Improving Coastside Communication Resilience

Prepared for:

The Coastal Leadership and General Public of San Mateo County, CA

Public Comment Edition

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Executive Summary:

The San Mateo County Coastside has faced persistent issues with internet connectivity and cellular service, ranging from an inability to browse the web to a lack of access to emergency services during power and fiber outages. The root causes of these communication problems are multi-faceted and include a lack of fiber optic cable redundancy for Comcast/Xfinity Communications, a lack of long-term generator power backup at many Coastside cellular sites, and gaps in coverage in certain areas.

To address these issues, the California Public Utilities Commission (CPUC) has given six resiliency strategies to all cellular providers operating in fire hazard zones, such as those along the SMC Coastside.

The goal of these six strategies was to:

1) Maintain access to 911 and 211 services.
2) Maintain the ability to receive emergency alerts and notifications
3) Maintain access to basic internet browsing.

The strategies include maintaining a redundant fiber optic connection via a secondary communication provider or a secondary fiber optic path. Additionally, these cellular service providers are have been asked to have at least 72 hours of backup power, typically through natural gas or diesel generators.

The commission gave wireless and wireline service providers the flexibility to decide how to implement the six groups of resiliency strategies.

* CPUC Resiliency Strategy: https://tinyurl.com/CPUC-Comm-Page

As we have seen from the storms in January of 2023, all service providers failed to maintain basic services in many parts of the Coastside. We could not find any record of audit or enforcement from the CPUC; we also could not find a compliance deadline given to any wireline or wireless provider.

Implementing these CPUC requirements through rigorous auditing and enforcement could help resolve the connectivity problems experienced by Coastside residents. Specifically, Comcast/Xfinity could create redundancy in their network by leasing fiber optic cables from AT&T, which already has a redundant path of fiber optic cable on the Coastside via the Tom Lantos Tunnel. Alternatively, those vendors could establish a redundant path underground alongside their current above-ground infrastructure, or utilize the same path as AT&T through the Tom Lantos Tunnel.

Another solution would be for the community to establish and operate its own fiber optic system that could be leased by multiple internet service providers, to compete with the oligopoly currently held by Comcast/Xfinity and AT&T. This system would have redundant fiber optic paths leading outside of the Coastside region and require that leases demonstrate resiliency through its use.

To hold service providers accountable for maintaining connectivity, particularly during emergencies, legislation should require them to provide records of cellular site maintenance, optic connectivity, and cellular coverage to the local community. Those providers who fail to maintain an acceptable service level could face substantial fines, with the revenue being directed toward a trust fund for a community fiber service.

Introduction:

The Coastside communication infrastructure that serves the communities surrounding Half Moon Bay is currently facing a range of challenges that urgently require attention. This report aims to bring these issues to the attention of the public and elected officials, highlighting the impact on reliability and accessibility of critical infrastructure, such as internet connectivity, mobile network coverage, and emergency communication systems. Degraded communication service and prolonged outages on the Coastside have existed for a number of years, but were punctuated by the severity of the recent storm damages. In particular, this report focuses on the recent severe storms that affected California in December, 2022 and January 2023, which caused prolonged power and communications outages of up to 240+ hours. These outages significantly impacted the ability of residents and first responders to communicate with emergency services, and with their families.

During this period, falling trees destroyed power and telecommunication lines, resulting in extensive outages, including the complete loss of communication due to the lack of resilience of the communication systems in the area. Moreover, the entire Coastside was disconnected from Xfinity's services twice in one week, causing significant disruptions in areas where home fiber or analog telephone services were not available. These outages are not isolated incidents, and residents in rural areas of San Mateo County regularly experience extremely slow internet services and poor cellular coverage, leading to even longer power and communication outages.

The largest age group in the Coastside, according to The United States Census Bureau, is between 50-64 years old. The second-largest group is individuals who are 65 years and above.

The CDC reports that in the United States in 2019, individuals aged between 50-64 had 4.8 times higher chances of experiencing a heart attack compared to individuals aged between 35-49. Additionally, people over the age of 65 had 11.3 times higher chances of experiencing a heart attack than the 35-49yr baseline. During the same period, 22% of individuals who were 18 years or older required emergency room visits. Such emergencies require quick response times and effective communication, and having access to life-saving emergency services for both medical and non-medical emergencies can be the difference between life and death for anyone.

Ages On Coast:

Town/City	Total	<19	%	20-34	%	35-49	%	50-64	%	>65	%
Princeton	316	73	23.1%	23	7.3%	93	29.4%	103	32.6%	24	7.6%
Pescadero	362	107	29.6%	68	18.8%	144	39.8%	25	6.9%	18	5.0%
Montara	2879	332	11.5%	488	17.0%	603	20.9%	510	17.7%	946	32.9%
Moss Beach	3227	930	28.8%	230	7.1%	749	23.2%	754	23.4%	564	17.5%
El Granada	5842	1089	18.6%	787	13.5%	1084	18.6%	1726	29.5%	1156	19.8%
Half Moon Bay	11792	2558	21.7%	2141	18.2%	1786	15.1%	2912	24.7%	2396	20.3%
Total	24418	5089	20.8%	3737	15.3%	4459	18.3%	6030	24.7%	5104	20.9%

Percentage of adults 18+ in the US in 2019:

Symtom/Problem	18-24	35-49	50-64	65
Heart Attack	0.1%	0.8%	3.9%	9.1%
COPD, Emphysema or Chronic Bronchitis	1%	2.3%	6.4%	10.4%
Diagnosed Diabetes	1.3%	5.5%	13.6%	20.2%
Fair or Poor Health Status	7.2%	12.1%	19.7%	25.1%
Hospital Emergency Room Visit	21.3%	20.6%	20.1%	26%

Source:
https://data.census.gov
https://wwwn.cdc.gov

To address these issues, this report recommends remediation efforts to improve the resiliency of coast-side connectivity between Half Moon Bay and Montara, CA on and around Highway 1. This report discusses the causes of system-wide failures and presents possible solutions to improve communication resiliency. These recommendations can also be used to benefit any county or municipality seeking to enhance their communication infrastructure.

Fiber Redundancy:

Telecommunication providers use a combination of fiber optic and copper cables to deliver services to customers. Fiber optic cables allow these service providers to transfer large amounts of information over very long distances, at very fast speeds. A redundant fiber optic path from he Coastside to service providers to the east and north allows a service provider to seamlessly switch paths that feed services to a given area in the case of damage to the cables along one of the paths.

AT&T and Comcast/Xfinity each have a single fiber optic cable (containing many strands of fiber) that travel from Palo Alto, west on Highway 84 to Highway 1, then north, all the way to Montara. AT&T's fiber optic cable continues through Montara into Pacifica and beyond via the Tom Lantos Tunnel, to eventually connect to the greater internet at a different point, creating redundant access to the SMC Coastside. The strands in the fiber optic cables branch off, like arterials in road work at many places along the path to provide data connectivity to different neighborhoods and customers.

The fiber optic cable Comcast/Xfinity uses on the Coastside is predominantly above-ground, on PG&E power poles. AT&T uses a blend of above-ground PG&E poles and underground utility passages.

Above-ground cables are vulnerable to falling trees, cars hitting power poles along the path, and even arborists trimming trees nearby. All of these factors are especially problematic on the path that traverses Highway 84 since it is full of dense tree vegetation.

Comcast/Xfinity's line supplies connectivity to Xfinity home and Comcast business Internet, TV, and Phone services. It also supplies Comcast Fiber customers including Verizon Wireless cellular services. Its worth noting that Comcast Fiber is the the primary connection for Verizon Wireless service. Around November, 2022 the service provider added AT&T Fiber at most of their cellular sites on the Coastside, as a lower speed redundant connectivity supplier following a different fiber path.

AT&T Fiber, which provides connectivity services to AT&T Wireless, T-Mobile, and Verizon (as a redundant network carrier), does have a redundant fiber optic cable path that originates from the Pacifica AT&T Fiber optic network (through the Tom Lantos Tunnel). This path has very few objects that could damage the cable along its path.

Please refer to the maps on the next page for a visual comparison of the fiber optic routes of Comcast/Xfinity and AT&T Fiber to the Coastside. It's worth noting that AT&T Fiber has a second route that connects to the internet in South San Francisco.

Most fiber paths and cellular site locations on the Coastside can be found by clicking the following link:

https://tinyurl.com/InfrastructureMap*

*The information on the map in the link is based on manually collected visual surveying and may not contain all installed infrastructure. Some fiber optic cable paths are underground and are estimated locations; these estimated are noted as such. By clicking on many items on the map more information is available.

The table on the next page details the location of critical infrastructure and cellular sites and whether or not they have multi-carrier or multi-path redundancy in the given survey area. The information provided was gathered by means of: visual observations of cellular sites and fiber optic infrastructure, testing during outages, and contact with companies running the systems.

Coastside cellular sites and infrastructure, multi-carrier or multi-path fiber:

Carrier	Location	Redundant
AT&T fiber	525 Kelly Ave, Half Moon Bay (Central Office)*	Y
	740 Etheldore St, Moss Beach (Central Office)*	Y
AT&T	Ritz Carlton, Half Moon Bay	Y
	Half Moon Bay High School, Half Moon Bay	Y
	78 Pilarcitos Creek Rd, Half Moon Bay	Y
	100 Ave Portola, El Granada	Y
	239 Avenue Del Oro, El Granada	Y
	9850 Cabrillo Hwy, Half Moon Bay	Y
	8425 Cabrillo Hwy, Montara	Y
T Mobile	500 Lewis Foster Drive, Half Moon Bay	Y
	78 Pilarcitos Creek Rd, Half Moon Bay	Y
	129 Main St, Half Moon Bay	Y
	661 Miramar Dr, Half Moon Bay	Y
	9850 Cabrillo Hwy, Half Moon Bay	Y
	500 California Ave, Moss Beach	Y
	8888 Cabrillo Hwy, Montara	Y
	8425 Cabrillo Hwy, Montara	Y
verizon	Ritz Carlton- Half Moon Bay	Y
	500 Lewis Foster Drive, Half Moon Bay	Y
	102 Princeton Ave, Half Moon Bay	N
	8888 Cabrillo Hwy, Montara	Y
comcast xfinity	**Offering services to more then 15,000 coastal customers with no communication redundancy**	N
Cruzio Internet	Offering service to Half Moon Bay and El Granada, using microwave link from Palo Alto for redundancy.	Y

*Central offices provide AT&T Fiber to the home, AT&T POTS (phone), and DSL Services.

As stated above, the largest issue with fiber optic cables on the Coastside is Comcast/Xfinity's lack of redundant paths for the services they provide. During a fiber cut many Coastside residences in areas with no cellular coverage lose BOTH telephone and data services in their home, effectively cutting their connection to emergency services. Considering the amount of people who purchase service from Comcast/Xfinity on the Coastside, this obviously poses a major health and safety issue. Furthermore, during our inspections of Comcast/Xfinitiy's infrastructure we noticed that many of their ground based systems where unlocked and easily accessible - if not just left open - posing a major security issue. Finally, Comcast uses a daisy chain network (Linear Bus Topology), which means that many neighborhood connections are linked together, passing data through each other to the next link in the chain. While this helps to keep build costs low, it also makes the network vulnerable to failure when one device in the chain fails.

