City of Salinas Preliminary Broadband Plan – Final 1.1

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1. Executive Summary

The City of Salinas has an opportunity to combine city-owned assets, development policy and excellent connections to major Internet hubs, and create an initiative to develop local broadband infrastructure that is capable of supporting high tech businesses and encouraging economic growth, particularly in targeted areas such as downtown, the Agricultural Technology Corridor and north Salinas.

This study examined the broadband infrastructure that is present in Salinas, including networks operated by the two primary carriers, AT&T and Comcast, and independent fiber routes. It also looked at the city's current resources, including city-owned conduit, and future plans. The following conclusions were reached:

Figure 1.1 – Fiber routes and city-owned conduit in Salinas Agricultural Technology Corridor.

- Generally broadband infrastructure in the City of Salinas is average, as compared to California as a whole, and above average compared to other communities in Monterey County.

- AT&T and Comcast offer broadband service to nearly all homes and businesses in Salinas, on generally the same terms and at the same service level as elsewhere in California.

- Broadband providers that specialize in serving business customers are also present in Salinas, although not on a widespread basis. The areas targeted by these specialty providers, particularly the southeast and downtown areas of Salinas, have also been targeted by AT&T and Comcast.

- Despite this focus, data provided by AT&T and Comcast to the California Public Utilities Commission indicates that the underlying broadband infrastructure in commercial and industrial areas of Salinas, and in the southeast area in particular, is substandard.

- Salinas is served by several fiber optic routes that provide connections to major Internet exchanges in the San Francisco Bay Area and southern California, and, in some cases, are capable of providing local service directly to locations within the city.

- The City of Salinas owns approximately 16,000 feet of conduit that is available to support construction of additional fiber optic networks, and has plans to build 108,000 feet of additional conduit in the next few years.

- The City's economic development goals include attracting new businesses and supporting the growth of existing businesses in the downtown area, including the adjacent Alisal Marketplace area, and developing the Agricultural Technology Corridor in the southeast area of Salinas.

- The City is also anticipating building several thousand new residential units in north Salinas.

- The City's existing conduit, its plans for building additional broadband facilities and its other assets coincide geographically with these development goals. The same is true of the privately owned fiber networks that connect Salinas to major Internet hubs and serve locations within the city.

Figure 1.2 – Fiber routes and city-owned conduit in downtown Salinas.

There are several steps that the City of Salinas can take to maximize the benefit of this opportunity, including establishing code requirements for broadband facilities in new developments, continued inclusion of broadband infrastructure in public works projects and in private sector excavations in the public right of way, and streamlining permit processes for broadband-related construction projects.

The greatest benefit, however, can obtained by proactively developing independent broadband infrastructure. This approach has been successfully used in other cities in California, including Watsonville and San Leandro, where city-owned conduit, similar to that owned by the City of Salinas, was used to build business-oriented fiber optic networks.

This report recommends distributing a request for proposals to experienced broadband infrastructure companies interested in partnering with the City of Salinas to build a commercially-focused fiber optic network and develop other broadband infrastructure, including facilities in new residential developments, fiber and wireless links to the Salinas Valley, and interconnection support for existing fiber routes in downtown Salinas and the Agricultural Technology Corridor.

2. Current broadband infrastructure in Salinas

2.1. Broadband overview

Access to broadband service – fast, reliable, high quality links to the Internet and internal networks – is a basic competitive requirement of twenty-first century economies. Broadband availability is one of the first criteria assessed when businesses consider relocating or expanding. It is considered to be a non-negotiable resource that is necessary for businesses to operate and to keep pace with global competitors.

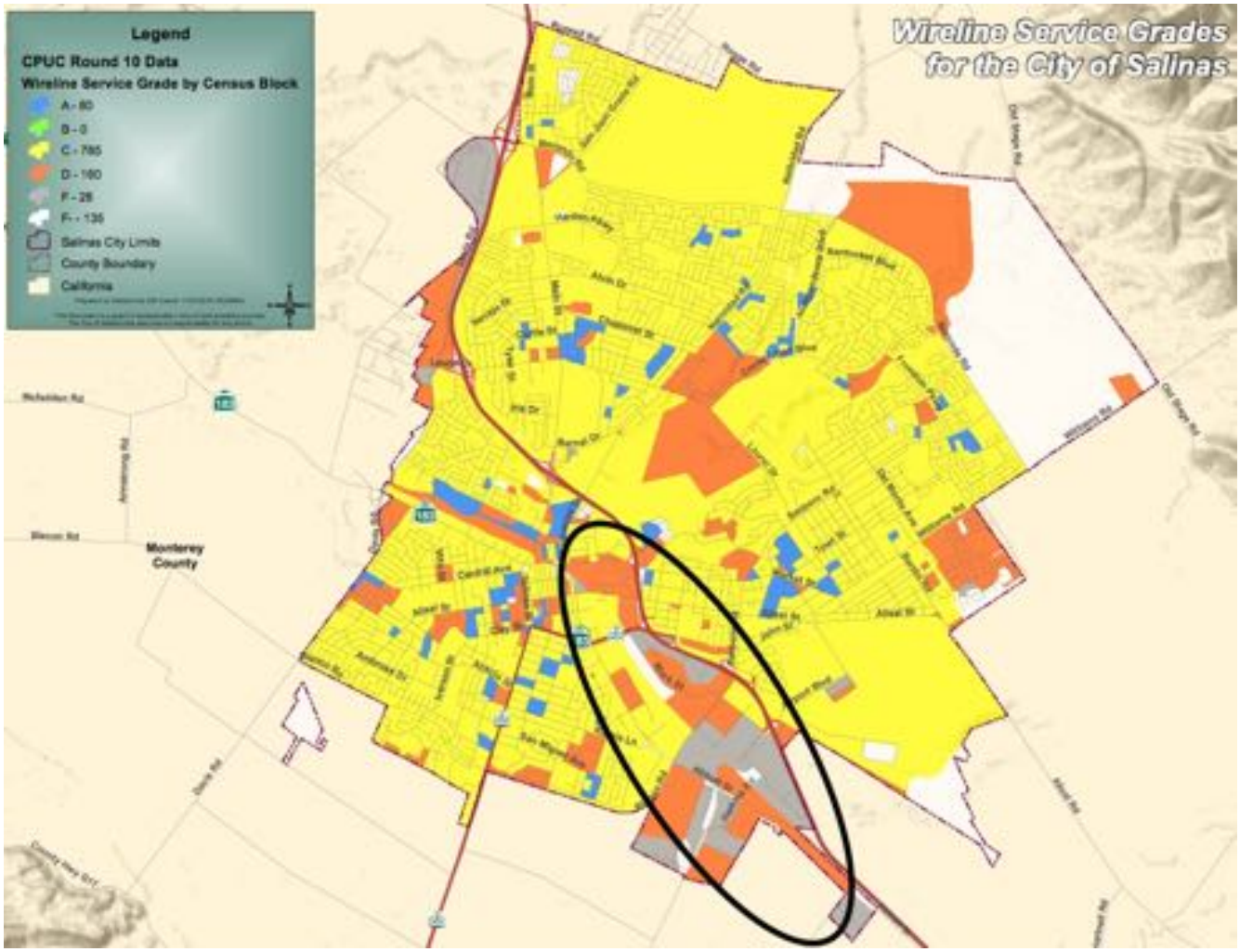


Figure 2.1 – Broadband infrastructure report card for the City of Salinas. Blue = "A", yellow = "C", red = "D", grey and white are "F".

"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.

The California Public Utilities Commission (CPUC) considers 6 Mbps download and 1.5 Mbps upload speeds to be the minimum for adequate residential broadband service; the Federal Communications

Commission uses a standard of 25 Mbps download and 3 Mbps upload speeds. Consumer-grade Internet access is typically a shared resource, with many subscribers contending for the same bandwidth, and is subject to speed and volume limits as determined by the provider.

This type of service often meets the needs of small and medium businesses, but not always. And it is generally inadequate for larger companies, which need commercial and industrial grade broadband facilities.

"Commercial grade" service is defined as being similar to residential service in that the provider takes effectively all responsibility for installing, maintaining and supporting the service. Speeds are similar or higher (6 to 100 Mbps or more), and quality levels, reliability, consistency and pricing are higher than residential service, although essentially the same infrastructure is used. Comcast's Business Class service or AT&T's business DSL service are examples of commercial grade service.

Figure 2.2 – Fiber optic conduit.

"Industrial grade" service refers to service where the customer plays a much greater role in building and supporting the service, including buying different elements from different vendors and managing installation and support. Speeds would be higher – there is effectively no limit except cost – and quality of service levels can be as high as the best found in top tier Internet exchanges. DS-3 circuits, dark fiber strands and dedicated Internet access via data centers are examples of industrial grade service.

It is much easier for primary broadband service providers such as AT&T or Comcast to make a business case for recovering construction and operating costs in urban and suburban residential areas, which have a high density of potential customers. Standardized equipment can be used to provide a managed level of service, and each home can be offered a wide range of products including Internet access, television programming and telephone service. It is a predictable business, and capital investments can be made with a reasonable degree of certainty, recent decreases in cable television subscription numbers notwithstanding.

Industrial and commercial customers are much more diverse and less predictable. One business might need gigabit speeds at top "quality of service" levels, while the one next door is content with a standard, relatively slow DSL connection. As a result, incumbent carriers tend to approach commercial and industrial customers on a case by case basis or, as AT&T and Comcast are doing, be very selective in choosing locations to upgrade. They do not prospectively build high speed infrastructure. Businesses seeking higher grade service are frequently presented with installation estimates in the thousands and tens of thousands of dollars range.

Broadband service can be delivered in a variety of ways, including telephone lines (e.g. AT&T DSL), coaxial cable (e.g. Comcast cable modem), fiber optic cable, wireless cellular/mobile service (e.g. cell phones, tablets, wireless modems), WiFi, point-to-point and point-to-multipoint fixed wireless service and hybrid networks.

Although improvements continue to be made in the technology used to move data over legacy networks, the primary means of increasing speed is to build fiber infrastructure closer and closer to end users, in order to make copper wire connections and wireless links shorter.

The capacity of mobile data networks – AT&T, Verizon, Sprint and T-Mobile – continues to increase, however the demand for mobile bandwidth is also increasing. There is no prospect for it to be a substitute for high capacity wired commercial and industrial services. Like legacy copper networks, one of the primary means of increasing mobile capacity is to extend the reach of fiber backbones in order to make the area covered by cell sites smaller and smaller.

2.2. Salinas's residential and commercial infrastructure grade

Wireline broadband infrastructure within the city limits of Salinas is average for California, receiving a "C" grade (2.0) using criteria developed by the Central Coast and East Bay broadband consortia[1] in combination with the most recent broadband availability data submitted by Internet service providers to the CPUC. It is better than the typical broadband infrastructure found in Monterey County, which received an overall grade of "D" (1.1). Salinas ranks 4th out of 29 incorporated cities and census designated places in Monterey County. More information on comparative rankings of Monterey County communities is in Appendix C.

Figure 2.3 – Comcast's claimed service area in Salinas.

The infrastructure grade of a census block is determined by the broadband service level it supports, as reported by primary wireline carriers. A "C" grade means a census block has the most common wireline service choices found in California, typical of the standard packages offered by AT&T and Comcast: at least two providers, one just meeting the minimum standard of broadband service set by the CPUC (6 Mbps download and 1.5 Mbps upload) and the other exceeding it. A "D" grade – below the Californian average – is given when wireline service meets but does not exceed this standard or where consumers only have access to one qualifying service provider. If no qualifying service is available, a failing grade – "F" – is given. "A" and "B" grades are given where superior service is offered. Details regarding the grading method are in Appendix C.

There are pockets of poor infrastructure, particularly in a largely industrial and commercial corridor that runs between the Union Pacific railroad tracks and U.S. 101, from East Market Street in the north

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

to the city limits in the south, and extending south of Abbot Street and east of Blanco Rd. There are also pockets of substandard broadband infrastructure in commercial areas in the downtown area, along Davis Road north of Laurel Dr. and in other locations scattered throughout the City. These particular census blocks received "D" and, in some cases, "F" grades.

On the other hand, there are several areas in Salinas which have superior broadband infrastructure and received an "A" grade. There is no particular pattern to these census blocks, except that clusters might indicate proximity to a central office or distribution point – a "node" – which serves surrounding census blocks. It is often the case that speed drops the further a customer is from a node or central office.

AT&T and Comcast are the two primary wireline carriers and Internet service providers in Salinas. Both own and operate extensive fiber optic backbone networks (see maps in Appendix A) that are connected to copper lines that ultimately deliver service to homes and businesses.

Table 2.1 – Broadband availability by primary wireline carrier

	Housing units	Population	Census blocks	Area (sq mi)
AT&T	41,867	148,087	1,020	19.5
	98%	98%	96%	84%
Comcast	41,567	146,704	983	18.7
	97%	98%	93%	80%
With at least 1 provider	42,218	149,390	1,053	20.4
	99%	99%	99%	88%
Salinas totals (per CCBC database)	42,651	150,441	1,060	23.2

2.3. Comcast

Comcast claims to offer a uniform level of service in nearly the entire city (97% of homes and 80% of the land area in Salinas), but its ability to actually deliver the speeds it advertizes depends on the level of investment it has made in particular neighborhoods and the usage patterns of residents – the more people subscribing to and accessing the Internet in a given area, the lower the speeds each will receive.

Comcast reports uniform service availability of greater than 100 Megabits per second (Mbps) download speed and between 25 Mbps and 50 Mbps upload speeds using DOCSIS 3 technology, which is capable of supporting that level of service. However, actual speeds experienced by both residential and commercial users will vary from that standard, depending on the age and condition of the lines and the number of users in a neighborhood.

Comcast recently announced that it is offering service of up to 10 Gbps to businesses in the Salinas Airport area, which is generally in the Agricultural Technology Corridor, discussed below. The decision

to focus on this area is consistent with the strategy followed by secondary providers, who focus on serving commercial and industrial customers, also as discussed below. Details regarding pricing, including installation costs which can be anywhere from zero to tens of thousands of dollars, were not disclosed. The company's announcement referred to the new offering as "Ethernet service", which indicates it is a managed service that might or might not be partially delivered via existing copper lines (see Appendix E for more information on broadband technology and Appendix F for a glossary of terms). The announcement also characterized the new service as "fiber-based", however that does not necessarily mean that it utilizes 100% fiber-to-the-premise infrastructure. In fact, if that were the case, then it should have been emphasized, since it is a significant selling point.

2.4. AT&T

AT&T also provides broadband service throughout Salinas (98% of homes and 84% of the land area), but the level of service it provides also varies greatly by neighborhood.

Figure 2.4 – AT&T's claimed DSL service area in Salinas.

With the exception of one census block where it reports using fiber-to-the-premise (FTTP) facilities, AT&T uses various kinds of copper wire-based DSL technology to deliver service to homes and businesses in Salinas. The company does not disclose which type of DSL technology it uses in which census blocks, but the range of speed levels offered (from 768 Kbps to 50 Mbps download and 200 Kbps to 10 Mbps upload) indicates that it uses a mix of its three mostly commonly used types: 1990s-style basic DSL, partial Uverse (IP-DSLAM) and full Uverse.

The most common service level that AT&T offers, though, is 10 Mbps to 25 Mbps download and 1.5 Mbps to 3 Mbps upload speeds, which is available in roughly three-quarters of Salinas census blocks. This level of service is consistent with the average DSL service offered in California and generally corresponds to the census blocks in Salinas that received a "C" grade. A small percentage of census blocks have download and/or upload speeds that are either better or worse than this average, and generally correspond to areas given "A" and "D"/"F" grades respectively.

The one census block where AT&T reports using FTTP technology is in east Salinas and contains what appears to be recently constructed homes. It is common for telecommunications infrastructure installed in new home developments to be fully and truly fiber optic because of the rising cost of copper and the falling price of fiber. However, neither AT&T or Comcast provide the level of service, i.e. gigabit speeds, that are commonly associated with FTTP systems. In this census block, AT&T offers the same level of service – 10 Mbps to 25 Mbps download/1.5 Mbps to 3 Mbps upload – as it does via copper wire in most of Salinas.

According to a statement from an AT&T representative, the company offers Ethernet-based commercial service of up to 10 Gbps in the downtown area and elsewhere Salinas, similar in nature to that offered

by Comcast in the Airport area. This similarity includes the likelihood that customer connections are copper-based, rather than fully delivered by fiber-to-the-premise facilities.

Table 2.2 – AT&T service levels by census block

At least:	200 Kbps	768 Kbps	1.5 Mbps	3 Mbps	6 Mbps	10 Mbps	25 Mbps	
Up to:	**768 Kbps**	**1.5 Mbps**	**3 Mbps**	**6 Mbps**	**10 Mbps**	**25 Mbps**	**50 Mbps**	**No service**
Download		1%	4%	1%	0.4%	**81%**	8%	4%
Upload	7%	4%	**73%**	4%	8%			4%

However, AT&T's ability to provide this level of service in any given location depends on the capacity of its existing infrastructure. Although it is generally good in Salinas, it is substandard in some areas and AT&T would not be able to definitively promise the availability of this kind of Ethernet-based service at any particular location without first doing an engineering survey. It is a common practice in the telecommunications to advertize the availability of a particular service over a wide area, but not be able to actually deliver it to every address, or condition delivery on construction of new network facilities or upgrades of existing ones.

