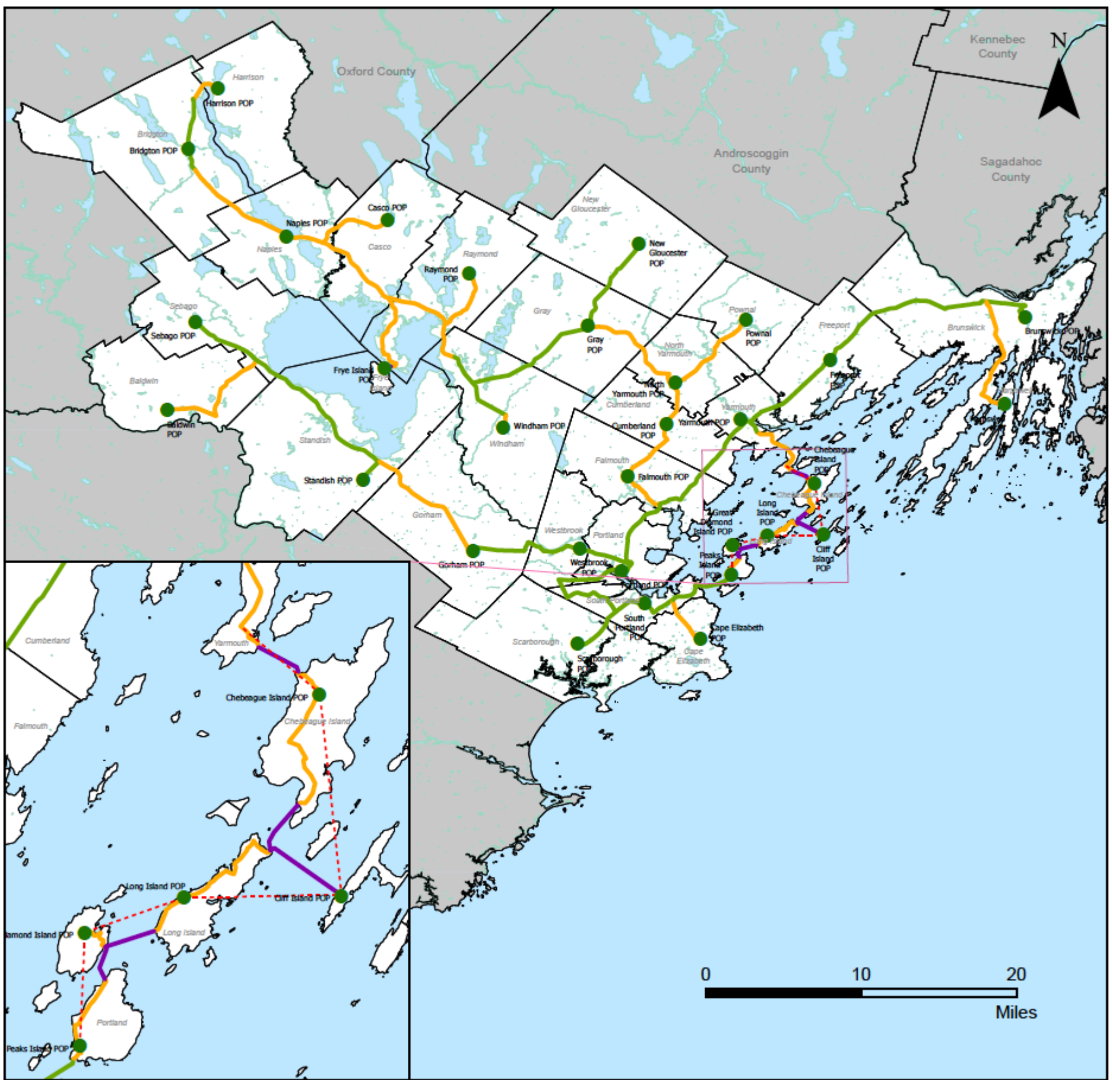
SEWALL
JAMES W. SEWALL COMPANY / Since 1880

Casco Bay Advisors, LLC
Broadband/Telecom Consulting

Maine
Cumberland County

Cumberland County Broadband Playbook

A Regional Broadband Planning and Management Guide
for the Municipalities of Cumberland County, Maine



June 30, 2019

Table of Contents

1 EXECUTIVE SUMMARY 6

2 HOW TO USE THE PLAYBOOK 6

3 INTERNET ACCESS AND BROADBAND DEFINITION 10

4 INTERNET ACCESS TECHNOLOGY OVERVIEW 11

4.1 DSL 11
4.2 CABLE MODEM 13
4.3 FIXED WIRELESS 14
4.4 4G/LTE ADVANCED BROADBAND 14
4.5 5G WIRELESS 15
4.6 SATELLITE 16
4.7 FIBER-TO-THE-HOME (FTTH) 17

5 MUNICIPAL STAKEHOLDER MEETINGS 18

6 CONSUMER AND BUSINESS SURVEY – SUMMARY 18

7 MAPPING OF PHONE COMPANY OPERATING TERRITORIES 20

8 CONNECTME AUTHORITY MAPPING 21

9 MAPPING OF EXISTING DARK FIBER AVAILABLE FOR LEASE 21

9.1 FIRSTLIGHT DARK FIBER 22
9.2 GWI DARK FIBER 23
9.3 MAINECOM/CMP DARK FIBER 24
9.4 MAINE FIBER COMPANY 25
9.5 OTELCO DARK FIBER 26

10 NETWORK DESIGNS AND COST ESTIMATES 27

10.1 REGIONAL FIBER OPTIC BACKBONE 28
10.1.1 Municipal Points-of-Presence (POP) 29
10.1.2 Network Design 29
10.1.3 Regional Network Costs 31
10.2 FIBER-TO-THE-HOME 34
10.2.1 Municipal Points-of-Presence (POP) 34
10.2.2 FTTH Network Design 34
10.2.3 FTTH Network Costs 35

11 5-YEAR FINANCIAL HIGHLIGHTS 37

11.1 REGIONAL BACKBONE PROFORMA 37
11.2 REGIONAL BACKBONE OPERATING ASSUMPTIONS 38
11.3 REGIONAL BACKBONE FINANCIAL SENSITIVITIES 40
11.4 FIBER-TO-THE-HOME PROFORMA 42
11.5 FIBER-TO-THE-HOME OPERATING ASSUMPTIONS 43
11.6 FIBER-TO-THE-HOME FINANCIAL SENSITIVITIES 45

12 FINANCING OPTIONS 47

12.1 ECONOMIC AND FINANCING OUTCOMES 47

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

12.2 FINANCING AVAILABILITY AND OPTIONS 48
12.3 FINANCING ALTERNATIVES AND CORRESPONDING COMMERCIAL STRUCTURES 51

13 UTILITY OPERATING MODELS 52

13.1 PUBLIC-PRIVATE PARTNERSHIP WITH INCUMBENT PROVIDER 52
13.2 PUBLIC-PRIVATE PARTNERSHIP WITH NEW PROVIDER 53
13.3 MUNICIPALLY OWNED NETWORK 53
13.4 MUNICIPALLY OWNED NETWORK STAFFING MODEL 54
13.5 SHARED SERVICES MODEL 54

14 OPPORTUNITIES AND RISKS OF MUNICIPAL OWNERSHIP 55

14.1 OPPORTUNITIES 55
14.2 RISKS 57

15 ALTERNATIVES TO FULL MUNICIPAL OWNERSHIP 59

15.1 PUBLIC-PRIVATE PARTNERSHIP – LEVERAGE COMMUNITY GOODWILL 59
15.2 PUBLIC-PRIVATE PARTNERSHIP – JOINT PUBLIC-PRIVATE OWNERSHIP 59
15.3 PUBLIC-PRIVATE PARTNERSHIP – JOINT CAPITAL/EXPENSE CONTRIBUTION WITH BUYOUT PROVISION 59
15.4 PUBLIC-PRIVATE PARTNERSHIP – ONE-TIME SUBSIDY OF PRIVATE OPERATOR 60

16 RECOMMENDATIONS 61

16.1 RECOMMENDATION #1 61
16.2 RECOMMENDATION #2 61
16.3 RECOMMENDATION #3 61
16.4 RECOMMENDATION #4 61

17 APPENDICES 62

17.1 DEFINITIONS OF TERMS USED IN THIS PLAYBOOK 62
17.2 FTTH MAPPING BY MUNICIPALITY 65
17.3 CONSUMER AND BUSINESS SURVEY – DETAILED RESULTS 96

List of Figures

Figure 1: ADSL2+ Frequency Utilization 12
Figure 2: VDSL2+ Frequency Utilization 12
Figure 3: Hybrid Fiber/Coax Network Architecture Diagram 13
Figure 4: Iterative Financing Process 47

List of Tables

Table 1: Regional Fiber Optic Backbone Cost Data 31
Table 2: Fiber-to-the-Home Cost Data 35
Table 3: Regional Backbone Financial Proforma 37
Table 4: Financial Sensitivities - Regional Backbone with Microwave Links to Islands 40
Table 5: Financial Sensitivities - Regional Backbone with Subsea Links to Islands 41
Table 6: Fiber-to-the-Home Financial Proforma 42
Table 7: Financial Sensitivities - Fiber-to-the-Home 45
Table 8: Financial Modeling Outcomes 47
Table 9: Municipal Ownership - Opportunities & Risks 55

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

List of Maps

Map 1: Traditional Phone Company Operating Territories 20
Map 2: FirstLight Dark Fiber 22
Map 3: GWI Dark Fiber 23
Map 4: Mainecom/CMP Dark Fiber 24
Map 5: Maine Fiber Company Dark Fiber 25
Map 6: OTELCO Dark Fiber 26
Map 7: Regional Fiber Optic Backbone 28

FTTH Designs

FTTH Design 1: Baldwin 66
FTTH Design 2: Bridgton 67
FTTH Design 3: Cape Elizabeth 68
FTTH Design 4: Casco 69
FTTH Design 5: Chebeague Island 70
FTTH Design 6: Cliff Island 71
FTTH Design 7: Cumberland 72
FTTH Design 8: Falmouth 73
FTTH Design 9: Freeport 74
FTTH Design 10: Frye Island 75
FTTH Design 11: Gorham 76
FTTH Design 12: Gray 77
FTTH Design 13: Great Diamond Island 78
FTTH Design 14: Harpswell 79
FTTH Design 15: Harrison 80
FTTH Design 16: Long Island 81
FTTH Design 17: Naples 82
FTTH Design 18: New Gloucester 83
FTTH Design 19: North Yarmouth 84
FTTH Design 20: Peaks Island 85
FTTH Design 21: Portland 86
FTTH Design 22: Pownal 87
FTTH Design 23: Raymond 88
FTTH Design 24: Scarborough 89
FTTH Design 25: Sebago 90
FTTH Design 26: South Portland 91
FTTH Design 27: Standish 92
FTTH Design 28: Westbrook 93
FTTH Design 29: Windham 94
FTTH Design 30: Yarmouth 95

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

Disclaimer

It is important to understand this report contains high level costs and projections based on the information readily available and should not be interpreted as providing the level of detail required for investing purposes.

All costs contained in this report are estimates based upon high-level desk-top network designs, our estimates of construction costs, and our knowledge of costs for similar types of projects. In order to develop precise costs, a detailed engineering analysis will need to be performed and actual construction costs determined.

All revenue and operating expense projections contained in this report are estimates developed based on our experience and knowledge with similar types of projects. In order to develop precise projections, a business plan will need to be developed based on actual construction costs, a known source of funding will need to be determined and an operating model will need to be chosen.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

1 Executive Summary

The team of James W. Sewall Company (Sewall) and Casco Bay Advisors, LLC (Casco Bay) is pleased to present this Broadband Playbook for the Municipalities of Cumberland County, Maine. With several Cumberland County municipalities suffering from a lack of access to affordable, reliable high-speed Internet and with consumers living along major arteries in the County reporting they cannot gain access to acceptable speeds for home and business use, Cumberland County has made access to broadband a priority goal. This Playbook, funded by a planning grant secured through the Community Development Block Grant Program, provides foundational information designed to support the various municipal initiatives in solving their broadband challenges.

Based on feedback received from municipal stakeholder meetings and an online survey for consumer and business input, dissatisfaction with the existing incumbent service providers suggests consumers may be willing to support municipal ownership and funding of an alternative broadband network infrastructure to improve broadband capabilities and competitive options. With the cooperation of five (5) different service providers that have shared maps of their dark fiber available for lease within the County, we have produced a desk-top design of a regional fiber optic network that leverages those existing assets combined with new construction to extend the capability of the 3-Ring-Binder (3RB) network to all municipalities within the County, including the islands in Casco Bay and Sebago Lake.

The Playbook includes high-level construction cost estimates, highlights from a 5-year financial proforma and financing options that demonstrate the potential to operate a County-wide fiber optic backbone and Fiber-to-the-Home (FTTH) network serving every potential subscriber in the County in a sustainable and profitable manner. Such a network could be municipally-owned and operated or be established as a Public-Private Partnership with an existing or new service provider. In the course of developing this Playbook, more than one provider expressed interest in partnering with the County on deployment of a regional fiber optic backbone.

With the completion of this Playbook, we recommend that Cumberland County continue leading an effort to support its municipal stakeholders by: collaborating with existing providers to realize its regional fiber optic backbone vision; continuing its efforts to improve the performance of the incumbent service providers while exploring a complete County-wide FTTH over-build; and developing a common financing mechanism and support structure to assist its municipalities with their individual efforts.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

About Casco Bay Advisors, LLC

Casco Bay Advisors, LLC (Casco Bay) is a telecommunications and broadband consulting firm located in Gardiner, Maine. Casco Bay specializes in developing broadband feasibility studies for state, county and locally funded broadband expansion initiatives, with an emphasis on facilitating and implementing Public/Private Partnerships. Casco Bay also provides network planning, network engineering, utility pole make-ready project management, construction management, and financial modeling of fiber optic networks, and acts as an owner's project manager for state, county and municipally funded fiber optic initiatives to expand the availability of high-speed broadband and developing new fiber optic networks.

Casco Bay prides itself on being the only truly independent broadband advisor/consultant in the state of Maine, providing communities with unbiased advice and analysis. Casco Bay does not build or operate broadband networks, nor do we sell broadband services. We do, however, leverage our deep past experience building and operating networks to provide our clients with the advice and expertise required to successfully negotiate with service providers, provide oversight of construction and monitor the performance of network operators.

Prior to establishing Casco Bay, Mr. Lippold served as EVP/COO of Integra Telecom, a Portland, Oregon based CLEC providing services across the western third of the United States. Over the course of his 35 years in the telecom industry, Mr. Lippold has held key executive leadership roles, including SVP Network Planning & Engineering for FairPoint Communications, built and led the business, government and wholesale sales channels for FairPoint across northern New England; SVP of State Government, Research & Higher Education sales at Level 3 Communications; VP Carrier Services at TelCove; and General Manager of Kansas, Oklahoma and Missouri for TelCove. Brian's early telecom career was devoted to various engineering and operations leadership roles within the long-distance telecommunications industry.

About James W. Sewall Company

James W. Sewall Company (Sewall) is a full-service consulting firm based in Old Town, Maine. The 139-year-old company offers a wide range of professional services, including engineering, surveying, construction management and inspection, land use planning, geospatial solutions (aerial & satellite imaging, mapping, application development, and asset management), and natural resources consulting. The Engineering Division includes professional engineers, professional land surveyors, GIS analysts, and technicians with expertise in virtually every discipline of civil engineering, including highway and intersection design, traffic and signal design, site design, structural design, and environmental permitting.

Sewall was established in 1880 by a civil engineering alumnus of Bowdoin College and a citizen of Old Town. In its early days, the small firm established a market niche in surveying and forestry appraisals for private and public sector clients, while also performing large civil engineering design projects throughout the eastern US. Since that time, Sewall has expanded to include over 50 employees and six

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

offices in four states. Sewall is owned by Treadwell Franklin Infrastructure Capital (TFIC), a company that undertakes project origination and development, financial structuring and project finance for the commercial infrastructure of the United States.

Sewall's corporate headquarters is located at 136 Center Street, Old Town, ME 04468; telephone: 207 827 4456. Sewall/TFIC offices are located at 40 Forest Falls Drive, Suite 2, Yarmouth, Maine 04096; telephone 207 817 5410. Regional Sewall offices are located in Caribou, Maine; International Falls, Minnesota; Newnan, Georgia; and Summerville, South Carolina.

Sewall's professionals assist public and private sector clients throughout the United States, Canada, and overseas with projects that range in size and scope from local municipal peer review services to large, multi-year highway design and site development projects.

2 How to Use the Playbook

Cumberland County has commissioned the creation of this Playbook to provide interested communities with a guide and high-level cost estimates to create a permanent, scalable utility; understand the upfront and ongoing costs associated with building service out to their taxpayers; and provide a thorough resource map of where fiber and other broadband resources currently exist. This information can be used to negotiate with potential partners to prevent duplication of efforts, and give residents, businesses, and other stakeholders an idea about how much it might cost to build out service to each town in the County.

The Playbook is organized to inform and educate in a logical manner by first providing background information to understand the different technologies, the results of the consumer and business survey and the service providers currently operating within the County. Detailed mapping is provided to illustrate the location of existing dark fiber available for lease that can be leveraged as part of a potential regional fiber optic backbone.

With the background information established, theoretical network designs and high-level cost estimates are provided and discussed for both a regional fiber optic backbone network and Fiber-to-the-Home networks for each municipality, followed by a review of the financial high-lights and financing options.

The Playbook concludes with a review of potential utility operating models, discussion of the opportunities and risks of municipal ownership of such networks and recommendations for next steps.

This Playbook is intended to provide basic and high-level information that will inform and assist municipalities to understand their options for expanding the availability of affordable, reliable high-speed broadband. Should a municipality wish to explore their options in greater detail, a specific plan should be developed based on the unique goals of the municipality, which would contain much more granular network designs and cost estimates.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

3 Internet Access and Broadband Definition

The terms "Internet access" and "broadband" are often used interchangeably. There is frequently confusion between the two, especially as the definitions evolve with technology changes.

Internet access connects individual computer terminals, computers, mobile devices, and computer networks to the Internet, enabling users to access Internet services such as email, applications and information delivered via the World Wide Web. Internet service providers (ISPs) offer Internet access through various technologies that offer a wide range of data signaling rates (speeds).

Consumer use of the Internet first became popular through dial-up Internet access in the 1990s. By the first decade of the 21st century, many consumers in developed nations used faster, broadband Internet access technologies.

Broadband is a generic term representing any wide-bandwidth data transmission method with the ability to transport multiple signals and traffic types simultaneously. This data can be transmitted using coaxial cable, optical fiber, radio or twisted pair copper. In the context of Internet access, broadband is used much more loosely to mean any high-speed Internet access that is always on and faster than traditional dial-up access. Different governing authorities have developed inconsistent definitions of what constitutes broadband service based on access speed.

In January 2015, the Federal Communications Commission (FCC) voted to define broadband as Internet service with at least 25 Mbps (megabits per second) download and 3 Mbps upload. Their definition affects policy decisions and the FCC's annual assessment of whether broadband is being deployed to all Americans quickly enough. In Maine, the ConnectME Authority Board[1] currently defines effective broadband network capacity as speeds equal to or greater than 25Mbps/3Mbps, and anything less as "unserved."

For those rural and high-cost areas served by Consolidated Communications, Inc. (CCI) where CCI has accepted subsidies through the Connect America Fund – Phase II (CAF-II), the FCC has adopted a minimum speed standard of 10Mbps/1Mbps.

The municipalities within Cumberland County may elect to pursue access options based on one of these established standards or define its own standard depending upon the serving technology architecture it wishes to pursue, the costs for deployment and funding strategies.

[1] In recognition of the critical importance of modern technology for education, health care, and business success in Maine, the Legislature created the ConnectME Authority (Authority) in 2006 as an independent state agency to develop and implement broadband strategy for Maine. The Authority is governed by a board which is comprised of members appointed by the Governor or specifically identified and designated by statute.

4 Internet Access Technology Overview

In this section, we present an overview of different Internet access technology, including digital subscriber line, cable modem, fixed wireless, 4G/LTE Advanced, 5G, satellite, and Fiber-to-the-Premise.

4.1 DSL

Digital subscriber line (DSL) is a technology most frequently used by traditional telephone system operators such as Consolidated Communications, Inc. (CCI), FirstLight and OTELCO, to deliver advanced services *(high-speed data and potentially video)* over twisted pair copper telephone wires. This technology has lower data carrying capacity than the hybrid fiber coaxial network deployed by cable system operators like Charter Communications (Spectrum). Data speeds are range-limited by the length of the copper cable serving the premise, the wire gauge of the copper conductors and the condition of the copper.

DSL service can be delivered simultaneously with wired telephone service on the same telephone line. This is possible because DSL uses higher frequency bands for data transmission than are required for the voice service transmission. On the customer premises, a DSL filter on each non-DSL outlet blocks any high-frequency interference to enable simultaneous use of the voice and DSL services.

The bit rate of consumer DSL services can range from 256 Kbps *(kilobits per second)* to over 100 Mbps in the direction of the service provider to the customer (downstream), depending on the DSL technology, line conditions, and the length of the copper loop. Until recently, the most commonly installed DSL technology for Internet access has been asymmetric digital subscriber line (ADSL). With ADSL, the data throughput in the upstream direction *(the direction from the consumer to the service provider)* is lower, hence the designation of asymmetric service.

At the central office, a digital subscriber line access multiplexer (DSLAM) terminates the DSL circuits and aggregates them, where they are handed off to other networking transport equipment. The DSLAM terminates all connections and recovers the original digital information. For locations beyond the maximum distance from the central office for the particular type of DSL technology deployed (7,000 – 12,000 feet), DSLAMs can be deployed in the field in outside plant cabinets *(remote terminals)* and connected to the central office by fiber optic cables. A shorter distance from the premise to the DSLAM results in greater bandwidth *(speed and/or capacity)* for the connected users.

The customer end of the connection consists of a terminal adaptor or "DSL modem." This converts data between the digital signals used by computers and the voltage signal of a suitable frequency range which is then applied to the phone line.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

There are additional formats of DSL technologies that can enhance the capacity of the network. ADSL2+ extends the capability of basic ADSL by doubling the number of downstream channels, increasing the frequency from 1.1 Mhz to 2.2 Mhz. The data rates can be as high as 24 Mbps downstream and up to 1.4 Mbps upstream, depending on the distance from the DSLAM to the customers' premises. Like the previous standards, ADSL2+ will degrade from its peak bit rate after a certain distance.

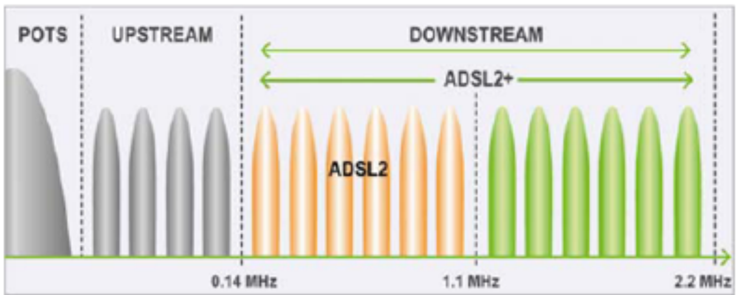


Figure 1: ADSL2+ Frequency Utilization

ADSL2+ allows port bonding, where multiple ports are physically provisioned to the end user and the total bandwidth is equal to the sum of all provisioned ports. When two lines capable of 24 Mbps are bonded, the end result is a connection capable of 48 Mbps download and twice the original upload speed.

Very-high-bit-rate digital subscriber line 2 (VDSL2+) permits the transmission of asymmetric and symmetric aggregate data rates up to 200 Mbps downstream and upstream on twisted pairs using a bandwidth up to 30 Mhz. It deteriorates quickly from a theoretical maximum of 250 Mbps at the source to 100 Mbps at 1,600 feet and 50 Mbps at 3,300 feet but degrades at a much slower rate from there. Starting from one mile, its performance is similar to ADSL2+. Bonding may be used to combine multiple wire pairs to increase available capacity or extend the copper network's reach.

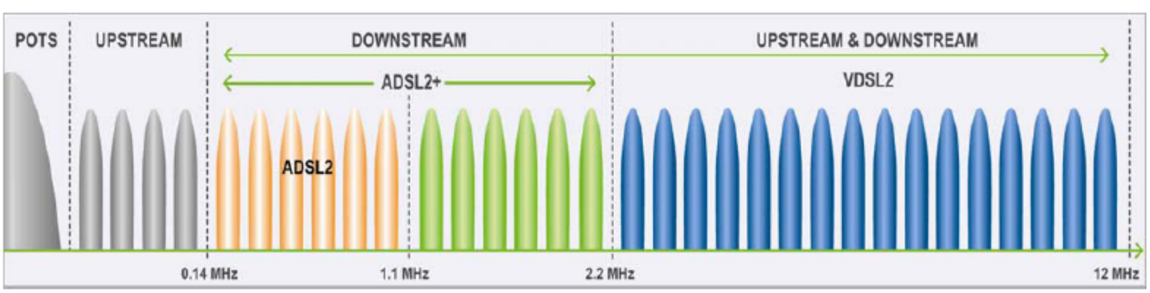


Figure 2: VDSL2+ Frequency Utilization

All new DSL deployments for CCI utilize VDSL2+ equipment.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

4.2 Cable Modem

Cable modem Internet access is provided over a hybrid fiber-coaxial (HFC) broadband network. It has been employed globally by cable television operators since the early 1990s and is the network architecture utilized by Spectrum and Comcast to provide service within Cumberland County. In an HFC cable system, the television channels are sent from the cable system's distribution facility, the headend, to local communities through optical fiber trunk lines. The fiber-optic trunk lines provide adequate bandwidth to allow future expansion for bandwidth-intensive services. At the local community, an optical node translates the signal from a light beam to an electrical signal and sends it over coaxial cable lines for distribution to potential subscribers.

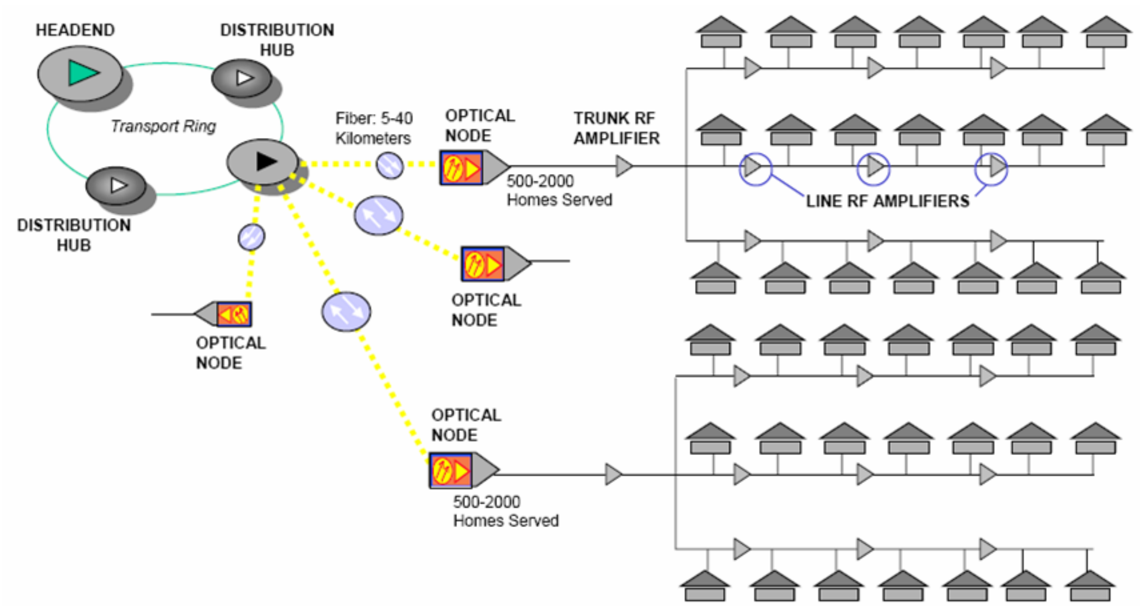


Figure 3: Hybrid Fiber/Coax Network Architecture Diagram

The coaxial portion of the network connects 25–2,000 homes in a tree-and-branch configuration off the node. RF amplifiers are used at intervals to overcome cable attenuation and passive losses of the electrical signals caused by splitting or "tapping" the coaxial cable.

The HFC broadband network is typically operated bi-directionally, meaning that signals are carried in both directions on the same network from the headend/hub office to the home, and from the home to the headend/hub office. The forward-path or downstream signals carry information such as video content, voice and data. The return-path or upstream signals carry information such as video control signals to order a movie or Internet data to send an email. The forward-path and the return-path are carried over the same coaxial cable in both directions between the optical node and the home.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

Data Over Cable Service Interface Specification (DOCSIS) is an international telecommunications standard that permits the addition of high-bandwidth data transfer to an existing cable TV (CATV) system. DOCSIS 3.1 has been deployed by Spectrum and Comcast to provide Internet access over their existing HFC infrastructure. The DOCSIS 3.1 standard is capable of supporting Internet speeds of up to 10 Gbps *(gigabits per second),* but most providers are currently offering speeds of 1 Gbps or less service for residential users.

4.3 Fixed Wireless

Fixed wireless broadband is the operation of wireless devices or systems used to connect two fixed locations *(e.g., building to building or tower to building*) with a radio or other wireless link. Fixed wireless data (FWD) links are often a cost-effective alternative to leasing fiber or installing cables between the buildings. The point-to-point signal transmissions occur through the air over a terrestrial microwave platform. The advantages of fixed wireless include the ability to connect with users in remote areas without the need for laying new cables and the capacity for broad bandwidth that is not impeded by fiber or cable capacities. Fixed wireless services typically use a directional radio antenna on each end of the signal. These antennas are generally larger than those seen in Wi-Fi setups and are designed for outdoor use. They are typically designed to be used in the unlicensed Industrial, Scientific, and Medical (ISM) radio frequency bands (900 MHz, 1.8 GHz, 2.4 GHz and 5 GHz). However, in many commercial installations licensed frequencies may be used to ensure quality of service (QoS) or to provide higher connection speeds.

To receive this type of Internet connection, consumers mount a small dish to the roof of their home or office and point it to the transmitter. Line-of-sight is usually necessary for Wireless Internet Service Providers (WISPs) operating in the 2.4 and 5 GHz bands. The 900 MHz band offers better non-line-of-sight (NLOS) performance. Providers of unlicensed fixed wireless broadband services typically provide equipment to customers and install a small antenna or dish somewhere on the roof. This equipment is usually deployed and maintained by the company providing that service.

4.4 4G/LTE Advanced Broadband

4G/LTE Advanced is wireless technology being deployed by cellular telephone providers such as AT&T, Verizon Wireless, US Cellular, Sprint and T-Mobile for traditional mobile phone and data services. The latest standard incorporates two new technologies - Carrier Aggregation, and Multiple Input Multiple Output (MIMO), in order to provide speeds in excess of 100 Mbps, and eventually up to 1 Gbps and beyond. While standard data connections use one antenna and one signal at any given time, 4G LTE Advanced has the capability of utilizing multiple signals and multiple antennas.

Mobile LTE wireless service uses MIMO technology to combine multiple antennas on both the transmitter and the receiver. A 2×2 MIMO configuration has two antennas on the transmitter and two

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

on the receiver, but the technology is not limited to 2x2. More antennas could theoretically operate at faster speeds as the data streams can travel more efficiently. The signal is then combined with "carrier aggregation," which allows a device to receive multiple 4G signals at once. The received signals don't have to be on the same frequency; one could receive an 1800 MHz and an 800 MHz signal at the same time, which is not possible with standard 4G. Up to five different 20 MHz signals can be combined to create a data pipe of up to 100 MHz of bandwidth.

4.5 5G Wireless[2]

Fifth-generation wireless (5G) is the latest iteration of cellular technology, engineered to greatly increase the speed and responsiveness of wireless networks. With 5G, data transmitted over wireless broadband connections could travel at rates as high as 20 Gbps by some estimates -- exceeding wireline network speeds -- as well as offer latency of 1 millisecond or lower for uses that require real-time feedback. 5G will also enable a sharp increase in the amount of data transmitted over wireless systems due to more available bandwidth and advanced antenna technology.

In addition to improvements in speed, capacity and latency, 5G offers network management features, among them network slicing, which allows mobile operators to create multiple virtual networks within a single physical 5G network. This capability will enable wireless network connections to support specific uses or business cases and could be sold on an as-a-service basis. A self-driving car, for example, would require a network slice that offers extremely fast, low-latency connections so a vehicle could navigate in real time. A home appliance, however, could be connected via a lower-power, slower connection because high performance isn't crucial.

5G networks and services will be deployed in stages over the next several years to accommodate the increasing reliance on mobile and internet-enabled devices. Overall, 5G is expected to generate a variety of new applications, uses and business cases as the technology is rolled out.

How 5G works - Wireless networks are composed of cell sites divided into sectors that send data through radio waves. Fourth-generation (4G) Long-Term Evolution (LTE) wireless technology provides the foundation for 5G. Unlike 4G, which requires large, high-power cell towers to radiate signals over longer distances, 5G wireless signals will be transmitted via large numbers of small cell stations located in places like light poles or building roofs. The use of multiple small cells is necessary because the millimeter wave spectrum -- the band of spectrum between 30 GHz and 300 GHz that 5G relies on to generate high speeds -- can only travel over short distances and is subject to interference from weather and physical obstacles, like buildings.

[2] https://searchnetworking.techtarget.com/definition/5G

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

Previous generations of wireless technology have used lower-frequency bands of spectrum. To offset millimeter wave challenges relating to distance and interference, the wireless industry is also considering the use of lower-frequency spectrum for 5G networks so network operators could use spectrum they already own to build out their new networks. Lower-frequency spectrum reaches greater distances but has lower speed and capacity than millimeter wave.

4.6 Satellite

Satellite Internet is available to virtually the entire lower 48 states, with some coverage in Alaska, Hawaii and Puerto Rico. The satellites are positioned more than 22,000 miles above the equator. These satellites are geostationary, which means they are always above a specific point on the earth as it rotates. The first Internet satellites successfully brought the Internet to a larger audience, but the rates were incredibly slow. Modern satellites use more advanced technology to transmit information which provides faster Internet access, but this is still much slower than landline-based Internet and terrestrial wireless Internet services.

When a consumer subscribes to satellite Internet, the company installs household equipment, which consists of an antenna dish and a modem. The antenna is located outside of the house and is generally two or three feet in diameter. The antenna must have an unobstructed view of the sky, called the line-of-sight, in order to communicate with the satellite. The antenna is connected to a modem, which connects to a computer with an Ethernet cable.

To manage bandwidth quality for all users, each plan comes with a cap on the data you can transmit or consume per month. The amount of data allotted depends on the subscriber’s plan. Plans typically range from 5 GB to 50 GB of data transmission per month with use limits prescribed. If you exceed the allotted data amount, Internet speeds will be throttled back until the next month. However, some companies allow subscribers to pay for more data capacity once the threshold is met, resetting normal operation levels.

Looking forward, at least a dozen companies, including Boeing, Amazon, SpaceX, OneWEb and Telesat are deploying, or planning to deploy thousands of Low Earth Orbit (LEO) satellites in massive constellations to provide Internet service to unserved and underserved regions of the world. The benefit of LEO satellites includes greater bandwidth and less latency, with the reported potential of displacing traditional land-line based Internet service. SpaceX and others have begun deploying LEO satellites and are in the process of testing the service to demonstrate their viability.

Satellite industry proponents say that now, unlike decades ago when Teledesic and the earlier iteration of Iridium failed to develop successful businesses, technology advancements are enabling satellite service to be offered more affordably and efficiently.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

4.7 Fiber-to-the-Home (FTTH)

Fiber-to-the-Home (FTTH) or Fiber-to-the-Premise (FTTP) is a network utilizing fiber optic cables directly to the home or business and is capable of offering virtually unlimited symmetrical bandwidth. Most FTTP networks can offer 1 Gbps of bandwidth in both download and upload directions, with some providers offering 2 Gbps and even 10 Gbps service capacity. The majority of new networks being deployed utilize this type of technology.

