost for this complete network.

Total Build Cost:	**$10,289,667.82**
Total public funding:	$7,717,250.87
Funding from Private:	$2,572,416.96
Total buildings:	1,692.00
Cost per building:	$6,081.36
Uptake of subscribers:	65.01%
Start Date:	May 1, 2020
Average revenue per customer:	$70.00

ISP Business:

Months:

Description:	**Budget Total:**	**Total:**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Customers passed:	1,692	1,692				71	71	71	71	71	71	71	71	71
Customers connected:		1,100				46	46	46	46	46	46	46	46	46
Customers connected running total:						46	92	138	183	229	275	321	367	413
Revenue from customers:						$3,208	$6,417	$9,625	$12,833	$16,042	$19,250	$22,458	$25,667	$28,875
ISP Expenditures:						$29,058	$29,058	$29,058	$29,058	$29,058	$29,058	$58,116	$58,116	$58,116
Net ISP revenue:						-$25,850	-$22,642	-$19,433	-$16,225	-$13,017	-$9,808	-$35,658	-$32,450	-$29,241
ISP revenue running total:						-$25,850	-$48,491	-$67,925	-$84,149	-$97,166	-$106,974	-$142,632	-$175,082	-$204,323

Description:	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Customers passed:	71	71	71	71	71	71	71	71	71	71	71	71
Customers connected:	46	46	46	46	46	46	46	46	46	46	46	46
Customers connected running total:	458	504	550	596	642	688	733	779	825	871	917	963
Revenue from customers:	$32,083	$35,292	$38,500	$41,708	$44,917	$48,125	$51,333	$54,542	$57,750	$60,958	$64,167	$67,375
ISP Expenditures:	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116
Net ISP revenue:	-$26,033	-$22,825	-$19,616	-$16,408	-$13,200	-$9,991	-$6,783	-$3,575	-$366	$2,842	$6,050	$9,259
ISP revenue running total:	-$230,356	-$253,181	-$272,798	-$289,206	-$302,405	-$312,397	-$319,180	-$322,755	-$323,121	-$320,279	-$314,229	-$304,970

Description:	25	26	27	28	29	30	31	32	33	34	35	36
Customers passed:	71	71	71									
Customers connected:	46	46	46									
Customers connected running total:	1008	1054	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
Revenue from customers:	$70,583	$73,792	$77,000	$77,000	$77,000	$77,000	$77,000	$77,000	$77,000	$77,000	$77,000	$77,000
ISP Expenditures:	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116
Net ISP revenue:	$12,467	$15,675	$18,884	$18,884	$18,884	$18,884	$18,884	$18,884	$18,884	$18,884	$18,884	$18,884
ISP revenue running total:	-$292,503	-$276,828	-$257,944	-$239,061	-$220,177	-$201,294	-$182,410	-$163,526	-$144,643	-$125,759	-$106,876	-$87,992

Description:	37	38	39	40	41	42	43	44	45	46	47	48
Customers passed:												
Customers connected:												
Customers connected running total:	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
Revenue from customers:	$77,000	$77,000	$77,000	$77,000	$77,000	$77,000	$77,000	$77,000	$77,000	$77,000	$77,000	$77,000
ISP Expenditures:	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116
Net ISP revenue:	$18,884	$18,884	$18,884	$18,884	$18,884	$18,884	$18,884	$18,884	$18,884	$18,884	$18,884	$18,884
ISP revenue running total:	-$69,108	-$50,225	-$31,341	-$12,458	$6,426	$25,310	$44,193	$63,077	$81,960	$100,844	$119,728	$138,611

Description:	49	50	51	52	53	54	55	56	57	58	59	60
Customers passed:												
Customers connected:												
Customers connected running total:	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
Revenue from customers:	$77,000	$77,000	$77,000	$77,000	$77,000	$77,000	$77,000	$77,000	$77,000	$77,000	$77,000	$77,000
ISP Expenditures:	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116	$58,116
Net ISP revenue:	$18,884	$18,884	$18,884	$18,884	$18,884	$18,884	$18,884	$18,884	$18,884	$18,884	$18,884	$18,884
ISP revenue running total:	$157,495	$176,378	$195,262	$214,146	$233,029	$251,913	$270,796	$289,680	$308,564	$327,447	$346,331	$365,214

Network Construction:

Months:

Description:	Budget Total:	Total:	1	2	3	4	5	6	7	8	9	10
Materials and Electronics:	$3,001,269	$3,001,269				$750,317					$750,317	
Construction Equipment:	$818,800	$818,800		$68,233		$68,233		$68,233		$68,233		$68,233
Logistics, Fuel, LOA:	$384,615	$384,615				$16,026	$16,026	$16,026	$16,026	$16,026	$16,026	$16,026
Manpower:	$4,170,329	$4,170,329				$173,764	$173,764	$173,764	$173,764	$173,764	$173,764	$173,764
Other Overheads:	$349,231	$349,231				$14,551	$14,551	$14,551	$14,551	$14,551	$14,551	$14,551
Undersea Link Between Islands:	$630,000	$630,000									$210,000	$210,000
Total:	$9,354,243	$9,354,243	$0	$68,233	$0	$1,022,891	$204,341	$272,574	$204,341	$272,574	$1,164,658	$482,574
Payments from public funders:		$7,717,251			$1,543,450			$1,028,967			$1,028,967	
Payments from private funders:		$2,572,417	$514,483	$85,747	$85,747	$85,747	$85,747	$85,747	$85,747	$85,747	$85,747	$85,747
Cash Flow:			$514,483	$531,997	$2,161,195	$1,224,051	$1,105,457	$1,947,597	$1,829,004	$1,642,177	$1,592,234	$1,195,407