Customers are often asked to pay the costs of upgrading facilities to provide these higher level services. The AT&T representative did state that "any infrastructure work on a customer's private property, necessary to complete the circuit installation" is "free of charge", although no information was given regarding other applicable terms, such as the length of service contracts required. It is also likely that this offer only applies in certain circumstances, such as at particular kinds of commercial properties or locations where existing facilities have already been upgraded, or that are within a certain distance of key telephone company resources, such as particular nodes or central offices.

Figure 2.5 – AT&T's sole reported census block with fiber-to-the-premise in Salinas.

Nationally, AT&T is extending the reach of its fiber optic networks directly to commercial properties in the central business districts of major cities, and reports healthy uptake so far. However, AT&T has also been candid in saying it will be very selective about where it builds new network infrastructure and it only intends to do so in locations where it can generate a high rate of return on its investments. It has shown no interest in significantly upgrading its wireline infrastructure in Monterey County, except in response to immediate requests from potential customers who wish to purchase a sufficiently high level of service.

2.5. Secondary wireline broadband service providers

Several second-tier companies offer broadband service in Salinas, either using copper lines leased from AT&T or via direct fiber connections, according to reports they've made to the CPUC.

The secondary company reporting the most service is Earthlink (which reports to the CPUC under the name of New Edge Networks, which it acquired). It offers service that ranges between 768 Kbps to 3 Mbps download and 200 Kbps to 3 Mbps upload speeds, indicating that it is using legacy DSL technology. Its customers are located in a few census blocks (43 out of 1,060 total in Salinas, see Appendix A for more detail), mostly in commercial and industrial areas.

Another secondary provider, Level 3, offers DSL-based service in the same speed range – and likely using the same legacy technology – in one census block in Salinas.

Table 2.3 – Fiber-to-the-premise speeds

	Download	Upload
AT&T	10 to 25 Mbps	1.5 to 3 Mbps
Level 3	Greater than 1 Gbps	Greater than 1 Gbps
Windstream	Greater than 1 Gbps	Greater than 1 Gbps

However, Level 3 also provides FTTP service to another census block, in a commercial area at the intersection of South Main Street and East Blanco Road.

A third company, Windstream, also provides FTTP service in one census block, in an industrial area at the intersection of Abbott Street and East Blanco Road. Both companies report being able to provide service in excess of 1 Gbps download and upload speeds, which is consistent with FTTP technology. This service level contrasts with AT&T's fiber utilization in east Salinas.

2.6. Intercity and metro fiber optic routes

Two intercity fiber optic routes currently connect Salinas to major Internet exchanges and data centers in the San Francisco Bay Area and southern California, and a third is under construction (see maps in Appendix B).

The largest route generally runs along the Union Pacific railroad right of way. At least three companies own fiber cables along this route: AT&T, Level 3 and Verizon. This route is primarily designed to connect northern and southern California, however a handful of access points exist in Salinas, mostly in the downtown and southeast areas of the city. Many more companies lease fiber strands on these cables and offer various levels of broadband service to commercial, industrial and institutional users.

The second existing route comes into Salinas from San Juan Bautista, generally over the San Juan Grade. It splits north of Salinas, with one leg following Old Stage Road and connecting to the fiber routes along the railroad right of way near Spence Road, south of Salinas. The other leg continues into Salinas, generally along North Main Street, passes through the downtown area, and continues via State Route 68 to Sand City. Both legs of this route pass alongside a major residential and commercial development area in north Salinas. Two companies, AT&T and OpticAccess, own or control fiber cables along this route. OpticAccess has designated 24 strands for "metro" (i.e. local) use, which makes it suitable for connecting two points within Salinas, rather than being limited to to long haul connections between Salinas and northern and southern California.

Sunesys LLC is currently building a new fiber optic route from Santa Cruz to Soledad. This route will generally pass through Salinas from the west to the southeast, south of the downtown area. It connects with long haul fiber routes to southern California in Soledad, and with its existing fiber route that connects Santa Cruz to Silicon Valley. Some of the capacity on this route will also be available for metro use.

Figure 2.6 – Major intercity and metro fiber routes through Salinas. Purple = Sunesys, green = AT&T & OpticAccess, red = north/south routes along railroad right of way.

The route is largely subsidized by a grant from the California Advanced Services Fund, and Sunesys is required by the CPUC to make dark fiber strands available at a price of $8.50 per stand per mile per month, with a $500 per month minimum. Sunesys has also committed to offering gigabit-class "lit" services, ranging from a maximum of $700 per month for 1 Gbps to $3,000 per month for 10 Gbps. Competitive commercial and industrial grade broadband service providers will also offer services via the Sunesys route, and lower prices and/or a broader choice of service level offerings is likely to develop.

2.7. Mobile broadband service

All four major mobile carriers – AT&T, Sprint, T-Mobile and Verizon – offer broadband service in Salinas (see maps in Appendix A). According to field tests conducted by the CPUC, AT&T provides the best, if uneven, service, generally achieving download speeds in excess of 10 Mbps in the northern half of the city and 6 Mbps to 10 Mbps in the southern half, with the southeast corner only receiving a maximum of 3 Mbps to 6 Mbps.

Both Sprint and Verizon provide broadband service with download speeds in the 3 Mbps to 6 Mbps range. T-Mobile only delivers speeds below 1.5 Mbps, where it is able to provide service at all.

It is worth noting that of the four companies, AT&T also has the most extensive fiber optic network in Salinas, with both long haul intercity capacity and metro/local routes throughout the city. In other places, increased availability of local and long haul fiber has led to improved mobile broadband service because it allows the construction of more cell sites, which can provide a denser level of service, and the upgrading of existing sites, since more bandwidth is available.

2.8. Other broadband service

No fixed wireless Internet service provider has submitted reports to the CPUC indicating that they offer service in Salinas. Fixed wireless service is based on technology that uses a permanently installed radio link between two specific points or from a central hub to many different users. Two companies have reported offering fixed wireless service near Salinas (see map in Appendix A). Etheric claims to deliver high speed service in Santa Cruz County as far south as Watsonville, and Pinnacles Telephone Company provides service in San Benito County.

Two other companies advertize fixed wireless and/or DSL service via lines leased from AT&T in Salinas. Redshift offers both types of service, while Razzolink only offers wireless connections. Neither company reports its service levels or other data to the CPUC.

3. Salinas broadband infrastructure and development

3.1. City-owned conduit and facilities

The City of Salinas routinely adds empty, city-owned conduit to public works projects that involve excavations, such as road construction. As a result, the City of Salinas owns underground conduit that can be used as the foundation of a fiber optic broadband network, and has plans to build more. In addition the City owns buildings, land, and right of ways throughout the city limits.

Figure 3.1 – Overview of fiber routes and city-owned conduit in Salinas.

So far, the City of Salinas has built a total of 16,000 feet of broadband conduit that is available for use (see maps in Appendix B). Approximately 5,400 feet is in the core downtown business district, 1,600 feet near the planned Agricultural Technology Corridor and another 9,000 feet in an unincorporated area southwest of the city.

Over the next ten years, the City plans to build an additional 108,000 feet of conduit, with construction in key areas – downtown, the Agricultural Technology Corridor, Alisal Marketplace and new developments in north Salinas – planned to be completed in two to five years.

3.2. Downtown and Alisal Marketplace

The City of Salinas' primary municipal facilities, including City Hall and public safety agencies, are located in the downtown area, as is the National Steinbeck Center, a transit hub and several new commercial developments. In addition to the city-owned conduit described above, the City owns streetlights and associated conduit in the downtown area, and several other properties. Salinas is the county seat of Monterey County, and major facilities, including courts and county offices, are located in and around the downtown area.

The City's conduit intersects with the existing OpticAccess intercity/metro fiber route. It will also intersect with the Sunesys intercity/metro fiber route, via conduit that is planned for construction in the near term, and the intercity fiber routes along the Union Pacific right of way.

The Alisal Marketplace district is just to the east of downtown, between the Union Pacific right of way and U.S. 101. Plans are underway to develop it into a mixed use environment, including professional office space, and commercial and residential developments. A new police station will be built there, and the City has plans to interconnect it with its existing downtown broadband infrastructure. Lateral connections to this backbone can be included in redevelopment plans.

Although the primary broadband infrastructure in downtown Salinas is generally average – i.e., a "C" grade – there are pockets of both substandard and superior infrastructure. The Alisal Marketplace area, on the other hand, is nearly completely substandard. Although Comcast offers service that meets the CPUC minimums, AT&T does not. Download speeds are consistent with partial Uverse service, but the upload speeds offered by AT&T are below the 1.5 Mbps minimum, which indicates that the basic infrastructure in the area – legacy copper wires – have not been upgraded to the point of being capable of supporting modern, commercial broadband demand.

Figure 3.2 – Fiber route markers on Union Pacific right of way in downtown Salinas.

As described above, it is possible for larger companies in downtown Salinas to purchase high capacity, commercial and industrial grade Internet service from specialty suppliers. However, the process for obtaining this kind of access is complicated and expensive.

The City's existing assets can be used as the basis for a commercially-focused downtown fiber network, either owned and operated by the City, as in Palo Alto, or by a private sector partner, as in San Leandro. In both cities, the availability of affordable, reliable and easy to access fiber and other broadband resources has contributed to economic growth, and has been particularly attractive to high tech and clean tech start ups. In San Leandro, for example, an underused office and industrial project – the Gate at West Gate Center – saw 60,000 square feet of additional space leased by several new, high tech companies within six months of being connected to the Lit San Leandro system.

3.3. Agricultural Technology Corridor

The southeast area of Salinas is being developed into a center for new agriculture-oriented technology companies, as well as the City's existing, core agricultural industry base. It extends from south of the downtown area, generally between the Union Pacific right of way and U.S. 101, to currently unincorporated (and undeveloped) area south of the city limits. It also encompasses existing industrial developments located to the west of the corridor, and major facilities to the east, such as the airport, fiber network access nodes and Monterey County offices, including the county's information technology center.

The City received a $3.5 million federal grant to rebuild infrastructure in the area, in order to support more intensive use of existing industrial properties and the development of new ones.

This area is also well served by existing intercity fiber optic routes, as discussed above, and will be a major hub for the new Sunesys intercity and metro fiber route that is currently under construction. Together with the City's existing and planned conduit in the area, the Agricultural Technology Corridor will have an accessible fiber optic backbone. Lateral connections can be easily made, either as

properties are built or redeveloped, or retrofitted with other construction techniques, such as microtrenching, as appropriate.

Figure 3.3 – Fiber routes and city-owned conduit in Salinas Agricultural Technology Corridor.

On the other hand, service from the primary incumbent broadband service providers is below the minimum standards set by the CPUC in many areas of the Agricultural Technology Corridor. As mentioned above, Comcast does offer service near the airport, there are significant gaps in its coverage of the area. AT&T's service levels are generally low and fail to meet CPUC standards, with upload speeds being particularly bad. The inconsistent nature of Comcast's availability and the poor quality of AT&T's service indicates that existing broadband infrastructure in the Agricultural Technology Corridor is poor, and based on the available, much of the area is eligible for broadband infrastructure construction subsidies from the CPUC.

Although the agricultural operations in the Salinas Valley are outside of the City of Salina's jurisdiction, connecting them to the Agricultural Technology Corridor is essential to its success. The intercity fiber routes that pass through Salinas on the way south are an important way of doing that. But wireless technology is also essential to the development of agricultural technology, such as centrally controlled smart irrigation systems, and can be an alternative means of providing connectivity to homes, farms and businesses, particularly in rural areas.

The existing fiber optic access points and routes, and planned new network construction in the Agricultural Technology Corridor can provide a solid foundation for extending wireless connectivity to the Salinas Valley. As noted above, the coverage and capacity of mobile networks depends greatly on the availability of long haul fiber connections, and the same is true for fixed wireless links. The Agricultural Technology Corridor can be the telecommunications hub for the entire Salinas Valley.

3.4. North Salinas

Undeveloped land, generally on the north side of East Boronda Road in north Salinas, is targeted for residential and commercial development. Plans include up to 15,000 new homes, as well as new business and office developments. As discussed above, the City has existing plans to include broadband conduit in street construction and improvement projects in the area, and intercity and metro fiber routes pass by two sides of it. City plans include construction of intersecting conduit along East Boronda Road.

As described above, it is common practice for fiber optic technology to be installed in new developments, instead of traditional copper wire infrastructure. However, as the experience with AT&T and Comcast in Salinas shows, incumbent service providers do not use it to provide inexpensive, high speed service to residents, instead opting to maintain existing pricing and service plans.

Two cities in California have addressed this problem by requiring newly constructed or remodelled homes to include independent conduit and/or fiber optic connections in development plans. The City of Brentwood requires new homes to be provisioned with two fiber optic conduits, one for an incumbent provider and the other owned by the City. Last year, Brentwood made an agreement with an independent Internet service provider to lease the conduit, install fiber and offer gigabit Internet service to residents for $40 per month.

Figure 3.4 – Fiber routes and city-owned conduit in north Salinas.

The City of Loma Linda also requires the installation of conduit, along with fiber and structured inside wiring, in new homes. The conduit and fiber are connected to the Loma Linda's municipal network, and residents can purchase Internet service from the City. This system also supports high capacity networks for a university, medical school and several hospitals.

4. Municipal broadband policy summary

4.1. Policy alternatives

There are specific steps the City can consider to build on its existing policy and provide further incentives for private companies to expand broadband infrastructure, as well as expand the base of city-owned assets:

- Formalize a policy, such as that currently being considered by the City and County of San Francisco, requiring entities that do certain kinds of excavation work in the public right of way provide it with the opportunity to install conduit. Such a shadow conduit policy would, in effect, formalize and expand the City of Salinas' existing process for installing its own conduit whenever a suitable excavation is undertaken.

- Consider code requirements for conduit sharing and joint use of trenches, including formalizing procedures for implementing both new and existing policy regarding street cuts and other types of excavations. Such requirements could include notification and coordination of street cuts by third parties.

- Evaluate development plans in order to 1. identify critical broadband infrastructure gaps and develop specific plans to fill those gaps, and 2. identify opportunities for low cost broadband infrastructure extensions, such as proactive microtrenching ahead of planned City street work.

- Establish detailed standards for submitting mapping data in GIS format, for both third party projects and City-owned facilities. Knowledge of where existing fiber and conduit routes are available will provide an opportunity for the City and telecommunications companies to explore the possibility of using existing routes, rather than paying for new construction and bearing the consequences of repeated excavations in public streets.

- Formalize inspection procedures for project work, and collection procedures and requirements for associated documentation, to support the above recommended policies.

- Develop broadband facilities requirements for new or major remodeled construction, either residential or commercial or both, similar to those in Brentwood and Loma Linda.

- Review permit processes and determine if any streamlining can be done.

- Establish the feasibility of creating a master encroachment permit and inspection process for large scale broadband infrastructure projects. Such a process would reduce costs and delays for prospective competitive broadband service providers and reduce the City's workload: a system intended to evaluate and manage unique, small scale projects is different from one used to manage a citywide project that uses standardized techniques, for example. This sort of process is similar to the one requested by Google Fiber[2] as it evaluated U.S. cities as locations for expansion of its fiber-to-the-

[2] *Google Fiber City Checklist*, Google Fiber, February 2014.

home business. It is not necessary to formally write and adopt this kind of policy, though. The objective is to be prepared to respond if a telecommunications company were to make such a request.

- Investigate potential sources of funding for broadband infrastructure development. Such sources include transportation and economic development grants, U.S. Department of Agriculture programs, the California Advanced Services Fund, other State of California and federal programs such as E-rate, and California Teleconnect, Telehealth and public safety funds. This development work can either be carried out independently by the City, or done in partnership with incumbent and/or independent private sector broadband companies.

Additional information on municipal broadband policy, business models and public/private partnerships is in Appendix D.

4.2. Case studies

In 2012, the City of San Leandro entered a public/private partnership with a venture called Lit San Leandro. The city provided non-exclusive access to the conduit network it installed to support its traffic signal system. In return the city received dark fiber for its own use, conduit lease revenue in later years and, most importantly, a boost to the local economy. In the second phase of this project, the city applied for and received a grant from the federal Economic Development Administration to install additional conduit in order to extend the fiber network.

The City of Watsonville has built a four-mile fiber optic network through business districts, including the downtown area. About three-quarters of that network was built using pre-existing conduit and fiber connections. The original intention was to replace an institutional network used to support the city's information technology system and previously provided for free by Charter Communications, but once built, private sector providers found it to be a valuable tool to support commercial and industrial grade broadband service.

Another example is the City of Santa Cruz, which has seen a significant increase in the number of people and businesses added to its downtown economy since an independently owned dark fiber link was built to Silicon Valley. This link, which the owner, Sunesys, is extending to Salinas, provided competition to (and a wider range of choices than) the services offered by AT&T and Comcast. Several co-working centers have sprung up to support entrepreneurs, freelancers, telecommuters and others. City government has taken the next step and entered into a negotiating agreement with a local Internet service provider to build fiber-to-the-premise infrastructure to every home and business in the city.

Other cities that are directly involved in promoting broadband development and pursuing projects include Palo Alto, Benicia, Alameda, Los Angeles and Santa Monica. More information can be found in Appendix D. Each city has different resources, needs and priorities, but all have a common interest in ensuring local businesses have access to state-of-the-art broadband service.

