DIGITAL MARIN
IMPLEMENTATION REPORT

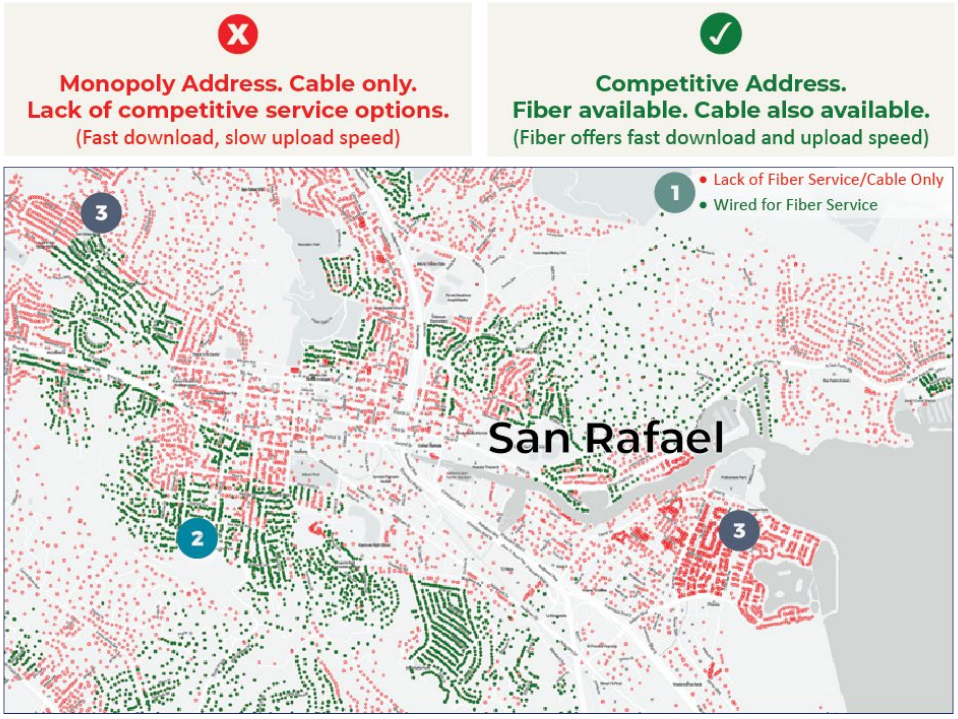
ENTRY POINT NETWORKS

DIGITAL MARIN

Table of Contents

Executive Summary

Since the adoption of the Digital Marin Strategic Plan by Marin County in February 2022, the broadband landscape for the residents of Marin has grown more troubling. New data confirms a **digital divide** still exists between served and underserved areas of Marin County, and exposes new, emerging digital divides due to technology, housing type, and location within and between communities and neighborhoods. The map below illustrates how available internet technology creates a digital divide in Marin.



1 **A digital divide exists on the type of technology available.** Fiber offers symmetrical speeds: incoming video quality (download) and outgoing video quality (upload) are the same. Cable is asymmetrical, with slow upload speeds that hinder working and attending school remotely. Red dots can *only* get cable service.

2 **A digital divide exists for the type of home you live in.** Even if you live in an area where fiber service is available next door or across the street, the home or community may not be served for fiber. Most apartment buildings and condominium units in Marin do not have access to fiber.

3 **A digital divide exists on access, affordability, and options.** Certain areas do not meet internet service providers (ISPs) qualifications for financial return on investment (ROI) formulas. Based on poor ROI, areas in red are not funded for fiber builds, and therefore residents can *only* get cable.

These problems with a digital divide are driven by the location and financial modeling behind building the underlying infrastructure. This infrastructure, which constitutes the metaphorical roadways upon which internet access travels, should not be built entirely based on various formulas generated for the pure purpose of turning a profit.

> The solution to these problems: treating the fiber infrastructure as a public utility. Marin needs a municipal network open to multiple internet service providers (ISPs), serving all residents and businesses, thus ensuring equity and competition, and driving down prices for the end user.

With the wide release of federal and state funding for broadband planning, there has been a sharp rise in organizations, both public and private, jockeying to position themselves to receive the lion's share of the capital funding to come. Navigating this broadband bonanza will require a focus on Marin leadership because obtaining Marin's share of these upcoming funds represents an irresistible potential windfall for stakeholders inside and outside of Marin, leading them to all vie for the County's attention by offering quick and easy solutions. For these reasons, it is imperative that leadership remains focused on plan execution.

Digital Marin has successfully secured funding to improve connectivity in unserved and underserved areas of the County. The deliverables laid out in the ensuing report will be essential to successfully obtaining additional state and federal broadband capital funding.

This Implementation Report details the progress made by Digital Marin in implementing the Strategic Plan. It also highlights Digital Marin's essential need for the County to continue incubating the expertise and capacity necessary for it to mature and evolve into a Countywide operational solution. The actions outlined in this report will position Digital Marin to leverage all the opportunities available and result in the best possible outcomes for Marin County residents and businesses.

Specific recommendations include:

- Action 1 – Establish and fund two (2) full-time positions on the Digital Marin team.
- Action 2 – Formalize the selection of an operational model.
- Action 3 – Assume or procure the virtual network provider (VNO) role.
- Action 4 – Continue to update and socialize the plan with the community and potential retail internet service providers.
- Action 5 – Research, evaluate, and institutionalize Digital Marin design standards.
- Action 6 – Establish the internal support mechanisms and assign ownership to establish a cohesive and progressive community engagement program.

"Over the next decade, technologies in their infancy will move from development to production. The internet we know today will evolve to accommodate these new services and applications like connected mobility, the blockchain, a transactive energy grid focused on renewable energy, digital education, healthcare delivery systems, and virtual reality technologies.

By leveraging the technical expertise of the Information Services and Technology (IST) Department, government and community leadership, Digital Marin is in the best position to manage the available funding opportunities and place Marin at the forefront of these advancements."

DIGITAL MARIN

Strategic Plan Update & History

Since the adoption of the Digital Marin Strategic Plan in 2022, the Federal Communications Commission (FCC) released a new version of the National Broadband Map. On November 18, 2022, counties like Marin could, for the first time, identify the type of internet service available to each household and resident. Prior versions of the map were based on provider coverage by census block, where if just one home in a block had service, the entire block was considered as served. Keep in mind, the average block in urban Marin contains 400-500 residential homes. This distorted service availability in favor of the internet service providers (ISPs), masking several concerns which have arisen from the new single-address-based map.

The pandemic focused the nation's attention on the digital divide between those residents with and those without access to readily available, affordable, adequate, and equitable internet service. Affordability and equity issues in the high-density, low-income communities of San Rafael's Canal neighborhood and unincorporated Marin City, both of which have significant K-12 student populations, are well documented. But the new FCC map reveals other digital divides between and within communities that were not previously known since they were masked by census block reporting.

In 2018/19, AT&T brought the first high-speed residential internet service to several communities in urban Marin delivered through an optical-fiber network. These communities included:

San Rafael, Larkspur, Sausalito, Corte Madera, Mill Valley, San Anselmo, Fairfax, and parts of unincorporated Marin (Sleepy Hollow, Strawberry, Tamalpais Valley-Homestead, Alto, Almonte)

AT&T, at the time, was responding nationwide to an FCC condition of its merger with Direct TV. "As part of the merger, AT&T-DirecTV will be required to expand its deployment of high-speed, fiber optic broadband internet access service to 12.5 million customer locations as well as to E-rate eligible schools and libraries," the FCC's announcement said.

Map Exhibit 1.0 reveals AT&T's pattern of investment. Rather than bringing fiber service to entire towns, cities, communities, neighborhoods, or even individual streets, as might be expected, AT&T more often parsed clusters of residential homes in wealthier neighborhoods and census tracts, primarily installing small, noncontiguous fiber networks that carved up the county into what can be described as Swiss cheese.

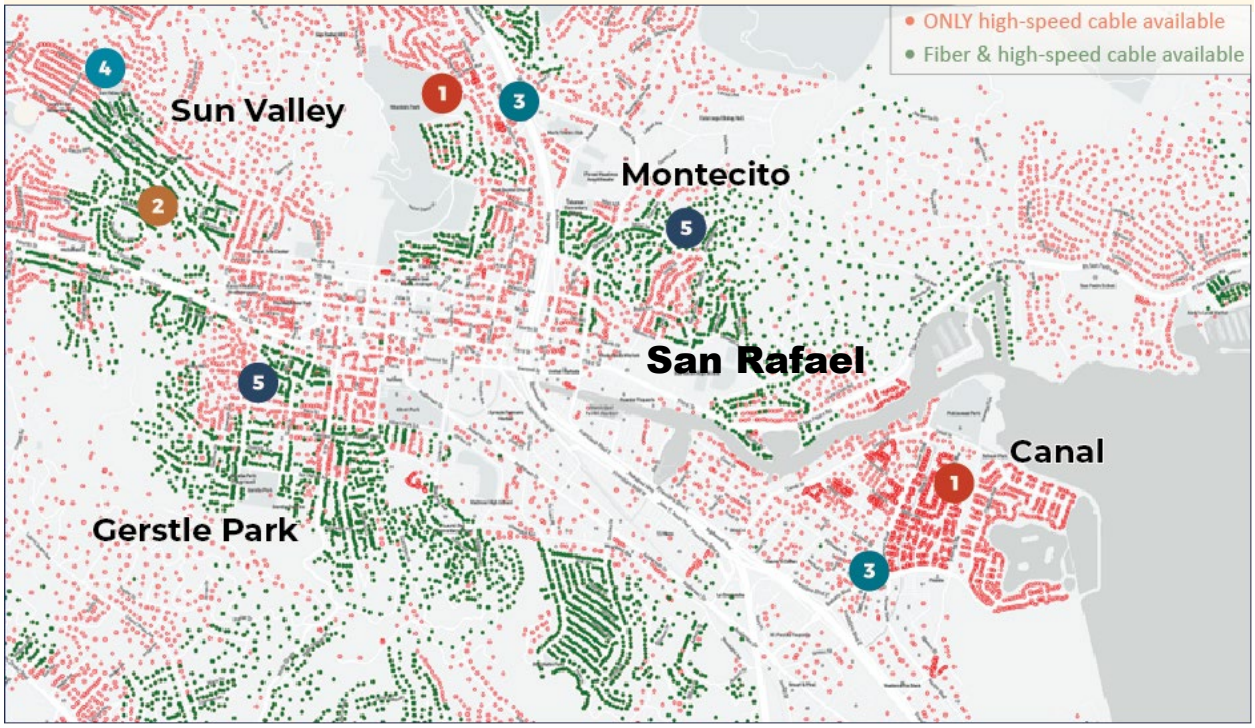
As troubling, AT&T bypassed almost every apartment building with ten (10) or more units and most condominium complexes when those facilities were often right next to a single-family home with fiber service.

According to the 2017-2021 American Community Survey 5-year estimates, updated on December 8, 2022, 24% of respondents in Marin County reported working from home, with a high of 48% in tract 1302.03 at the north end of Sausalito composed almost entirely of condominiums and apartments. And, despite all efforts made when Marin's schools were shuttered during the pandemic, an estimated 3,400 school-age children living in the Canal still experience a significant "homework gap" for a lack of adequate internet access at home.

DIGITAL DIVIDE

Technology A digital divide exists on the type of technology available. Fiber is superior to cable.

Competition Green dots have a choice. They can sign up for Cable or Fiber from either of two providers. Red dots lack competition entirely.



1 High demand, low capacity, low Median Household Income, maximum population density in apartments and condos.

Every new customer that fiber takes off of the cable network relieves bandwidth pressure on the Comcast Shared neighborhood node.

Most apartment buildings do not have access to fiber.

2 Low demand, high capacity, high Median Household Income neighborhood receives all the benefits and improved performance of a fiber network.

3 Digital Divide on access, affordability, and options. These areas have only one choice, cable, and everyone shares.

4 Digital Divide on location led to fiber not being built to the balance of Single-Family homes in the adjacent neighborhood, creating a fiber island.

5 Digital Divide on the type of home you live in, even if fiber service is available or close by.

Internet service providers continually raise their prices making affordability an ongoing concern despite federal subsidy programs like the FCC's Affordable Connectivity Program (ACP). Now we can add digital divide and inequities between housing types, locations, competitive pricing, and bandwidth capacity.

If you are fortunate enough to live in a single-family home in a neighborhood where AT&T fiber and Xfinity / Comcast cable internet services are available, you can pay less for higher speeds and more bandwidth. When a neighborhood with exceptionally high bandwidth demand shares a single network, the resulting halt in internet performance feels just like rush hour traffic. Rush hour traffic is too many cars and not enough road. Peak usage time is too many users, not enough network capacity. It typically happens weeknights from 7:00-11:00 p.m. when most people are home from work or working late from home and adolescents are not in school and may be doing homework or playing video games. The vast majority of people use the internet simultaneously during peak usage time. The internet connection becomes very sluggish.

Marin County has an average of 4,400 people per square mile. For those living in one of the thousands of apartments or condominiums in the Canal neighborhood (56,000 people per square mile) or the Larkspur Bon Air neighborhood (10,000 people per square mile), Xfinity / Comcast is the only high-speed internet service provider and residents are likely paying higher prices for a neighborhood network node with extremely high demand and significantly lower capacity. The problem is magnified for users that can only afford Xfinity / Comcast's lowest speed tier (75 Mbps) when a family of four with two school-age children needs a minimum of 800 Mbps to support the bandwidth demand inside the home.

For Marin residents and businesses, equity in access and affordability is critical to their ability to engage in the modern world. Likewise, digital equity is essential to the functioning of government entities and the healthcare system. Broadband is now essential like water, power, schools, and roads. Private enterprises do not typically own or manage these essential infrastructures. Imagine a world where UPS builds and maintains certain roads and highways while FedEx builds its separate highway system and roadways. If UPS and FedEx were to bundle the road (infrastructure) costs with shipping packages, they would operate like current national internet service providers. Marin's fiber infrastructure will be treated as a public utility to achieve an equitable digital future for all. The infrastructure should always remain separate.