FTTH networks can be configured and operated in a number of different ways. These include:

- As a single service provider in a closed network environment;
- As an open access dark fiber configuration where competing providers can lease the fiber and place their own optical/electronics to complete the service;
- As an open access dark fiber configuration where the network owner provides the optical/electronics and leases the service to competing providers; and,
- As a Software Defined Network, where competing providers interconnect with the network and users select their provider in a virtual manner.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

5 Municipal Stakeholder Meetings

Cumberland County and Casco Bay hosted four (4) stakeholder input meetings with municipal officials to share the purpose and scope of this project and to solicit input specific to the municipalities. The meetings were held on February 20th in Naples, February 21st in Freeport and Cape Elizabeth and February 27, 2019 in Windham. Representatives from twelve (12) communities participated in these events and others have reached out to Casco Bay independently to discuss the project.

6 Consumer and Business Survey – Summary

The survey was open to public access using a link on the Cumberland County website. Respondents were recruited via a public outreach effort made by the County staff and other local community groups collaborating with the County's team. With few exceptions, respondents provided valid address locations which enabled a geographic profile of the group. The survey represents a cross section of the County and represents urban, suburban and rural regions where the majority of locations are reported to have at least one service provider delivering basic level or better broadband options as currently defined by the FCC and the ConnectME Authority.

The majority of respondents represented residential users. Though traditional businesses were not as active in the poll, there were a significant number of home-based businesses represented in the group profile. Respondents consider access to Internet services a critical infrastructure item in today's economy. As found in other industry studies, this belief is consistent among both personal and business users of broadband services.

75% of respondents currently subscribe to services from Charter Communications (Spectrum) with Consolidated Communications and Verizon Wireless a distant second and third.

The service data indicates most subscribers believe they utilize plans that provide between 25 and 100 Mbps in download service speeds while approximately 10 percent subscribe to higher speeds. Based on the current reported service availability data from ConnectME, 80 to 85% of Cumberland County has at least one service option that provides capacity to deliver up to 100 Mbps download speed or higher, yet only 45.5% of potential subscribers who responded to the survey claim to utilize packages that provide that level of service. This suggests factors beyond network speed are influencing those buying decisions.

74.84% of respondents utilize Spectrum, which provides a minimum level of service at 100Mbps/10Mbps, yet only 32.52% of responses suggest they subscribe to service of up to 100Mbps. We believe this disconnect can be attributed to two factors. First, the subscribers may not actually know the level of service to which they subscribe, and two, while Spectrum advertises a minimum

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

100Mbps/10Mbps service, actual speeds reportedly vary, especially during the high-usage times of the day.

Some measure of buyer satisfaction can be seen in the data. Responses suggest that about 30% of subscribers in the two highest subscription ranges feel some level of dissatisfaction with their purchase. Further study into this aspect of user sentiment by the current network operators might reveal ways to improve customer satisfaction about those purchases within the capacity of the current solutions offered. For example, it may be possible to improve customer satisfaction by providing guidance that helps users understand the relationship between service levels and the demands of the implements *(phones, computers, personal devices, smart tvs and other appliances)* that drive that service requirement or perhaps the factors created by their home or business network components that may affect service performance.

Responses suggest that the current users of broadband services are largely unencumbered from performing the tasks/functions that they want to. The anecdotal information provided in commentary suggests that the respondent's frustration is more within the business process with their provider, and as a result there is a desire to seek other service options in those instances.

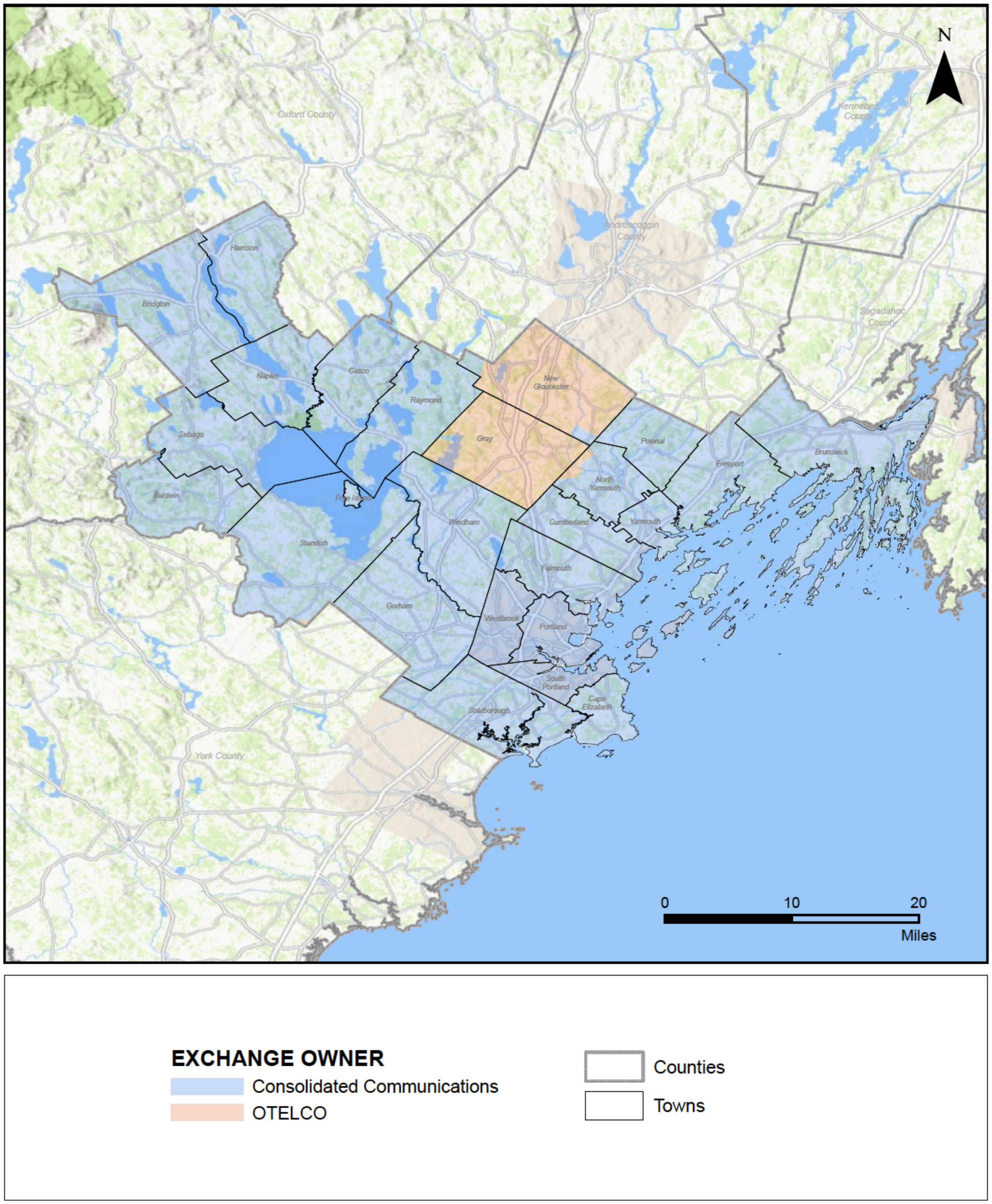
Respondents largely envision their service capacity needs will increase over time and have an interest in acquiring faster broadband services. The survey results suggest there would be wide support in the event communities chose to pursue a solution to any unmet need that might include the use of public funds to develop or enhance the delivery system.

For a list of the survey questions and detailed results, please refer to the Appendix of this document.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

7 Mapping of Phone Company Operating Territories

Map 1: Traditional Phone Company Operating Territories



8 ConnectME Authority Mapping

Accurate information is one of the key elements to an effective expansion of broadband. To that end, the ConnectME Authority has compiled the best information it has available and has published that data in a series of spreadsheets located on their website[3].

ConnectME fully understands that its data isn't complete and there are inaccuracies as a result of the way information is reported. They are asking residents, businesses and providers to update the list to ensure that they have captured all of the areas that do not have access to 25Mbps/3Mbps broadband service. If an area is listed on these spreadsheets, ConnectME considers that area to be unserved for the purposes of a ConnectME Infrastructure grant.

The Excel spreadsheets on the ConnectME website are separated by county and by town with street ranges that have service less than 25/3 Mbps. If you believe your address should be captured, please fill out the Broadband Mapping form[4] and complete a Speed Test[5] so ConnectME can add your address to the list of unserved.

If you have any questions, please contact Brooke Johnson – Assistant Director, ConnectME Authority at 207-624-9849.

9 Mapping of Existing Dark Fiber Available for Lease

In January 2019, we solicited industry standard GIS-based maps from all known service providers with assets deployed in Cumberland County to identify routes where they have dark fiber available for lease. Three (3) providers declined to provide maps of their dark fiber assets, one (1) provider was unresponsive and five (5) provided the information as requested.

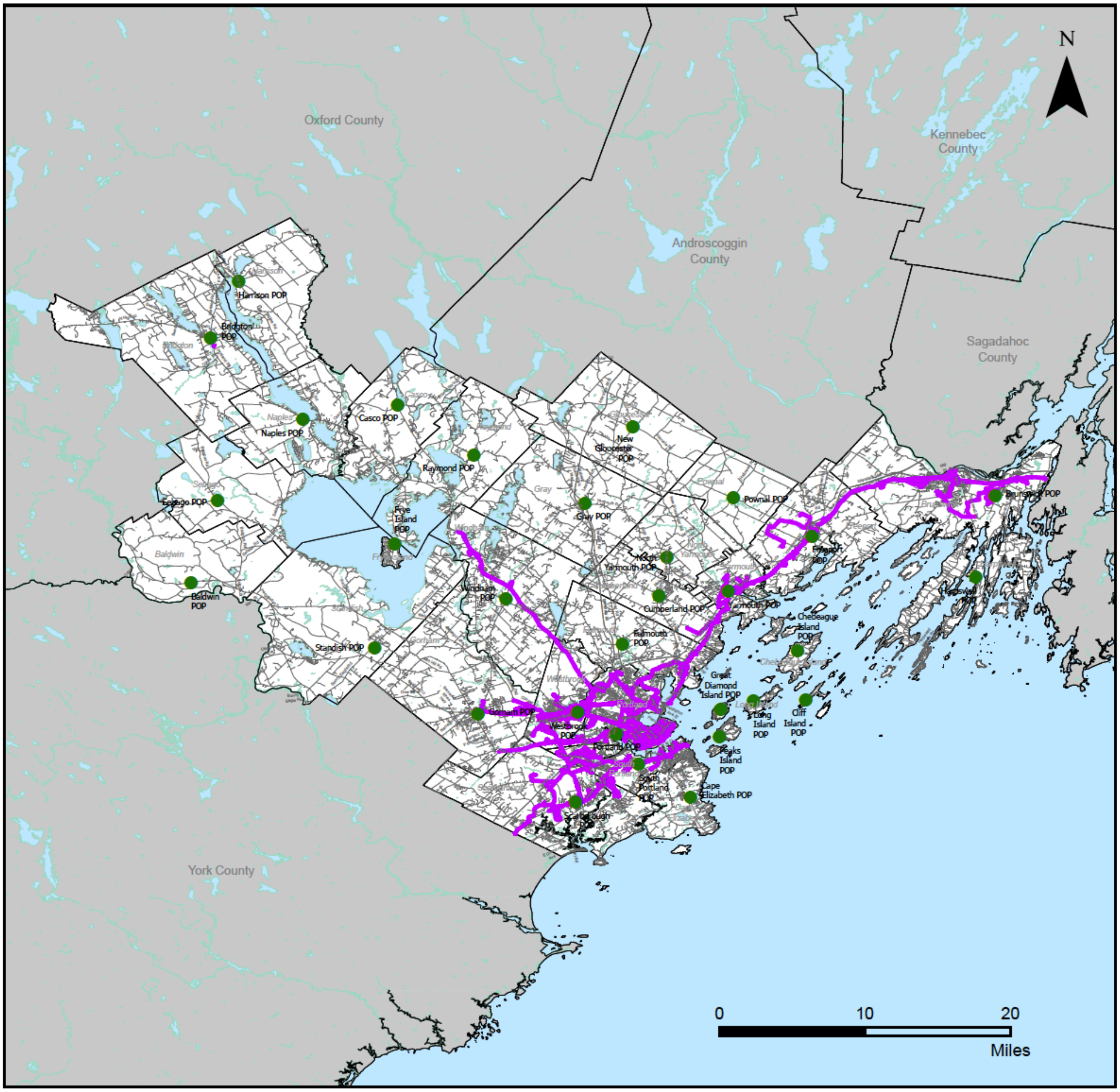
A map of each of the five (5) providers dark fiber availability are contained on the following pages. Those providers include:

- FirstLight
- GWI
- Mainecom/CMP
- Maine Fiber Company
- OTELCO

[3] https://www.maine.gov/connectme/communities-resources/Broadbandmapping
[4] https://appengine.egov.com/apps/nics/maine/connectmebroadband
[5] https://speed.measurementlab.net/#/

9.1 FirstLight Dark Fiber

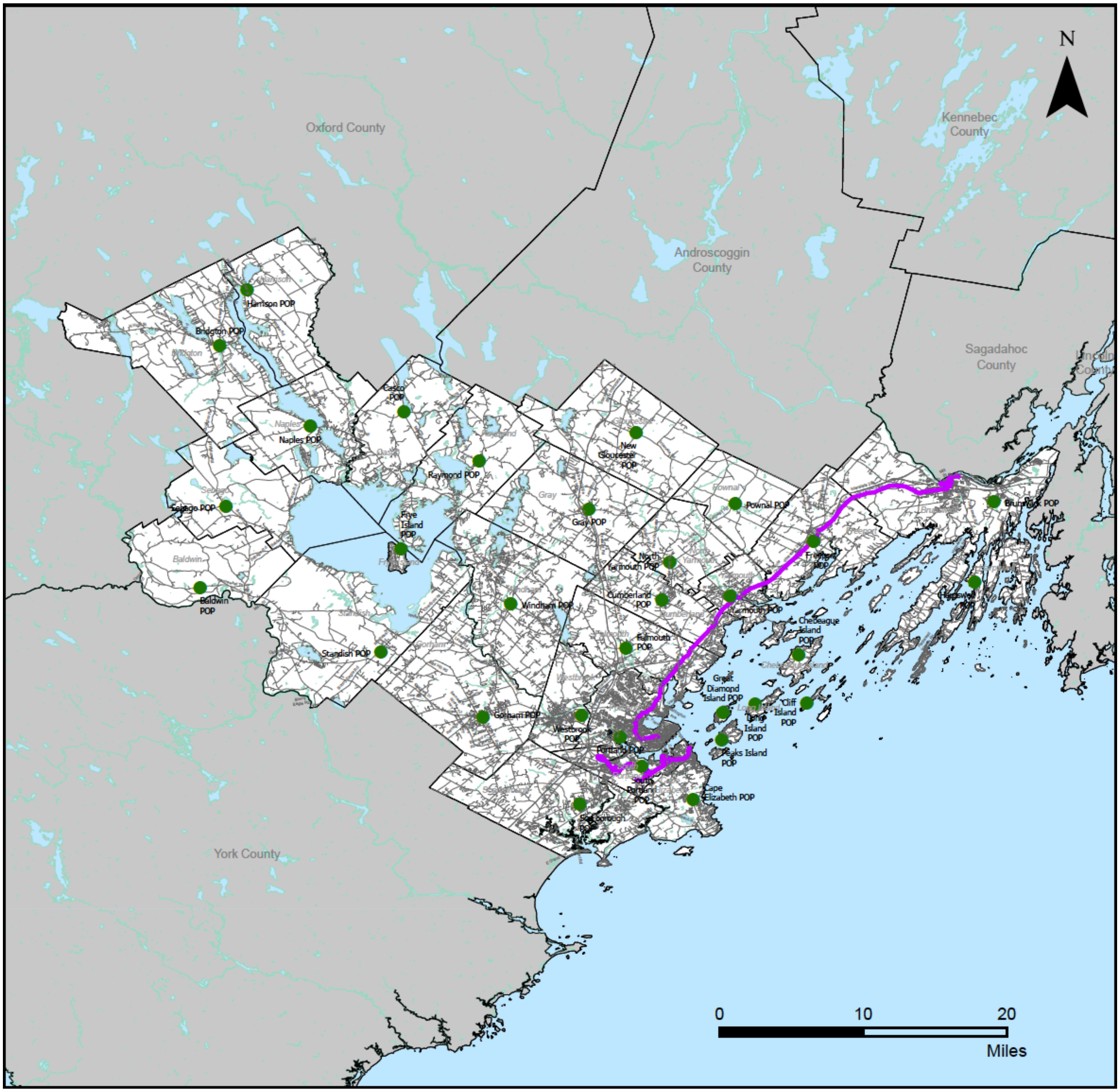
Map 2: FirstLight Dark Fiber



2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

9.2 GWI Dark Fiber

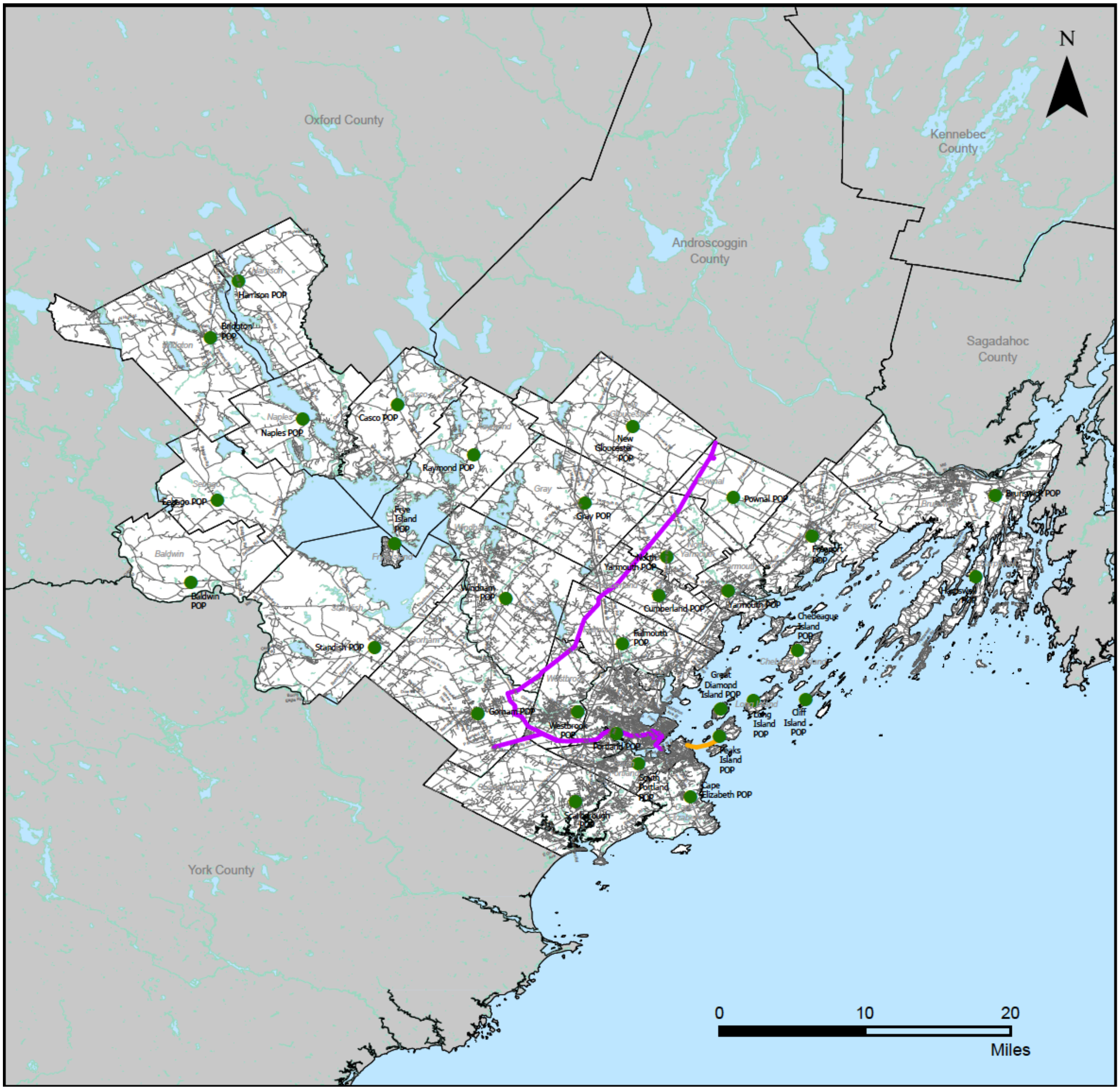
Map 3: GWI Dark Fiber



2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

9.3 Mainecom/CMP Dark Fiber

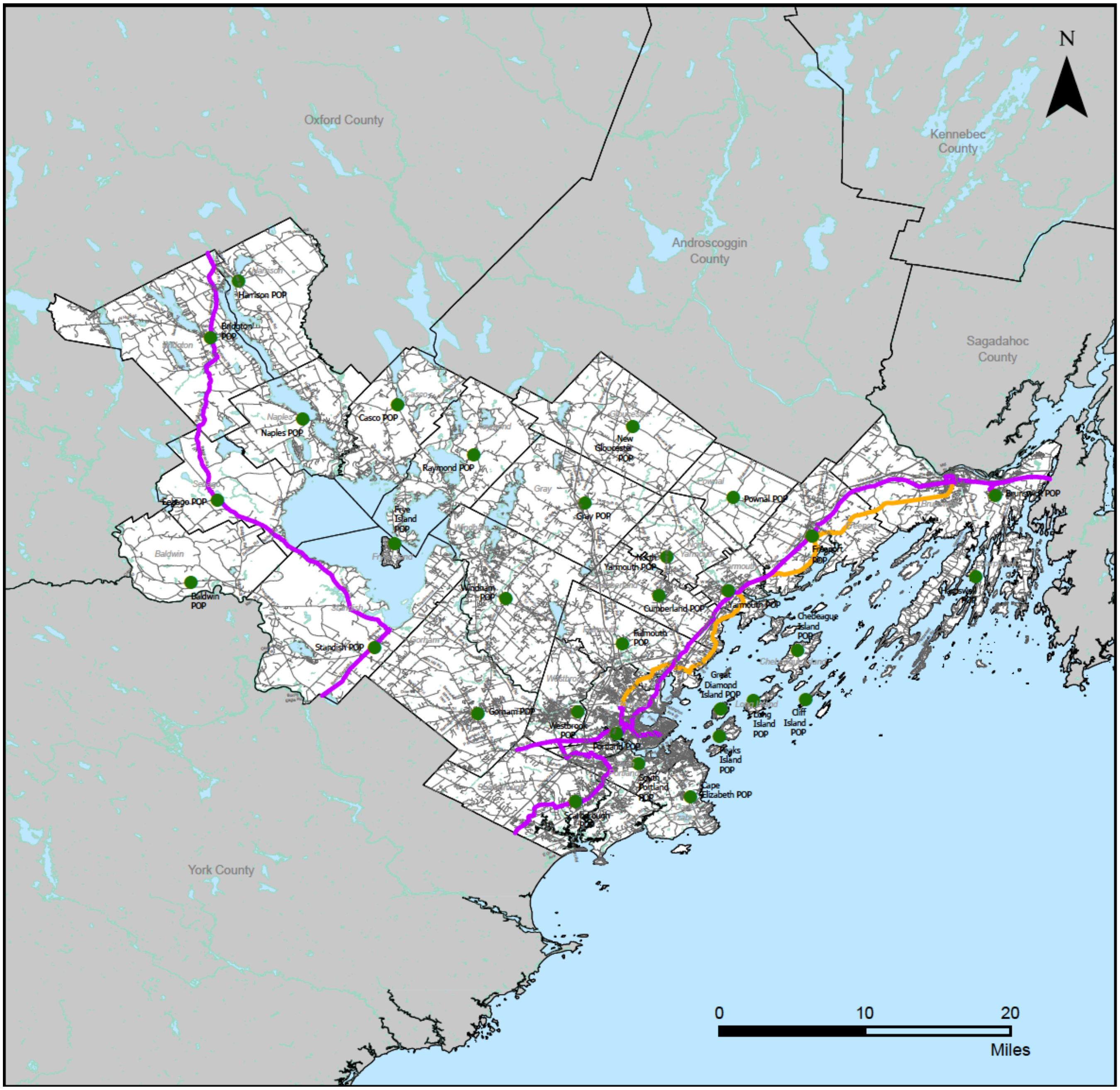
Map 4: Mainecom/CMP Dark Fiber



2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

9.4 Maine Fiber Company

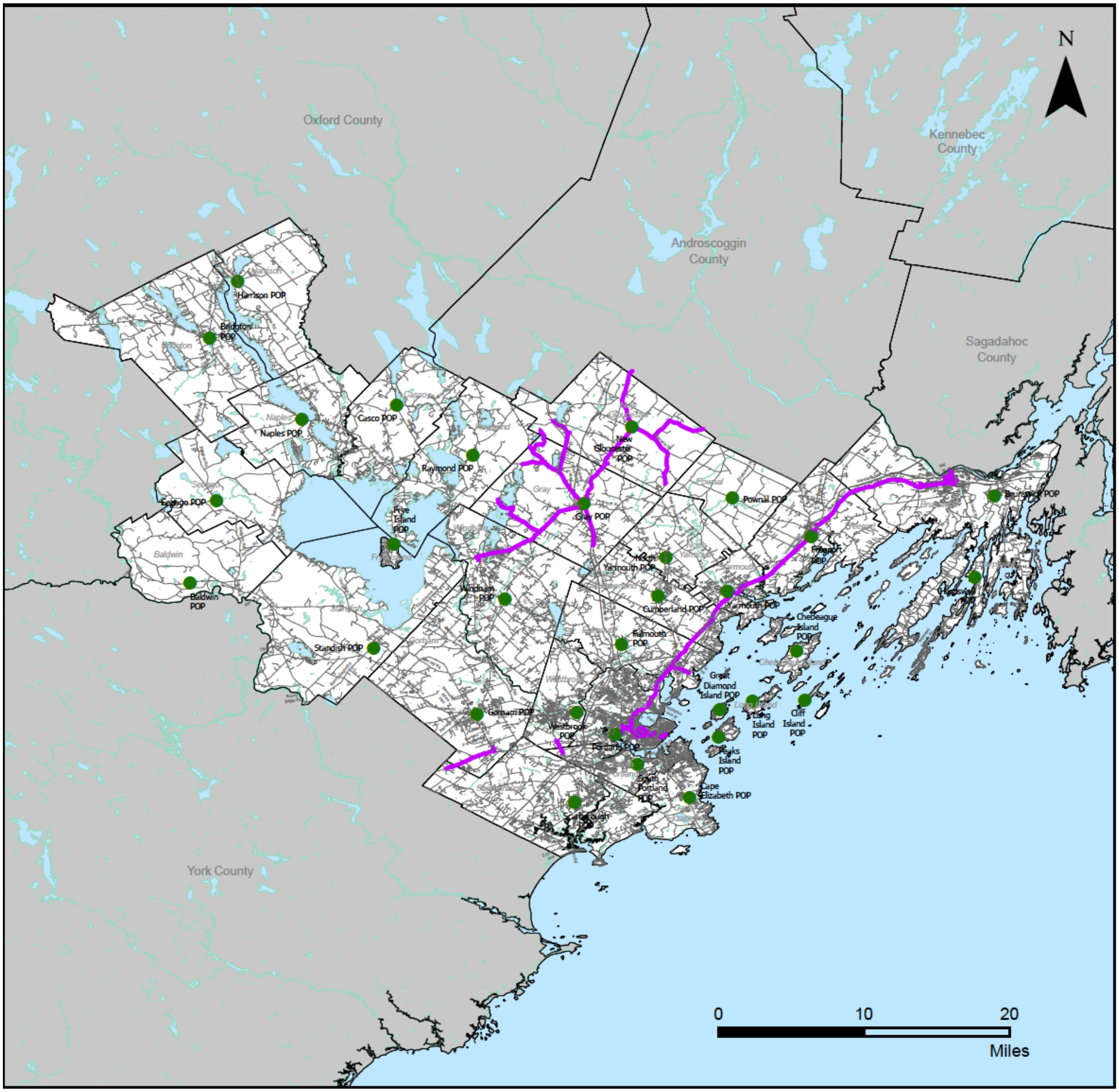
Map 5: Maine Fiber Company Dark Fiber



2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

9.5 OTELCO Dark Fiber

Map 6: OTELCO Dark Fiber



10 Network Designs and Cost Estimates

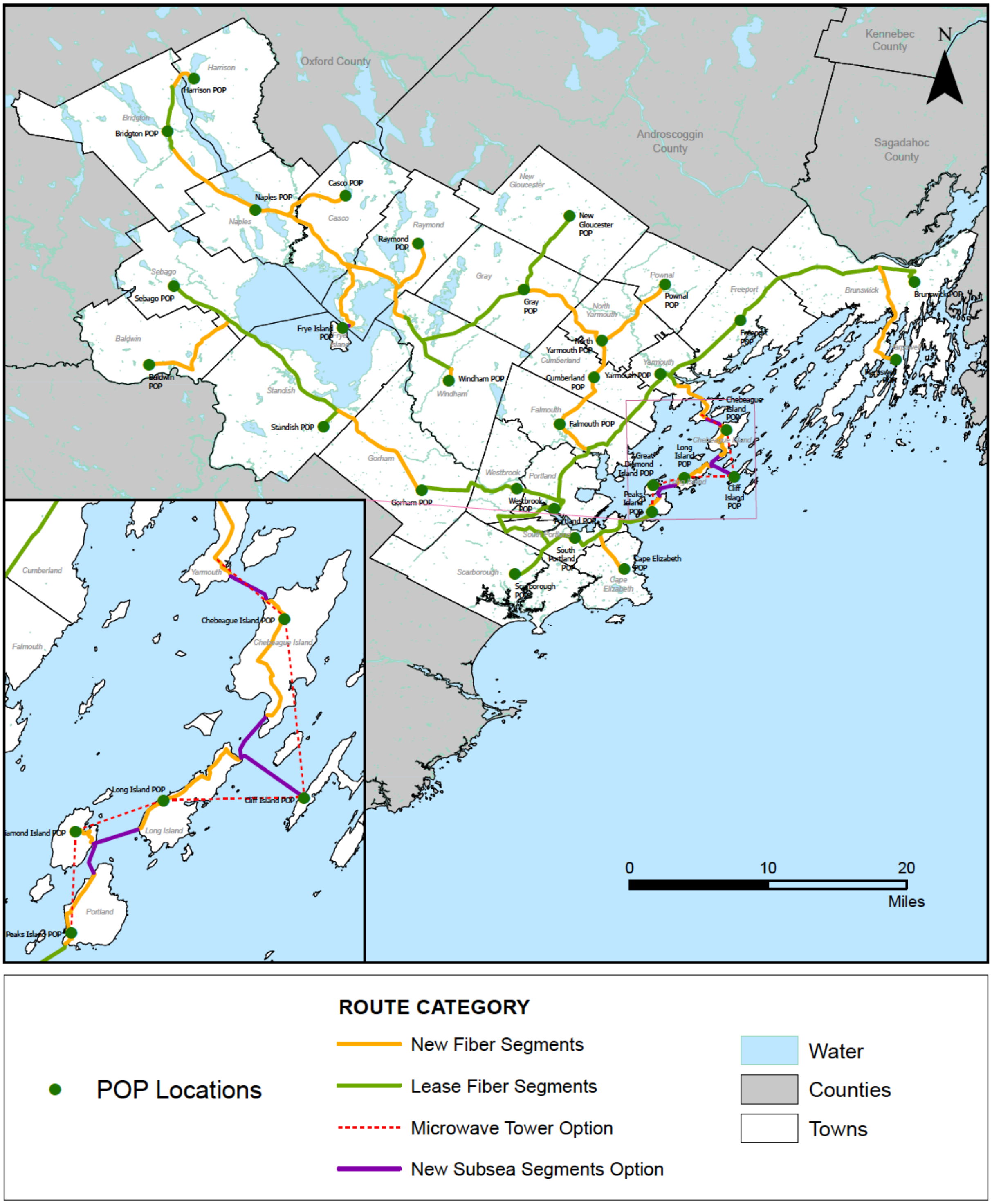
The first of three key objectives this Playbook is intended to provide is a high-level county-wide network design and the corresponding high-level estimated costs to build a major fiber optic artery to each municipality within the County. For the municipally incorporated islands in Casco Bay and on Sebago Lake, and the islands with year-round residents that are a part of another municipality; the design is intended to create a diverse loop from the Portland area through the targeted islands and back to the mainland in the Falmouth/Yarmouth area. The design is intended to incorporate existing privately-owned fiber optic infrastructure wherever it may be available in order to avoid duplication and reduce new construction costs.

While it is important for all municipalities to have access to these major arteries, the County wants each municipality to understand the high-level estimated costs to extend the capability to each potential end-user. Our approach includes a Regional Fiber Optic Backbone leveraging the existing dark fiber available for lease and a complete Fiber-to-the-Home network for each municipality. The following page contains a map of the Regional Fiber Optic Backbone to which the discussion will refer.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

10.1 Regional Fiber Optic Backbone

Map 7: Regional Fiber Optic Backbone



2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

10.1.1 Municipal Points-of-Presence (POP)

Our first task for this exercise was to define the location for a Point-of-Presence (POP) in each municipality that would serve as a central location for the future potential deployment of a Fiber-to-the-Home (FTTH) broadband network (*green dot* ● *on map*).

In a traditional telephone network, this would be the "Central Office" or "CO." Historically, these structures were developed in various sizes depending upon the equipment to be housed and the quantity of potential subscribers to be served. With the advances in technology and miniaturization, these POP structures are now commonly prefabricated concrete structures as small as 8' x 10', up to 8' x 30'. The locations we selected are hypothetical at this point and reflect a balance of the following attributes:

- Reasonably central to the roadway network within each community in order to minimize the distance from the POP to all potential end-user subscribers of a FTTH network;
- Utilizes land owned by the municipality or school system that can be leveraged at lower costs than acquiring commercial properties; and,
- As close to existing dark fiber infrastructure as possible.

The selection of the actual location will be dependent upon a full and detailed FTTH engineering design specific to the municipality. It is also possible to have a single POP location serve multiple communities should a more regional approach be pursued.

The POP location selected for Portland could also serve as a regional POP for the entire County. That location is on the same land as the Maine Fiber Company POP that serves as a regional gateway to the 3-Ring-Binder network and is also the POP location for the Northern New England Neutral Internet Exchange (NNENIX)[6] and Hurricane Electric[7], which provides a peering location to connect to other Internet Service Providers (ISPs) and IP Transit access to the world.

10.1.2 Network Design

With the POP locations overlaid on the maps of dark fiber available for lease, we designed new network routes to connect the municipal POP locations back to the Portland POP, by stitching together a combination of new construction (*orange line* ▬ *on map*) and leasing of existing dark fiber (*green line* ▬ *on map*).

[6] http://www.nnenix.net

[7] Hurricane Electric operates its own global IPv4 and IPv6 network and is considered the largest IPv6 backbone in the world as measured by number of networks connected. Within its global network, Hurricane Electric is connected to over 200 major exchange points and exchanges traffic directly with more than 7,500 different networks.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

Like the selection of the POP locations, the new construction segments of the Backbone are hypothetical in this design and were created by balancing the effort to find the shortest distance to reduce the overall construction cost and having the backbone pass as close to potential commercial and institutional users as possible. The selection of the actual routes will be dependent upon a full and detailed engineering design taking into account a more thorough review of potential users along the route and the costs for making utilities poles and conduits ready for placement of new fiber optic cables.

This desktop design exercise assumed 100% aerial construction and has not taken into account any potential underground segments, which will increase the costs if existing conduit capacity is not available.

In order to create a diverse loop from the Portland area through the targeted islands and back to the mainland in Yarmouth, we examined two (2) different deployment methods. Microwave construction (*dashed red line* ■ ■ ■ ■ *on map*) and subsea fiber optic cable (*purple line* ▬▬ *on map*). Both the microwave and subsea fiber would be new construction with the exception of the route from South Portland to Peaks Island, which is an existing subsea fiber cable available for lease by CMP.

Using this hybrid approach (*leasing existing dark fiber combined with new construction*), the overall length of the Backbone as illustrated in Map 7 is 195.9 miles in length, with 94.2 miles of new aerial construction, 5.0 miles of subsea fiber construction and 96.7 miles of existing dark fiber available for lease. It is interesting to note that close to 50% of such a Regional Backbone is already in place through a combination of at least five (5) dark fiber providers, and for many of the leased route segments, there is more than one provider with available dark fiber capacity.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

10.1.3 Regional Network Costs

The high-level estimated cost for the new construction segments of the **Regional Backbone is <u>$5,625,726</u> if deploying the subsea fiber option**, or **<u>$5,352,378</u> if deploying the microwave option** to connect the islands. The table below provides the breakdown of the costs and is further explained on the following pages.

