Increasing High Speed Internet Access

in Santa Cruz, California

Prepared for the City of Santa Cruz Economic Development Agency

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Speaking Truth to Power

The author conducted this study as part of the program of professional education at the Goldman School of Public Policy, University of California at Berkeley. This paper is submitted in partial fulfillment of the course requirements for the Master of Public Policy degree. The judgments and conclusions are solely those of the author, and are not necessarily endorsed by the Goldman School of Public Policy, by the University of California or by any other agency.

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Executive Summary

The City of Santa Cruz is considering increasing high-speed internet access, particularly to its commercial and industrial areas. While nearly half of Santa Cruz' residents are college-educated, many of these individuals commute to other counties for work. Moreover, the City's unemployment rate peaked at 10% in 2011. The City's Economic Development Agency is looking to address these issues by attracting businesses that will employ their highly educated population--businesses that usually require a high speed internet connection. High speed internet connections for commercial uses are typically delivered via fiber-optic cable.

By increasing high speed internet access, the City has several goals: 1) Positive economic impacts, 2) Increased access and competition, 3) Maximize the value of capital improvement projects (CIP), and 4) Minimize administrative and fiscal barriers to entry.

The primary challenge in increasing high speed connectivity is the middle mile problem. Ted Stevens once said that the internet "..is not a big truck. It's a series of tubes." He wasn't altogether wrong: though the internet itself is not a series of tubes, the infrastructure it relies upon *is*. The middle mile is the tube, or the conduit and the contained fiber, that connects our homes to the network backbone. Private telecom investment has been responsible for much of the existing middle mile infrastructure. These investments are declining as telecoms have already invested in communities they consider profitable, leaving less dense communities, like Santa Cruz, without infrastructure that is becoming more and more essential for economic development. Cities like this face the challenge of how to provide connectivity without private investment.

As the City considers how to either attract investment in the middle mile or build it out themselves, it is crucial to look at the current state of conditions. For example, the City of Santa Cruz has few options for commercial high-speed internet access, but educational institutions have received large federal subsidies allowing them to build out strong middle mile infrastructures that support fiber connections. Another important finding is that the City's I-Net (institutional network, or essentially internet for government communication purposes) is currently leased from Comcast at a rate of \$1/year, a rate that will likely increase at the end of the contract term, 2021. Additionally, a number of internal inefficiencies should be remedied in order to make the process of middle mile build-out more efficient, such as the planning of street cuts in advance and inventorying existing underground utilities.

A few municipalities around the state and in the region have led the way in owning, managing, or leasing conduit and/or fiber. Three primary case studies exist: 1) cityowned conduit, privately-managed fiber, 2) city-owned, city-managed conduit & fiber, and 3) city-owned, utility-managed conduit & fiber. Many of these cities initially built out their fiber loops as part of an electrical system upgrade. **All of these cities have strongly emphasized that city ownership of a fiber network has stimulated economic development, either by keeping businesses local or attracting businesses through dark fiber services.** Additionally, three cities--San Francisco, Boston, and Seattle--have progressive street cut policies, which are required for installing conduit and fiber. Each of these case studies provide valuable insight for Santa Cruz as they further develop their broadband policies.

This report makes five recommendations regarding such policies: 1) Adopt broadband as a key component in the City's economic development strategy, 2) Determine if there is existing conduit in the proposed conduit routes, 3) Adopt street excavation policies / Streamline internal processes, 4) Determine if there is overlap between the city's proposed conduit route and AT&T's build-out for Santa Cruz City Schools, and 5) Perform a break-even analysis (to determine at what rate the City can continue to lease fiber). Each of these recommendations meets some or all of the goals outlined by the City. This report concludes that the City will need to install conduit in order to increase access to high speed internet.

Introduction

In September 2011, an Ad Hoc Committee of the City Council focused on Technology was impanelled to comprehensively review existing technology practices and make recommendations that would increase efficiency, transparency and economic opportunity within the City of Santa Cruz. Composed of both council members and a group of 15 volunteers who work in the technology sector, the group made three recommendations to the Santa Cruz City Council after six months of intense research and study.