Next Steps

Ensuing activities to be reimbursed by LATA Grant Funding

1. Establish and fund two full-time IST positions to support LATA work in-house.
2. Formalize the selection of an operational model based on recommendations in this report.
3. Assume or procure the virtual network provider role.
4. Continue to update and socialize the plan with the community and potential retail service providers.

The output from the preceding steps will be a detailed design and business model information sufficient to apply for state and federal funding to create one-to-three operational pilot projects. These projects can be scaled to serve the entire county.

Guiding Principles

The Digital Marin project follows four (4) guiding principles as outlined in the Strategic Plan.

Broadband for All

To close the **digital divide** so everyone in Marin can take advantage of all digital resources and opportunities.

Inclusive & Equitable

Digital projects and initiatives are inclusive and equitable, involving and benefitting all of Marin's communities and sectors.

Community Driven

Digital solutions are community driven to address what communities say is important.

Forward Thinking

Digital projects are forward thinking with near-term wins and long-term gains.

Marin's Digital Roadmap

Four (4) goals with enabling strategies create Marin's digital roadmap.

Goal 1: High-quality broadband is available to everyone in Marin.

Strategies:

- Assist with the deployment of universally accessible public and public/private broadband services throughout Marin.
- Improve the quality, reliability, resiliency, and safety of Marin's broadband services.
- Increase access to affordable broadband service.

Goal 2: Everyone in Marin can take advantage of all online opportunities.

Strategies:

- Coordinate and expand digital literacy training in Marin.
- Expand community-based programs to provide end user devices and support.
- Help organizations create easy to use digital services that work for everyone.

Goal 3: Marin has a high rate of digital adoption that benefits everyone.

Strategies:

- Improve privacy, security, and digital accessibility across Marin.
- Address barriers through education and community problem solving.
- Increase public value from investments in technology.

Goal 4: Marin has a community driven organization with a mission to deliver broadband for all.

Strategy:

- Obtain funding and create an independent operating entity.

DIGITAL MARIN

Goal #1

High-quality broadband is available to everyone in Marin.

Strategies:

- Assist with the deployment of universally accessible public and public/private broadband services throughout Marin.
- Improve the quality, reliability, resiliency and safety of Marin's broadband services.
- Increase access to affordable broadband service.

History

In June 2019, the Marin County Board of Supervisors approved the development of a Digital Infrastructure Strategic Plan, which became the Digital Marin project. At the same time, the Marin County Civil Grand Jury released Marin's Telecommunications Disconnect Report (Jury, 2019) underscoring the need for improved County and Municipal leadership to coordinate solutions. The resulting Strategic Plan provided a roadmap to move Marin into a better digital future by creating leadership, governance, and collaboration via actions that advance broadband deployment and digital adoption.

The Marin County Board of Supervisors unanimously adopted the Digital Marin Strategic Plan on February 1, 2022, shifting the focus for Digital Marin from planning to implementation. Since then, the Strategic Plan was adopted by Sausalito, Mill Valley, San Anselmo, Tiburon, and San Rafael and endorsed by numerous organizations.

Timeline

The Strategic Plan included a timeline for initial activities as follows.

2022 Accomplishments:

- ✓ Digital Marin successfully negotiated with Golden State Net to increase their middle mile route and access nodes in Marin.
- ✓ Digital Marin has also been awarded $950,000 in State Local Agency Technical Assistance (LATA) funding to support data collection, market analysis, shovel-ready design, and plan development.
- ✓ Secured adoption and endorsement of the Strategic Plan.
- ✓ Began the process of establishing the community-driven operating entity.
- ✓ Initiated the development of a business plan.
- ✓ Launched the Marin Security and Privacy Council.
- ✓ Launched a project to develop the high-level network design.
- ✓ Started digital adoption efforts.

Planned Activities for 2023 and Beyond:

- Begin deployment of broadband infrastructure in un- and underserved areas.
- Accelerate data and resource-sharing projects.
- Initiate key programs for devices, support, and digital literacy training.
- Initiate projects to address the affordability of internet service.
- Accelerate deployment of smart technologies.
- Establish a Digital Business Incubator Program.

In addition to achieving a majority of 2022's planned activities, Digital Marin also took advantage of emerging opportunities to secure additional resources to implement the Strategic Plan's goals and strategies.

Organization

The Digital Marin Strategic Plan correctly prioritized the establishment of Digital Marin as the organization responsible for community engagement, needs assessment, funding identification, and implementation. The importance of maintaining local broadband leadership and strategy is underscored by the diverse challenges that need to be addressed. Numerous coastal Marin residents represent one end of the need spectrum with sparse, rural populations and geography challenges creating high capital costs for construction that leave them unserved. While residents in the Canal District in San Rafael are considered served with densities of more than 2,000 people per square mile, they represent the opposite end of the needs spectrum as many do not have broadband access in their living units. Those that do often cannot afford it. Addressing these disparate challenges cannot be accomplished by outsourcing leadership to a regional broadband company or initiative.

The potential for regional solutions to capture funding while solving only part of the problem and the negative outcomes that will result emphasizes the importance of maintaining a strict focus on Digital Marin as the chosen entity with the capacity to execute the tasks necessary for success inside the County. If this once-in-a-generation funding is mismanaged, it could fortify the remaining gaps by funding the wrong model and failing to create the desired changes, eroding public confidence and damaging Marin's future funding prospects.

The funding available today will be captured and expended with or without Marin's leadership. The challenge facing Marin is establishing internal governance structure capable of capturing and focusing the funding to benefit Marin. The availability of funding to support the development of new operations within Marin for the benefit of Marin residents highlights the need to avoid simply allowing existing regional or national operators to step in and consume these assets, as this will dilute the benefits to Marin. Because the available funding is focused on designing and constructing a generational broadband infrastructure intended to solve current gaps, the questions of significance are:

- What will get built?
- What business model will be used?
- Where will new infrastructure be built?
- Who will own and operate the assets?

The answers to these questions become increasingly important as the availability of public funding at the federal and state level to perform broadband planning and capacity building followed by capital funding results in, numerous entities, some public and some private, both large and small stepping forward with applications of varying merit.

In particular, the Rural County Representatives of California (RCRC), in partnership with the Utah Telecommunication Open Infrastructure Agency (UTOPIA), is a regional solution pursued by many rural counties in California. While the RCRC Golden State Connect (GSC) solution appears to represent no risk to Marin and has the potential to bring about numerous improvements in service, competition, and costs, Marin must remember that the solution is ultimately a regional solution that will replicate the results demonstrated throughout the UTOPIA serving areas. The UTOPIA model consistently replicates improved choice by implementing an open access model where a common broadband infrastructure is shared by

competing internet service providers but has largely failed to reduce costs for services below $65 a month for residential users.

> **Open access** allows multiple internet service providers (ISPs) to share the same wiring to connect consumers, providing better capital investment returns and more competitive choices for faster, cheaper internet access.

This outcome highlights that while the broadband industry broadly uses the term open access to describe several technically different models where competing internet service providers (ISPs) share a common infrastructure, there is a need to define open access as used in this report. Open access, as used in this report, means that the infrastructure is available to all market participants at equal conditions, which requires a neutral party, not a service provider, to own the infrastructure and unbundle the costs to the subscriber. The UTOPIA model meets the infrastructure requirements of this definition but does not correctly unbundle all costs for subscribers. In addition, the scale at which RCRC and UTOPIA will operate in California precludes them from performing the more granular analysis and solutions development that Digital Marin has already completed, as shown in the Appendix to this report. For these reasons, it should be expected that implementing the GSC solution will NOT result in the development of improved models. It will not result in a community-driven solution. Public safety and education will be required to purchase services from GSC. Ultimately, the GSC solution uses public funds and Marin's authority to establish an open access infrastructure outside of the control or oversight of the local community.

Currently, Digital Marin is a community-driven organization completely inside of County operations. Digital Marin has already been awarded $950,000 in State Local Agency Technical Assistance (LATA) funding to support data collection, market analysis, shovel-ready design, and plan development. Digital Marin is also the only local government organization that successfully engaged Golden State Net (GSC), the State's third-party open access middle mile administrator, to negotiate for the construction of more state-funded middle mile assets and access nodes in Marin. None of these benefits would have been realized without Digital Marin taking on the local leadership role and engaging with the communities and other stakeholders. The ability to develop local solutions that address the specific needs of each community, access public funding, and use it to create blended funding mechanisms that drive down the cost of capital and implement models that can successfully manage the shift of broadband from a luxury to an essential service in a way that benefits all stakeholders represent the key attributes unique to Digital Marin. It is these unique abilities that result from Digital Marin being a local, community-driven organization fueled by the funding access and expertise provided by the County that has the potential to not only bring about real solutions but to propel Marin County into the role of a national leader by demonstrating models that create next-generation ubiquitous broadband access and affordability.

The guiding principles outlined in the plan and adopted by the County and five (5) of Marin's municipalities require community-driven solutions. Success will require granular needs assessments and robust community engagement that are critical to maintaining the momentum necessary to receive federal, state, and other funding. Hesitation on the part of County leadership in incubating Digital Marin as the organization with the necessary representation, expertise, ownership, and authority will result in the loss of community confidence and funding opportunities. These imperatives continue to recommend the

evolution of Digital Marin into a formal organization capable of developing, managing, and owning public network assets.

> Evolve Digital Marin into a formal organization to **develop, manage, and own public network assets with the Executive Steering Committee** as initial Board of Directors.
>
> — Magellan Advisors' Needs and Options Report

Digital Marin has demonstrated substantial progress towards the goal of becoming the desired independent operating entity with the ability to inform and influence policymakers, make decisions, raise capital, and spend funds, as shown by its progress towards meeting the Strategic Plan's goals largely within the time frames outlined in the plan. Continuing this progress will require allocating more resources within the County of Marin's Information Services and Technology (IST) Department to nurture the fledgling Digital Marin organization until it can operate independently.

The IST Department has the technical expertise and proven leadership to continue serving as the County voice, operational arm, and trusted advisor for Digital Marin. The IST can best serve these needs due to its unique ability to serve as the liaison between the County Board of Supervisors (BOS) and the Digital Marin Board and implement guidance using the authorities and capacities conveyed by the County and any other supporting entities included by joint powers.

Operating under the direction of the County BOS, the IST Department has successfully and efficiently provided the necessary leadership, vision, and oversight to accomplish the action items outlined in the Digital Marin Strategic Plan. IST has also taken the initiative to collaborate with other community stakeholders in securing $950,000 in State Local Agency Technical Assistance (LATA) funding.

State LATA grants were established to reimburse pre-construction expenses by local agencies, including cities and counties, in advance of broadband deployment. Eligible pre-construction activities include costs incurred in forming a joint powers authority for bringing broadband to communities in need. The LATA grant applications already awarded through the collaborative efforts spearheaded by the IST include:

- Coastal Marin (Unincorporated)
- Southern Marin (Unincorporated)
- Marin City (Unincorporated)
- Novato Area (Unincorporated)
- Gallinas Valley/San Pedro (Unincorporated)
- San Rafael Canal Qualified Opportunity Zone – Canal Neighborhood (Incorporated)
- Tiburon (Incorporated)

Work product details for these applications can be found in the Appendix to this report. These work products will provide further details to the Digital Marin Strategic Plan by providing low-level design, cost estimates, and more granular business modeling. Collaboration with other incorporated areas to develop and submit additional applications is ongoing, with the expectation that increased funding will be secured to support this important pre-construction planning for other incorporated areas in the County.

Because these LATA grants are provided in the form of reimbursement for specific work products and not as an upfront award of a lump sum, it is essential that the County take the following recommended actions to provide the resources required to develop these reimbursable products and continue the evolution of Digital Marin.

Action 1 – Establish and fund two (2) full-time IST positions.

The awarded LATA grant applications were developed using one-time funding to support no less than two (2) temporary County IST positions:

1. Systems Engineer
2. Department Analyst

The County's strategic ability to support the LATA program's reimbursement structure and provide a path for professional staff development starting in the County and ending in Digital Marin fills a need critical to plan success. These positions should be immediately created within the IST department and funded as a part of the County's IST budget appropriations with the understanding that most, if not all, the funding expended in support of these positions will be reimbursed by the pending and awarded LATA grant projects which include reimbursement for County staff contributing to the deliverables. It should also be understood and expected by the County and the IST that these positions will continue to be essential as the LATA-funded planning transitions to the state and federally funded broadband construction projects. These positions will be needed as construction projects transition to an operational County broadband asset. The funding and organizational structure under which the asset is operated should be expected to shift over time from the County IST Department to Digital Marin as operating revenue increases.

Operating Entity

Digital Marin was established as a cross-sector collaborative working towards a future where everyone in Marin has access to high-speed internet that is available, affordable, reliable, resilient, and safe. Desired outcomes include:

- High-quality broadband is available to everyone in Marin.
- Everyone in Marin can take advantage of all online opportunities by having robust devices, digital literacy, and technical support.

Marin will be able to achieve a high rate of digital adoption that benefits everyone by improving security, privacy, and digital accessibility and increasing the public value of investments in broadband.

- Marin will have a community-driven organization with a mission to deliver broadband for all.

Achieving these outcomes will require identifying the optimal operating model(s) and the governance structure(s) capable of supporting the selected operational model(s). This report supports the County's desire to protect its existing budgets, funds, and operations by identifying governance frameworks and operational models capable of being bootstrapped with minimal or virtually no County funding. This report provides recommendations that focus on the solution's ability to achieve the desired outcomes as paramount while also giving preference to models that maintain a light touch by minimizing ongoing County involvement or investment beyond incubating initial projects and solutions. Any failure in strategy or implementation will exacerbate the underlying problems, waste funding, erode community confidence, and make it even more challenging to achieve the desired outcomes. For these reasons, while multiple options are considered, only the operational models and governance frameworks that can provide the desired level of access and affordability are recommended.

