Northeastern California Broadband Project

Strategic Plan – Draft 1.0

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1. Executive Summary

Lassen, Modoc, Plumas and Siskiyou counties have severely deficient broadband infrastructure and service. Incumbent wireline companies have not, on the whole, fully built out broadband-capable systems. Where wireline broadband is offered, it appears to be based on legacy DSL and cable modem technology and it is not generally compliant with current standards. Wireless companies have cherry-picked areas where profit potential is high and ignored the rest. Compared to the Californian average, infrastructure in these four counties ranges from substandard to failing.

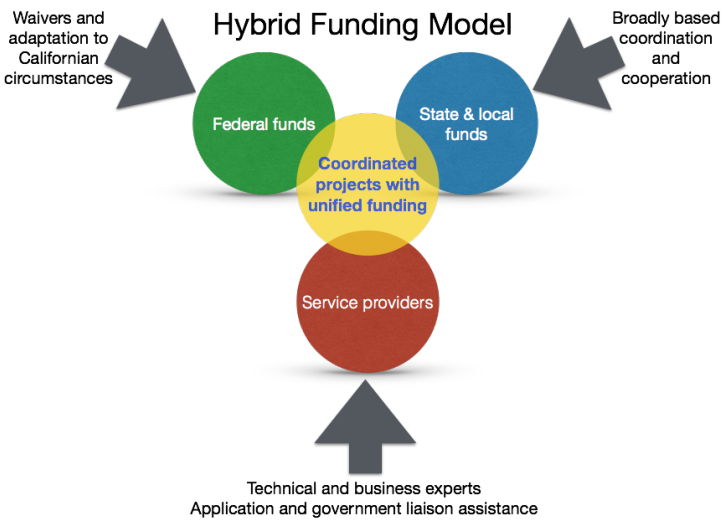


Figure 1.1

Because of the poor state of broadband service in the region, about half of the population is eligible for construction subsidies from the California Advanced Service Fund, and half of those – a quarter of the total – is arguably unserved and therefor eligible for the higher, 70% subsidy rate. Many areas of the four counties are also eligible for broadband operating subsidies from the federal Connect America Fund. Other federal funding opportunities exist as well.

An aggressive program to identify deficiencies, recruit partners, resolve inconsistencies between federal and state funding programs, develop projects that can meet the requirements of both and execute those plans is outlined below, with completion expected in 2015. Fast implementation and completion of this effort is necessary because current funding sources cannot be assumed to be available beyond this year.

The core of this program is a centrally coordinated effort to 1. identify and, where possible, modify conflicting requirements of federal, state and local funding sources, 2. recruit project participants and create hybrid funding packages on a county and/or regional basis, and 3. provide the necessary expert assistance to successfully fund and build projects quickly.

2. Lassen, Modoc, Plumas and Siskiyou Broadband

Wireline broadband infrastructure and service in Lassen, Modoc, Plumas and Siskiyou counties is well below the statewide average in California. Using a grading method developed by the East Bay and Central Coast broadband consortia, and adopted by broadband consortia in other regions, by the California Emerging Technology Fund and by many local agencies, all four counties receive a failing grade.

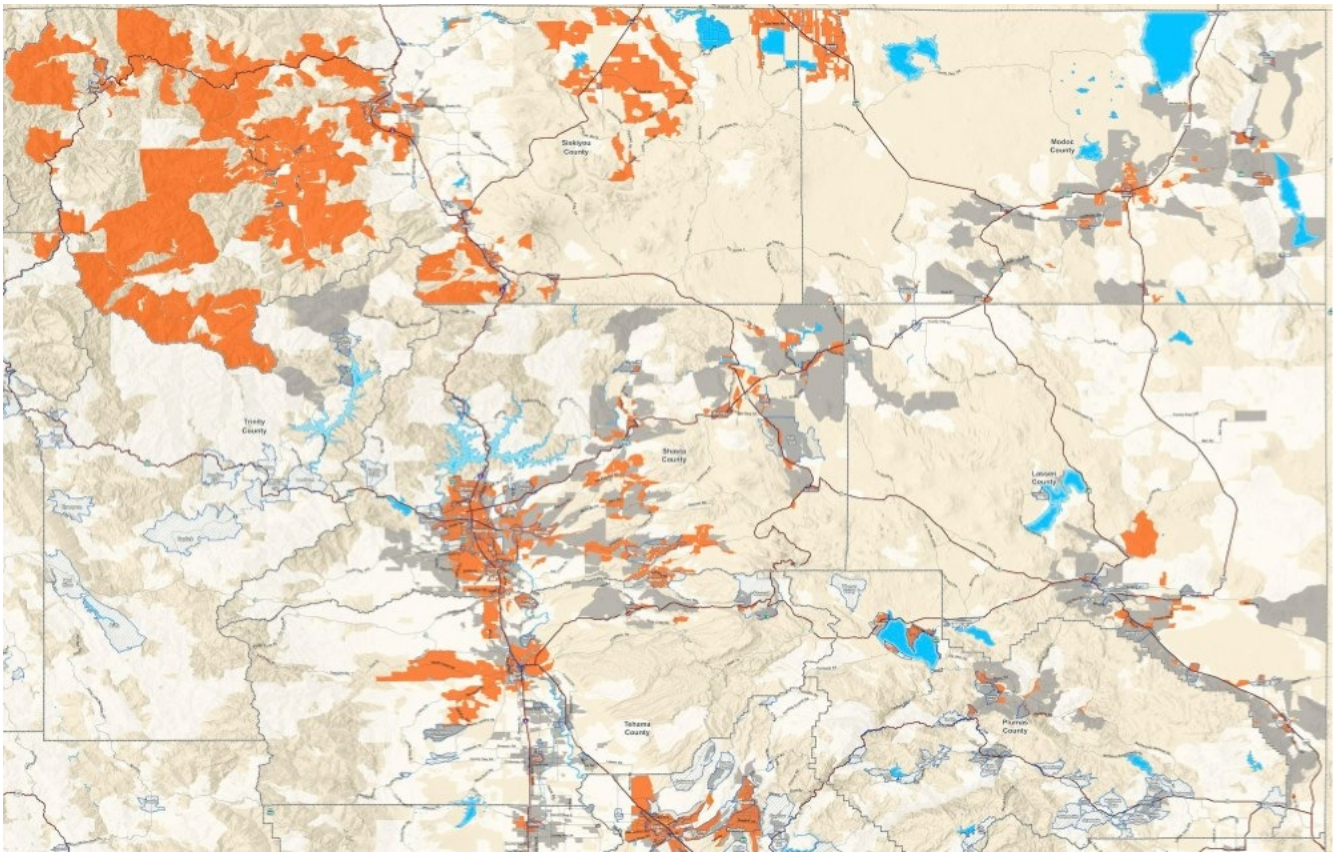


Figure 2.1 – Broadband infrastructure grades, by census block. Red = D, Grey = F, White = F-. No census blocks in Lassen, Modoc, Plumas or Siskiyou counties received an A, B or C grade. See Appendix B for tabular grades by community and additional detail.

Of the nearly 5,500 census blocks in the four counties, the majority receive a grade of "F" or "F-", and none rate better than a "D", according to the latest data reported by service providers to the California Public Utilities Commission (see map above and in Appendix A and tabular data in Appendix B).

Table 2.1: Broadband infrastructure grades

County	GPA	Grade
Lassen	0.1	F
Modoc	0.5	F+
Plumas	0.2	F

Siskiyou	0.6	F+

A full table of grades and grade point averages for cities and census designated places, as well as a full explanation of the methodology used, may be found in Appendix B.

Mobile broadband infrastructure and service is equally bad. According to field tests conducted by the California Public Utilities Commission (CPUC), T-Mobile provides no service in the four counties and Sprint is present in a handful of small pockets, but does not provide any service that meets the CPUC's minimum standard of 6 Mbps download speed. AT&T and Verizon have a somewhat greater presence in the four counties, but also generally fail to meet the CPUC's minimum standards.

Telephone companies

Several telephone companies operate in the four counties (see maps in Appendix A). On the whole, it appears that most of the available service is delivered via older versions of DSL technology, which are significantly less capable than current VDSL systems deployed in urban areas.

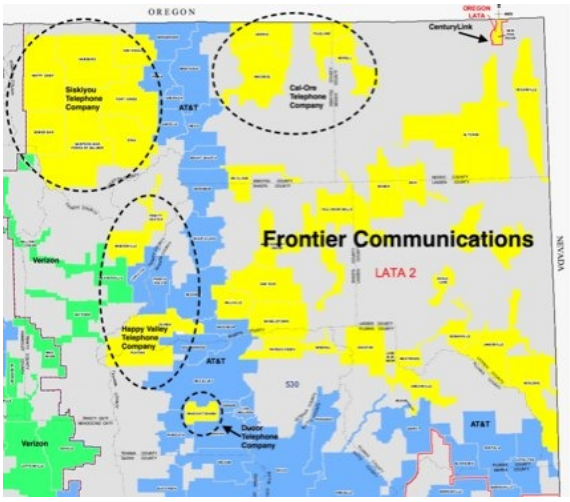


Figure 2.2 – Telephone company service areas. See Appendix A for additional detail.

Generally, southern Plumas County and the areas along the I-5 corridor in Siskiyou County are served by AT&T, which offers DSL service in much, but not all, of its service area.

Frontier Communications is the incumbent telephone company in the northwest area of Plumas County and most of Modoc County, and is the only one serving Lassen County. Its DSL service is limited and offered primarily only in towns. However, Frontier recently accepted $6.1 million in subsidies from the Federal Communications Commission based on a commitment to upgrade all of its Californian systems – including those in Plumas, Modoc and Lassen counties – to a minimum of 10 Mbps download and 1 Mbps upload speeds. The company has not released details of how it plans to carry out these upgrades, or what technology it will be using or when the work will be done.

Siskiyou Telephone Company serves Siskiyou County west of the I-5 corridor, and offers DSL service in much of its service area. Cal-Ore Telephone Company serves Siskiyou County east of the I-5 corridor and the northwest corner of Modoc County, and likewise provides DSL service but not comprehensively. Cal-Ore also operates a wireless Internet service using licensed frequencies on a competitive basis outside of its service territory, primarily along the I-5 corridor. A small area of northeast Modoc County, around New Pine Creek, is in CenturyLink's territory – attached to an Oregon exchange – but DSL service is not reported as being available.

Cable companies

Only one cable operator – Northland Communications in Siskiyou County – reports offering any broadband service at all. Northland's broadband service is restricted to a few communities along the Interstate 5 corridor, which represents only a fraction of the franchise area it claims. It reports service levels of between 10 Mbps and 25 Mbps, which is significantly below the 100 Mbps standard that cable companies typically claim to meet in California. It reports using an outdated pre-DOCSIS 3 cable modem technology to provide this service.

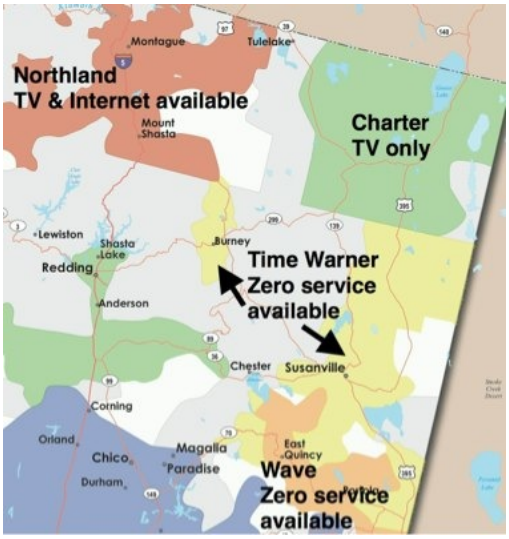


Figure 2.3 – Claimed cable franchise areas; not all companies have built infrastructure. See Appendix A for additional detail.

Charter Communications provides television service in Modoc County, but not broadband. According to information published by the California Cable and Telecommunications Association, Time Warner Cable and Wave Broadband hold franchises in Lassen and Plumas Counties, but neither company offers any service – television or broadband – in those areas (see maps in Appendix A).

Other Internet service providers

Through a subsidiary, the Plumas Sierra Rural Electric Cooperative offers fixed wireless Internet service using unlicensed frequencies in areas generally along state routes 70 and 89. As reported to the CPUC, this service does not meet minimum standards. However, the subsidiary – Plumas-Sierra Telecommunications – received grant money from the federal American Recovery and Reinvestment Act of 2009 and the California Advanced Services Fund to build a $17 million middle mile fiber project in its service area.

Although the company isn't reporting any fiber or other wireline-based residential service, it is offering commercial-grade fiber service in some areas. Generally, Plumas-Sierra's service area takes in much of the eastern side of Lassen and Plumas counties, generally south of Susanville, east of Quincy, north of Sierraville and Loyalton, to just over the Nevada border.

Two other fixed wireless companies report offering service in the area. Digital Path (unlicensed frequencies) and Velocity (licensed frequencies) claim to provide Internet service over a wide area. However, examination of the mapping data provided by the two companies to the California Public Utilities Commission indicates that these reports are based on unsophisticated modelling of relatively few access points and cannot be taken at face value.

3. Grants and Loans

There are four primary sources of grant funding for commercial broadband infrastructure in the four counties, one from the State of California and three from the federal government.

California Advanced Services Fund

The State of California has established the California Advanced Services Fund (CASF) to build broadband infrastructure in areas where service that meets the CPUC's minimum standard of 6 Mbps download and 1.5 Mbps upload speeds is not available. Typically, CASF will subsidise 60% of construction costs in areas where substandard service is available and 70% in areas where broadband service is not available at all. An additional 20% of constructions costs, up to a total of $500,000, can be covered via loans from CASF.

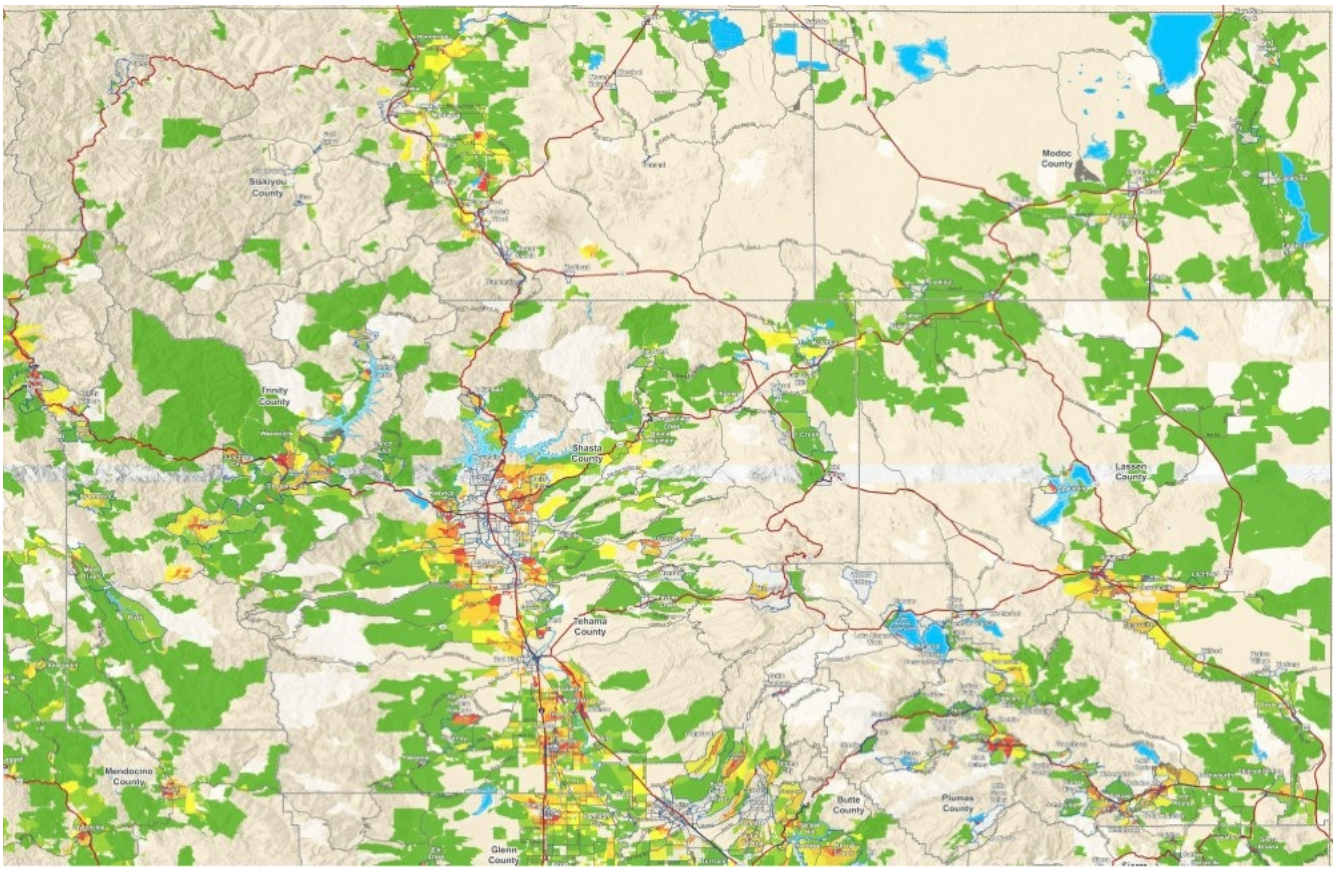


Figure 3.1 – "Heat map" of areas eligible for broadband construction subsidies from the California Advanced Services Fund. Colors indicate populated areas that are eligible; red indicates densely populated area, green indicates lightly populated areas.