Comcast/Xfinity Senior Director of Communications Joan Hammel told reporters that they have faced issues running a redundant cable path through the Tom Lantos Tunnel because of *"National Security issue concerns with the U.S Department of Homeland Security"*. The question raised is how AT&T Fiber was able to achieve the same feat. One plausible explanation is that Comcast/Xfinity is unwilling to provide compensation to contracted fiber optic installers who have passed DHS background checks and are qualified to work in critical infrastructure.

Hammel also mentioned that the company had proposed running their redundant cable across the Montara State Marine Sanctuary, but this is not feasible due to the terrain. To accomplish this Comcast/Xfinity would have to run the fiber optic cable on cliffs or in the ocean; thus this option is not realistic, and they already have Fiber Optic lines running nearly parallel to Highway 1.

Hammel then stated that Comcast/Xfinity looked into a path across the Crystal Springs Reservoir, stating that they faced difficulties because "it was a sensitive area". AT&T Fiber already has a fiber optic cable buried along part of the path of Highway 92 crossing the Crystal Springs Reservoir that they use to provide data to a cellular site located on Skylawn Funeral Home property. It appears that Comcast/Xfinity senior management may have provided vague excuses to the public because the company is not willing to invest in its Coastside infrastructure.

Source HMB Review: https://tinyurl.com/hmb-review-article

Potential Solutions:

A. To address their fiber optic redundancy issue on the Coastside, Comcast/Xfinity should:
    1. Consider leasing fiber optic strands from AT&T Fiber's redundant path. However, if AT&T Fiber refuses to lease to their competitor, elected officials should remind them that this is a matter of public safety that must be addressed.
    2. Bury a new fiber optic cable on the same path as the existing Hwy 84 cable. This also opens the opportunity for Comcast to upgrade their network path with a higher fiber optic strand count, increasing capacity. This option is also requires less negotiations with multiple landowners, however they would remain exposed to the risks of a single path (e.g. earthquakes and landslides).
    3. Run a redundant path of fiber optic cable using the same path that AT&T Fiber uses (via the Tom Lantos Tunnel).
    4. Find a completely new underground redundant path for a new fiber optic cable.
    5. The State, County or a new local district could install their own fiber optic cable, then lease back strands to multiple providers while also laying the groundwork to create a community owned fiber optic network system.
B. To prevent damage to fiber optic lines, it is important to trim or remove any trees that are within close proximity and may potentially fall on the lines.
C. Allow Comcast/Xfinity 18 months to construct a new fiber path for their Coastside service. If they fail to meet their deadline, fine them 20% of their revenue from Coastside customers on a monthly basis until the new line is built.
D. To ensure reliable network performance and mitigate frequent outages that are not caused by fiber optic cable damage, lawmakers should contemplate introducing a policy for both AT&T and Comcast/Xfinity to replace optical transceivers every eight years and report monthly records of replacements to CPUC. Failure to replace obsolete optical transceivers within the prescribed time frame may incur a fine of 20% of the revenue earned from customers who could be impacted by the potentially defective equipment for each month that the replacements are delayed.
E. It is essential for Comcast/Xfinity to give priority to securing their ground-based enclosures in order to safeguard their equipment against unauthorized access and potential damage.
F. Comcast/Xfinity might consider decreasing the number of fiber optic nodes that are dependent on each other. This could involve reconfiguring the network infrastructure to create more independent segments, and/or adding redundancy to critical network components to ensure that failures in one area do not have a cascading effect on other parts of the network.
G. To expedite the deployment of fiber optic networks and reduce costs, it is recommended that the County or State establish a telecommunications task force dedicated to identifying above and underground construction opportunities. This task force would also facilitate connections between service providers and projects involving trenching or utility installation. By doing so, service providers would be incentivized to accelerate their deployment efforts.
H. Direct all fines towards a trust fund that is exclusively dedicated to the construction and upkeep of a community fiber service.

The State and County could be very helpful in expediting all of these options by helping reduce regulation that slows permit approvals, and by assisting vendors with negotiations between service providers and private land owners that new cable paths will cross. We recommend that local regulators *(list below)* create a program or task force for fast tracking telecommunication projects.

To offer an example, the following list includes all parties required to review and approve a single cellular site on the Coastside near Martin's Beach:

1. California Coastal Commission (CCC)
2. California Department of Fish and Wildlife
3. California Bay Delta Region 3 (CDFW)
4. California Department of Parks and Recreation
5. California Department of Transportation
6. District 4 (DOT), California Highway Patrol
7. California Native American Heritage Commission (NAHC)
8. California Public Utilities Commission (CPUC)
9. California Regional Water Quality Control Board
10. San Francisco Bay Region 2 (RWQCB)
11. Caltrans
12. California Division of Aeronautics
13. California Department of Water Resources
14. California Natural Resources Agency

Generator Backup:

Generators, in combination with batteries, are used at critical infrastructure points to ensure the non-stop operation of the network. Batteries generally provide a few minutes to a few hours of back-up power in the case of a power outage, this gives generators on-site sufficient time to start and warm up before delivering power.

Unfortunately, most cellular sites on the Coastside lack a generator backup. This means that during the time of a power outage, customers will lose cellular service after 4-6 hours or whenever the batteries run out. During most power outages, not having a generator back up at every cellular sites is not an issue. This is due to cellular site coverage overlap, meaning many cellular service providers have overlapping cellular coverage from other neighboring cellular sites. Coastside, due to the unique geography containing many hills and mountains, signals will not pass, making overlapping coverage inadequate with the current antennae installations.

Usually if a cellular site goes off-line, other cellular sites in the area can take over. This allows a carrier to backup only a few sites and still maintain minimal levels of service (texting and calling), by taking on more users but slowing speeds to accommodate the higher density of customers at an overloaded cellular site.

Comcast/Xfinity networks also use batteries and generators at key locations that will keep fiber-optic-only customers' services active (e.g. cellular carriers & enterprise clients). Residential & small business coaxial based networks use batteries distributed across their service areas in local neighborhoods; these backups usually only last up to 6 hours, obviously leaving many without phone or internet service in a serious power outage.

For all cellular sites, and wireline infrastructure listed in the table "*Permanent generator backup status at critical infrastructure points on the Coastside:*" below, we conducted a visual survey to check for generator backup. For fixed wireless internet we contacted Cruzio and inquired about their backup and redundancy systems.

Based on our findings, we created the following table to indicate how backup availability affects customers in various locations around our surveyed area on the Coastside. Our coverage estimates were determined by combining the consideration of multiple factors such as the physical location of each cellular site, the topology surrounding the site, the direction of each cellular antenna on the tower, and actual service availability during an outage.

Given the information below, it becomes very obvious that in a serious power outage many Coastside residences would lose cellular coverage, home internet, and phone services after just a few hours.

Permanent generator backup status at critical infrastructure points on the Coastside:

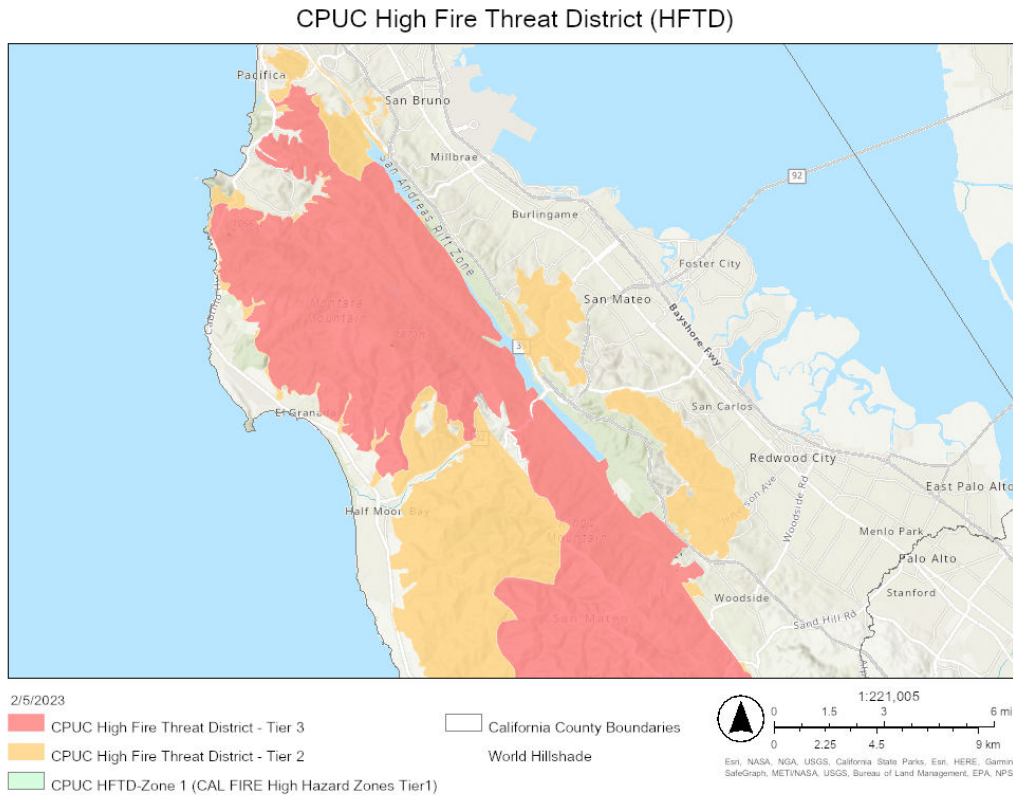| Carrier	Location	Generator
AT&T fiber	525 Kelly Ave, Half Moon Bay (Central Office)*	Y
AT&T fiber	740 Etheldore St, Moss Beach (Central Office)*	Y
comcast xfinity	**Offering services to more then 15,000 coastal customers with no generator backup and only 6 hours of battery backup.**	N
AT&T	Ritz Carlton, Half Moon Bay	N
AT&T	Half Moon Bay High School, Half Moon Bay	N
AT&T	78 Pilarcitos Creek Rd, Half Moon Bay (92/35)	Y
AT&T	100 Ave Portola, El Granada	N
AT&T	239 Avenue Del Oro, El Granada	N
AT&T	9850 Cabrillo Hwy, Half Moon Bay	N
AT&T	8425 Cabrillo Hwy, Montara	N
T Mobile	500 Lewis Foster Drive, Half Moon Bay	N
T Mobile	78 Pilarcitos Creek Rd, Half Moon Bay	N
T Mobile	129 Main St, Half Moon Bay	N
T Mobile	525 Kelly St, Half Moon Bay	N
T Mobile	661 Miramar Dr, Half Moon Bay	N
T Mobile	9850 Cabrillo Hwy, Half Moon Bay	Y
T Mobile	500 California Ave, Moss Beach	N
T Mobile	8888 Cabrillo Hwy, Montara	N
T Mobile	8425 Cabrillo Hwy, Montara	N
verizon	Ritz Carlton, Half Moon Bay	N
verizon	500 Lewis Foster Drive, Half Moon Bay	Y
verizon	102 Princeton Ave, Half Moon Bay	Y
verizon	8888 Cabrillo Hwy, Montara	N
Cruzio Internet	**Cruzio Coastal Internet**	Y

*Central offices provide AT&T Fiber to the home, AT&T POTS (phone), and DSL Services.