4.3. Municipal broadband matrix

		Markets Served				
City	**Ownership**	**Business**	**Industrial**	**Public uses**	**Amenity WiFi**	**Homes**
Alameda	Formerly public, now private; revenue bond funding.	•		•		•
Austin, TX	Google Fiber, private.	•	?	•		•
Benicia	Private with public funding via transportation grant.	•	•			
Brentwood	Conduit developer funded & city-owned; private system operator.	•	?	•		•
Kansas City	Google Fiber, private.	•	?	•		•
Loma Linda	Conduit developer funded; city owns & operates system.	•	•	•		•
Lompoc	City owned & operated, funded via electric utility. WiFi only.			•	•	•
Pacific Grove	Private, city funding undefined.	•		•		•
Palo Alto	City owned & operated, funded via electric utility. Dark fiber only.	•	•	•	•	
Provo, Utah	Built via city utility revenue bonds; sold to Google for $2; ratepayers still liable.	•	?	•		•
San Francisco	CCSF owned; operated as an ad hoc service; built with IT budget funds.		•	•		
San Leandro	City owned conduit, partially funded by EDA grant; leased to private company.	•	•	•	•	
Santa Clara	City owned & operated, funded via electric utility. Dark fiber only.	•	•	•	•	
Santa Monica	City owned & operated “lit service”: system built with IT budget funds.	•	•	•	•	
Watsonville	City owned; operated as an ad hoc service; built with IT budget funds.		•	•		

5. Conclusions and options

5.1. Findings

The information gathered and analyzed during the course of this study, regarding existing broadband infrastructure, City resources and policy, and development objectives, leads to the following conclusions:

- Generally broadband infrastructure in the City of Salinas is average, as compared to California as a whole, and above average compared to other communities in Monterey County.

- AT&T and Comcast are the two primary telecommunications carriers in Salinas and offer broadband service to nearly all homes and businesses, on generally the same terms and at the same service level as elsewhere in California.

- Broadband providers that specialize in serving business customers are also present in Salinas, although not on a widespread basis. The areas targeted by these specialty providers, particularly the southeast and downtown areas of Salinas, have also been targeted by AT&T and Comcast.

- Despite this focus, data provided by AT&T and Comcast to the California Public Utilities Commission indicates that the underlying broadband infrastructure in commercial and industrial areas of Salinas, and in the southeast area in particular, is substandard.

- Salinas is served by several fiber optic routes that provide connections to major Internet exchanges in the San Francisco Bay Area and southern California, and, in some cases, offer the potential to provide local service directly to locations within the city.

- The City of Salinas owns approximately 16,000 feet of conduit that is available to support construction of additional fiber optic networks, and has plans to build 108,000 feet of additional conduit in the next few years.

- The City's economic development goals include attracting new businesses and supporting the growth of existing businesses in the downtown area, including the adjacent Alisal Marketplace area, and developing the Agricultural Technology Corridor in the southeast area of Salinas.

- The City is also anticipating building several thousand new residential units in north Salinas.

- The City's existing conduit, its plans for building additional broadband facilities and its other assets coincide geographically with these development goals. The same is true of the privately owned fiber networks that connect Salinas to major Internet hubs and serve locations within the city.

Taken together, these conclusions point to an opportunity for the City of Salinas to foster economic growth and residential construction by proactively developing broadband infrastructure, facilities and service, particularly for commercial and industrial users.

5.2. Development options

Similar to planning roads and water supplies, assessing broadband infrastructure alternatives includes consideration of the immediate needs of existing companies as well as long term growth requirements for planned commercial and industrial development, new businesses that might be relocated or started in Salinas and new residential construction.

Even though existing broadband infrastructure is average, and in some key economic areas sub-standard, the City of Salinas is well positioned to make targeted improvements in its broadband infrastructure and meet the increasing demand for low cost, high capacity, reliable broadband infrastructure and service from consumers as well as new and existing businesses. The City owns and plans to build conduit routes in areas targeted for economic development and, as described above, can adopt policies that extend this infrastructure even further. Several existing and planned long haul fiber routes pass through Salinas, and can provide competitive, state of the art connections to major Internet hubs, if developed properly.

Options include:

Evaluate the use of existing city conduit as the basis for a commercial and industrial grade fiber network. Although costs would depend on a number of unknown factors, such as the type and extent of the desired network, installing fiber optic lines in existing conduit and building the necessary supporting infrastructure is possible, either as a municipal project or as a public/private partnership.

Issue an RFP. In line with the goals set, a request for proposal (or similar) could be used to ask private sector companies to submit ideas for using the City's broadband facilities, and particularly its conduit. The request could be structured around a public-private partnership, or a straight lease arrangement, or simply left open.

Develop a phased build out plan. There are steps the City can take immediately with its existing conduit and fiber resources, steps that can taken in the near future in conjunction with existing projects, such as street maintenance, and steps that are difficult to implement now but could be done over time. These phases could, if desired, mix municipal and private sector projects, and commercial and residential development.

Assess interest in and capacity for financing broadband infrastructure. Although it can be difficult to gain approval for bond measures, new legislation enacted last year (Senate Bill 628) gave local agencies the ability to form enhanced infrastructure financing districts and issue tax increment financed bonds with 55% voter approval. These districts can also use incremental property tax gains to pay back other kinds of financing, including private loans. Additionally, Assembly Bill 2292 added broadband infrastructure to list of allowable projects that may be pursued by traditional infrastructure financing districts. It is possible to pursue grant money from both the State of California and the federal

government. For example, the California Public Utilities Commission offers grants for the installation and/or upgrading of broadband facilities in public housing.

Assess the potential for using existing City funds. This option is likely to be limited in scope, but, for example, the City could be an anchor tenant on new infrastructure built by a private carrier. Even a small amount of guaranteed revenue at the beginning of a long term, capital-intensive project can make a big difference in the attractiveness of the business model to investors.

5.3. Public/private partnerships

As detailed in Appendix D, cities that have successfully built and operated completely municipally owned broadband systems tend to be those that either have a long track record of utility operation, such as Palo Alto, or are in unique circumstances, such as Loma Linda, which is four square miles and has more hospital beds than homes. Public/private partnerships, on the other hand, have been successful when the city involved is both an active partner and has significant assets to contribute. San Leandro is an example of a city that jump started economic development by combining its existing conduit network with a committed private sector partner and federal grants.

The City of Salinas is in the latter category. It owns conduit, it is building conduit, it is improving key economic development areas with local, state and federal funds, and, like San Leandro, it has a small core of high tech businesses – agriculturally related, in Salinas' case – that can immediately benefit from improved broadband service.

A public/private partnership has advantages and disadvantages. The City would give up day-to-day control of any system that is built, so care would have to taken to ensure that agreements are designed to identify key interests of all parties and structured so that those interests are aligned.

On the plus side, the public/private partnership model is a proven method of pursuing infrastructure projects, including broadband upgrades. It can be implemented quickly and with little risk to the City. On the whole, it is the most suitable alternative for Salinas.

5.4. Recommendation

The City of Salinas should explore the possibility of entering into a partnership with one or more experienced fiber optic network companies to build and operate either a unified system that directly serves commercial and industrial customers, indirectly supports the development of improved residential broadband and serves as a hub to extend broadband connectivity to the Salinas Valley, or a combination of systems that achieves the same goals.

A request for proposals (RFP) or similar solicitation should be distributed to potential partners. The RFP would set out basic economic development goals for key areas in Salinas, describe existing and planned City assets and contain information that quantifies the market opportunity, particularly in terms of commercial real estate development.

The City of Salinas would offer:

- Systemwide access to conduit.
- Method, plans and budget for conduit extensions.
- Right to serve new construction via City-owned conduit.
- Access to intercity fiber.
- Access to other City assets, e.g. data centers, antenna sites, real estate.
- Development and coordination of anchor customers.

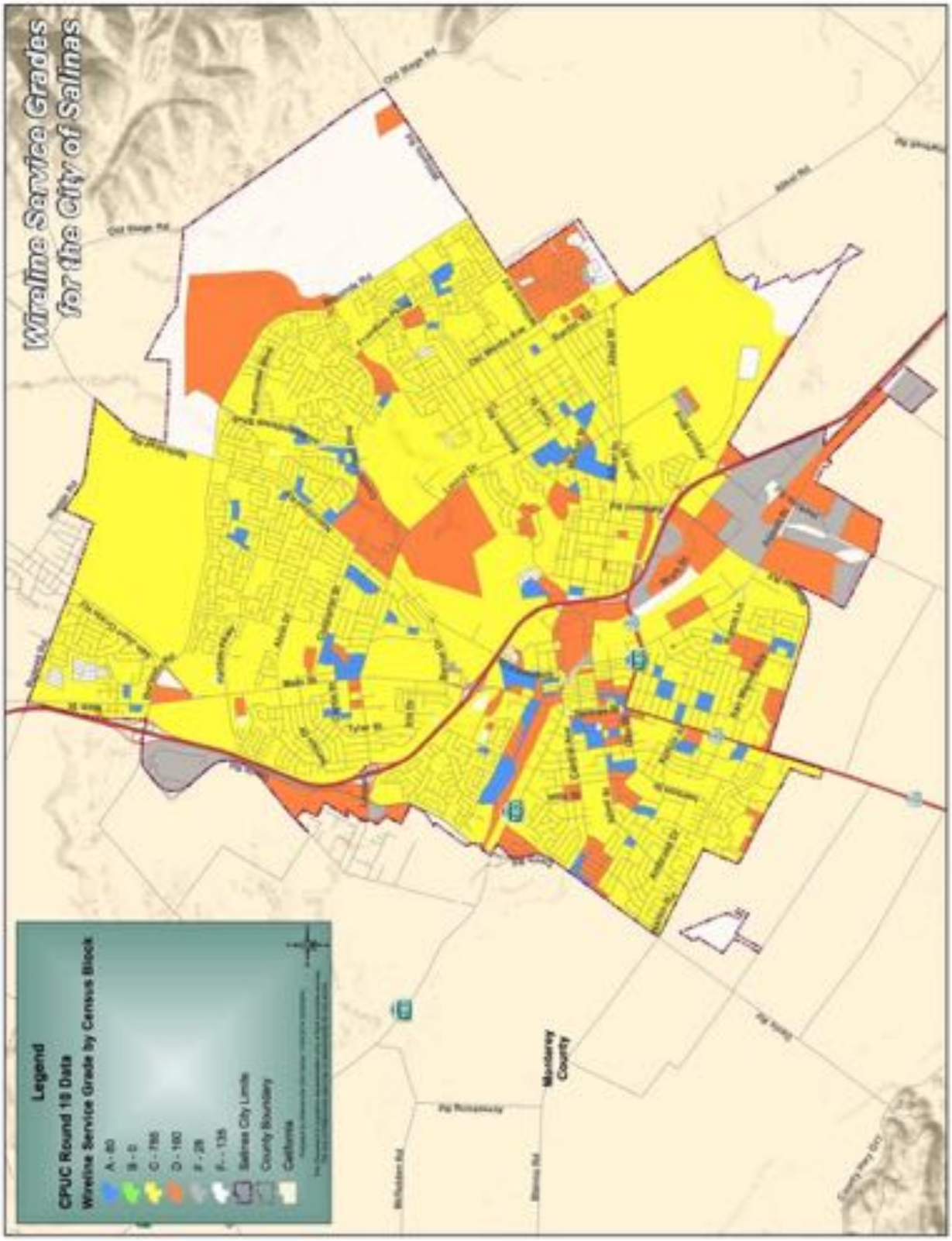
The City of Salinas would request:

- Installation of high strand-count cables in 100% of existing and future conduit.
- Plans for and a commitment to fill gaps in the system, with specific provisions for economic development priorities.
- Plans to support wireless connectivity and, to the degree appropriate, support broadband development in the Salinas Valley.
- Full commercial access to dark fiber.
- Public rate card for fiber lease, lit services, connections to network.
- Participation in conduit extensions.

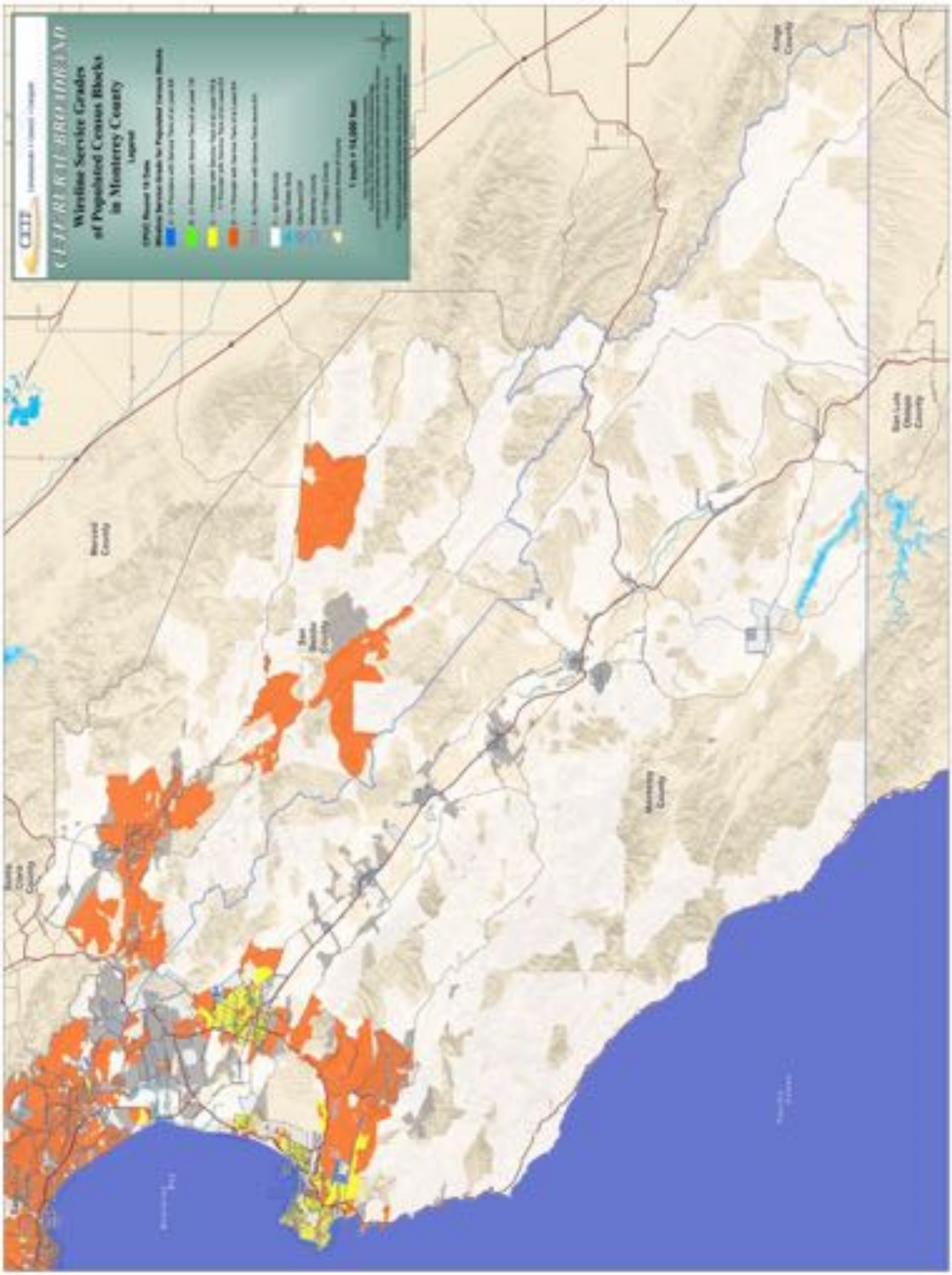
Respondents should be encouraged to be creative, look for synergies with other projects and to be brief but specific. Long and/or generic responses should be discouraged. The immediate objective is to attract as many high quality proposals for building out a modern fiber network in Salinas as possible.