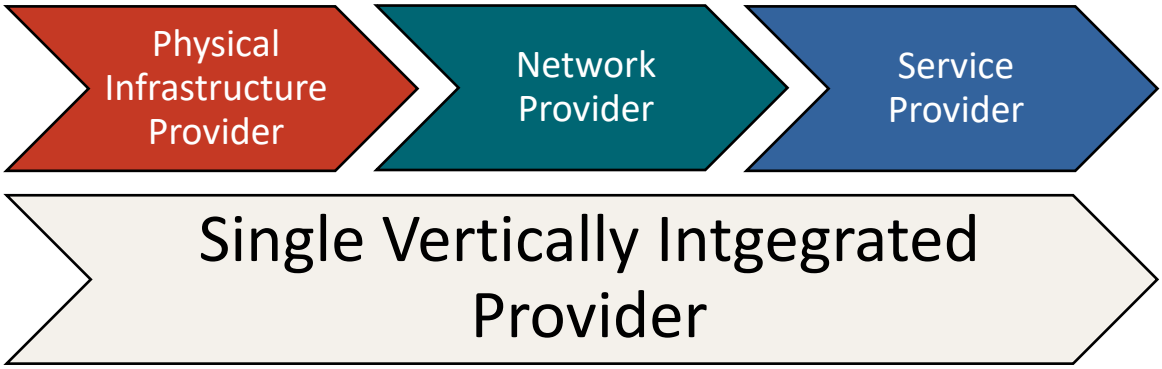
Operational Models

Choosing the right operational model depends on the roles of the market actors in the broadband value chain. For this report, three (3) possible roles are identified:

1. The Physical Infrastructure Provider (PIP)
2. The Virtual Network Operator (VNO)
3. The Service Provider(s) (SP)

Different business models arise depending on which roles the market actors take within the operational model.

Figure 1: Vertically Integrated Model



If one market actor takes all three (3) roles, it is said to be vertically integrated, and the resulting business model is referred to as a vertically integrated model. AT&T, Comcast, and Frontier operate in Marin County under this model.

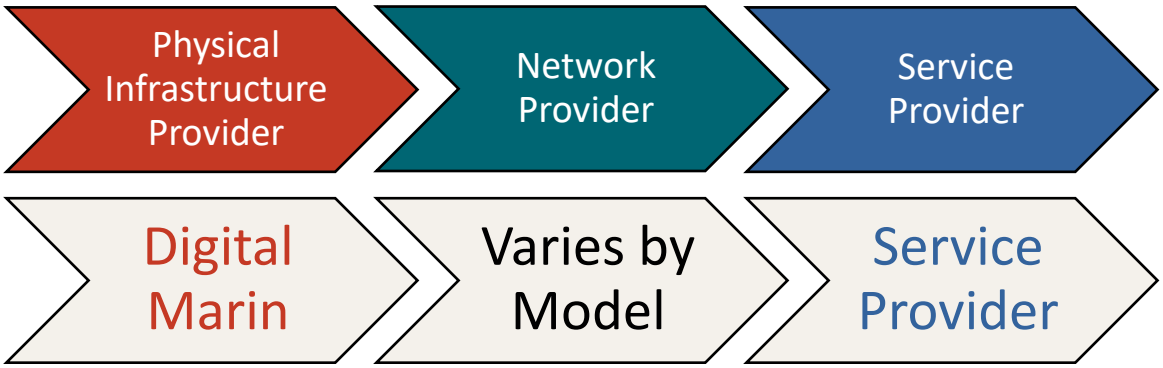
Incumbent industry models typically provide single ownership for the infrastructure and services offered to end users. While there are variations where an owner offers wholesale access, which means offering access to competing internet service providers (ISPs) to use their infrastructure, the wholesale costs usually protect a private owner's desired rate of return, creating cartel-like pricing rather than true competition. There have been many instances where public authorities have built broadband networks following vertically integrated models. This was not uncommon in the pioneering years of municipal networks. The Electric Power Board (EPB) of Chattanooga, Tennessee, is a successful public implementation of the model.

In some cases, the network owner designs the network to deliver its services and gives access to its competitors in forms compatible with the network design. Although this is sometimes referred to as open access, this is a vertically integrated model with service unbundling, not true open access, because the model lacks the neutral infrastructure host required by this report's definition of open access. The Westminster Fiber Network in Westminster, Maryland, is one example of this type of model.

This model is not recommended for the following reasons:

- It would require significantly more ownership investment and ongoing support compared to models that separate infrastructure and service responsibilities.
- Models that separate infrastructure and service responsibilities have proven superior for most public entities because focusing on creating open public infrastructure for private market competition best aligns with public policy, funding, and operations and has proven to be capable of achieving superior access and affordability.

Figure 2: Open Access or Wholesale-Only Network Model



An open access or wholesale-only network model can be created if the roles are separated. An open access network makes the infrastructure available to all market participants at equal conditions. This requires a neutral party, not a service provider, to own and operate or oversee the operation of the infrastructure. The "unbundling" of roles does not necessarily result in the "unbundling" of subscriber costs. While this section considers the value of separating infrastructure, operations, and service delivery, the unbundling of costs is considered in the business plan portion of this report. It is important to remember that establishing a clear separation of roles and responsibilities within the operational model is required to unbundle subscriber costs successfully.

Open access models (Langer, 2021) support the following:

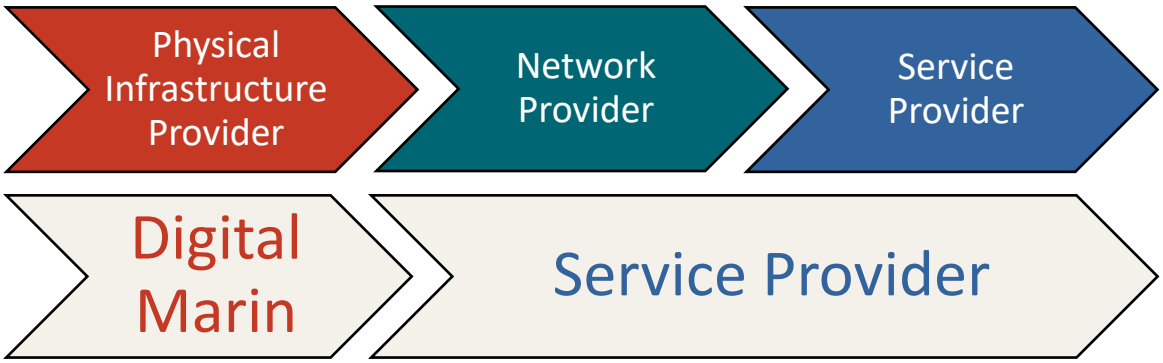
1. Access improvements are achieved by improving investment efficiencies that connect more subscribers compared to vertically integrated model investments.
2. Affordability improvements are achieved by creating a robust universal facility capable of true service competition unencumbered by the high capital costs associated with entering the market.

This can take different forms, depending on whether the network owner operates at the physical infrastructure provider (PIP) level alone or also at the virtual network operator (VNO) level. If the network owner is only involved at the PIP level, the network owner decides either to leave the higher layers to market players (i.e., market competition for services) or to contract the VNO role to a third-party market actor with the task of providing end-user connectivity to competing internet service providers (ISPs)

Consequently, three unbundled business model variations can be identified:

- Open Access Dark Fiber Leasing
- Open Access Lit Fiber
- Open Access Virtual Fiber

Figure 3: Open Access Dark Fiber Leasing Model



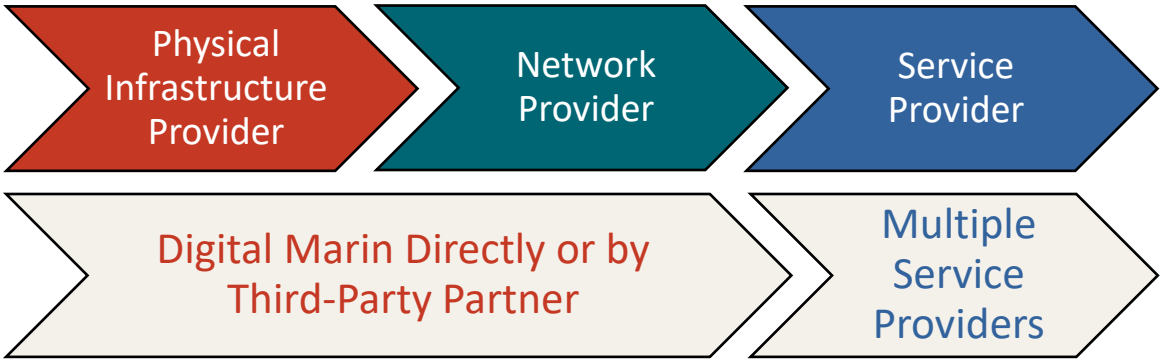
In this model, an entity (typically the public authority or utility) builds and maintains a passive infrastructure (e.g., dark fiber) available to all market actors under fair and non-discriminatory conditions. This entity deploys the passive infrastructure directly or through standard procurement to the market consisting of civil engineering and fiber optic deployment companies but not network operators. The physical infrastructure provider (PIP) keeps ownership of the passive or unlit infrastructure and maintains a dark fiber outside plant. The Huntsville, Alabama, dark fiber network is one example of this model.

In such a model, only the unlit fiber strands are open for competing integrated network operators and Internet service providers to install the necessary electronics throughout the system to sell services. While this arrangement reduces the cost for ISPs to get access to the end users through the sharing of a common passive infrastructure, each provider must still invest in their network equipment resulting in the following challenges:

1. Shared fiber strand termination access and colocation facilities must be clearly defined and provided as a part of the model.
2. Ownership of the subscriber drop cable, which is the cable installed from the common cable in the rights-of-way (ROW) to the property, must be clearly defined and provided as a part of the model. This is typically bundled with the installation of the electronics inside the property, which will necessarily remain in the internet service providers' ownership requiring a new installation within the property each time the subscriber desires to change ISPs.
3. Each provider in the model will require their inventory of fiber strands to serve subscribers, placing noticeably clear limitations on the model's ability to scale with competition or innovation.

These barriers have resulted in models labeled as "open access" but operating as vertically integrated public-private partnerships (i.e., only a single provider is available to subscribers). For these reasons, this model is not recommended.

Figure 4: Open Access Lit Fiber Model



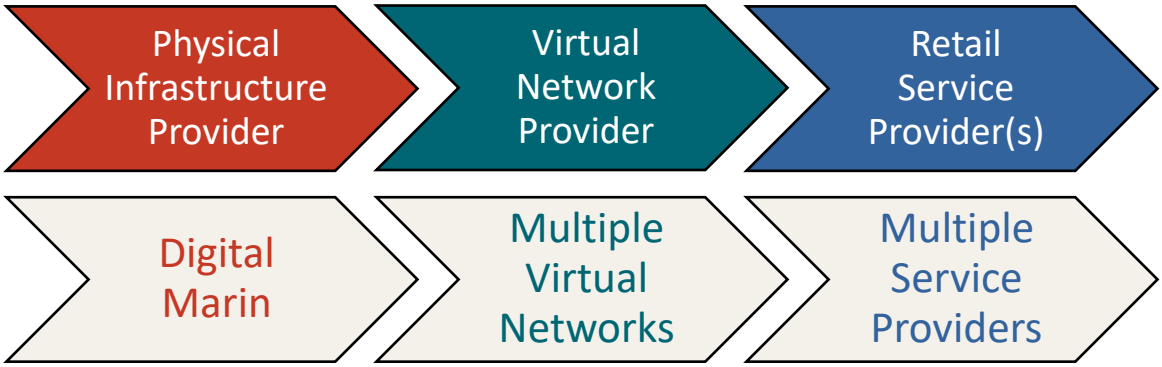
In this model, one or two partnered entities deploy and operate the passive and active layers (i.e., lit fiber), acting as integrated physical infrastructure and network providers. This single or partnered entity builds an open, operator-neutral network over which all Internet service providers can deliver their services to all end users by placing active equipment in all access nodes. The UTOPIA network in Utah is one example of this type of model.

Compared with open access dark fiber leasing, the main difference of this model is that one entity oversees installing active equipment in all access nodes. While this arrangement directly influences the service provider's ability to manage shared network equipment unilaterally, it has demonstrated significant cost reductions for all stakeholders, internet service providers, and subscribers.

This model is superior in its ability to separate infrastructure and service costs. It also provides a truly neutral host for the infrastructure. Careful implementation of this model has successfully demonstrated the ability to improve costs across the board. These improvements can create a truly open access model when coupled with an open access business plan.

This model does require a higher level of technical expertise and support on the part of the virtual network operator (VNO). Adding or changing services, ISPs, and subscribers tends to be a repetitive manual process. This results in improved operational and business models that are stable but can be slow to change. Careful coordination of network segments, addresses, and service labels must be maintained by the VNO and followed by every SP for the model to work. This is a disadvantage whenever changes are needed to support a provider, subscriber, or the market in general. Any disruption or innovation within the market requires careful planning and labor-intensive support from the VNO and may require equipment upgrades. Due to the rapid pace of innovation combined with the expectation that there is any number of imminent smart technologies such as smart grid, connected mobility, hospital at home, and others that will desire to enter this open access model with minimal time and expense, this model is not recommended.

Figure 5: Open Access Virtual Fiber Model



In the Open Access Virtual Fiber Model, the roles of PIP, VNO, and SP are explicitly separated. In this case, the public authority has the same role as the Open Access Dark Fiber Model. Still at the active layer, the VNO role is assigned by procurement to an external entity capable of providing network virtualization. The Ammon, Idaho, fiber optic utility is one example of this type of model. (Woodruff, 2019)

Network virtualization (NV) refers to making network resources traditionally delivered in hardware available in software. NV can combine multiple physical networks into one virtual, software-based network or divide one physical network into separate, independent virtual networks. Network virtualization software allows network administrators to move virtualized assets across different domains without reconfiguring the network. The software creates a network overlay that can run separate virtual network layers on top of the same physical network fabric. The VNO can use this scalable functionality to create a live marketplace for services capable of supporting instantaneous and sweeping change.

This third-party VNO, therefore, supports the neutral host owner by placing active equipment in all access nodes to create an operator-neutral network capable of supporting any number of virtual instances. User interfaces that provide stakeholder access are provided as a part of the open access software platform to create virtual connections using the underlying physical infrastructure.