This report is concerned with the first of these recommendations: fiber policy development. In developing these policies, the Committee recommended that the delivery of high-speed internet should be council economic development priority. This policy objective is targeted at industrial and commercial land use districts, as well as community anchor institutions (education, public services, public safety, and health) and the City of Santa Cruz's downtown.



Fiber-optic Cable

I was hired by the City's Economic Development Coordinator to as-

sist in researching the City's first Broadband Master Plan, which is scheduled to return to the City Council in Fall of 2012. This report looks at the main obstacles in expanding fiber infrastructure, assesses best practices in broadband policy in other municipalities, documents the current permitting process, and develops alternatives the City may choose to pursue to cost-effectively install conduit around the City to provide high-speed internet access to industrial and commercial end users.

This report makes recommendations on lowering barriers (administrative and fiscal) to entry for telecoms to provide internet service through installing middle mile infrastructure, improving coordination between commercial telecom providers and projects chartered by the Public Works and Water Departments, and increasing communication between excavators and communications companies when there is a project that involves a street opening. Ultimately, the report recommends that City should install its own fiber network, as continually leasing strands from telecom providers is untenable.

Background

A number of unique characteristics well-positions the City of Santa Cruz to invest in high-speed internet connectivity. First, the population of Santa Cruz is young and welleducated. The median age in the City is 29.9 years old, with about half (49.8%) of the city's population between 20-49 years old¹. The population is highly educated, especially compared to the County and surrounding regions; more than 44% have at least a college degree, compared to 35% in the County, 37% in the region, and 28% for the state². This demographic is one of the strongest base of internet users; Pew Research finds that over 94% of people ages 18-29 use the internet and 88% of people ages 30-49 use the internet. A stunning 97% of individuals with college degrees are internet users.³

Secondly, the City's proximity to economic hubs in the area makes high-speed connectivity necessary to remain competitive and economically viable in the region. San Francisco can be found about 70 miles to the north, while Silicon Valley tech firms are only 30 miles away. About 40 miles south of Santa Cruz lies Monterey's research institutions, including the Naval Postgraduate School and the Defense Language Institute, as well as a number of marine research organizations like the State Marine Laboratories in Moss Landing and the West Coast Marine Headquarters of the US Geological Survey.

Despite the well-educated population, the major employers in the City, after the public sector, are retail and accommodation/food services⁴. This discrepancy is further high-lighted by the high number of people who commute to other counties for work, approximately 35% (See Appendix A)⁵. Moreover, between 2000-2006, the city's unemployment rate ranged between 4-6%, but jumped to 10% in 2011⁶. The City, particularly the Economic Development Department, is looking for ways to attract more informa-

¹ U.S. Census Bureau, 2010 Census, Profile of General Population and Housing Characteristics: Santa Cruz, city 2 City of Santa Cruz Planning and Community Development, 2004. 2005-2020 General Plan and Local Coastal Program Background Report

³ http://www.pewinternet.org/Static-Pages/Trend-Data/Whos-Online.aspx

⁴ U.S. Census Bureau, 2007 Economic Census, 2007 Economic Census of Island Areas, and 2007 Nonemployer Statistics.

⁵ California Employment Development Department, Labor Market Information, Santa Cruz County Profile. 6 Ibid.

Advanced Policy Analysis, 2012

tion, knowledge-based industries to the area in order to address the issues mentioned above.

One of the options under consideration is whether increasing connectivity to high-speed internet access to industrial and commercial zones would boost economic development. In fact, the General Planning Background Report finds that the professional/scientific/ technical industry is one of the few that is growing from 3% in 1991, to 6% in 2000--an industry that requires a high speed connection⁷.