An analysis of broadband availability reports submitted by service providers to the CPUC and census data indicates almost half – 27,000 or 49% – of the 55,000 homes in populated areas of the four counties are eligible for CASF construction subsidies. Of those eligible homes, nearly half – 13,000 or 47% – are unserved by wireline providers and, given the poor state of wireless broadband service in the region, are likely to be effectively unserved by mobile and fixed wireless providers as well (See Appendix A for additional detail).

The four counties are well positioned to benefit from the CASF program. All of the incumbent service providers are eligible to receive CASF grants and loans. The CPUC has a history of funding projects in

the region, giving $58,000 to AT&T for a DSL upgrade in Siskiyou County, $41,000 to Frontier for backhaul facilities in Plumas County and $1.7 million for the Plumas-Sierra fiber project. At the present time, there is approximately $100 million in CASF that's available for grants, but that figure is expected to drop rapidly during the second half of 2015.

Table 3.1: Homes Eligible for California Advanced Services Fund Subsidies

	Underserved homes	Unserved homes	CASF eligible homes	Unserved percentage of eligible homes	Percentage of county homes eligible for CASF funding
Lassen	7,980	2,082	10,062	21%	82%
Modoc	578	1,165	1,743	67%	35%
Plumas	4,629	4,870	9,499	51%	65%
Siskiyou	1,186	4,465	5,651	79%	24%
Total	14,373	12,582	26,955	47%	49%

Connect America Fund

The Federal Communications Commission gives operating subsidies to telephone companies that provide broadband service in rural and/or remote areas, as a part of its universal service mandate. In the current round – Phase 2 – of the Connect America Fund (CAF) program, the FCC is offering large telephone companies a right of first refusal to accept these funds or not, on a state by state basis. Frontier has already accepted $6.1 million, which involves a commitment to upgrade all of its subsidised service territory in California, including Plumas, Modoc and Lassen counties.

Table 3.2: Unserved premises eligible for CAF-2 funding

	AT&T	CenturyLink	Frontier	Total	Approximate percentage of county homes eligible for CAF-2 funding
Lassen County			690	690	6%
Modoc County		41	787	828	16%
Plumas County	307		196	503	3%
Siskiyou County	244		7	251	1%
	551	41	1,680	2,272	4%

Significant portions of AT&T's service territory in Siskiyou and Plumas counties and all of CenturyLink's small area in Modoc County are eligible for CAF subsidies, however neither company has indicated a willingness to take up the FCC's offer. If they don't, then presumably the money will be made available to other eligible telecommunications carriers (ETCs).

Both Siskiyou and Cal-Ore are eligible for CAF broadband subsidies, but through a different, and more traditional mechanism. The extent of their involvement in and use of the CAF program is still to be determined.

Subsidies from the current CAF phase 2 round are available for a much smaller percentage of homes in the four counties than CASF, however the need to deploy facilities that meet a higher standard and the binding nature of the commitments from incumbent telephone companies will have a knock on effect in upgraded areas since eligible and ineligible homes will have to share core facilities, such as middle mile fiber and central offices.

The FCC closed its application window last year for its rural broadband experiments program, also funded through CAF. Initially, three projects in California – two in Monterey County and one in the San Joaquin Valley – were provisionally funded, but all three failed to meet program requirements and were dropped from consideration. In at least two cases, the applicants were unable to obtain the particular kind of technical and financial expertise required by the FCC and other federal agencies. This sort of expertise is not typically employed in Californian broadband projects.

Rural Utilities Service

The U.S. Department of Agriculture runs several broadband-related grant and loan programs via the Rural Utilities Service (RUS). These programs include Community Connect Grants, loans and loan guarantees and a series of gigabit community pilot projects. The loan programs are available on a year-round basis, while application windows are periodically announced for the grant programs. None are currently open.

In the past, service providers in California have had difficulty qualifying for and/or winning RUS funding. The programs have been designed with midwestern and southern business models and demographics in mind, which are markedly different from conditions in California.

Economic Development Administration

Jurisdictions that are eligible for grants from the federal Economic Development Administration (EDA) may apply for grants, typically 50% of construction costs, to build certain types of broadband infrastructure. The first such grant was received by the City of San Leandro to build underground telecommunications conduit, which it then made available to a private telecommunications company.

Other funding sources

Both the State of California and the federal government operate programs that provide funding to various types of agencies – for example police and fire departments, sheriffs' offices, hospitals, health care providers and schools – for the purpose of purchasing broadband and other telecommunications services and facilities. Typically, this money is not directly available for construction of commercially available broadband infrastructure but can used to support business plans on an ongoing basis.

4. Hybrid Funding Model

Local agencies in California are in a position to help Internet service providers obtain both capital and operating funds, from local, state and federal sources. Some ISPs are already making use of federal and state programs, but there has been no concerted effort on a regional or county basis to usefully

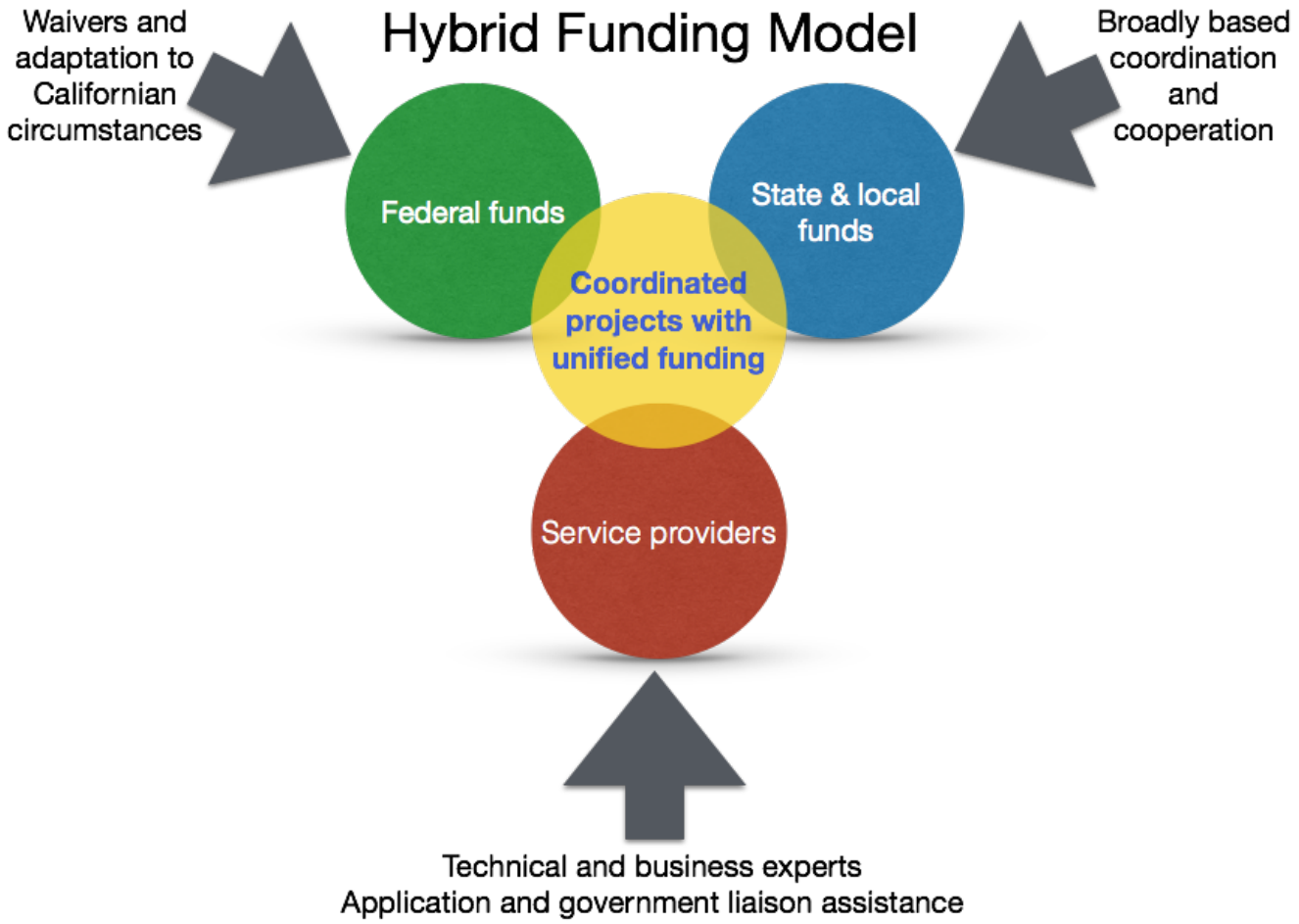


Figure 4.1

aggregate all available sources of funds into a single business model aimed at coordinated, large scale upgrades of incumbent telephone or cable infrastructure, or independently owned facilities.

With the impending rapid drawdown of state CASF money and the short time frames for taking advantage of federal CAF subsidies, there is a window of opportunity in the next six months to put together hybrid funding packages that combine:

1. CASF and EDA construction subsidies.
2. Ongoing CAF operating subsidies.
3. RUS loans.
4. Revenue from anchor institutions, which is often highly subsidised by state and federal programs.

All these programs have different eligibility and matching fund requirements, service levels, application processes, design and due diligence standards and schedules. To a degree, these programs are complementary, but in many respects there are conflicts between the requirements of different. Another, larger problem is that each program – including local telecommunications budgets that receive state and federal subsidies – is independently administered and, with the occasional exception of CASF, is managed without regard for the others.

To an extent, this variety is useful. For example, as Table 4.1 illustrates, homes that are not eligible for CAF subsidies might be eligible for funding from CASF. The challenge is to comprehensively analyse eligibility on a census block by census block and project by project basis, and coordinate grant and loan applications and service contracts accordingly.

Table 4.1: Percentage of unserved premises within areas eligible for CAF-2 funding

	AT&T	CenturyLink	Frontier	Total
Lassen County			47%	47%
Modoc County		100%	41%	43%
Plumas County	100%		45%	68%
Siskiyou County	100%		100%	100%
	100%	100%	44%	52%

It is unrealistic to expect systematic changes in federal programs; the best that can be hoped for is to obtain waivers of particular requirements or eligibility standards that are demonstrably incompatible with market, industry and demographic conditions in California. But the CPUC has shown a significant willingness to grant exceptions to standardised CASF rules to account for local needs and conditions throughout the state, particularly when there is significant local support for a particular project. Local agencies have considerable discretion in how budgets are allocated and services are purchased, if there is the will to do so.

The final piece of the puzzle is creating business models for particular projects that meet all the requirements of all the funding sources. In some cases, this task might be relatively simple, or at least course-of-business: rural telephone companies, for example, are used to navigating a maze of subsidy programs. In other cases, for example cable companies or independent ISPs that do not typically pursue subsides, the necessary expertise may be completely absent.

Technical, GIS, financial, accounting, business development and legal experts should be recruited and made available to prospective grant and loan applicants on a coordinated basis. Problems that need to be solved include legal forms of corporate organisation, particular technical due diligence requirements and accounting standards.

These experts, as well as negotiations with federal and state agencies and commitments from local agencies, must be centrally coordinated. In the past, project opportunities have been lost because of disorganised applicants, competing interests and narrow pursuit of individual organisational priorities.

5. Recommendations

The work plan below outlines certain preliminary steps that can be completed on a region-wide within the first month of the project. The action steps below should then be implemented on the indicated schedule, with separate programs pursued for Siskiyou and Plumas counties, due to the unique mixes of service providers and existing infrastructure, and a combined program for Modoc and Lassen counties.

Budget

TBD.

Preliminary steps

1. Establish a central organisational structure to coordinate projects and funding, and provide assistance to applicants.
2. Create a draft reference model for evaluating and combining disparate funding sources.
3. Ascertain Frontier's intentions regarding upgrading its territory to 10/1. Will upgrades be done throughout its service territory, or just in areas where it will receive CAF subsidies?
4. Ascertain AT&T's intentions regarding CAF subsidies. Will it accept the subsidies offered for California? Will there be any exceptions? Does it plan to upgrade its wireline plant?
5. Ascertain Siskiyou's, Cal-Ore's and Plumas-Sierra's current activities and future plans regarding CAF and CASF subsidies.
6. Investigate CCTA's claim that Charter, Time-Warner and Wave have franchises in northeastern California.
7. Ascertain the true extent and nature of Northland's broadband service offering, and its interest in pursuing CAF and CASF subsidies.
8. Develop and maintain a liaison with CenturyLink.
9. Identify fiber optic routes in the four counties, particularly middle mile resources.

Action items

1. Identify immediately relevant sources of federal funding and develop a model process for creating projects, organisational structures and business plans that meet federal requirements.
2. Develop model funding packages that combine state and federal funding, including working with federal agencies to adapt program requirements to Californian conditions.
3. Recruit a panel of technical and financial experts with the ability to review and critique projects and assist applicants with federal program compliance.
4. Identify and recruit broadband stakeholders in the four counties, particularly anchor institutions with significant telecommunications budgets or access to federal and state operating subsidies, and obtain binding commitments to buy services on systems that are upgraded with their cooperation.
5. Develop a middle mile strategy and recruit potential participants.
6. Facilitate CASF and other funding applications for middle mile infrastructure development.
7. Develop specific proposals for Frontier, AT&T, Northland, Siskiyou, Cal-Ore, Plumas-Sierra and CenturyLink to build out last mile wireline infrastructure, with CASF and federal support.

8. Determine if Frontier, AT&T, Northland, Siskiyou, Cal-Ore and CenturyLink are willing to constructively engage with the proposals and make an enforceable promise to perform accordingly.
9. If necessary, intervene in the CPUC's review of Frontier's purchase of Verizon's systems with the goal of requiring Frontier upgrade its systems to provide compliant wireline broadband service to all telephone customers within 2 years.
10. If necessary, identify and assist companies that are willing to either enter the market or expand their existing service territory to include areas where incumbents are not willing to upgrade or install wireline infrastructure.
11. Intervene in the CPUC's review of Charter's purchase of Time Warner and Bright House systems, with the goals of 1. requiring Charter build out compliant wireline broadband service to all homes passed by television service within 2 years and 2. requiring Charter to build out compliant broadband service to all areas in which it holds a statewide or local franchise within 5 years or surrender the franchise.
12. Implement funding and buildout plans.