Cellular sites permanent generator backup coverage by area:

Location	verizon✓	AT&T	T·Mobile
HMB (South of Miramontes Point Rd.)	N	N	N
HMB (North of Miramontes Point Rd.)	N	N	N
HMB (Downtown)	Y	N	N
HMB (North of 92)	Y	N	N
HMB (South of 92)	Y	N	N
Hwy 92 Between Hwy 1 & 35	Y	Y	N
Miramar	Y	N	N
El Granada (Upper)	Y	N	Y
El Granada (Mid)	Y	N	Y
El Granada (Lower)	Y	N	Y
Princeton	Y	N	Y
Seal Cove	Y	N	Y
Moss Beach South	Y	N	Y
Moss Beach North	N	N	N
Moss Beach West	N	N	N
Montara East	N	N	N
Montara South	N	N	N
Montara North	N	N	N
Montara East	N	N	N
Montara Beach	N	N	N
Gray Whale Cove	N	N	N
Devils Slide	N	N	N
Tom Lantos Tunnel	N	N	N
Share of cellular areas with generator backup:	**48%**	**4%**	**29%**

At at state level, the California Public Utilities Commission (CPUC) adopted six groups of resiliency strategies for all facilities-based wireless and wireline service providers with facilities located in Tier-2 and Tier- 3 high fire threat district (see map below).

The Commission gave service providers the flexibility to decide how to implement these six groups of resiliency strategies:

CPUC High Fire Threat District (HFTD)

2/5/2023

CPUC High Fire Threat District - Tier 3	
CPUC High Fire Threat District - Tier 2	
CPUC HFTD-Zone 1 (CAL FIRE High Hazard Zones Tier1)	

California County Boundaries

World Hillshade

1:221,005

Esri, NASA, NGA, USGS, California State Parks, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, Bureau of Land Management, EPA, NPS.

A. Implement 72-hour back-up power to support essential communications equipment and minimum service levels for the public.

B. Build and maintain redundant communication networks.

C. Harden communication networks to withstand damage.

D. Restore service to damaged or destroyed facilities. Use temporary facilities (mobile cell sites, mobile satellite, and microwave backhaul, etc.).

E. Establish communication and coordination processes with first responders, other public utilities, the Commission, and the general public.

F. Establish preparedness planning for employees and ensure sufficient staffing levels.

Source CPUC:
https://tinyurl.com/CPUC-Comm-Page
https://tinyurl.com/CPUC-Requirements-Doc-1
https://tinyurl.com/CPUC-Decision-21-02-029

Despite the Commission's guidelines, service providers have not complied with them, and the CPUC has not taken steps to enforce them, as is evident from our survey findings.

Potential Solutions:

We recommend the following action items be required by service providers and enforced by elected representatives and public officials:

A. Public officials (CPUC) should audit and enforce all of these regulations with fines that are equivalent to 40% of the cost of a permanently installed generator backup for the location in question, to be fined every month cellular sites are without a generator or portable generator contract.
B. Install and maintain at least a 72 hour generator backup at every cellular location on Coastside, unless it has a neighboring cellular site with a clear line of sight. Ideally, require indefinite power backup by generator, by means of contracted refueling agreements with fuel service providers.
C. Require coaxial network service providers (Comcast/Xfinity) to at minimum increase battery storage capacity in neighborhood networks power systems at least four-fold to at least 24 hours of emergency service capacity.
   • Ideally, require coaxial network service providers to install and maintain generator backup systems at each neighborhood power injection site (many listed on the Coastside infrastructure map: https://tinyurl.com/InfrastructureMap).
D. Require all critical fiber optic infrastructure providers (Comcast/Xfinity and AT&T Fiber on the Coastside) to have permanently installed generator back power that will run indefinitely in the case of an extended outage.
E. Require cellular service providers who do not install permanent generator backups to set up agreements with portable generator system rental companies.
   1. These agreements must require the renter to provide a cellular site generator backup on-site delivery within 6 hours of an outage (i.e. before batteries fail) or at least 24 hours before the report of severe weather in the area.
   2. These services must be dispatched within 1 hour of the report of a cellular site power outage or severe weather.
   3. Portable generators should still be dispatched even if power is restored within 1 hour; this service should be provided 24/7/365.
   4. Portable generators should stay on-site for at least 1 week following a power outage to ensure there are no residual outages caused by electrical repair work.
F. Require VoIP-based home phone service providers to furnish VoIP consumer devices with batteries that can continue to keep their home phone devices (Analog Telephone Adaptor, Optical Network Terminal/Fiber Modem) working in a power outage for more then 12 hours.
G. Direct all fines towards a trust fund that is exclusively dedicated to the construction and upkeep of a community fiber service

Cellular Phone & Radio Networks:

Cellular sites depend on radio frequencies to transmit and receive data and calls from mobile devices. Higher frequencies can transmit vast amounts of data but have major challenges penetrating things like walls, or even vegetation. Lower frequencies carry less information but can travel farther and penetrate through walls and vegetation better. Even low frequencies still have challenges when penetrating objects at a distance, especially when cellular site towers have a low height and surrounded by dense vegetation, in some cases making the cellular site ineffective even when very close.
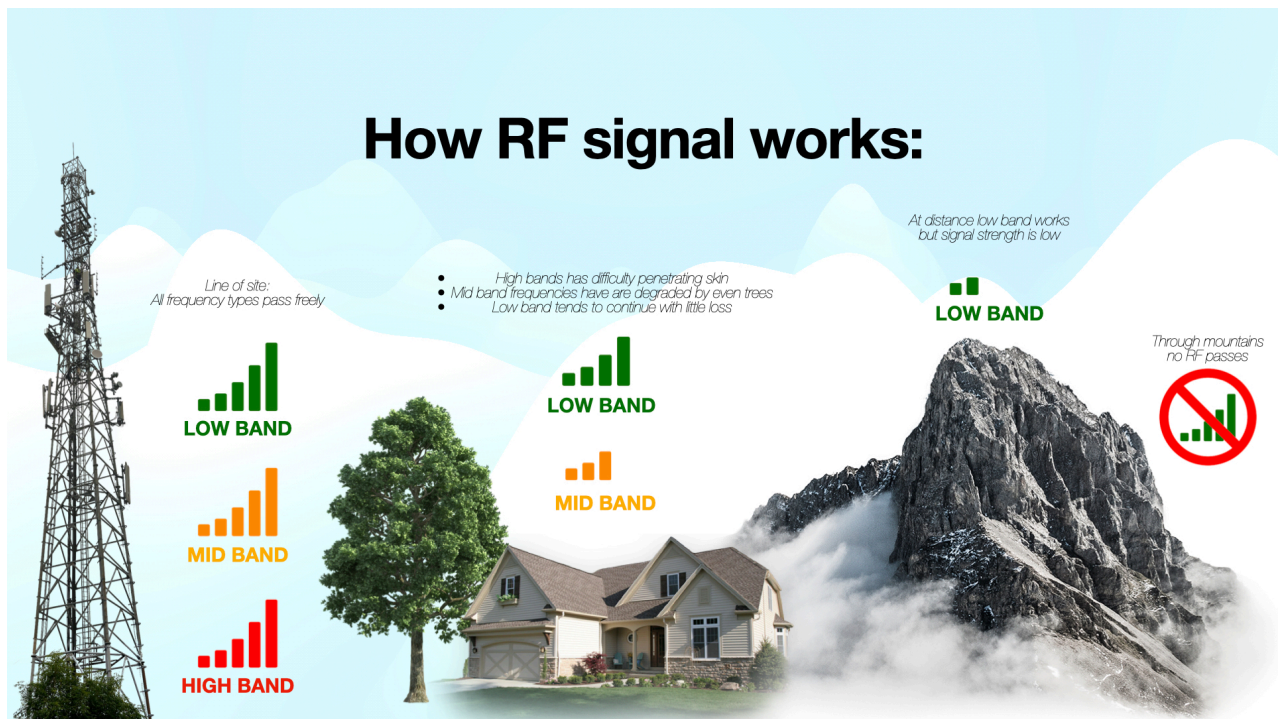
On the Coastside, cellular sites use a combination of these radio frequencies, sometimes at the same location, and sometimes service providers spread different radio frequencies across multiple cellular sites. Usually this decision process is made by a radio frequency engineer who considers variables like vegetation, population density, tower height, desired coverage and available cellular site tower locations. Engineers then balance these environmental factors with federal, state and local regulations.

From our site surveys we have concluded that the largest issues effecting cellular service on the Coastside are: cellular tower location, height, and the surrounding vegetation. Many cellular site towers are located where they cannot be seen, and generally these locations are not ideal for superior service. When combined with heavy tree growth in several neighborhoods on the Coastside we found that there are many areas with poor to no cellular coverage.

Verizon Wireless:
Verizon Wireless was the most disrupted service in the most areas, as displayed in our detailed review below. Verizon had the largest coverage issues in Montara and Moss Beach. We believe the position and height of their cellular site tower is the cause of the issue. The site is positioned fairly close to sea level in-between Moss Beach and Montara at the MWSD Office; it is positioned with trees nearly growing into it. Our samples indicate that past about 3000' from the cellular site, the service begins to have difficulty even maintaining a call, leaving north and east Montara with nearly zero coverage. We believe that due to this same tower position Verizon was unable to provide coverage in the west portion of Moss Beach and Seal Cove. Verizon also has coverage issues in parts of El Granada. Verizon's maximum download speed was recorded at 286 Mbps and max upload speed was recorded at 52.1 Mbps, with average download speeds of 50.45 Mbps and average upload speeds of 5.70 Mbps. It is also notable that if one was to test at the Montara Verizon cellular site they would be able to use Verizon's 5G UW service and achieve very high download and upload speeds, but just 1130' away the service is not available because it requires a nearly clear view of the tower site.

T-Mobile:
Our tests concluded T-Mobile performed well in most neighborhoods on the Coastside, sharing some of the same challenges as Verizon Wireless in east and north Montara. In Montara T-Mobile shares a cellular site with Verizon Wireless at the MWSD office. We do think that this cellular site is not serving many customers since, like Verizon's, it is close to sea level and surrounded by dense tree vegetation. It is also worth noting that the Montara T-Mobile cellular site is one of the only sites in populated coastal areas that supports their 5G UC high bandwidth network, but unless the customer is next to the cellular site it is not usable. T-Mobile has additional sites in Montara and Moss Beach that support LTE speeds (Long Term Evolution, the 4th generation of network technology, LTE speeds are generally 150Mbps download and 50 Mbps upload or lower) and give them working coverage in those areas. T-Mobile's max recorded download speed was 319 Mbps and max upload speed was 59.4 Mbps. T-Mobile's average download speed was 43.07 Mbps and average upload speed was 15.81Mbps.