Table 1: Regional Fiber Optic Backbone Cost Data

Cumberland County - Cost Data

Regional Backbone Cost Assumptions		Annual Pole License Fees				Microwave Construction	
Aerial Construction Cost per Mile	$ 40,000	Consolidated Sole Owned Pole	$ 10.60			Casco Bay Nodes	$ 132,034
Average Poles per mile	33	Consolidated Joint Owned Pole	$ 5.30	$ 23.59	Assume all poles are joint owned	Frye Island Nodes	$ 220,000
20-year IRU per mile per fiber	$ 4,789	CMP Joint Owned Pole	$ 18.29				
Sub-sea Fiber per mile	$ 375,000	CMP Sole Owned Pole	$ 21.60				

	Regional Backbone									
	Aerial Construction				Dark Fiber Capital Lease		Subsea Construction		Microwave Construction	
Municipality	Miles	Estimated Construction Cost	Estimated Quantity of Poles	Annual Pole License Expense	Miles	Estimated 20-Year IRU Cost per Fiber	Miles	Estimated Construction Cost	Nodes	Estimated Design-Build Cost
Baldwin	6.15	$ 246,058	203	$ 4,789	0.02	$ 86	n/a	n/a	n/a	n/a
Bridgton	3.83	$ 153,344	127	$ 2,984	4.87	$ 23,338	n/a	n/a	n/a	n/a
Brunswick	4.01	$ 160,298	132	$ 3,120	8.99	$ 43,033	n/a	n/a	n/a	n/a
Cape Elizabeth	2.14	$ 85,414	70	$ 1,662	n/a	n/a	n/a	n/a	n/a	n/a
Casco	7.84	$ 313,641	259	$ 6,104	n/a	n/a	n/a	n/a	n/a	n/a
Chebeague Island	2.92	$ 116,883	96	$ 2,275	n/a	n/a	1.78	$ 666,291	2.5	$ 330,085
Cliff Island	n/a	n/a	n/a	n/a	n/a	n/a	1.43	$ 537,720	2.5	$ 330,085
Cumberland	3.03	$ 121,198	100	$ 2,359	2.64	$ 12,666	n/a	n/a	n/a	n/a
Falmouth	4.80	$ 192,140	159	$ 3,739	4.32	$ 20,699	n/a	n/a	n/a	n/a
Freeport	n/a	n/a	n/a	n/a	7.71	$ 36,909	n/a	n/a	n/a	n/a
Frye Island	0.07	$ 2,694	2	$ 52	n/a	n/a	0.28	$ 103,298	2.0	$ 264,068
Gorham	6.79	$ 271,746	224	$ 5,289	3.68	$ 17,616	n/a	n/a	n/a	n/a
Gray	3.20	$ 128,017	106	$ 2,491	6.90	$ 33,049	n/a	n/a	n/a	n/a
Great Diamond Island	n/a	n/a	n/a	n/a	n/a	n/a	0.61	$ 227,180	2.5	$ 330,085
Harpswell	3.88	$ 155,158	128	$ 3,020	n/a	n/a	n/a	n/a	n/a	n/a
Harrison	0.97	$ 38,907	32	$ 757	n/a	n/a	n/a	n/a	n/a	n/a
Long Island	2.84	$ 113,477	94	$ 2,208	n/a	n/a	0.86	$ 323,268	2.5	$ 330,085
Naples	7.29	$ 291,654	241	$ 5,676	n/a	n/a	n/a	n/a	n/a	n/a
New Gloucester	n/a	n/a	n/a	n/a	3.46	$ 16,579	n/a	n/a	n/a	n/a
North Yarmouth	9.04	$ 361,564	298	$ 7,037	n/a	n/a	n/a	n/a	n/a	n/a
Peaks Island	1.67	$ 66,675	55	$ 1,298	1.72	$ 8,237	n/a	n/a	n/a	n/a
Portland (mainland)	0.66	$ 26,208	22	$ 510	9.09	$ 43,512	n/a	n/a	n/a	n/a
Pownal	1.86	$ 74,587	62	$ 1,452	n/a	n/a	n/a	n/a	n/a	n/a
Raymond	12.52	$ 500,708	413	$ 9,745	n/a	n/a	n/a	n/a	n/a	n/a
Scarborough	n/a	n/a	n/a	n/a	2.41	$ 11,518	n/a	n/a	n/a	n/a
Sebago	0.60	$ 24,114	20	$ 469	5.28	$ 25,307	n/a	n/a	n/a	n/a
South Portland	0.78	$ 31,262	26	$ 608	9.98	$ 47,794	n/a	n/a	n/a	n/a
Standish	1.00	$ 39,896	33	$ 776	9.12	$ 43,671	n/a	n/a	n/a	n/a
Westbrook	n/a	n/a	n/a	n/a	4.47	$ 21,429	n/a	n/a	n/a	n/a
Windham	2.46	$ 98,420	81	$ 1,915	7.67	$ 36,753	n/a	n/a	n/a	n/a
Yarmouth	3.85	$ 153,909	127	$ 2,995	4.39	$ 21,017	n/a	n/a	n/a	n/a
Totals	**94.2**	**$ 3,767,970**	**3,109**	**$ 73,331**	**96.7**		**5.0**	**$ 1,857,756**	**12.0**	**$ 1,584,408**
							Total Regional Backbone CAPEX	**$ 5,625,726**	**or**	**$ 5,352,378**

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

a) **Regional Backbone Aerial Construction Cost per Mile** - There are a number of variables that will impact the average construction cost per mile, including: the quantity of poles requiring make-ready, the amount of make-ready work required, the fiber count within the cable and the corresponding amount of splices required, the amount of traffic that must be contended with during deployment, to name a few. For purposes of this high-level estimate, we are using an average cost of $40,000, which includes all engineering, make-ready, materials, construction, splicing and testing.

b) **Average Poles per Mile** – The quantity of poles per mile will vary depending upon the population density, the quantity of cables attached to those poles and the type and quantity of electric distribution. For purposes of this high-level estimate, we are using an average quantity of 33, which mirrors our experience on similar projects in Maine.

c) **20-year IRU per Mile per Fiber** – This amount represents the one-time, up-front cost to lease one mile of one strand of fiber over a 2-year period. An IRU (Indefeasible Right to Use) is a contractual arrangement where the buyer of the IRU can unconditionally, and exclusively, use the fiber for a 20-year period and can be considered a one-time investment. Usually, an IRU can be considered to be a physical asset, which can be resold, traded or used as collateral.

   The price contained in the table has been provided by Maine Fiber Company and is the price they currently charge. We made no attempt to determine the price charged by other dark fiber providers but assume their pricing will be similar in this competitive environment.

d) **Subsea Fiber per Mile** – This cost includes all environmental, DEP, Army Corp of Engineers, municipal and archeological permitting, materials, engineering, construction, testing and commissioning. Actual costs cannot be determined until site specific review, design and engineering is conducted. In an effort to minimize permitting costs, we have designed the routes for subsea cables to follow existing cable crossings.

e) **Annual Pole License Fees** – The utility pole owners charge an annual license fee per pole to attach a cable. The majority of poles in Maine are jointly owned by the power company and incumbent telephone company. For purposes of this analysis, we are assuming Central Maine Power (CMP) and Consolidated Communications (CCI) jointly own all of the poles in Cumberland County, but we recognize OTELCO may solely own or jointly own the poles in Gray and New Gloucester. We have included pricing contained in pole attachment agreements we have reviewed in the past *(3 years old)* but made no attempt to determine current pricing. In this analysis, the sum of the fees from CMP and CCI total $23.59 per pole per year. While this expense is not factored into the overall CAPEX for the Regional Backbone or FTTH networks, it is factored into the financial proforma for the ongoing operation of these networks.

f) **Microwave Construction** – The microwave construction amount per node includes the following: site acquisition, municipal approvals, survey, design, civil/structural engineering, FCC registrations, all equipment including poles/towers, installation and commissioning. Path from Peaks Island to Yarmouth includes six (6) poles/towers and five (5) paths. Costs are spread across four (4) islands, resulting in a cost allocation of 2.5 nodes per island. Frye Island, as a single path, results in a higher cost per node.[8]

g) **Cost by Municipality** – All of the costs are detailed by municipality, and the mileage of new construction versus dark fiber capital leases, subsea construction or optional microwave costs are detailed. *It is important to note these costs by municipality are for illustrative purposes only and cannot be utilized for individual municipal planning purposes, as the nature of a regional backbone requires dependencies on adjacent municipalities for service continuity and extension.*

h) **Estimated 20-Year IRU Cost per Fiber** – The costs in this column may appear to be high for the use of a single fiber. Keep in mind this is the total cost for 20 years of use. As example, a single fiber lease in South Portland, a distance of 9.98 miles is $47,794. In reality, the monthly cost is just $199.14 per month (*$47,794 divided by 20 years divided by 12 months*). These fibers would only be leased as needed.

As stated previously, the route design and corresponding costs represent a hypothetical network. Actual routes and costs may differ.

[8] We believe the cost of microwave can be avoided on Frye Island by purchasing bulk access to the Internet from CCI which serves Frye Island with an under-water fiber optic cable. The scope of this desk-top analysis did not include negotiations with CCI to determine the cost/expense of such a solution.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

10.2 Fiber-to-the-Home

Maps depicting FTTH networks each municipality and island can be found in the Appendix.

10.2.1 Municipal Points-of-Presence (POP)

Please refer to Section 10.1.1 for a description of the Municipal POPs

10.2.2 FTTH Network Design

The FTTH maps depict coverage of all roadways, with the exception of limited access, divided highways *(Interstates)* and roadways in a municipality where there are no 911 addresses present. Actual design and engineering will likely identify additional road segments that do not require deployment of fiber but could still provide ubiquitous coverage to all potential subscribers.

The design and corresponding cost data provided in the next section includes both an Open-Access *Dark* Fiber network and an Open-Access *Lit* Fiber network.

An Open-Access *Dark* Fiber network - is a network where the Internet Service Provider (ISP) leases a fiber from the Municipal POP to the subscriber and places their own optical/electronics interface at the subscriber premise to deliver the service.

An Open-Access *Lit* Fiber network - is a network where the municipality would provide the optical/electronics in both the Municipal POP and at the subscriber premise and the ISP would lease both the fiber and the optical/electronics to deliver the service.

10.2.3 FTTH Network Costs

The high-level estimated **cost for the deployment of an open access dark fiber network passing all potential subscribers county-wide, including each municipality or island, is <u>$204,201,943</u>,** assuming 50% of the households passed subscribe to the service from an Internet Service Provider that utilizes the network. Converting this network into **an open access lit fiber network, increases the cost to <u>$233,291,743</u>**. The table below provides the breakdown of the costs and is further explained on the following pages.

Table 2: Fiber-to-the-Home Cost Data

Cumberland County - Cost Data

Fiber-to-the-Home

	Aerial Construction				POP Construction			Drop Construction		ONTs		
								50%	$ 300	$ 500		
Municipality	**Miles**	**Estimated Outside Plant Cost**	**Estimated Quantity of Poles**	**Annual Pole License Expense**	**Population**	**Household Estimate**	**POP CAPEX**	**Take Rate (Subscribers)**	**Subscriber Drop Install Costs**	**ONT Install Costs**	**Total CAPEX Dark Fiber Network**	**Total CAPEX Lit Fiber Network**
Baldwin	64.31	$ 3,215,500	2,122	$ 50,063	1,587	635	$ 250,000	317	$ 95,220	$ 158,700	$ 3,560,720	$ 3,719,420
Bridgton	193.42	$ 9,671,000	6,383	$ 150,572	5,372	2,149	$ 300,000	1,074	$ 322,320	$ 537,200	$ 10,293,320	$ 10,830,520
Brunswick	239.14	$ 11,957,000	7,892	$ 186,163	20,495	8,198	$ 350,000	4,099	$ 1,229,700	$ 2,049,500	$ 13,536,700	$ 15,586,200
Cape Elizabeth	90.01	$ 4,500,500	2,970	$ 70,070	9,304	3,722	$ 300,000	1,861	$ 558,240	$ 930,400	$ 5,358,740	$ 6,289,140
Casco	118.04	$ 5,902,000	3,895	$ 91,891	3,880	1,552	$ 250,000	776	$ 232,800	$ 388,000	$ 6,384,800	$ 6,772,800
Chebeague Island	23.00	$ 1,150,000	759	$ 17,905	349	140	$ 250,000	70	$ 20,940	$ 34,900	$ 1,420,940	$ 1,455,840
Cliff Island	5.08	$ 254,000	168	$ 3,955	100	40	$ 100,000	20	$ 6,000	$ 10,000	$ 360,000	$ 370,000
Cumberland	109.42	$ 5,471,000	3,611	$ 85,180	7,714	3,086	$ 300,000	1,543	$ 462,840	$ 771,400	$ 6,233,840	$ 7,005,240
Falmouth	139.80	$ 6,990,000	4,613	$ 108,830	11,988	4,795	$ 300,000	2,398	$ 719,280	$ 1,198,800	$ 8,009,280	$ 9,208,080
Freeport	148.34	$ 7,417,000	4,895	$ 115,478	8,316	3,326	$ 300,000	1,663	$ 498,960	$ 831,600	$ 8,215,960	$ 9,047,560
Frye Island	17.05	$ 852,500	563	$ 13,273	200	80	$ 100,000	40	$ 12,000	$ 20,000	$ 964,500	$ 984,500
Gorham	202.09	$ 10,104,500	6,669	$ 157,321	17,181	6,872	$ 350,000	3,436	$ 1,030,860	$ 1,718,100	$ 11,485,360	$ 13,203,460
Gray	138.85	$ 6,942,500	4,582	$ 108,091	8,044	3,218	$ 300,000	1,609	$ 482,640	$ 804,400	$ 7,725,140	$ 8,529,540
Great Diamond Island	8.65	$ 432,500	285	$ 6,734	200	80	$ 100,000	40	$ 12,000	$ 20,000	$ 544,500	$ 564,500
Harpswell	155.26	$ 7,763,000	5,124	$ 120,865	4,872	1,949	$ 250,000	974	$ 292,320	$ 487,200	$ 8,305,320	$ 8,792,520
Harrison	101.12	$ 5,056,000	3,337	$ 78,719	2,804	1,122	$ 250,000	561	$ 168,240	$ 280,400	$ 5,474,240	$ 5,754,640
Long Island	11.36	$ 568,000	375	$ 8,843	238	95	$ 250,000	48	$ 14,280	$ 23,800	$ 832,280	$ 856,080
Naples	123.91	$ 6,195,500	4,089	$ 96,460	3,976	1,590	$ 250,000	795	$ 238,560	$ 397,600	$ 6,684,060	$ 7,081,660
New Gloucester	122.07	$ 6,103,500	4,028	$ 95,028	5,679	2,272	$ 300,000	1,136	$ 340,740	$ 567,900	$ 6,744,240	$ 7,312,140
North Yarmouth	67.64	$ 3,382,000	2,232	$ 52,656	3,740	1,496	$ 250,000	748	$ 224,400	$ 374,000	$ 3,856,400	$ 4,230,400
Peaks Island	19.64	$ 982,000	648	$ 15,289	1,000	400	$ 250,000	200	$ 60,000	$ 100,000	$ 1,292,000	$ 1,392,000
Portland (mainland)	246.52	$ 12,325,857	8,135	$ 191,906	66,700	26,680	$ 750,000	13,340	$ 4,002,000	$ 6,670,000	$ 17,077,857	$ 23,747,857
Pownal	47.09	$ 2,354,500	1,554	$ 36,658	1,522	609	$ 250,000	304	$ 91,320	$ 152,200	$ 2,695,820	$ 2,848,020
Raymond	132.89	$ 6,644,500	4,385	$ 103,451	4,526	1,810	$ 250,000	905	$ 271,560	$ 452,600	$ 7,166,060	$ 7,618,660
Scarborough	241.60	$ 12,079,905	7,973	$ 188,077	19,691	7,876	$ 350,000	3,938	$ 1,181,460	$ 1,969,100	$ 13,611,365	$ 15,580,465
Sebago	71.32	$ 3,566,000	2,354	$ 55,520	1,781	712	$ 250,000	356	$ 106,860	$ 178,100	$ 3,922,860	$ 4,100,960
South Portland	123.87	$ 6,193,301	4,088	$ 96,426	25,255	10,102	$ 400,000	5,051	$ 1,515,300	$ 2,525,500	$ 8,108,601	$ 10,634,101
Standish	174.04	$ 8,702,000	5,743	$ 135,485	10,139	4,056	$ 300,000	2,028	$ 608,340	$ 1,013,900	$ 9,610,340	$ 10,624,240
Westbrook	101.32	$ 5,066,000	3,344	$ 78,875	17,886	7,154	$ 350,000	3,577	$ 1,073,160	$ 1,788,600	$ 6,489,160	$ 8,277,760
Windham	235.18	$ 11,759,000	7,761	$ 183,081	17,816	7,126	$ 350,000	3,563	$ 1,068,960	$ 1,781,600	$ 13,177,960	$ 14,959,560
Yarmouth	84.94	$ 4,247,000	2,803	$ 66,123	8,543	3,417	$ 300,000	1,709	$ 512,580	$ 854,300	$ 5,059,580	$ 5,913,880
Totals	**3,556.96**	**$ 177,848,063**	**117,380**	**$ 2,768,988**	**290,898**	**116,359**	**$ 8,900,000**	**58,180**	**$ 17,453,880**	**$ 29,089,800**		
								Total FTTH CAPEX	**$ 204,201,943**	**$ 233,291,743**		
									Dark FiberNetwork	**Lit Fiber Network**		

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

Cost Variables - The cost variables for FTTH construction are similar to the variables for the Regional Backbone discussed above, with the exception and added expense of many more splice cases and splicing costs to facilitate subscriber drop installations. As such, we have increased the construction cost per mile for FTTH from $40,000 to $50,000.

a) **Household Estimate (potential subscribers)** – for purposes of this analysis, we have assumed there are 2.5 individuals per household. We have made no allowance for the quantity of potential business subscribers for the purposes of determining the quantity of subscriber drops.

b) **POP CAPEX** – This the capital expense associated with deploying a POP, along with the corresponding optical/electronics, generator, etc., to enable the FTTH network in each municipality. The costs vary depending upon the population density of each municipality. A single POP could serve multiple municipalities, and a portion of the corresponding cost could be avoided if the municipalities collaborated together to operate a single network.

c) **Subscriber Drop** – This is the fiber connection from the street to the subscriber. This model assumes drops will be installed only for those subscribers who sign up for service.

d) **ONT** – This is the Optical Network Terminal installed at the subscriber to convert the optical signal to an electrical signal and acts as an interface to the subscriber's inside wiring. The cost includes the ONT, battery backup and an allocation for incremental POP optical/electronics to interface with the ONT. This cost category represents the cost difference between a *Dark* Fiber network and a *Lit* Fiber network.

Unlike the cost breakdown for each municipality in the Regional Backbone discussed previously, the cost breakdown by municipality found in the FTTH network table can be utilized by the individual municipality for high-level planning purposes.

As stated previously, the route design and corresponding costs represent a hypothetical network. Actual routes and costs may differ.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

11 5-Year Financial Highlights

11.1 Regional Backbone Proforma

The following table reflects a high-level financial proforma of the hypothetical regional backbone. We believe this reflects a reasonable and conservative representation of the potential financial performance of such an operation. While it does not reflect a robust return on investment, it is important to remember such a regional backbone, like the Maine Fiber Company 3-Ring-Binder network, enables the delivery of high-speed broadband services to many communities not currently competitively served. The variables highlighted in yellow are described in the next section of this Playbook.

Table 3: Regional Backbone Financial Proforma

Regional Backbone Financial Proforma						
		Year 1 Total	Year 2 Total	Year 3 Total	Year 4 Total	Year 5 Total
Revenue						
Circuits sold per month	15					
Circuits in service		180	360	540	720	900
Average miles per circuit	5					
Fiber miles in service		900	1,800	2,700	3,600	4,500
Recurring revenue per fiber per mile	$ 30					
Total recurring revenue		$ 175,500	$ 499,500	$ 823,500	$ 1,147,500	$ 1,471,500
Non-Recurring Installation Fees per circuit	$ 2,000	$ 360,000	$ 360,000	$ 360,000	$ 360,000	$ 360,000
Total Revenue		**$ 535,500**	**$ 859,500**	**$ 1,183,500**	**$ 1,507,500**	**$ 1,831,500**
Operating Expense						
Expense Inflation per year	3%					
Cost of Goods Sold						
Fiber miles leased		450	900	1,350	1,800	2,250
MRC per fiber mile leased	$ 25					
Total fiber lease expense		$ 73,125	$ 208,125	$ 343,125	$ 478,125	$ 613,125
Pole & conduit license		$ 73,331	$ 75,531	$ 77,797	$ 80,131	$ 82,535
Regional POP Lease per month	$ 2,500	$ 30,000	$ 30,900	$ 31,827	$ 32,782	$ 33,765
Utilities / Fuel	$ 400	$ 4,800	$ 4,944	$ 5,092	$ 5,245	$ 5,402
Splicing = Non-Recurring Installation Fees		$ 360,000	$ 360,000	$ 360,000	$ 360,000	$ 360,000
Outside Plant Maintenance per mile per month	$ 25	$ 28,260	$ 29,108	$ 29,981	$ 30,880	$ 31,807
Insurance per month	$ 5,000	$ 60,000	$ 61,800	$ 63,654	$ 65,564	$ 67,531
COGS subtotal		$ 629,516	$ 770,408	$ 911,476	$ 1,052,727	$ 1,194,165
Gross Margin		*$ (94,016)*	*$ 89,092*	*$ 272,024*	*$ 454,773*	*$ 637,335*
		-18%	*10%*	*23%*	*30%*	*35%*
Sales / General / Administrative						
Network Operator - Base Management Fee	$ 60,000	$ 60,000	$ 61,800	$ 63,654	$ 65,564	$ 67,531
Network Operator - Percent of revenue fee	10%	$ 53,550	$ 85,950	$ 118,350	$ 150,750	$ 183,150
Accounting / Legal	$ 12,000	$ 12,000	$ 12,360	$ 12,731	$ 13,113	$ 13,506
Bad debt (per month)	0.25%	(1,339)	(2,149)	(2,959)	(3,769)	(4,579)
Total Operating Expense		**$ 753,727**	**$ 928,369**	**$ 1,103,252**	**$ 1,278,384**	**$ 1,453,773**
EBITDA		(218,227)	(68,869)	80,248	229,116	377,727
		-41%	-8%	7%	15%	21%
Cumulative EBITDA		(218,227)	(287,096)	(206,849)	22,267	399,994

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

11.2 Regional Backbone Operating Assumptions

Revenue

- **Circuits Sold per Month** – Our base model assumes an average of 15 circuits (fibers) will be sold per month with an average distance of each circuit of five (5) miles. Said another way, seventy-five (75) miles of fiber strands will be sold each month, on average. The actuals results will vary widely on a month-to-month basis.

- **Monthly Recurring Revenue per Fiber per Mile** – Our base model assumes pricing of thirty dollars ($30) per mile per fiber per month. This pricing is five dollars ($5) higher than the most common pricing utilized by the Maine Fiber Company 3-Ring-Binder as of this writing.

- **Non-Recurring Installation Fees per Circuit** – This is the average price incorporated into the model and is intended to cover any 3rd party construction and splicing costs to enable the customer to connect their facilities to the fiber.

Expenses

- **Expense Inflation** – The majority of expenses have been increased by a conservative 3% each year.

- **Fiber Miles Leased** – The base assumption of this analysis and model assumes new network will be constructed where existing dark fiber is not available. As mentioned previously, approximately 50% of the total network is made up of leased fiber. As a result, we are assuming 50% of the fiber miles sold per month on average will be obtained by leasing from other providers.

- **Monthly Recurring Revenue per Fiber Mile Leased** - For purposes of this analysis, we are assuming this fiber will cost $25 per mile per month, although in actual practice, this leased fiber could be acquired at a lower cost by entering into long-term IRUs with the underlying providers.

- **Pole & Conduit License** – This represents the annual license fee for the right to utilize the existing utility poles.

- **Regional POP Lease per Month** – This is the cost to lease space for the central office to terminate the regional backbone fiber and provide access to other interconnected service providers.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

- **Utilities / Fuel** – This expense may or may not be included in the POP lease expense.

- **Splicing – Non-Recurring Installation Fees** – This is the companion to the Non-Recurring Revenue item discussed above.

- **Outside Plant Maintenance per Mile per Month** – This is the cost to maintain the fiber cables attached to the utility poles, including repairs, pole transfers, road widening, etc.

- **Insurance** – This is primarily insurance for repair as a result of an act of God.

- **Network Operator** – Management Fee & Percent of Revenue Fee – Combined, this represents the cost to contract with an established network operator to provide overall general management of the network, including marketing, sales, installation, testing, repair coordination, billing, collections and maintenance oversight for the outside plant.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

11.3 Regional Backbone Financial Sensitivities

We have examined the three primary variables that we believe can have the biggest impact on the financial operation performance of the regional backbone network, and consequently, on how such an investment may perform over the long term. Those variables include:

- The price per mile per fiber per month
- The construction cost per mile
- The quantity of circuits sold per month

The table below examines sensitivity of each with a design that utilizes microwave links to serve the islands.

Table 4: Financial Sensitivities - Regional Backbone with Microwave Links to Islands

Regional Backbone with Microwave Links to Islands									
	Price per Mile per Fiber per Month			Construction Cost per Mile			Circuits Sold per Month		
Key Finance Assumptions	28	30	32	30,000	40,000	50,000	14	15	16
Debt Amount	5,352,378	**5,352,378**	5,352,378	4,410,386	**5,352,378**	6,294,371	5,352,378	**5,352,378**	5,352,378
Tax Exempt Funding Rate	3.75%	**3.75%**	3.75%	3.75%	**3.75%**	3.75%	3.75%	**3.75%**	3.75%
Assumed (target) Tenor (years)	25	**25**	25	25	**25**	25	25	**25**	25
Amortization (years)	20	**20**	20	20	**20**	20	20	**20**	20
Financial Outcomes									
Net Debt	5,352,378	**5,352,378**	5,352,378	4,410,386	**5,352,378**	6,294,371	5,352,378	**5,352,378**	5,352,378
Average Debt Service Coverage Ratio	0.85x	**1.12x**	1.39x	1.36x	**1.12x**	0.95x	0.98x	**1.12x**	1.26x
Loan Life Coverage Ratio	1.39x	**1.85x**	2.31x	2.24x	**1.85x**	1.57x	1.61x	**1.85x**	2.08x
Net Equity (or tax exempt working capital)	1,577,825	**808,991**	718,831	703,017	**808,991**	1,219,964	1,019,845	**808,991**	767,476
IRR Result	-11.27%	**6.25%**	16.52%	13.63%	**6.25%**	-2.09%	-0.48%	**6.25%**	11.68%
Enterprise Value	6,930,203	**6,161,369**	6,071,210	5,113,403	**6,161,369**	7,514,335	6,372,223	**6,161,369**	6,119,855
EBITDA Performance									
Positive EBITDA Achieved in month	28	**24**	22	24	**24**	24	26	**24**	23
Monthly EBITDA in Month 60	29,367	**37,489**	45,612	37,489	**37,489**	37,489	33,312	**37,489**	41,667
Cumulative EBITDA in Month 60	152,258	399,994	647,730	399,994	399,994	399,994	278,333	399,994	521,655

- **Price per Mile per Fiber per Month** – Setting the construction cost per mile at $40,000 and the circuits sold per month at 15, we ran the model using the price per mile per fiber per month at $28, $30 and $32. The return at $28 generates a negative return, while the return at $32 provides an attractive return. We believe $30 per month is both conservative and a competitive rate in the marketplace for those route segments with competitive providers.

- **Construction Cost per Mile** – Construction costs can vary widely based upon the amount of utility pole make-ready required, the labor rates employed and the availability of construction contractors. Setting the price per mile per fiber per month at $30 and the circuits sold per month at $15, the ability to drive construction costs to $30,000 per mile results in an attractive return, while the excessive cost of $50,000 per mile generates a negative return. We believe $40,000 per mile is conservative and actual constructions costs will be less based upon our

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

experience with construction costs in similar projects.

- **Circuits Sold per Month** – This variable is perhaps the most difficult to forecast as actual demand for the service is difficult to predict. A slight change in demand *(one circuit less or more)* can cause the return to swing to negative or positive. We believe our forecast of 15 circuits per month at an average of 5 miles per circuit, or 75 miles of fiber strand sold per month is conservative.

In the table below, we examine the same sensitivities, but in this example, we replace the microwave link with subsea fiber to connect to the islands.

Table 5: Financial Sensitivities - Regional Backbone with Subsea Links to Islands

Regional Backbone with Subsea Links to Islands									
	Price per Mile per Fiber per Month			Subsea Construction Cost per Mile			Circuits Sold per Month		
Key Finance Assumptions	28	30	32	250,000	375,000	500,000	14	15	16
Debt Amount	5,625,726	**5,625,726**	5,625,726	5,006,474	**5,625,726**	6,244,979	5,625,726	**5,625,726**	5,625,726
Tax Exempt Funding Rate	3.75%	**3.75%**	3.75%	3.75%	**3.75%**	3.75%	3.75%	**3.75%**	3.75%
Assumed (target) Tenor (years)	25	**25**	25	25	**25**	25	25	**25**	25
Amortization (years)	20	**20**	20	20	**20**	20	20	**20**	20
Financial Outcomes									
Net Debt	5,625,726	**5,625,726**	5,625,726	5,006,474	**5,625,726**	6,244,979	5,625,726	**5,625,726**	5,625,726
Average Debt Service Coverage Ratio	0.81x	**1.07x**	1.33x	1.20x	**1.07x**	0.96x	0.94x	**1.07x**	1.20x
Loan Life Coverage Ratio	1.32x	**1.76x**	2.20x	1.98x	**1.76x**	1.58x	1.53x	**1.76x**	1.98x
Net Equity (or tax exempt working capital)	1,899,612	**872,232**	749,583	770,077	**872,232**	1,184,120	1,213,258	**872,232**	798,228
IRR Result	negative	**4.01%**	14.56%	9.00%	**4.01%**	-1.59%	-3.46%	**4.01%**	9.66%
Enterprise Value	7,525,338	**6,497,959**	6,375,310	5,776,551	**6,497,959**	7,429,099	6,838,985	**6,497,959**	6,423,955

The scope of this Playbook project did not include a detailed examination of the costs for subsea fiber construction, which can vary widely depending upon the permitting process and construction coordination. As you can see, the returns can vary significantly as the cost decreases or increases. Before making a decision on deploying microwave, we believe a detailed examination of the cost of deploying subsea fiber is warranted, as the capacity of fiber is exponentially greater than microwave and the costs to place fiber *could be* less.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

11.4 Fiber-to-the-Home Proforma

The following table reflects a high-level financial proforma of the hypothetical Fiber-to-the-Home network. We believe this reflects a reasonable and conservative representation of the potential financial performance of such an operation. The variables highlighted in yellow are described in the next section of this Playbook.

Table 6: Fiber-to-the-Home Financial Proforma

Fiber-to-the-Home Financial Proforma						
		Year 1 Total	Year 2 Total	Year 3 Total	Year 4 Total	Year 5 Total
Revenue						
Potential subscribers	120,000					
Market share end of 5th year	40%					
Subscribers added by month		10,656	12,960	15,264	17,568	19,872
Subscribers disconnected by month	2%	(1,056)	(3,360)	(5,664)	(7,968)	(10,272)
Subscribers in service, net of disconnects		9,600	19,200	28,800	38,400	48,000
Monthly recurring revenue	$ 60	$ 3,744,000	$ 10,656,000	$ 17,568,000	$ 24,480,000	$ 31,392,000
Non-Recurring Installation Charge per subscriber	$ 60	$ 639,360	$ 777,600	$ 915,840	$ 1,054,080	$ 1,192,320
Total Revenue		**$ 4,383,360**	**$ 11,433,600**	**$ 18,483,840**	**$ 25,534,080**	**$ 32,584,320**
Cumulative Revenue since Inception		**$ 4,383,360**	**$ 15,816,960**	**$ 34,300,800**	**$ 59,834,880**	**$ 92,419,200**
Operating Expense						
Expense Inflation per year	3%					
Cost of Goods Sold						
IP Transit (Internet Capacity) - % of revenue	1%	$ 37,440	$ 106,560	$ 175,680	$ 244,800	$ 313,920
Pole & conduit license		$ 2,768,988	$ 2,852,057	$ 2,937,619	$ 3,025,748	$ 3,116,520
Utilities / Fuel	$ 10,400	$ 124,800	$ 128,544	$ 132,400	$ 136,372	$ 140,463
Outside Plant Maintenance per mile per month	$ 25	$ 1,067,088	$ 1,099,101	$ 1,132,074	$ 1,166,036	$ 1,201,017
Insurance per mile per month	$ 15	$ 640,253	$ 659,461	$ 679,244	$ 699,622	$ 720,610
COGS subtotal		$ 4,638,569	$ 4,845,723	$ 5,057,018	$ 5,272,578	$ 5,492,531
Gross Margin		*$ (255,209)*	*$ 6,587,877*	*$ 13,426,822*	*$ 20,261,502*	*$ 27,091,789*
		-6%	*58%*	*73%*	*79%*	*83%*
Sales / General / Administrative						
Network Operator - Base Management Fee	$ 100,000	$ 100,000	$ 103,000	$ 106,090	$ 109,273	$ 112,551
Network Operator - Fee per subscriber	$ 10	$ 624,000	$ 1,776,000	$ 2,928,000	$ 4,080,000	$ 5,232,000
Marketing	4%	$ 149,760	$ 426,240	$ 702,720	$ 979,200	$ 1,255,680
Accounting / Legal	$ 24,000	$ 24,000	$ 24,720	$ 25,462	$ 26,225	$ 27,012
Bad debt (per month)	2%	($87,667)	($228,672)	($369,677)	($510,682)	($651,686)
Total Operating Expense		**$ 5,448,662**	**$ 6,947,011**	**$ 8,449,613**	**$ 9,956,594**	**$ 11,468,088**
EBITDA		(1,065,302)	4,486,589	10,034,227	15,577,486	21,116,232
		-24%	39%	54%	61%	65%
Cumulative EBITDA		**($1,065,302)**	**$3,421,287**	**$13,455,515**	**$29,033,000**	**$50,149,232**
Success-based CAPEX						
Drop & ONT Installations	$ 800	$ 8,102,400	$ 9,024,000	$ 9,945,600	$ 10,867,200	$ 11,788,800
Total Success-based CAPEX		**$ 8,102,400**	**$ 9,024,000**	**$ 9,945,600**	**$ 10,867,200**	**$ 11,788,800**
Cumulative Success-based CAPEX since Inception		$ 8,102,400	$ 17,126,400	$ 27,072,000	$ 37,939,200	$ 61,516,800

11.5 Fiber-to-the-Home Operating Assumptions

Revenue

- **Potential Subscribers** – This quantity was determined by dividing the population of Cumberland County by 2.5 to represent the number of households and then rounding up to the nearest 10,000. No attempt has been made to include potential business subscribers of the network. We believe this is a very conservative calculation and the quantity of potential subscribers could be significantly higher.

- **Market Share End of 5th Year** – We believe our base assumption of 40% market share is achievable based upon our experience in another northern New England jurisdiction with similar levels of competition.

- **Subscribers Added per Month** - The quantity assumes disconnected subscribers are replaced the month the disconnect occurs.

- **Disconnect Percent per Month** - Includes subscribers who disconnect to move to another provider and disconnects to move to another location and reconnect.

- **Monthly Recurring Revenue per Subscriber** – Our base model assumes pricing of sixty dollars ($60) as the average revenue per subscriber.

- **Non-Recurring Installation Fees per Subscriber** – Our base model assumes a one-time installation fee equal to the monthly recurring fee.

Expenses

- **Expense Inflation** – The majority of expenses have been increased by a conservative 3% each year.

- **IP Transit** - This is the bulk connection to the Internet that all FTTH subscribers share. A large portion of the data would bypass this connection as peering arrangements are established with other large networks, such as the local Cable TV company, local telephone company, and the large content providers, such as Google, Apple, Microsoft, etc., where Internet traffic in both directions would be exchanged at little or no cost.