Additionally, the City's future plans include development and infrastructure that should have high-speed capabilities. Such opportunities include business partnerships with the University that is off-campus and within the City, expanding the main downtown tourist centers to include a new conference center linked to high quality services and to the hotels, and partnerships with the Marine Research and Education Center at Terrace Point. Most importantly, the Planning Department re-zoned several industrial zones in order to make them Amore suitable "employment centers that could include light industrial uses, local high technology start-up companies, bio/nano technology companies and associated support services."⁸

It is important to note that developing fiber will not necessarily lead to increased economic growth. Several concerns exist that should be further examined by the City. For example, the City of Santa Cruz is geographically isolated from Silicon Valley and the tech industry, making relocation of existing businesses to the area less attractive. Moreover, it is unlikely that the existing tech businesses in the City will serve as an anchor to bring in major players. Relative to Silicon Valley, the tech businesses in Santa Cruz are relatively small (employing 1-50+ workers).

8 Title 24. Santa Cruz Municipal Code. Section 10.1600.

⁷ City of Santa Cruz Planning and Community Development, 2004. 2005-2020 General Plan and Local Coastal Program Background Report

Advanced Policy Analysis, 2012

The Middle Mile Problem

Broadband Network

Former US Senator Ted Stevens was infamously quoted as saying that the Internet is "not a big truck", but instead "a series of tubes". Though the internet itself may not be "a series of tubes", the infrastructure it relies on actually could be considered a series of

tubes. Being connected requires fiber, copper, or cable in the ground or on poles. A broadband network consists of three components: 1) the network backbone, 2) the middle mile, and 3) the last mile. The analogy often given to understand this system is that the network backbone is a "super highway" that traverses the country, that the middle mile is the on/off-ramp that leads to communities, and that the last mile is the road that leads to your home.



Fiber vs. copper. The orange conduit contains 72 fiber strands, one of which can transmit as much data as the entire copper bundle in the black conduit.

A network backbone refers to the long distance

fiber-optic cables or 'trunks' that connect all the major cities and hubs around the country and around the world. Only six internet service providers (ISPs), also referred to as Tier 1 providers, have network backbones in the United States.⁹

The middle mile--the segment which this report is concerned with--connects cities and towns to the network backbone and sends data and information back to the network backbone. The middle mile can connect from the network backbone to the local ISPs central office or extend to community anchor institutions, which include education, public services, public safety, and health. The middle mile is the biggest challenge in providing universal high-speed connectivity due to the high costs of construction in linking . Profit-maximizing firms like telecoms providers are only willing to invest in the middle mile if it eventually leads to a dense market where they will be able to recover

⁹ The six Tier 1 providers are Verizon, AT&T, Qwest, Sprint, Level 3, and Global Crossing. Advanced Policy Analysis, 2012

their costs through subscription fees or leasing of fiber to smaller ISPs¹⁰. Rural areas, where the middle mile may in fact be hundreds of miles, lack broadband connection because private companies have no financial incentive to invest. As a tertiary market, Santa Cruz has also seen little investment and attention from telecoms. As high speed connectivity is becoming more essential to economic development, building out this middle mile is becoming a concern for local municipalities, particularly in communities that cannot attract telecom investment¹¹.

The last mile refers to the last segment of transport that connects the premise (home or business receiving internet access) to the middle mile. Whereas only six ISPs control network backbones, hundreds of ISPs are able to be last mile providers because the cost of market entry is lower at this segment. Last mile providers can be small, local businesses, regional entities, or even a Tier 1 provider.

¹⁰ Ironically enough, this is possible due to the deregulation allowed for by the Telecommunications Act of 1996. The goal of deregulation was to lower barriers to entry for entities to enter the market and to "accelerate rapidly private sector deployment of advanced telecommunications and information technologies and services to all Americans". In other words, the Act was supposed to lead to private investment of telecoms infrastructure, such as the middle mile. Conference Report, Telecommunications Act of 1996, House of Representatives, 104th Congress, 2d Session, H.Rept. 104-458

¹¹ Federal Communications Commission. National Broadband Plan, Chapter 13, Section 4. Local and Regional Economic Development

Advanced Policy Analysis, 2012

Telecom investment

Telecom investment has provided much of the existing middle mile infrastructure in the United States. Gaps in investment though have led to uneven access to highspeed connectivity, that cities and municipalities are left grappling with. According to the OECD Communications Outlook (published biannually), telecoms capital expenditures peaked in early 2000 and is currently declining¹. Other academic papers, which use different sources for their numbers, report similar findings². One such paper written for the FCC finds that capital expenditures have dropped from \$59 to \$51 billion between 2008-2009 and is projected to decrease through 2015³.