AT&T Wireless:
We had the most success with AT&T Wireless, in the majority of our tests AT&T was able to provide usable coverage. We did experience lower coverage in east Montara as with other carriers, but we could still run our test. In Downtown Half Moon Bay, AT&T Wireless did have some challenges connecting to our testing server; while there was signal, service was intermittent. We later found that as of January, 2022 the city of Half Moon Bay approved AT&T request to add a new cellular site nearby to fix this issue, however construction has still not started. AT&T Wireless max download speed was recorded at 280 Mbps and max upload speed was recorded at 92.9 Mbps. AT&T average download speed was 72.69Mbps and the average upload speed was 13.09 Mbps

All carriers lack coverage north of Montara Beach, around the south side beach entrance, and inside of Tom Lantos Tunnel. The tunnel passage does offer emergency call boxes throughout its length, however accidents often occur at and around Gray Whale Cove where no or very low cellular coverage exists. Its known that even emergency services have difficulty communicating from this area via emergency radio. Cellular coverage would be vital in calling for emergency services and when first responders are coordinating at those locations.

It is worth noting that because of the failures in communications networks, the Coastside Fire Protection District tested Starlink satellite internet during the early January, 2023 network outages and will now be adding it to all static and moving assets to ensure that Coastside fire emergency services can communicate with each other and their emergency dispatch HQ.

In our coverage summary on the next page, you can see that we were able to come to the conclusion that Verizon Wireless has the most problematic service on the Coastside, and AT&T Wireless had the best overall speed and coverage. We will review some suggested solutions later in this report.

To calculate the information presented we conducted 29 different cellular speed tests inside of a vehicle in residential neighborhoods from Montara to Miramontes Point Road that represent the average customer use outdoors. We then scored carriers with one of 4 grades (Good, Ok, Poor, None), based on download and upload speed and the ratios of both together. This ratio is helpful in determining the usability of the coverage that a carrier is providing to a given area, with the lower the ratio the better. If the ratio of download to upload is too large or the upload speed is very low (<1Mbps), then despite the signal strength the carrier is not usable. If the carrier provides a good upload and a great download it makes for superior service.

An iPhone 12 mini was used to test AT&T Wireless services, and an iPhone 14 Pro was used to test Verizon Wireless and T-Mobile services. Speed tests were conducted using the Speediest iOS App by Ookla. We then compiled the test results and averaged both the speed and coverage to provide summaries and detailed information.

Full test results are available here: https://tinyurl.com/coast-results

Legend:

A "**Good**" grade was achieved by providing at least 50 Mbps download and 6 Mbps upload speed however as you can see from the chart below some carriers where able to provide nearly 300 Mbps download and nearly 100 Mbps upload speed.

A "**Ok**" grade was given by providing a connection that was not able to surpass about 20 Mbps download with about 2 Mbps upload.

A "**Poor**" grade was given to providers who could not sustain download speeds of more then about 5 Mbps and upload Speeds of more then about 0.7 Mbps.

A "**None**" grade was given when a service provider could not connect to our testing server.

Summarized wireless carrier grades on the Coastside:

	verizon✓	AT&T	T Mobile
Good	30%	37%	30%
Ok	7%	37%	33%
Poor	36%	23%	20%
None	27%	3%	17%

In the table above you can see that Verizon Wireless has the highest percentage of Poor and None ratings. AT&T had the highest percentage of working connections, with T-Mobile not far behind.
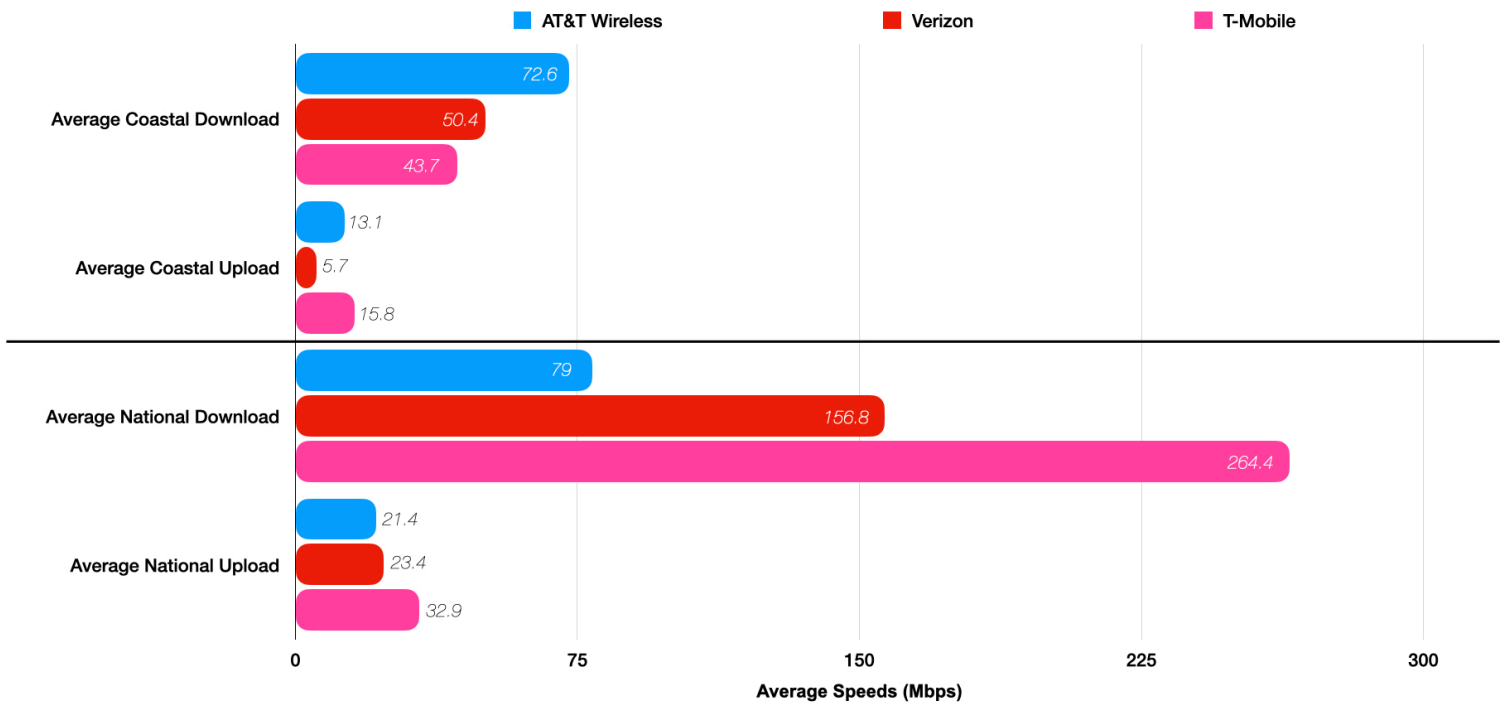
The graphs on the next page show that Verizon Wireless offers better download speeds then T-Mobile, while their upload is the worst. As stated, without good upload speed then the service becomes unusable. We had to retry our tests many times in order to get results from Verizon Wireless in many test locations.

Overall the carriers had the following average ratios:

AT&T Wireless: 5.55:1
T-Mobile: 2.72:1
Verizon Wireless: 8.86:1

While T-Mobile had the lowest ratio of download to upload, AT&T received a better Good and Ok rating because it offered a higher download speed on average with usable upload.

Coastal vs. National Average Carrier Speed:

Legend: AT&T Wireless ■ (blue) Verizon ■ (red) T-Mobile ■ (pink)

Category	AT&T Wireless	Verizon	T-Mobile
Average Coastal Download	72.6	50.4	43.7
Average Coastal Upload	13.1	5.7	15.8
Average National Download	79	156.8	264.4
Average National Upload	21.4	23.4	32.9

Average Speeds (Mbps)

National results are sourced from PC Magazine:
https://www.pcmag.com/news/best-mobile-networks-2022

We thought it important to draw comparison to national averages for carriers in large cities (see graph above). We did not include max upload and download speeds because they were so high that they would have made the graph nearly unreadable for normal speeds. Verizon Wireless offers speeds of nearly 4 Gbps (4000 Mbps), with T-Mobile max speeds reaching more then 1.3 Gbps (1300 Mbps) and AT&T reaching speeds over 1 Gbps.(1000 Mbps). Its important to note that these very high speeds are generally only found in areas with very dense amounts of customers such as Stadiums, Airports and Malls.

As demonstrated by the speed and coverage results presented in the tables below, we have identified several areas in need of improvement across multiple carriers. In particular, we found that certain locations, including Montara, Moss Beach, Downtown Half Moon Bay, and the Tom Lantos Tunnel, presented challenges in terms of speed and coverage.

Cellular coverage quality by location :

Location	Verizon	AT&T	T Mobile
El Granada- Lower	Good	Ok	Ok
El Granada- Mid	Poor	Ok	Ok
El Granada- North	Poor	Good	Good
El Granada- Upper	Poor	Good	Ok
Gray Whale Cove	Poor	Poor	Poor
HMB- Airport	Good	Good	Good
HMB- Downtown	Ok	Ok	Ok
HMB- Farmers Market	Good	Good	Good
HMB- North	Good	Ok	Ok
HMB- Ocean Colony	Good	Poor	Good
HMB- South	Ok	Ok	Poor
HMB- The Ritz Carlton/	Good	Good	Ok
Miramar	Poor	Ok	Ok
Montara Beach	Poor	Ok	Ok
Montara- Central	None	Good	Good
Montara- East	None	Poor	None
Montara- Far North	None	Ok	None
Montara- North	Poor	Ok	Poor
Montara- North East	Poor	Poor	None
Montara- North West	None	Poor	None
Montara- South	Good	Ok	Good
Moss Beach- East	Poor	Good	Poor
Moss Beach- Far East	None	Ok	Poor
Moss Beach- Far North	Good	Poor	Good
Moss Beach- North	Poor	Good	Good
Moss Beach- North West	Poor	Poor	Good
Moss Beach- West	None	Good	Ok
Princeton	Good	Good	Ok
Seal Cove	None	Good	Poor
Tom Lantos Tunnel	None	None	None

Emergency Amateur Radio:

There is another form of emergency communication that many may not know about, yet there is an entire community of volunteers who use and maintain it. This community is known as the Coastside CERT, or the Coastside Community Emergency Response Team. This community is activated by a decision from the county or CalFire organization. C.E.R.T. uses a system of consumer and professional 2-way radios (GMRS- General Mobile Radio Service) and radio repeaters (a radio repeater is a device that can take a weak signal and repeat it so that it has further reach) that can communicate over long distances. Anyone can participate in the C.E.R.T. network (but to be apart of C.E.R.T. one must complete a training course and obtain explicit certification); the equipment to participate is not costly, there are no subscriptions, and best of all, these systems continue to work without an internet connection. You can think of this network like a party-line radio service, where everyone can hear and talk to everyone else. With the addition of radio signal repeaters placed atop Montara Mountain, signals from the Coastside can make their way over the ridge to peninsula emergency services or to other repeaters spread across California and Nevada. The network of radio repeaters spread across the region is called the California Amateur Radio Linking Association or C.A.R.L.A.

Currently, there are a few flaws with the C.A.R.L.A network. The first is that it is 100% volunteer-run and funded. Considering this fact, these dedicated community members have done an excellent job of using and maintaining the system. However, at the moment, only one repeater system on the Coastside exists that could relay emergency communication to and from the Coastside (repeater C.A.R.L.A 32), This station has a significant battery backup life of ~8 days. However, it still lacks an infinite life generator backup, and this system is also without a redundant radio repeater. Amateur radio repeaters use licensed frequencies, much like cellular service providers. However, unlike cellular service providers, the FCC does not choose what frequencies are assigned to communities. Instead, they leave it to local regions to try to claim frequencies in their area. This can create major delays in the deployment of vital radio repeaters.