- **Pole & Conduit License** – This represents the annual license fee for the right to utilize the existing utility poles.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

- **Utilities / Fuel** – Electric and fuel expenses for POPs in each community.

- **Outside Plant Maintenance per Mile per Month** – This is the cost to maintain the fiber cables attached to the utility poles, including repairs, pole transfers, road widening, etc.

- **Insurance** – This is primarily insurance for repair as a result of an act of God.

- **Network Operator – Management Fee & Fee per Subscriber** – Combined, this represents the cost to contract with an established network operator to provide overall general management of the network, including marketing, sales, installation, testing, repair coordination, billing, collections and maintenance oversight for the outside plant.

- **Drop & ONT Installations** - as new subscribers are added to the network, a drop from the street to the home will be installed along with an Optical Network Terminal (ONT) which is the demarcation point between the subscriber and the network. The costs for the drop and ONT are considered capital expenses. In this model, we refer to this type of CAPEX as "success-based", meaning there would be no cost unless a subscriber is being added to the network.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

11.6 Fiber-to-the-Home Financial Sensitivities

We have examined the three primary variables that we believe can have the biggest impact on the financial operation performance of the FTTH network, and consequently, on how such an investment may perform over the long term. Those variables include:

- Monthly Revenue per Subscriber
- The construction cost per mile
- Market Share achieved

The table below examines sensitivity of each.

Table 7: Financial Sensitivities - Fiber-to-the-Home

Fiber-to-the-Home Network									
	Monthly Revenue per Subscriber			Construction Cost per Mile			Market Share		
Key Finance Assumptions	**50**	**60**	**70**	**40,000**	**50,000**	**60,000**	**35%**	**40%**	**45%**
Debt Amount	233,291,743	**233,291,743**	233,291,743	197,722,130	**233,291,743**	268,861,356	233,291,743	**233,291,743**	233,291,743
Target Leverage	100.00%	**100.00%**	100.00%	100.00%	**100.00%**	100.00%	100.00%	**100.00%**	100.00%
Taxable Funding Rate	4.50%	**4.50%**	4.50%	4.50%	**4.50%**	4.50%	4.50%	**4.50%**	4.50%
Tax Exempt Funding Rate	3.75%	**3.75%**	3.75%	3.75%	**3.75%**	3.75%	3.75%	**3.75%**	3.75%
Assumed (target) Tenor (years)	25	**25**	25	25	**25**	25	25	**25**	25
Amortization (years)	20	**20**	20	20	**20**	20	20	**20**	20
Target Return	14.00%	**14.00%**	14.00%	14.00%	**14.00%**	14.00%	14.00%	**14.00%**	14.00%
Financial Outcomes									
Net Debt	233,291,743	**233,291,743**	233,291,743	197,722,130	**233,291,743**	268,861,356	233,291,743	**233,291,743**	233,291,743
Minimum DSCR	-	**-**	-	-	**-**	-	-	**-**	-
Average Debt Service Coverage Ratio	0.86x	**1.24x**	1.61x	1.46x	**1.24x**	1.07x	1.00x	**1.24x**	1.47x
Loan Life Coverage Ratio	1.43x	**2.05x**	2.68x	2.42x	**2.05x**	1.78x	1.66x	**2.05x**	2.45x
Net Equity (or tax exempt working capital)	57,591,610	**21,643,499**	17,279,565	17,641,917	**21,643,499**	28,416,420	32,659,852	**21,643,499**	18,215,786
IRR Result	-11.89%	**14.94%**	33.57%	24.07%	**14.94%**	6.38%	1.51%	**14.94%**	26.70%
Enterprise Value	290,883,353	**254,935,242**	250,571,308	215,364,048	**254,935,242**	297,277,776	265,951,595	**254,935,242**	251,507,529
EBITDA Performance									
Positive EBITDA Achieved in month	20	**16**	13	16	**16**	16	18	**16**	14
Monthly EBITDA in Month 60	1,210,801	**1,689,390**	2,167,978	1,689,390	**1,689,390**	1,689,390	1,390,448	**1,689,390**	1,988,331
Cumulative EBITDA in Month 60	19,779,380	34,612,244	49,445,108	34,612,244	34,612,244	34,612,244	25,317,596	34,612,244	43,906,892

- **Monthly Revenue per Subscriber** – Setting the construction cost per mile at $50,000 and the market share achieved at 40%, we ran the model using the monthly revenue per subscriber at $50, $60 and $70. The return at $50 generates a negative return, while the return at $70 provides a very attractive return. We believe $60 per month is both conservative and a competitive rate in the marketplace.

- **Construction Cost per Mile** – Construction costs can vary widely based upon the amount of utility pole make-ready required, the labor rates employed and the availability of construction contractors. Setting the monthly revenue per subscriber at $60 and the market share at 40%, the ability to drive construction costs to $40,000 per mile results in a very attractive return,

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

while the excessive cost of $60,000 per mile produces a positive, yet less than desirable return. We believe $50,000 per mile is conservative.

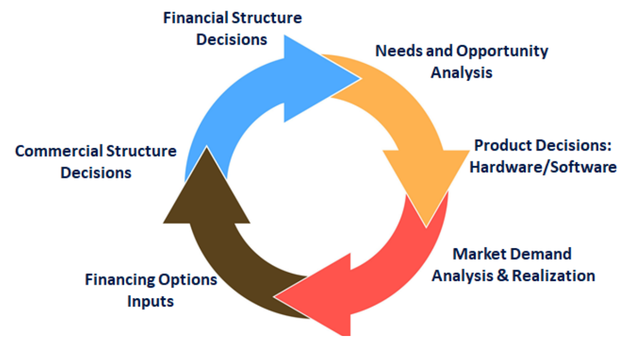
- **Market Share** – This variable is perhaps the most difficult to forecast as actual demand for the service is difficult to predict. The competition, especially by the local Cable TV provider who has a large, national presence has considerable power to lower pricing to retain market share. Lower competitor pricing will also drive down the potential per subscriber monthly revenue of this network, making it more difficult to produce attractive returns. Of course, if this network provides local, responsive customer service, combined with service performance guarantees, effective competion with the Cable TV company should be achievable. Under this model, a market share of at least 35% will be required to produce positive returns. As mentioned previously, we believe our base assumption of 40% market share is achievable based upon our experience in another northern New England jurisdiction with similar levels of competition.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

12 Financing Options

Development of financial and commercial structures for broadband infrastructure and service implementation is an iterative and interactive process, with interdependencies among all aspects of a project: All aspects of a project's development impact its financing, and the financing informs project development. Interdependent elements include physical and system infrastructure choices, market demand and pricing, public support, commercial model, financing cost, availability and structure.

Figure 4: Iterative Financing Process



The financing options and outcomes discussed below begin the iterative interaction toward a final commercial and financial structure.

12.1 Economic and Financing Outcomes

The proforma financial model reveals robust economic and financial results, commensurate with risks associated with broadband development in Cumberland County, and sufficient to enable competitive financing of the project(s). Net revenues (EBITDA) from project operations total over $590 million over a 25-year hypothetical concession term, versus a gross projected capital expenditure of $252 million (including capitalized interest and reserve funding).

The model permits analysis of taxable and tax-exempt structures (with or without privately funded equity). Assumptions used in modeling are consistent with current market practice and are intended to reflect general assumed financing levels and metrics, as appropriate for this early stage of planning and development. Outcomes of the modeling are shown in the table below:

Table 8: Financial Modeling Outcomes

Assumptions; Metric	Taxable Funding	Tax-Exempt Funding
Resulting CapEx	$251,910,208	$270,345,722
Financial Leverage	75.00%	100%
Amortization	20-Year	25-Year
Average Debt Svce. Coverage	1.83x	1.59x
Loan Life Coverage	3.30x	2.47x
Equity Return (25-year IRR)	11.53%	N.A.
Equity Cross-over	10 years	N.A.
Total Interest Expense	$136,635,029	$133,385,766

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

The metrics resulting from the 'test' finance modelling indicate generally likely financability for implementation of the broadband strategy, subject to further review, due diligence and structuring. As is common, movements in interest rates, capital costs, market demand, competing products, and financial market receptivity all dictate actual outcomes in implementation.

12.2 Financing Availability and Options

Based upon the above outcomes from the preliminary financial review and current understanding of financial market conditions, funding may be available from a variety of sources. Depending upon timing of market approach and desired outcomes, certain funding sources may be more desirable than others, or may confer greater or lesser benefits for the issuer. Certain characteristics of potential project finance sources are discussed below. All of these funding sources should be considered viable options for Cumberland County.

Commercial Bank Debt

Local, regional and international commercial banks have been historically reliable lenders to the telecom/broadband industry and collateralized non-recourse project finance generally.

Commercial banks have the benefit of being able to structure relatively flexible loan products. These can include short term 'bullet' structures (intended to be refinanced) and longer-term amortizing loans spanning all or most of a project's useful life.

Commercial bank project finance lenders utilize a variety of metrics in assessing credit quality, including debt service coverage, loan-to-value, and collateral value considerations.

In recent years commercial banks have been more challenged to provide very long term (> 10 year) funding, due to erosion of deposit bases and revised capital adequacy restrictions. Commercial banks frequently require hedging of interest rates for longer term obligations, against floating rate indices.

Institutional Debt (taxable)

Institutional loans, notes and bonds are funds sourced in a variety of formats from non-bank lenders. These include 'duration matching' and 'real money' investors, such as life insurance companies, endowments, pensions, and corporate credit enterprises, and 'intermediary' funds, such as private debt funds and mutual fund investors.

Historically, institutions have provided long-term fixed-rate funding to match obligations over a similar period. Loans, notes or bonds

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

for credit worthy project financings have taken a variety of forms. Very often institutional debt assumes the form of Regulation D ("Reg D") debt, based on long-term note purchase agreements not required to be registered with the SEC. Such debt forms are funded by Qualified Institutional Buyers ("QIBs") and are executed similar to bank facilities. In other circumstances, institutional debt can be SEC registered or issued with registration rights, where deemed helpful to ensure liquidity in the market.

Institutional debt is generally issued for "investment grade" debt (ie. with issued or inferred credit ratings of BBB-/Baa3 or better), however liquidity does exist for sub-investment grade assets, albeit in smaller amounts, with higher pricing and shorter durations. The decision to seek credit ratings or not, depends upon project complexity and other features, pricing targets, and the size and liquidity of facilities. Frequently institutional lenders will rely on opinions of the NAIC SRO (Securities Valuations Office).

In general, where institutional debt excels in duration and pricing, it struggles in terms of structuring flexibility. Institutions frequently lack administrative capacity to facilitate incremental drawdowns and reporting-heavy transaction mechanics.

Tax Exempt Notes and Bonds

Depending upon the disposition of the assets, debt for the project might be provided on a tax-exempt basis. In particular, in the case that project assets or improvements are the property of the County or municipalities, municipal revenue bonds are likely to be a real option for financing.

Tax exempt debt for such projects is usually offered on a fixed or swapped basis for longer tenors, often consistent with the project's useful life. Although tax exempt funds lack much of the structuring flexibility, similar to institutional debt, certain features are routinely accepted that facilitate project finance dynamics, such as CABs (Capital Appreciation Bonds) and 'step-up' coupon debt service.

Tax-exempt issues are underwritten and purchased primarily by tax-exempt mutual funds and their managers, on behalf of investors seeking tax-exempt income. This aspect provides an added incentive that frequently confers pricing tension that transcends the credit and economics of the project.

Like institutional debt, tax exempt issues can be rated or unrated (with corresponding impacts on price and terms). Issuance of tax-

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

exempt debt requires an opinion from a qualified tax-exempt bond counsel indicating the basis and qualification of such facility's tax exemption.

Project Finance Equity Equity (ie. funded instruments conferring rights of ownership) in project finance assets is a highly attractive and competitive financing instrument, sought after by investors in alternative and real assets. Buyers of project finance equity are frequently also buyers of real estate trusts, MLPs and similar hard-asset-linked character, due to such assets' inherent revenue generation potential.

Equity funding confers the 'ultimate' funding flexibility and is sourced from a wide variety of providers. Project equity is significantly risk-sensitive, pricing risk as one of few structuring tools available to project owners.

For purposes of an issuer such as the subject project, a key distinction among equity providers is between near- and long-term investors. Shorter term investors seek to dispose of assets in a shorter window (frequently 5-7 years), often combining multiple projects into operating businesses, and seeking operational and financial uplift. Long-term investors will 'buy and hold' investments, seeking long term reliable income. Both formats have implications for structuring and pricing of project financings.

Other forms of financing are heavily dependent upon ultimate structure of a project, and might be available to a project finance issuer, on a specialized basis.

Lease Finance Parts or all of a project might be considered a leased asset, and thereby attract lease debt and equity investors. Such investors are frequently attracted to specific tax benefits of certain types of depreciating project lease assets.

Vendor Financing Manufacturers of broadband equipment and software sometimes offer purchase funding, often coupled with long-term service agreements that support their larger businesses. Offshore OEMs may also utilize export credit agency facilities which can offer extremely competitive funding rates and terms.

Agency programs Tax credits, technology grants, rural benefit programs, and other types of government agency incentives might be available for broadband projects, depending upon the specific characteristics of the project.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

Certain Public Markets In certain circumstances, a project may be able to issue public market debt or equity without registration requirements. In particular, certain beneficial dispensations are provided for issues to investors within a state or jurisdiction where the project and its revenues are also derived in the same jurisdiction. These can have benefits for local acceptance and receptivity to a project.

12.3 Financing Alternatives and Corresponding Commercial Structures

Determining the optimal commercial structure for a project depends upon a variety of factors, including determination of a best-fit financing solution. Chief among considerations in structuring is disposition of project assets, both during the project term and at its conclusion. Decisions about project disposition frequently hinge on issues of control, local ordinances, and public perception of local government scope of responsibility.

A variety of structures correspond to the many sources of financing discussed above. In a subsequent iteration of considering financing and commercial options, Cumberland County should consider and review, among others, commercial structures including:

- Public (county or municipally) owned and operated project(s)
- Public owned/financed assets, with private implementation and operation
- Municipal lease of assets (capital or operating) to private developer/operators
- Privately owned and operated assets (under BOO/BOT) structures
- Publicly developed project asset with subsequent sale or lease to private parties

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

13 Utility Operating Models

There are a number of viable models available to build and operate both a regional backbone and a FTTH network. This can be accomplished on an individual municipal basis, as a group of similarly situated or logically situated municipalities, or on a county-wide basis. As example, logical groups could include:

- Gorham and Windham
- New Gloucester, Gray and Raymond
- Cape Elizabeth, South Portland and Scarborough

Depending upon the road network *(utility pole rights-of-way)* and shared communities of interest, each municipality could be associated with a regional operating entity.

The financial models presented in this Playbook assume a county-wide implementation of both the regional backbone and FTTH network.

13.1 Public-Private Partnership with Incumbent Provider

The lowest cost solution with the least amount of risk for a municipality is to partner with an incumbent provider to upgrade and expand an existing network. An existing provider has the following advantages:

- Nearly ubiquitous infrastructure that can be upgraded at much lower cost than over-building with new infrastructure. For example, the local phone company already has cabling attached to the utility poles where new fiber cables can be over-lashed without incurring the utility pole make-ready costs, which typically represent 20% - 40% of new construction costs.

- Operational and maintenance infrastructure is already in place and trained, including, vehicles, customer service, network monitoring, billing, etc.

- Less competition to enable greater potential market share resulting in a lower potential capital contribution from the municipality.

In this type of arrangement, the service provider assume 100% of the ongoing operating risk and the municipality's involvement is limited to funding an agreed upon subsidy, that may or may not include pricing and performance guarantees. The drawback to this type of arrangement is that the municipality has little control over the operation of the network.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

13.2 Public-Private Partnership with New Provider

Providing a public subsidy to a new provider to over-build the incumbent networks carries the same benefits and drawbacks as partnering with the incumbents, with the exception that this solution is more expensive due to the additional utility pole make-ready costs. An added benefit to this arrangement is the likelihood of being able to negotiate greater pricing and performance guarantees with a new provider.

As an example, Franklin County, Maine, is in the midst of collaborating with a new service provider to apply for USDA low interest loans to deploy their network in eleven (11) of its thirty-six (36) participating communities. Franklin County is also collaborating with another new provider proposing to deploy their network in sixteen (16) of its participating communities. Similar opportunities are likely available to the communities within Cumberland County.

This arrangement is also likely the most cost-effective arrangement to achieve the County's vision for a regional fiber optic backbone. During the course of developing this Playbook, more than one dark fiber provider has expressed interest in collaborating with the County to achieve this vision.

13.3 Municipally Owned Network

Many communities in Maine and across the United States are pursuing the development of a municipally owned network and the high-level network designs and financial modeling in this Playbook have been developed with this arrangement in mind. While this is the costliest arrangement and carries the greatest risk, the municipalities or County retains 100% control and responsibility for the operational and financial performance.

As mentioned elsewhere in this Playbook, a municipally owned network can be operated in three different ways.

- **Open-Access *Dark* Fiber network** - is a network where the Internet Service Provider (ISP) leases a fiber from the Municipal POP to the subscriber and places their own optical/electronics interface at the subscriber premise to deliver the service.

- **Open-Access *Lit* Fiber network** - is a network where the municipality would provide the optical/electronics in both the Municipal POP and at the subscriber premise and the ISP would lease both the fiber and the optical/electronics to deliver the service.

- ***Closed*-Access Lit Fiber network** - is a traditionally operated network where the municipality is responsible for and provides all service components of the network and is the sole service provider operating on the network. In other words, any competition must build their own infrastructure to compete.

The cost modeling in this Playbook can be utilized to support each of these three different models, while the financial proformas support only the Closed-Access Lit Fiber network model.

13.4 Municipally Owned Network Staffing Model

Within the financial proformas for both the regional backbone and FTTH networks, we have assumed all staffing will be outsourced to an experienced network operator. At the outset, this arrangement will provide the least amount of risk, although we recognize a qualified team could be assembled at a similar cost.

The best arrangement, especially in the beginning, would be to create a general manager position and senior leadership team under the Cumberland County umbrella who would be responsible for the overall success of the network and outsource all other staffing to a qualified network operator, with the contractual ability to transition to an internal team over time.

13.5 Shared Services Model

If the individual communities within Cumberland County decided to pursue a network for their community on their own or as a group of communities, the County could create a shared services model to assist the municipalities with the planning, engineering, construction and operations of the individual networks, including:

- Negotiating contracts with Internet service providers
- Negotiating contracts with construction and maintenance firms
- Serving as the fiscal agent on behalf of the participating municipalities
- Performing legal work, make-ready negotiations and all other functions required for building and maintaining broadband service

Whatever solution is determined, County-wide or individual municipalities, scale matters. The larger the initiative, the lower the per unit costs for equipment and construction and the more efficient the operation will perform. Every consideration should take this reality into account.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

14 Opportunities and Risks of Municipal Ownership

The opportunities and risks of municipal ownership of an Open Access Fiber-to-the-Home (FTTH) network are unique to each community. The table below and the discussion following highlights some of the considerations but is not intended to be an exhaustive accounting.

Table 9: Municipal Ownership - Opportunities & Risks

Municipal Ownership - Open Access Fiber-to-the-Home (FTTH) Network	
Opportunities	**Risks**
100% Coverage and Availability	Technical Obsolescence
100% Control of Quality and Price	Competitive Services
Citizens Influence of Outcomes	Competitive Pricing Power
Net Neutrality Assurance	Sustainability
Unlimited Capacity	
Promotes Competition	
Eliminates need for duplicative infrastructure	
Facilitates deployment of 4G & 5G Wireless Services	
Enables "Smart Cities" Applications	
Promotes Economic Development	
Increases Property Values	

14.1 Opportunities

100% Coverage and Availability – Many communities, especially rural, lack sufficient broadband coverage due to lack of population density to attract for-profit investment. A municipal investment does not need to provide a for-profit type return-on-investment (ROI) over a short period of time common with private investment expectations. Rather, the principal and interest can be paid over a long term, 20-years or more, and cash flow only needs to provide for operation and maintenance of the network and service provided. A community could also decide to subsidize the ongoing operation of such a network over the long-term if subscriber revenue is not sufficient. As a result, a municipally-owned network could provide a much greater degree of geographic coverage.

100% Control of Quality and Price – Many of the large, for-profit, publicly-traded incumbent service providers are willing to sacrifice service quality and customer service, charge high prices and require the purchase of confusing bundled services, in order to generate profits to meet their investors demands for improvements in their financial results and corresponding stock price. This is especially true in communities without a sufficient level of competition. Municipally-owned networks can make decisions regarding the quality of service and pricing without investor pressure for profits.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

Citizens Influence of Outcomes – Unlike large, for-profit companies, municipally-owned networks are part of the local government where citizens have much greater access to the decisionmakers and community leaders (*town/city managers, mayors, councils, select boards*). Municipal government has far greater transparency, forums for input, citizens can intervene if their service needs are not being met and local government leaders can be held accountable to their subscribers.

Net Neutrality Assurance – Net neutrality is the principle that Internet service providers (ISPs) must treat all Internet communications equally, and not discriminate or charge differently based on user, content, website, platform, application, type of equipment, or method of communication. In a municipally-owned network, citizens determine net neutrality, not private for-profit corporations.

Unlimited Capacity – Fiber networks have the capability for virtually unlimited bandwidth. FTTH networks are commonly configured with symmetrical 1Gbps service to each home and can easily be upgraded to 10Gbps service.

Promotes Competition – An open access FTTH network allows an unlimited number of Internet Service Providers (ISPs) to provide a retail service across the network. Subscribers can choose who they do business with and are free to change providers at their discretion. The cost of entry into the market for ISPs is dramatically reduced because they don't need to construct their own network, rather, the ISP simply connects to the FTTH network at a centralized interconnection point (POP) and utilizes the open access FTTH network to reach their subscribers.

Eliminates Need for Duplicative Infrastructure – With an open access FTTH network, there is no need for other providers to attach cables to utility poles or dig up the streets / sidewalks to construct their own network.

Facilitates Deployment of 4G and 5G Wireless Services – A ubiquitous, community-wide FTTH network can easily serve the needs of wireless service providers seeking to expand and densify their 4G and 5G network deployments.

Enables "Smart Cities" Applications – The foundation for deployment of 5G and the Internet of Things (IoT) will likely be a ubiquitous fiber network deployed to all areas of the community. 5G and IoT are expected to be the building blocks for future Smart Cities. An open access FTTH network can easily support these applications.

Promotes Economic Development – A community-wide FTTH network can be instrumental in promoting economic development in communities where the existing providers are providing substandard service and especially in communities that are unserved by broadband service. An open-access FTTH network can provide the following benefits:

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

- Enhance the viability of home-based businesses
- Attract taxpayers who want to “work where they live” instead of “living where they work”
- Enable home-based call center employees and other remote workers
- Enhance the rentability of second homes and short-term rental properties
- Enable second home owners to visit their second home for longer periods of time
- Serve small business locations not as easily served by traditional network providers
- Help to limit out-migration and promote in-migration

Increases Property Values – Many believe the presence of affordable, reliable high-speed broadband increases a home’s value, and shortens the time on the market for resale.

14.2 Risks

While all of the opportunities discussed above may be attractive, planning, constructing, operating and maintaining a broadband network should not be taken lightly and all of the risks and alternatives should be explored thoroughly before taking on such a complex commitment. Some of those risks include, but are not limited to:

Lack of Broadband Expertise – it is very rare for a local government entity to have the requisite level of technical and operational expertise on staff, or the depth of expertise required to successfully operate and maintain a fiber optic network. Much of the burden will fall to municipal staff with no experience or a committee made up of community volunteers, who while well meaning, will not have the experience and may not be able to achieve success. Any implementation should rely on vendors specializing in engineering, constructing and operating such networks, and even then, will require oversight by the municipal government entity.

Technical Obsolescence – Fiber optics are commonly believed to be “future proof” and no technology can overtake its capabilities. While that may be true, other technologies may be embraced in the future by potential subscribers effectively obsoleting the network in favor of competing services, such as the new low-earth orbit (LEO) satellite constellations being deployed by SpaceX, Amazon and others, purporting to eventually offer high-speed, low-latency broadband service to all areas of the world.

Competitive Services – Thus far, we have not seen any examples whereby the large incumbent Cable TV and phone companies are willing to utilize an open-access municipally-owned FTTH network. These providers, especially the Cable TV companies, have the ability to improve the quality of the service in fairly short order and without tremendous expense. If a municipal FTTH network is deployed, both could be formidable competitors jeopardizing the sustainability of the municipal network. It is also important to note that many users, especially the younger generations, have relied upon their wireless devices for broadband access and have never sought to buy a fixed, landline-based broadband service.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

As the reliability and capacity of mobile wireless networks continue to improve with the introduction of 5G and further densification of 4G, wireless may continue to challenge any land-based service.

Competitive Pricing Power – The large, nationwide incumbent service providers are unregulated and have the ability to lower prices to squeeze out the competition. It is important to accept that fact that many potential subscribers will purchase the lowest priced service that it sufficient for their needs, regardless of the bandwidth capability of a FTTH network and that it may be owned by the municipality where they live and pay taxes.

Sustainability – All of the risks discussed above may contribute to the challenge of achieving sustainability without ongoing operating subsidies. Any decision to move forward with a municipal network should carefully forecast the financial operating realities, sensitivity to pricing and take-rate, and have plans to mitigate the challenge if sustainability cannot be achieved.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

15 Alternatives to Full Municipal Ownership

There are many different initiatives that may lead to deployment of affordable, reliable high-speed broadband that do not require full ownership by the community. Below are some brief examples to consider, recognizing each community and their needs are different. No one solution will fit every situation.

15.1 Public-Private Partnership – Leverage Community Goodwill

There are a number of initiatives a community can engage in that may attract a service provider with little to no cost to the community beyond donated time by municipal staff and engaged citizens' participation in a broadband committee. Those initiatives can include, but not necessarily be limited to:

- Produce a feasibility study identifying existing broadband assets within the community, identify gaps within the existing assets, determine quantity of potential subscribers in both the served and unserved areas and the potential subscribers per mile of each
- Survey the community to determine current satisfaction and willingness to support a new competitor
- Gather commitments from potential subscribers to contract for services for a minimum period of time should the new competitor enter the market

As example, in Franklin County, Maine, a feasibility study was produced that attracted a service provider to seek low interest USDA-RUS loans to help fund a FTTH buildout for 100% coverage of six communities and partial coverage of five communities within the County.

15.2 Public-Private Partnership – Joint Public-Private Ownership

A municipality could partner with an established private service provider, contributing capital and other services or assets of value, in return for board participation based upon the value each contributes and sharing of any profits that may be realized. Ownership of the network could be split based upon the amount of capital contributed. The private service provider would be responsible for all aspects of operating and maintaining the network, leveraging their existing capabilities and the municipality would be an active participant to attract subscribers.

15.3 Public-Private Partnership – Joint Capital/Expense Contribution with Buyout Provision

As a result of a feasibility study performed for Franklin County, Maine, a service provider has offered the following:

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

- Provider builds and owns the network with 100% coverage of 16 communities within the County.
- Municipality pays for one-time cost of utility pole make-ready and annual license fees
- Municipality provides central office location and electricity to power equipment to serve subscribers
- Contract includes a predefined formula for municipality to assume ownership of network after three (3) years with a decline purchase price between year three and year twenty. After 20 years, purchase price is one dollar.

15.4 Public-Private Partnership – One-time Subsidy of Private Operator

Supported by a feasibility study, detailed engineering plan and financial proforma; a municipality could provide a sufficient one-time subsidy to the service provider to turn an uneconomic investment for the service provider into an economic investment that will provide the service provider with a reasonable return on their investment over a reasonable time period. The following programs are examples of one-time subsidies:

- State of Maine - ConnectME Authority Implementation Grants
- State of Maine – Universal Service Fund
- USDA ReConnect Grant program
- FCC Connect America Fund

As example, the Town of Mount Desert provided Charter (Spectrum) a one-time subsidy of approximately $350,000 to extend the Cable TV system along 25 miles of roadway, passing 325 potential subscribers, significantly expanding the availability of high-speed broadband throughout the Town. The Town used taxpayer funds for approximately $250,000 and successfully submitted a grant application to the ConnectME Authority for the remaining $100,000.

16 Recommendations

16.1 Recommendation #1

With close to 50% of the Regional Fiber Optic Backbone as designed already in place by virtue of the existing dark fiber availability, we recommend the County open discussions with the existing providers to explore developing a Public-Private Partnership (P3). We are aware that at least one provider has interest in expanding their reach within the County. Under an appropriate P3 model, we believe a private provider may potentially be willing to cover more than 50% of the $3,767,970 cost to complete the Backbone network, excluding the costs to reach the islands.

16.2 Recommendation #2

Given the dissatisfaction with the performance of the incumbent Cable TV and Phone providers, the County should take a leadership position on behalf of the municipalities in an attempt to improve the performance and customer service of these providers. At the same time, the County should explore the opportunity to create a Public-Private Partnership with these providers to close the gaps in their current service capability. In parallel with these efforts, the County should initiate discussions with other service providers who may be interested in a County-wide over-build in collaboration with the County.

16.3 Recommendation #3

Develop a common financing mechanism and support structure to assist the municipalities with the process of securing funds for individual municipal efforts. If there is more than one municipality pursuing their own solution, it will be more efficient to pursue funding in a combined manner.

16.4 Recommendation #4

The County should continue to take an active role at the State level to support and collaborate with other communities and counties in the State-wide advocacy for deploying affordable, reliable high-speed broadband to all citizens, regardless of where they live.

17 Appendices

17.1 Definitions of Terms Used in this Playbook

1. **3RB – Three Ring Binder –** Name for the Maine Fiber Company middle-mile open access dark fiber network. The network is deployed in a design that creates three rings serving southern, middle and northern Maine.
2. **A-CAM –** The FCC's Alternative Connect America Fund Cost Model program.
3. **Broadband –** Any wide-bandwidth data transmission method with the ability to transport multiple signals and traffic types simultaneously.
4. **CAF-II –** The FCC's Connect America Fund – Phase II program.
5. **Central Office –** A local telephone company building typically located in the center of a community or group of communities that houses optical and electronic equipment to distribute services via cables which emanate from the central office to all locations of the community.
6. **CLEC –** Competitive Local Exchange Carrier. (Examples in Maine are GWI, LCI, Pioneer Broadband, Otelco, and FirstLight.)
7. **ConnectME Authority –** An independent State agency formed to develop and implement broadband strategy for Maine.
8. **Dark Fiber –** A single fiber optic strand without the optical electronics required to light the fiber and provide services.
9. **DSL –** Digital Subscriber Line. A technology used to deliver Internet Access over twist-pair copper cable.
10. **DSLAM –** Digital Subscriber Line Access Multiplexer. Electronic device used to aggregate multiple DSL circuits into a single downstream connection to the Internet. Commonly located in a central office or remote terminal.
11. **Drop –** The connection from the service provider's cabling running along the roadway in front of a subscriber to the subscriber building.
12. **FCC –** Federal Communications Commission.
13. **Fiber Optic –** A glass strand smaller than a human hair that it capable of transmitted a virtually unlimited amount of bandwidth using optical lasers.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

14. **FTTH –** Fiber-to-the-Home (FTTH) is a network utilizing fiber optic cables directly to the home or business and is capable of offering virtually unlimited symmetrical bandwidth.

15. **Hybrid Fiber/Coax –** The infrastructure deployed by cable TV providers that utilizes fiber optic cables to a node and coaxial cable from the node to the subscriber.

16. **ILEC – Incumbent Local Exchange Carrier –** The local telephone company serving the area.

17. **IP Transit -** Bulk connection to the Internet shared by all users of a FTTH network.

18. **ISP –** Internet Service Provider. Most all ILECs, RLECs, RBOCs and CLEC are ISPs.

19. **Internet access –** Connects individual computer terminals, computers, mobile devices, and computer networks to the Internet, enabling users to access Internet services, such as email, applications and information delivered via the World Wide Web. Internet service providers (ISPs) offer Internet access through various technologies that offer a wide range of data signaling rates (speeds).

20. **Latency -** Latency is a networking term to describe the total time it takes a data packet to travel from one node to another. In other contexts, when a data packet is transmitted and returned back to its source, the total time for the round trip is known as latency. Latency refers to time interval or delay when a system component is waiting for another system component to do something. This duration of time is called latency.

21. **Lit Fiber –** Dark fiber that has been activated (lit) with optical electronics on either end of the dark fiber to provide broadband or telecommunications services.

22. **Make-Ready –** Process to make a utility pole ready for attachment of a new communications cable.

23. **Outside Plant –** Communications cabling attached to utility poles or run through underground conduits.

24. **OSP –** Outside Plant.

25. **POTS –** Plain Old Telephone Service.

26. **Potential Subscriber –** A residential or business location that could potentially subscribe to broadband service.

27. **Remote Terminal –** An outside plant cabinet located on the ground or attached to a utility pole or some other supporting structure that houses optical electronics for the provision of DSL service over a twisted-pair copper cable.

28. **Three Ring Binder (3RB) –** Name for the Maine Fiber Company middle-mile open access dark fiber network. The network is deployed in a design that creates three rings serving southern, middle and northern Maine.

29. **Twisted-pair copper –** The type of outside plant cabling initially used to provide POTS and more recently to provide DSL-based Internet access.