 OECD (2011), OECD Communications Outlook 1999-2011, OECD Publishing. http://dx.doi.org/10.1787/comms_outlook-2011-en

2. Wieck, R. & Vidal, M. (2010). "Investment in telecommunications infrastructure, growth, and employment-recent research"

21st European Regional ITS Conference, Copenhagen 2010. 3.Atkinson, R. & Schults, I. (2009). "Broadband in America: WhereIt Is and Where It Is Going (According to Broadband Service Providers)." Columbia Institute for Tele-Information



Goals

The City has a number of goals in developing policies that increase high speed connectivity. These goals should be considered when evaluating the recommendations for the City's next steps.

#1: Positive economic impacts

The first and primary goal of increasing high speed connectivity is to stimulate positive economic impacts. The recommendations adopted should address the high unemployment rate while also making use of the city's highly educated work force that commutes out of county every day. The policies adopted to increase high speed connectivity should bring in businesses (new or relocating) and thus jobs, creating economic impacts in both employment figures and tax revenue for the City.

#2: Increase Access and Competition

Another goal of policies aimed to increase high-speed connectivity is to increase access to this connectivity and to increase competition amongst ISPs in order to make access reasonably priced. Policies adopted should consider current internet dead zones and areas of need and lead to reliable high speed internet access throughout the City. Moreover, it is important that any policies adopted should not favor certain ISPs over others but instead foster competition between all ISPs. Favoring certain ISPs is likely to create a monopolistic situation with exorbitant prices that ultimately would not be favorable to local businesses, health care providers, schools or municipalities.

#3: Maximize value of CIP investments

Currently, the City's Capital Improvement Project chartering process, is limited to coordination between existing municipal utilities: water, storm water, and wastewater. By including broadband infrastructure in current or existing Capital Improvement Plans, the City can reduce the number of projects in one area, reduce street cuts, and prolong the value of its investment in the City's physical plant. In doing so, the City reduces inefficiencies (fiscal and administrative) by consolidating multiple projects into one and reducing the disruption caused to local residents and businesses.

#4: Minimize administrative and fiscal barriers to entry

One of the biggest problems facing the City is lack of private investment in the middle mile. Recommendations on how to increase high speed connectivity should make the process for private investment in infrastructure as streamlined as possible. Administratively, this requires that different city departments work together in looking at proposals from private entities looking to build out broadband infrastructure, so that the applicant doesn't have to repeat the same processes at different agencies. Reducing fiscal barriers to entry is a more complex issue and can range from the City providing engineering designs to better coordination of plans to share costs.

Statement of Current Conditions

Service providers, speeds, & technologies

Currently, the Santa Cruz residents and businesses can get internet access through Comcast, AT&T, or Cruzio (a local ISP). These ISPs rely largely on cable and copper services, with limited offerings for businesses. There is no fiber option for local businesses. According to the National Broadband Map, the average internet speed in Santa Cruz is 10 mbps. Based of a map from the California Public Utilities Commission (CPUC), the maximum advertised speed for most of the City is between 10-24 mbps, with only one area reaching an advertised 1gbps, and several areas with only 3-5 mbps. These numbers are overestimated, as advertised numbers are often much higher than actual speeds, a fact confirmed by local ISPs such as Cruzio as well as work undertaken by the University of California, Santa Cruz.