Appendix A - Broadband infrastructure and service maps

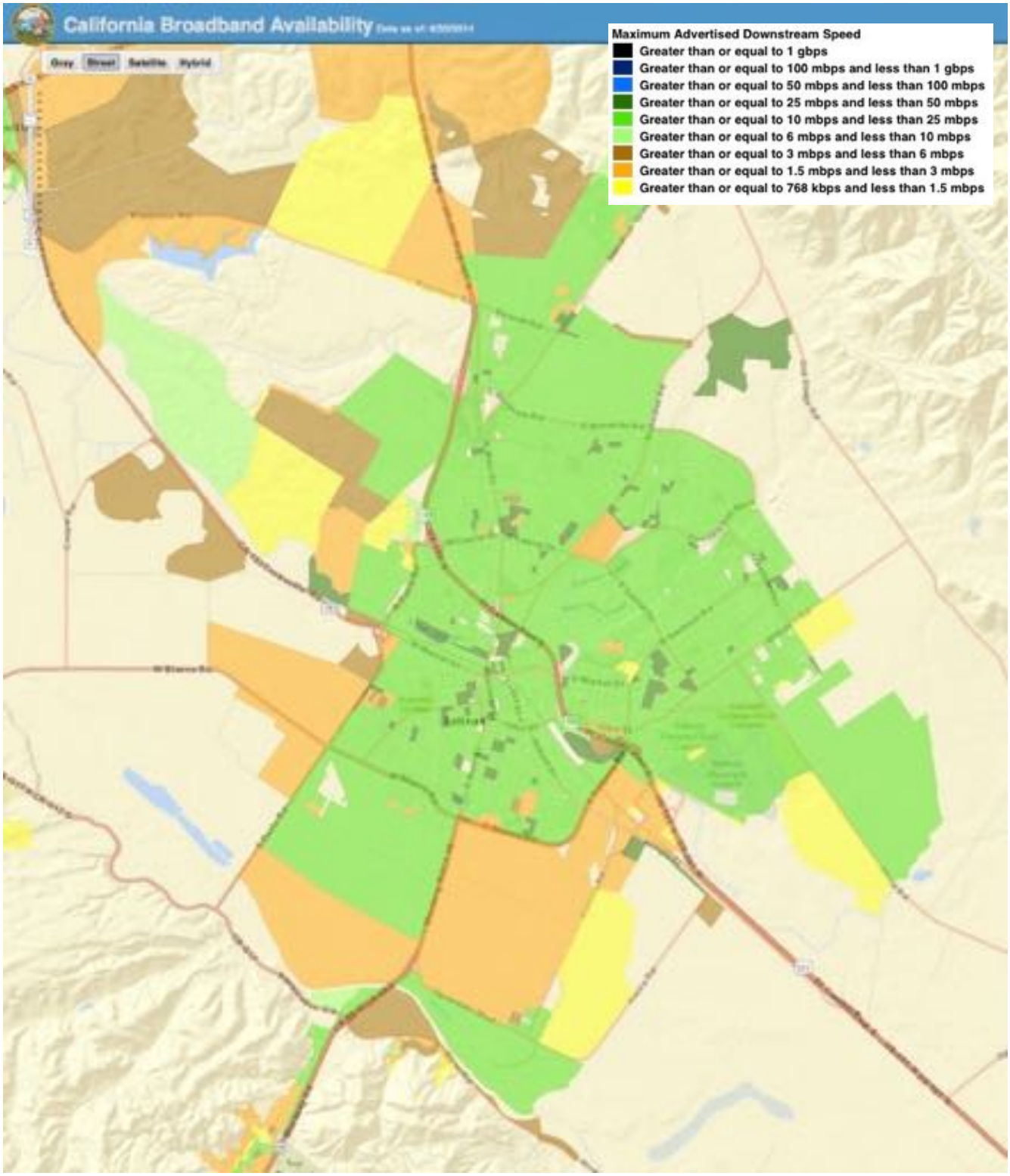
City of Salinas broadband infrastructure report card



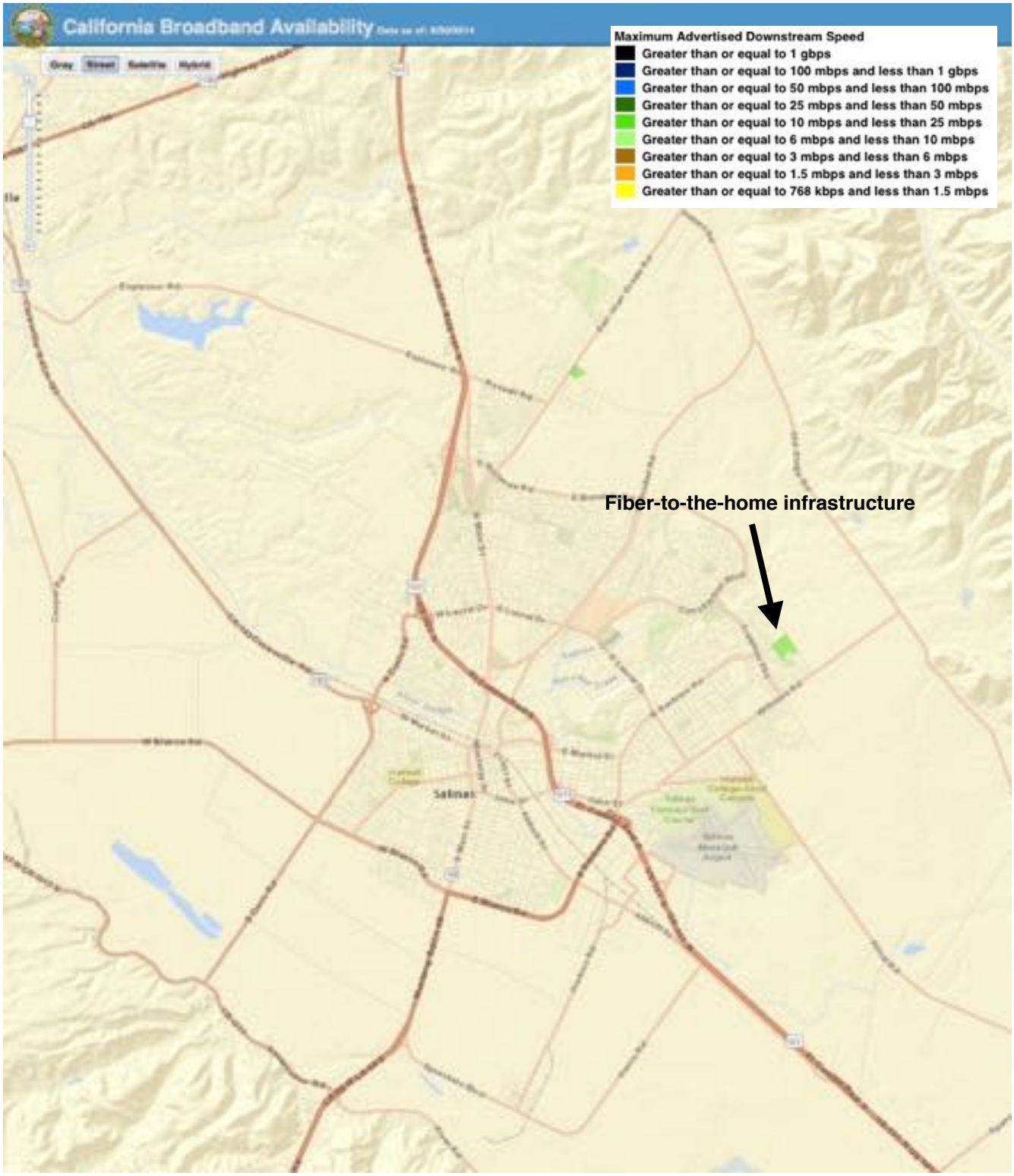
Monterey County broadband infrastructure report card