30. **World Wide Web –** The World Wide Web (abbreviated WWW or the Web) is an information space where documents and other web resources are identified by Uniform Resource Locators (URLs), interlinked by hypertext links, and can be accessed via the Internet.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

17.2 FTTH Mapping by Municipality

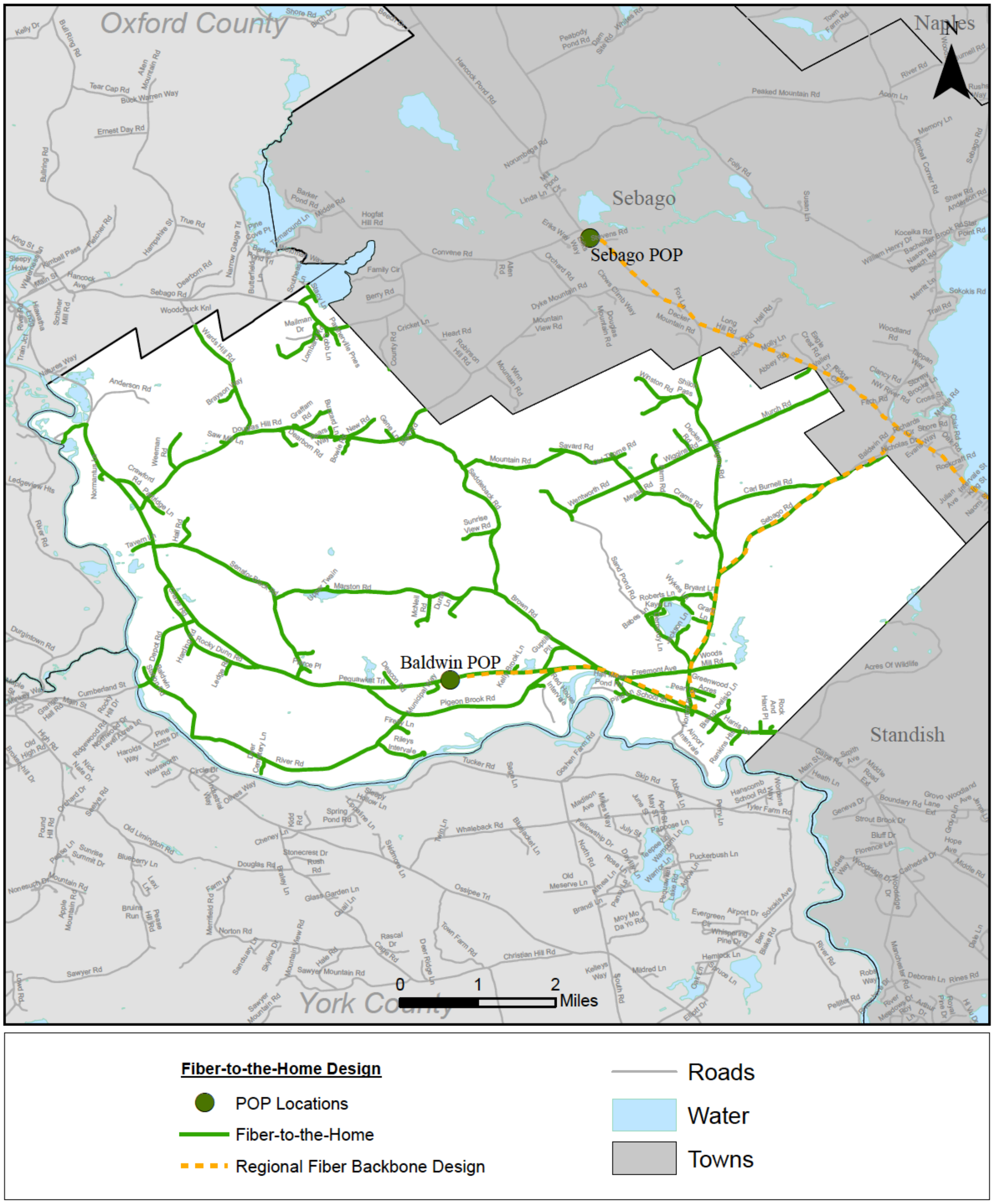
This page is intentionally left blank. The following pages include the FTTH Maps for each municipality.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

FTTH Design 1: Baldwin

Cumberland County – Fiber-to-the-Home (FTTH) Design

Baldwin



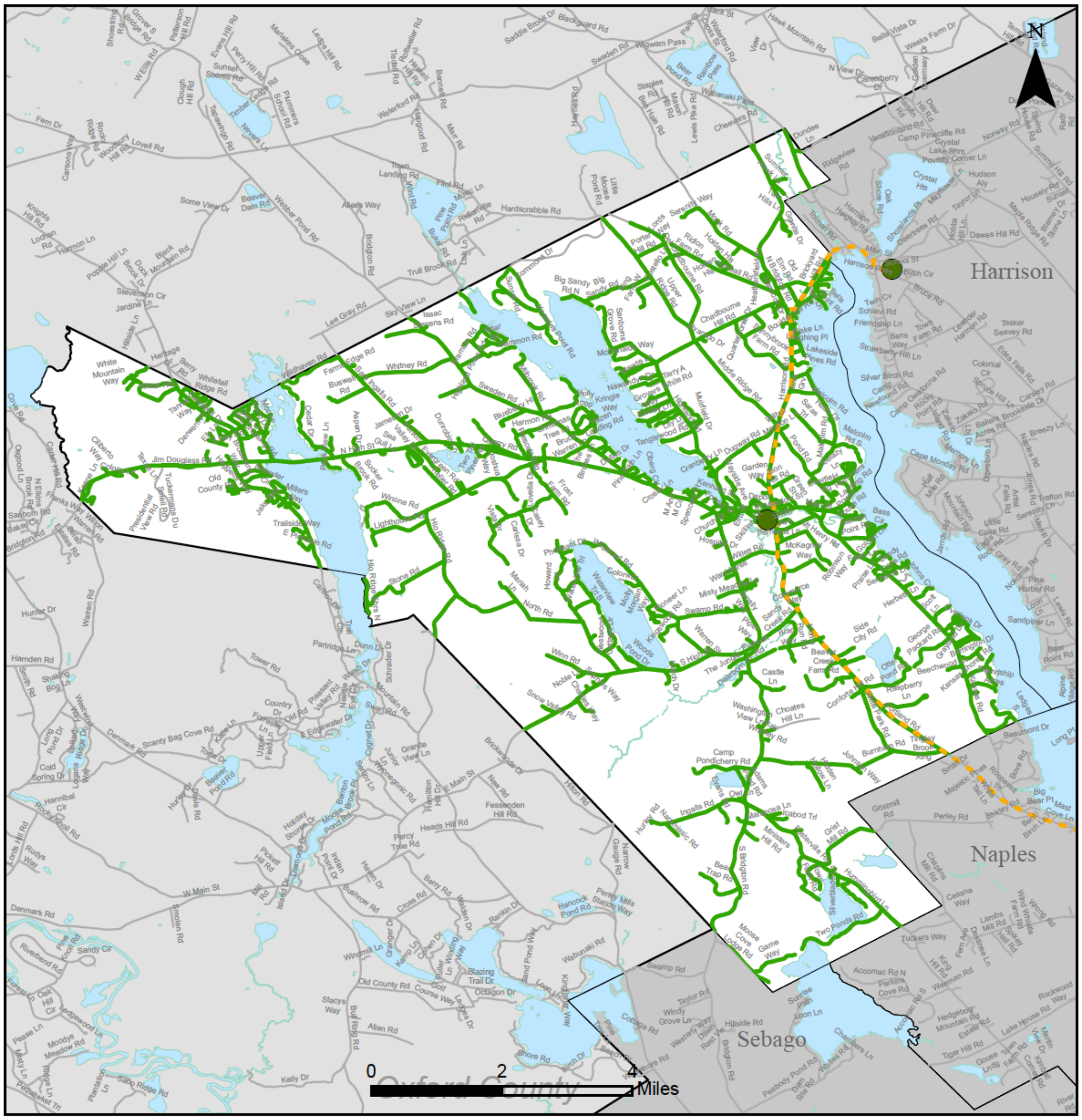
Maine Cumberland County
Casco Bay Advisors, LLC Broadband/Telecom Consulting
SEWALL JAMES W. SEWALL COMPANY / Since 1880

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

FTTH Design 2: Bridgton

Cumberland County – Fiber-to-the-Home (FTTH) Design

Bridgton



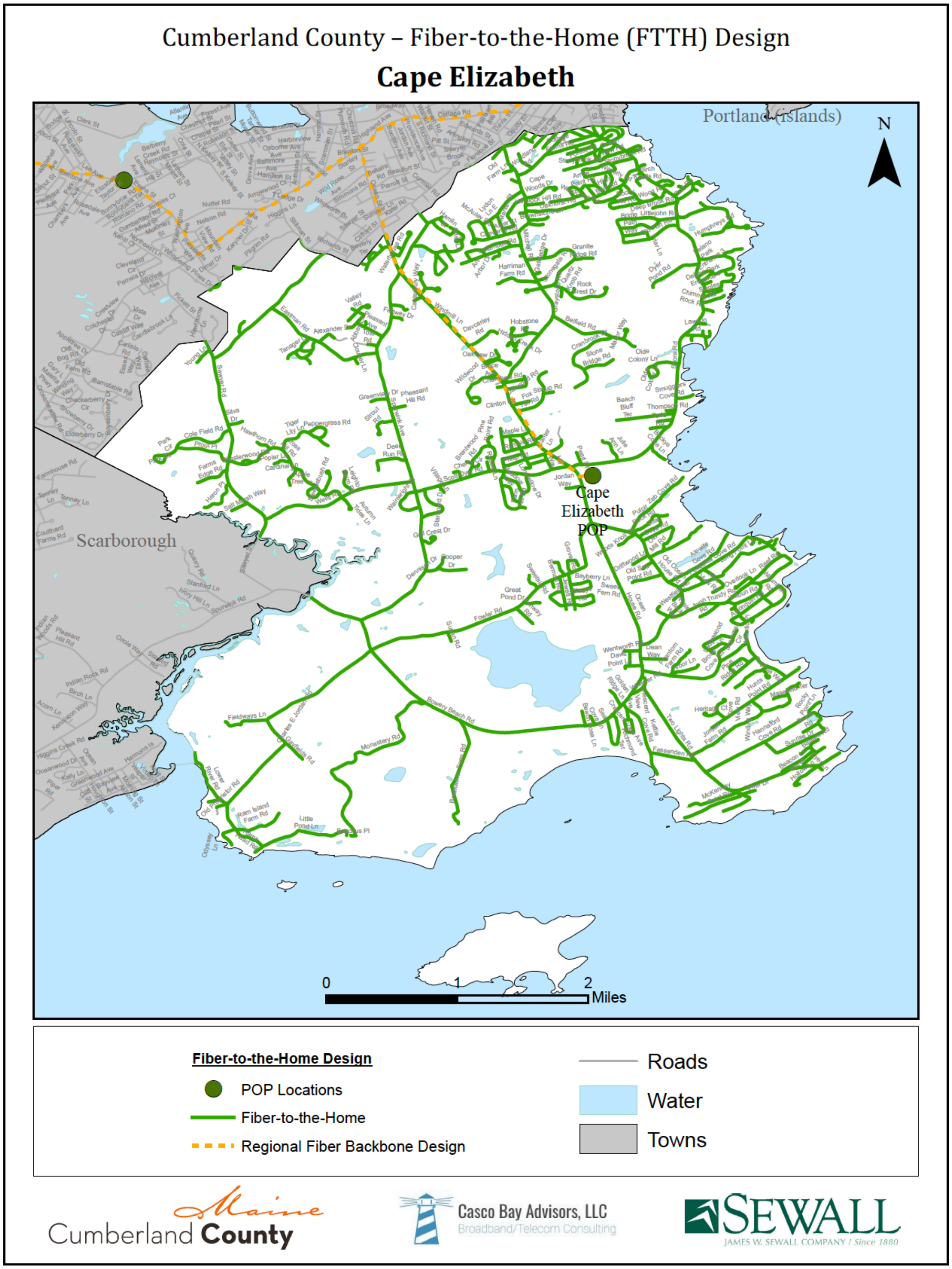
Fiber-to-the-Home Design

- POP Locations
- Fiber-to-the-Home
- Regional Fiber Backbone Design
- Roads
- Water
- Towns

Cumberland County Maine | Casco Bay Advisors, LLC Broadband/Telecom Consulting | SEWALL JAMES W. SEWALL COMPANY / Since 1880

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

FTTH Design 3: Cape Elizabeth

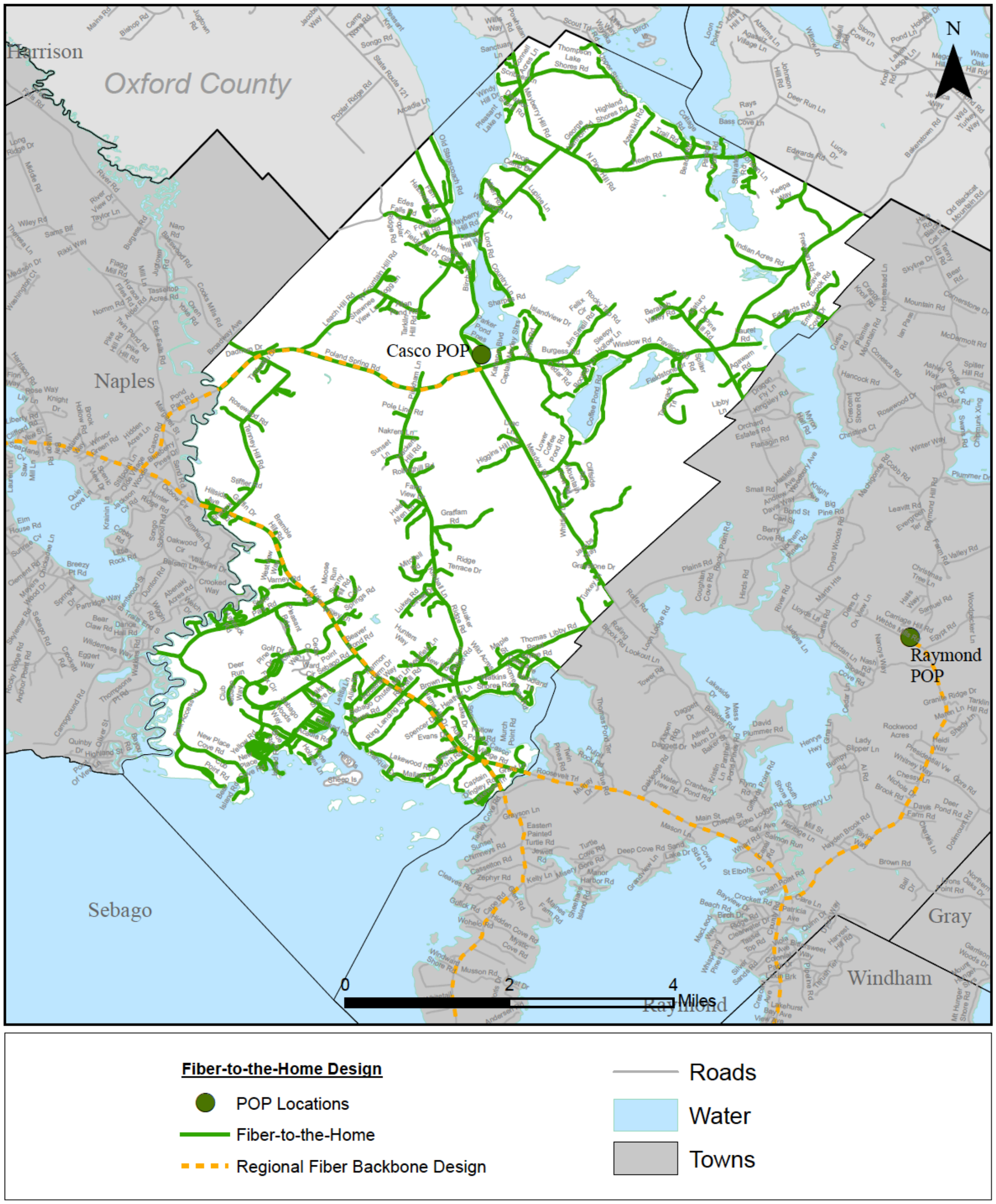


2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

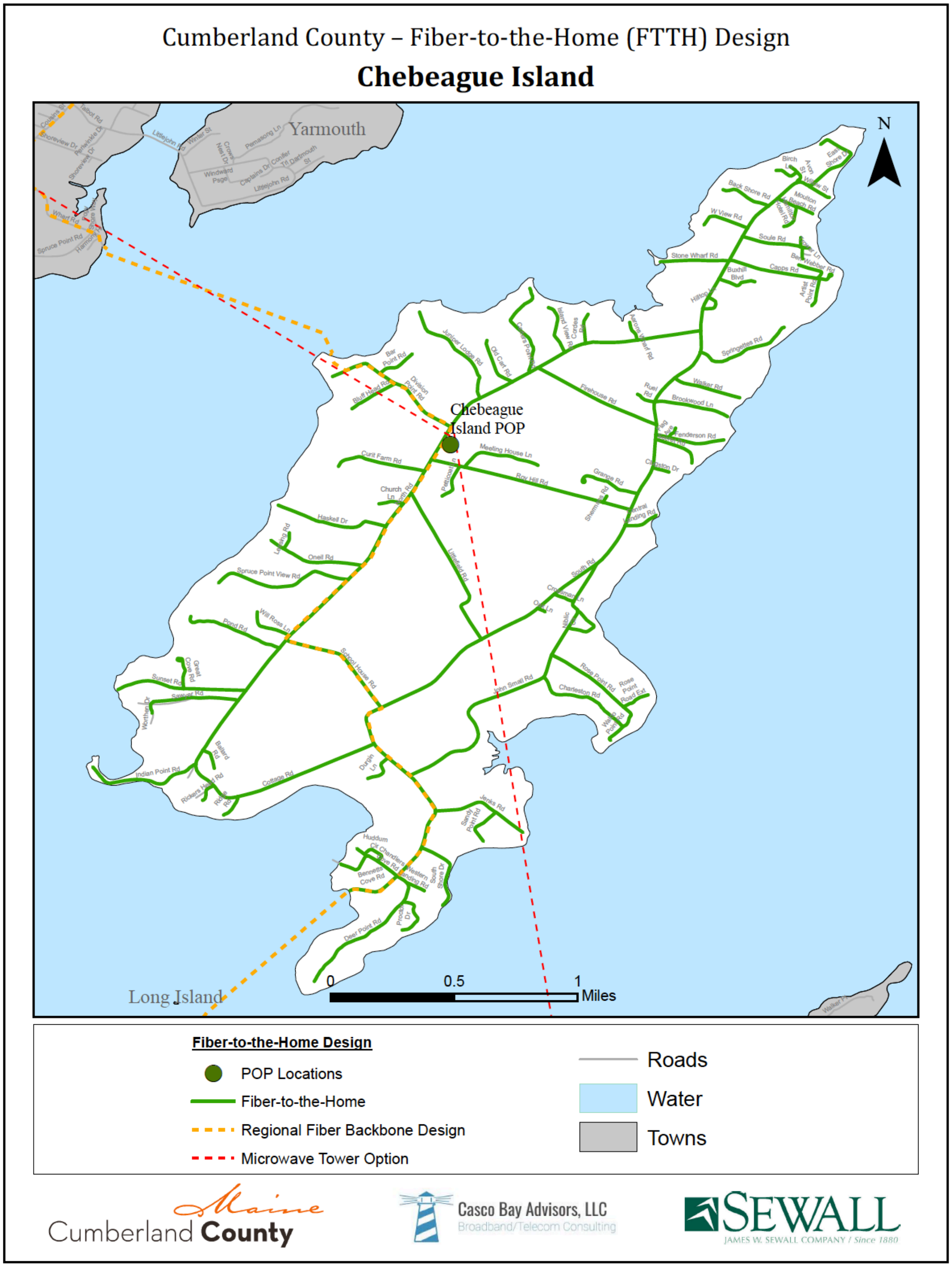
FTTH Design 4: Casco

Cumberland County – Fiber-to-the-Home (FTTH) Design

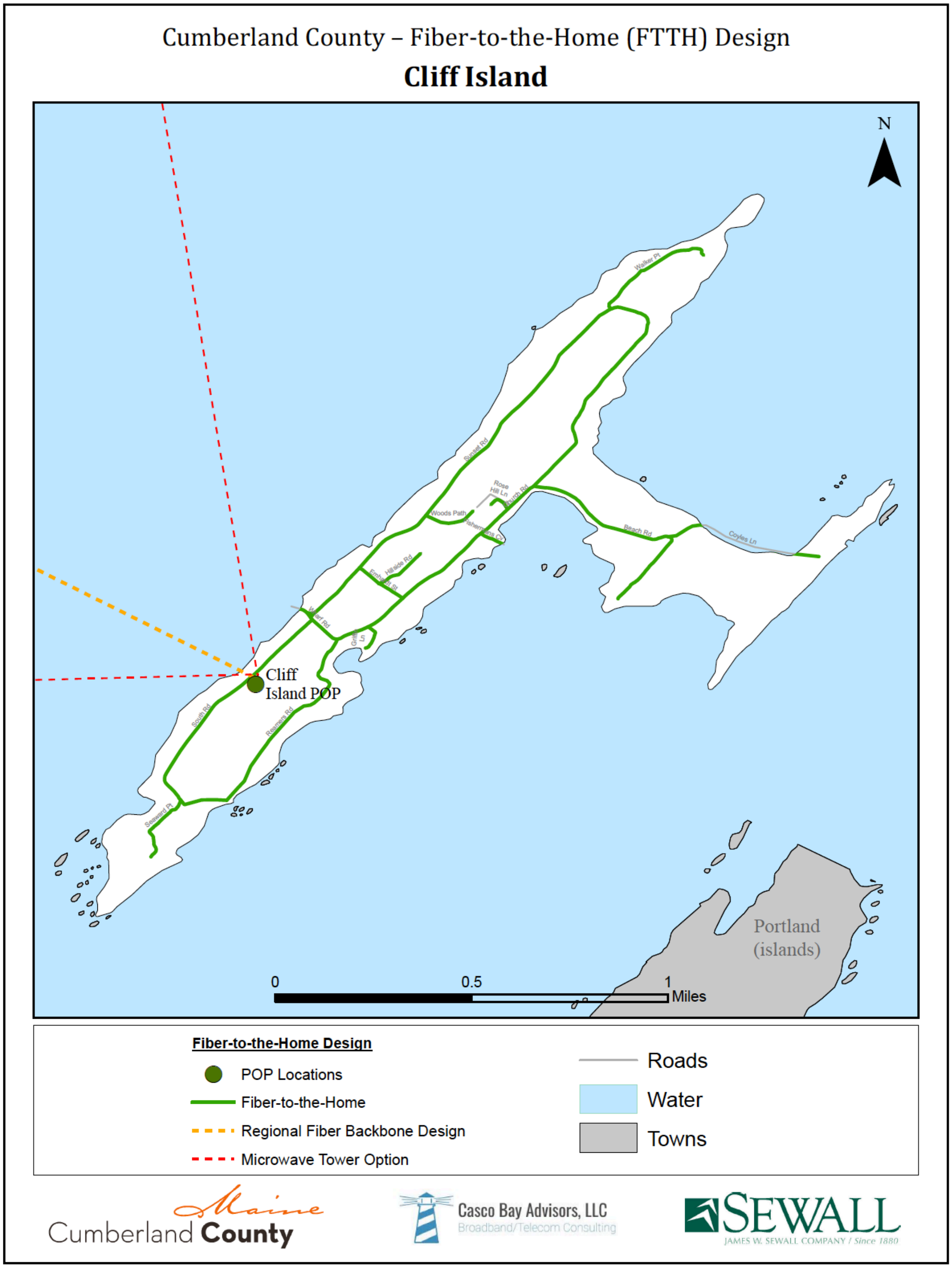
Casco



FTTH Design 5: Chebeague Island



FTTH Design 6: Cliff Island

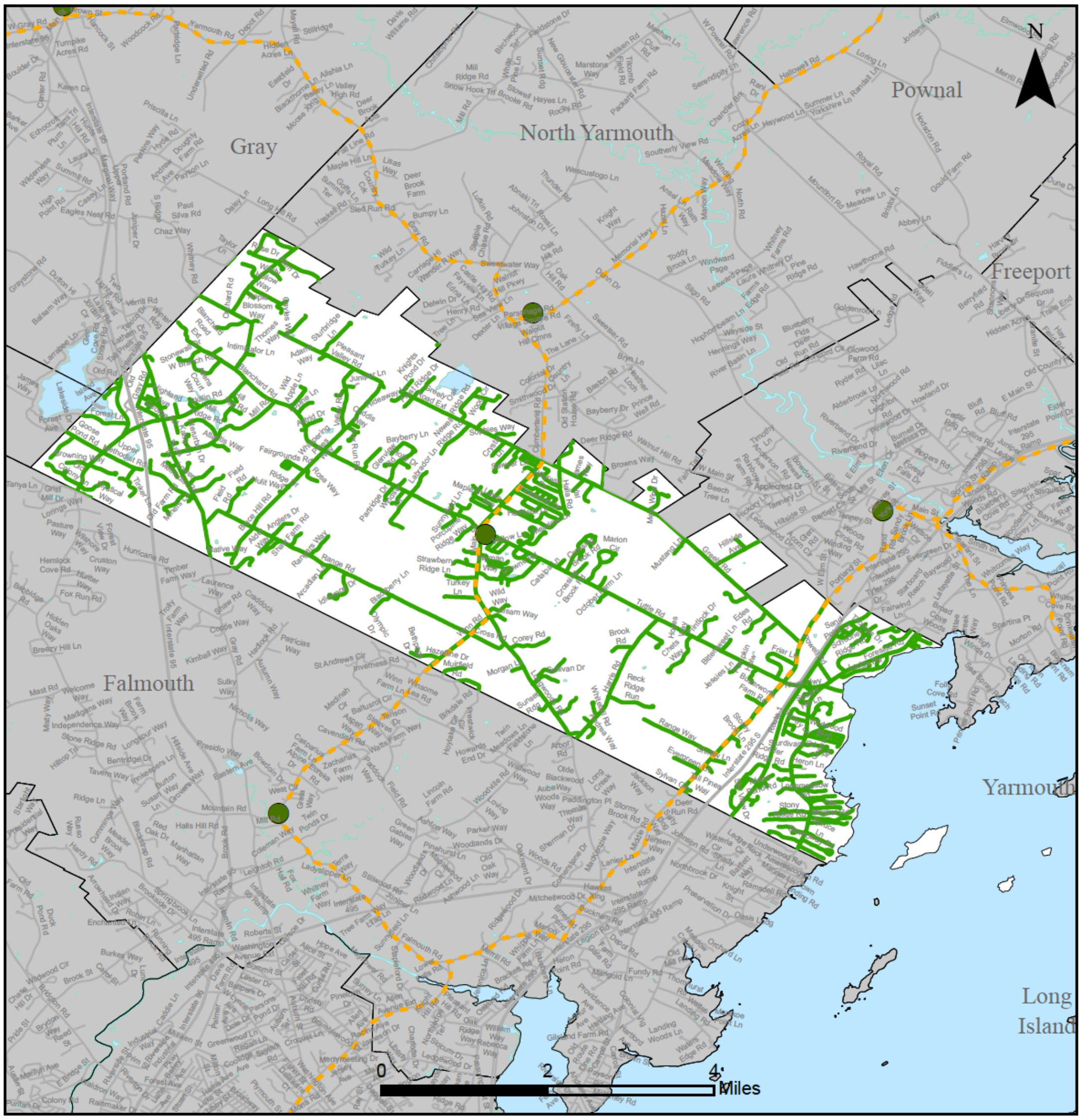


2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

FTTH Design 7: Cumberland

Cumberland County – Fiber-to-the-Home (FTTH) Design

Cumberland

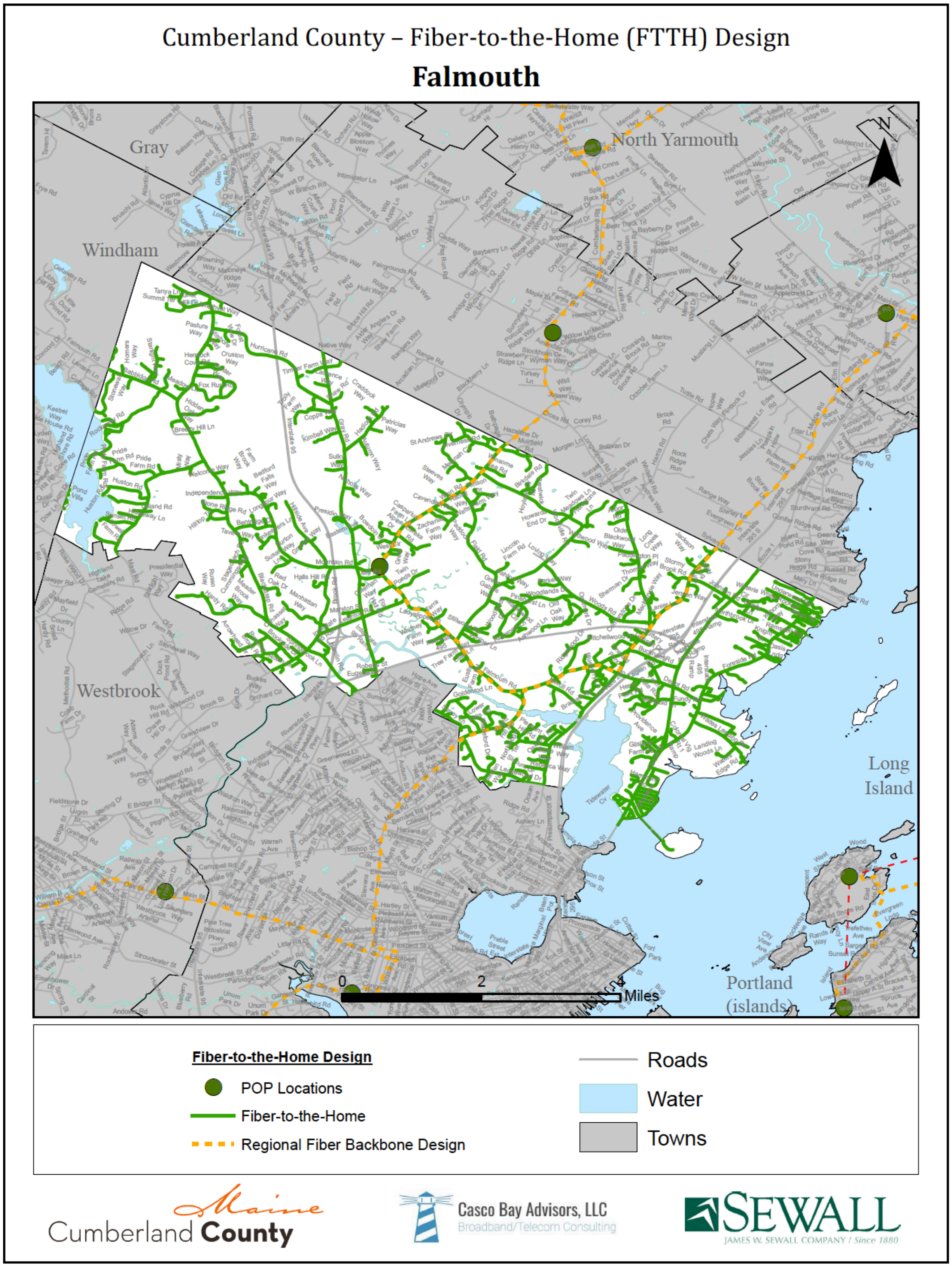


Fiber-to-the-Home Design

- POP Locations
- Fiber-to-the-Home
- Regional Fiber Backbone Design
- Roads
- Water
- Towns

Maine
Cumberland County
Casco Bay Advisors, LLC
Broadband/Telecom Consulting
SEWALL
JAMES W. SEWALL COMPANY / Since 1880

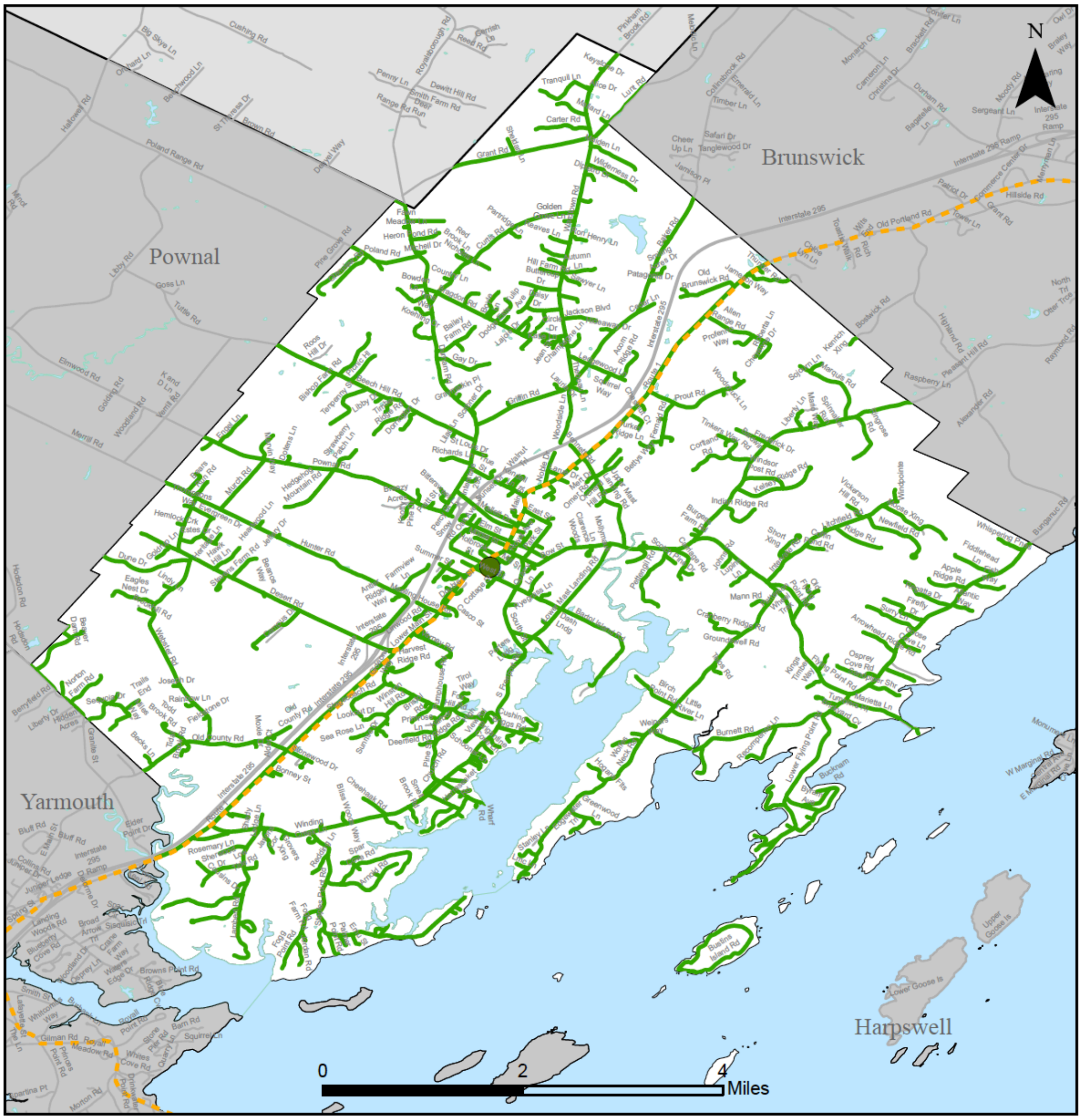
FTTH Design 8: Falmouth



FTTH Design 9: Freeport

Cumberland County – Fiber-to-the-Home (FTTH) Design

Freeport



Fiber-to-the-Home Design

- POP Locations
- Fiber-to-the-Home
- Regional Fiber Backbone Design
- Roads
- Water
- Towns

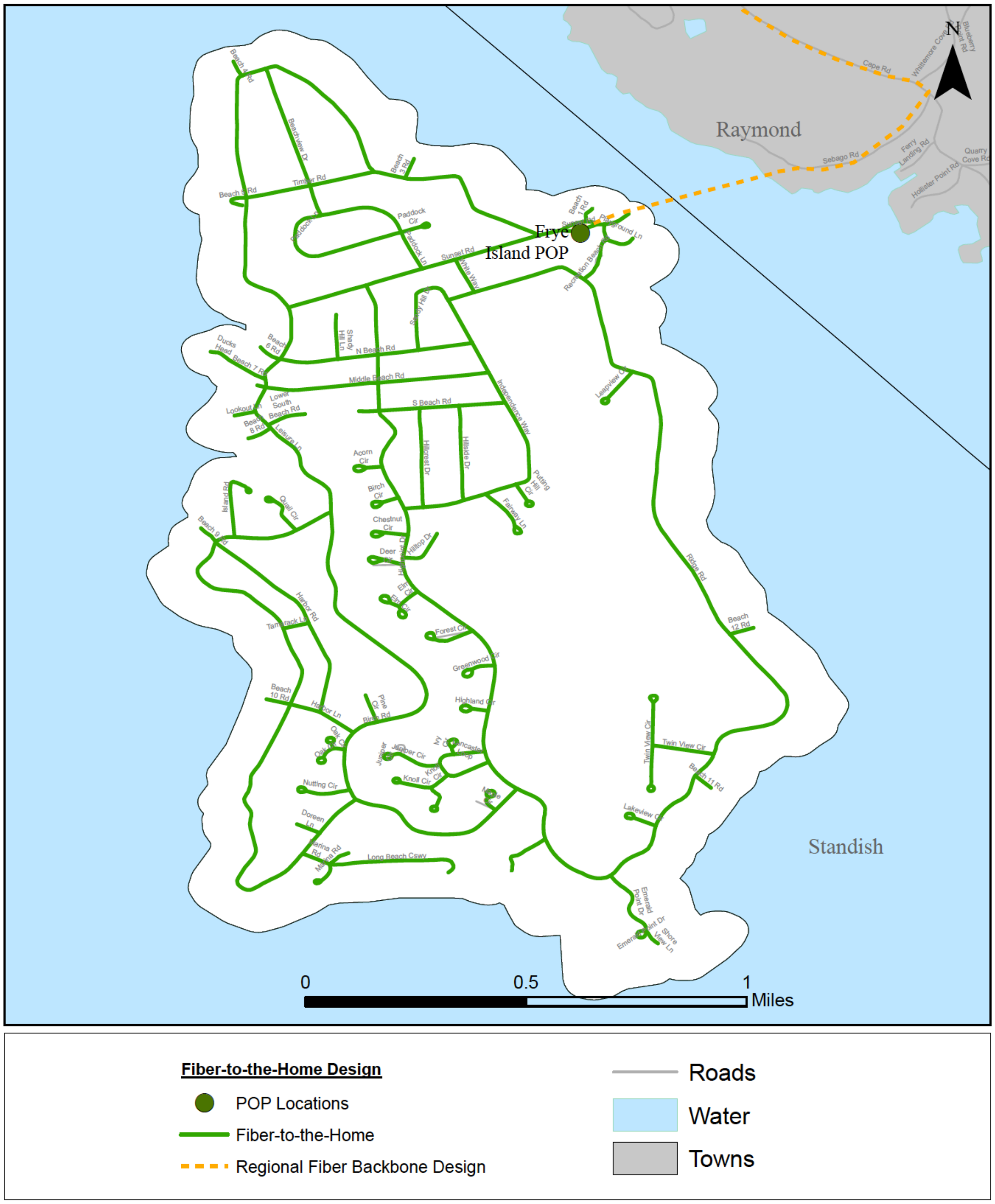
Maine
Cumberland County
Casco Bay Advisors, LLC
Broadband/Telecom Consulting
SEWALL
JAMES W. SEWALL COMPANY / Since 1880