Schedule

July-August 2015

1. Complete preliminary steps above.
2. Convene a stakeholder meeting in northeastern California, if possible to coincide with Frontier/ Verizon hearings.
3. Meet with federal agency representatives with knowledge of broadband subsidy programs and the jurisdictional competence and authority to agree to program modifications, waivers and/or compliance methods.
4. Recruit expert panel.
5. Meet with service providers.

September-October 2015

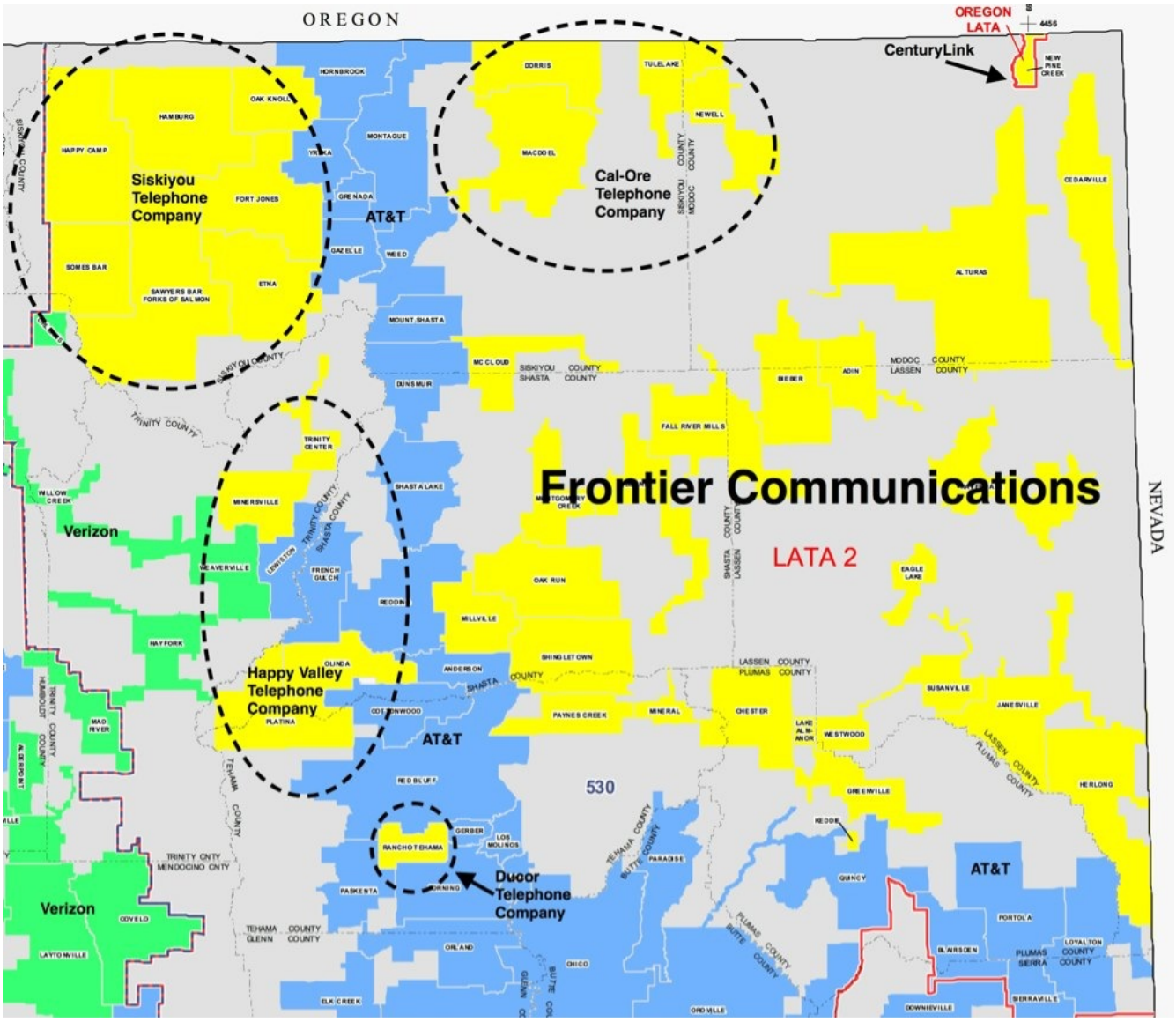
1. Develop middle mile strategy and identify partners.
2. Adjust plans to account for CAF decisions made by AT&T and CenturyLink.
3. Develop funding models and proposals for incumbent service provider projects.
4. Present proposal to incumbent service providers on a time-limited right of first refusal basis.
5. As necessary, develop alternatives to incumbents-led projects and recruit participants.

November-December 2015

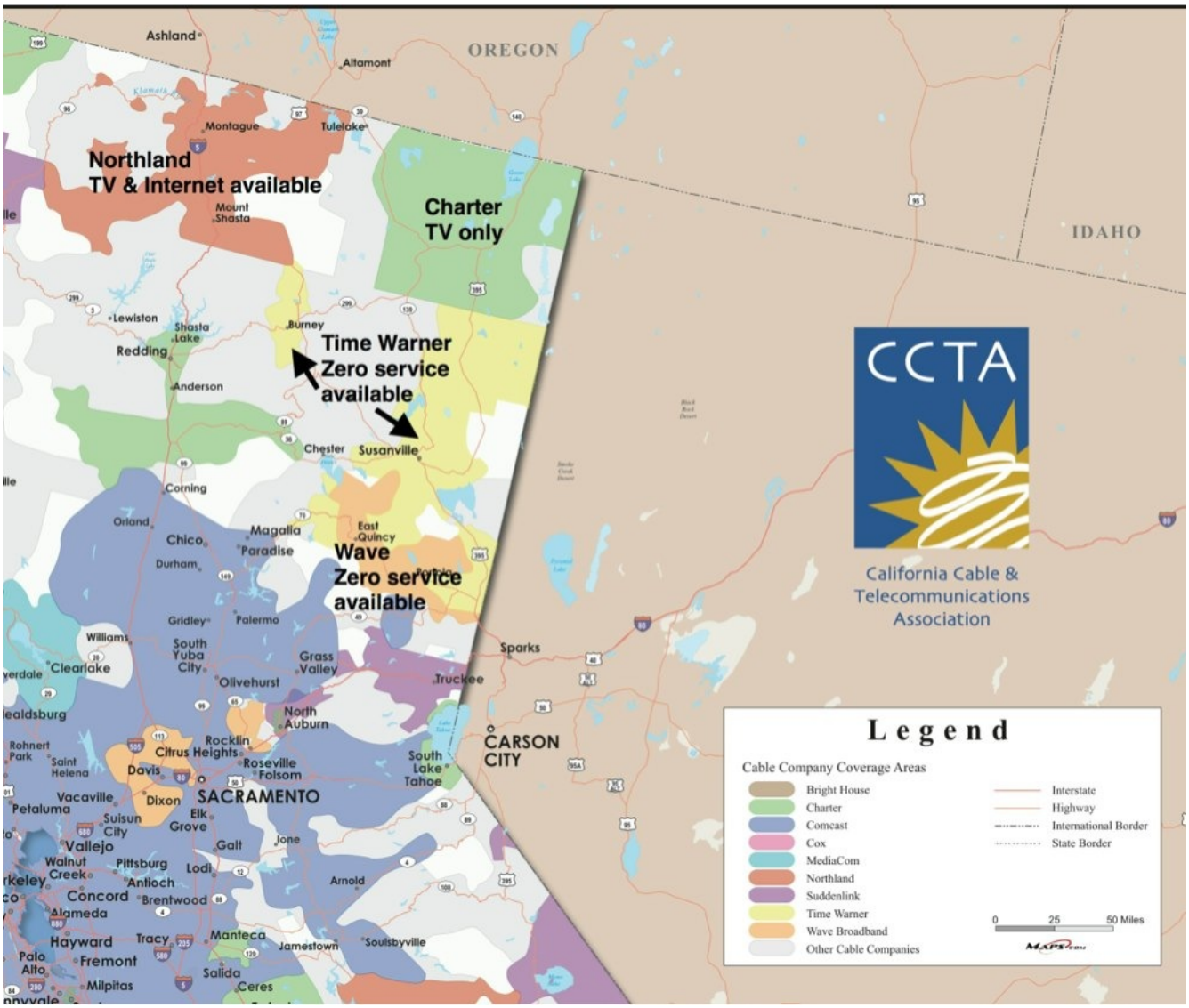
1. Submit CASF grant and loan proposals.
2. Submit EDA grant proposals.
3. Fully utilise any opportunities presented by other federal agencies to submit grant proposals.