High speed education connections

Comparatively, the education institutions in the City have strong broadband infrastructure and inexpensive high speed connections. Major research projects at the University of California Santa Cruz, including the Genome Browser, the Lick–Carnegie Exoplanet Survey, the Santa Cruz Institute for Particle Physics, and the Climate Change and Impacts Laboratory require substantial bandwidth. UCSC's data connection ranges from 1 gbps around campus to 10 gbps for research units. Sunesys, an independent company that designs builds networks for K-12 schools, built the existing infrastructure while Corporation for Educational Network Initiatives in California (CENIC) serves as the UC's ISP. The University has a long-term contract with Sunesys that gives them the right to use their strands for 20 years¹². More importantly, Sunesys overbuilt this network, and there are currently 184 available strands for lease in this conduit.

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¹² Warner, Jim. "Questions on Santa Cruz Master Plan." Message to Linh Vuong. 26 Apr. 2012. Email.
Advanced Policy Analysis, 2012 Install Conduit

The lack of high speed internet connectivity in the City can also be found in Santa Cruz City Schools (SCCS). Recent reports that the "current limitations of the network are restricting instructional options in the classrooms" have led SCCS to accept a bid with AT&T to increase their speed by 665 times¹³. (See Recommendation #4 for more detail.) City schools, along with other education institutions, are able to fund these projects through the federal E-rate program, which provides heavy subsidies to schools based on the percentage of students subscribing to the National School Lunch Program and urban/rural locations. Under this discount structure, Santa Cruz City Schools would receive a 60-70% E-rate discount on telecommunications services. ¹⁴ SCCS has also approved a contract with the County Office of Education--which is located in the center of an industrial zone with no internet connectivity--to provide internet service. Also deeply discounted through E-rate, the contract will run for three years, from July 1, 2012 to June 30, 2015.

Cable Franchise

The City (and County) of Santa Cruz are currently under a cable franchise agreement with Comcast through June 30, 2014. This is the last locally controlled cable franchise in the state of California following the 2006 passage of the Digital Infrastructure and Video Competition Act (DIVCA), which allows cable service providers to obtain a state-issued franchise to provide cable service in a local community.

Part of this franchise agreement (which was obtained through protracted legal discussions) is a provision for the leasing of fiber strands and conduit that Comcast has installed throughout the area strictly for government communications purposes. It is specified in the agreement that the City cannot overbuild in the conduits that Comcast's fiber currently is located. The rate stipulated in the agreement is \$1/year until 2014, which was recently extended until June 30, 2021. After this date, Comcast will be able to set a rate at their discretion. With little to no competition and no regulation over rates,

¹³ Santa Cruz City Schools. "District Governing Board Meeting." 14 Mar. 2012. Accessed online at: http://www.sccs.santacruz.k12.ca.us/images/stories/files/Board_Books_2011-12/Board_Book_3.14.12_Final.pdf 14 Santa Cruz City Schools. "Free/Reduced Student Eligibility and Participation YTD 2011-2012" Accessed online at: http://district.schoolnutritionandfitness.com/santacruzcs/files/student_frel_egilibity.pdf

the City should expect this rate to skyrocket. In Monterey, the end of the cable franchise agreement led to an I-Net rate of \$10,000/month¹⁵. A number of cities have been able to use these monthly fees as justification to build out their own fiber networks, as discussed in the Lessons Learned section below.

Permitting Process

One of the biggest obstacles in building out the middle mile is the permitting process involved in laying down fiber or conduit¹⁶. Fiber is typically installed underground. While aerial routes are possible by using utility poles, Santa Cruz, like many cities, require that utilities be placed underground¹⁷. Furthermore, like many cities in Northern California, the City of Santa Cruz does not own the wooden utility poles found in its neighborhoods, which while in the public right of way, are owned by the local utility, PG&E. Underground placement of fiber or conduit requires street excavation, which requires permits from the Department of Public Works. An interview with DPW leadership revealed several administrative efficiencies that could be realized in order to encourage further investment in communications infrastructure.

1. **Turnaround time:** The time from application to permit approval is about 2-3 months. The hardest part to schedule is to include the required permits on the agenda for City Council meetings. An ordinance allowing great administrative discretion for smaller projects may speed up approval time.