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

FTTH Design 10: Frye Island

Cumberland County – Fiber-to-the-Home (FTTH) Design

Frye Island

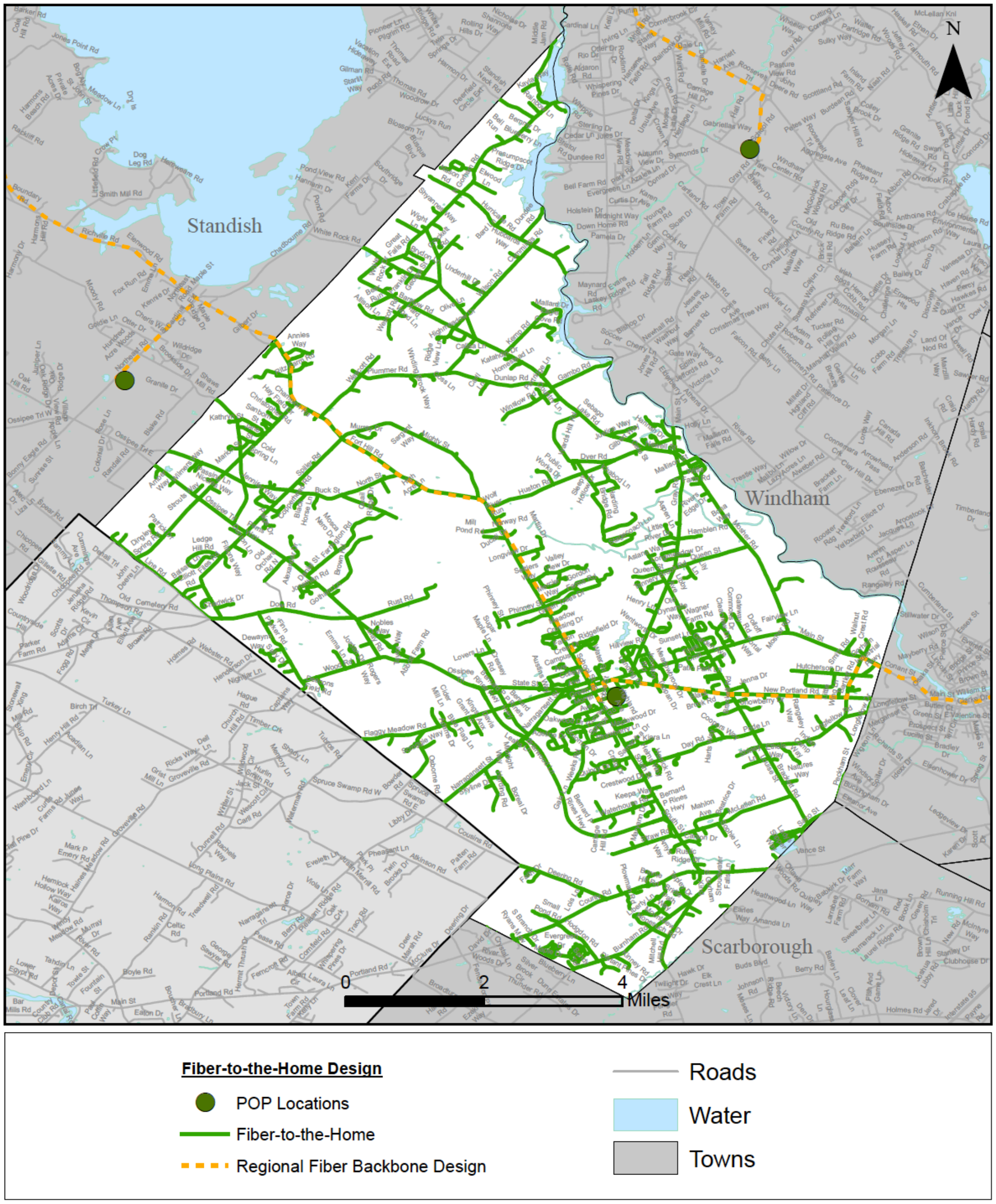


2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

FTTH Design 11: Gorham

Cumberland County – Fiber-to-the-Home (FTTH) Design

Gorham



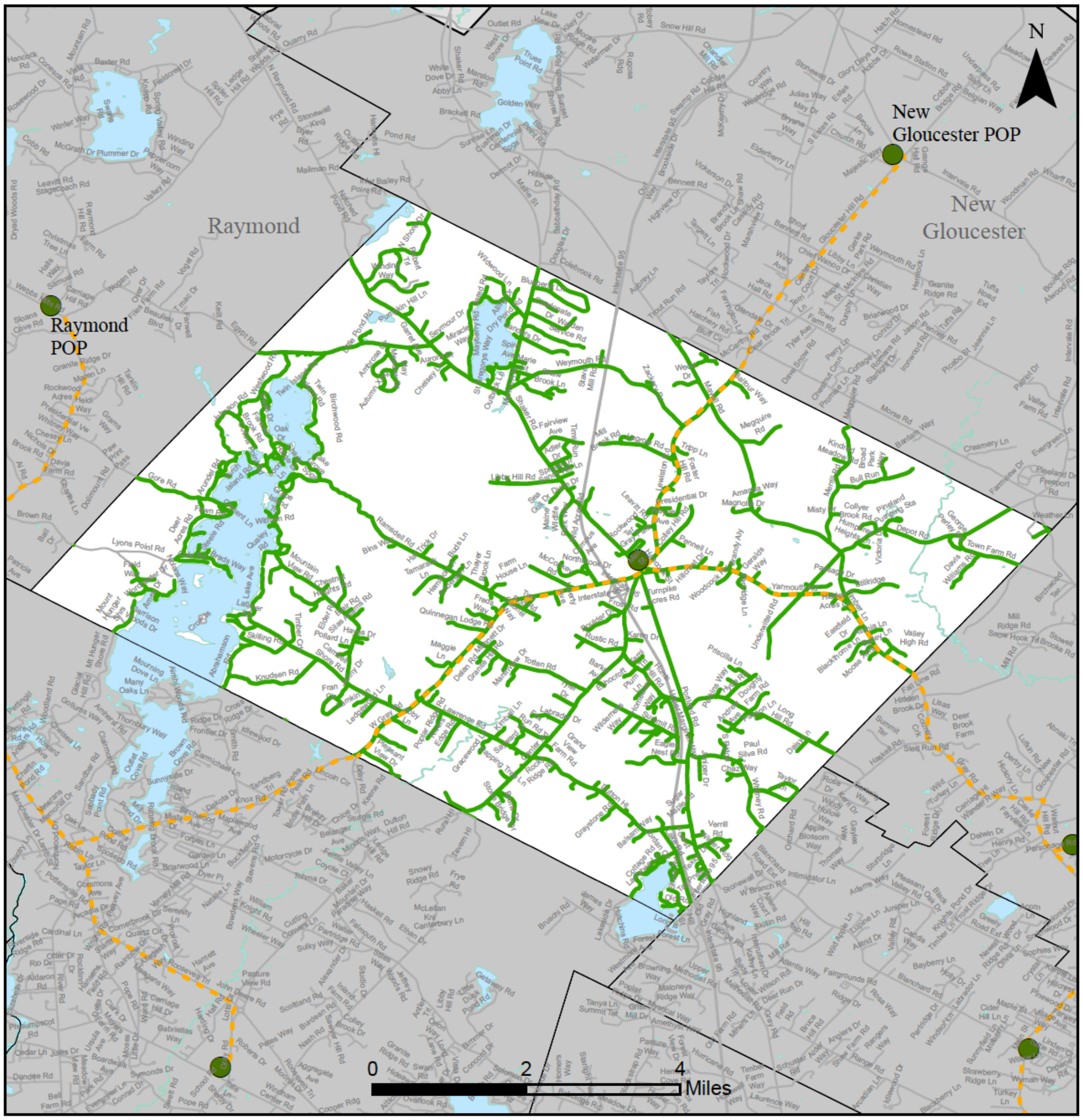
Maine Cumberland County
Casco Bay Advisors, LLC Broadband/Telecom Consulting
SEWALL JAMES W. SEWALL COMPANY / Since 1880

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

FTTH Design 12: Gray

Cumberland County – Fiber-to-the-Home (FTTH) Design

Gray



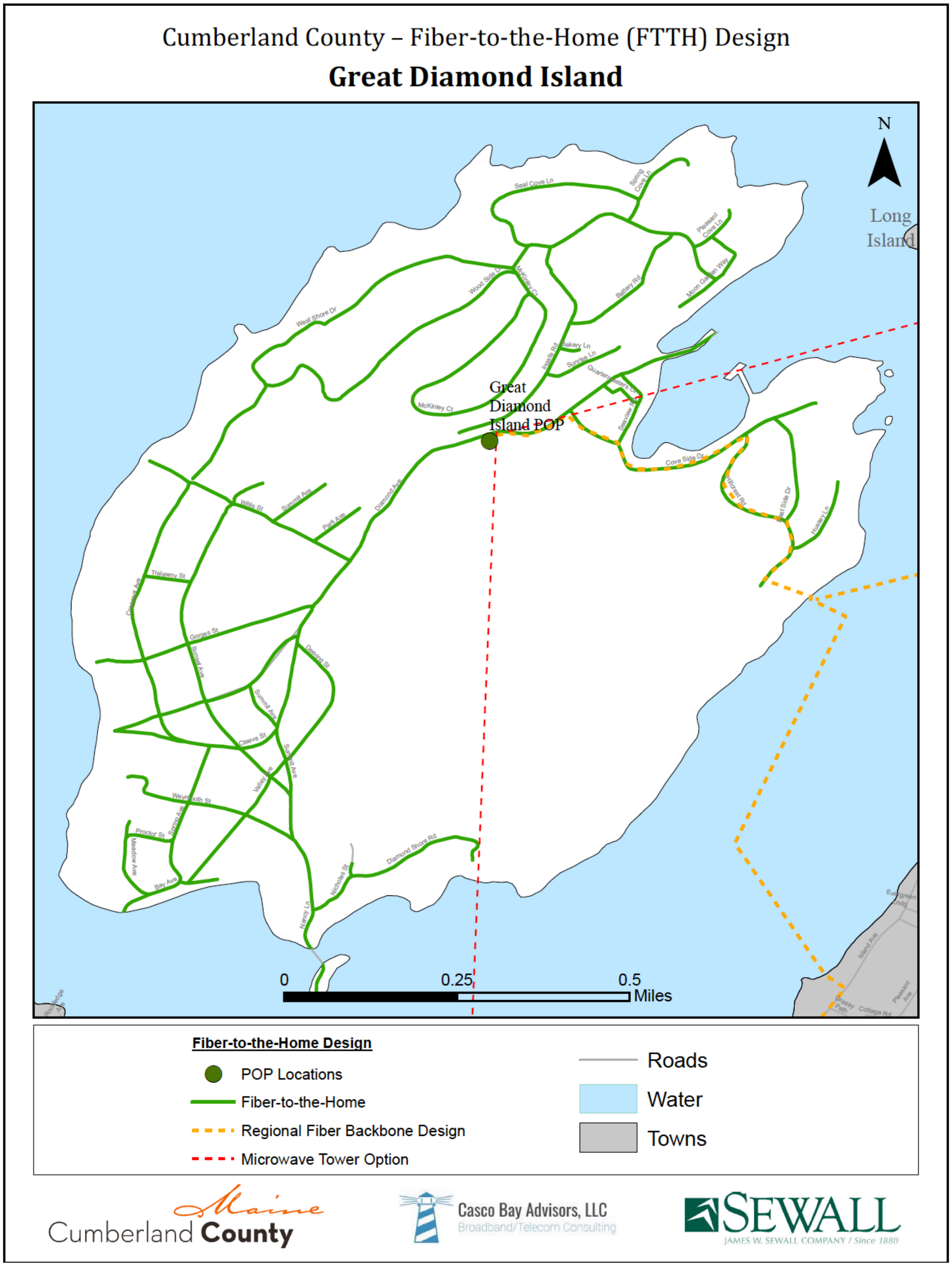
Fiber-to-the-Home Design

- POP Locations
- Fiber-to-the-Home
- Regional Fiber Backbone Design
- Roads
- Water
- Towns

Maine
Cumberland County
Casco Bay Advisors, LLC
Broadband/Telecom Consulting
SEWALL
JAMES W. SEWALL COMPANY / Since 1880

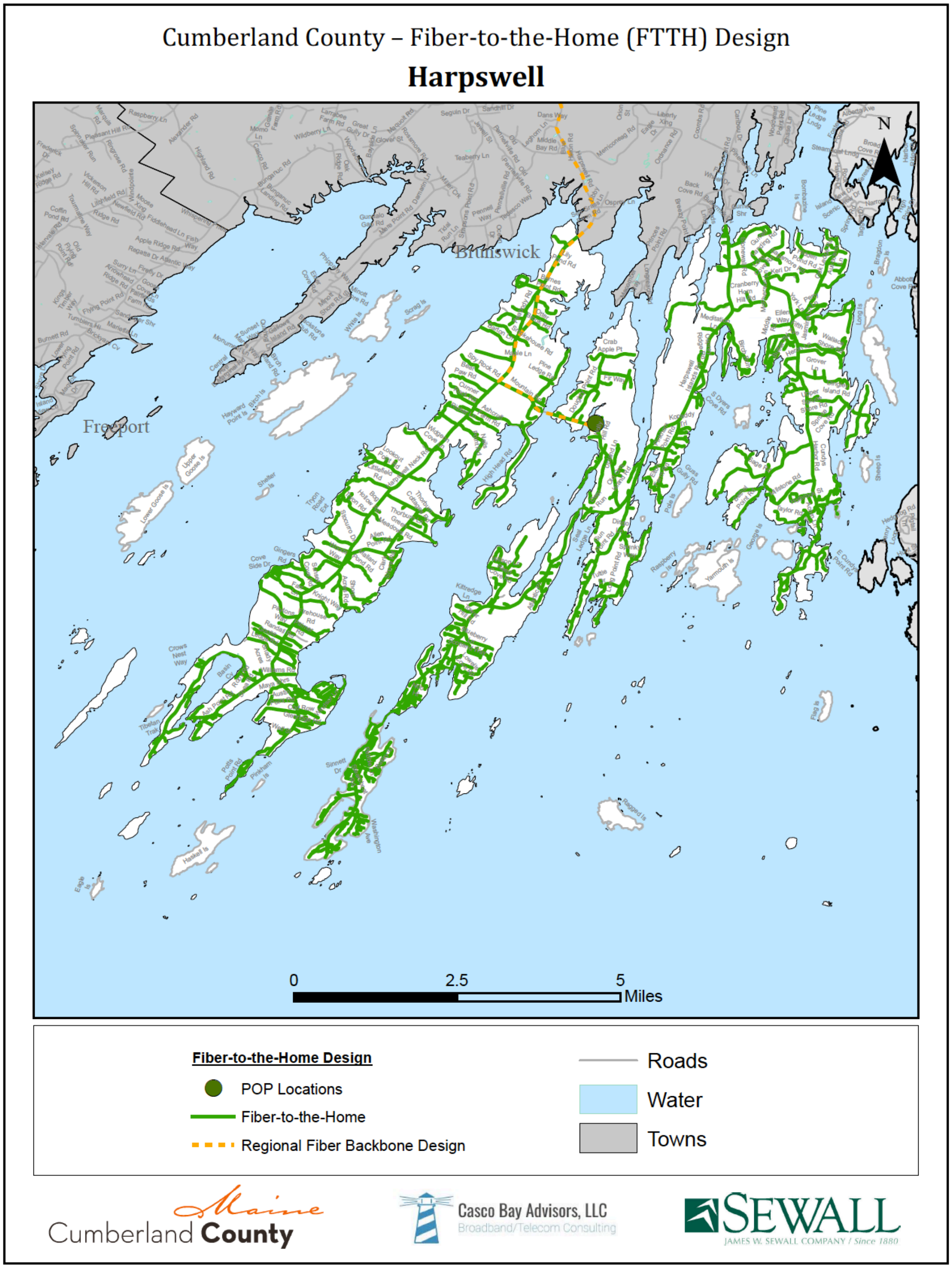
2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

FTTH Design 13: Great Diamond Island



2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

FTTH Design 14: Harpswell

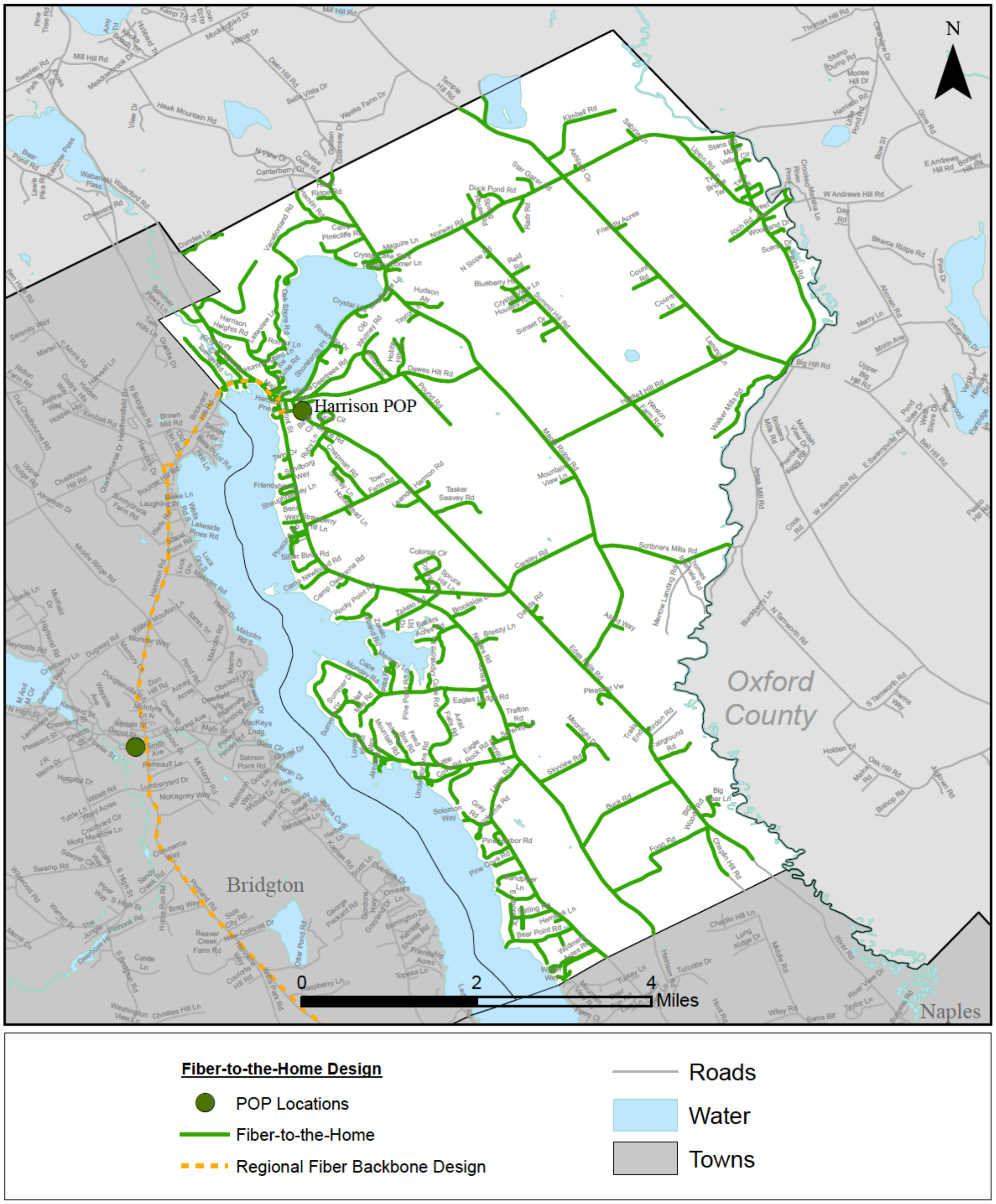


2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

FTTH Design 15: Harrison

Cumberland County – Fiber-to-the-Home (FTTH) Design

Harrison

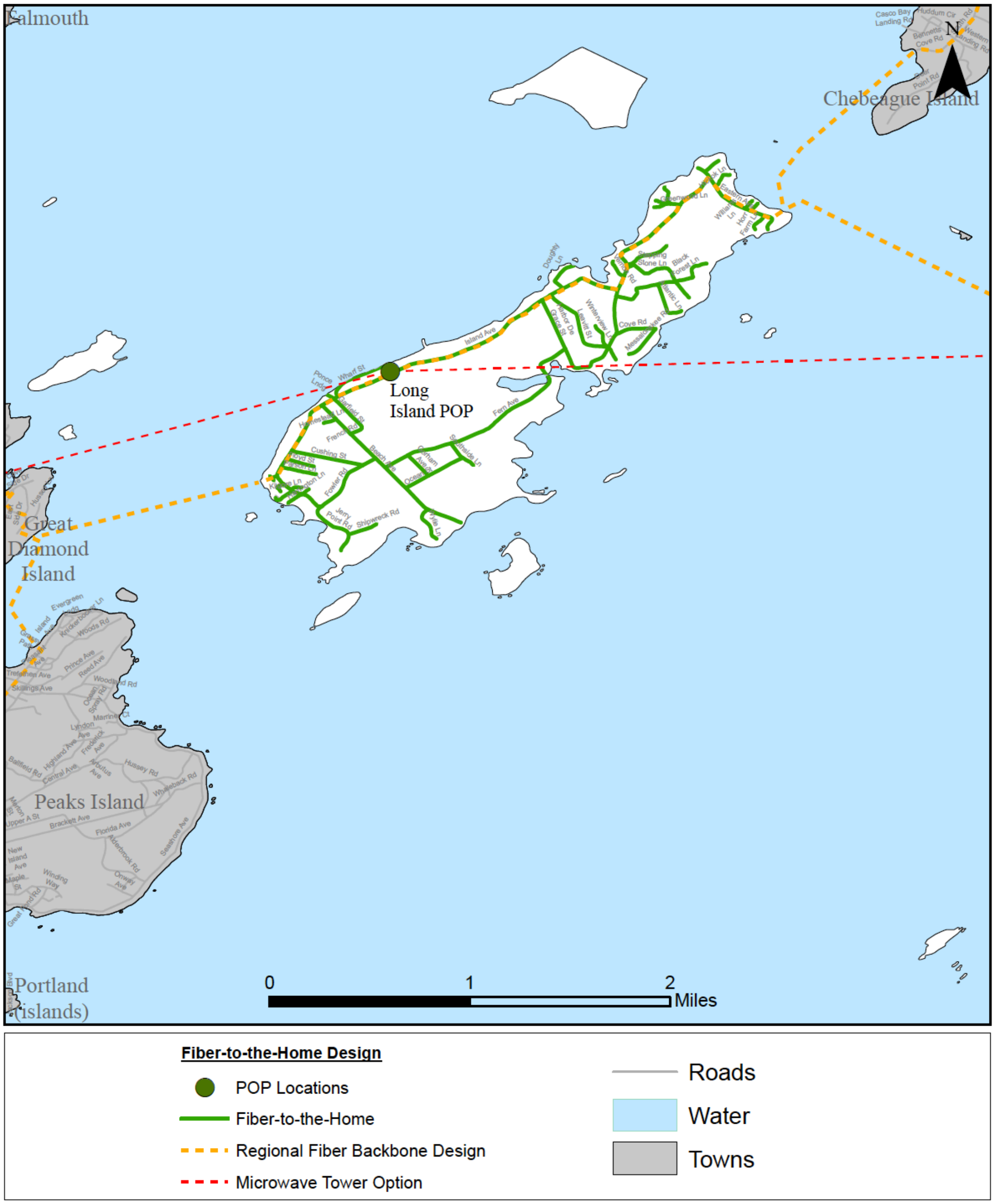


Maine Cumberland County
Casco Bay Advisors, LLC
Broadband/Telecom Consulting
SEWALL
JAMES W. SEWALL COMPANY / Since 1880

FTTH Design 16: Long Island

Cumberland County – Fiber-to-the-Home (FTTH) Design

Long Island

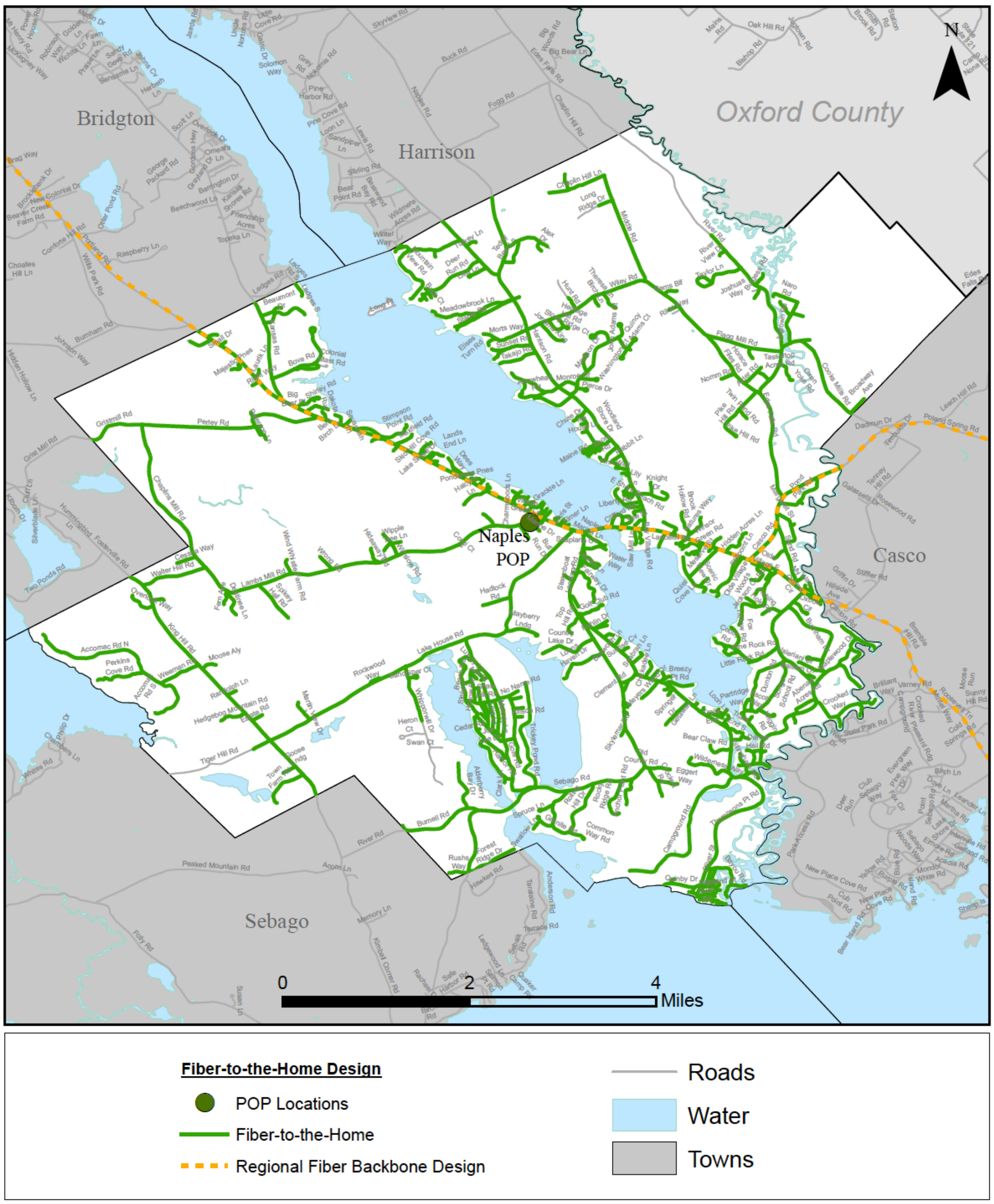


2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

FTTH Design 17: Naples

Cumberland County – Fiber-to-the-Home (FTTH) Design

Naples

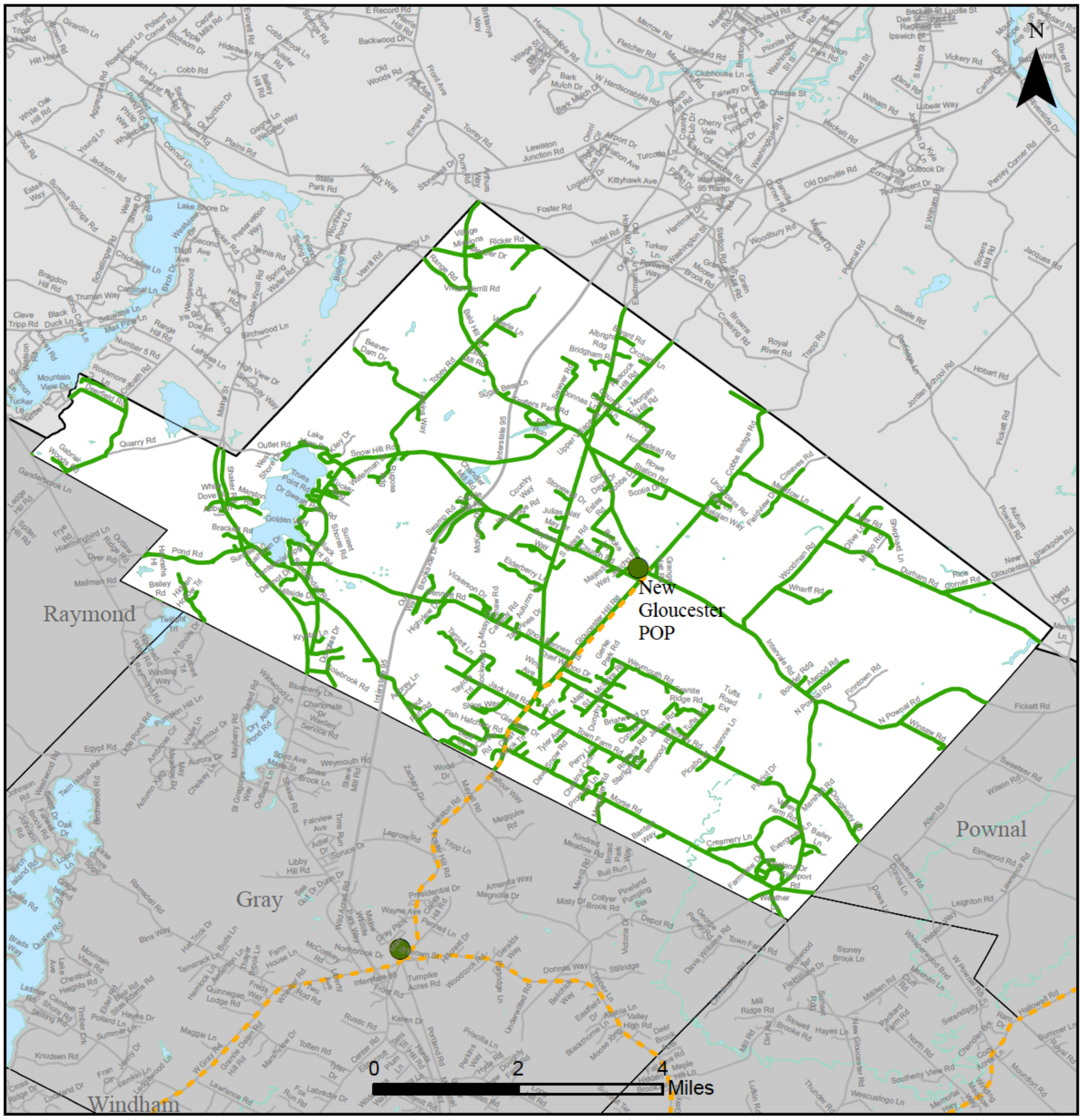


2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

FTTH Design 18: New Gloucester

Cumberland County – Fiber-to-the-Home (FTTH) Design

New Gloucester



Fiber-to-the-Home Design

- POP Locations
- Fiber-to-the-Home
- Regional Fiber Backbone Design

- Roads
- Water
- Towns

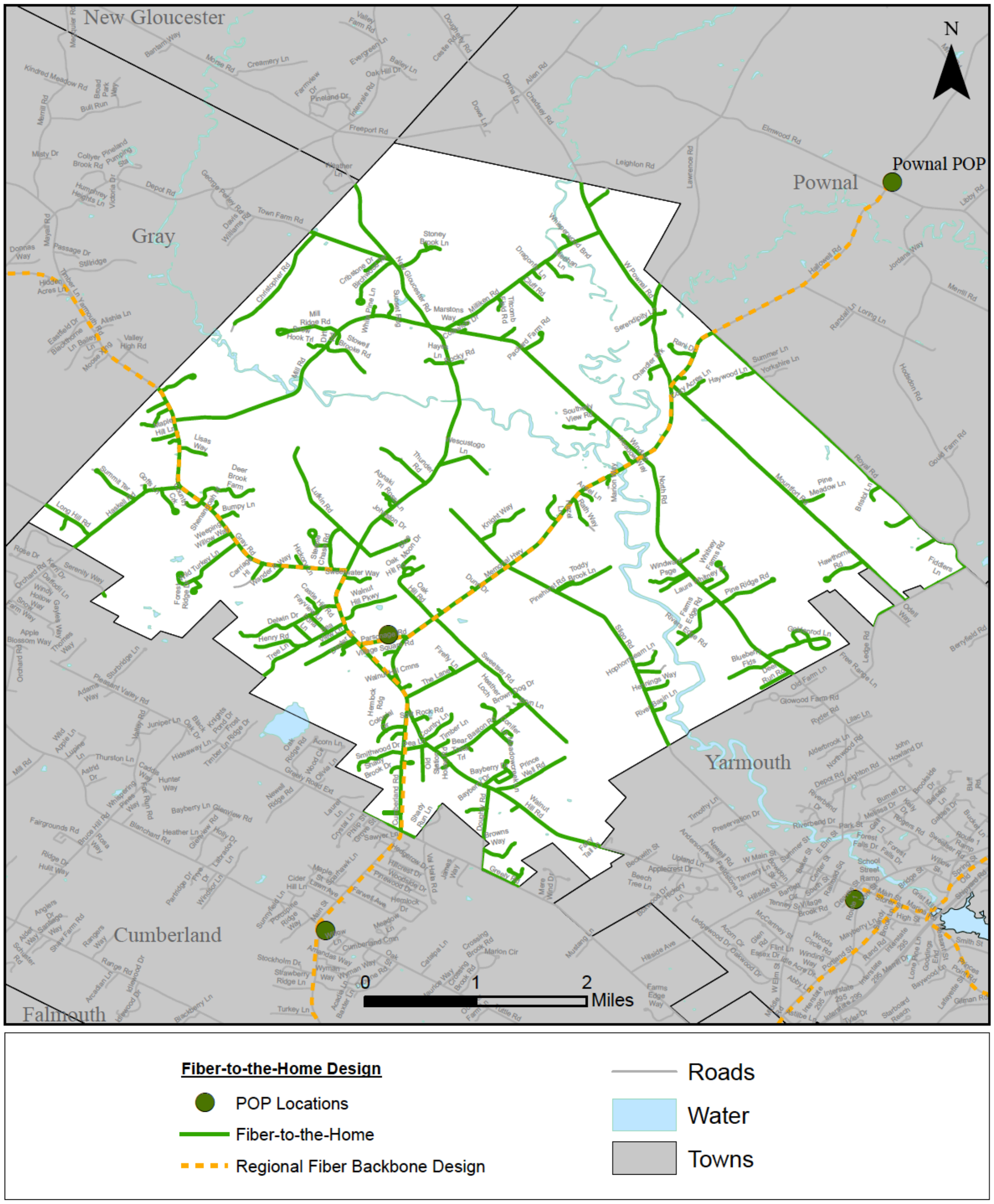
Maine
Cumberland County
Casco Bay Advisors, LLC
Broadband/Telecom Consulting
SEWALL
JAMES W. SEWALL COMPANY / Since 1880