Description:	11	12	13	14	15	16	17	18	19	20	21	22
Materials and Electronics:				$750,317					$750,317			
Construction Equipment:		$68,233		$68,233		$68,233		$68,233		$68,233		$68,233
Logistics, Fuel, LOA:	$16,026	$16,026	$16,026	$16,026	$16,026	$16,026	$16,026	$16,026	$16,026	$16,026	$16,026	$16,026
Manpower:	$173,764	$173,764	$173,764	$173,764	$173,764	$173,764	$173,764	$173,764	$173,764	$173,764	$173,764	$173,764
Other Overheads:	$14,551	$14,551	$14,551	$14,551	$14,551	$14,551	$14,551	$14,551	$14,551	$14,551	$14,551	$14,551
Undersea Link Between Islands:	$210,000											
Total:	$414,341	$272,574	$204,341	$1,022,891	$204,341	$272,574	$204,341	$272,574	$954,658	$272,574	$204,341	$272,574
Payments from public funders:		$1,028,967			$1,028,967			$1,028,967			$1,028,967	
Payments from private funders:	$85,747	$85,747	$85,747	$85,747	$85,747	$85,747	$85,747	$85,747	$85,747	$85,747	$85,747	$85,747
Cash Flow:	$866,814	$1,708,954	$1,590,360	$653,216	$1,563,590	$1,376,763	$1,258,170	$2,100,310	$1,231,399	$1,044,572	$1,954,946	$1,768,119

Description:	23	24	25	26	27	28	29	30	31
Materials and Electronics:									
Construction Equipment:		$68,233							
Logistics, Fuel, LOA:	$16,026	$16,026	$16,026	$16,026	$16,026				
Manpower:	$173,764	$173,764	$173,764	$173,764	$173,764				
Other Overheads:	$14,551	$14,551	$14,551	$14,551	$14,551				
Undersea Link Between Islands:									
Total:	$204,341	$272,574	$204,341	$204,341	$204,341	$0	$0	$0	$0
Payments from public funders:				$0	$0	$0	$0	$0	$0
Payments from private funders:	$85,747	$85,747	$85,747	$0	$0	$0	$0	$0	$0
Cash Flow:	$1,649,526	$1,462,699	$1,344,106	$1,139,765	$935,424	$935,424	$935,424	$935,424	$935,424

ISP Monthly Expenditure & Revenue and Profit Model

The tables below are the operational budget and revenue model for the network. The monthly operation expenditure budget is based on a staff of 2 technicians, 1 manager and 3 administrators. The revenue model shows a conservative and an aggressive revenue model. The different variables in the two models are the Average Monthly Billing rate and the Number of Subscribers.

General Monthly Expenditure:			
Description:	**Monthly Cost:**	**Description:**	**Monthly Cost:**
Gateway connection	$8,000.00	**Additional Vehicle allowance**	$400.00
One Call and Locates	$100.00	**New Equipment Accrual**	$1,666.00
Maintenance and Repairs	$625.00	**Insurance**	$2,966.00
Office Rental & Overheads	$3,000.00	**Software**	$200.00
Utilities	$400.00	**Staffing**	$37,859.40
Vehicles and Tools	$2,000.00		
Fuel	$600.00	**Total Monthly Expenditure:**	**$58,116.40**
Ferry Costs	$300.00	**Total Annual Expenditure:**	**$697,396.80**

Conservative Revenue:		Aggressive Revenue:	
Average Monthly Billing:	$70.00	**Average Monthly Billing:**	$110.00
Number of Subscribers:	1100	**Number of Subscribers:**	1400
Total Monthly Revenue:	**$77,000.00**	**Total Monthly Revenue:**	**$154,000.00**
Profit:		**Profit:**	
Total Monthly Expenditure:	$58,116.40	**Total Monthly Expenditure:**	$58,116.40
Total Monthly Revenue:	$77,000.00	**Total Monthly Revenue:**	$154,000.00
Gross Monthly Profit:	$18,883.60	**Gross Monthly Profit:**	$95,883.60
Annual Profit		**Annual Profit**	
Total Annual Revenue:	**$924,000.00**	**Total Annual Revenue:**	**$1,848,000.00**
Gross Annual Profit:	**$226,603.20**	**Gross Annual Profit:**	**$1,150,603.20**

Summary

The cost of permitting, outsourced engineering services, materials, installation, construction, operating, project cashflow and ownership options have been analyzed in this appendix. The different costs have been estimated to a ± 20% range of accuracy utilizing an experienced-based cost estimating system.

Note that CDC project management costs are not included.
All dollars in the above tables are in fourth quarter 2019 Canadian Dollars.