Appendix A - Maps

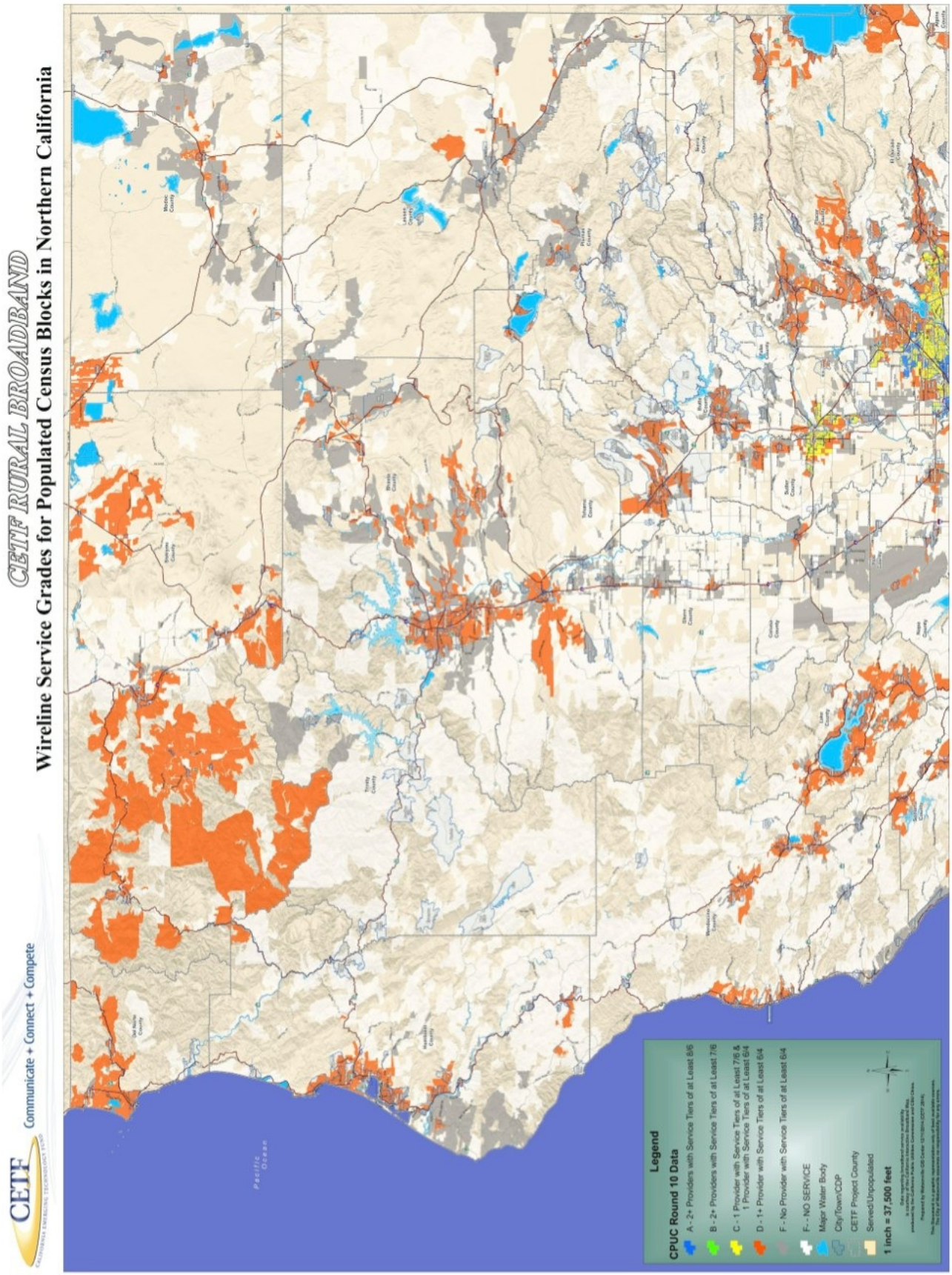
Telephone company service areas



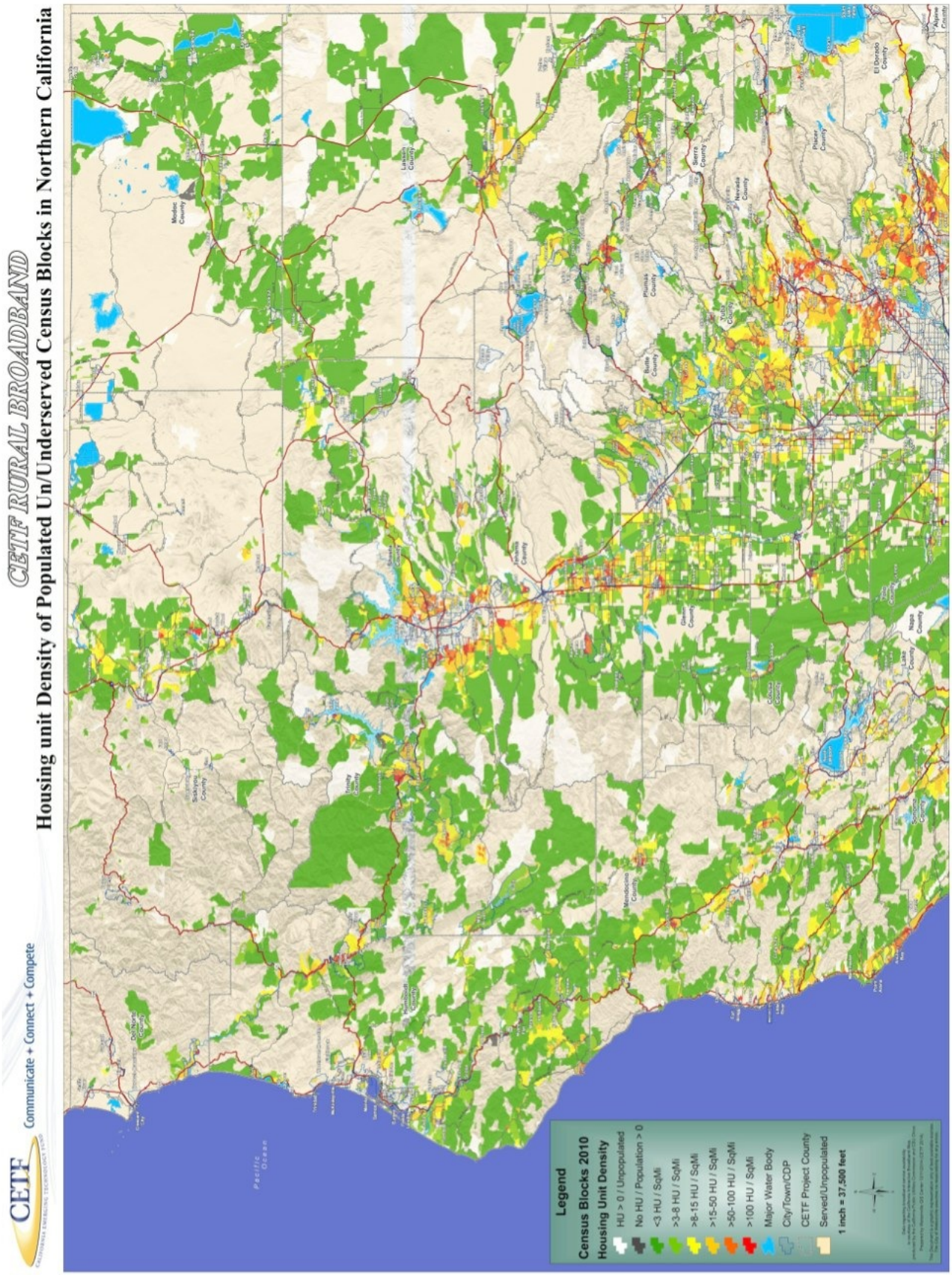
Cable franchise areas claimed



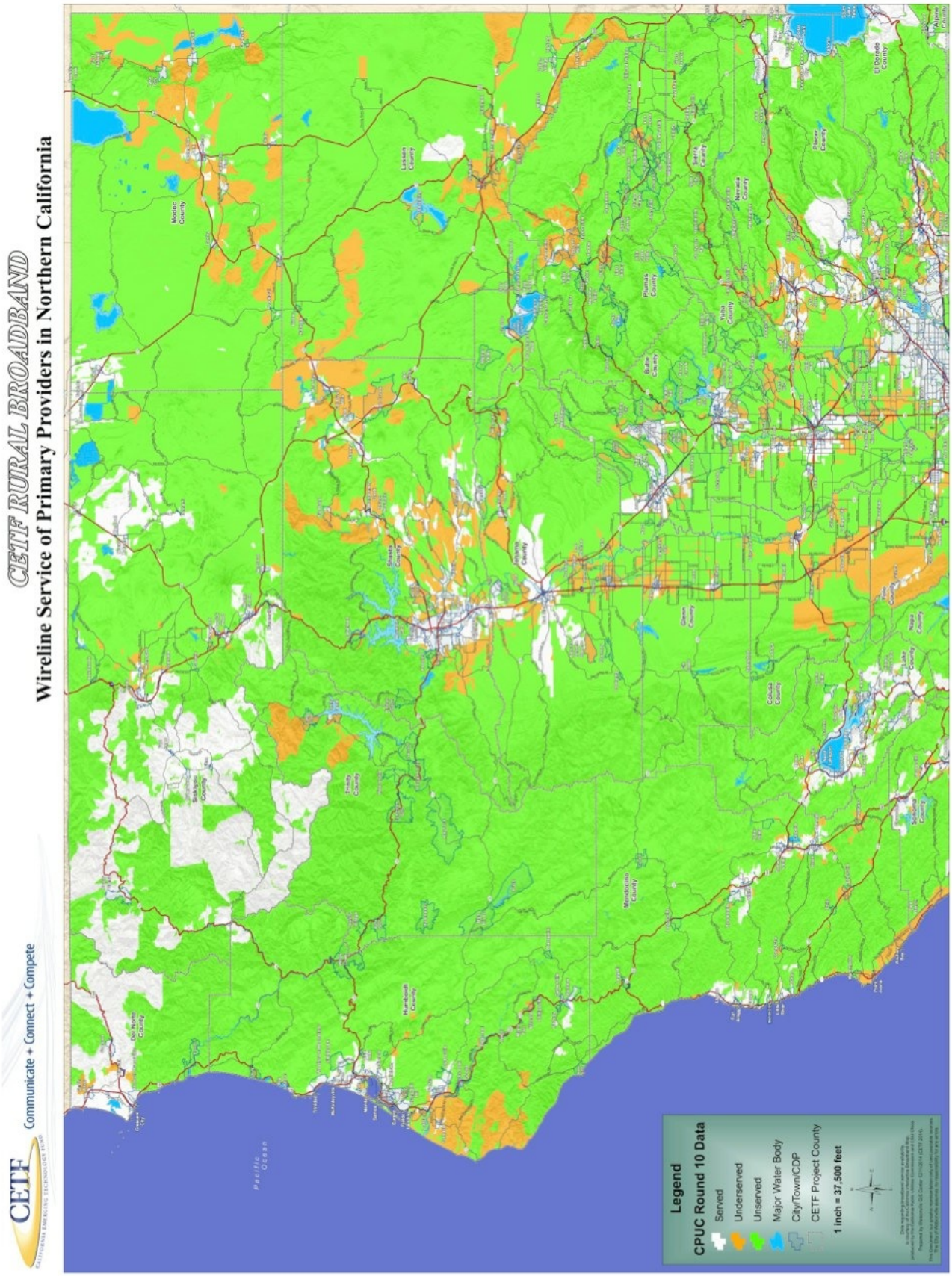
Infrastructure grades



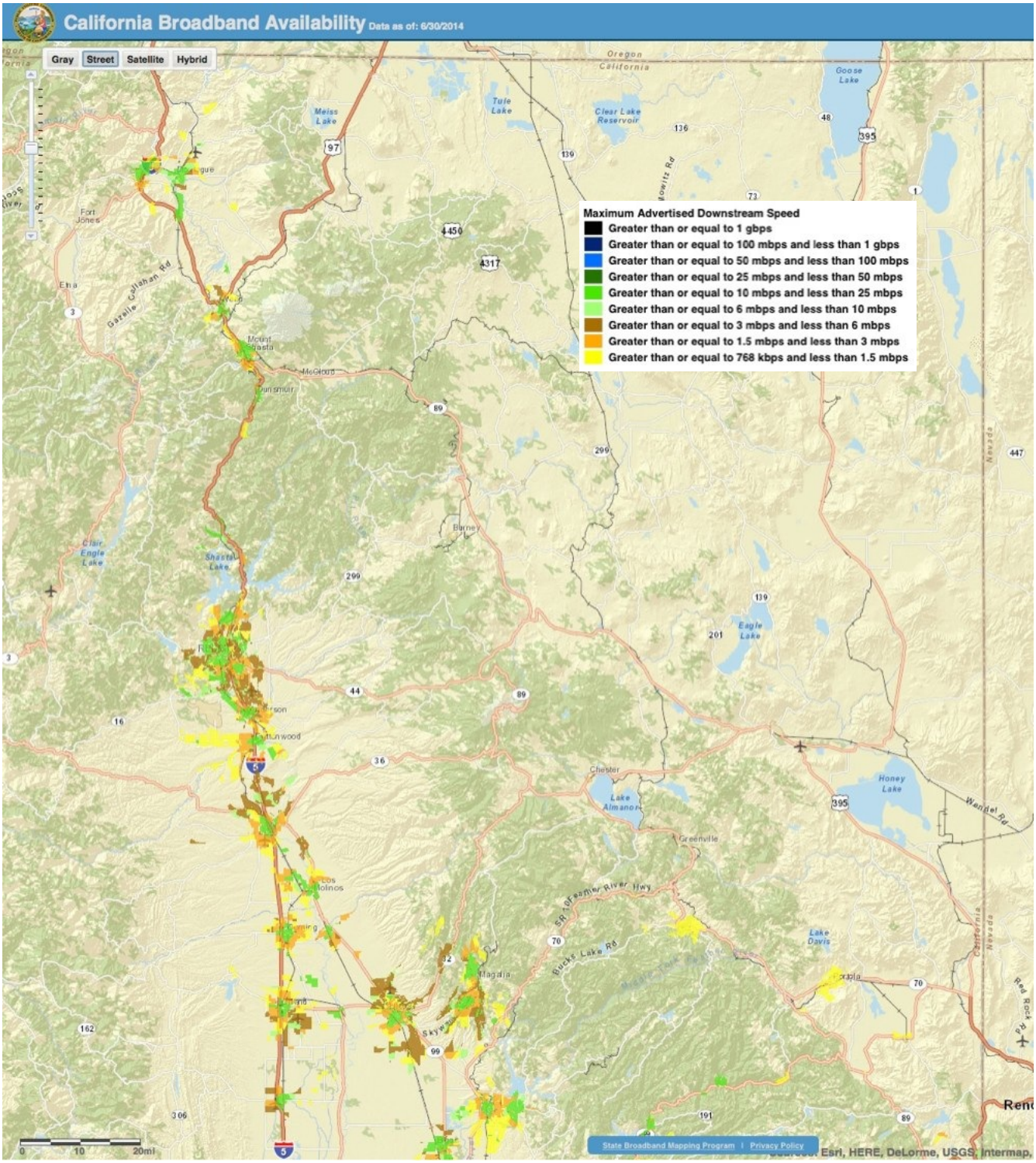
CASF eligible areas by market density



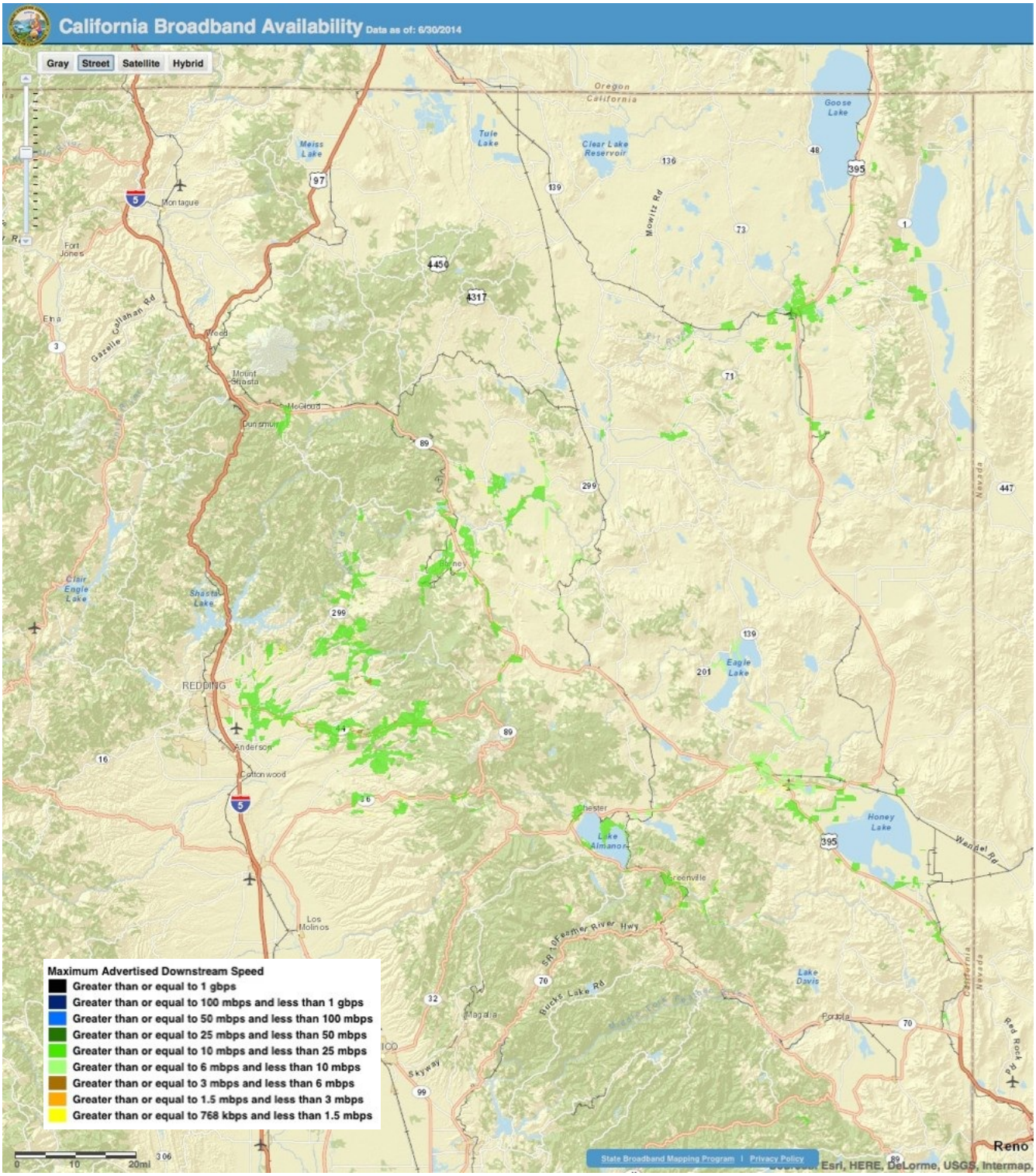
CASF eligible areas by unserved, underserved and served status