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

FTTH Design 19: North Yarmouth

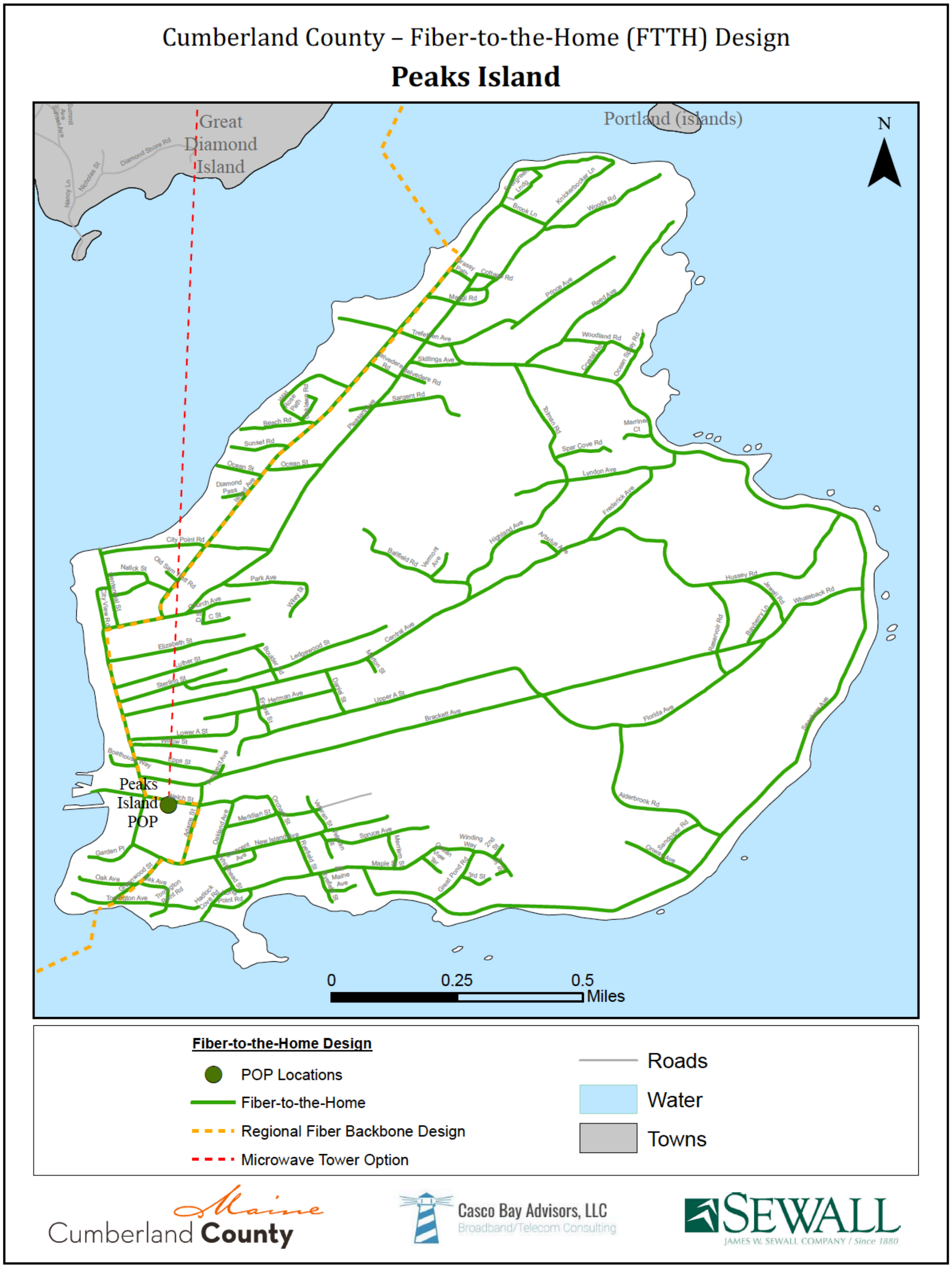
Cumberland County – Fiber-to-the-Home (FTTH) Design

North Yarmouth



Maine Cumberland County
Casco Bay Advisors, LLC Broadband/Telecom Consulting
SEWALL JAMES W. SEWALL COMPANY / Since 1880

FTTH Design 20: Peaks Island

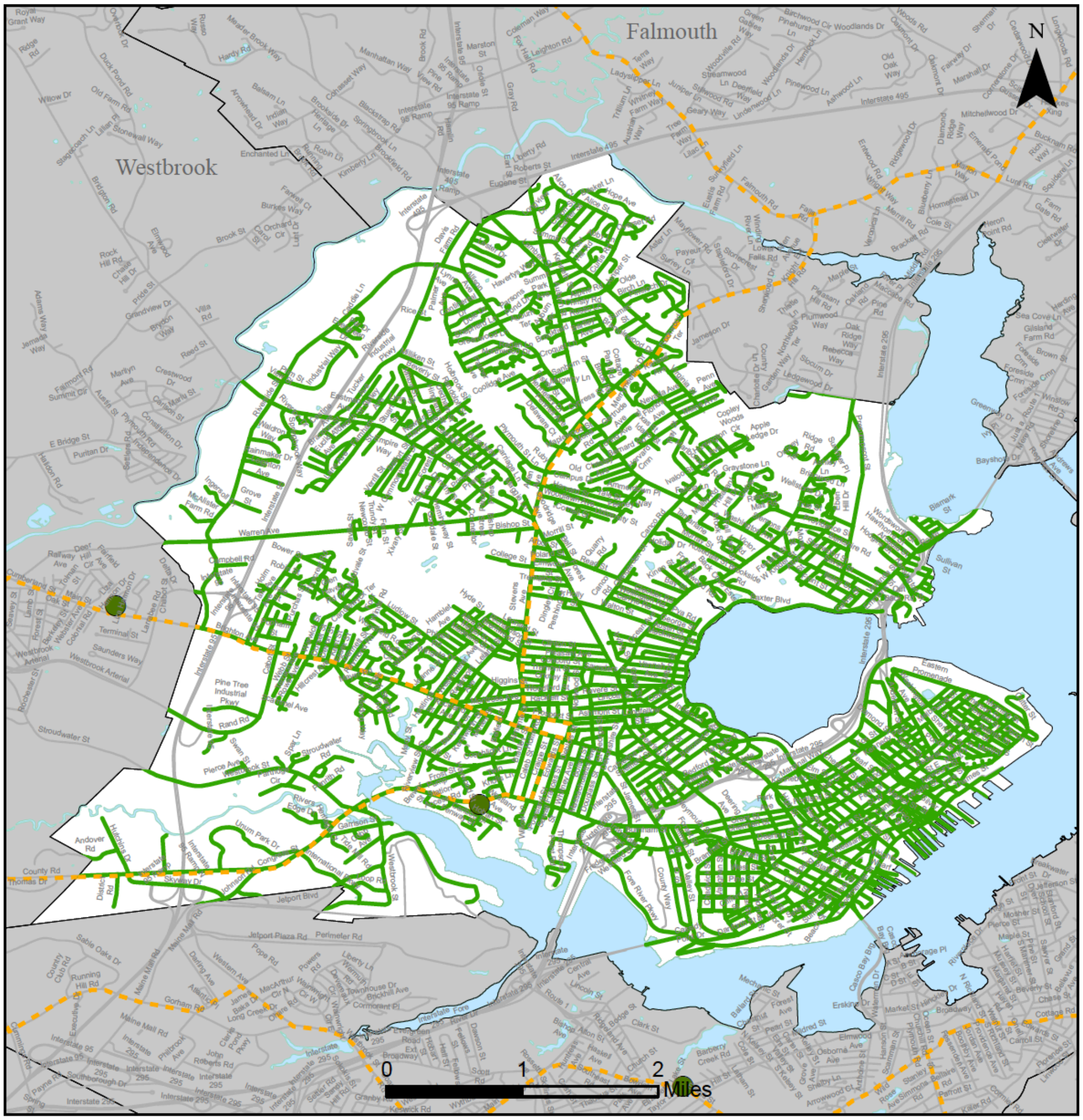


2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

FTTH Design 21: Portland

Cumberland County – Fiber-to-the-Home (FTTH) Design

Portland (mainland)



Fiber-to-the-Home Design

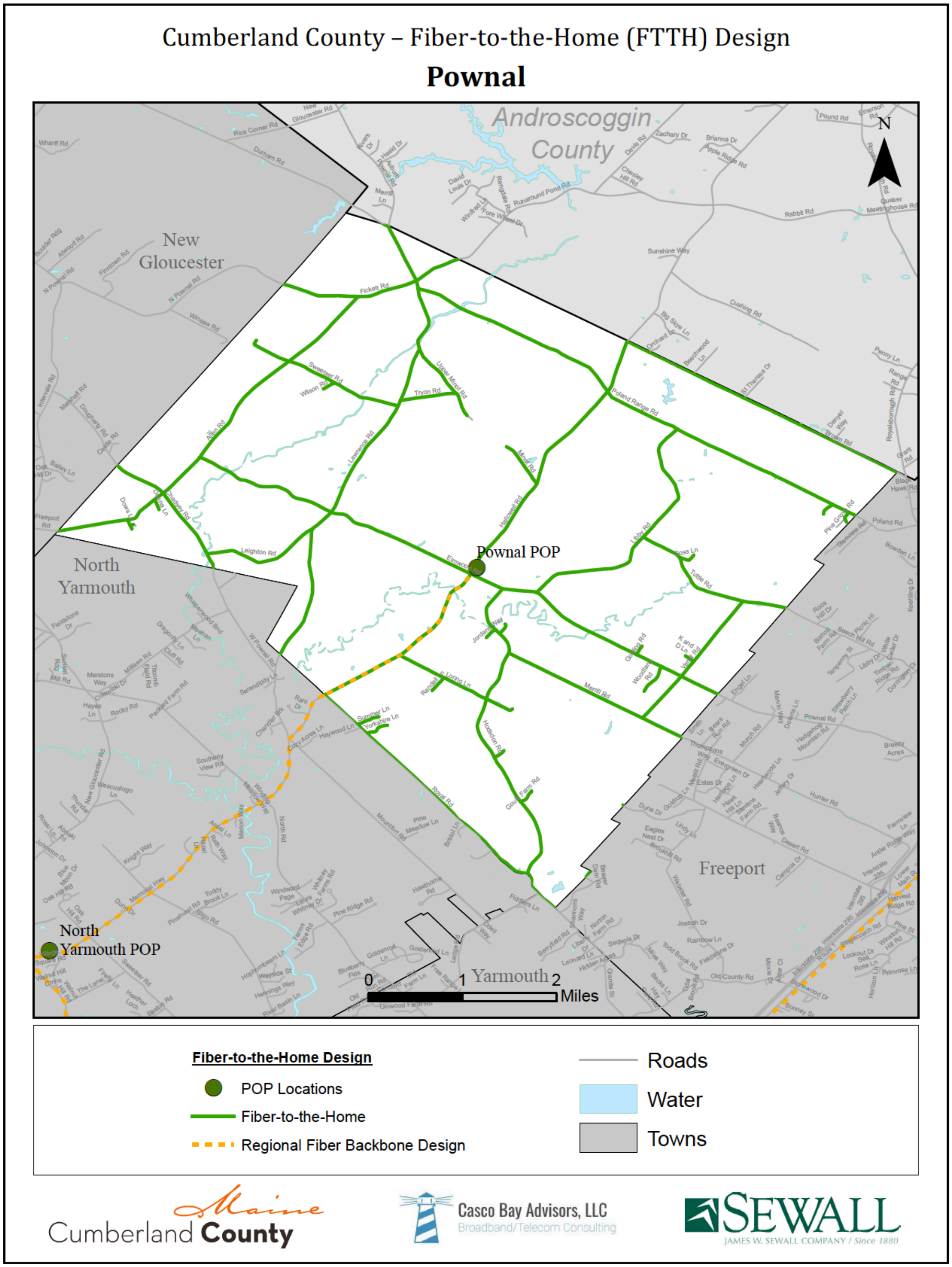
- POP Locations
- Regional Fiber Backbone Design
- Fiber-to-the-Home

Roads
Water
Towns

Maine
Cumberland County
Casco Bay Advisors, LLC
Broadband/Telecom Consulting
SEWALL
JAMES W. SEWALL COMPANY / Since 1880

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

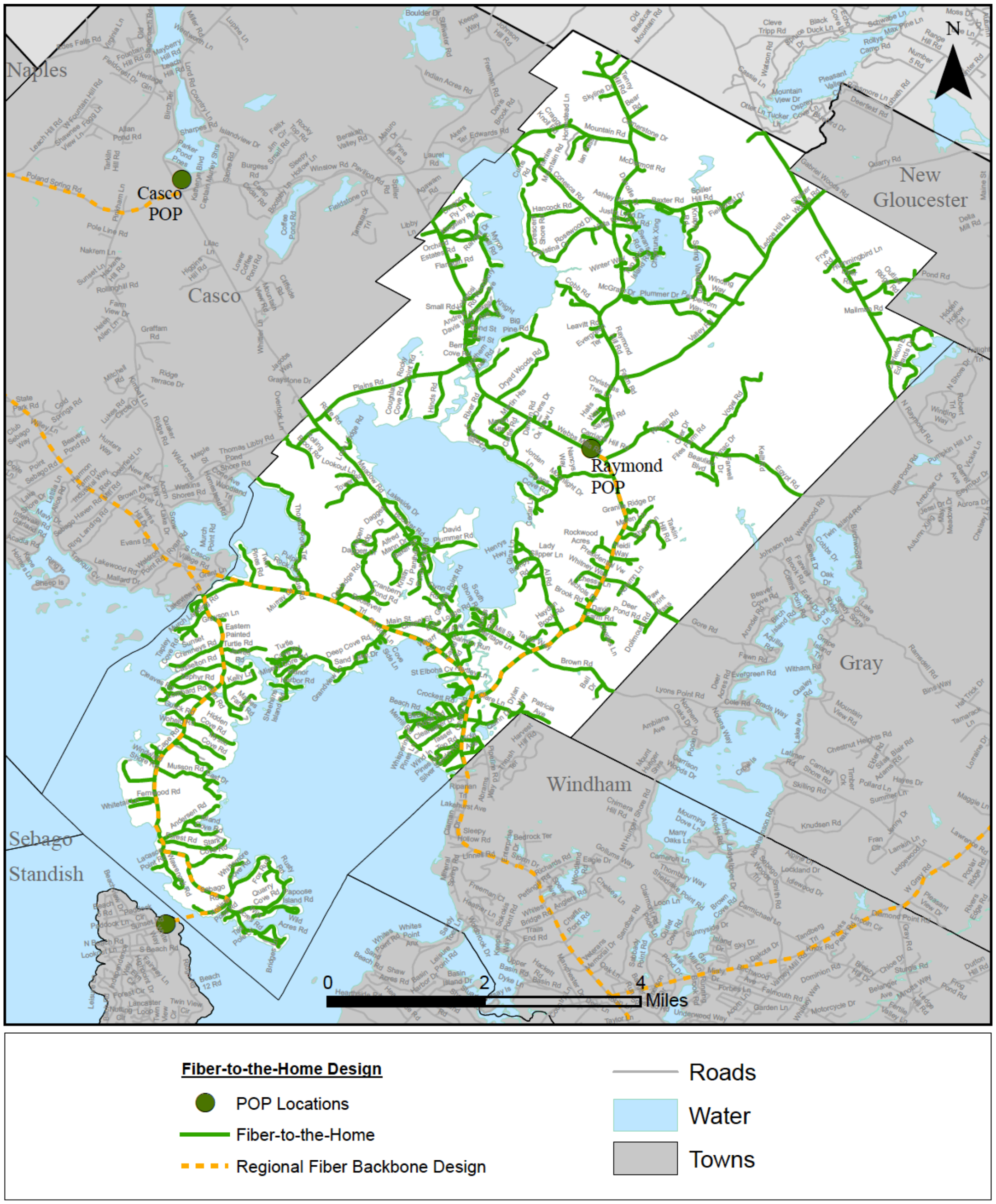
FTTH Design 22: Pownal



FTTH Design 23: Raymond

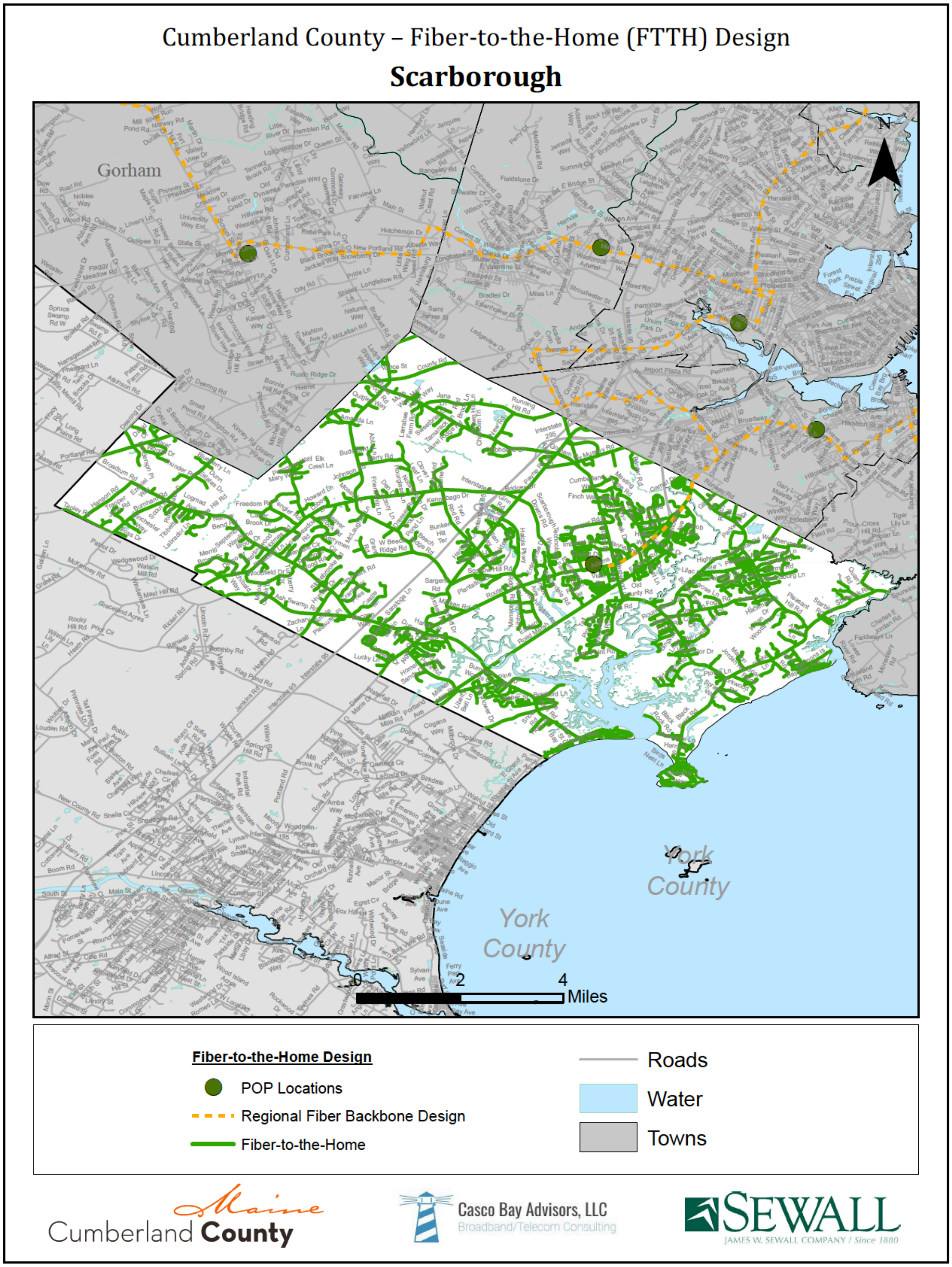
Cumberland County – Fiber-to-the-Home (FTTH) Design

Raymond



2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

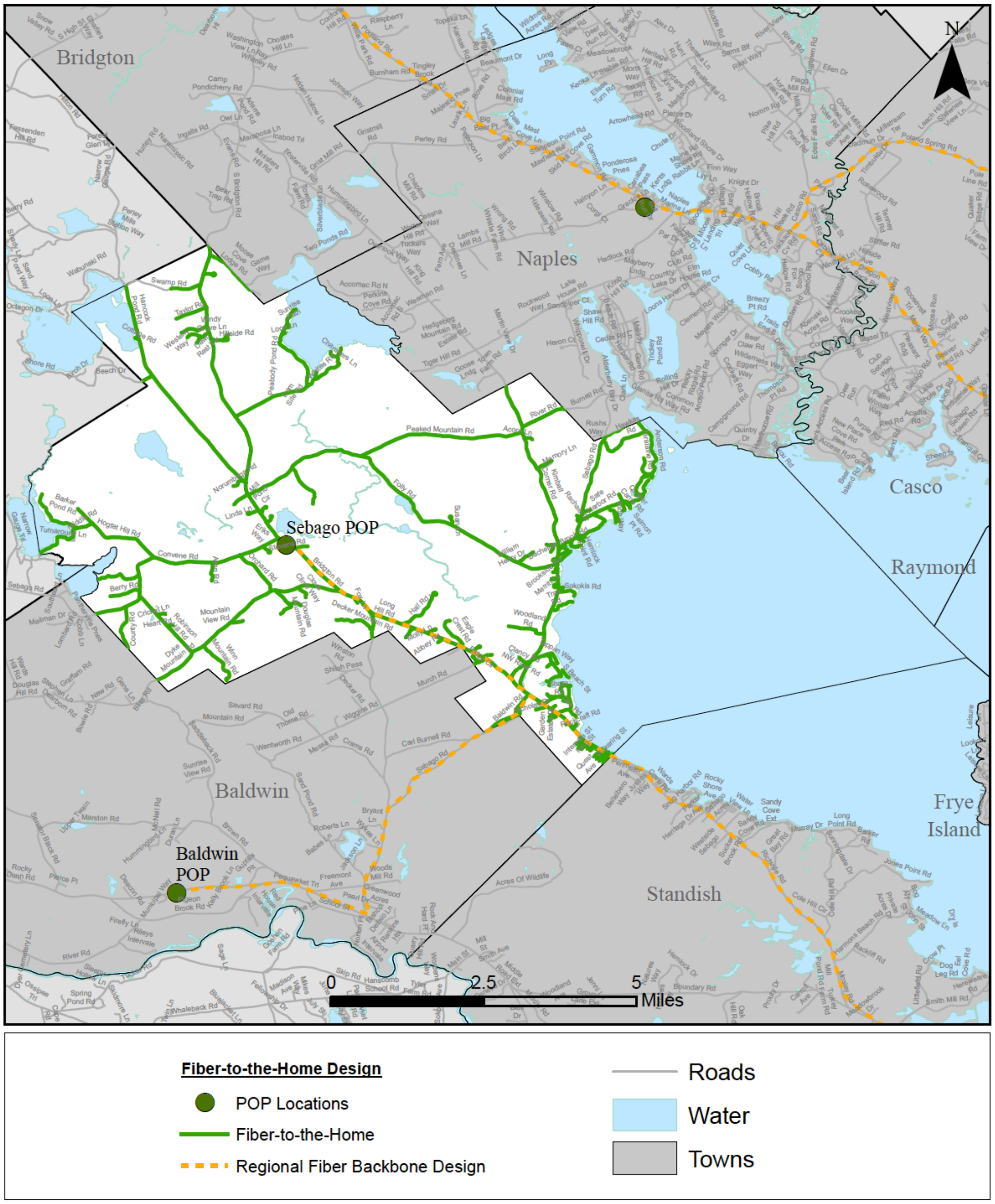
FTTH Design 24: Scarborough



FTTH Design 25: Sebago

Cumberland County – Fiber-to-the-Home (FTTH) Design

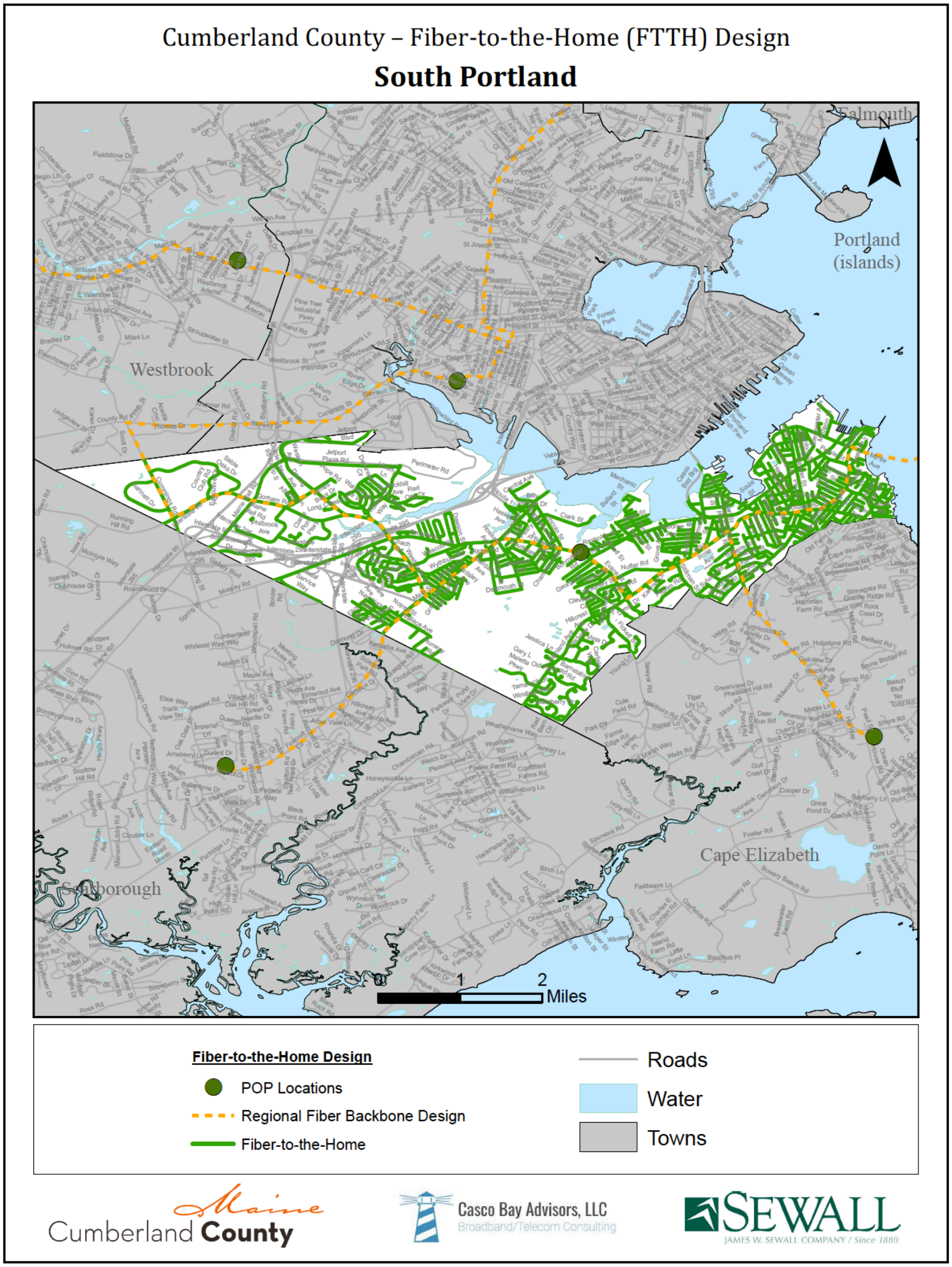
Sebago



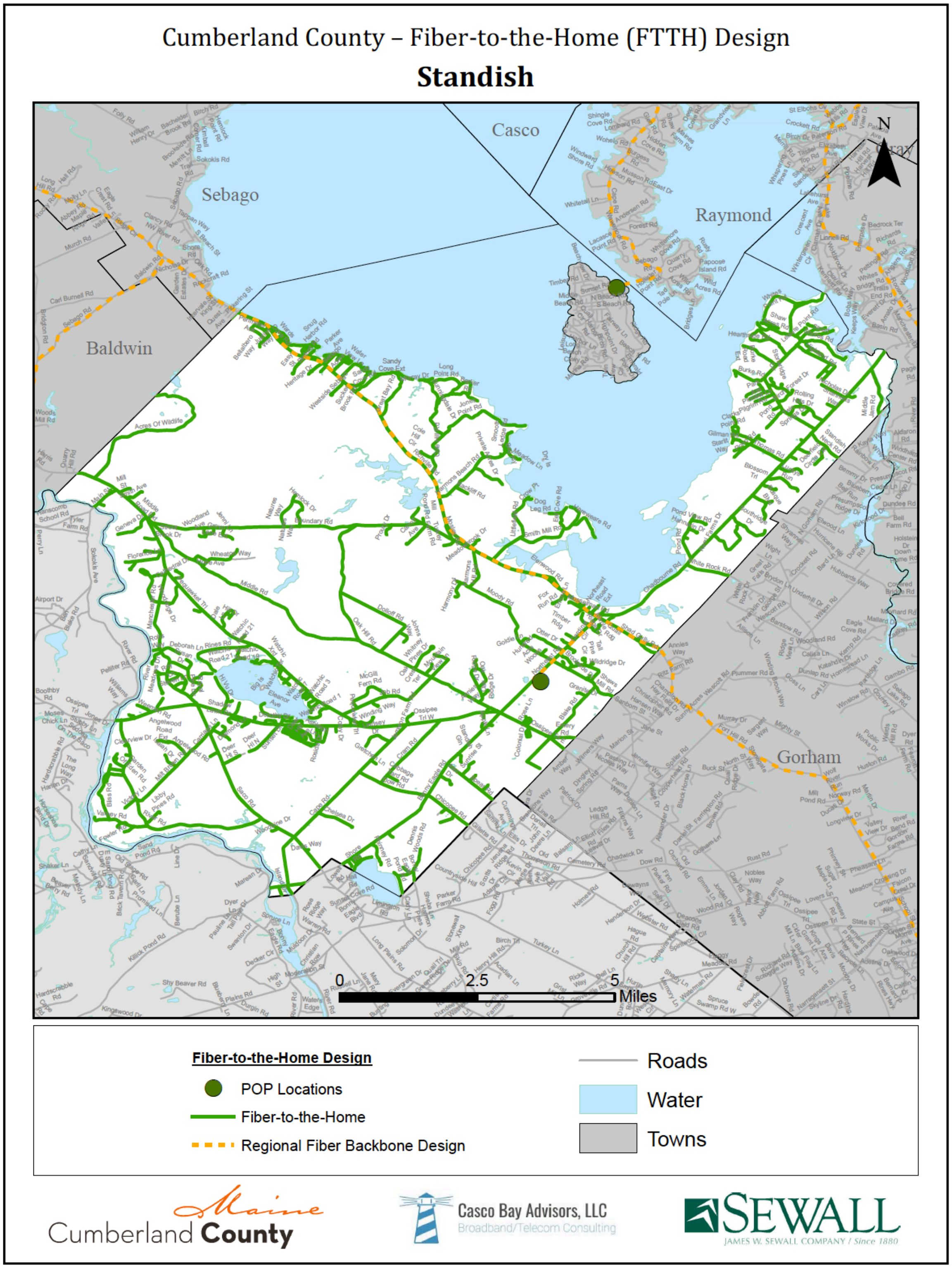
Maine Cumberland County
Casco Bay Advisors, LLC Broadband/Telecom Consulting
SEWALL JAMES W. SEWALL COMPANY / Since 1880

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

FTTH Design 26: South Portland



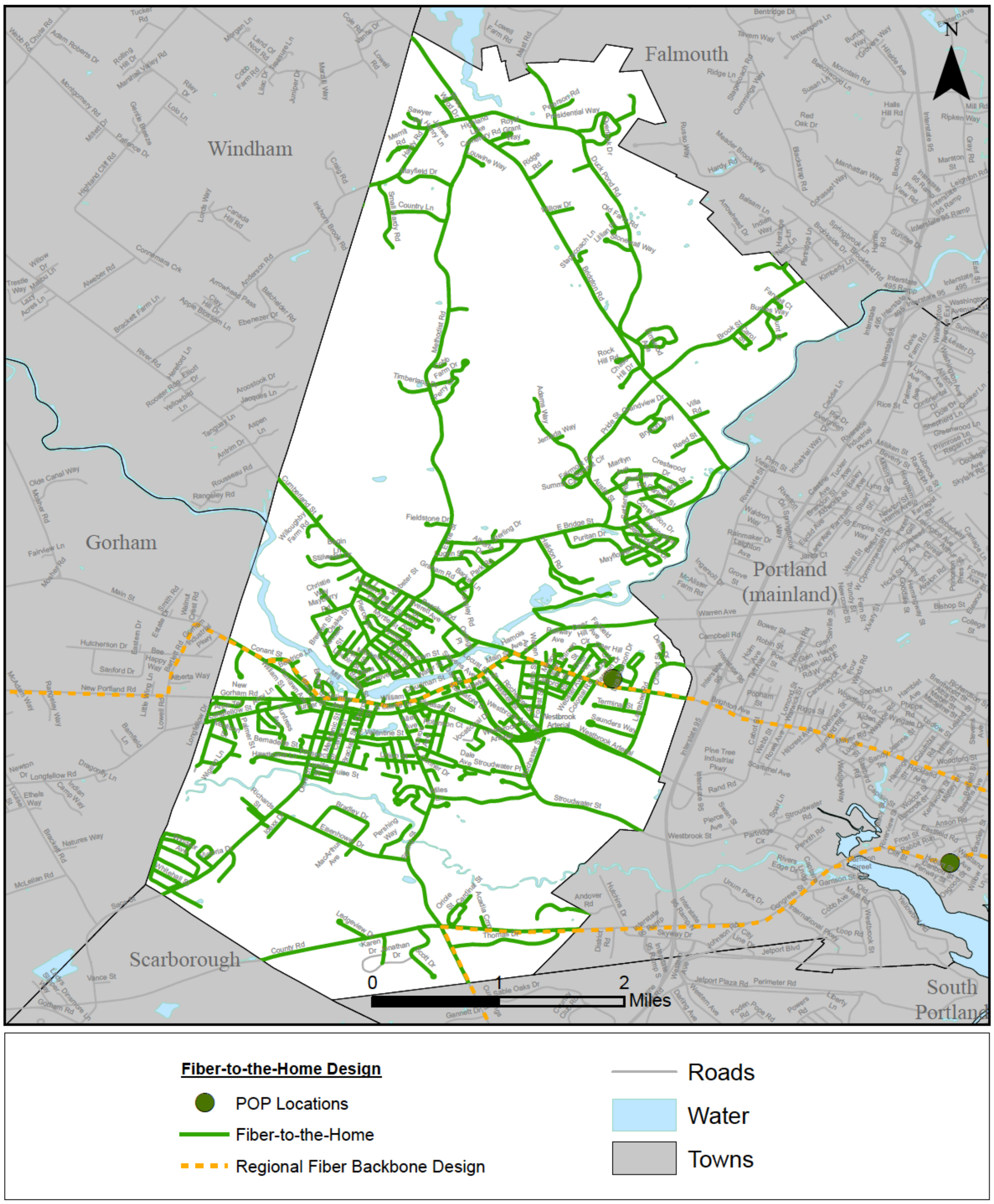
FTTH Design 27: Standish



FTTH Design 28: Westbrook

Cumberland County – Fiber-to-the-Home (FTTH) Design

Westbrook



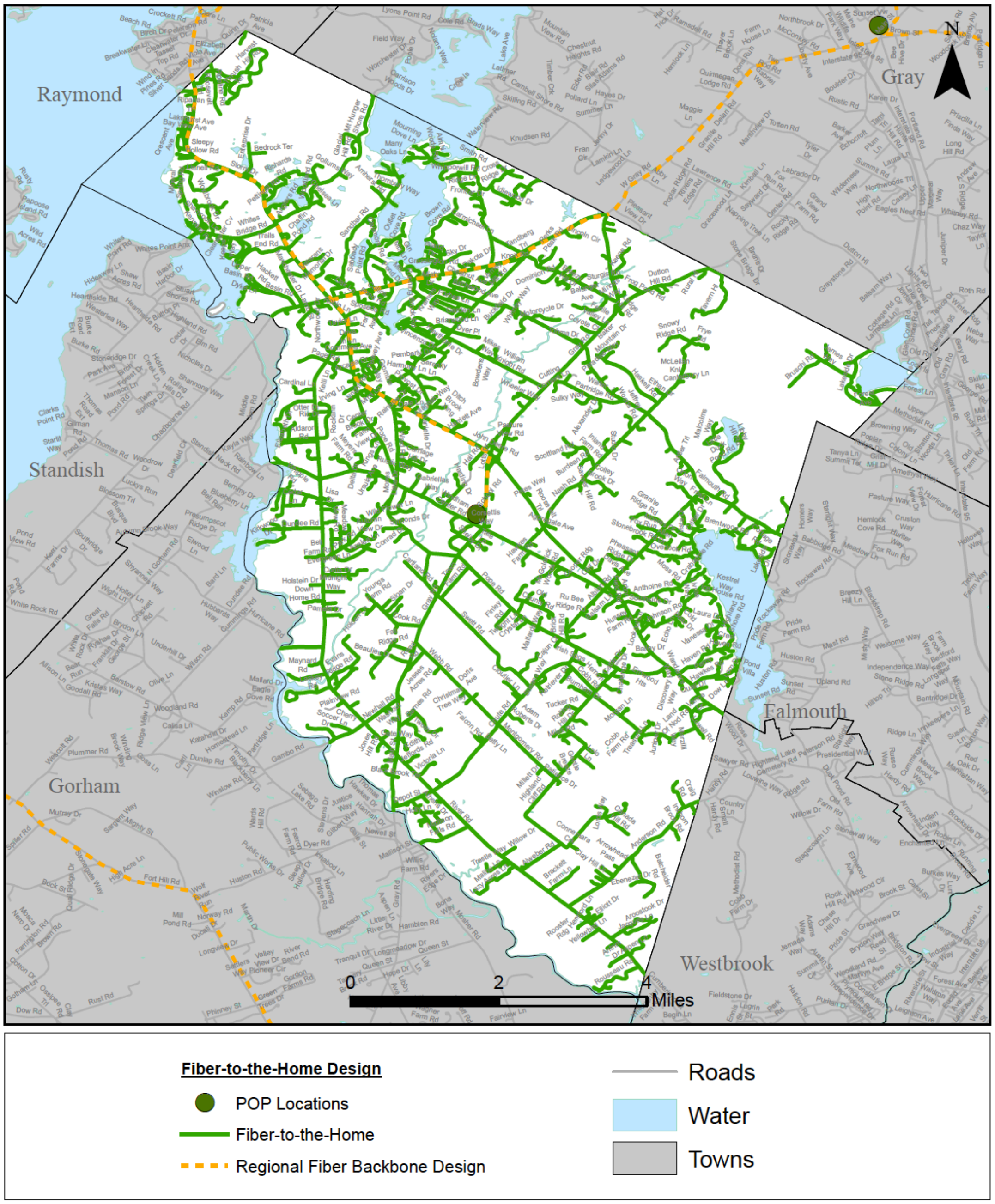
Cumberland County | Casco Bay Advisors, LLC Broadband/Telecom Consulting | SEWALL JAMES W. SEWALL COMPANY / Since 1880