AT&T DSL service

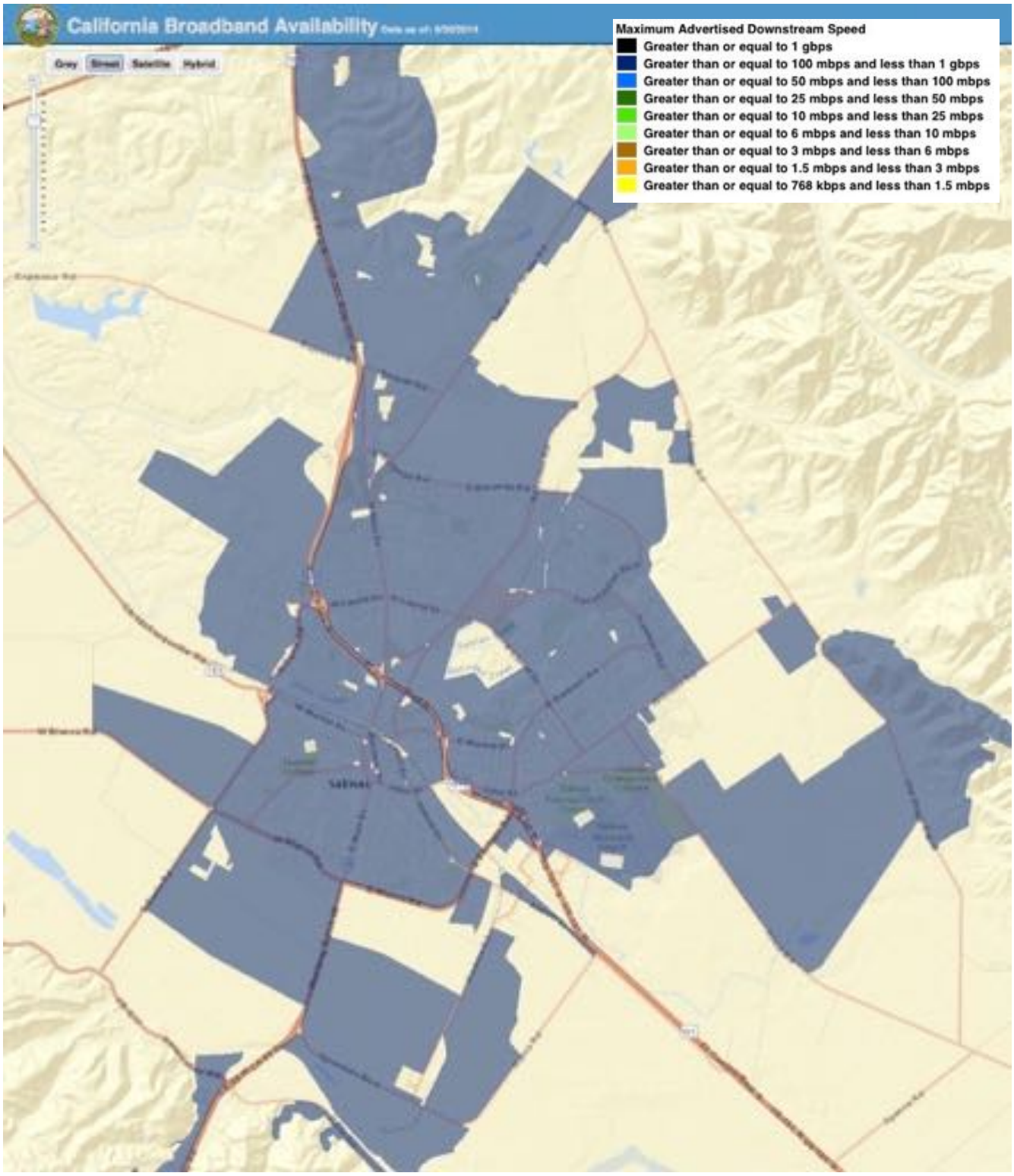


AT&T fiber service



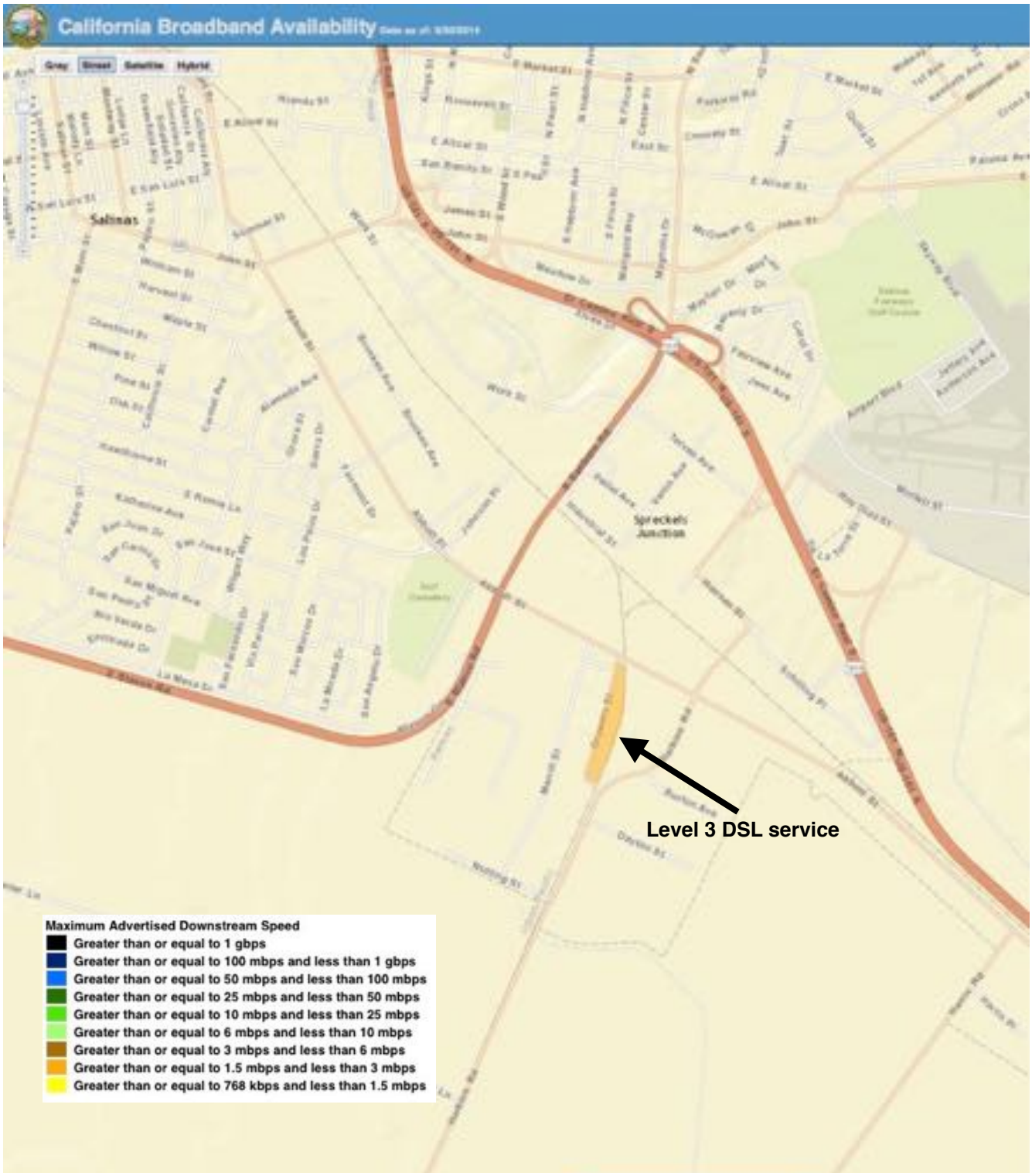
AT&T local backbone fiber network

Comcast DOCSIS 3 service

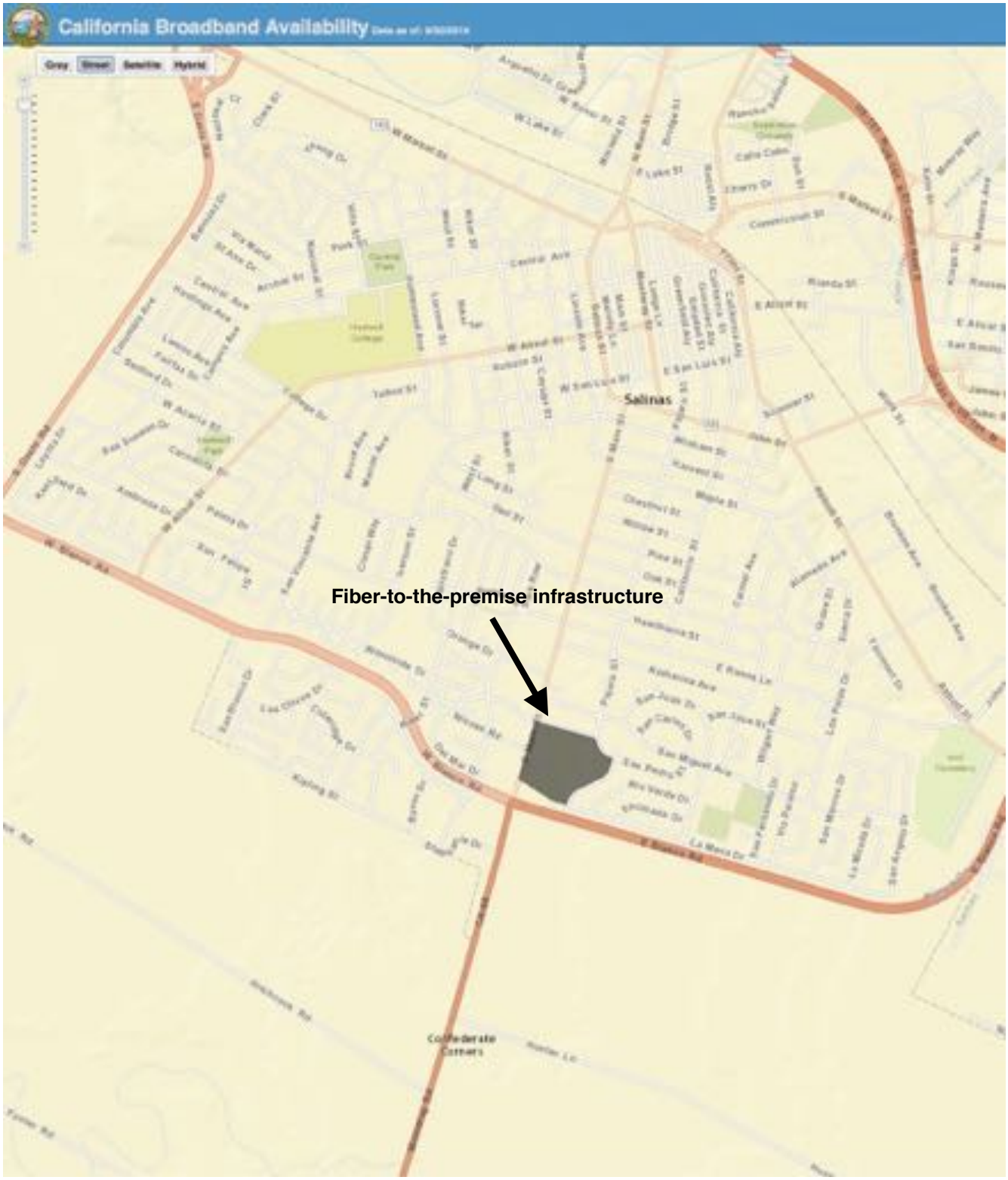


Comcast backbone fiber network

Level 3 DSL service

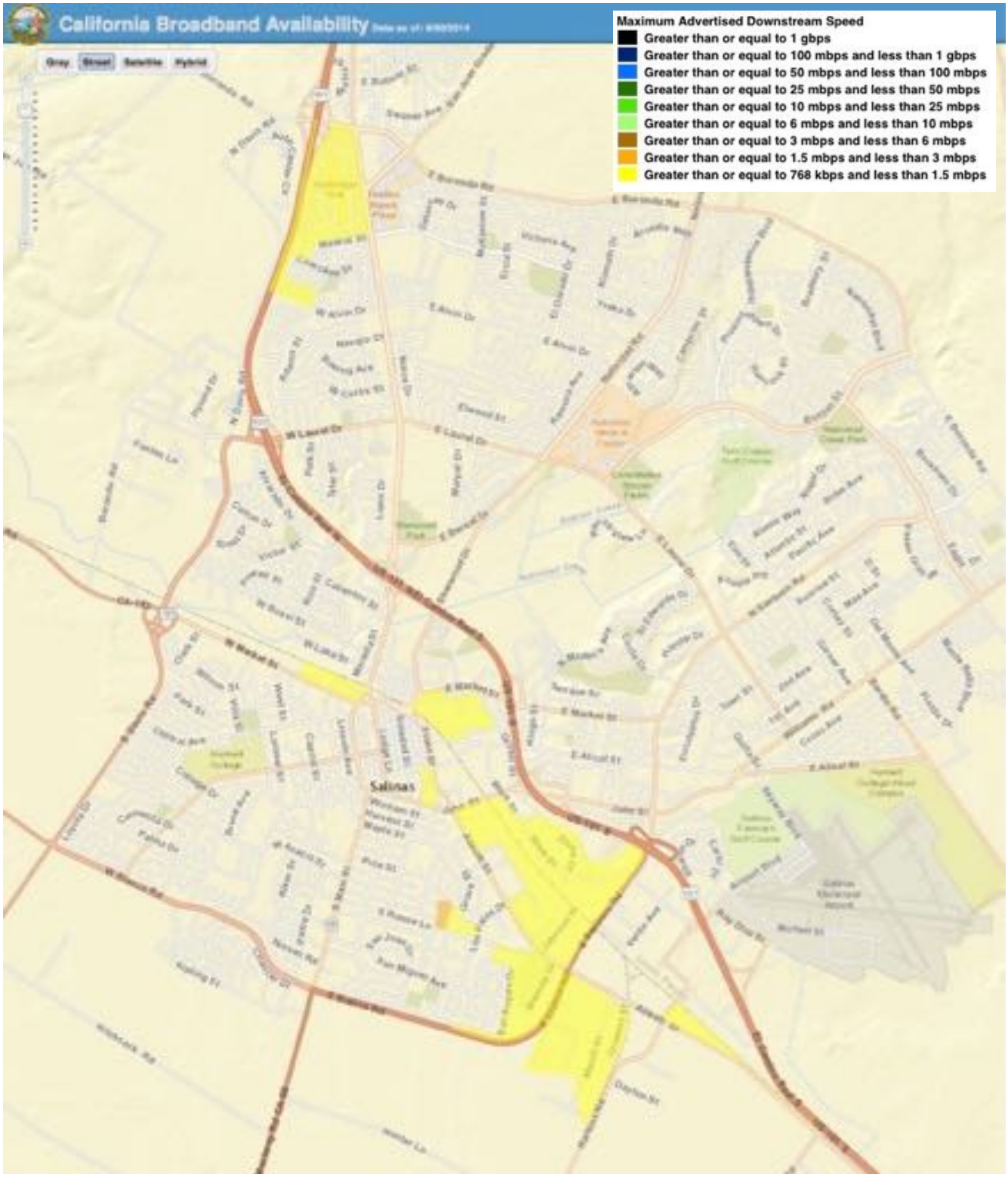


Level 3 fiber service

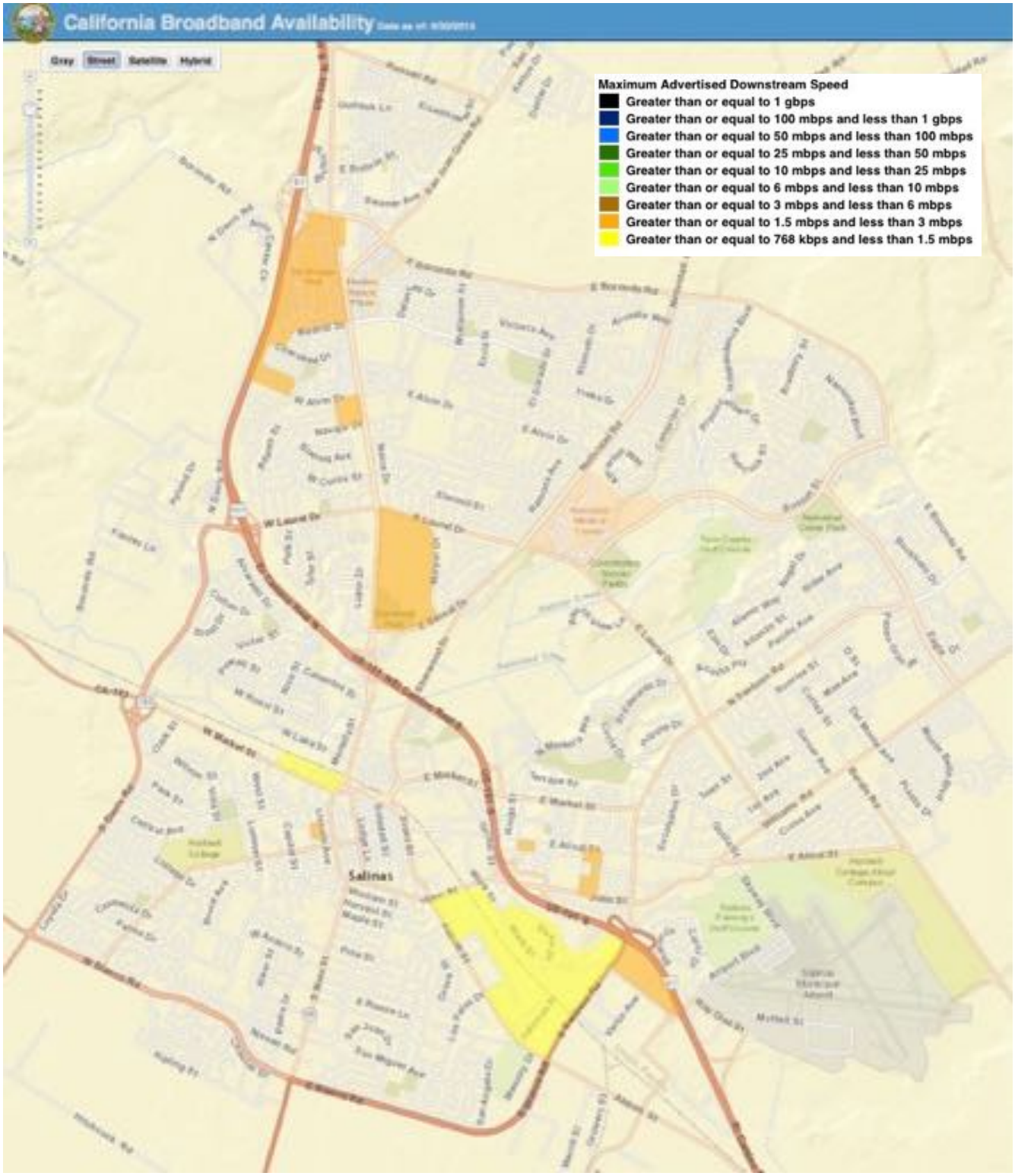


Earthlink DSL service

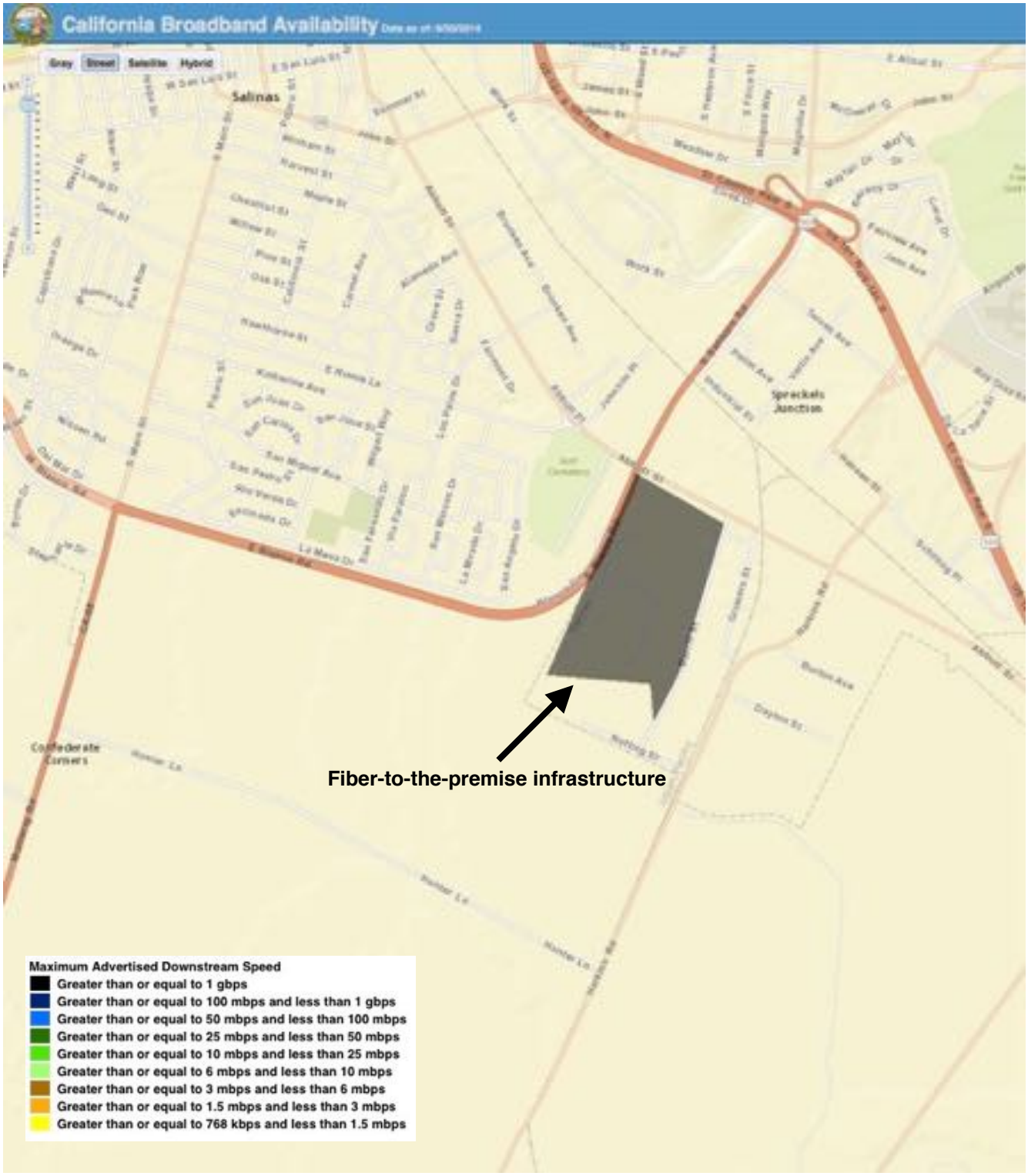
Earthlink symmetrical DSL service



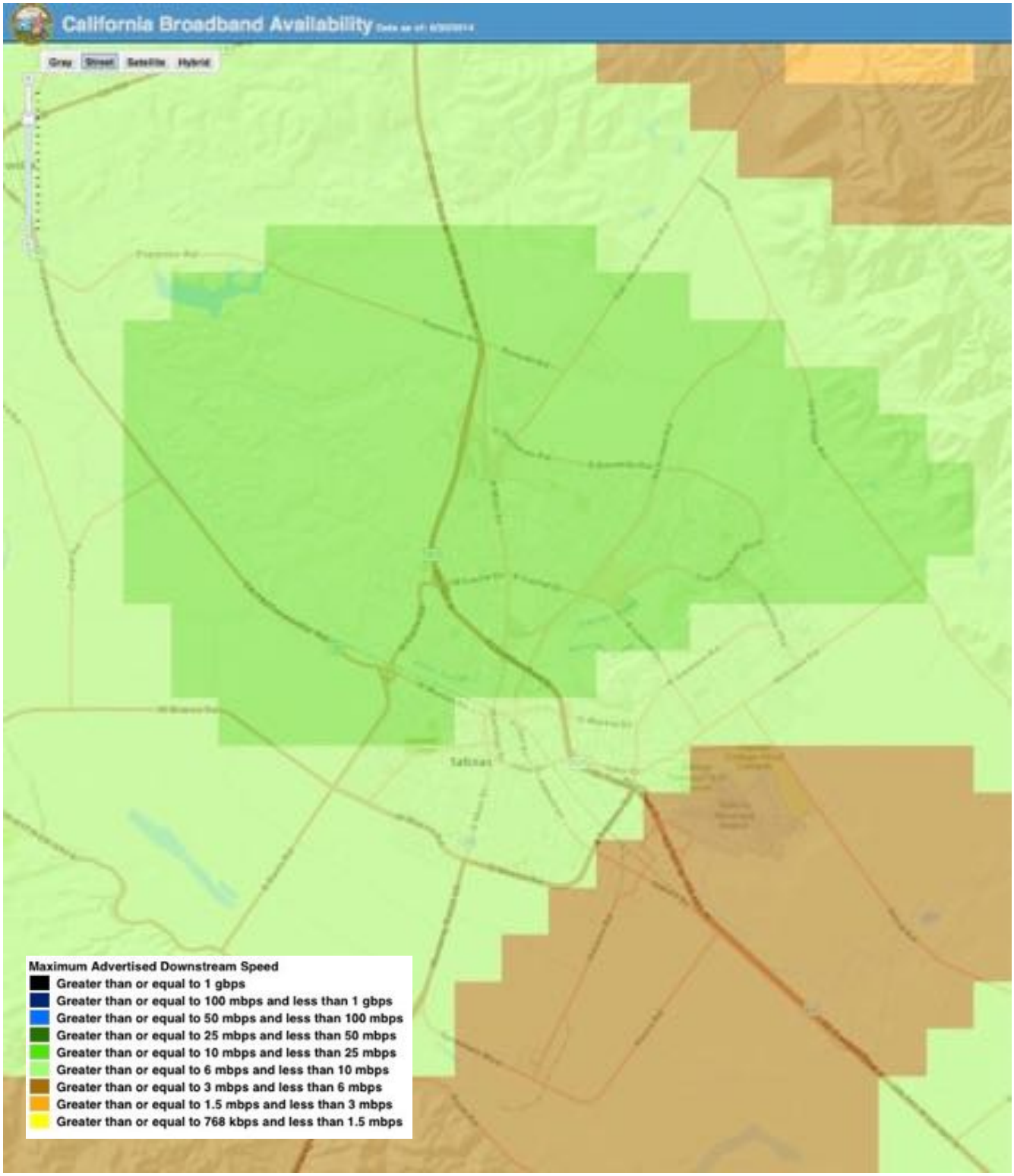
Earthlink asymmetrical DSL service



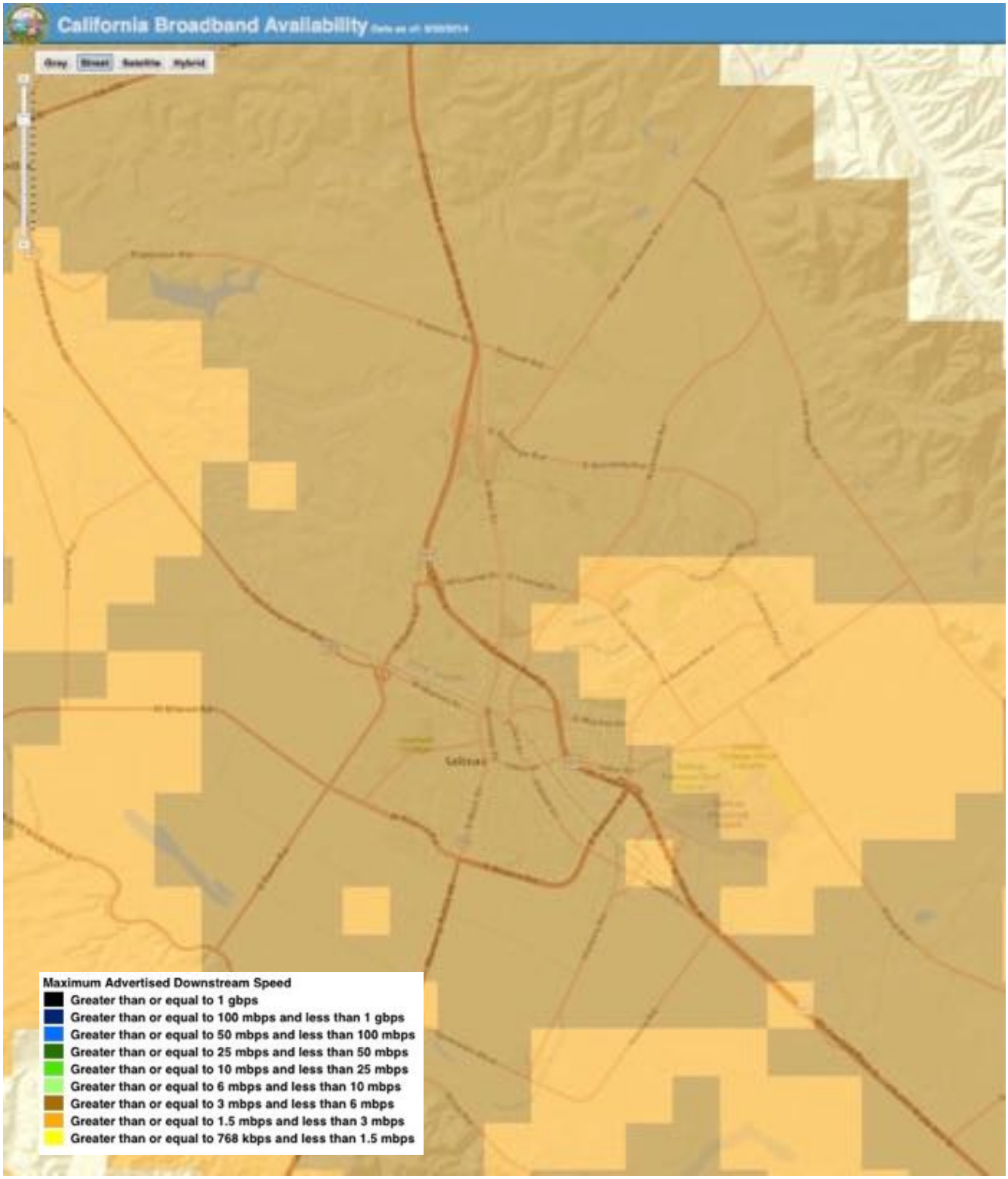
Windstream fiber service



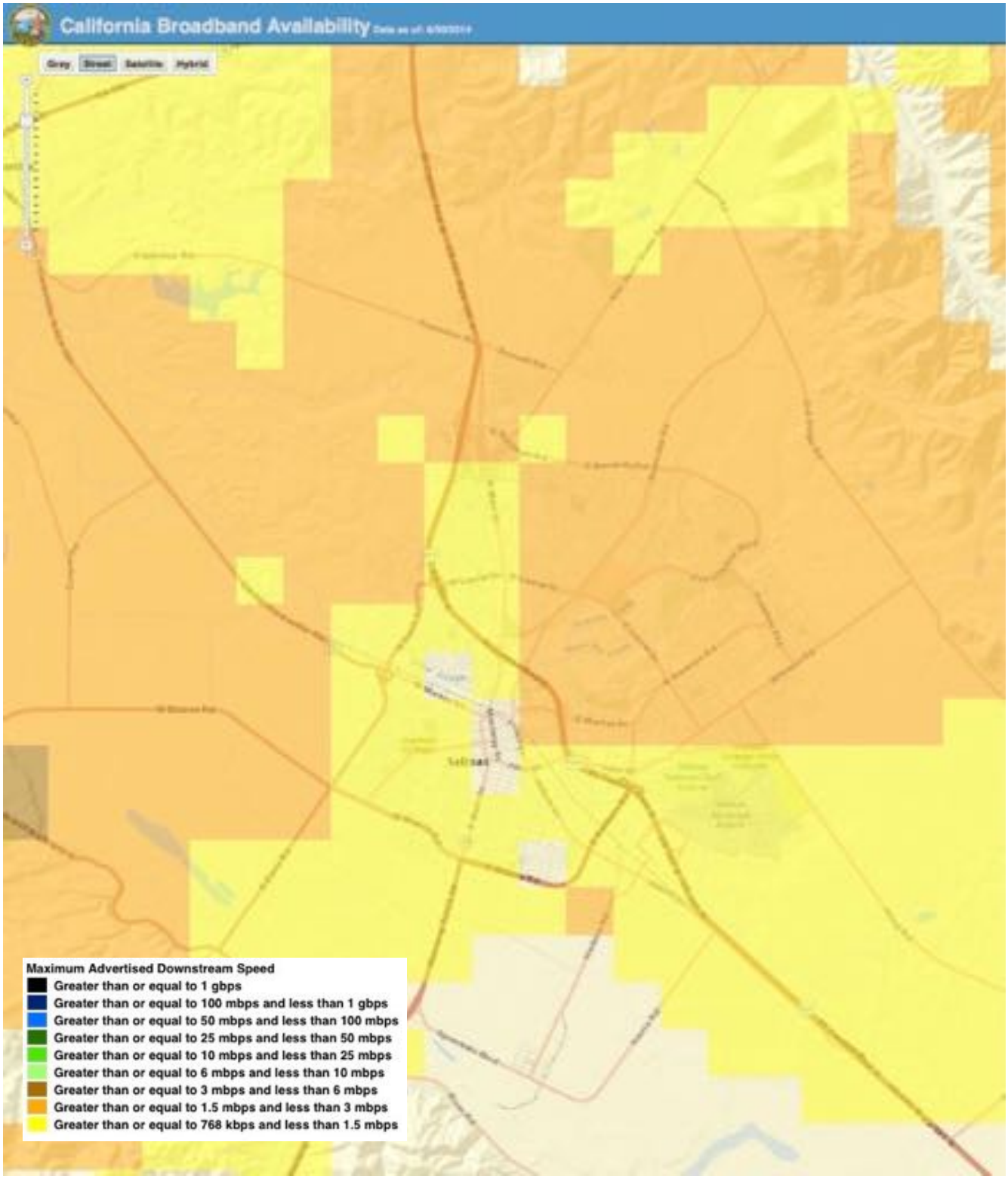
AT&T mobile broadband service



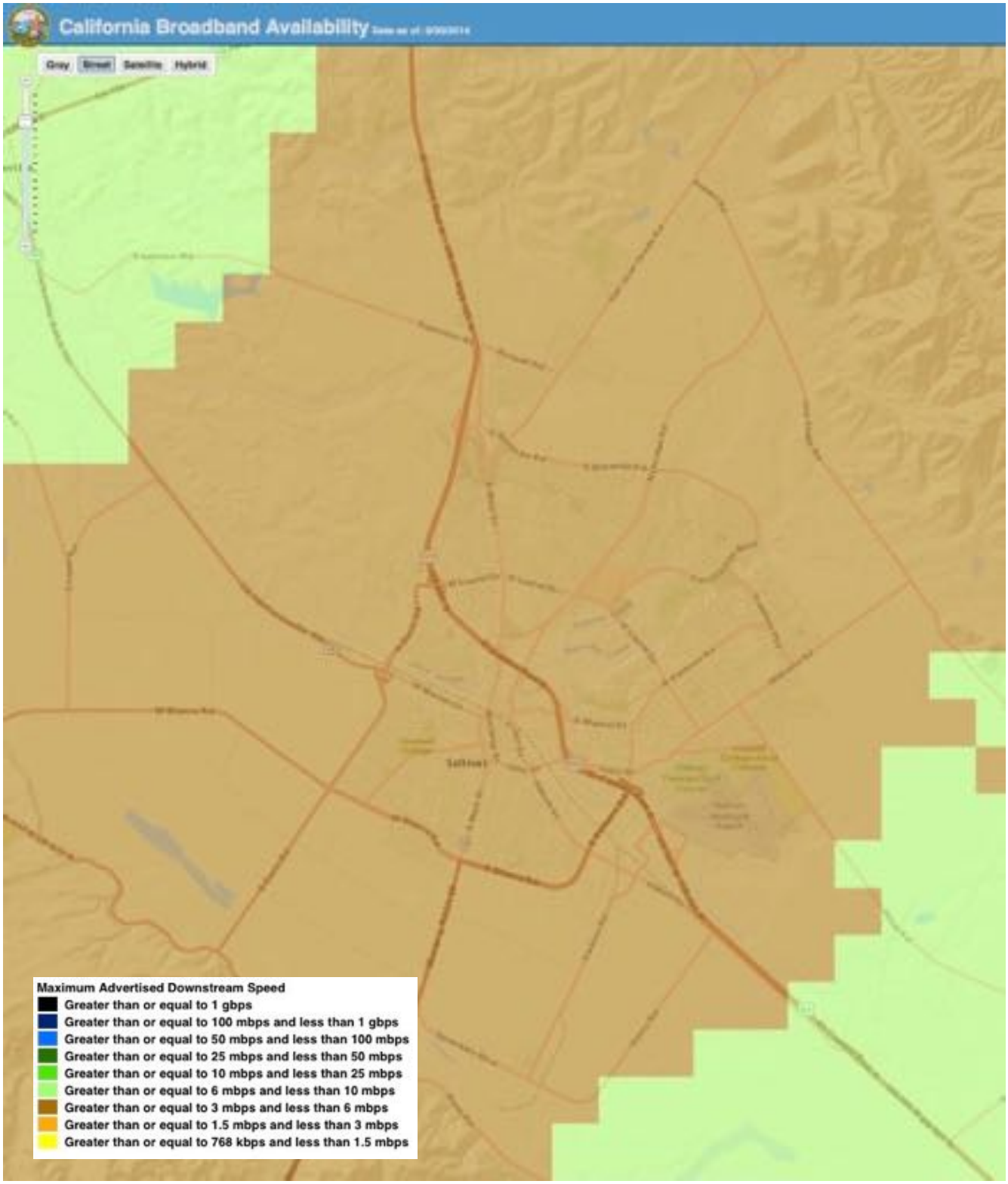
Sprint mobile broadband service



T-Mobile mobile broadband service



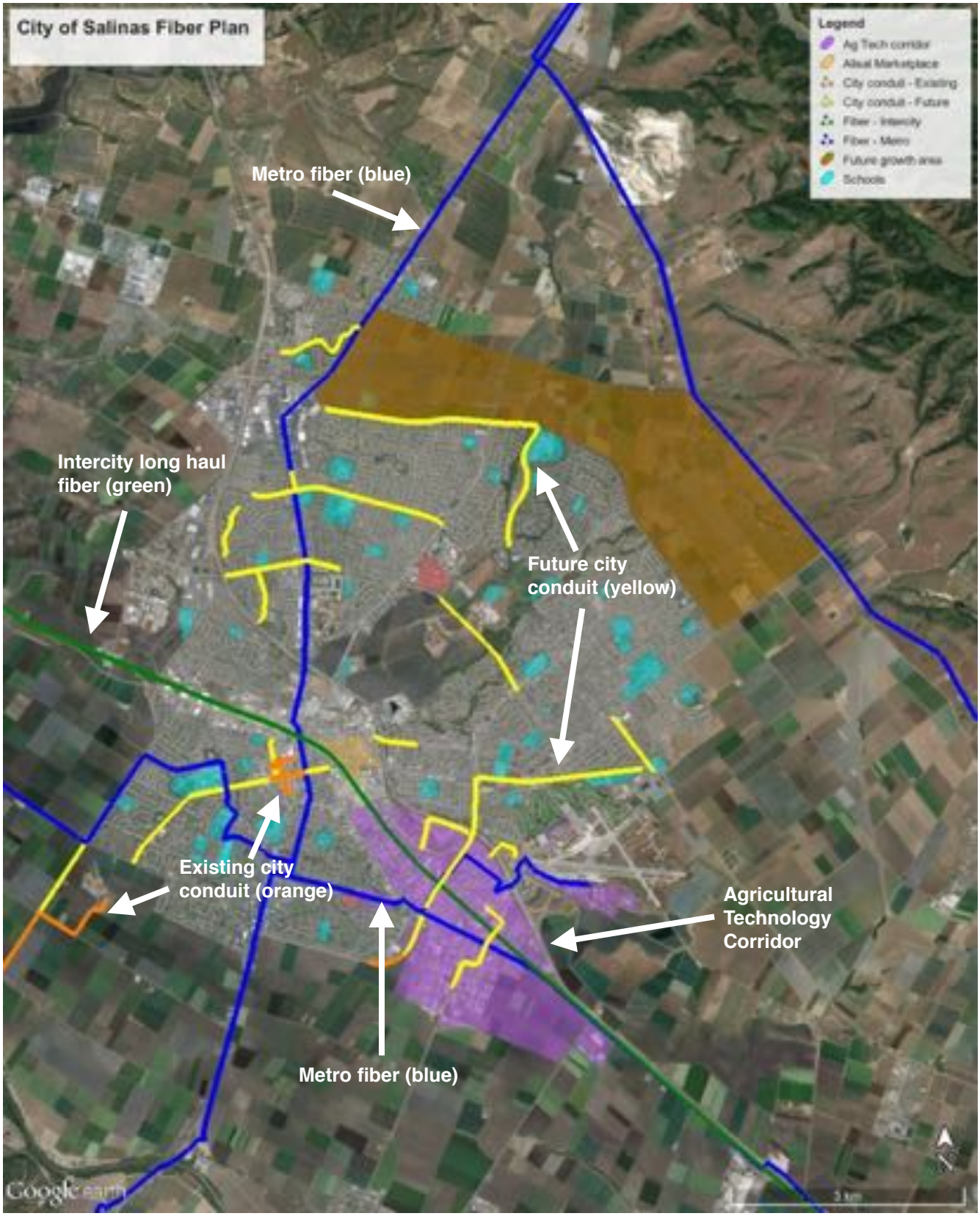
Verizon mobile broadband service



Fixed wireless broadband service

Appendix B - City of Salinas broadband infrastructure maps

Overview



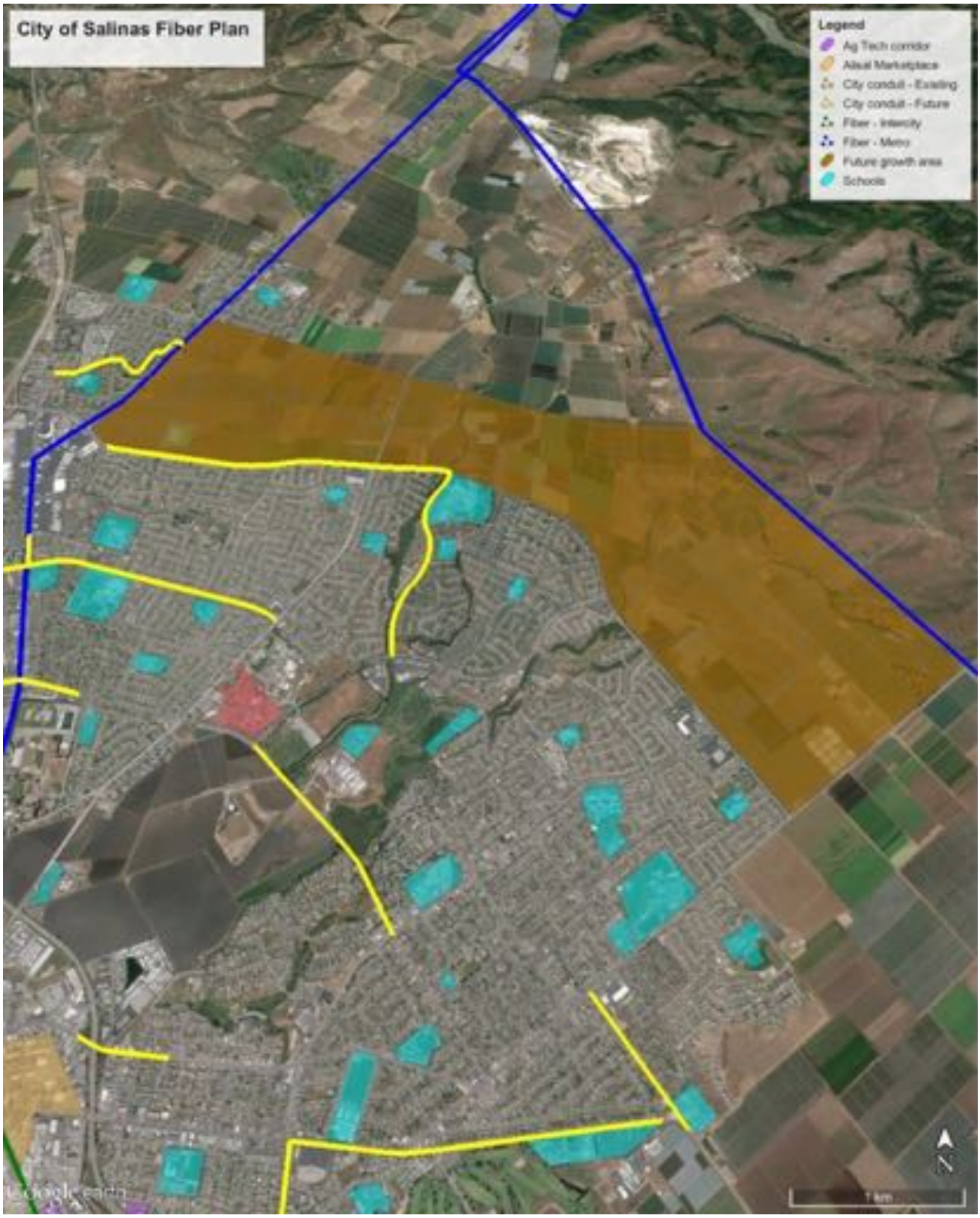
Salinas - fiber and conduit

Downtown Salinas - fiber and conduit

Salinas Agriculture Technology Corridor - fiber and conduit

Alisal Marketplace - fiber and conduit