On the Coastside, the last challenge to amateur radio emergency use is coverage. Since there is only one repeater on the top of Montara Mountain, due to topography, this repeater has difficulty reaching some residences. Ideally, an additional repeater would be constructed in Montara at the top of Alta Vista Road, and another in the Harbor near El Granada. These two additional repeaters should allow for complete amateur radio coverage along the entire Coastside.

If the Montara Mountain repeater were to fail, there is an additional line of defense: The Amateur Radio Emergency Service or A.R.E.S. otherwise known as "HAM" radio operators. These radio operators are licensed by the FCC but generally own both A.R.E.S. and C.E.R.T. radio systems, and are trained to provide support during emergencies. The advantage of A.R.E.S radios is that they can reach great distances by bouncing radio signals off the atmosphere (at times around the world). This type of radio would allow A.R.E.S. operators to become the relay between the Coastside and emergency services all over California. For this to be a feasible backup plan, there would have to be A.R.E.S. operators located inside Emergency Operation Centers 24/7/365 listening for emergency transmissions. This request should not be a large ask since Emergency Operation Centers generally have professionally trained radio operators for Emergency Communications.

With the state's propensity for natural disasters, including earthquakes, wildfires, tsunamis, and floods, traditional communication networks can be easily disrupted, leaving communities without vital communication channels. Overall, the inclusion of amateur radio communication networks in emergency response and disaster preparedness planning is critical to ensuring that communities have access to reliable communication channels during times of crisis.

Source:
https://www.coastsidecert.com/
https://www.carlaradio.net/
https://www.arrl.org/ares
CalOES

Potential Cellular & Radio Network Solutions:

Public officials can require the following changes from service providers and local regulators can enforce them within 24 months. A small amount of public outreach and education about cellular technologies could also be helpful in the public perception of cellular towers.

    A. Help residents take into consideration the safety implications of having cellular coverage vs. blocking a view. Many residents do not want to see cellular towers, but sometimes if they do not have enough height they are not able to reach many customers.

    B. Require all cellular site towers to be built above the tree lines, this will dramatically increase coverage, by building towers taller it also opens the possibility for multiple carriers to host services from the same place (colocation).

- Cellular carriers also have the ability to disguise cellular site towers as trees, flag poles, or even chimneys (see image below that is a rendering of a proposed cellular site tower for AT&T in downtown Half Moon Bay).

    C. Require service providers to include all radio frequencies they offer at each tower installed on the Coastside, this will allow for the best coverage and speed at as many places possible.

    D. Suggest that cellular service providers use microwave radio data path in between cellular sites as a method for additional redundancy to neighboring cellular sites that are within line of sight of each other.

    E. Encourage cellular service providers to host cellular sites at the same locations.

    F. Local, county, and state representatives, should help cellular carriers find both public and the private locations that are best suited and most beneficial to the public to host cellular sites.

    G. Limit firmware upgrades to after 11pm and require technicians to be on-site during such upgrades.

    H. If a cellular tower radio system outage occurs, require a cellular provider be on-site within 4 hours to fix the issue. If the issue cannot be fixed then a COW (Cell on Wheels) must be deployed within 12 hours of the outage start. If this replacement cannot be made within 12 hours then the carrier is obligated to refund customers for all days of service outage X3 (outage will be based on residential address). Outage refund must be automatically applied without the need of a customer complaint.

I. Drawing on past recommendations by the CPUC, we suggest that cellular site installations should allocate floor space, tower space, and/or rack space for public safety communication use, if feasible. These public safety communication uses should include, but are not limited to:

These public safety communication uses should include but are not limited to:
1. US Amateur Radio Systems used for emergency communications
2. CHP
3. Country Sheriff
4. Police
5. CalTrans
6. Fire/EMS Communications (P25 Phase 2/ AMBE2+)

The guidelines established for a small chain of micro cellular sites along the Highway 1 Coastside should be replicated by the CPUC and enforced for all tower sites located in California.

Source: https://tinyurl.com/CPUC-Public-Radio

J. Funding should be allocated to support community amateur radio systems used for emergency purposes. This funding should cover a range of activities, including the installation of backup systems to ensure redundancy, expanding coverage to new locations, and ongoing maintenance, testing, and training.
K. To ensure effective emergency communication, it is advisable to have licensed HAM/HF radio operators and amateur radio operators (GMRS) available at County, State and Regional Emergency Operations Centers around the clock, every day of the year.
L. Require cellular service providers to install micro cellular sites in neighborhoods that are difficult for even well placed and tall macro (wide area, high capacity) cellular site towers to reach (see image on next page).
   • Micro cellular sites are cellular tower sites that cover a small area usually used in areas with dense populations or areas that lack macro cellular site coverage.
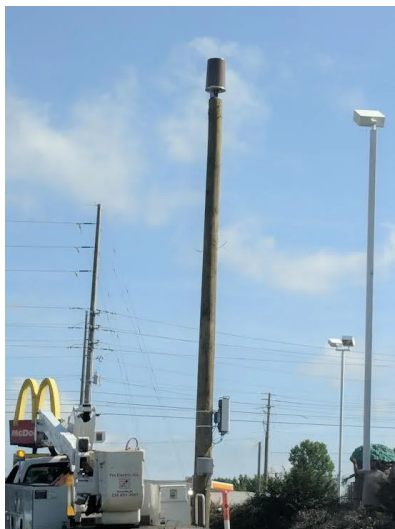

Example of cellular micro site   Example of cellular macro site

Summary of Cell Service Coverage:

In the above shared carrier coverage data, the largest lack of coverage our survey unveiled is in Moss Beach and North & East Montara. Currently AT&T Wireless and T-Mobile host cellular site towers on top of the Ocean View hotel on Main Street in Montara; both services host LTE/5G speeds and cover many residences, both still have issues covering the far north east corners of Montara. Moss beach is lacking coverage in most areas from Verizon Wireless. T-Mobile and Verizon both host cellular site towers at the MWSD office in Montara; both towers host high bandwidth 5G services. The simulated coverage maps on the next page help demonstrate actual coverage from the 3 providers in Moss Beach and Montara.
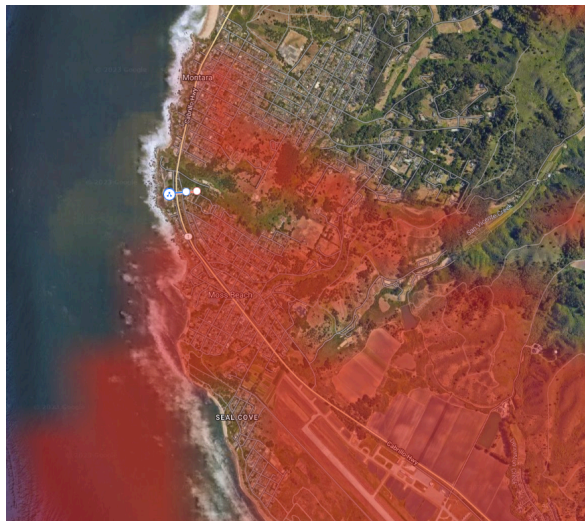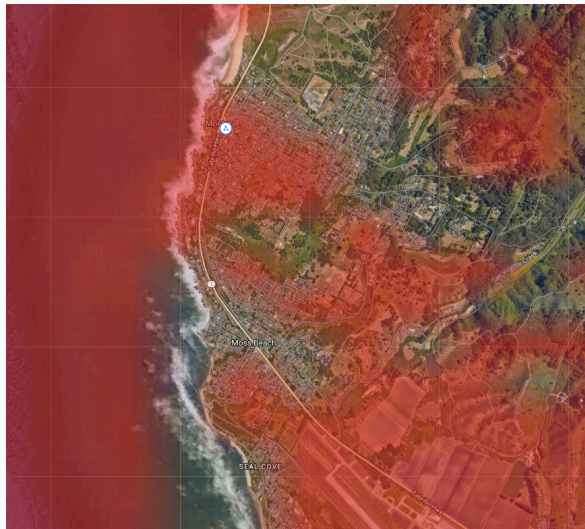
*Red clouding indicates estimated usable coverage in the depicted areas for each service provider

If cellular tower sites were constructed at the MWSD water tank locations near 775 Alta Vista Road in Montara and 501 Buena Vista Street in Moss Beach, it would result in significant coverage improvements in the respective areas. This would enable all customers to access high-speed services. To cater to all three major carriers, the Buena Vista tower would need to be at least 75 feet tall, and the Alta Vista tower should be at least 45 feet tall. The towers could be designed to resemble trees to blend in with the surroundings. However, only minimal camouflage may be necessary at the Alta Vista site since it is already somewhat secluded and situated at a high altitude out of view of residences.

AT&T has applied to the FCC for a cellular site at the MWSD water tanks near 775 Alta Vista Road, and their application (File Number A1226629) has been approved. Although constructing a new site can be challenging and time-consuming, one advantage of the MWSD Buena Vista Rd. Water tank site is its proximity to the MWSD office. This means that running fiber optic cable, which is one of the more difficult aspects of cellular site construction, to provide connectivity for the proposed tower would not be an overreach.
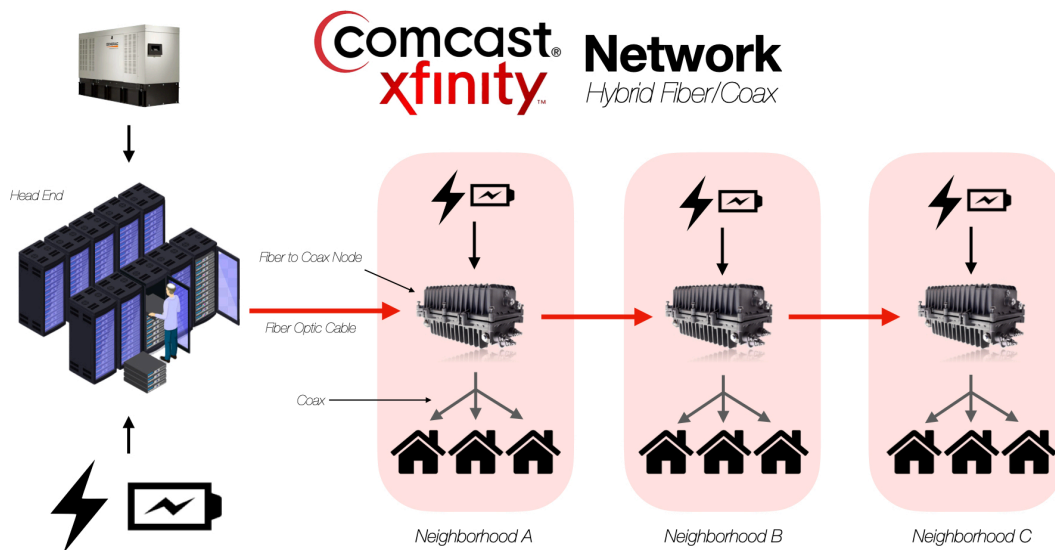
See the proposed new coverage map below.