Independent internet service providers get active-layer access by plugging into the network. ISPs can be agnostic to any other services on the network because virtualization does not require any address or labeling coordination, freeing each of them to architect their networks as needed or desired. ISPs can also advertise their services directly to subscribers connected to the network in an online marketplace. In this services marketplace, ISPs maintain their storefronts. Publishing service packages and pricing to subscribers does not require any support from the VNO or PIP, making the model truly open to dynamic competition and innovation.

New installations are not required for service changes. Internet service providers (ISPs) and subscribers benefit from instantaneous service turnup and delivery when ordering from the online market. This model also supports completely unbundled pricing to the subscriber, improving transparency for the subscriber, and correctly supporting the individual economic models required by the PIP, VNO, and SPs.

From the physical infrastructure owner's (PIP) perspective, this model requires a similar level of engagement and technical competence as the dark fiber lease model.

The open access virtual fiber model is recommended due to its ability to:

- Separate infrastructure and services.
- Improve affordability by eliminating facilities competition while creating true competition for services.
- Provide an infrastructure-only business plan because the available funding is infrastructure focused.
- Support dynamic competition and innovation.
- Create a sustainable 50-year infrastructure investment model.

Additional Considerations

As Marin formalizes the selection of an operational model and potentially procures a third-party network provider, these outcomes will logically drive future architectural and business plan decisions. Because these components are increasingly listed as eligibility or scoring criteria by potential funding sources, Marin's leadership will want to follow an operational, architectural, and business plan that maximizes funding opportunities.

Federal Policy and Opportunities

Multiple federal programs have demonstrated a clear preference for open access fiber.

The Reconnect Loan and Grant Program will not fund legacy copper or wireless systems, only fiber, by listing a requirement for 100 megabits per second symmetrical service. The program awards extra points for applications meeting public ownership and open access requirements. (AGRICULTURE, 2022) The recent National Telecommunications and Information Administration (NTIA) Middle Mile Grant Program was open to public entities, required fiber, and favored open access in scoring. (Administration, Middle Mile Grant Program, 2022)

NTIA's Broadband Equity, Access, and Deployment Program (BEAD) will also be open to applications from public entities, prioritizing the deployment of fiber and encouraging scoring that favors open access on the part of the state offices overseeing the application and award processes. (Administration, BROADBAND EQUITY, ACCESS, AND DEPLOYMENT PROGRAM, 2022)

State Policy and Opportunities

Executive Order N-73-20, signed by Governor Newsom, prioritizes fiber optic deployment statewide. (CALIFORNIA E. D., 2020)

In response to this executive order, the California Broadband Council developed the "Broadband for All" Action Plan, which prioritizes fiber and open access for middle mile deployments. (COUNCIL, 2020)

SB 156 directed the California Department of Technology to develop a statewide, open-access middle mile network. SB 156 provides $3.25 billion to build the necessary infrastructure to bring internet connectivity to homes, businesses, and community institutions. (CALIFORNIA S. O., 2021)

SB 156 also established a $750 million Broadband Loan Loss Reserve Fund to support the costs related to financing local broadband infrastructure development. The reserve fund expands local government's

ability to secure financing for building last mile projects that connect individual properties to middle mile or regional networks, with an emphasis on public broadband networks. (Commission, 2022)

Policy and Funding Summary

Selecting an operational model that provides optimal support for an open access fiber solution will maximize the funding opportunities available to Digital Marin. State investments in a similar open access middle mile solution also support the selection of an open access operational model for the last mile. Aligning Marin's local model with the selected State model will result in an intrinsic compatibility capable of improving operational efficiencies and reducing both capital and operational costs by creating a true "plug and play" option where any community can join Digital Marin by simply plugging into the State's open access network. This will greatly reduce the technical, operational, and investment barriers that would normally be associated with network expansion essentially providing a path for the repeatable, non-contiguous expansion that will be required to address the existing patchwork of unserved and underserved properties.

Action 2 – Formalize the selection of an operational model.

There are downstream architecture and business plan decisions that require model selection. For example, a vertically integrated solution's infrastructure and business plan differ significantly from an open access solution. This makes the selection of the operational model the next major step for Marin.

The County's IST Department should take the lead in presenting the options outlined in this report to the County, municipalities, and Digital Marin board, providing technical support to inform decision-making. The final selection should be memorialized in the meeting minutes and properly documented to inform the procurement process that will follow.

Wholesale open access models are uncommon in the United States compared to other countries due to deregulation in the 1980s and 1990s, as well as a lack of public investment in broadband infrastructure. The Electronic Frontier Foundation recently commissioned a cost model analysis that compared the vertically integrated operator model common in the US with the wholesale or open access operator model common in other countries. They found that capital funding used in wholesale open access models was able to connect close to 30% more households compared to the vertically integrated models. The research also showed that the wholesale open access model was better suited to longer-term, lower cost capital investments, like the capital available to Marin, resulting in more efficient business models and lower costs for subscribers. The preeminent example of a municipal open access fiber optic utility is the Ammon, Idaho, model where subscribers have multiple options for 1 GB fiber service for under $50 per month and the option to pay upfront for their installation resulting in monthly costs below $30 for 1 GB internet service.

DIGITAL MARIN

Goal #2

Everyone in Mairn can take Advantage of all online Opportunities.

Strategies:

- Coordinate and expand digital literacy training in Marin.
- Expand community-based programs to provide end user devices and support.
- Help organizations create easy to use digital services that work for everyone.

Business Plan

Digital Marin's level of involvement will ultimately determine how much influence it has on the business model. Demographic, commercial, and cultural conditions may also play a role in business plan development. In general, a business plan that provides a win-win situation for all stakeholders will increase Digital Marin's chances for success. While it is true that Digital Marin's business plan cannot be finalized in advance of selecting an operational model, a basic understanding of expected costs and fees is possible. This information, combined with a market analysis, should be used to identify business plan development next steps designed to lead to a clear understanding of the potential solution's economic model. Assuring that unbundled access and the associated costs are explicit in the final business plan will be a key requirement for overall success. This transparency will be necessary to help stakeholders see how they can benefit from participating in the solution.

The broadband capital funding currently available makes Digital Marin the perfect neutral host of the resulting infrastructure. A "neutral host infrastructure" in networking describes a network, or broadband, infrastructure that is owned and maintained by a third-party that does not offer any retail services (i.e., they do not offer service directly to end users for a fee) but instead provide open access to the infrastructure, without discrimination, to any party desiring to use the infrastructure to deliver their products or services. Open access, when used in networking, is a term to describe a business model that separates the physical ownership of the infrastructure from the delivery of services. Digital Marin is the perfect host for this business model for the following reasons.

1. Digital Marin is eligible for federal and state broadband infrastructure funding as grants and loans, providing a path to own and manage these opportunities to ensure public funding results in public infrastructure.
2. Digital Marin leadership has the diversity in local representation to properly balance private and public interests to achieve advantageous outcomes for all of Marin's broadband stakeholders.
3. Digital Marin's natural incentives of providing affordable, reliable, high-speed access to everyone naturally align with the incentives of a neutral host in contrast with the incentives of retail internet service providers.
4. As the neutral host, Digital Marin will be well-positioned to define stakeholders' roles and responsibilities and leverage the public infrastructure to create the incentives necessary to achieve desired outcomes.

Roles, Responsibilities, and Typical Costs

The separation of roles and responsibilities will be required to align with the selected operational model. The information presented in this report focuses on the recommended operational models' separations which include the physical infrastructure provider, virtual network operator, and retail service provider(s). Fortunately, these same roles and responsibilities are already well documented and separated by organizational elements within the nation's large vertically integrated provider models, making the costs associated with supporting these various operational activities easily identifiable. Additionally, there are existing operational examples of the recommended model that can be used to further inform business planning.

Physical Infrastructure Provider (PIP)

Infrastructure Construction

Digital Marin is the perfect fit for the physical infrastructure provider (PIP) role because it can obtain the capital necessary to construct the infrastructure and recover those costs when necessary. It can apply for and receive state and federal funding through grants and loans. There are programs, like California's Loan Loss Reserve Fund, that only an entity like Digital Marin can access to reduce startup costs.

Grant funding is typically available to fund broadband infrastructure construction in the high-cost areas of Marin. The match requirements for these programs can often be waived based on need, resulting in a direct capital subsidy for high-cost projects. These programs and Digital Marin's unique ability to use these public funds to create an open public asset are essential to implement an effective, sustainable solution for the rural unincorporated areas of Marin.

Alternative funding will be required for Marin's more suburban or metro areas, as they will not qualify for these grant programs. In these areas, low-interest, long-term infrastructure bonds can be applied to the construction using programs like California's Loan Loss Reserve Fund, which is only available to public or non-profit entities like Digital Marin.

This ability to utilize a broad spectrum of federal, state, local, and philanthropic programs, combined with Digital Marin's ability to leverage the existing assets and relationships of the area's stakeholders to create a single, robust, and reliable infrastructure for the benefit of all represents Marin's best opportunity to create an effective and sustainable solution. The number of organizations with the capacity to leverage these same resources is limited. Digital Marin is the right candidate because it is the right size of organization, having local leadership on the board that represents all community elements with an interest in solving the digital gaps for everyone, including the rural, suburban, and metro areas. This is not necessarily true for larger organizations that would represent additional interests outside of Marin or smaller organizations within Marin that would tend to favor solutions directed towards their demographic segment of Marin.

Infrastructure Maintenance

Physical infrastructure provider (PIP) infrastructure maintenance responsibilities include performing locates, duct, cable, vault, and fiber repairs and maintaining, changing, or adding electronics as needed. These functions require physical access to the infrastructure. Still, they tend to be non-technical, like other public works type of maintenance and operations. Wage scales and training are like public works positions. These operations will require obtaining the proper skills and equipment necessary to perform these functions if performed in-house by Digital Marin, or the entire function or subsets thereof could be outsourced to a third-party. For example, many utilities outsource all their locating needs to a third-party. A third-party contract could also be used for outside plant maintenance (e.g., repair and maintenance of the duct, cable, vaults, and fibers). These contracts usually involve a monthly retainer fee that includes a base number of hours for a nominal fee and a discounted rate for any hours over the retainer base.

Virtual Network Operator

Network operation responsibilities include the provisioning and monitoring of the circuits or links used by internet service providers and end users. These functions should provide an interface for system users, including the physical infrastructure provider, retail internet service providers, and end users, to access and perform self-service tasks. Monitoring, messaging, and alarming should also be included for every stakeholder to provide proactive management and troubleshooting of their responsibilities. A virtual operator performs these functions in software to improve efficiency and costs.

> **The virtual network operator** combines network resources and functionality into a single, software-based administrative entity capable of providing access and control to users in software that creates an experience equivalent to owning the underlying infrastructure.

The virtual network operator (VNO) is responsible for granting access to internet service providers (ISPs) (or other service providers) that do not require coordination on the part of competing ISPs. This includes providing the ability for all users to test and verify the performance of their services. The VNO must also identify problems, who owns them, and who can solve them transparently to all users.

Retail Service Provider(s)

Retail internet service providers can be public, providing a public service. They can also be private enterprises that provide retail internet service. Service provider responsibilities include hosting the necessary backend equipment and network operations to deliver their service. ISPs are each responsible for network addressing, routing, and service termination. They are also responsible for providing customer support for their service(s).

Customer Support

Effective end user support will require specific levels of participation from the physical infrastructure provider, the virtual network operator, and the retail service provider(s). The internet service provider (ISP) must serve as the initial point of contact for all end user troubleshooting. Over 95% of support cases are the result of end user error. As the end service provider, the RSP has both the ability and responsibility to directly assist the end user. This service would be considered tier 1 support. A tier 2 ticket would be created with the network operations center (NOC) after tier 1 support has identified that the service problem is the result of either an infrastructure outage or virtual configuration issue.

The network operations center could be hosted by the primary infrastructure provider, the virtual network operator, or outsourced to a third-party. Tier 2 support provides the ability to diagnose and resolve operational problems resulting from the underlying hardware or software used to create the virtual assets used by ISPs and customers. Tier 2 support will resolve the problem if the issue is in software. If the problem is in hardware, a tier 3 support ticket would be created for the primary infrastructure provider or the contracted maintenance provider to identify the physical source of the problem that needs to be addressed.

DIGITAL MARIN

Goal #3

Marin has a high rate of digital adoption that benefits everyone.

Strategies:

- Improve privacy, security, and digital accessibility across Marin.
- Address barriers through education and community problem solving.
- Increase public value from investments in technology.

Costs

Correctly separating roles and responsibilities will also extend to unbundling costs for users. Additional plan development is required before explicit costs can be identified. Model sustainability will require these costs to be recoverable by charging commensurate fees to users. The relational nature of these costs confirms the need for clear strategies by Digital Marin. For example, focusing on the least cost for infrastructure may result in choices that are subject to rapid technology change, incur higher operational costs, and require more frequent capital reinvestments, making their total cost of ownership higher when considered over long periods. This helps to underscore the importance of separating the underlying infrastructure from the services, as the life cycles are significantly different. Separating them economically, in principle and practice, provides the means to support different investment returns for infrastructure when compared to service, which is important.

This stage of business planning focuses on making fiber optic broadband internet at speeds of 1 gigabit per second for $70 per month or less and providing programs to provide 100 megabits per second speeds for $10 per month for those with a low socioeconomic status. These goals align with current state and federal policies and funding programs, presenting the best opportunity to locate and acquire funding support outside Marin County's established budgets.

Business plan strategies to reach $70 per month or less will require user fees to support the virtual network operator roles as follows:

Role	Minimum	Maximum	Average
PIP	$25.00	$35.00	$30.00
VNO	$ 5.00	$10.00	$ 7.50
RSP	$10.00	$25.00	$17.50

Achieving total out-of-pocket costs of $60 per month for gigabit fiber internet is possible using the strategies outlined. It will result in take-rates high enough to support the model.

Physical Infrastructure Provider (PIP) Costs

The largest percentage of consumer fees paid to the PIP is used to recover the initial capital used to construct the infrastructure. A smaller percentage is used for ongoing infrastructure maintenance and creating a fund reserve. This stage of business planning requires assumptions based on historical model performance in similar markets with the expectation that completing system design and a market analysis will support these assumptions, progressively improving confidence in these initial estimates.