North Salinas development area - fiber and conduit



Salinas – intercity fiber optic cable routes

Appendix C - Infrastructure grades

Broadband Report Card - Monterey County

Rank	Community	Grade	GPA
1	Sand City	C+	2.6
2	Pacific Grove	C+	2.3
3	Seaside	C	2.1
4	**Salinas**	**C**	**2.0**
5	Del Monte Forest	C-	1.9
6	Monterey	C-	1.9
7	Marina	C-	1.7
8	Del Rey Oaks	D	1.2
9	Boronda CDP	D	1.1
10	Pajaro CDP	D-	0.9
11	Carmel Valley Village CDP	D-	0.9
12	Las Lomas CDP	D-	0.8
13	Spreckels CDP	F	0.2
14	Carmel-by-the-Sea	F	0.1
15	Prunedale CDP	F	0.1
16	Moss Landing CDP	F	0.1
17	Castroville CDP	F	0.0
18	Soledad	F	0.0
19	Aromas CDP	F	0.0
20	Bradley CDP	F	0.0
21	Chualar CDP	F	0.0
22	Elkhorn CDP	F	0.0
23	Gonzales	F	0.0
24	Greenfield	F	0.0
25	King City	F	0.0
26	Lockwood CDP	F	0.0
27	Pine Canyon CDP	F	0.0
28	San Ardo CDP	F	0.0
29	San Lucas CDP	F	0.0
	Rest of County	F+	0.4
	Monterey County (overall)	D	1.1

Methodology

In a study conducted for the East Bay Broadband Consortium (EBBC) in 2013[3], 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 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, and to do in-depth analysis of broadband service and infrastructure in Monterey, Santa Cruz and San Benito counties.