**Estimated improved cellular coverage from all three major providers:**
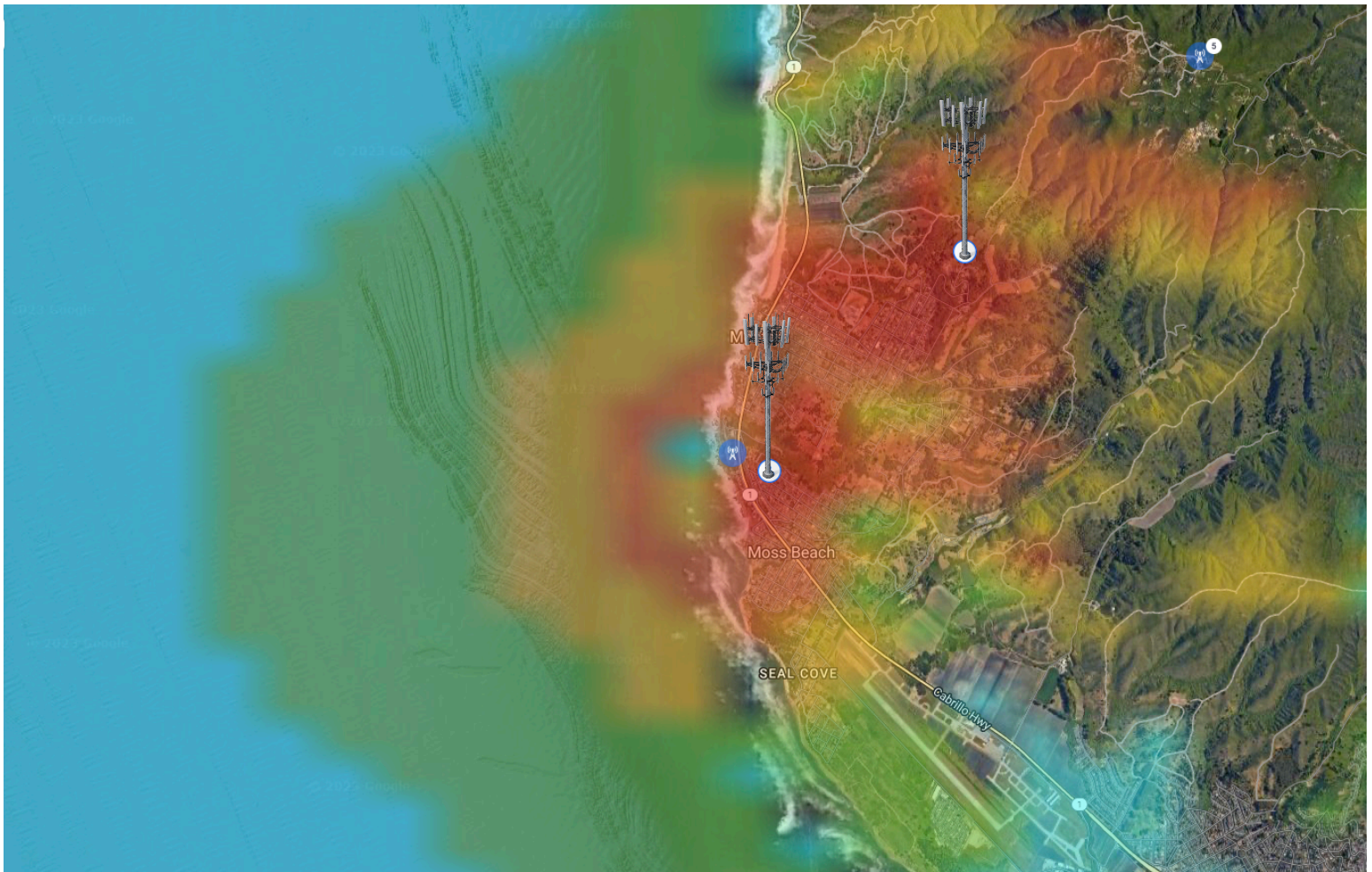
*Proposed coverage for all carriers is estimated based on geography calculated using computer models.

Lack of Access To Modern Internet Services:

comcast xfinity **Network**
Hybrid Fiber/Coax

Head End

Fiber to Coax Node

Fiber Optic Cable

Coax

Neighborhood A   Neighborhood B   Neighborhood C

98%~ of residences on the Coastside have access to Comcast/Xfinity internet service. Generally this service can offer download speeds of up to 1200 Mbps, along with telephone and television service. Comcast/Xfinity uses fiber optic and coaxial-based hybrid systems; they run fiber to a certain point in a neighborhood then convert it to coaxial which then eventually distributes to homes, These points are called fiber optic nodes. Beside coaxial systems being vulnerable to power outages, they can also be affected by radio frequency or RF interference and corrosion from water. Coaxial interference can come in the form of something as simple as a loose coaxial cable in you or your neighbor's home.

Head End

Fiber to Coax Node

Fiber Optic Cable

Coax

Neighborhood A   Neighborhood B   Neighborhood C
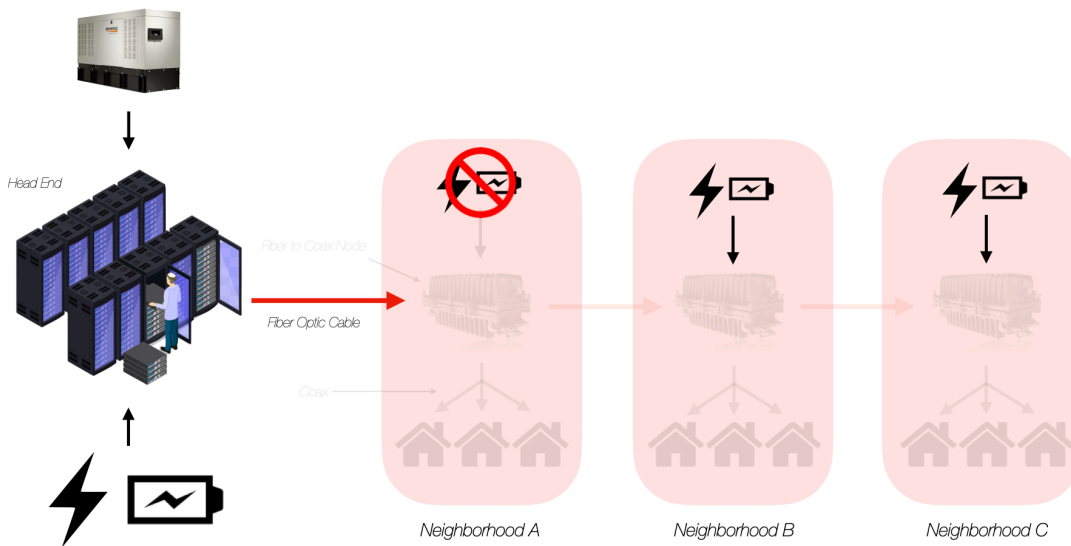
One other major disadvantage of the Comcast/Xfinity network design is that as displayed above each node has fiber optic cable running to it then to another in a separate part of the same neighborhood or an adjacent neighborhood. If one neighborhood loses power or a network piece has a fault it takes all other downstream nodes out of service. (See above)

Coastside DSL Powered by AT&T
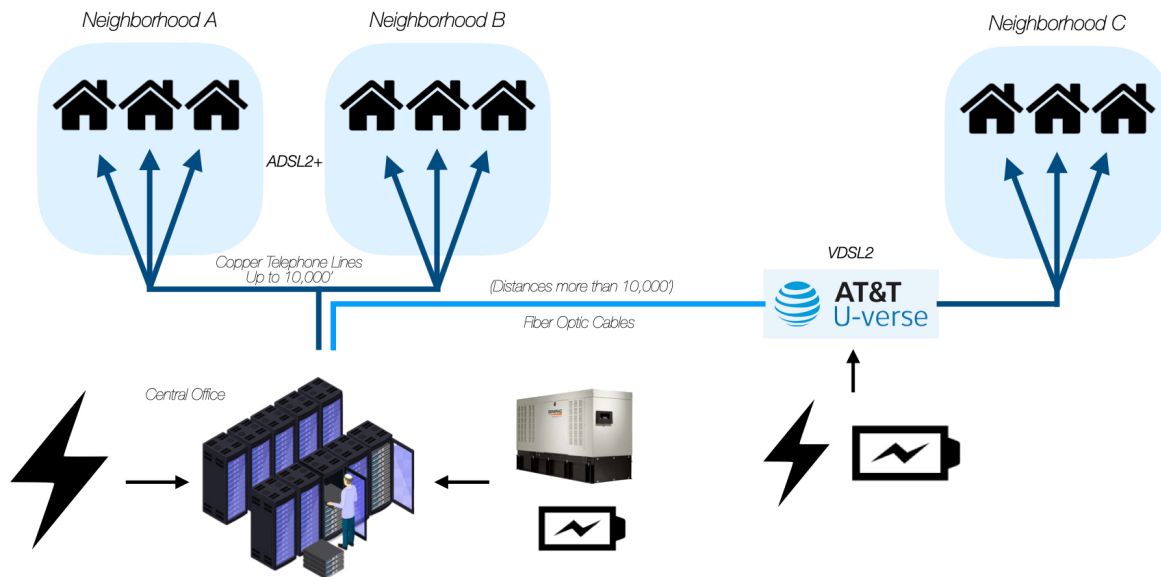
AT&T offers DSL (Digital Subscriber Line) internet services to customers in 85%~ of Coastside areas. These services take advantage of the originally installed copper lines that analog telephones use; in some places in the nation these lines are over 100 years old. One large advantage to these analog telephone lines is that they will remain active indefinitely during power outages using a service called POTS or legacy circuit-switched access lines. These lines are powered from one central location in a city or neighborhood and those locations always have a generator backup. POTS can deliver small amounts of electrical current to analog telephones allowing them to work during a power outage. Despite POTS lines being able to stay active in a power outage, as an effort to persuade service providers to offer faster services, the FCC has mandated POTS to be sunset by 8-22-2022, so service providers no longer install POTS lines.

In 2008, copper telephone lines service providers (like AT&T) started updating these networks to offer faster speeds to customers (around a max download speed of 150 Mbps). Copper lines that DSL services use have distance limitations. The further you are from a central office or a system repeater, the slower the speed. Copper telephone lines (and coaxial cables) are also vulnerable to corrosion from water damage and RF interference.

In most neighborhoods on the Coastside, AT&T has not upgraded their systems to offer better speeds, and most of their central offices are far from customers. This makes Coastside DSL speeds vary from 5 Mbps of download speed in the worst case and up to 18 Mbps of download speed in the best case. DSL on the Coastside can also reach speed of up to 36 mbps via CLEC's or Competitive Local Exchange Carrier, like sonic.net and coastside.net (now Cruizio) who bond 2 DSL connections to achieve faster speeds. Even with updated DSL systems, there is still a lack of power redundancy. These updated systems take advantage of neighborhood based repeaters that require power; these locations do not utilize a generator for backup, leaving only batteries that will no longer be able to power that system after about 6 hours.

Another major disadvantage that copper coaxial and telephone lines share is the lack of ability to upload data fast, with telephone lines reaching about a maximum of 1.5 Mbps and coaxial-based systems reaching a max of about 45 Mbps, compared to fiber speeds of 1,000+ Mbps.