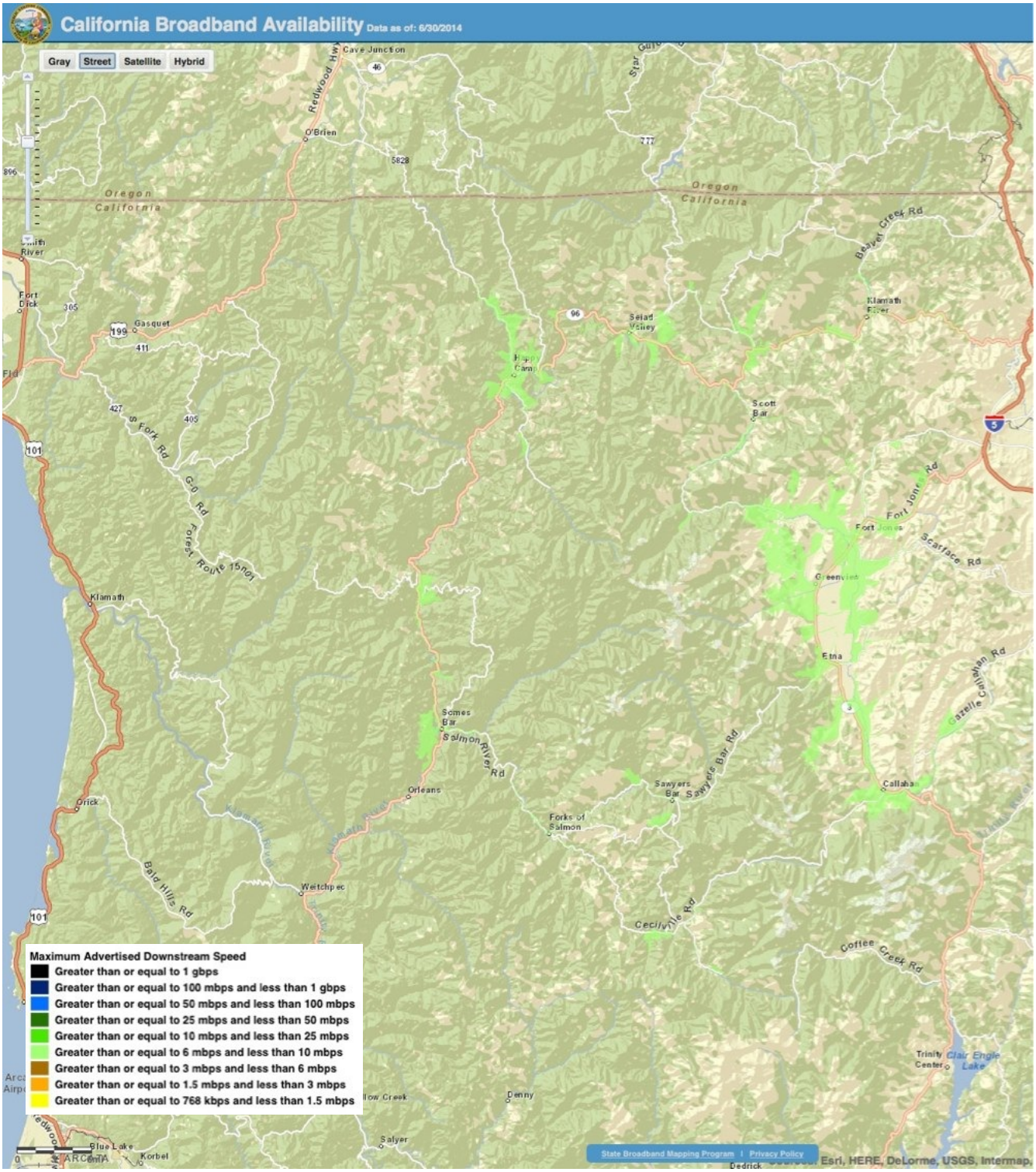
AT&T DSL service



Frontier Communications DSL service

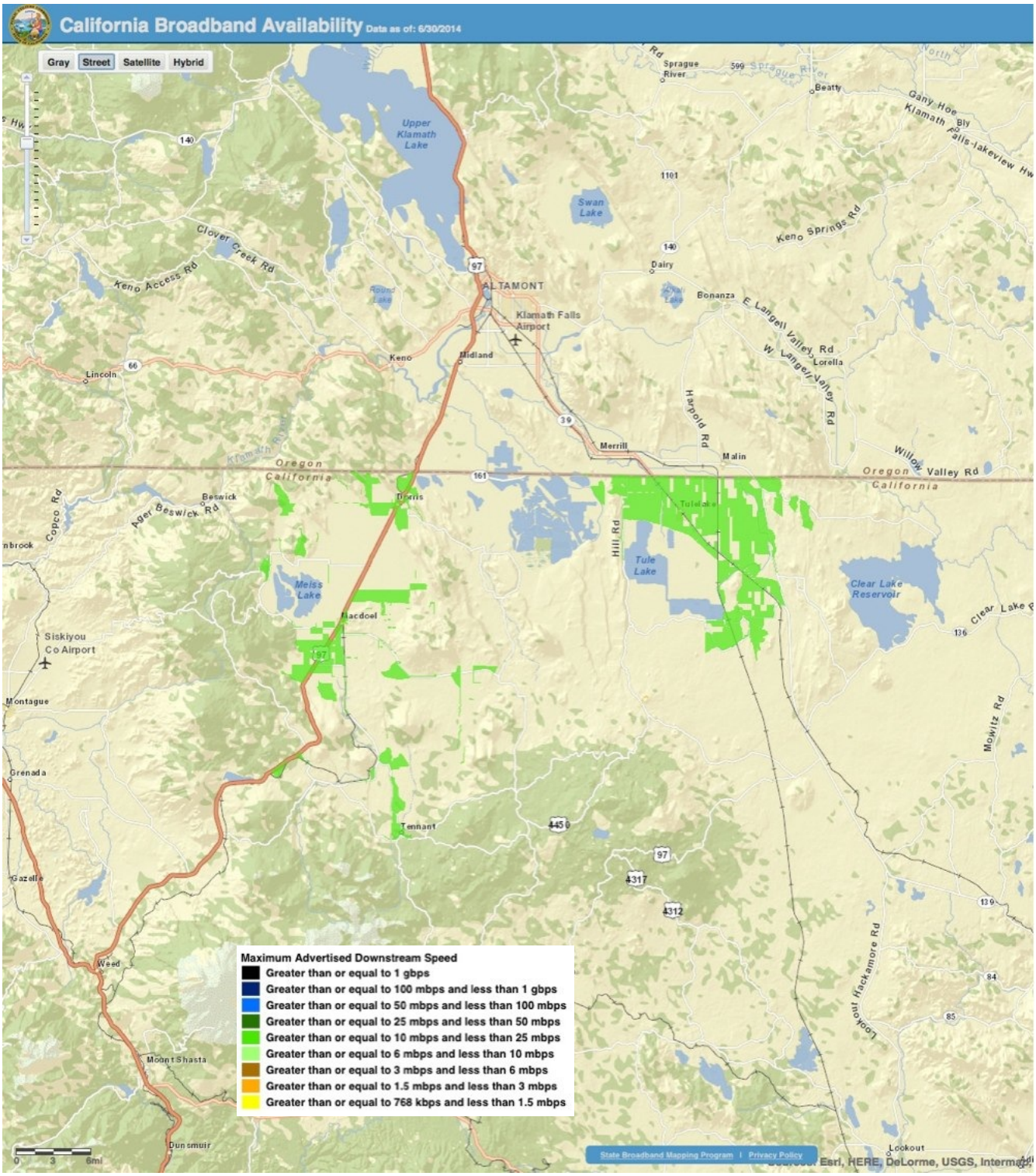


Siskiyou Telephone Company DSL service



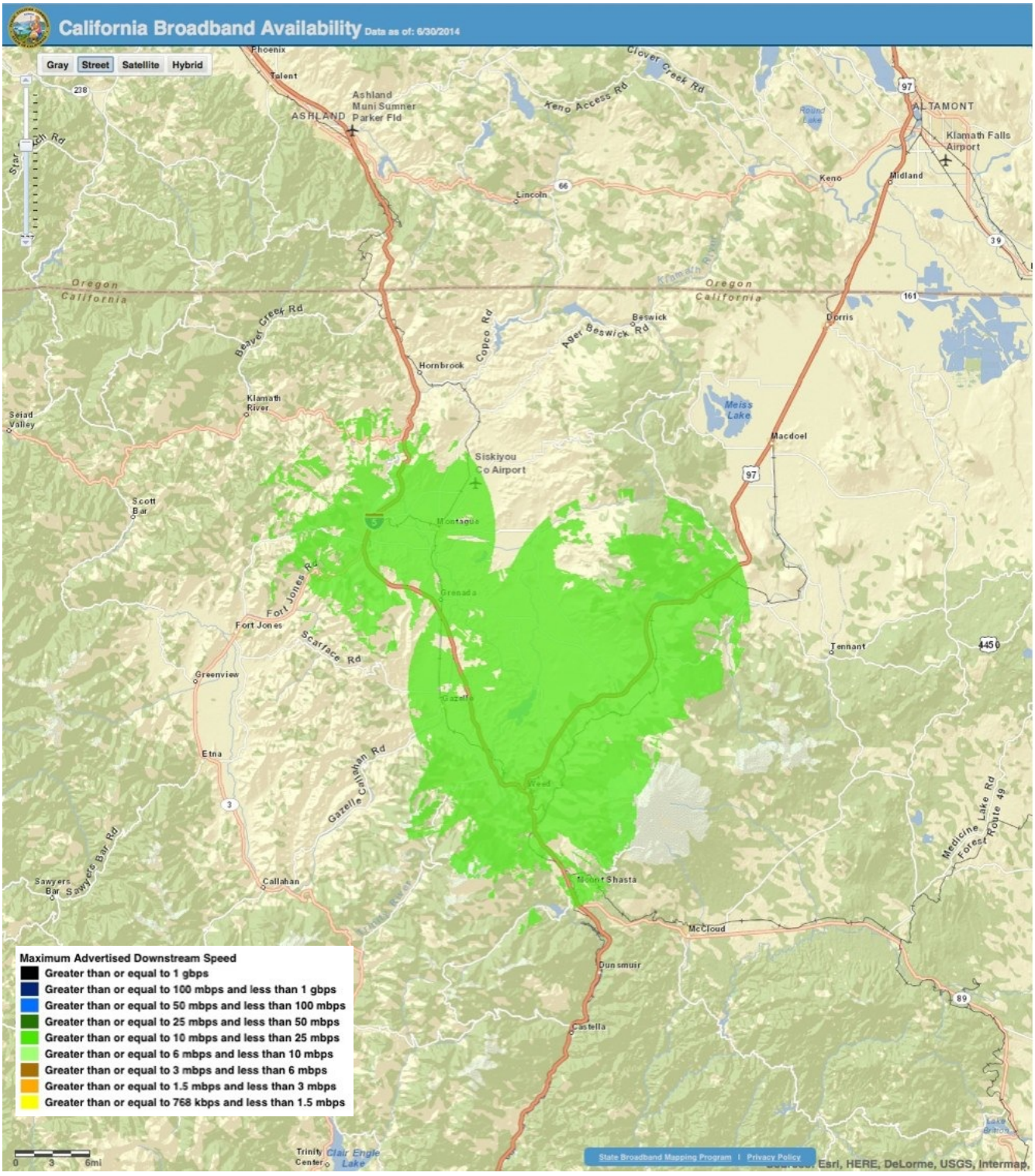
Cal-Ore Telephone Company

DSL service

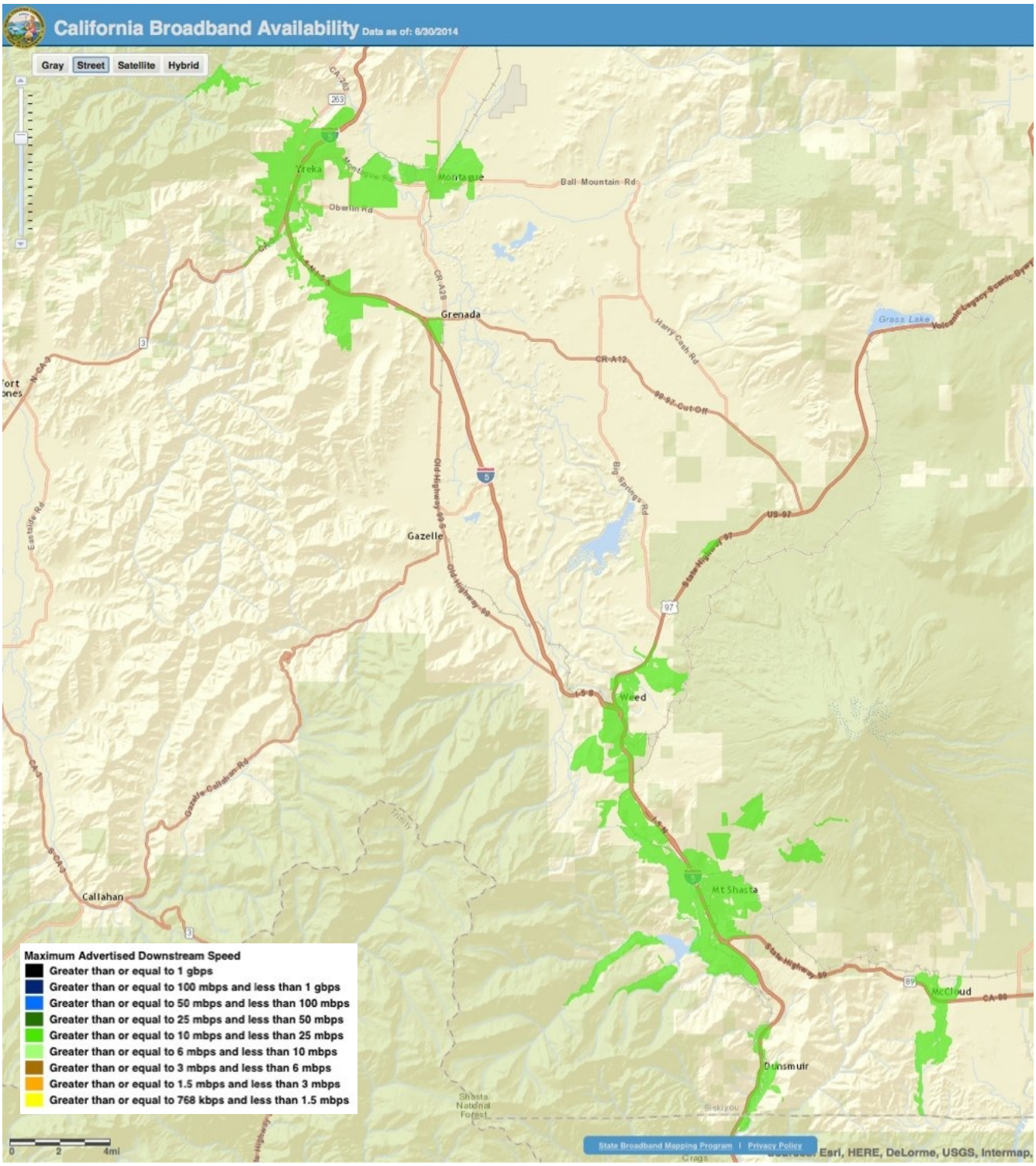


Cal-Ore Telephone Company

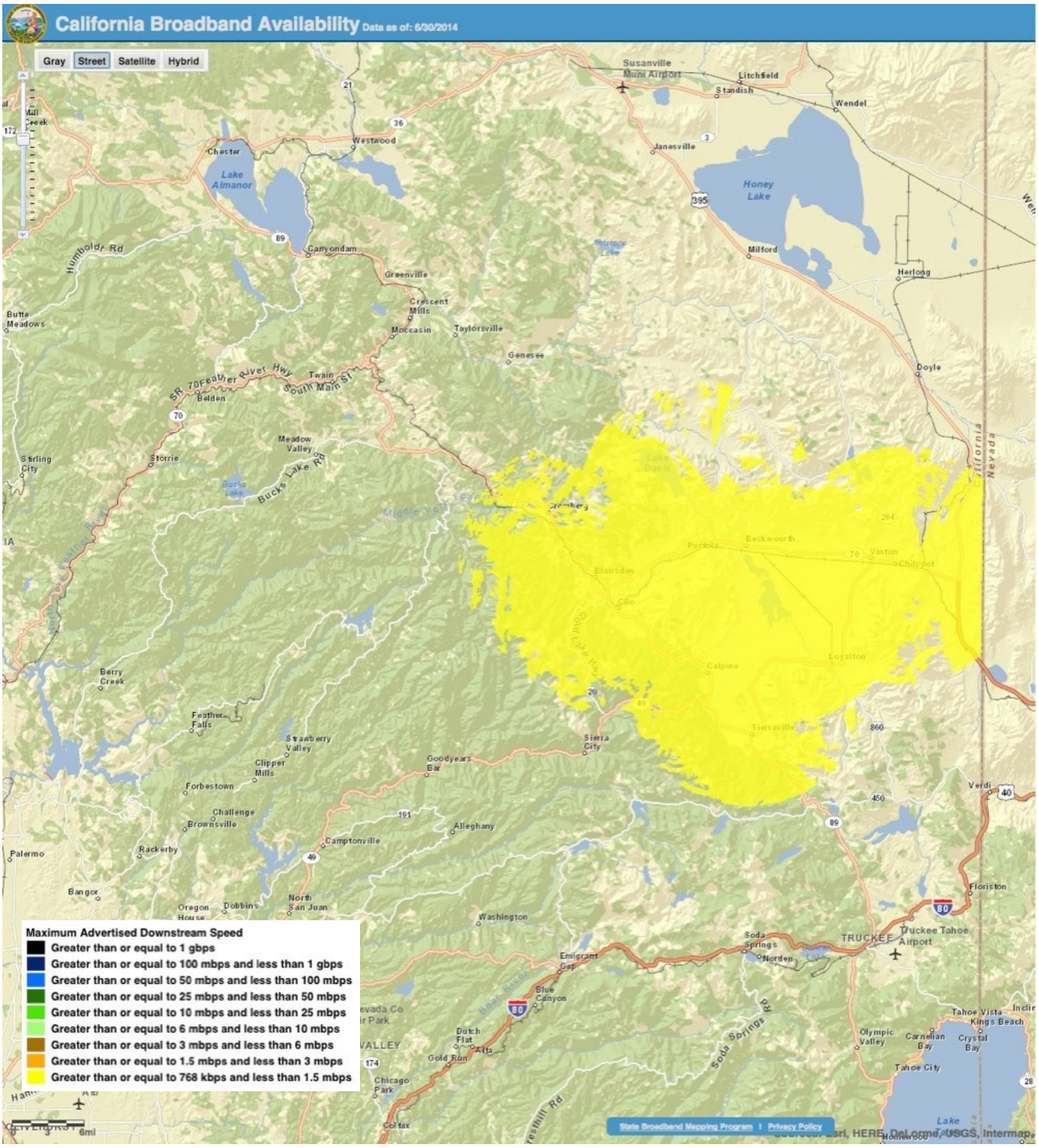
Fixed wireless broadband service (licensed)



Northland Communications cable modem service (non-DOCSIS 3)