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. The most recent data available was submitted by carriers as of 30 June 2014. 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.

The data was examined, and irrelevant data points that skewed results were removed, such as data for undeveloped land or institutions such as jails or prisons. 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.

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

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 D – Municipal broadband planning

A. Role of municipalities

The California Public Utilities Commission (CPUC) regulates "telephone corporations" and, to a lesser extent, "cable television corporations" and "video service providers"[4]. These categories include AT&T and, to a restricted extent, Comcast, which are the two primary retail broadband service providers in Salinas. Intercity carriers are also regulated as telephone corporations.

Responsibility for regulating telephone corporations is shared between the CPUC and the Federal Communications Commission (FCC). Municipalities are allowed no authority in that regard.

Cable television regulation

Originally, regulation of cable television corporations was the responsibility of local government in California, however that changed with the adoption of the Digital Infrastructure and Video Competition Act (DIVCA) by the California legislature in 2006.

DIVCA established statewide franchises for video service providers, which now includes telephone companies such as AT&T. DIVCA severely limits the role cities and other local government entities may play in regulating or otherwise influencing video service providers. Cities still receive a 5% franchise fee from video franchise holders, and have a limited opportunity to inspect their books to ensure compliance. Requirements for public access channels, consumer protection rules and obligations to build out infrastructure are also subject to municipal review, but enforcement authority is severely limited, often to the point of being impractical.

Encroachment permits

The primary regulatory role remaining to cities is the ability to approve or deny applications for encroachment permits for the use of the public right of way on the basis of neutral "time, place and manner" standards.

The FCC's recent decision[5] to bring "broadband Internet access service" under common carrier regulation (often referred to as the "network neutrality" decision) tries to draw a clear line between what kind of regulation does and does not apply to providers of those services. In particular, the FCC has ruled out regulation, by itself or states, of Internet service offerings, rates, or access to infrastructure by third parties, except to say that it will review complaints on an after-the-fact basis using a "just and reasonable" standard. The decision specifically allows "any body politic, or municipal organization", as well as individuals and state utility commissions, to file complaints. It establishes

[4] The distinction between "cable television corporation" and "video service provider" is *de minimis* for the purpose of this report, and the terms will be used interchangeably.

[5] *In The Matter of Protecting and Promoting the Open Internet;* Report and Order on Remand, Declaratory Ruling, and Order; Federal Communications Commission; adopted February 26, 2015 and released March 12, 2015.

formal and informal procedures for doing so, and creates an ombudsman's position to facilitate the process.

However, some aspects of Internet service and infrastructure are still open to regulation under common carrier rules, including pole attachments and conduit access and, to an unspecified extent, universal service policies, both of which are under the CPUC's jurisdiction. Other rules that will be enforced include those that relate to consumer protections and privacy, and accessibility provisions.

Cities have greater flexibility when it comes to managing publicly-owned assets and providing services directly. Cities in California are free to decide whether or not to build and operate telecommunications facilities, establish Internet service utilities or manage assets that could be used for those purposes. The FCC has reaffirmed that cities maintain wide discretion when negotiating with telecommunications companies over the use of city-owned facilities, as opposed to simply regulating access to the public right of way.

Municipal broadband utilities

The FCC has also affirmed the right of cities to compete on an even basis with privately-owned Internet service providers. In a decision[6] that pre-empted state-imposed restrictions on municipally owned broadband utilities, the FCC said, in effect, that states have the authority to prevent cities from building broadband infrastructure and providing Internet service, but cannot impose restrictions that put municipal systems at a competitive disadvantage to privately owned ones.

California law contains no such ban and makes a few, relatively minor distinctions between municipal and privately owned Internet service providers. This preemption of authority by the FCC is being appealed in federal court by two States – Tennessee and North Carolina – but assuming it withstands those challenges it would inhibit changes to the status quo in California.

B. Types of infrastructure

Definitions

Consumer-grade Internet access is typically a shared resource, with many subscribers contending for the same bandwidth, and is subject to speed and volume limits as determined by the provider. This type of service often meets the needs of small and medium businesses, but not always. And it is generally inadequate for larger companies, which need commercial and industrial grade broadband facilities.

"Commercial grade" service is defined as being 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. Comcast's Business Class service or AT&T's business DSL service are examples of commercial grade service.

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[6] *In the Matter of City of Wilson, North Carolina Petition for Preemption of North Carolina General Statute Sections 160A-340 et seq. and the Electric Power Board of Chattanooga, Tennessee Petition for Preemption of a Portion of Tennessee Code Annotated Section 7-52-601*; Memorandum Opinion and Order; Federal Communications Commission; adopted February 26, 2015 and released March 12, 2015.

"Industrial grade" service refers to situations where the customer plays a much greater role in building 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 found in top tier Internet exchanges. DS-3 circuits or dark fiber strands are examples of industrial grade service. Large industrial customers frequently buy services directly from middle mile providers.

Differences

It is much easier for broadband service providers to generate an acceptable return on investment in residential areas than in commercial or industrial ones, particularly densely populated urban and suburban neighborhoods. Standardized equipment can be used to provide a managed level of service, and each home can be offered a wide range of products including Internet access, television programming and telephone service. It is a predictable business, and capital investments can be made with a reasonable degree of certainty.

Industrial and commercial customers are more diverse and less predictable than residential subscribers. One business might need Gigabit speeds at the highest quality-of-service levels, while the one next door is content with a standard, relatively slow DSL connection. As a result, incumbent carriers tend to approach commercial and industrial customers on a case by case basis or, as AT&T is doing, be extremely selective in choosing which neighborhoods and business districts to upgrade. They do not prospectively build high speed infrastructure. Businesses seeking higher grade service are frequently presented with installation estimates in the thousands and tens of thousands of dollars range.

The experience of other cities, particularly those in the Bay Area (see below), shows that relatively small-scale efforts can result in significant improvements in commercial and industrial grade broadband infrastructure by reducing the risk for private telecommunications companies. These steps have included streamlining permitting procedures, directing redevelopment funds towards broadband projects and other measures.

C. Broadband policy

As discussed above, cities have little or no direct role in regulating Internet service providers. However, cities can implement policies that help or hinder broadband infrastructure development and competition. Options include managing the use of city-owned facilities by Internet service providers, setting policy for shared use of public right of ways and becoming directly involved in developing broadband infrastructure and even providing services, with or without private sector partners. Policy initiatives that encourage broadband infrastructure development can have a significant impact on the availability of service and facilities. Cities have attracted private, competitive broadband service providers by lowering barriers to entry and leveraging existing city infrastructure and budgets.

City facilities

City facilities that can support broadband development fall into two general categories: conduit and pole routes, and real estate.

Pole routes

Most California cities do not own pole routes. The exceptions are cities that also operate municipal electric utilities, such as Alameda, Santa Clara and Palo Alto. Not coincidentally, these three cities were the first in the San Francisco Bay Area to embark on large scale, municipal broadband projects.

Conduit

On the other hand, it's common to find cities that own significant conduit routes, particularly ones used to manage traffic signal networks. Because traffic signals tend to be installed on busy streets in commercial areas, the conduit routes that serve them are usually well suited to support business-oriented broadband service and middle mile facilities. The City of San Leandro was the first in the Bay Area to make large scale use of traffic signal conduit for this purpose

Other types of municipal conduit include empty conduit installed on a prospective basis – the Cities of Brentwood and Watsonville are examples – as well as conduit specifically designed to support internal city data networks and street light systems. Conduit installed for IT network purposes can be useful, but is usually more limited in scope than traffic signal systems. Electrical conduit installed for street light purposes is usually not well suited for broadband systems because of differences in the way electrical distribution networks are designed and maintained. Using other city utility systems, such as sanitary and storm sewers, is likewise problematic.

Real estate

City-owned real estate – either vacant land or space inside buildings – can be used to house network electronics and data centers for fiber and other wireline projects. City buildings, street lights and other facilities can support public WiFi access points. Towers, tall structures and vacant land can be used for cellular sites.

Cities can use these resources to build municipally owned broadband infrastructure. Many different kinds of business arrangements can also be made with major incumbent providers and competitive independent companies, including swaps of service for access to facilities, partnerships and normal purchase agreements. Cities are also in a position to use economic development resources, including federal and state grants and other financing vehicles to expand existing facilities, either on behalf of private companies or as part of a municipal enterprise. Examples of potential funding sources include the federal Economic Development Administration, the California Teleconnect Fund, the California Advanced Services Fund and the California Infrastructure and Economic Development Bank.

Agency IT budgets

Public agencies are usually among the biggest users of broadband service at the local level. Although there are restrictions on the use of services and facilities purchased with public funds, particularly those earmarked for educational purposes, public agencies can serve as anchor customers of new broadband projects. Within limits, municipal information technology and telecommunications budgets can be directed in ways that support broadband development goals.

Although educational money cannot be used to subsidize municipal or public broadband service, it can be used to purchase service from competitive privately or municipal providers. For example, purchase commitments made on behalf of U.C. Santa Cruz provided the critical initial revenue stream which made it possible for a private company, Sunesys LLC, to build a fiber line from Silicon Valley to Santa Cruz, and to apply for state grant funds to build a second line from Santa Cruz to Soledad.

Management of street cuts

Cities retain the ability to establish reasonable conditions and procedures for utility companies, including telecommunications carriers, to do construction work in the public right of way. There are many different approaches, but in general most street cut policies intended to promote broadband fall into two categories: “open trench” and “shadow conduit”.

Open trench policies (also sometimes referred to as “dig once” policies) require some degree of advance notice of any digging that’s done in streets, sidewalks or other public places. This notice goes to other utilities that might be interested in installing facilities in that location or local agencies or both. If another utility wants to take advantage of the opportunity presented by the work, cost sharing arrangements can be negotiated or specified by policy. Some policies, such as one written for the City and County of San Francisco, go one step further and require a moratorium – five years is common – on any other utility work at that location.

Shadow conduit policies build on the opportunity presented by open trench notifications. Cities can make it a routine practice to install empty conduit prospectively any time a suitable trench is available. Or requirements for installation of empty, fiber-ready conduit can be imposed on new construction and major remodeling projects. Ownership of the conduit can be passed to the city, as in Brentwood, or remain with the property owner with the requirement it be connected to a municipal network, as in Loma Linda.

An important adjunct to both open trench and shadow conduit policies is a requirement that all conduit installed by public agencies and, ideally, private utilities, be logged into the city’s GIS database. The City of Watsonville was able to build its own city-wide data network because it had taken care over the years to keep its records up to date. Cities that have failed to do so often lose track of where municipal conduit has been installed.

Finally, complicated permitting processes can serve as barriers to entry for broadband companies that want to bring competitive service into a city. Although care must be taken to protect the public’s interests and ensure community values are maintained, some jurisdictions are moving plan reviews for

broadband facility construction out of planning departments and completely into the hands of public works departments, which can use a relatively streamlined encroachment permit process to achieve the same ends.

D. Municipal enterprises

Several cities, including San Leandro, Benicia, Palo Alto and Santa Clara in the Bay Area, either own and operate commercial and industrial grade fiber optic networks, or partner with private companies to make sure those resources are available to the community.

Dark fiber

Palo Alto and Santa Clara operate dark fiber networks which have proved very profitable. Once installed these systems require little upkeep other than fixing accidental breaks, and customer service is mostly limited to making the initial connections – for a fee – and sending periodic bills. San Leandro has given a local company non-exclusive access to its traffic signal network, a near-loop of approximately 11.5 miles in length, and to 7.5 miles of new conduit it built using a federal grant. In return, the city received ownership of approximately 10% of the fiber installed by the company and eventually will receive cash payments, as the business becomes profitable.

Direct service

On the other hand, direct municipal involvement in providing consumer-grade service has a less successful track record, particularly in communities such as Salinas which are served by two consumer-oriented, full service broadband providers. Comcast and AT&T offer high speed residential Internet service, extensive television lineups and telephone service in Salinas. Although both companies are the target of complaints about service and prices, on most days they generally meet the broadband needs of most people in their service areas. Both companies have a national presence and millions of customers. They enjoy substantial operating economies of scale, including the ability to negotiate favorable terms with television programming providers, and can pick and choose which neighborhoods to upgrade on the basis of expected return on investment.

City-run systems do not have those economies of scale and cannot discriminate amongst residents on the basis of their economic potential. Consequently, it is usually impossible to compete with entrenched incumbents on the basis of lower prices, due to national-scale purchasing power, or lower costs incurred as a result of limiting the provision of advanced services to high potential customers.

Although a municipal FTTH system could theoretically offer more television programming options and greater broadband speeds at the same price as copper-based incumbent service providers, this competitive strategy usually results in lower net revenue and ongoing operating losses, particularly when employed against full-service providers such as AT&T or Comcast.

The only successful example of a municipally operated fiber to the home system in California is Loma Linda, which only provides Internet service – and not television service – to newly constructed or remodeled homes where the developer or property owner has installed empty conduit for the city's use.

The City of Loma Linda – which is 4 square miles in size and largely suburban in character – has invested in a fiber backbone network to support this service, but much of the cost of building and operating it is borne by the several colleges and hospitals in town which act as anchor customers.

It is possible for cities in competitive urban markets to build and operate FTTH systems, but it is not reasonable to expect that operating costs and capital pay-back requirements – bond payments, for example – will be met by customer revenue in the near to mid term. Instead, a municipal FTTH operator must expect to subsidize operations for the foreseeable future, via the general fund, grant money, tax increment financing or assessments on property owners or utility ratepayers.

E. Municipal initiative options and business models

Several cities in the Bay Area, as well as elsewhere in California and the U.S., are involved in municipal broadband projects. Some are city-owned and operated, some are public/private partnerships and some are a mixture of both. Goals vary as well. Most focus on improving basic fiber infrastructure for businesses and industrial use, and to provide facilities that independent Internet service providers can use to offer upgraded service to businesses and/or consumers. A few, however, also deliver service to homes.

A summary chart of examples – by no means exhaustive – is below. More information about these initiatives can be found in Appendix D. Markets are broken out into five categories:

Business – standardized, commercial grade Internet service for small and medium-sized businesses.
Industrial – high capacity, customised service and facilities used by large enterprises.
Public uses – government agencies, schools, hospitals.
Amenity WiFi – publicly available, limited capacity WiFi access points.
Homes – standardized residential service.

A question mark in the table indicates that the providers (Google and Sonic in the examples below) have not disclosed availability or terms for a type of service.

Municipal broadband case studies

Some cities, such as Palo Alto, San Leandro, Benicia and Santa Monica, are involved to one degree or another in developing broadband facilities and services for commercial and industrial areas. Other cities, for example Alameda, Loma Linda, Lompoc and Provo, Utah, have pursued broadband projects that are focused on providing consumer-grade Internet service to homes. Still others, such as Santa Cruz, Brentwood, Kansas City and Austin, Texas, have used policy initiatives to attract private fiber-to-the-home projects.

Each city has its own particular set of circumstances, constraints and needs, but all have determined that broadband is an essential twenty-first century utility – as necessary for economic development and social equity as water or electricity – and that there is a public interest in encouraging its development.

Municipal broadband business models include city or county owned and operated networks, partnerships with private companies, and facilitation of the development of completely private systems (see Appendix D for more details).

Examples (in California unless otherwise indicated) include:

City of Palo Alto – the municipal electric utility has installed more than 40 miles of fiber optic cables, which it makes available to business and industrial customers, and is supplementing this coverage with publicly available, amenity grade WiFi access (i.e. intended to meet occasional, on-the-spot needs of tourists and shoppers, for example, rather than daily household, business or educational needs). No residential service is offered. The system generates more than $2 million in surplus revenue a year.

City of Santa Clara - similar to Palo Alto, the city's electric utility provides access to fiber optic lines to businesses, and also uses the smart meter infrastructure it has installed to support amenity grade WiFi service. This system also generates an annual surplus.

City of San Leandro - the city entered into an agreement with a local company, Lit San Leandro, to provide access to city-owned conduit. This private company installed fiber optic lines in the city's conduit, to support commercial and industrial customers as well as public uses. In the second phase of this project, the city applied for and received a grant from the federal Economic Development Administration to install additional conduit in order to extend the fiber network. In exchange, the city receives access to the network for its own use and, eventually, will receive conduit lease revenue. The city incurs costs to support the project and currently generates no direct revenue, but has had significant success in attracting new, high technology businesses.

City of Benicia - the city has awarded a contract to Lit San Leandro to provide industrial-grade Internet service to a local industrial and a nearby redevelopment area. This project is funded via a re-purposed transportation grant, and supported by city facilities such as its corporation yard.