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

FTTH Design 29: Windham

Cumberland County – Fiber-to-the-Home (FTTH) Design

Windham



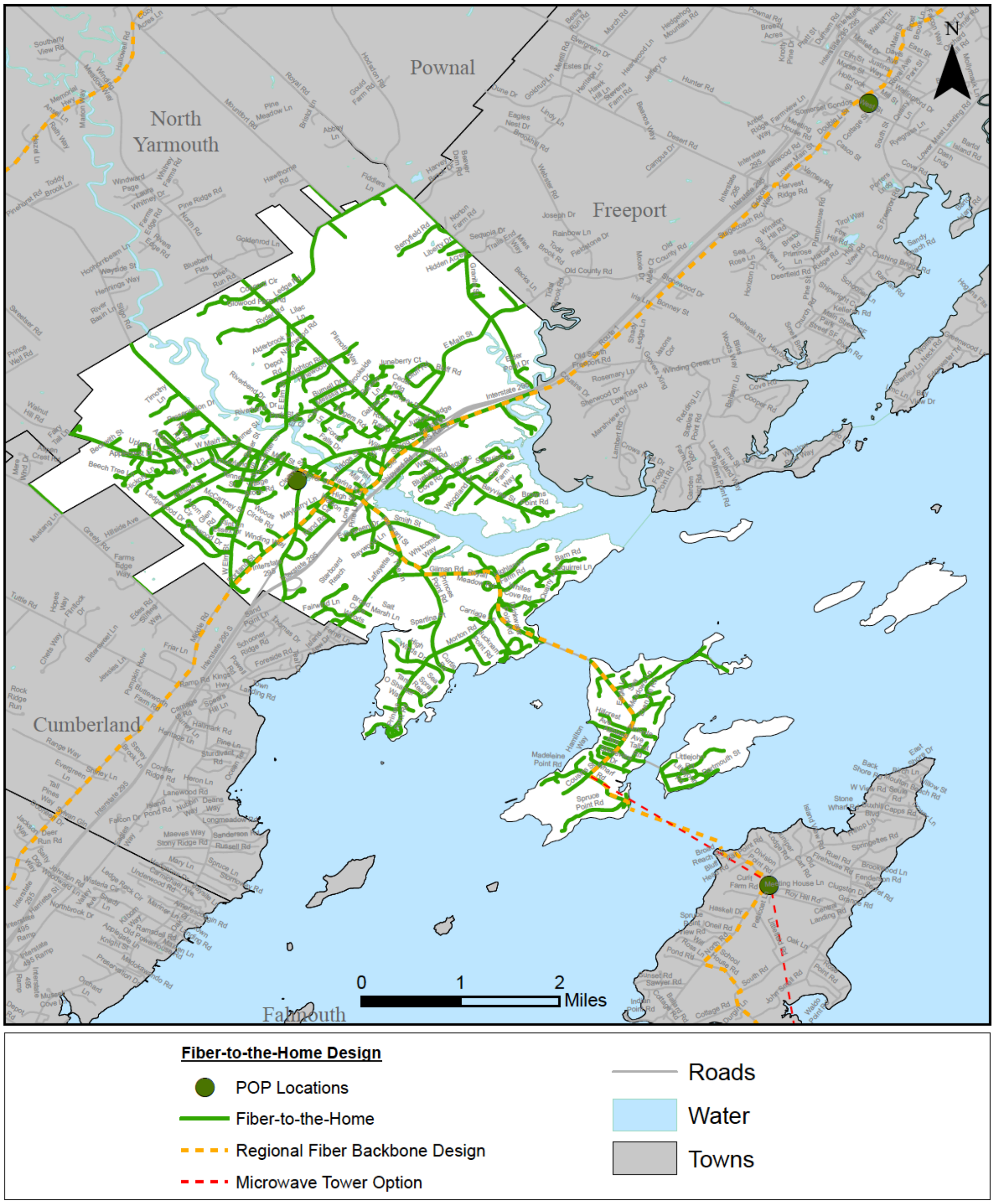
Maine
Cumberland County
Casco Bay Advisors, LLC
Broadband/Telecom Consulting
SEWALL
JAMES W. SEWALL COMPANY / Since 1880

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

FTTH Design 30: Yarmouth

Cumberland County – Fiber-to-the-Home (FTTH) Design

Yarmouth



Maine Cumberland County
Casco Bay Advisors, LLC Broadband/Telecom Consulting
SEWALL JAMES W. SEWALL COMPANY / Since 1880

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

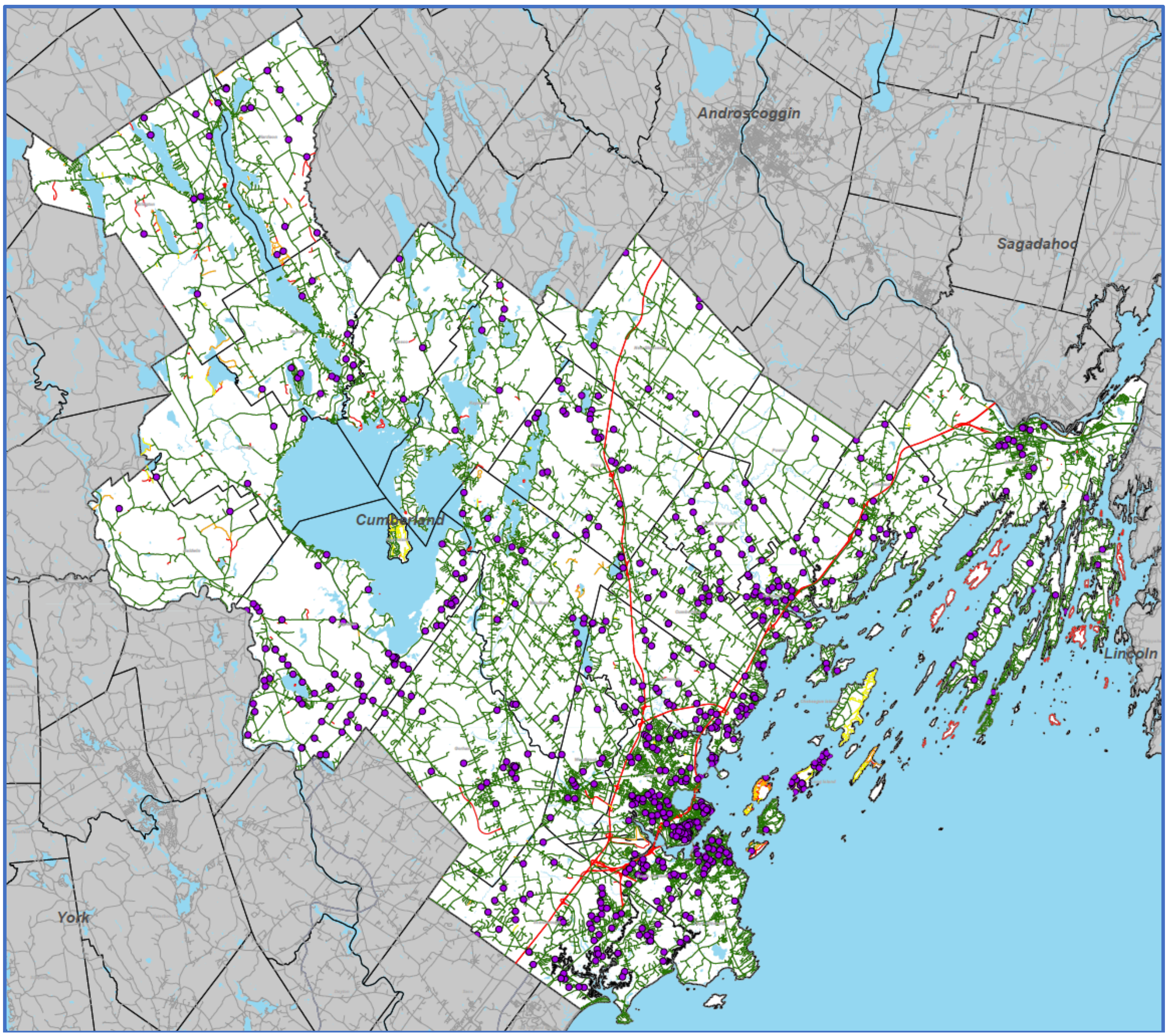
17.3 Consumer and Business Survey – Detailed Results

This page is intentionally left blank. The following pages include the detailed survey results.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

Q1 - What is the location where you currently access or would prefer to access the internet from?

The survey was open to public access using a link on the Cumberland County website. Respondents were recruited via a public outreach effort made by the County staff and other local community groups collaborating with the County's team. With few exceptions, respondents provided valid address locations which enabled a geographic related profile of the group. The survey represents a cross section of the County as illustrated on the following map. The group represents urban, suburban and rural regions where the majority of locations are reported to have at least one service provider delivering basic level or better broadband options as currently defined by the FCC and the ConnectME Authority.



2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

Q2 - Is this location a home or business address?

Answered: 775 Skipped: 0

ANSWER CHOICES	RESPONSES	
Home	88.13%	683
Business	1.42%	11
Both	10.45%	81
TOTAL		775

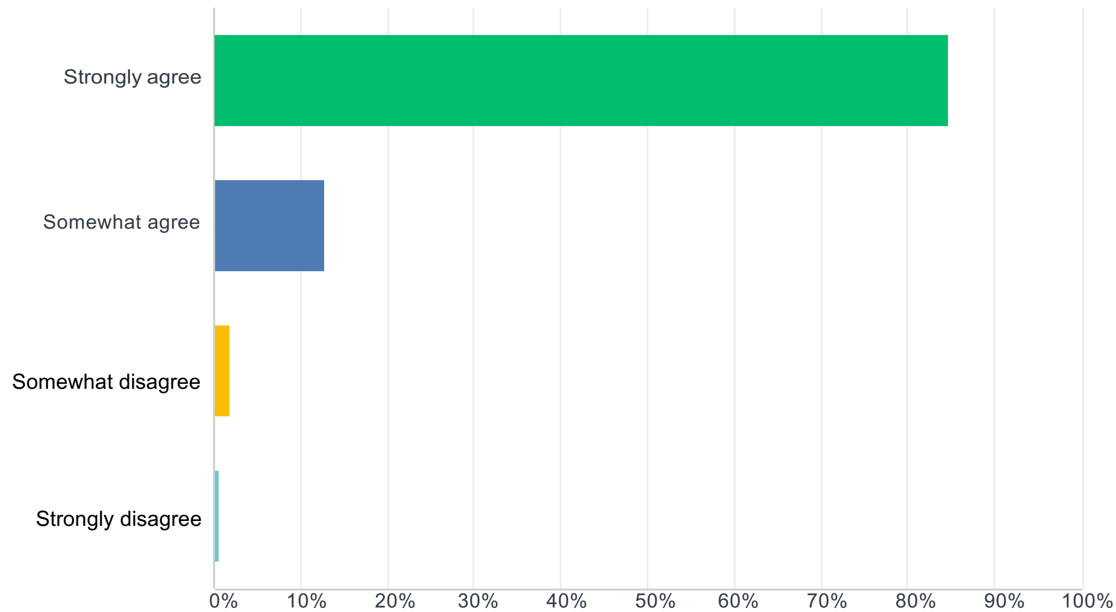
The majority of respondents represented residential users. Though traditional businesses were not as active in the poll, there were a significant number of home-based businesses represented in the group profile. Those communities where home-based businesses were indicated in the response include:

Town Name	Home-based Businesses
Bridgton	3
Brunswick	2
Cumberland	3
Cumberland Center	1
Cumberland Foreside	1
Falmouth	4
Freeport	2
Gray	3
Harpswell	1
Harrison	5
Long Island	5
Naples	1
New Gloucester	1
North Yarmouth	5
Portland	10
Raymond	1
Scarborough	11
South Portland	3
Standish	6
Westbrook	2
Windham	3
Yarmouth	8
TOTAL	**81**

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

Q3 - To what extent do you agree with the following statement? “Internet service is as important as electricity and telephone service.”

Answered: 775 Skipped: 0

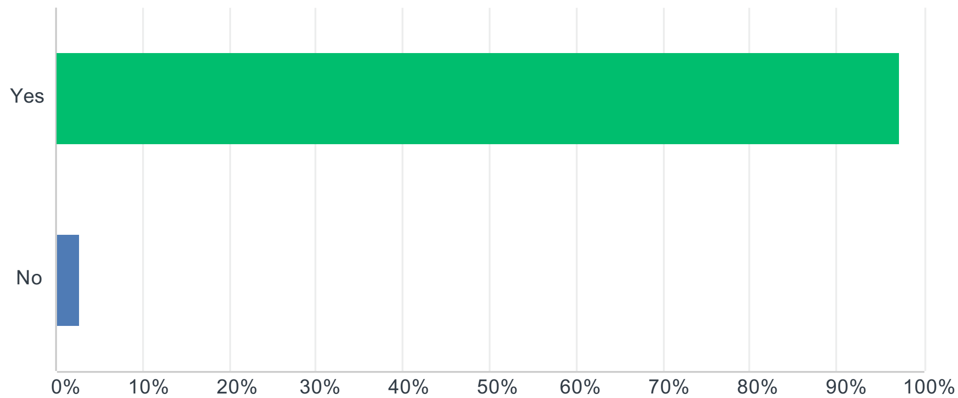


ANSWER CHOICES	RESPONSES	
Strongly agree	84.65%	656
Somewhat agree	12.77%	99
Somewhat disagree	1.94%	15
Strongly disagree	0.65%	5
TOTAL		775

Respondents consider access to Internet services a critical infrastructure item in today’s economy. As found in other industry studies, this belief is consistent among both personal and business users of broadband services.

Q4 - Do you currently subscribe to Internet service at the preferred location you provided?

Answered: 775 Skipped: 0



2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

Q5 - From which provider do you currently subscribe? *(Select all with whom you have an active account)*

Answered: 775 Skipped: 0

75% of respondents currently subscribe to services from Spectrum with Consolidated Communications and Verizon a distant second and third.

Answer Choices	Responses	
Spectrum	74.84%	580
Consolidated Communications	9.94%	77
Verizon	8.39%	65
Comcast Xfinity	6.71%	52
AT&T	6.06%	47
T-Mobile	2.32%	18
GWI	2.32%	18
US Cellular	2.06%	16
OTT/Otelco	1.68%	13
Redzone	1.03%	8
Sprint	0.77%	6
HughesNet	0.39%	3
FirstLight	0.13%	1
LCI	0.00%	0
No Service at this location	1.94%	15
Other (please specify)	2.19%	17

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

Q6 - Which of the following best describes the plan you currently subscribe?

Answered: 775 Skipped: 0

ANSWER CHOICES		RESPONSES
Up to 7 Mbps	6.71%	52
Up to 10 Mbps	8.00%	62
Up to 25 Mbps	20.26%	157
Up to 50 Mbps	15.87%	123
Up to 100 Mbps	32.52%	252
More than 100 Mbps	9.94%	77
Do not have a service option at this location	6.71%	52
TOTAL		**775**

There is an unexplainable disconnect between those who indicated in Q4 they did not currently subscribe to an internet service plan (21) and those that indicate they do not have a service plan option here (52) in this question.

That item aside, the service data indicates most subscribers believe they utilize plans that provide between 25 and 100 Mbps in download service speeds while approximately 10 percent subscribe to higher speeds. Based on the current reported service availability data from ConnectME, 80 to 85% of Cumberland County has at least one service option that provides capacity to deliver up to 100 Mbps download speed or higher, yet only 45.5% of potential subscribers who responded to the survey claim to utilize packages that provide that level of service. This suggests factors beyond network speed are influencing those buying decisions.

There is also a disconnect between the responses in Q5 where 74.84% of respondents utilize Spectrum, which provides a minimum level of service at 100Mbps/10Mbps and the 32.52% respondents in this question who suggest they subscribe to service up to 100Mbps. We believe this can be attributed to two factors. First, the subscribers may not actually know the level of service to which they subscribe, and two, while Spectrum advertises a minimum 100Mbps/10Mbps service, actual speeds reportedly vary, especially during the high-usage times of the day.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

Q7 - Which of the following best describes the cost you pay monthly for your current service?

Answered: 775 Skipped: 0

ANSWER CHOICES	RESPONSES	
$20.00 or less	0.65%	5
$21.00 to $30.00	2.32%	18
$31.00 to $45.00	12.52%	97
$46.00 to $75.00	50.58%	392
More than $75.00	31.23%	242
	TOTAL	**775**

Q8 - Which of the following best describes the most you are willing to pay for internet service monthly, regardless of speed?

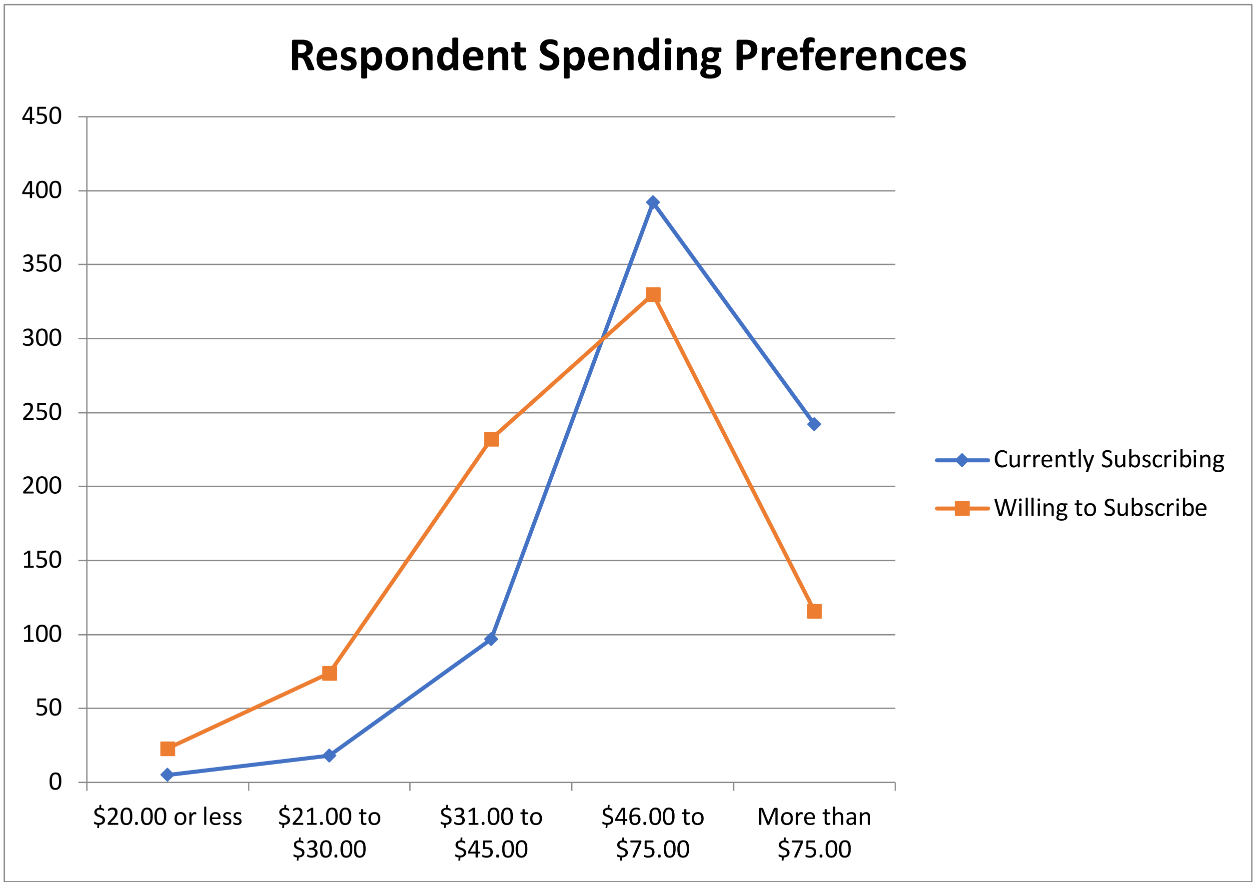
Answered: 775 Skipped: 0

ANSWER CHOICES	RESPONSES	
$20.00 or less	2.97%	23
$21.00 to $30.00	9.55%	74
$31.00 to $45.00	29.94%	232
$46.00 to $75.00	42.58%	330
More than $75.00	14.97%	116
TOTAL		775

Some measure of buyer satisfaction can be seen in the data presented in these two questions. The following chart created from these groups of responses suggests that about 30% of subscribers in the two highest subscription ranges feel some level of dissatisfaction with their purchase. Further study into this aspect of user sentiment by the current network operators might reveal ways to improve customer satisfaction about those purchases within the capacity of the current solutions offered. For example it may be possible to improve customer satisfaction by providing guidance that helps users understand the relationship between service levels and the demands of the implements *(phones, computers, personal devices, smart tvs and other appliances)* that drive that service requirement or

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

perhaps the factors created by their home or business network components that may affect service performance.



2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

Q9 - Which of the following items are not supported by your current Internet service? *(choose all that apply)*

Answered: 775 Skipped: 0

ANSWER CHOICES	RESPONSES	
Basic web browsing	6.71%	52
Email	6.19%	48
Online shopping and banking	6.32%	49
Social networking apps (Facebook, Twitter, YouTube, Instagram)	6.32%	49
Streaming video or music	10.19%	79
Video chat/conferencing	7.87%	61
Sending photos or videos	5.81%	45
Online gaming	8.13%	63
Multiple users at the same time	15.10%	117
Work at home/remote office	9.94%	77
E-commerce website support	11.87%	92
Field workforce support	11.23%	87
Telemedicine services (heart monitor or other sensor)	14.19%	110
Transmitting large data files	20.39%	158
I can do all of the items on this list	56.65%	439
Other (please specify)	10.97%	85
Total Respondents		**775**

This data point suggests that that the current users of broadband services are largely unencumbered from performing the tasks/functions that they want to. The anecdotal information provided in commentary suggests that the respondent's frustration was found more within the business process with their provider and there is a desire for other options to seek service in those instances.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

Q10 - Rate the importance of the following items for how you want to use the Internet

Answered: 775 Skipped: 0

	NOT IMPORTANT		NEUTRAL		VERY IMPORTANT	WEIGHTED AVERAGE
Basic web browsing	0.39% 3	0.00% 0	2.97% 23	8.00% 62	88.65% 687	4.85
Email	0.39% 3	0.52% 4	1.81% 14	7.23% 56	90.06% 698	4.86
Online shopping and banking	1.94% 15	0.39% 3	6.97% 54	14.06% 109	76.65% 594	4.63
Social networking apps (Facebook, Twitter, YouTube, Instagram)	12.65% 98	5.55% 43	24.90% 193	19.74% 153	37.16% 288	3.63
Streaming video or music	5.03% 39	2.58% 20	13.42% 104	20.00% 155	58.97% 457	4.25
Video chat/conferencing	14.19% 110	6.84% 53	24.39% 189	17.16% 133	37.42% 290	3.57
Sending photos or videos	3.61% 28	3.74% 29	19.10% 148	23.10% 179	50.45% 391	4.13
Online gaming	52.65% 408	9.03% 70	18.32% 142	6.97% 54	13.03% 101	2.19
Multiple users at the same time	7.74% 60	1.68% 13	6.84% 53	10.71% 83	73.03% 566	4.40
Work at home/remote office	11.10% 86	3.61% 28	13.42% 104	10.45% 81	61.42% 476	4.07
E-commerce website support	32.90% 255	7.48% 58	27.74% 215	10.71% 83	21.16% 164	2.80
Field workforce support	36.26% 281	6.32% 49	31.87% 247	8.65% 67	16.90% 131	2.64
Telemedicine services	32.90% 255	5.42% 42	34.84% 270	10.84% 84	16.00% 124	2.72
Transmitting large data files	16.39% 127	4.65% 36	23.10% 179	16.90% 131	38.97% 302	3.57

The list of functions in this question represents a cross section of processes that support common personal and business use of broadband service. The cross section represents a range of bandwidth and speed needed to perform a given task represented. In a vacuum, this technical need defines the service plan level a subscriber should choose in order to support their intended use. For planning purposes, this data can help frame the potential take rate for a plan package that is offered by a service provider, thus helping to set the market offering. The response values represent a five-point rating system where a score of 1 represents an item that is not as important (low demand) and a score of 5 is considered very important (high demand).

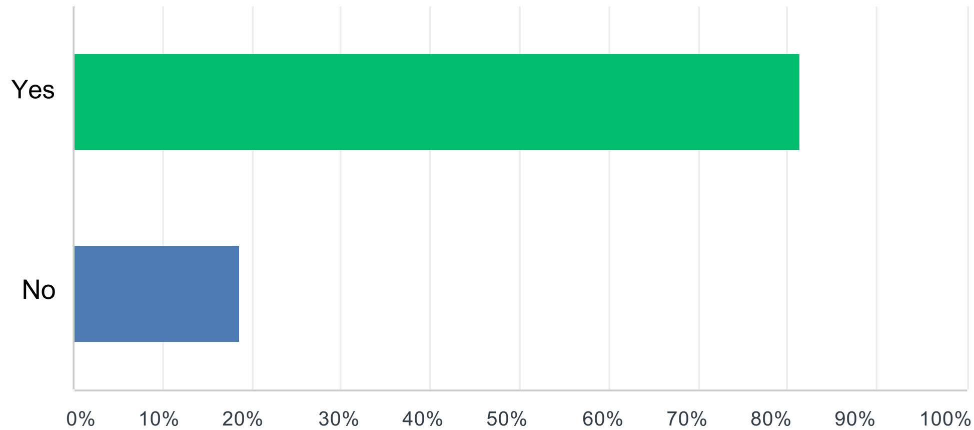
Using this data, we can see a weighted order of need among this population based on the way subscribers are most interested in using the technology. A lower weighted score should not be interpreted to mean that item is not important to support, but rather a measure for the size of the subscriber group using the Internet in that manner. The following table summarizes the ranked measure for this survey result in order of high demand processes to lower demand processes.

User Function	Weighted Average
Email	4.86
Basic web browsing	4.85
Online shopping and banking	4.63
Multiple users at the same time	4.40
Streaming video or music	4.25
Sending photos or videos	4.13
Work at home/remote office	4.07
Social networking apps (Facebook, Twitter, YouTube, Instagram)	3.63
Video chat/conferencing	3.57
Transmitting large data files	3.57
E-commerce website support	2.80
Telemedicine services	2.72
Field workforce support	2.64
Online gaming	2.19

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

Q11 - Do you believe you will need faster, higher capacity service in the future to support your Internet devices?

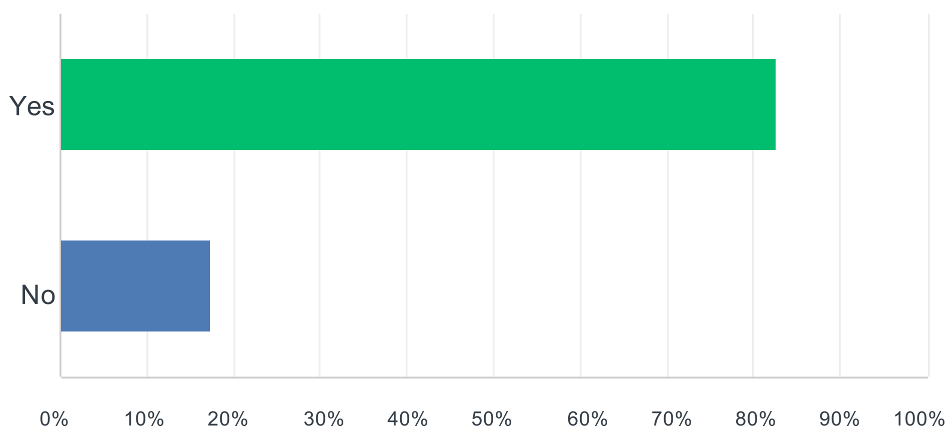
Answered: 775 Skipped: 0



Respondents largely envision their service capacity needs will increase over time. They also indicate an interest to acquire faster broadband services.

Q12 - If you could get faster, higher capacity service now, would you subscribe?

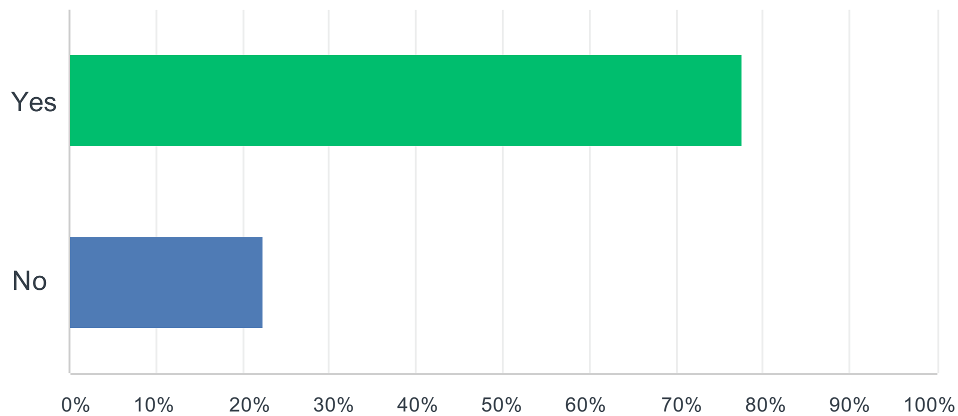
Answered: 775 Skipped: 0



2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

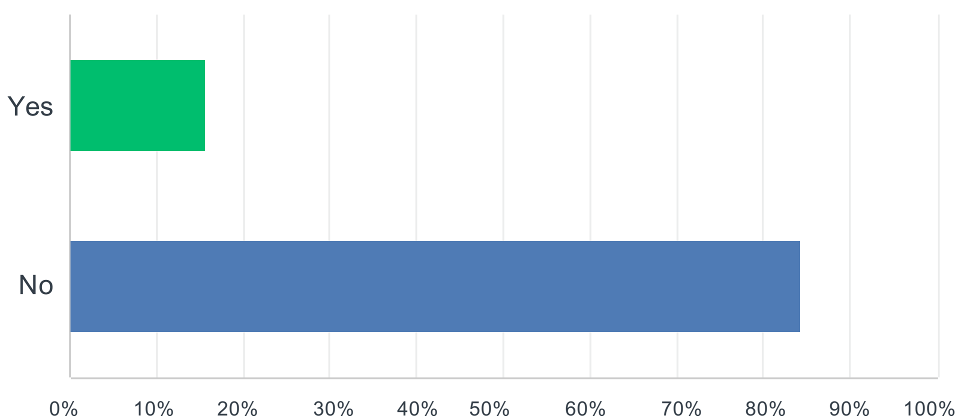
Q13 - If 100 Mbps service were available at your location for a monthly rate of $60 would you subscribe?

Answered: 775 Skipped: 0



Q14 - If 1000 Mbps (1 GB) service were available at your location for a monthly rate of $150 would you subscribe?

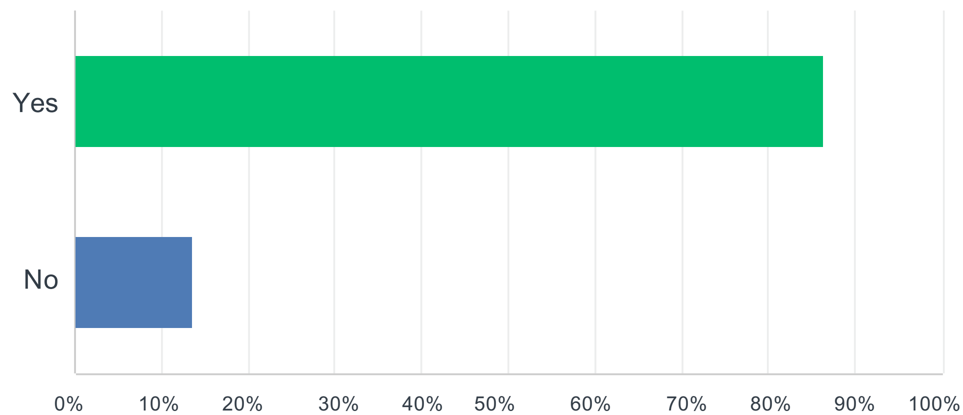
Answered: 775 Skipped: 0



2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com

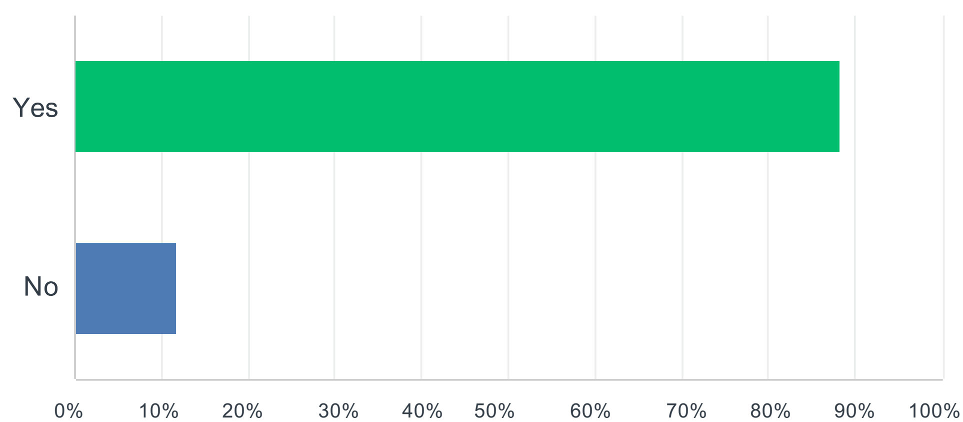
Q15 - Could you support a community led, bond funded effort to build a faster, higher capacity network that will provide service in your area?

Answered: 775 Skipped: 0



Q16 - Could you support the community owning fully or a share of a broadband utility network that will provide faster, higher capacity service?

Answered: 775 Skipped: 0



The survey results suggest there would be wide support in the event that communities chose to pursue a solution to any unmet need that might include the use of public funds to develop or enhance the delivery system.

2 Streamside Lane
Gardiner, Maine 04345
(207)233-2976
www.cascobayadvisors.com