The take-rate, or percentage of potential subscribers who are offered service that does subscribe, has the single greatest impact on the monthly costs charged to subscribers to recapture the capital investment made to construct the infrastructure. To illustrate, the properties passed by a broadband infrastructure that have a take rate of 50% would have five (5) out of ten (10) properties subscribe to service(s) with a portion of their monthly fees being used to recover the capital costs expended to construct the

infrastructure. While a reduction in take-rate will reduce the number of drops to private property or fiber optic extensions run from the roadway edge into the property and the customer premise equipment installations, the cost of the mainline fiber installation will remain largely the same. This reduces the take-rate, increasing the monthly fee amount required from subscribers to recover the capital investment.

An average cost per connected customer of $3,500 is possible in the non-rural areas of Marin based on achieving a 50% take-rate. (Community Networks, 2022) Digital Marin will need to pursue grant funding or capital subsidies in the rural areas to achieve similar financial performance in high-cost areas. There are several grant and loan programs capable of providing this type of subsidized capital funding. For example, a 20-year bond rate of 4% would result in a monthly cost to the customer of under $22 per month for capital recovery. A $30 per month average fee is the desired goal. This would leave $8 per month, sufficient for maintenance and reserve funding once a minimal operational scale is reached.

Virtual Network Operator (VNO) Costs

Consumer fees paid to the VNO are used to recover software development and maintenance costs. These costs vary by provider and service level. Software as a service (SaaS) options are available for as little as $2.50 per month per customer. A separate line item to recover costs associated with supporting the internet service providers will need to be charged to fund this support operation from the PIP, VNO, or a third-party. Again, options are available based on a monthly charge of $2.50 per month per customer.

The unbundling process, combined with the model's bias toward customer choice, also requires that ownership of the customer premises equipment (CPE) be identified and agreed to by all parties as a part of operations. This is not unusual as today's dominant vertically integrated internet service providers offer the option of renting by paying a monthly fee for an operator-provided CPE, or owning, by purchasing the CPE directly. A rental or leasing program to support an operator-provided leasing program could be supported by an additional $2.50 per month.

Supporting all these costs results in a monthly $7.50 out-of-pocket expense to the VNO or the parties supporting these activities.

ISP Costs

Consumer fees paid to the ISP are used to recover their wholesale internet and operational costs. The availability of middle mile access can significantly impact their internet costs. Digital Marin can assist in minimizing these costs by engaging Golden State Net, California's state-owned and operated open access middle mile network, to create multiple points of presence (POPs) directly collocated within Digital Marin facilities. This will reduce costs for both parties through facilities sharing resulting in lower costs for internet service providers (ISPs) using the Digital Marin infrastructure. Creating this competitive environment will help to ensure that these savings are passed on to consumers.

ISP also incur significant costs to provide customer support as a part of their operations. There are numerous examples of the costs charged by ISP to provide unbundled services. Where competitive middle mile options are available and operational scales of more than 1,500 customers are available to ISP, monthly costs between $10 and $25 for 1 gigabit internet are experienced.

Cost Conclusions

Although business planning at this stage produces an estimated range for the roles rather than explicit out-of-pocket costs to the consumer, it does prove that the identified strategies can achieve the desired outcomes. Next step actions can also be established.

Plan Refinements

Action 3 – Assume or procure the virtual network operator (VNO) role.

Some operational models allow or require Digital Marin to take on the network operator role. If Digital Marin selects an operating model where it will assume the network operator role, clear responsibilities will need to be assigned, and resources will need to be allocated within Digital Marin to establish the workforce and expertise necessary to perform network architecture, oversee design, select materials and equipment for cost modeling, and so forth. Should Digital Marin own the network operator role, it could choose to outsource these responsibilities to a third-party. Therefore, before assuming the network operator role, Digital Marin should perform an analysis to determine which option will result in the best possible outcomes for the residents and businesses of Marin.

Other operational models provide for, or require, outsourcing to a third-party for the network operator role. For models where this is the case, selecting a partner with the demonstrated ability to support the desired operational model and business plan at this stage is critical to achieving desired outcomes. The ability to deliver desired technical and economic functionalities will be directly related to the network operator's capabilities. This makes the selection and procurement process one of the most important initial steps Digital Marin will take. Procuring this solution at this stage of development is paramount as this solution will inform system architecture and business planning. Finalizing these details will be required to complete applications for state, federal, or even private funding.

With the County's oversight and approval, the Information and Services Technology (IST) Departme has demonstrated the technical expertise necessary to guide and manage this procurement process.

The awarded network operator will need to inform architecture for the design and assist in completing the business plan.

Action 4 – Continue to update and socialize the plan with the community and potential internet service providers.

Digital Marin should continue a progressive educational process to set expectations for consumers and providers. Digital Marin will need to take a leadership role as the neutral host to convene the stakeholders around the solution.

This report provides some refinements to the plan adopted by Marin in 2022 by clearly setting forth the access and affordability goals of making 1 gigabit fiber internet available to all of Marin County. This goal aligns with established state and federal policies and programs. Specific strategies and actions to support those strategies are outlined.

> **Strategy** involves defining the goals (desired end state) and determining the actions necessary to achieve desired outcomes and mobilizing resources to execute the actions. **A strategy describes how the ends (goals) will be achieved by the means (resources).**

Network Design

Infrastructure functionality is a direct result of the selected architecture and network design. For example, some network infrastructures closely couple the service with the infrastructure eliminating the ability to unbundle or provide open access, thereby forcing a vertically integrated business model. Digital Marin will need to provide the necessary architectural expertise to establish design standards or perform a procurement process to select a qualified consulting partner.

Action 5 – Research, evaluate, and institutionalize Digital Marin design standards.

These design standards should include standards for the physical infrastructure and technical standards for system operation.

DIGITAL MARIN

Goal #4

Marin has a community-driven organization with a mission to deliver broadband for all.

Strategy: Improve privacy, security, and digital accessibility across Marin.

Digital Adoption

Community engagement plays a key role in driving adoption. The following strategies and tactics should be implemented and refined in conjunction with plan refinements.

Evaluation & Education

The deliverable from the LATA funding will document the current state of broadband and determine the level of interest among residential users and business owners.

Community Survey

Residents and business owners will be surveyed to determine the level of interest in Digital Marin's proposed model. Education and promotion programs should be influenced by ongoing survey engagement and response.

Publish Educational Information

Digital Marin should continue to leverage and improve website content specific to the model, emphasizing the core message of broadband as a local utility that offers lower costs, an increase in choice, subscriber control, and fosters digital inclusion. Create and use customized videos to educate online visitors on topics such as the functionality of the Digital Marin network, options for services, frequently asked questions (FAQs), and more.

Map Community Interest

Distribute an "I am interested" sign-up form with an associated heat map where residential and business property owners can register as someone interested in municipal fiber.

Marketing & Promotion

Utilize press releases and social media platforms (e.g., Facebook, Instagram, Twitter) to promote the Digital Marin network, driving traffic to the website to educate community members, generate interest, and encourage community participation.

Grassroots Engagement

Webinars & Open House Events

Use webinars and open house events to educate residents and business owners about Digital Marin, ask questions, and become educated about the business model, infrastructure, and costs.

Webinars and open house events can be promoted using utility bill inserts, press releases, public service announcements, local news reports, websites, social media platforms, and more.

Webinars and open house events are intended to educate residents, promote the network, and identify fiber champions. Fiber champions are individuals that demonstrate a voluntary commitment to promoting the network within their community. Fiber champions may be incentivized by building to those communities with the highest demand, as shown on the published heat map. Fiber champions can assist sign-up efforts within their communities. They organize and lead local meetings where neighbors can

learn about Digital Marin. Digital Marin would provide logistical support to the fiber champions in their efforts. Fiber champions drive conversations and contractual commitments via the door-to-door sales and education campaign.

Digital Marin will want to provide an advisory governance role for area champions that allows their experience to better inform the Digital Marin Plan by representing diverse views and lived experiences.

Door-to-Door Campaign

Individuals representing Digital Marin should contact residents and business operators within any project footprint before construction to answer questions and ascertain the potential subscribers' interest in participating.

This direct person-to-person contact allows everyone in the community an opportunity to ask questions, clarify understanding, and express a level of interest in participating.

To maximize the effectiveness of this process, door hangers could be distributed to every home and business before neighborhood canvassing. These could inform property owners that a project is planned for their area and explain the Digital Marin value proposition, pointing them to resources to get any questions answered, and sign-up for a connection.

Door-to-door campaigns are very effective in allowing people an opportunity to learn and ask questions in a one-on-one interaction.

It is important to support this effort with public notifications, press releases, mass emails, websites, social media sites, mobile applications, and other community outreach venues. This may include outside professional marketing or public relations firms.

Some philanthropic and community organizations could be leveraged to provide doorknockers to talk with residents about issues they are facing, and services they might be eligible for. These groups could contribute to community engagement and door-to-door efforts.

Action 6 – Establish the internal support mechanisms and assign ownership to establish a cohesive and progressive community engagement program.

Digital Marin will initially require County support to achieve this but should, over time, require less and less support. The LATA work should be used to fund the initial establishment and outline a path to sustainability for this outreach.

Looking Ahead to Initial Deployments and Future Planning

Over the next decade, technologies in their infancy will move from development to production. The internet we know today will evolve to accommodate these new services and applications like connected mobility, the blockchain, a transactive energy grid focused on renewable energy, digital education, healthcare delivery systems, and virtual reality technologies. By leveraging the technical expertise of IST, government, and community leadership, Digital Marin is in the best position to manage the available funding opportunities and place Marin at the forefront of these advancements.

The technologies and models used in broadband networks today have seen very modest changes in the past twenty (20) years. Most networks built today still follow the vertically integrated model established decades ago. These networks are closed and rigidly organized for the internet service providers' profitability resulting in a lack of competition and innovation that favors the status quo.

A key differentiator for network infrastructures will be future technology resilience. Software-defined networks open to any service or innovation, organized as utility infrastructure, and designed with a data center architecture will likely offer distinct economic development advantages over static networks missing these attributes. Due to its comprehensive composition, Digital Marin is in the best position to manage this change to create economic opportunities.

Digital Marin should focus on constructing a publicly owned, next-generation fiber optic infrastructure that provides the resilience, flexibility, and cost savings needed to attract and foster businesses dependent on advanced digital infrastructure for the benefit of all stakeholders, not just the infrastructure owner. This will result in long-term solutions to lower costs and connect all residents and businesses. As the owner of this enabling digital infrastructure, Digital Marin will be positioned as a national digital access and affordability leader.

Next Steps

Ensuing activities to be reimbursed by LATA Grant Funding

1. Establish and fund two full-time IST positions to support LATA work in-house.
2. Formalize the selection of an operational model based on recommendations in this report.
3. Assume or procure the network provider role.
4. Continue to update and socialize the plan with the community and potential retail service providers.

The output from the preceding steps will be detail, design, and business model information sufficient to apply for state and federal funding to create one-to-three operational pilot projects. These projects can be scaled to serve the entire county.

Appendix

Appendix A

Project: Muir Beach Community

This small, semi-isolated coastal community in unincorporated Marin is directly on the CA SB-156 Middle Mile path. It currently has no wireline internet service providers (ISPs). **Muir Beach Lan** offers fixed wireless service: "We have arranged for a connection that permits, for the overall LAN, 200 Mbps. The speed experienced by each user will vary depending upon location within our system, but it is typical to have 5 Mbps download, and greater than 1 Mbps upload."

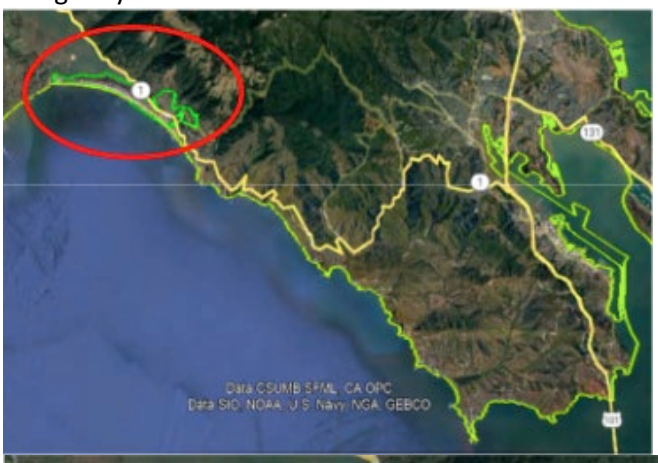
- Population: 316
- Households: 43
- Internet Service Providers (ISPs) & Speeds:
    - Muir Beach LAN Fixed Wireless: 5/1 Mbps
- Community Fiber Network interconnects with CA SB-156 Open Access Middle Mile Network along HWY 1

Unserved Community

Appendix B

Project: Stinson Beach / Census Designated Place – New FTTH Overbuild

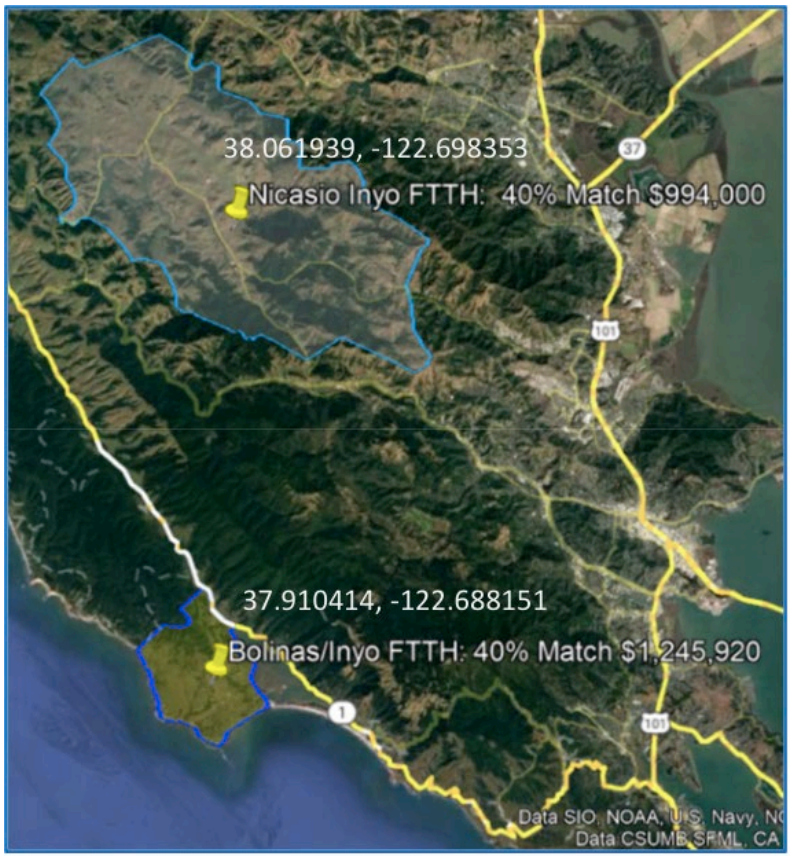
- Population: 644
- Households: 343
- Internet Service Providers (ISPs) & Speeds:
  - AT&T 25/2 Mbps
  - Horizon Cable 100/10 Mbps
- CASF Status:
  - Unserved >= 25 Mbps download/3 Mbps upload
  - Underserved 100 Mbps download/20 Mbps upload
- Community fiber network interconnects with CA SB-156 Open Access Middle Mile Network along Hwy 1



Underserved at 100/20 Mbps

Appendix C
Project: Inyo Bolinas & Nicasio CASF Grant Areas

The Nicasio/Inyo FTTH Project was completed in 2018 and the network is operational. As of August 2022, the Bolinas FTTH project is stalled due to lack of matching funds.