Cruzio Internet — Network — Fixed Wireless

Internet Source · *Microwave Redundancy* · *Fiber Optic Cable* · *Neighborhood A* · *Neighborhood B* · *Neighborhood C*
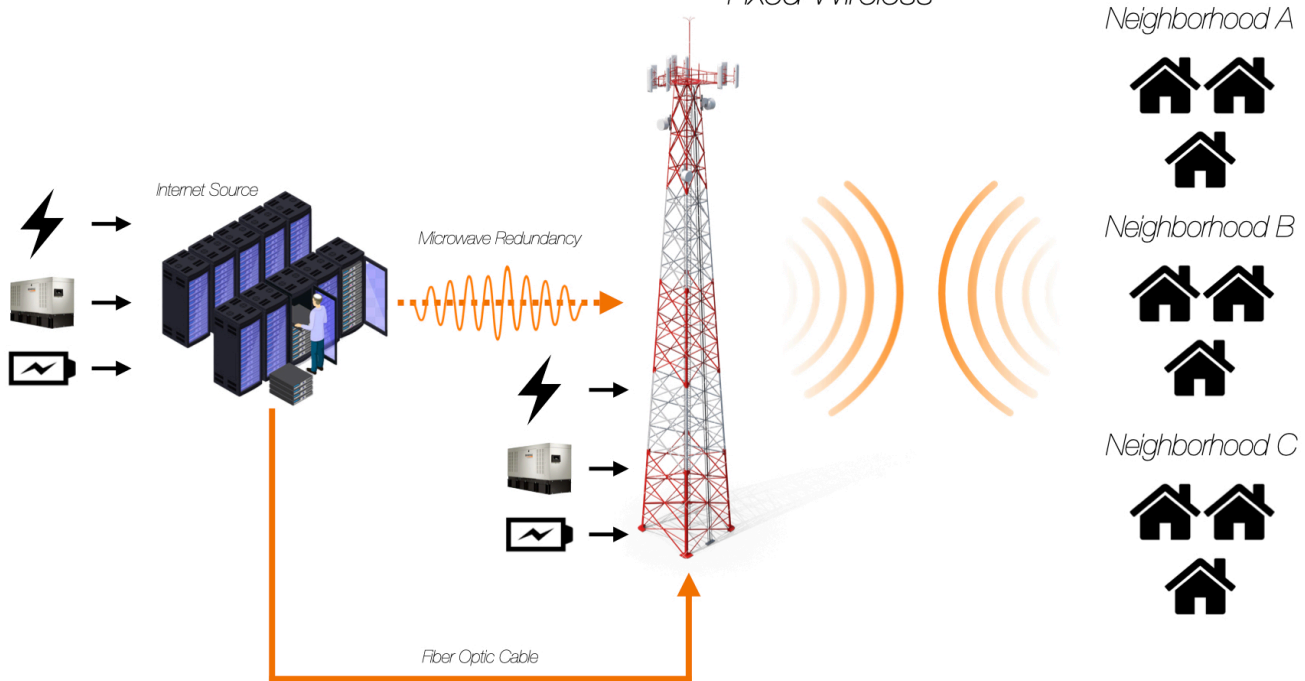
There is one last option that exists for 43%~ of Coastside residences - fixed wireless home and business internet from Cruzio Wireless Internet. Cruzio is a local company headquartered in Santa Cruz. Unfortunately, customers have to be within the line of sight of one of Cruzio's cellular tower sites, which are limited to specific areas of the Coastside. While it is locally owned, it still does not provide ultra fast, low latency connectivity, with a maximum download speed of up to 100 Mbps and a maximum upload speed of up to 50 Mbps. Furthermore Cruzio's maximum speed is also affected by the signal strength between a customer's home and the transmitting tower.

Most of the Coastside is within less then an hour's drive of San Francisco or the Silicon Valley, yet it is still lacking modern telecommunication systems. These modern systems are called 'fiber to the premise' (FTTP) or 'fiber to the home'. Some communities, such as portions of Half Moon Bay and El Granada, are lucky enough to already have FTTP services. These services can continue to operate during power outages, with users who have home power backup and with vendor services being powered from one central office location via a generator.
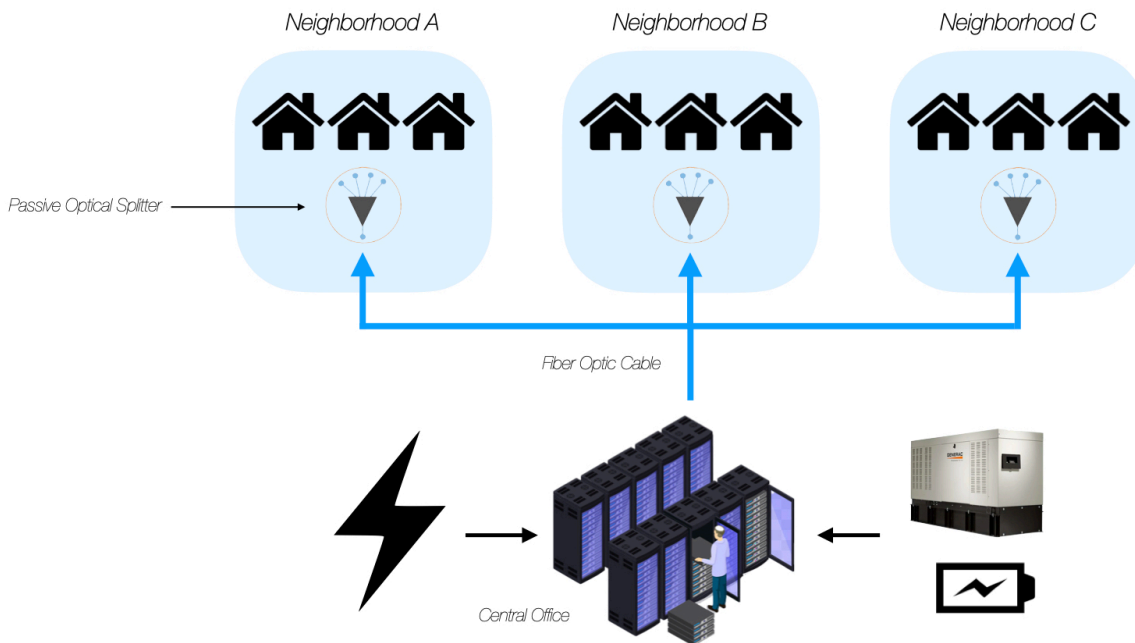
FTTP services offer unprecedented levels of connectivity, with symmetrical speeds that can go up to 10Gbps (10,000 Mbps), although most speeds average at 1Gbps (1,000 Mbps) and ultra-low latencies. Another major advantage of fiber optic cables is that they do not have the same limitations as copper-based systems: they do not corrode, have longer distance capabilities, and are not susceptible to outside Electro magnetic interference.

Faster upload speeds enable instant sharing of pictures or videos, while video calls and classrooms can be of higher quality, making it seem as if all parties are in the same room. FTTP also opens the doors to telecommuting, telemedicine, more efficient workflows, and new technologies that have yet to be developed.

On the Coastside, AT&T has already built the backbone to provide shared FTTP services in more populated towns along the Coastside, such as Pescadero, Miramar, North El Granada, Princeton, Moss Beach, and Montara. However, the installation of "last mile" cabling to homes is still required. The "last mile" is the most challenging aspect of an FTTP deployment, as it involves running fiber optic cables on every street where the carrier wants to make its services available. Once the cabling is installed, it will lower the service providers' costs of maintaining the infrastructure and improve end-user service reliability and quality.

AT&T fiber Network

100% Fiber Optic Shared Network

Neighborhood A   *Neighborhood B*   *Neighborhood C*

Passive Optical Splitter

Fiber Optic Cable

Central Office

Since many residences only have the options of DSL, Cruzio, or Comcast/Xfinity because of the slow roll out of AT&T Fiber, the graphic provided below highlights that Comcast/Xfinity has a near monopoly in providing high-speed internet, phone, and television services to most Coastside customers, and those services are unreliable, as discussed above.

When asked about the slow deployment of FTTP, AT&T Fiber employees have responded by saying that "it's likely on a network engineer's desk waiting to be built for their next bonus".

It's worth noting that we've received multiple reports from residents who have attempted to start new AT&T Fiber service, but have been told that the service is not available, particularly in unincorporated areas. For example, a resident in El Granada tried to acquire new fiber services for two years but was told they were not available at their address. However after realizing services were actually available at their address, they had to change their city to Half Moon Bay for AT&T's sales pre-qualification system to acknowledge that the address existed and services could be installed.

It's evident that service providers do not prioritize the public communication, connectivity, and public safety of Coastside residences.

Residential home wired and fixed wireless connectivity available by neighborhood:

Location	AT&T fiber	AT&T	comcast xfinity	Cruzio Internet
HMB (South of Miramontes Point Rd.)	N	40 Mbps	Y	Y
Ocean Colony	N	40 Mbps	Y	Y
HMB Downtown	N	18 Mbps	Y	Y
HMB West of Hwy 1 / South of Kelly	Y	18 Mbps	Y	Y
HMB West of Hwy 1 / North of Kelly	Y	18 Mbps	Y	Y
Hwy 92 Between Hwy 1 and Hwy 35	N	40 Mbps	Y	Y
Grandview Blvd, Half Moon Bay	Y	18 Mbps	Y	Y
Terrace Ave, Half Moon Bay	Y	18 Mbps	Y	Y
North Miramar	N	N	Y	Y
Frenchmans Creek	Y	40 Mbps	Y	N
South Miramar	Y	5 Mbps	Y	Y
East of Hwy 1 / North of Hwy 92	N	10 Mbps	Y	Y
El Granada (Central)	Y	100 Mbps	Y	Y
El Granada (Central North)	N	100 Mbps	Y	Y
El Granada (South)	N	N	Y	Y
El Granada (North)	Y	100 Mbps	Y	Y
Princeton	N	N	Y	Y
Seal Cove	N	18 Mbps	Y	N
Moss Beach South	N	18 Mbps	Y	N
Moss Beach East	N	18 Mbps	Y	N
Moss Beach North	N	18 Mbps	Y	N
Moss Beach West	N	18 Mbps	Y	N
Montara East	N	5 Mbps	Y	N
Montara South	N	10 Mbps	Y	N
Montara North	N	10 Mbps	Y	N
Sunshine Valley	N	18 Mbps	Y	N
Pillar Ridge	N	18 Mbps	Y	N
Montara East	N	5 Mbps	Y	N

*Cruzio internet has not been tested as part of our survey; we are providing their claims.