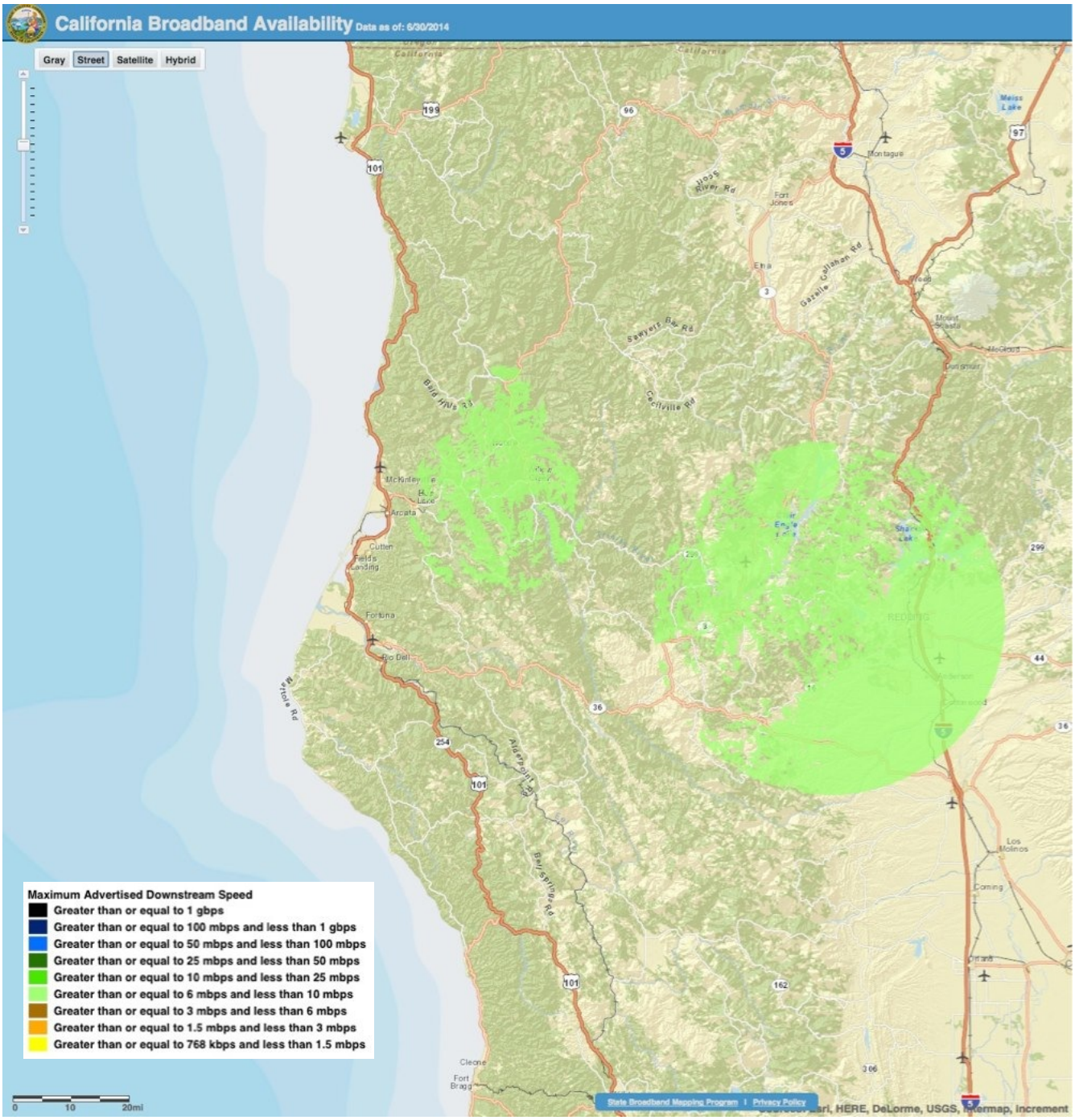


Plumas-Sierra Rural Electric Cooperative fixed wireless service (unlicensed)

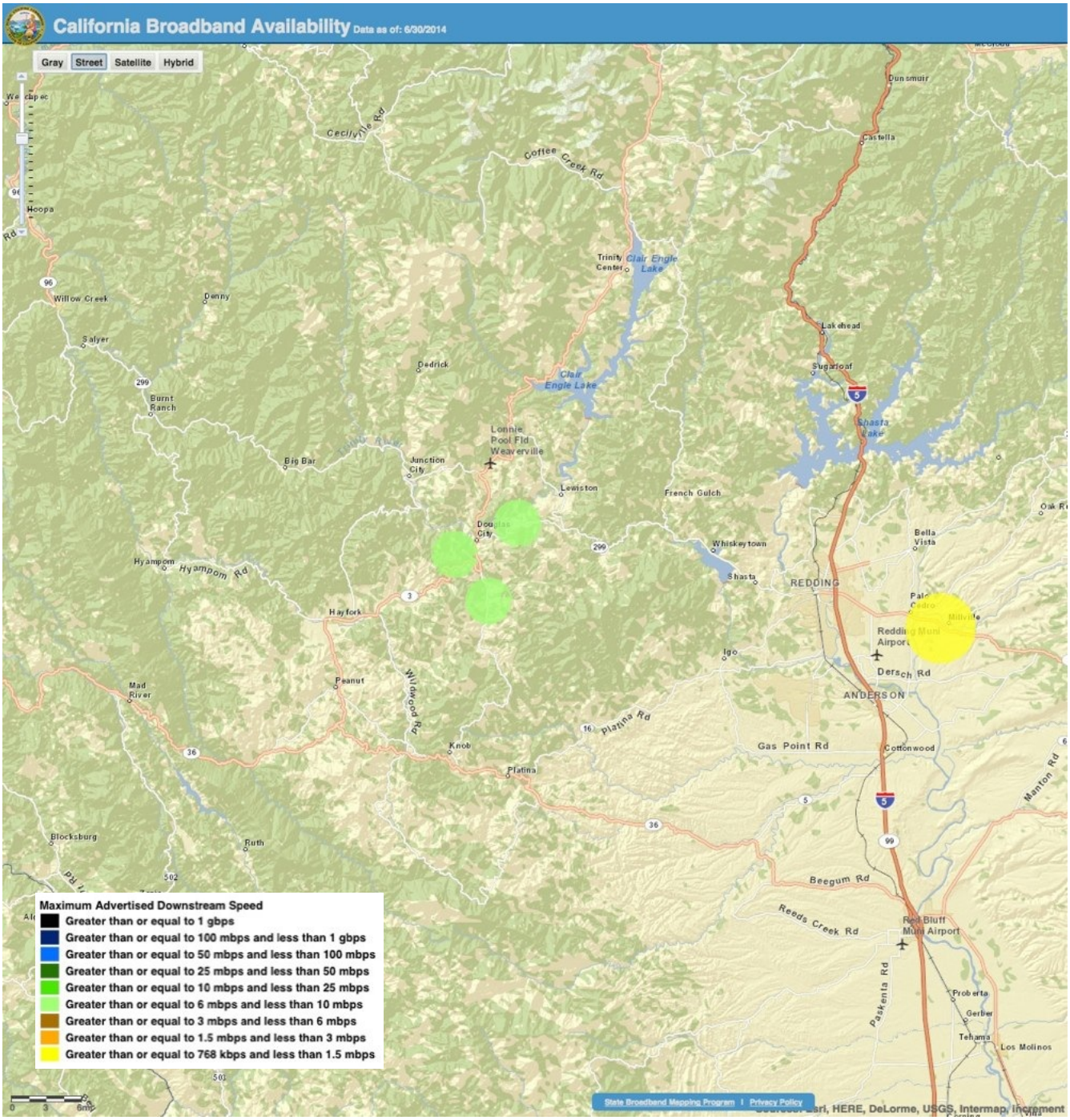


Velocity fixed wireless broadband service

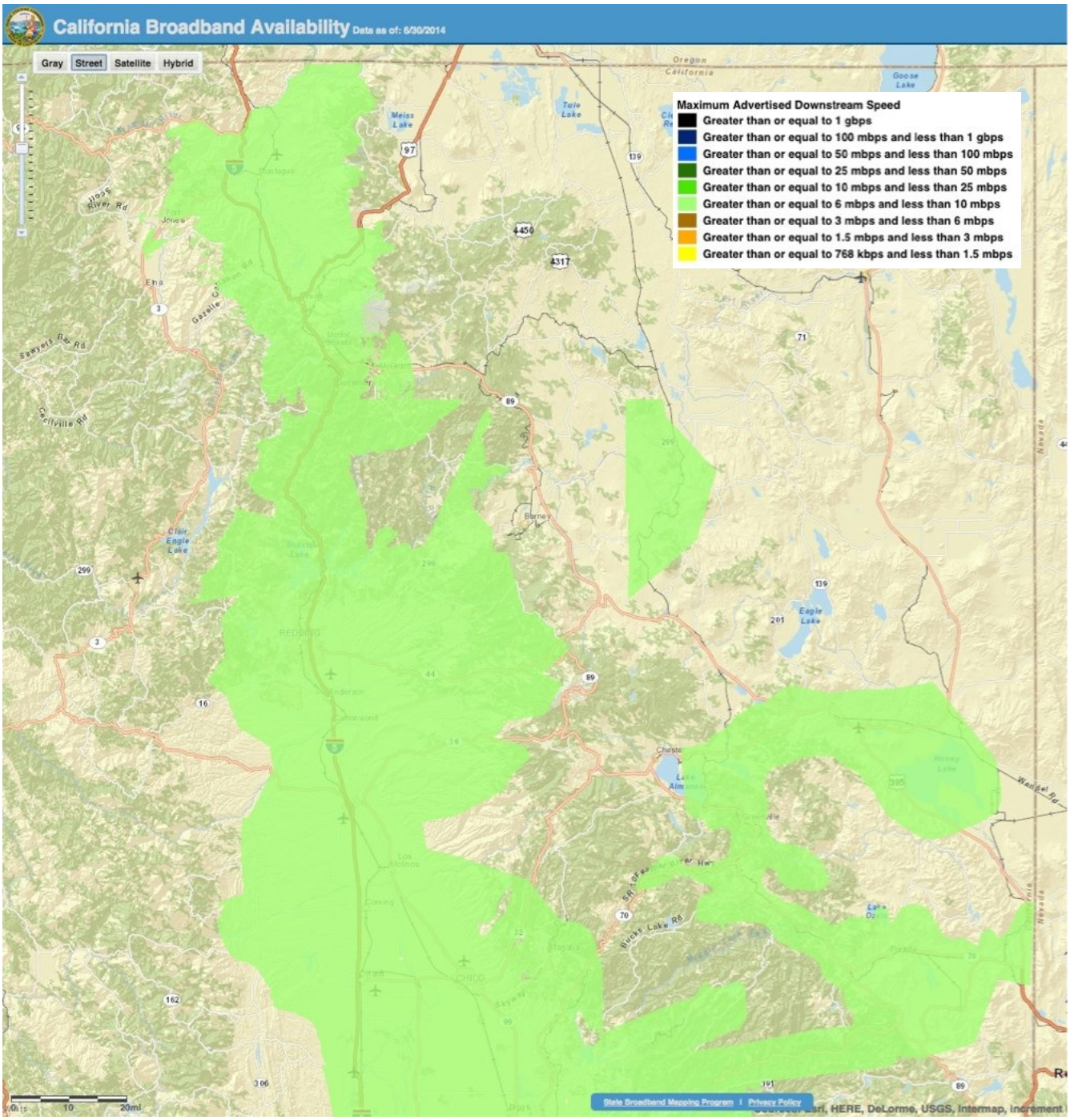
Licensed spectrum:



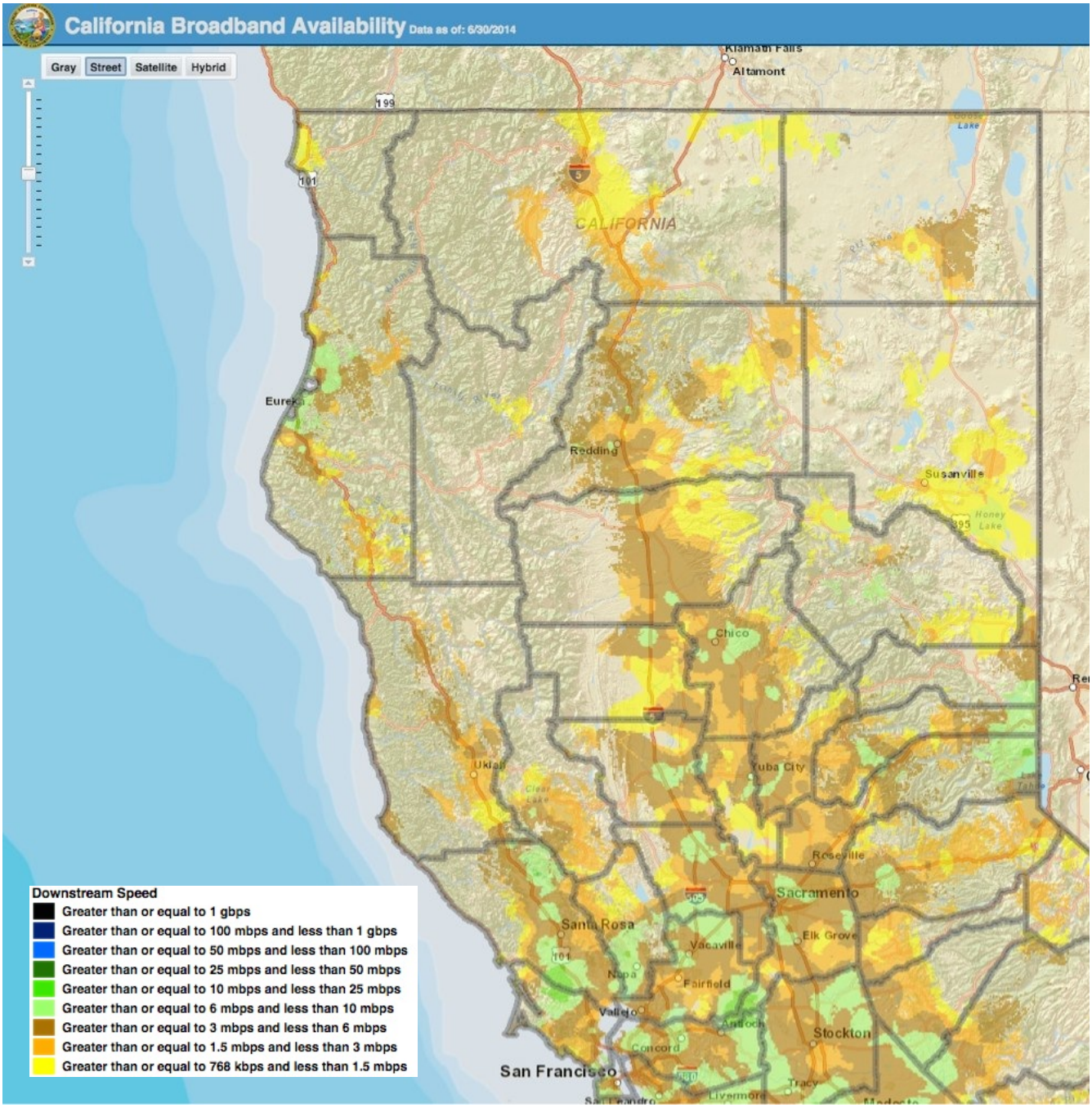
Licensed spectrum:



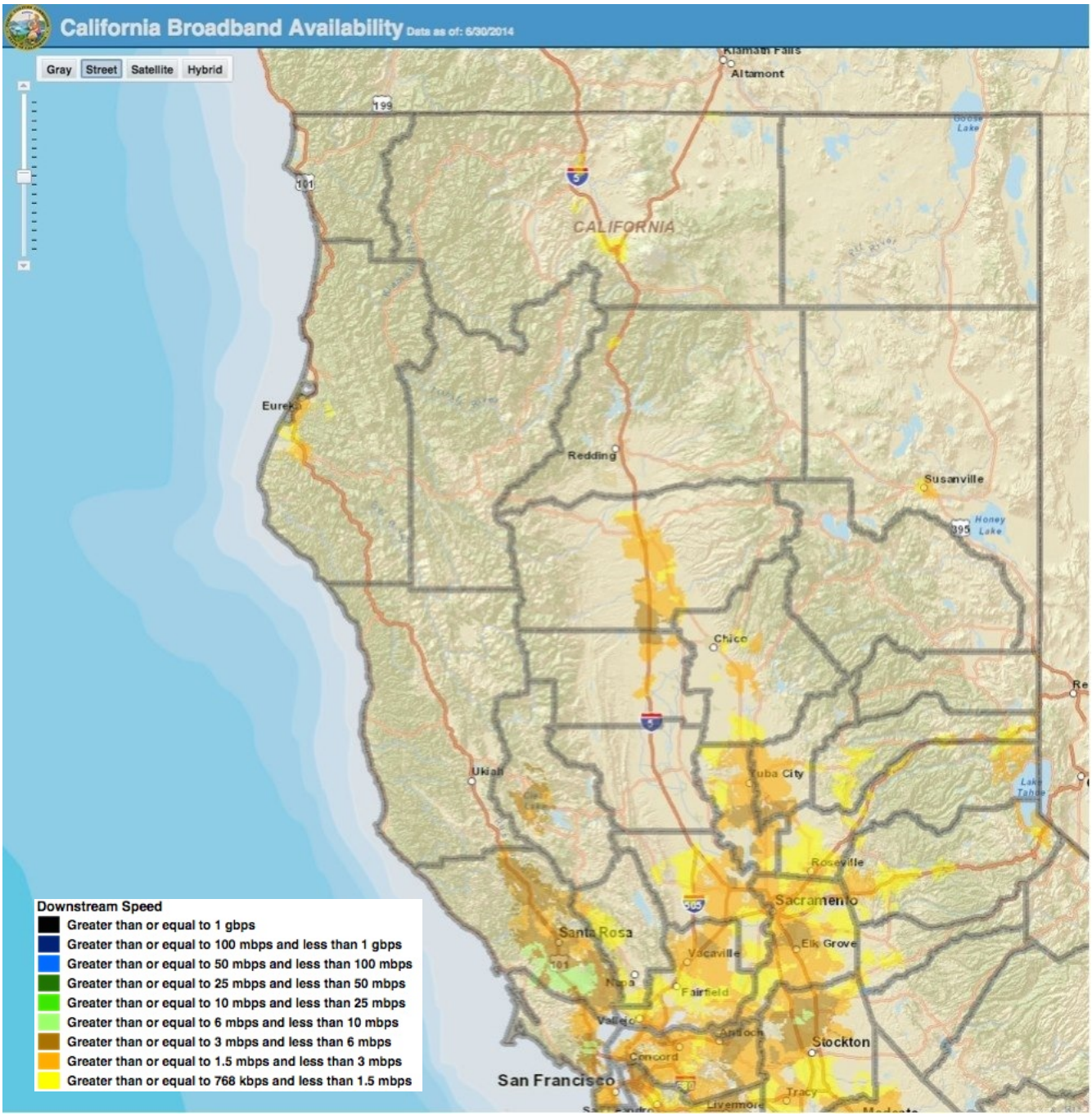
Digital Path fixed wireless broadband service (unlicensed)



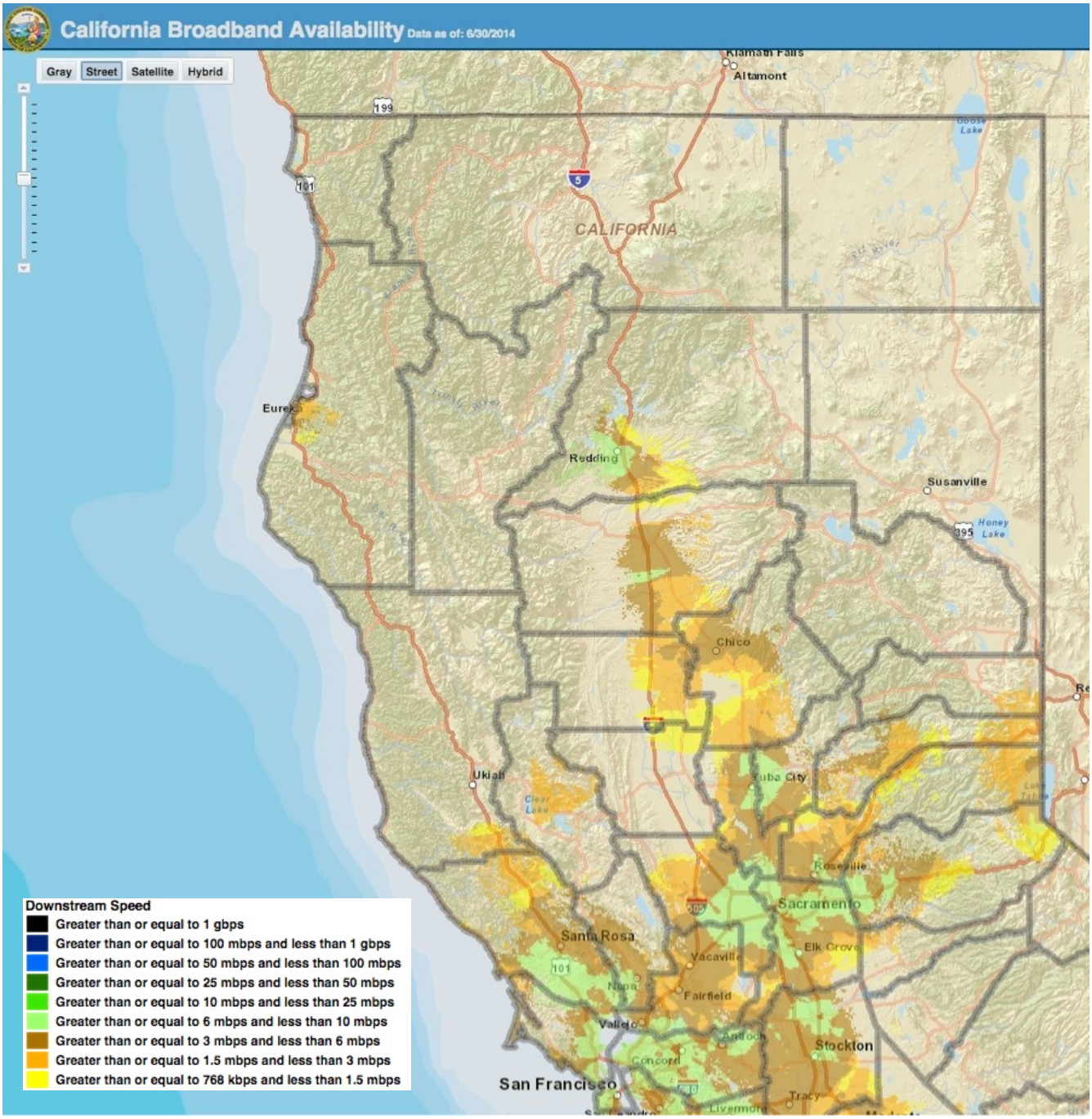
AT&T mobile broadband service



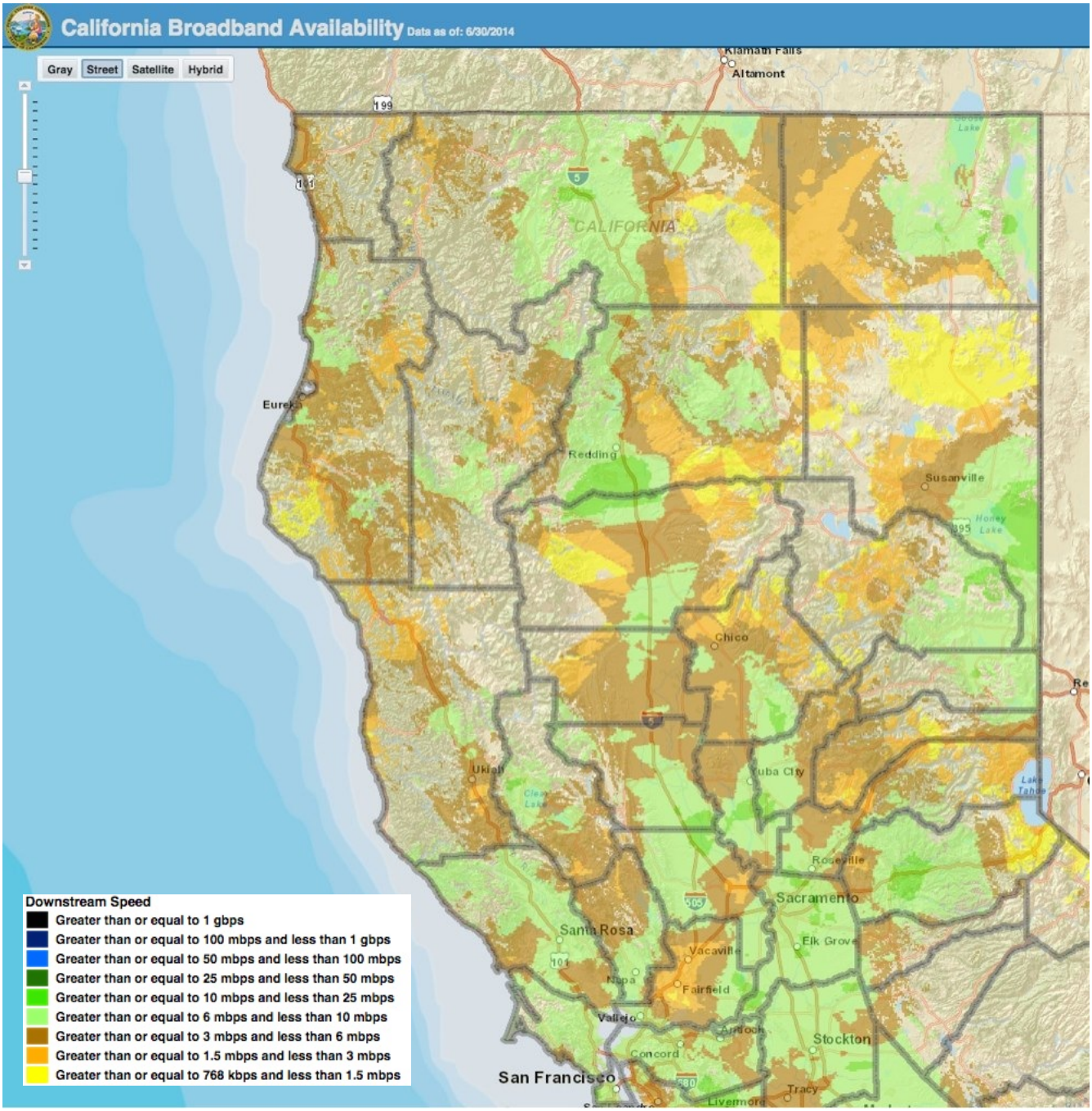
Sprint mobile broadband service



T-Mobile mobile broadband service



Verizon mobile broadband service



Appendix B - Infrastructure grades

Community grades

County	GPA	Grade
Lassen	0.0	F
Modoc	0.1	F
Plumas	0.1	F
Siskiyou	0.2	F

Lassen County	GPA	Grade
Bieber CDP	0.0	F
Clear Creek CDP	0.0	F
Doyle CDP	0.5	F+
Herlong CDP	0.7	D-
Janesville CDP	0.6	F+
Johnstonville CDP	0.0	F
Litchfield CDP	0.2	F
Milford CDP	0.3	F+
Nubieber CDP	0.0	F
Patton Village CDP	0.6	F+
Spaulding CDP	0.0	F
Susanville city	0.1	F
Westwood CDP	0.0	F

Modoc County	GPA	Grade
Adin CDP	0.8	D-
Alturas city	1.0	D
California Pines CDP	0.6	F+
Canby CDP	0.5	F+
Cedarville CDP	0.9	D-
Daphnedale Park CDP	1.0	D
Eagleville CDP	0.4	F+
Fort Bidwell CDP	0.4	F+
Lake City CDP	0.6	F+
Likely CDP	1.0	D
Lookout CDP	0.4	F+
New Pine Creek CDP	0.0	F
Newell CDP	0.6	F+

Plumas County	GPA	Grade
Beckwourth CDP	0.0	F
Belden CDP	0.0	F
Blairsden CDP	0.0	F
Bucks Lake CDP	0.0	F
C-Road CDP	0.0	F
Canyondam CDP	0.2	F
Chester CDP	1.0	D
Chilcoot-Vinton CDP	0.0	F
Clio CDP	0.0	F
Crescent Mills CDP	0.8	D-
Cromberg CDP	0.0	F
Delleker CDP	0.0	F
East Quincy CDP	0.0	F
East Shore CDP	0.8	D-
Gold Mountain CDP	0.0	F
Graeagle CDP	0.0	F
Greenhorn CDP	0.0	F
Greenville CDP	0.8	D-

Hamilton Branch CDP	1.0	D
Indian Falls CDP	0.6	F+
Iron Horse CDP	0.0	F
Johnsville CDP	0.0	F
Keddie CDP	0.0	F
La Porte CDP	0.0	F
Lake Almanor Country Club CDP	1.0	D
Lake Almanor Peninsula CDP	1.0	D
Lake Almanor West CDP	0.5	F+
Lake Davis CDP	0.0	F
Little Grass Valley CDP	0.0	F
Mabie CDP	0.0	F
Meadow Valley CDP	0.0	F
Mohawk Vista CDP	0.0	F
Paxton CDP	0.0	F
Plumas Eureka CDP	0.0	F
Portola city	0.0	F
Prattville CDP	0.4	F+
Quincy CDP	0.0	F
Spring Garden CDP	0.0	F
Storrie CDP	0.0	F
Taylorsville CDP	0.9	D-
Tobin CDP	0.0	F
Twain CDP	0.0	F
Valley Ranch CDP	0.0	F
Warner Valley CDP	0.0	F
Whitehawk CDP	0.0	F

Siskiyou County	**GPA**	**Grade**
Carrick CDP	1.0	D
Dorris city	0.8	D-
Dunsmuir city	0.9	D-
Edgewood CDP	0.0	F
Etna city	0.9	D-
Fort Jones city	1.0	D
Gazelle CDP	0.0	F
Greenview CDP	0.9	D-
Grenada CDP	0.8	D-
Happy Camp CDP	0.7	D-
Hornbrook CDP	0.0	F
Macdoel CDP	0.9	D-
McCloud CDP	1.0	D
Montague city	1.0	D
Mount Hebron CDP	1.0	D
Mount Shasta city	0.9	D-
Tennant CDP	1.0	D
Tulelake city	0.9	D-
Weed city	0.9	D-
Yreka city	0.9	D-

Methodology

In a study conducted for the East Bay Broadband Consortium (EBBC) in 2013[1], in cooperation with the Central Coast Broadband Consortium, core broadband infrastructure was evaluated in Alameda, Contra Costa and Solano Counties using data submitted to the California Public Utilities Commission by Internet service providers. A comparative report card was developed, with the average grade – "C" – set

[1] *East Bay Broadband Report Card,* Tellus Venture Associates, 28 January 2014.

at the most prevalent infrastructure, and corresponding service levels, in the state: a combination of relatively high speed cable modem and mid-range telephone company DSL facilities.

This methodology was subsequently used by the Central Coast Broadband Consortium to evaluate California broadband infrastructure and service on a statewide basis, on behalf of the California Emerging Technology Fund.

The primary data for assessing the quantity and quality of broadband infrastructure in the East Bay region (Alameda, Contra Costa and Solano counties) comes from the California Public Utilities Commission, which collects service level reports from providers throughout the state. This data can be broken down to the census block level, and shows what level of service Internet companies claim to provide, but not necessarily what they deliver. The accuracy of this data and the definition of service levels varies from company to company, although it is generally consistent within any given company. In other words, if Company Z exaggerates the speeds and availability of home Internet service, it tends to do so to more or less the same extent everywhere. By using a comparative system for ranking, rather than using the absolute values provided, the variation in the accuracy of the data can be smoothed out and an apples-to-apples comparison can be achieved.