Resolution T-17523

Inyo's Nicasio Project

Key Information

Project Name	**Nicasio**
Project Plan	To construct a fiber-to-the-premises last mile network utilizing point-to-point protocol over ethernet transmission electronics with the initial capability of delivering 1 gigabit (GB) symmetrical data along with voice and high-definition video. The network will be upgraded to 10 GB, as future needs require.
Proposed Project Budget (Total)	$2,485,130
Amount of CASF funds requested (60%)	$1,491,078
Applicant funded (40%)	$994,052

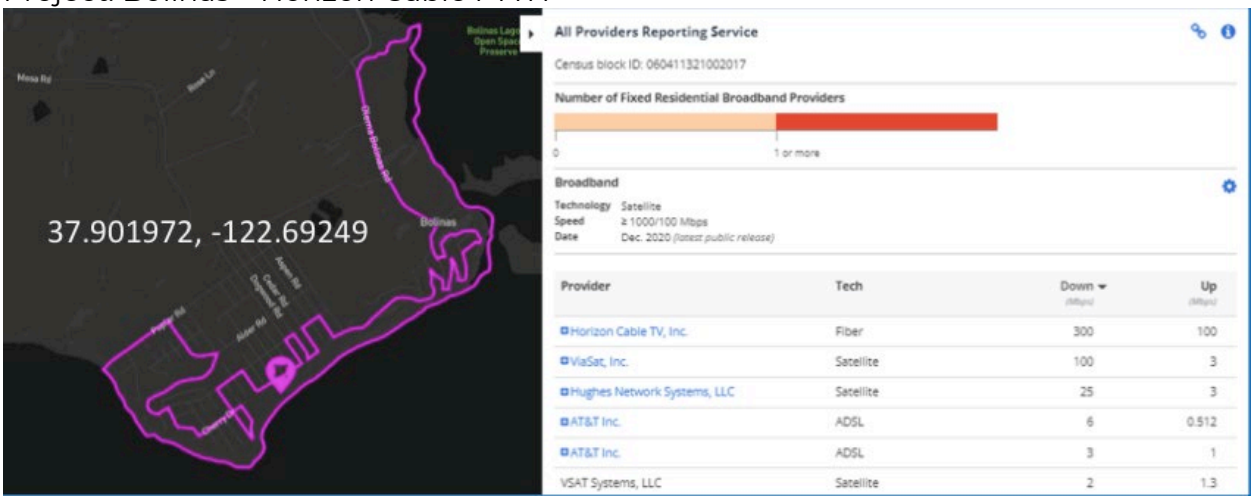
Resolution T-17523

Inyo's Networks Bolinas Gigabit Network

CASF Applicant Key Information

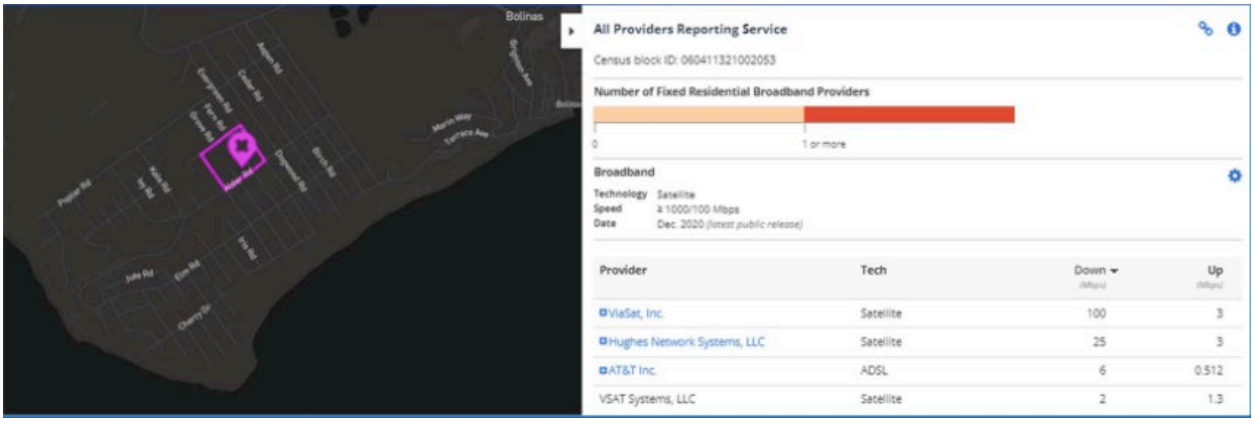
Project Name	**Nicasio**
Deployment Schedule (from Commission approval date)	15 months
Proposed Project Budget (Total)	$3,114,801
Amount of CASF funds requested (60%)	$1,868,881
Applicant funded (40%)	$1,245,920

Appendix D
Project: Bolinas – Horizon Cable FTTH



According to the current FCC Fixed Broadband deployment map, Horizon Cable is delivering speeds of 300/100 Mbps in just one Census Block in Bolinas.

AT&T DSL serve the balance of the blocks**.**

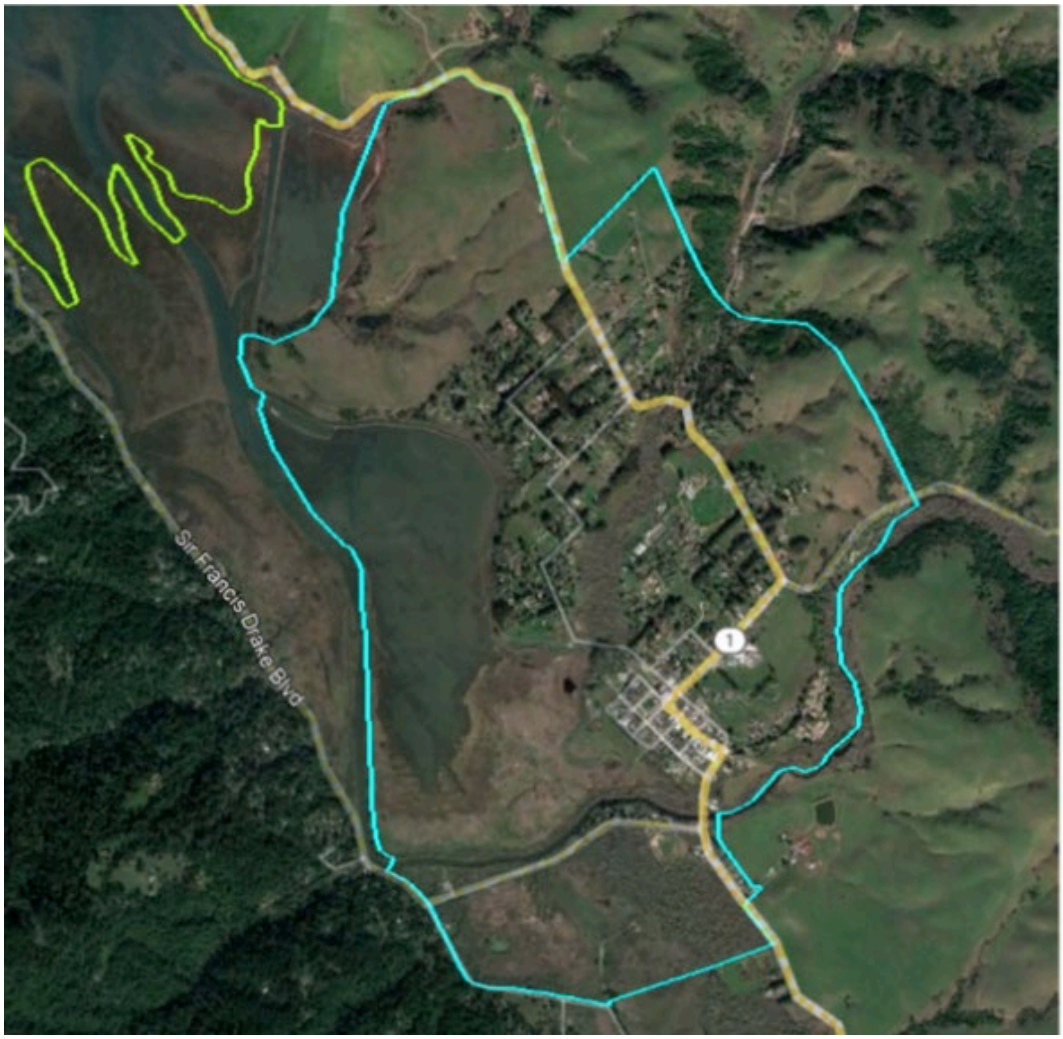


According to the CIBM, Bolinas has 664 total households.

- 327 are served >25/3 Mbps
- 337 are Priority Unserved <10/1 Mbps

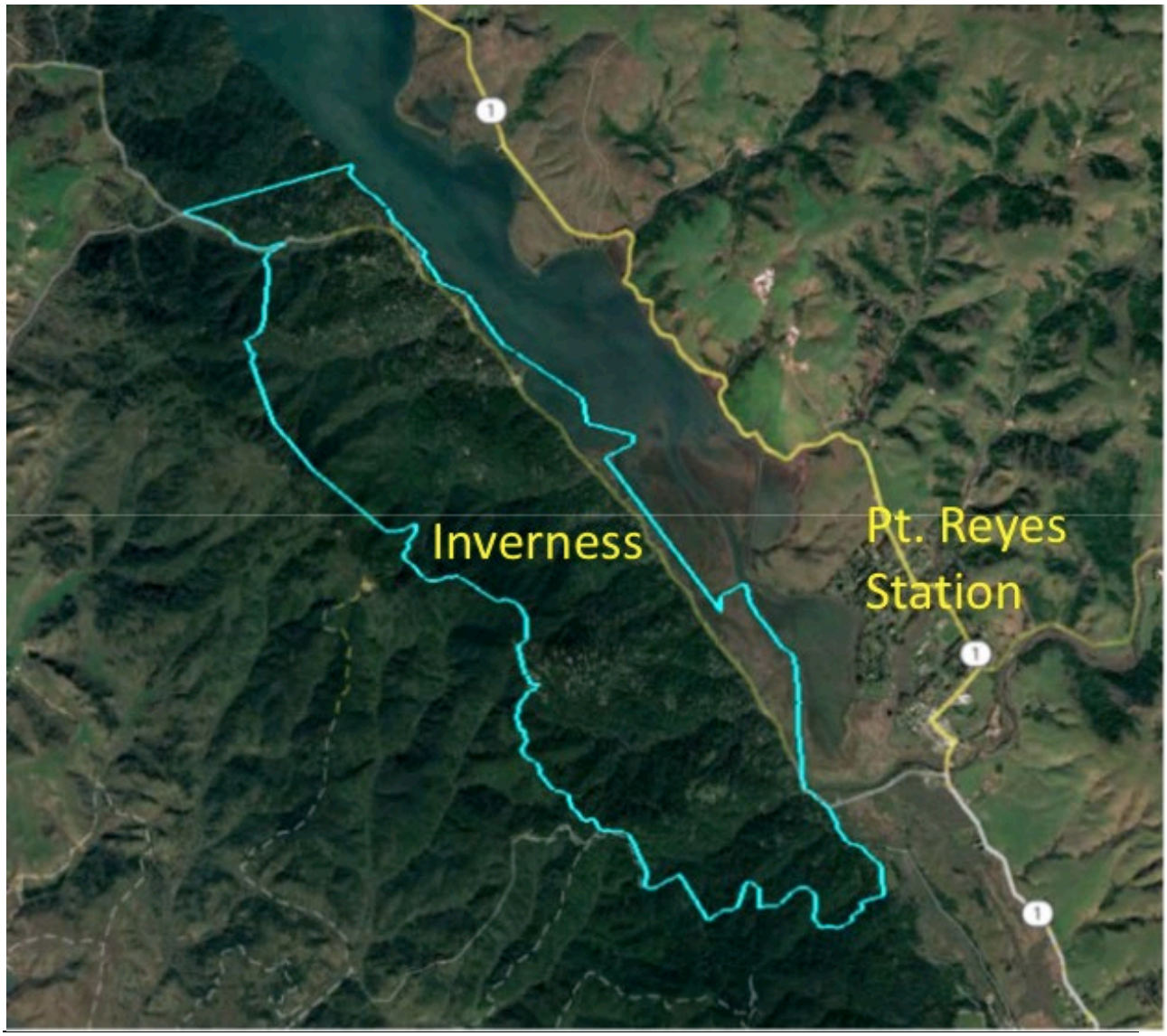
Appendix E
Project: Pt. Reyes Station / Census Designated Place – New FTTH Overbuild