Home Internet Availability:

AT&T fiber	AT&T sonic.	comcast xfinity	Cruzio Internet
27%~	**86%~**	**98%~**	**43%~**
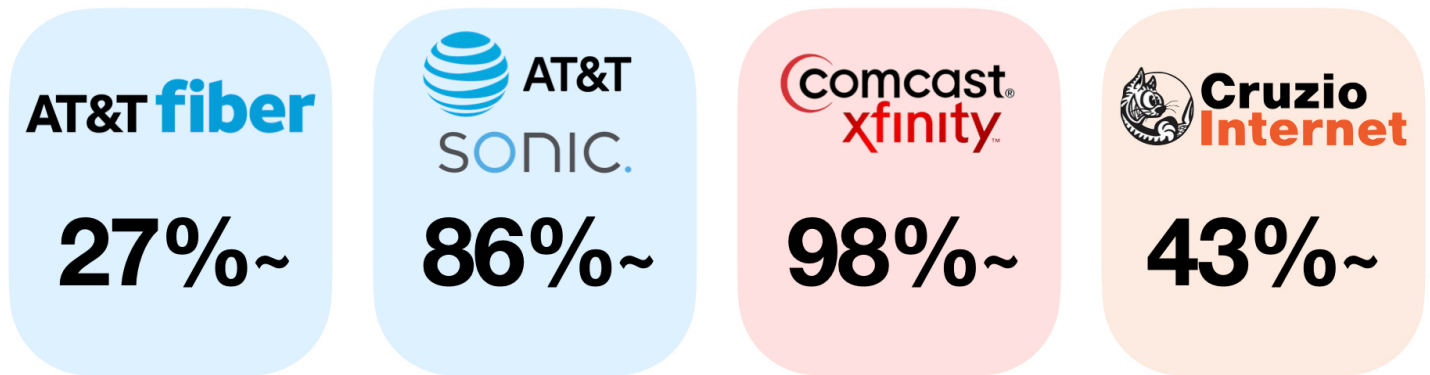
Above are the results of availability of service pervaders to the residents of the survey's Coastside area. To calculate the values we used the following various methods.

AT&T Fiber: We counted the amount of homes whom had AT&T Fiber available using observation of installed infrastructure; we then divided by the total number of households in the surveyed area.

AT&T DSL: We conducted multiple service availability checks in the areas we surveyed with AT&T, Sonic.net, and the CPUC broadband availability tool. We then compared the total

number of surveyed areas (a fair sample of Coastside residences) to DSL service availability.

Comcast/Xfinity: We used a combination of Comcast/Xfinity's pre-qualification tool, visually observing where their network infrastructure is installed, and the CPUC broadband availability tool.

Cruzio Internet: Since Cruzio was not listed in the CPUC's list of broadband providers we wholly used their online pre-qualification tool to to determine service availability. We then compared the total number of surveyed areas (a fair sample of Coastside residences) to fixed wireless service availability.

Source:
https://www.broadbandmap.ca.gov/
https://www.att.com/internet/availability/
https://www.xfinity.com/local/
https://www.sonic.com/availability
https://cruzio.com/services/broadband/

Emerging Alternative Approach to Modern Internet:

An emerging approach nationwide* to improving our local internet would be for public officials on the Coastside to take the lead in establishing a community-owned fiber optic network that can offer dedicated FTTP connectivity. Several other communities have successfully deployed such networks. By building their own fiber optic supply and distribution infrastructure, communities can create an environment that allows multiple telecommunication providers to offer services in the same area, leading to better service, lower prices, faster speeds and more choices for customers. There is a growing national movement** to municipally owned internet providers.

Coastside Community Fiber Network
100% Fiber Optic Dedicated Network

Neighborhood A   Neighborhood B   Neighborhood C

Fiber Optic Cable

Central Office
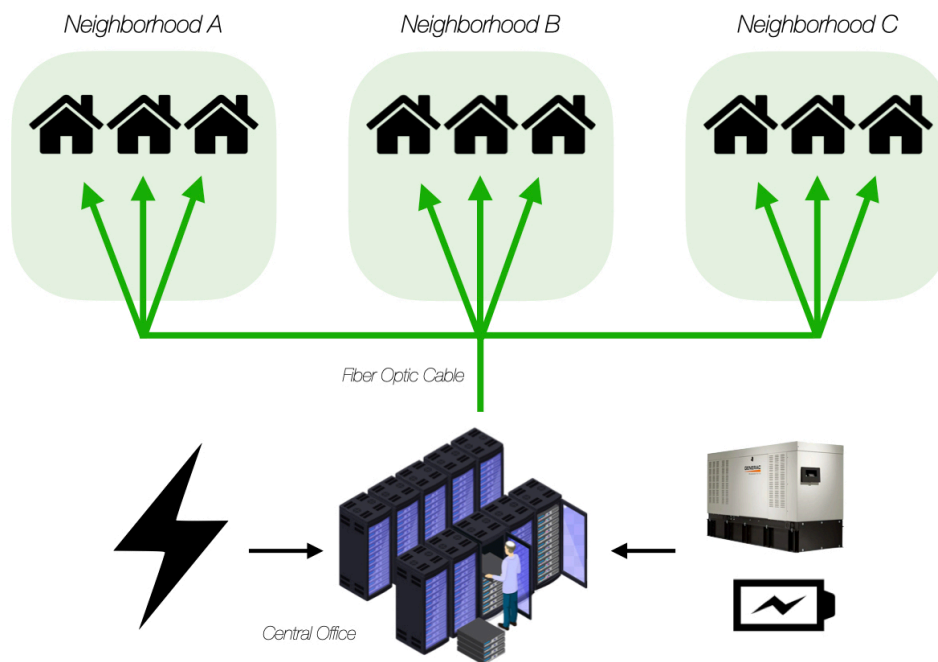
Sources:
*Governor Newsom Signs Historic Broadband Legislation to Help Bridge Digital Divide
Bridging the Digital Device Article
California Readies 3,000 Miles of Network Infrastructure to Achieve Broadband for All
California Network Infrastructure Article
Installation begins on broadband network to deliver internet to under-served communities
Internet to Underserved Communities Article
California Resident Rallies Neighbors to Build Fiber Network
Build Fiber Network Article
Biden-Harris Administration Announces $502 Million for High-Speed Internet in Rural Communities
502M For High Speed Internet Article
** *Municipal broadband: Using today's technology to support your community's future*

The difference between a shared fiber optic network and a dedicated fiber optic network lies in the distribution of connectivity to homes. In a shared network, a provider runs a limited amount of fiber optic strands in a cable form a central office to a neighborhood. At interconnection points within each neighborhood, the fiber optic cable is split into 32 to 64 additional strands that connect to homes and businesses, who then share the bandwidth of the split fiber strand. This shared bandwidth can range from 1 Gbps (1,000 Mbps) to 10 Gbps (10,000 Mbps).

On the other hand, in a dedicated network, a service provider runs a much larger number of fiber optic strands from their central office to each neighborhood. This allows each customer to have their own dedicated connection that does not have to be shared with neighboring buildings. This also enables service providers to offer symmetrical speeds in excess of 100 Gbps (yes 100 Gbps+), which are much faster and reduce consumer prices, improve consumer service, and support home businesses.

Some examples of successful community fiber projects:

A. Utopia Fiber- Murray, Utah
   • Population: 49,729
   • Average household income $86,075
B. Atherton Fiber- Atherton, CA
   • Population: 6,915
   • Average household income $250,001
C. Santa Cruz Fiber, CA
   • Population: 61,950
   • Average household income $117,992
D. Los Altos Hills Community Fiber
   • Population: 30,700
   • Average household income $240,094

To draw a comparison, below are coastal household income averages taken from Half Moon Bay, Pescadero, El Granda, Montara, and Moss Beach:

Population: 26,019
Average household income: $186,986

*Souce: point2homes.com

Cruzio Internet, a local company based in Santa Cruz, is ready and willing to assist Coastside representatives in securing funding from Federal, State and Local sources to help build community-owned fiber optic networks on the coast. We can also draw on the experience and success of our neighboring communities who have already implemented FTTP networks. By building our own networks, we could increase competition and incentivize larger corporations to improve their own networks, while providing the public with more reliable and diverse options. Community ownership of these networks also ensures greater control and accountability over the infrastructure, keeps the money in our local economy, and allows for a more responsive and tailored approach to meeting the unique needs of coastal residents.

In a coastal community fiber optic network, the community also chooses where to construct infrastructure, which enables the network to reach even the most remote customers rather than just focusing on the most profitable ones.

Recommendations for Wired Internet Carriers:

For current wired network carriers we suggest the following:

A. Require AT&T to complete the FTTP installation within 24 months or be faced with fines (especially since they are sunsetting POTS lines) these fines should be equivalent to 20% of the cost of the average FTTP subscriber per month that cannot get services at their home.
B. Regulators must create fast track approval and construction paths for providers to install FTTP networks.
C. Mandate that Comcast/Xfinity installs their updated "Node 0" infrastructure, which utilizes their existing copper infrastructure but removes signal amplification hardware from the system. Instead, all signals come directly from their fiber optic conversion nodes to homes, allowing for symmetric bandwidth services without the need for a complete network rebuild.
D. If wireline access providers do not plan to update POTS lines then they must install a 4G/5G cellular site that can cover all areas of the aging POTS service areas. If service providers refuse to update line access and install a new cellular site then fine them the value of 50% of the subscribers bill monthly until updates or cellular service is installed.
E. Require all wireline and fixed wireless service providers to combine multiple address verification sources (USPS, FedEx, UPS), to improve their product pre-qualification tools.
F. Direct all fines towards a trust fund that is exclusively dedicated to the construction and upkeep of a community fiber service.

Conclusion:

The lack of modern telecommunication systems on the San Mateo County Coastside poses a significant challenge for residents and businesses alike. However, there are solutions available to improve the situation, and funding opportunities exist from various sources. Investing in better telecommunication infrastructure can have far-reaching benefits, from increased safety to reduced carbon emissions. By working together and advocating for change, we can achieve better connectivity on the coast, avoid failures in lifeline services, lay the foundation for a significant productive work-from-home employment base, and pave the way for a safer and more connected future.

How You Can Help Today:

You can help start the improvement process by participating in the Federal Communications Commissions Measuring Broadband America (MBA) Program, this program provides you with the tools necessary to test your speeds on home internet and while mobile.

You can participate at the following link:
https://www.fcc.gov/general/measuring-broadband-america

Contact our local representatives and tell them we deserve better:

Here is a template script you can start with

"I am writing to express my concerns regarding the poor internet connection on the San Mateo Coastside. As you may know, this issue poses a significant threat to safety and well-being, and residents demand immediate action to address it.

If corporations are unwilling to invest in building better networks for our communities, and regulators will not hold them accountable, then it's up to the communities themselves to take matters into their own hands. By building their own fiber networks, small communities will ensure that they have access to reliable and high-quality internet services that meet their unique needs.

Community leaders can work together to secure grants and funding from various government and private sources to make these projects a reality. We ask our legislators to prioritize the interests of the people they represent and pass laws that encourage and support community-led initiatives to bridge the digital divide.

Our community is taking proactive steps to empower ourselves and ensure that everyone has access to the essential services they need, including reliable internet access. I urge you to prioritize this issue and take action to support community-led initiatives to improve internet connectivity on the San Mateo Coastside.

Thank you for your attention to this critical issue.

Sincerely,
[Your Name]"

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AT&T's Executive Offices: (210) 821-4105
At this direct line to AT&T's corporate office you can ask to speak with senior AT&T executives like the CEO or General Counsel (AT&T's top lawyer). While you won't get through to a senior executive directly, BUT their assistant will usually transfer you to an escalated customer service process that will prove more proactive than the general customer service line.
(Take caution: some customers have reported hostile and aggressive responses from AT&T when they try this out, but if you are brave enough, go for it.)

Comcast Corporate Headquarters: 1-215-286-170

Our Local Representatives:

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* Most URL's have been shortened for print media.