City of Santa Monica - the city's information technology department provides ethernet connectivity between local businesses and nearby data centers, where high capacity Internet bandwidth can be obtained relatively inexpensively.

City of Loma Linda - the city requires newly built and remodeled homes to include fiber optic connections to the city-run network, which offers optional Internet service to residents.

City of Provo, Utah - the city's municipal electric utility built a fiber-to-the-home system using bonds that were to be paid back via the revenue generated. However, the revenue was insufficient to meet bond obligations and a mandatory $5.25 monthly fee was added to residential and commercial electric bills. The system was subsequently sold to Google for a nominal amount, although the bond obligations remain with the city and local electric ratepayers.

City of Alameda - the city's electric utility built a cable system offering video and Internet service which competed for customers with the incumbent private telephone and cable companies. It could not generate sufficient revenue to meet its bond obligations and the system was sold at a loss to the local

private cable operator, Comcast. Because the bonds were only backed by revenue from the cable system, and not the electric utility or the city's general fund, bondholders bore the loss. The city was able to successfully defend the subsequent lawsuits.

City of Lompoc - the city's electric utility department built and continues to operate a municipal WiFi utility which was originally intended to provide ubiquitous Internet access to homes and businesses. Although using WiFi to provide primary Internet access to homes proved problematic, the system provides a valuable, albeit low speed, lifeline option for residents and access for visitors. The revenue generated by this service is not sufficient to meet costs, and it is currently subsidized by other city funds.

City and County of San Francisco - a policy is under development to require inclusion of broadband conduit in public projects and to provide an option for placement of publicly-owned conduit in private projects which involve cutting into streets and other right of ways.

City of Santa Cruz - the city council adopted a package of broadband development policies, including a "dig once" ordinance and a master lease template for use of city-owned assets.

City of Watsonville - since the end of local cable television franchising in California, cable companies have begun charging cities for the use of institutional networks – INETs – originally provided at little or no cost. Charter Communications initially wanted to charge the City of Watsonville $150,000 a year for the use of its INET, which connected critical city facilities. Because the city had a policy of routinely keeping an inventory of conduit and other network assets that had been installed on a prospective basis as well as for specific projects over the year, it was able to use conduit routes it already owned to duplicate all but a few segments, totalling a mile, of the INET system. The remaining gaps were connected via conduit installed by the city for less than the cost of two years service from Charter.

City of Brentwood - for the past 15 years, the city has required new home construction to include empty conduits which are deeded over to the city. An agreement has been reached with an independent Internet service provider, Sonic.net, to use the city-owned conduit to install fiber lines and provide fiber-to-the-home service to homes already served by conduit, and extend the system over time throughout the city.

City of Pacific Grove - a contract was approved with SiFi Networks, a U.K.-based company, which provides provide the company with access to city streets, right of ways and sewers in order to build a fiber-to-the-home network. The project is still in the planning stages and the ultimate source of funding is yet to be identified.

Kansas City, Kansas and Missouri and Austin, Texas – local governments have worked with Google Fiber to facilitate construction of privately-owned, competitive fiber-to-the-home systems. This facilitation includes access to government owned facilities, such as right of ways and pole access for fiber installation and real estate leases for equipment huts, as well as a high degree of cooperation in granting permits and carrying out inspections.

Municipal Broadband Case Studies

City	Business Model	Municipal Utility?	Markets Served: Business	Industrial	Public uses	Amenity WiFi	Homes	Financial Notes
Alameda	City sold system to Comcast after failure of City-run model.	Yes, broadband & electric	●		●		●	Funded by revenue bonds, bondholders lost money when system was sold at 50% of bond value.
Austin, TX	Google Fiber, no direct city involvement.		●	?	●		●	No direct city investment, provided concessions regarding access to city assets and permits.
Benicia	City partners with private company.	No	●	●				Under development, funded by transportation grant
Brentwood	City partners with private company.	No	●	?	●		●	City requires conduit to be laid in new construction, and then deeded to the city. City leases conduit to 3rd party provider.
Kansas City	Google Fiber, no direct city involvement.		●	?	●		●	No direct city investment, provided concessions regarding access to city assets and permits.
Loma Linda	City provides service to homes and businesses.	Yes, operated by IT dept.	●	●	●		●	Conduit attached to city system required in new & major remodel construction. Service is optional & fee-based.
Lompoc	City provides WiFi-based service on a fee basis to homes.	Yes, broadband & electric			●	●	●	WiFi-only system, funded by 10 year lease-back and subsidized by utility department.
Pacific Grove	City partners with private company.	No	●		●		●	Under development. Either city or private service provider will have to pay monthly fee to company that funds/builds system.
Palo Alto	City provides dark fiber service.	Yes, broadband & electric	●	●	●	●		$2 million surplus revenue/year, initially funded as electric utility infrastructure, now self supporting.

Municipal Broadband Case Studies

City	Business Model	Municipal Utility?	Markets Served: Business	Industrial	Public uses	Amenity WiFi	Homes	Financial Notes
Provo, Utah	City sold system to Google Fiber after failure of City-run model.	Yes, operated by IT dept.	●	?	●		●	Sold to Google for $2; rate payers still paying off electric revenue bond obligations incurred to build network.
San Francisco	Ad hoc use of CCSF fiber and conduit by businesses.	Informal		●	●			City conduit and fiber originally installed for public purposes; funded out of agency budgets.
San Leandro	City partners with private company.	No	●	●	●	●		Uses city traffic signal conduit, plus extension funded by EDA grant. City will receive revenue in future years.
Santa Clara	City provides dark fiber service.	Yes, broadband & electric	●	●	●	●		$500K surplus revenue/year, initially funded as electric utility infrastructure, now self supporting.
Santa Monica	City provides "lit" connections between businesses and wholesale ISPs.	Yes, operated by IT dept.	●	●	●	●		System built for public purposes & funded by IT budget. Revenue appears to be at or above break even level.
Watsonville	City provides dark fiber service & conduit access on an ad hoc basis.	No		●	●			Saved the City $150,000/year in telecoms costs, funded by IT budget.

F. Business Models

California cities have a wide range of choices when considering how to pursue broadband projects. They can work with, or even own, for profit corporations, participate in cooperatives and non profit corporations or they can own and operate a broadband network, either fully or in partnership with a private sector company.

Generally, California cities (and some special districts) can provide telecommunications services within their boundaries with few restrictions. Even if a city provides a service that falls under the CPUC's jurisdiction, it is exempt from CPUC oversight. On the other hand, it is subject to all the controls, restrictions and obligations that pertain to any other municipal function, such as public oversight, open access and Brown Act requirements.

Full City Ownership

A common way of organizing a municipal telecommunications utility is to run it via a separate enterprise fund. Several cities received stimulus grants for the purpose of building publicly available telecommunications networks. Examples given above include the cities of Palo Alto, Santa Clara, Santa Monica, Lompoc and Alameda.

The City of Chattanooga, Tennessee is another example. It received approximately $100 million in grants through the American Recovery and Reinvestment Act of 2009 (ARRA) and, via its municipal electric utility, used it to build a fiber-to-the-home system.

Advantages: City controls operating policy and benefits from any profits generated, most regulatory requirements do not apply.

Disadvantages: City would have to support any financial deficits, could require additional costs such as staff time.

Partial City Ownership

When a city contributes resources to a broadband network project, it can take ownership of specific parts of that network, rather than owning and operating the entire system.

Examples above include the cities of San Leandro and Brentwood. Another example is the City of Monterey. When Comcast installed an institutional network as part of its former franchise agreement, the city paid for extra fiber strands to be installed. Those strands are the property of the city, and are now being used to provide effectively free connectivity between city locations even though local franchise agreements have been preempted at the state level.

Advantages: City gains access to telecommunications resources for its own use and can exercises a degree of control over the operation of a system that it helped to fund.

Disadvantages: Control is only partial. Continued access to the resource may depend on the viability or cooperation of a private sector partner. Care must be taken to avoid exposure to liability or unreasonable ongoing costs.

Corporation/LLC

Limited liability companies and for-profit corporations of various types can do business with few restrictions. Telecommunications companies are potentially an exception. For example, if it is deemed to be a telephone company (CLEC/competitive local exchange carrier) a private company would fall under the California Public Utilities Commission's jurisdiction.

Corporations are owned by shareholders, and different classes of stock can have different voting rights. The assets of a corporation can be sold or assigned to shareholders or others with few restrictions. To a great degree, ongoing governance and control of a corporation can be predetermined by the founders, who can also put requirements and restrictions on how it can do business and structure it to achieve goals they set (and benefit from), within limits.

For profit organizations make money, pay taxes and distribute dividends to shareholders. Individual shareholders can usually sell their stock, although there are ways to limit the ability of new stock owners to control the company. The City can be shareholder of such a corporation.

Examples run from the national organizations (AT&T and Comcast) to intrastate networks (Sunesys, Abovenet, IP Networks) to local companies (Cruzio Internet). Cruzio has agreements with the Cities of Watsonville and Santa Cruz for conduit access and colocation of wireless facilities, and participates with other local government agencies in the three-county Central Coast Broadband Consortium.

Several public-private partnerships were formed to apply for ARRA grants in 2009 and 2010. Examples include the City of Oakland and the City of Watsonville, which did not receive funds.

Advantages: freedom of action, ability to maintain control, able to operate company for the direct benefit of shareholders, able to borrow money and take private investment.

Disadvantages: could bear a regulatory burden, would likely require arms-length dealings with the City, no guarantee that it will always put the public interest foremost.

Non-Profit

A non-profit corporation can do nearly everything a for-profit corporation can do. The major differences are that a non-profit must offer some kind of public benefit, has limits on the amount of cash surplus it can generate from its operations and its governance structure is less controllable by the founders.

Non-profits aren't owned by anyone. The corporation is governed by a board that can be chosen by voting members, named by organizations designated in the bylaws or by the board itself. There are

restrictions on the degree to which board members can act on items in which they have a financial interest.

With self-perpetuating boards and boards chosen by voting members, there is a chance that the organization will take a direction that was not intended by the founders. A board with directors appointed by other people or organizations, for example the founders, is less likely to take an unintended direction but there are limits on the extent to which appointed directors can act in the interest of their parent organization.

A mutual benefit corporation is another type of non-profit, and is similar in concept to a cooperative.

In California, CENIC (Corporation for Education Network Initiatives in California) is a non-profit that runs a statewide broadband network supporting K-12 and higher education institutions. It is a membership based non-profit, controlled primarily by major public and private universities, which in turn are its major customers. Because it is a non-profit serving primarily government entities (as well as a few private non-profit schools) it can more directly serve the needs of its members than it could if its members were for-profit companies.

The Nevada Hospital Association (technically a not-for-profit professional association) received a $20 million ARRA grant to build a public access fiber network throughout Nevada. OneCommunity received a similar grant to build a fiber network in Ohio, as did the University Corporation for Advanced Internet Development, which is working on a national network primarily for higher education use.

Advantage: some freedom of action, less potential for conflict of interest with the City.

Disadvantage: can be difficult to maintain control over the long term, financial and managerial options are restricted.

Cooperative

Cooperatives are not-for-profit corporations that are usually set up to provide some kind of benefit to members. Commonly, cooperatives are set up to pool buying power. Although there can be different classes of membership with different rights, generally governance is on the basis of one vote per member, regardless of the amount of business a member does with the cooperative. Operating surpluses, on the other hand, are usually distributed to members according to how much business they do with the co-op.

The board of directors is chosen by a vote of eligible members. Although there are ways that founders can maintain a large degree of influence, it is possible that other members, representing a majority of votes, can gain control.

Examples:

California Broadband Cooperative. This ARRA grant recipient built and is now operating a 500 mile fiber optic network from Reno, down the eastern side of the Sierra generally along U.S. 395 in California to Barstow.

Plumas-Sierra Rural Electrical Co-op. A rare California example of a traditional rural utilities cooperative. These sorts of organization are common in the midwest and south, and provide telecommunications services as well as electricity.

Mid-Atlantic Broadband Cooperative. Located in rural Virginia, operates a fiber optic network of several hundred miles. Built with tobacco settlement money and ARRA funds.

Advantages: can be run strictly for the benefit of members, has freedom of action and can do business as a private company would.

Disadvantage: can be run strictly for the benefit of members (rather than focusing on public policy objectives), difficult for the founders to maintain control.

Appendix E – Broadband technology

There are two principal types of broadband technology: wireline and wireless. Both types have advantages and disadvantages. There are applications where either might work, and applications where only one type of technology is suitable. Wireline technologies include copper telephone and cable television systems as well as fiber optic lines.

Definitions

Wireless technology includes cellular telephone and data services, such as those offered by AT&T, Verizon and other mobile phone companies, WiFi access points, satellite services and fixed wireless systems.

"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, wireless cellular/mobile service (e.g. cell phones, tablets, wireless modems), WiFi, point-to-point and point-to-multipoint fixed wireless service and hybrid networks. Technical distinctions can be made between "broadband" and "Internet" service and facilities, but in this report the terms are used interchangeably.

Another distinction that's often made is between "middle mile" and "last mile" infrastructure. Similar to local streets and driveways, last mile facilities provide direct service to homes and businesses. Wireline networks installed by telephone and cable companies, and cellular tower sites are examples. Middle mile infrastructure connects last mile systems to the core of the Internet, providing bulk bandwidth that, in turn, is shared among customers. It's similar to arterial streets and highways, in that it's used to stitch neighborhood facilities together and link these larger systems to inter-city and international networks.

Service standards

Although different organizations use different criteria, the California Public Utilities Commission (CPUC) currently considers 6 Mbps download and 1.5 Mbps upload speeds to be the standard for adequate residential broadband service. The Federal Communications Commission, on the other hand, recently adopted 25 Mbps download/3 Mbps upload as the minimum acceptable level of service, and efforts are under way in the legislature and at the CPUC to raise the Californian standard to that level. It should be noted that, in either case, the standard refers to the capacity of the infrastructure installed by service providers. So long as the minimum level is available, consumers may also be offered the option of purchasing less expensive, lower speed service.

Types of systems

Many different kinds of technology can be used to deliver broadband service, and most are currently in use in and around Salinas. Dedicated wireless links, copper wires and even mobile services can support

high speed service. However, these technologies quickly hit limits that are frequently inadequate for businesses, including home-based ones, and often fail to meet the needs of consumers, particularly when cost is considered.

Last mile infrastructure is usually owned and used by consumer-focused telephone and cable companies, although competitive carriers have some rights of access to copper lines owned by telephone companies. Ownership of middle mile infrastructure is split between the major last mile providers and specialized fiber optic network operators.

Mobile networks

The capacity of mobile data networks – AT&T, Verizon, Sprint and T-Mobile – continues to increase, however the demand for mobile bandwidth is also increasing. There is no prospect for it to be a substitute for high capacity wired services. In fact, like legacy copper networks, one of the primary means of increasing mobile capacity is to extend the reach of middle mile fiber in order to make the area covered by cell sites smaller and smaller. Cost is also an issue for mobile networks. Although typical monthly usage limits are adequate for smart phones and other hand held devices, in-home use can be an order or two of magnitude greater leading to bills ranging from several hundred dollars to more than a thousand dollars a month.

Although improvements continue to be made in the technology used to move data over legacy networks, the primary means of increasing speed is to build fiber infrastructure closer and closer to end users, in order to make copper wire connections shorter and enable the construction of more mobile cell sites.

Fiber optic networks

Fiber optic cables themselves, though, can support the highest levels of service and provide the maximum degree of flexibility for sophisticated users, particularly businesses. Newly built networks, whether designed for business or residential customers, tend to be completely fiber based – fiber to the home (FTTH) or fiber to the premise (FTTP) – because the cost of installing fiber is roughly the same as, and sometimes less than, traditional copper wire facilities. The labor involved in installing cables in conduit or on poles, and installing or upgrading conduit and poles, constitutes most of the cost in either case.

Fiber construction costs can vary greatly. For example, installing fiber optic cable in existing conduit or on poles can cost as little as $10 per foot, although costs in the $15 to $30 per foot range are more common. When conduit has to be installed or poles upgraded, costs can range upwards from $30 per foot to $100 or more. Generally speaking, it is less expensive to install conduit in bare dirt than to cut into and repair streets, and to follow existing utility and transportation right of ways than to acquire new paths.

Fiber network enterprises are often categorized as “lit” or “dark” or “managed services” systems. A lit network is one where the operator installs both the fiber optic cable and the electronics that’s used to transmit information over it, and then sells a transportation service between two or more points to the

end user. Dark fiber comes without any electronics and only provides a physical connection between two or more points. The customer is responsible for installing, maintaining and operating all the required equipment.

"Managed service" is the type of service most commonly – often exclusively – offered by major carriers such as AT&T and Comcast. The carrier simply agrees to provide broadband service that meets particular, company-defined specifications for speed, availability and quality, and customers have a limited range of options from which to choose. The available options can be adequate for consumer and small business purposes, but often fail to meet the needs of larger and/or more sophisticated enterprises.

Appendix F - 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.
Microtrenching	A technique of deploying cables, e.g. for broadband networks, at a lower cost than by the usual method. A micro trencher is a "small rockwheel" specially designed for work in urban area. It is fitted with a cutting wheel that cuts a microtrench with smaller dimensions than can be achieved with conventional trench digging equipment. The trench dimensions are widths ranging from about 30 mm to 130 mm, and a maximum depth of about 500 mm.Micro trenchers may also be used to install FTTx connections.
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, EU.