- Population: 864
- Households: 417
- Providers & Speeds:
  - AT&T 25/2 Mbps
  - Horizon Cable 75/10 Mbps
- CASF Status:
- CASF Status:
  - Unserved >= 25 Mbps download/3 Mbps upload
  - Underserved 100 Mbps download/20 Mbps upload
- Community fiber network interconnects with CA SB 156
  Open Access Middle Mile Network along Hwy 1

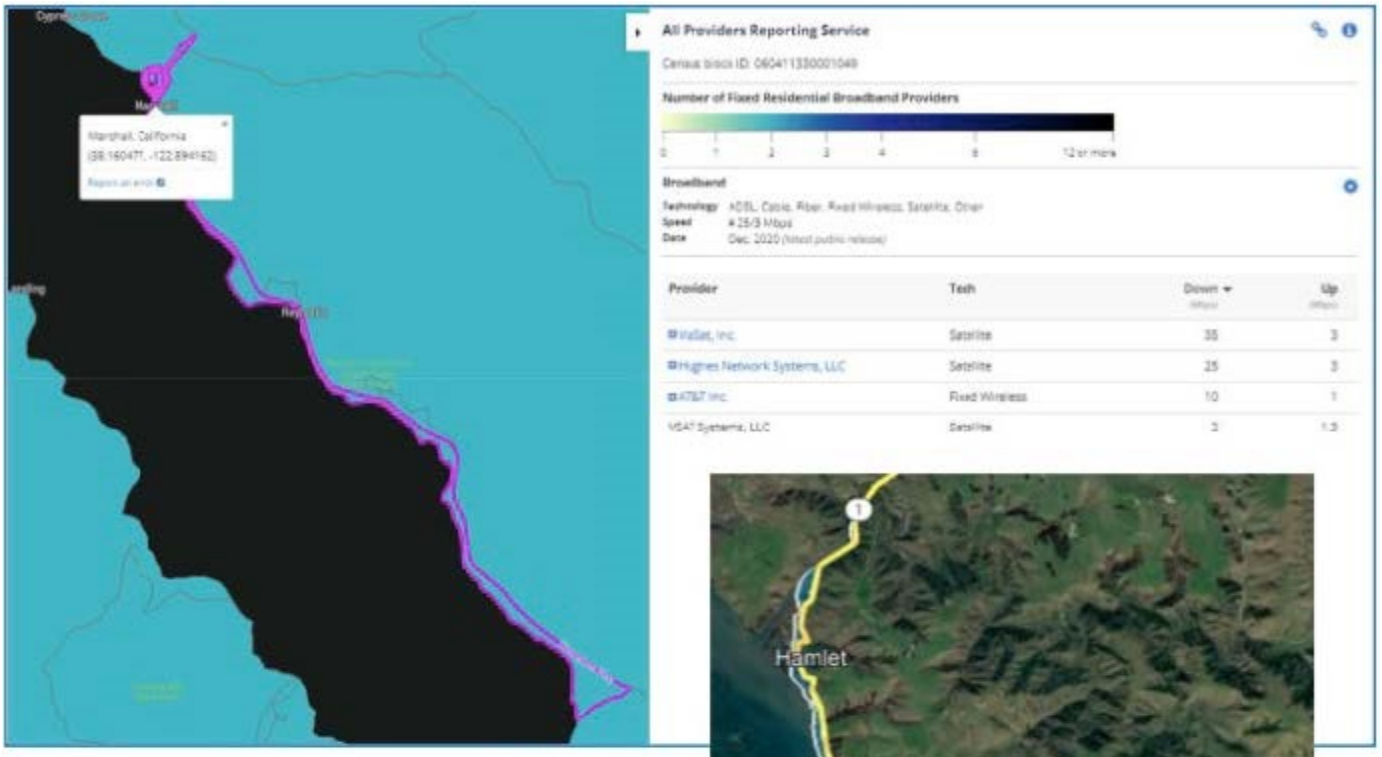


Appendix F
Project: Inverness / Census Designated Place – New FTTH Overbuild:

- Population: 1328
- Households: 700
- Providers & Speeds:
  - AT&T 25/2 Mbps
  - Horizon Cable 75/10 Mbps
- CASF Status:
  - Ineligible, Served >= 25 Mbps download/3 Mbps upload
  - Underserved 100 Mbps download/20 Mbps upload
- Community fiber network interconnects with CA SB-156 Open Access Middle Mile Network along Hwy 1



Appendix G
Project: Marshall & East Shore Old Community – New FTTH Overbuild



Unserved Community

- Population (Marshall): 94
- Households: 49
- Providers & Speeds:
  - AT&T 10/1 Mbps
- CASF Status:
  - Eligible, Unserved <25 Mbps download/3 Mbps upload
- Community fiber network interconnects with CA SB-156 Open Access Middle Mile Network along Hwy 1

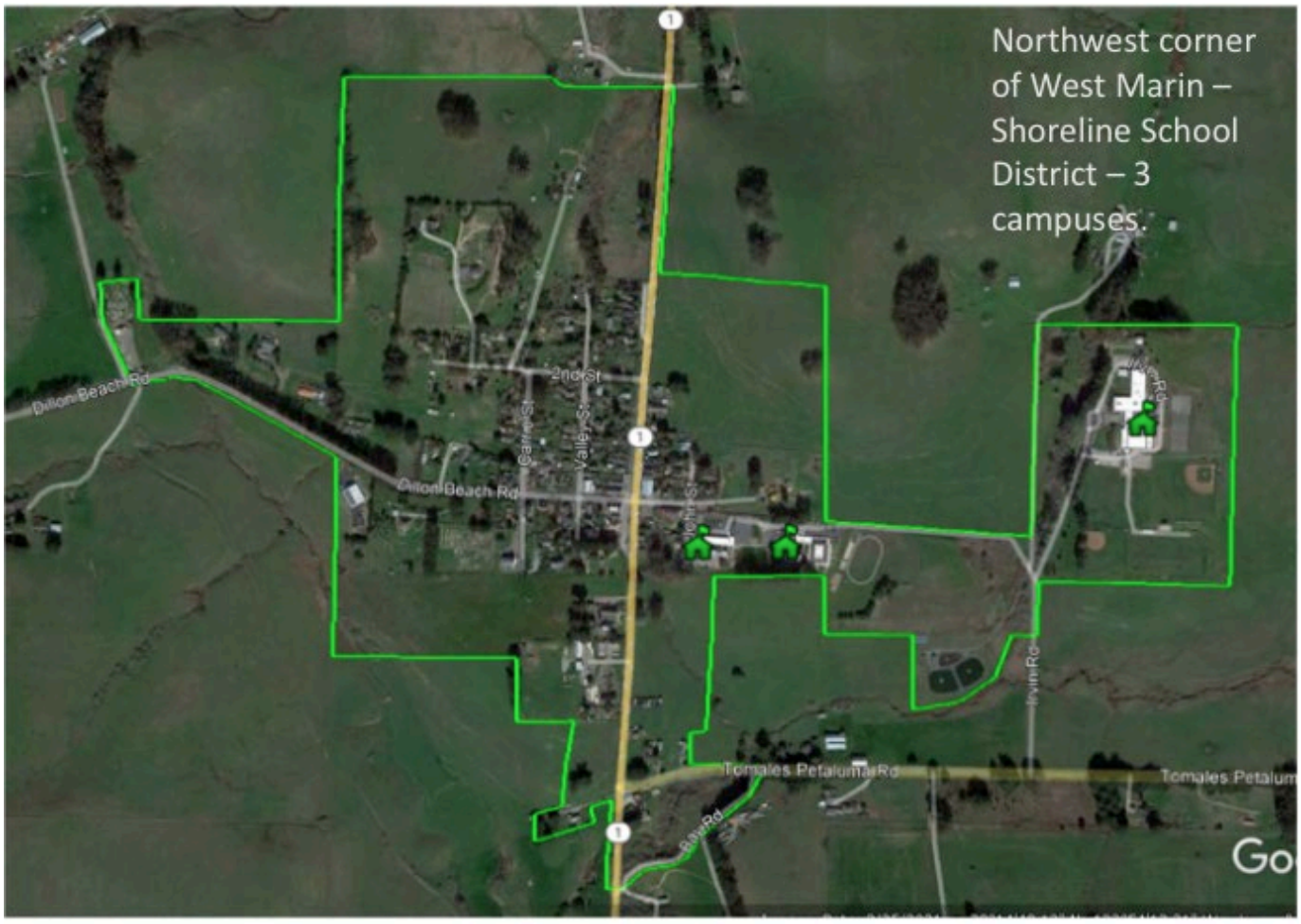
Appendix H

Project: Tomales / Census Designated Place – New FTTH

The Shoreline School District, in cooperation with the Marin County Free Library, Marin County, and private donors are currently conducting a three-year test of the Starlink service in a limited number of eligible households.

- Population: 208
- Households: 101
- Providers & Speeds:
  - AT&T 25/2 Mbps
- CASF Status:
  - Eligible, Unserved < 25 Mbps download/3 Mbps upload
- Community fiber network interconnects with CA SB-156 Open Access Middle Mile Network along Hwy 1
- Shoreline School District – three campuses

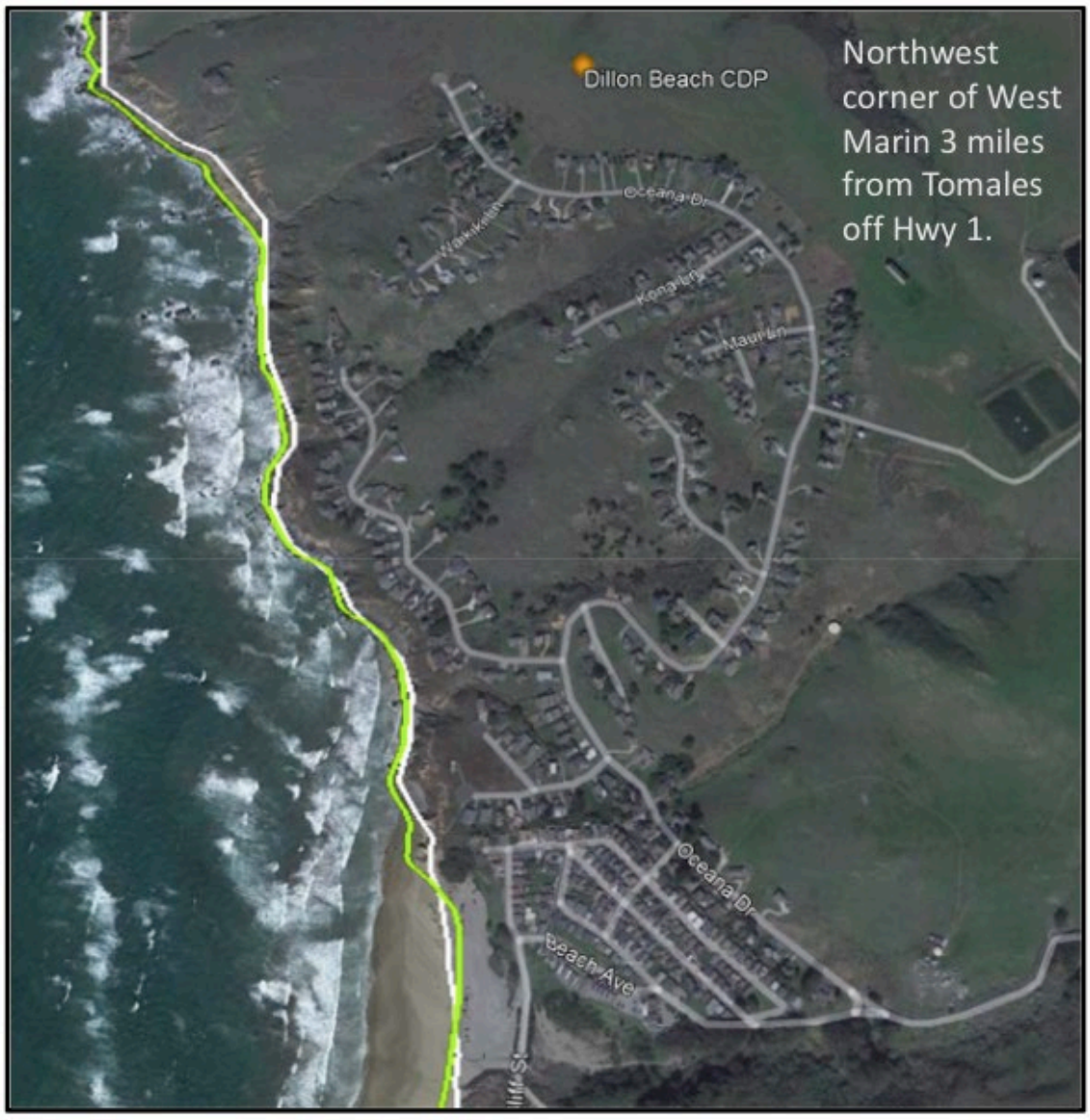
Unserved Community



Appendix I
Project: Dillon Beach / Census Designated Place – New FTTH

- Population: 288
- Households: 149
- Providers & Speeds:
  - AT&T 1.5/1 Mbps
  - Dillon Beach LAN Fixed Wireless (local business)
- CASF Status:
  - Ineligible, Served >= 25 Mbps Download/3 Mbps Upload
  - Served at 100 Mbps download/100 Mbps upload **but may be using unlicensed Spectrum**
- Community fiber network interconnects with CA SB-156 Open Access Middle Mile Network along Hwy 1

No High-Speed wireline Service

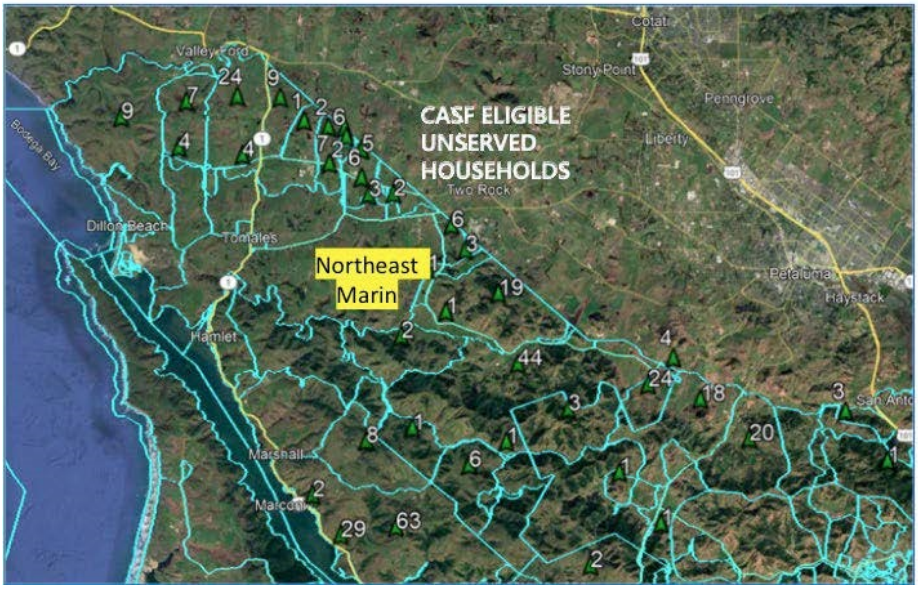


Appendix J
Project: Northeast Marin – Petaluma Region

Project: Northeast Marin – Petaluma Region

We have no idea of how to approach this area.