The data collected by CPUC was divided into three categories: core wireline service, commercial broadband service providers and mobile carriers.

Consumer-grade service throughout California was assessed, and used as one of the two primary grading benchmarks, the other being the CPUC's standard for minimum acceptable service of 6 Mbps download/1.5 Mbps upload speed. Upload speed was given equal weight to download speed, even though it's generally less critical for consumers, because upload speed gives a good indication of the capacity of the underlying infrastructure. When a service provider skimps on upload speeds, as frequently happens, it is usually because its cables and other core equipment have a limited capacity.

Grades were then assigned as follows:

A - Two competing providers, both advertising maximum download speeds of at least 25 Mbps and maximum uploads speeds of 6 Mbps, or 3 or more competing providers offering that standard of service in combination.

B - Competing providers, both advertising maximum download speeds of at least 10 Mbps and maximum uploads speeds of 6 Mbps.

C - Competing providers, one advertising max down/up speeds of at least 10/6 Mbps and the remainder meeting CPUC's minimum 6 down/1.5 up standard.

D - At least one provider advertising speeds that meet the CPUC's minimum standards of 6 Mbps down and 1.5 Mbps up.

F - At least one provider offers service, but no service is available that meets the CPUC's minimum standard of 6 Mbps down and 1.5 Mbps up (meets CPUC's definition of underserved).

F- - No broadband service available (meets CPUC's definition of unserved).

A "C" grade indicates that the consumer grade broadband services, and consequently the underlying core infrastructure, in a given area meets the statewide average. A "D" grade means it meets the minimum passing service standard set by the CPUC. "F" grades indicate full or partial failure, which also means the area is eligible for infrastructure construction subsidies from the Commission. "A" and "B" grades show that service in an area is superior to the California average.

The first step in grading was to give a letter grade to each census block in the three counties. Then, the grade points were tallied, weighted by population and averaged for the census blocks within cities, counties and unincorporated areas, to produce a numerical grade on a four point scale, which was rounded to the nearest tenth.

The numerical grade point average for an area was then converted to a letter grade on the following scale:

A	4.0
A-	3.7-3.9
B+	3.3-3.6
B	3.0-3.2
B-	2.7-2.9
C+	2.3-2.6
C	2.0-2.2
C-	1.7-1.9
D+	1.3-1.6
D	1.0-1.2
D-	0.7-0.9
F+	0.3-0.6
F	0.0-0.2
F-	No service available

Appendix C - Glossary

ADSL	Asymmetric Digital Subscriber Line: DSL service with a larger portion of the capacity devoted to downstream communications, less to upstream. Typically thought of as a residential service.
ATM	Asynchronous Transfer Mode: A data service offering by ASI, that can be used for interconnection of customer's LAN. ATM provides service from 1 Mbps to 145 Mbps utilizing Cell Relay Packets.
Backhaul	Connecting Internet access to a location over long or short distances. Traditionally, wired networks have been necessary for backhaul, but with 802.16, also known as WiMAX, backhaul via wireless will become even more common than it is with WiFi.
Bandwidth	The amount of data transmitted in a given amount of time; usually measured in bits per second, kilobits per second, and megabits per second.
Bit	A single unit of data, either a one or a zero. In the world of broadband, bits are used to refer to the amount of transmitted data. A kilobit (Kb) is approximately 1,000 bits. A megabit (Mb) is approximately 1,000,000 bits.
Broadband	"Broadband" refers generally to any telecommunications service capable of supporting digital data transmission at high speeds. These services can include and/or support Internet, television, telephone, private data networks and various specialized uses. Broadband service can be delivered in a variety of ways, including telephone lines (e.g. DSL), coaxial cable (e.g. cable modem), fiber optic cable (e.g. Lit San Leandro), wireless cellular/mobile service (e.g. cell phones, tablets, wireless modems), WiFi, point-to-point and point-to-multipoint wireless service (e.g. TelePacific, Etheric) and hybrid networks (XO Communications). Although different organizations use different criteria, the California Public Utilities Commission considers 6 Mbps download and 1.5 Mbps upload speed to be a standard for adequate broadband service availability. Unless otherwise stated, this report uses the CPUC definition.
Byte	The amount of memory space needed to store one character, which is normally 8 bits.
Cable modem	A device that hooks to your cable TV line to allow your computer to receive data at about 1.5 Mbps. The theoretical maximum for downstream transactions is 27 Mbps and 2.5 Mbps upstream, but the connection is usually much slower because the provider may be hooked to the Internet via a T-1 line.
CDMA	The type of digital cellular phone network used throughout most of the United States, but rare elsewhere in the world. CDMA stands for Code Division Multiple Access, and CDMA2000 1x is the third-generation, or 3G, extension to which CDMA cellular operators are upgrading their networks. It is a digital cellular technology that uses spread-spectrum techniques. Unlike competing systems, such as GSM, that use TDMA, CDMA does not assign a specific

	frequency to each user. Instead, every channel uses the full available spectrum. Individual conversations are encoded with a pseudo-random digital sequence. CDMA consistently provides better capacity for voice and data communications than other commercial mobile technologies, allowing more subscribers to connect at any given time, and it is the common platform on which 3G technologies are built.
Cell	The geographic area covered by a cellular telephone transmitter. A connected group of cells form a cell system, which is what you gain access to when you sign up for cellular telephone service.
Cellular	A mobile communications system that uses a combination of radio transmission and conventional telephone switching to permit telephone communications to and from mobile users within a specified area.
CLEC	Competitive Local Exchange Carrier: Wireline service provider that is authorized under state and Federal rules to compete with ILECs to provide local telephone service. CLECs provide telephone services in one of three ways or a combination thereof: a) by building or rebuilding telecommunications facilities of their own, b) by leasing capacity from another local telephone company (typically an ILEC) and reselling it, and c) by leasing discreet parts of the ILEC network referred to as UNEs.
Coaxial cable	A type of cable that can carry large amounts of bandwidth over long distances. Cable TV and cable modem service both utilize this technology.
Commercial grade	Broadband service similar to residential service in that the provider takes effectively all responsibility for installing, maintaining and supporting the service. Speeds are similar (6 to 100 Mbps), but service levels, reliability, consistency and pricing are higher.
CPCN	Certificate of Public Convenience and Necessity: Authorization given by the CPUC to telecommunications carriers in order to provide service in the state of California.
Dark fiber	Fiber optic cables are comprised of many, very thin fiber optic strands made of glass. A laser is used to send a beam of light through a fiber optic strand, and this beam carries data from one end to the other. If no electronic equipment (i.e. the laser) is connected to a strand, it is literally dark, and cannot carry data. Dark fiber is sought after and used by telecommunications carriers and large companies that prefer to install and operate their own electronic equipment at either end.
Dial-Up	A technology that provides customers with access to the Internet over an existing telephone line.
DS3	A dedicated phone connection supporting data rates of about 43Mbps (megabits per second). Also called a T-3, the line actually consists of 672 individual channels, each of which supports 64Kbps. DS3 lines are used mainly by

	Internet Service Providers (ISPs) connecting to the Internet backbone. Large businesses also use DS3 lines when they have large sites to interconnect.
DSL	A common form of broadband Internet connection. DSL stands for Digital Subscriber Line.
E-Rate	A Federal program that provides subsidy for voice and data lines to qualified schools, hospitals, CBOs, and other qualified institutions. The subsidy is based on a percentage designated by the FCC. CTF benefits are calculated net of the E-rate subsidy.
E911	Enhanced 911, an emergency service that automatically sends phone number and location information to the operator. E911 comes in handy, say, when you need to get emergency help and are unable to speak or don't know your location.
Ethernet	The most common networking standard in the world, formally known as IEEE 802.3.
Fixed wireless	Broadband systems based on fixed wireless technology provide Internet service using outdoor antennas installed on homes and businesses. It is most commonly found in rural areas, but it is also sometimes used by businesses to compensate for poor wireline service in urban areas. Fixed wireless systems can provide services between two specific locations – i.e. point to point – or from a central access point to many locations in the surrounding areas – i.e. point to multipoint.
FTTN	Fiber To The Neighborhood: A hybrid network architecture involving optical fiber from the carrier network, terminating in a neighborhood cabinet with converts the signal from optical to electrical.
FTTP	Fiber To The Premise (Or FTTB
Gigahertz	A measure of electromagnetic wave frequency equal to one thousand million (1,000,000,000) hertz, often abbreviated as GHz and used to specify the radio frequency used by wireless devices. 802.11a networks operate at 5 GHz. 802.11b and g networks use 2.4 GHz, which is susceptible to interference from nearby cordless phones and microwave ovens that use the same frequency.
GPON	Gigabyte-Capable Passive Optical Network: GPON uses a different, faster approach (up to 2.5 Gbit/s in current products) than BPON.
GSM	Global System for Mobile Communications: This is the current radio/telephone standard in Europe and many other countries except Japan and the United States.
Hub	A common connection point for devices, such as computers and printers, in a network.
ILEC	Incumbent Local Exchange Carrier. An ILEC is a telephone company that was providing local service when the Telecommunications Act of 1996 was enacted.

	Compare with CLEC, a company that competes with the already established local telephone business.
Industrial grade	Broadband service where the customer plays a much greater role in provisioning and supporting the service, including buying different elements from different vendors and managing installation and support. Speeds would be higher – perhaps as high as a Gigabit per second or more – and quality of service levels could be as high as Tier 1. Comcast's Business Class service or AT&T's business DSL service are examples of commercial grade service. A DS-3 or dark fiber strands are examples of industrial grade service.
I-Net	Institutional Network. Provides a high-speed connection between government, educational and community entities. It is often negotiated with a cable franchise, in exchange for using right- of-way in a jurisdiction.
ISP	Internet Service Provider: A company providing Internet access to consumers and businesses, acting as a bridge between customer (end-user) and infrastructure owners for dial-up, cable modem and DSL services.
LAN	Local Area Network: A geographically localized network consisting of both hardware and software. The network can link workstations within a building or multiple computers with a single wireless Internet connection.
Last mile	Infrastructure (e.g. fiber optic lines, distribution boxes, equipment vaults, poles, conduit) that provides broadband service to end users or end- user devices (including households, and businesses).
Lit fiber	Fiber optic cables are comprised of many, very thin fiber optic strands made of glass. A laser is used to send a beam of light through a fiber optic strand, and this beam carries data from one end to the other. When this kind of electronic equipment (i.e. the laser) is installed and operating, then the fiber strand is literally "lit" and ready to transmit data, either for the company that operates it or for third-party customers.
Local Loop	A generic term for the connection between the customer's premises (home, office, etc.) and the provider's serving central office. Historically, this has been a wire connection; however, wireless options are increasingly available for local loop capacity.
MAN	Metropolitan Area Network: A high-speed date intra-city network that links multiple locations with a campus, city or LATA. A MAN typically extends as far as 50 kilometers.
Managed services	The type of service provided by dominant incumbent providers, such as AT&T and Comcast. Rather than providing a simple connection between points – via lit or dark fiber – these companies provide full Internet bandwidth services, at a speed and quality of service level they specify, and sometimes with quantity limits, i.e. data caps. It is analogous to water service: these companies sell "water" and don't rent out access to their "pipes".

Mbps	Megabits per second: 1,000,000 bits per second. A measure of how fast data can be transmitted.
Middle mile	Broadband infrastructure that does not predominantly provide broadband service to end users or to end-user devices, and may include interoffice transport, backhaul, Internet connectivity, or special access. Middle mile facilities are the link between last mile facilities and major interconnection points, such as those that form the core of the Internet.
Modem	Short for modulator/demodulator. A modem modulates outgoing digital data into analog signals so they can be sent over copper phone lines, and demodulates incoming analog signals into digital.
Overbuilders	Building excess capacity. In this context, it involves investment in additional infrastructure project to provide competition.
PON	Passive Optical Network: A Passive Optical Network consists of an optical line terminator located at the Central Office and a set of associated optical network terminals located at the customer's premise. Between them lies the optical distribution network comprised of fibers and passive splitters or couplers. In a PON network, a single piece of fiber can be run from the serving exchange out to a subdivision or office park, and then individual fiber strands to each building or serving equipment can be split from the main fiber using passive splitters / couplers. This allows for an expensive piece of fiber cable from the exchange to the customer to be shared amongst many customers thereby dramatically lowering the overall costs of deployment for fiber to the business (FTTB) or fiber to the home (FTTH) applications.
Rights-of-Way	Legal rights of passage over land owned by another. Carriers and service providers must obtain rights-of-way to dig trenches or plant poles for cable systems, and to place wireless antennae.
Router	An intelligent network device that goes one step beyond bridging by converting address-based protocols that describe how packets move from one place to another. In practice, this generally comes down to translating between IP addresses and MAC addresses for data flowing between your local network and the Internet. Many people use the term interchangeably with "gateway." You must enter the IP address of your router when configuring network settings manually.
Subscribership	Subscribership is how many customers have subscribed for a particular telecommunications service.
Switched Network	A domestic telecommunications network usually accessed by telephones, key telephone systems, private branch exchange trunks, and data arrangements.
T-1	The T-1 standard was introduced in 1961 in order to support a bi-directional speed of 1.5 Mbps at a high quality-of-service level, using the copper wires of the time. Because it is a dedicated and managed circuit, its performance is usually substantially better than shared services such as DSL or cable modem,

	even in cases where the claimed top speed of those shared services is many times higher. A T-1 circuit is generally considered to be the lowest level of service that can be described as industrial or carrier grade.
Telco	An abbreviation for Telephone Company.
Telecommunications	Refers to all types of data transmission, from voice to video.
Throughput	The amount of data that can be transmitted in a given amount of time. Throughput is commonly measured in bits per second. (Although throughput is not really a measurement of speed, most people, including us, use the word "speed" when talking about a high-throughput network.)
Universal Service	The idea of providing every home in the United States with basic telephone service.
Videoconferencing	Conducting a conference between two or more participants at different sites by using computer networks to transmit audio and video data.
VLAN	Virtual Local Area Network. A network of computers that behave as if they are connected to the same wire even though they may actually be physically located on different segments of a LAN.
VoIP	Voice Over Internet Protocol: A new technology that employs a data network (such as a broadband connection) to transmit voice conversations.
VPN	A method of creating an encrypted tunnel through which all traffic passes, preventing anyone from snooping through transmitted and received data. VPN stands for virtual private network.
WAN	Wide Area Network, A collection of local area networks connected by a variety of physical means. The Internet is the largest and most well-known wide area network. Wide area network is generally abbreviated to WAN.
WiFi	Short for wireless fidelity and is meant to be used generically when referring of any type of 802.11 network, whether 802.11b, 802.11a, dual-band, etc. The term is promulgated by the WiFi Alliance. Any products tested and approved as "WiFi Certified" (a registered trademark) by the WiFi Alliance are certified as interoperable with each other, even if they are from different manufacturers. A user with a "WiFi Certified" product can use any brand of access point with any other brand of client hardware that also is certified. Typically, however, any WiFi product using the same radio frequency (for example, 2.4 GHz for 802.11b or 11g, 5 GHz for 802.11a) will work with any other, even if not "WiFi Certified." Formerly, the term "WiFi" was used only in place of the 2.4 GHz 802.11b standard, in the same way that "Ethernet" is used in place of IEEE 802.3. The Alliance expanded the generic use of the term in an attempt to stop confusion about wireless LAN interoperability.
WiMAX	Another name for the 802.16 wireless networking specification used for long-haul and backhaul connections.

Wireless ISP	A company that provides wireless Internet access. The term is often abbreviated to WISP.
WLAN	Wireless Local Access Network, a LAN that can be connected to via a wireless connection.

Sources: Tellus Venture Associates, California Public Utilities Commission, Neratech, Wikipedia.