PROJECT AREA	Sum of Households 2020	Sum of Population 2020
Northeast Marin	359	870
Priority Unserved < 10 Mbps Down / 1 Mbps Up	276	637
Served >= 25 Mbps Down / 3 Mbps Up	83	233
Grand Total	359	870



Sum of Households CASF			
	Ineligible	Priority Eligible	Grand Total
NORTHEAST MARIN (PETALUMA REGION) CENSUS BLOCK	Served >= 25 Mbps Down / 3 Mbps Up	Priority Unserved < 10 Mbps Down / 1 Mbps Up	
060411230001046	63		63
060411230001026		44	44
060411230001055		29	29
060411230001027		24	24
060411230003000		24	24
060411230001011	20		20
060411230001015		19	19
060411230001012		18	18
060411230003019		9	9
060411230003002		9	9
060411230001029		8	8
060411230003013		7	7
060411230003037		7	7
060411230001018		6	6
060411230001035		6	6
060411230003011		6	6
060411230003006		6	6
060411230003007		5	5
060411230001059		5	5
060411230003015		4	4
060411230001013		4	4
060411230003026		4	4
060411230001017		3	3
060411230003041		3	3
060411230001005		3	3
060411230001031		3	3
060411230001025		2	2
060411230003005		2	2
060411230003004		2	2
060411230001061		2	2
060411230003042		2	2
060411230001049		2	2
060411230001028		1	1
060411230001020		1	1
060411230001024		1	1
060411230001036		1	1
060411230001034		1	1
060411230001003		1	1
060411230002000		1	1
060411230003002		1	1
Grand Total	83	276	359

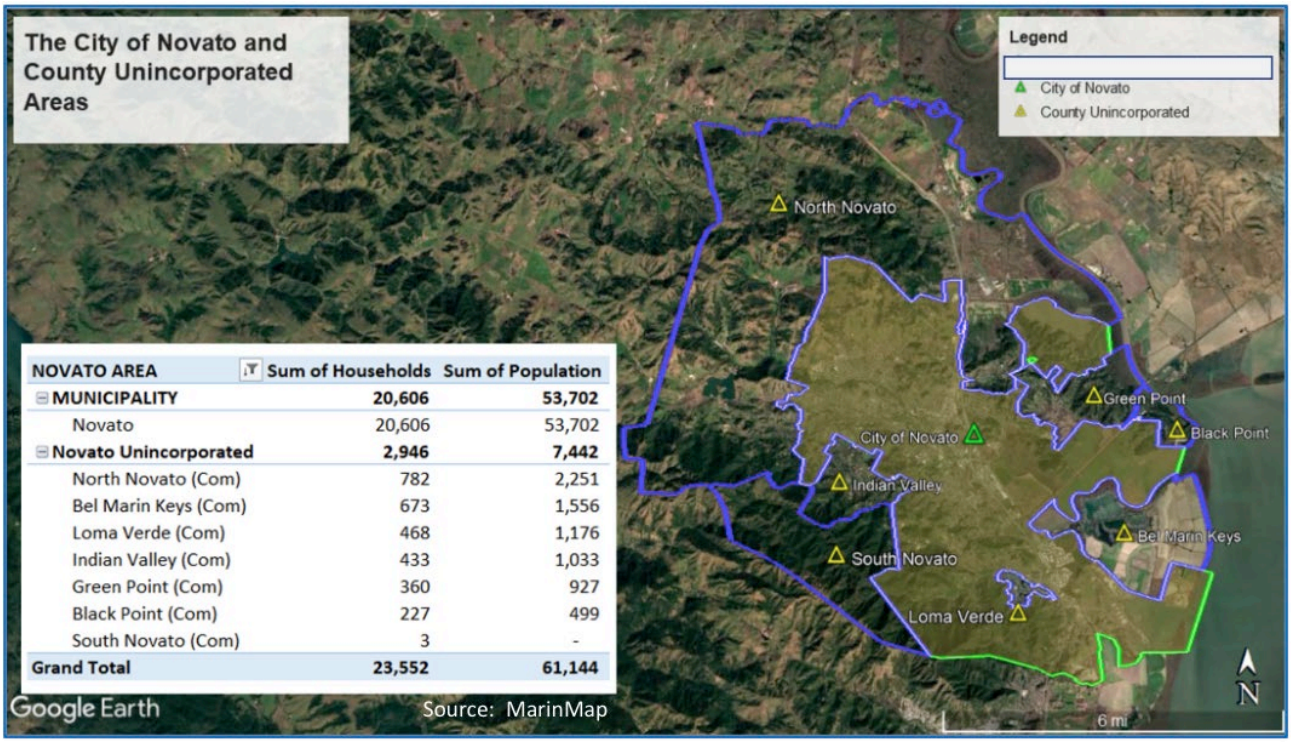
Appendix K
Project: Novato + County Unincorporated LATA Collaboration

Novato is a city located in Marin County, CA and has a 2020 population of 53,489. Novato is currently growing at a rate of 0.25% annually, and its population has increased by 0.50% since the most recent census, which recorded a population of 53,225in 2010. The average household income in Novato is $133,368 with a poverty rate of 6.42%. The median rental cost in recent years is $1,975 per month and the median house value is $804,900. The median age in Novato is 46.9 years, 45.8 years for males, and 48.4 years for females.

Internet Service Providers (ISPs):

- Comcast coaxial is up to or exceeds 1000/35 Mbps.
- Frontier provides DSL service, much of it reported to the FCC 477 at 25/2 Mbps or below.
- AT&T provides some DSL service at 100/20 at the southern end of the City.
- Sonic has installed fiber to the Bel Marin Keys Industrial Park, home to Novato's burgeoning BioTech cluster.

Households & Population



NOVATO AREA	Sum of Households	Sum of Population
MUNICIPALITY	**20,606**	**53,702**
Novato	20,606	53,702
Novato Unincorporated	**2,946**	**7,442**
North Novato (Com)	782	2,251
Bel Marin Keys (Com)	673	1,556
Loma Verde (Com)	468	1,176
Indian Valley (Com)	433	1,033
Green Point (Com)	360	927
Black Point (Com)	227	499
South Novato (Com)	3	-
Grand Total	**23,552**	**61,144**

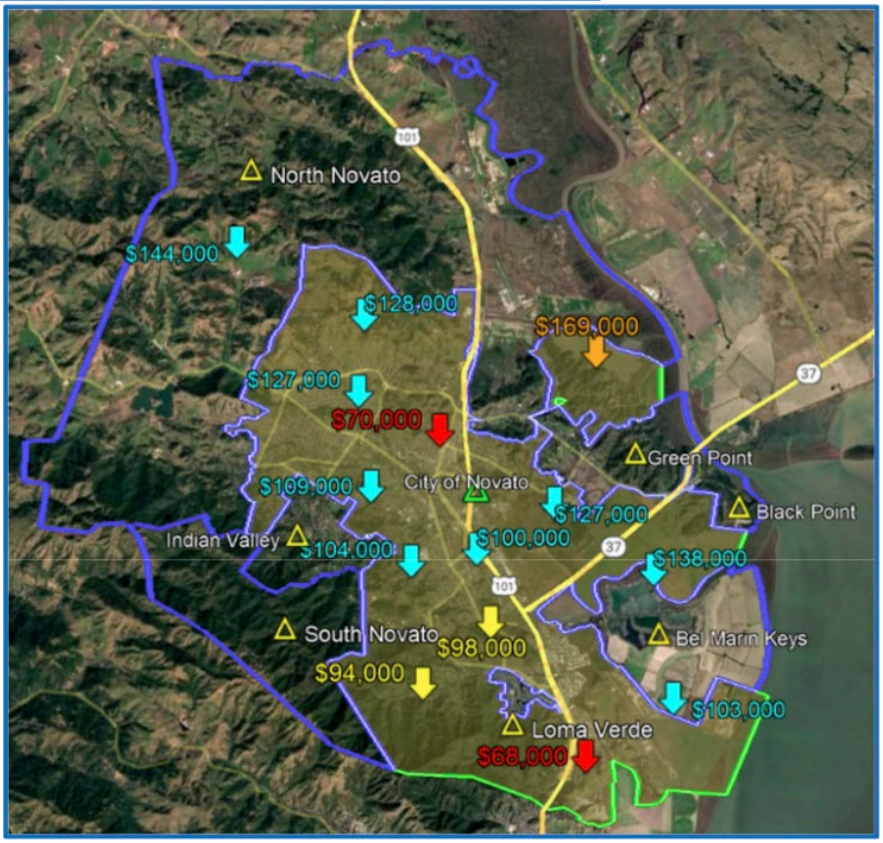
Unincorporated Parcel Breakdown – 2,908 Single Family residential sites

Count of Site Address	COUNTY UNINCORPORATED AREA								
Use Description - Source MarinMap	BEL MARIN KEYS	BLACK POINT	GREEN POINT	NORTH NOVATO	INDIAN VALLEY	SOUTH NOVATO	LOMA VERDE	Grand Total	
	2	1	1	7			3	14	
Agricultural - Improved				13	3	1		17	
Agricultural - Unimproved				15	2	1		18	
Commercial - Improved		8	3	9	1	1	2	24	
Commercial - Unimproved		1	1	4				6	
Common Area	2		5	9		1	1	18	
Exemption - Improved	5		4	2	2		7	20	
Exemption - Vacant		16	3	2				21	
Farmland - Imprv				1				1	
Industrial - Improved	1		3	1				5	
Industrial - Unimproved				6				6	
Mobile Homes				26				26	
Multiple-Resid. - Improved		10	18	6	22		4	60	
Multiple-Resid. - Unimproved		4			1			5	
Open Space - Improved				1	1	1		3	
Open Space - Unimproved				2	3	5		10	
Rural - Improved			1	8	1			10	
Rural - Unimproved	4			21		2		27	% Total
Single Family Attached	42							42	1.24%
Single-Resid. - Improved	656	216	364	578	373	4	487	2,678	78.97%
Single-Resid. - Unimproved		81	58	19	25	2	3	188	5.54%
Tax Exempt	44	19	19	70	8	16	14	190	
Valued By S.B.E.		2						2	
Grand Total	**756**	**358**	**480**	**800**	**442**	**34**	**521**	**3,391**	**85.76%**
Single Family Residential	**698**	**297**	**422**	**597**	**398**	**6**	**490**	**2908**	

Novato Project MM Parcel Master

Unincorporated Parcel Breakdown

2022 Median Income Adjusted for Inflation



Bibliography

Administration, N. T. (2022, July 18). *BROADBAND EQUITY, ACCESS, AND DEPLOYMENT PROGRAM.* Retrieved from broadbandusa.ntia.doc.gov: https://broadbandusa.ntia.doc.gov/sites/default/files/2022-05/BEAD%20NOFO.pdf

Administration, N. T. (2022, September 30). *Middle Mile Grant Program.* Retrieved from broadbandusa.ntia.doc.gov: https://broadbandusa.ntia.doc.gov/sites/default/files/2022-05/MIDDLE%20MILE%20NOFO.pdf

AGRICULTURE, U. D. (2022, September 06). *ReConnect Loan and Grant Program.* Retrieved from usda.gov: https://www.usda.gov/reconnect

CALIFORNIA, E. D. (2020, August 8). *EXECUTIVE ORDER N-73-20.* Retrieved from gov.ca.gov: https://www.gov.ca.gov/wp-content/uploads/2020/08/8.14.20-EO-N-73-20.pdf

CALIFORNIA, S. O. (2021, July). *Middle-Mile Broadband Initiative.* Retrieved from cdt.ca.gov: https://middle-mile-broadband-initiative.cdt.ca.gov/

Commission, C. P. (2022, September). *Loan Loss Reserve Fund.* Retrieved from cpuc.ca.gov: https://www.cpuc.ca.gov/industries-and-topics/internet-and-phone/broadband-implementation-for-california/loan-loss-reserve-fund

Community Networks. (2022). *Community FTTH Networks Get High Take Rate.* Retrieved from muninetworks.org: https://muninetworks.org/content/community-ftth-networks-get-high-take-rate

COUNCIL, C. B. (2020, December). *2020 CALIFORNIA BROADBAND FOR ALL.* Retrieved from broadbandcouncil.ca.gov: https://broadbandcouncil.ca.gov/wp-content/uploads/sites/68/2020/12/BB4All-Action-Plan-Final.pdf

Jury, M. C. (2019, June 13). *Marin's Telecommunicaitons Disconnect.* Retrieved from marincounty.org: https://www.marincounty.org/-/media/files/departments/gj/reports-responses/2018-19/marin-telecom-disconnect.pdf?la=en

Langer, B. F. (2021, October 27). *Wholesale fiber is the key to broad US FTTP coverage.* Retrieved from eff.org: https://www.eff.org/document/wholesale-fiber-key-broad-us-fttp-coverage

Woodruff, J. (2019, October 21). *The city with the best fiber-optic network in America might surprise you.* Retrieved from fastcompany.com: https://www.fastcompany.com/90416863/the-city-with-the-best-fiber-optic-network-in-america-might-surprise-you