2. Lack of planning mechanism: DPW is not currently able to plan ahead in order to anticipate future street excavation or infrastructure expansions. In instances where DPW is aware of future plans, they will try to coordinate, but this process is informal and ad-hoc. For instance, when an applicant wants to excavate a street that has recently been repaved, DPW will ask the applicant to consider different excavating technologies (to minimize repaving) or choose a different path. DPW will typically not reject a permit on these grounds. Lack of a formal planning process reduces the likelihood of joint ex-

¹⁵ Koht, Peter. "DIVCA / I-Net Research." Message to Linh Vuong. 25 Apr. 2012. Email.

¹⁶ Fiber must be placed inside conduit, which is a protective cover for cables,.

¹⁷ Title 24. Santa Cruz Municipal Code. Section 12.710.

Advanced Policy Analysis, 2012

cavation. While it may not be possible to implement a software system to aide with future planning, developing a broadband master plan and specifying priority fiber routes that serve commercial and industrial areas will allow DPW to incorporate those plans into other city plans from Water, Sewer, Wastewater, etc. Alternatively, DPW currently has a list of contacts registered in their Underground Service Alert. These members are contacted so they can mark their utilities prior to street excavation. Moving up this notification earlier in the process can help utilities coordinate street cuts.

3. **Need for digital map of existing infrastructure:** Although DPW does require applicants to detail where they are excavating, the maps submitted by applicants are not in digital formats. Thus, information, such as a map, on existing conduit in the City is not readily accessible nor is it incorporated in the to City's GIS (Geographic Information System). If the City knew where conduit existed, and which conduit could be used, installing fiber could be done cost-effectively as there is no need to excavate the street. Because inventorying existing infrastructure is likely too time/labor intensive, requiring applicants to submit maps in GIS or CAD would at least allow the city to inventory future infrastructure.

Connectivity & Commercial absorption

The city has recently been witnessing an informal relationship between highspeed connectivity and commercial absorption. With the recent economic downturn, commercial vacancies have increased from 11% in 2007 to 16% in 2010. Yet in 2011, when Cruzio, the local ISP, offered office space with highspeed connectivity, they reached 93% occupancy in less than three months¹¹. Meanwhile, the Cooper House--a mixed use retail/office building--in downtown Santa Cruz has remained mostly vacant since their last tenant, Light Surf Technologies vacated in 2008.



Cruzioworks



Old Sentinel Building --> New Cruzio Building



Cooper House

Мар

The next page provides a map of the current needs and proposed path for a fiber route in the City of Santa Cruz. In order to stimulate economic development, high speed connectivity should reach the highlighted zones: the Harvey West and the West Side Industrial Park, and downtown Santa Cruz, the location of nearly all its Class A office space. After that, the City would want to connect areas ancillary commercial corridors and then tourist serving areas. Based on this projection, the City's IT/GIS contact estimates about 19.5 miles of conduit necessary to reach within a block of the proposed areas.



Lessons Learned from other Municipalities

Municipally Owned Conduit/Fiber

A number of municipalities have addressed the middle mile challenge and growing I-Net rates by building out their own fiber networks. The following case studies highlight three different ways municipalities have managed these fiber networks: city-owned conduit & privately-managed fiber, city-owned & city-managed fiber, city-owned & utility managed fiber. Other models exist, such as Maine Fiber Company and Vermont FiberConnect, but will not be covered in this doc.

#1: City owned conduit, privately-managed fiber

San Leandro and Milpitas have the simplest model for municipalities. Both of these cities leased conduit space to private companies to install fiber. The city generates minimal revenue in conduit leases, though greater benefits lie in raising the tax base. Milpitas did not respond to several attempts by the author to learn more about the city's network and is thus not presented in this version. An analysis of conduit leases offered by cities like San Leandro and Milpitas are included in Appendix B of this report.

In San Leandro, Dr. Patrick Kennedy, owner of a local tech company and one of the city's biggest employers, OSISoft, proposed building out the city's fiber loop in order to grow his business and remain in the city. Like Santa Cruz, the City of San Leandro hopes that building out fiber will attract new tech businesses that cannot afford the high rents of Silicon Valley. As part of the proposal, Dr. Kennedy set up Lit San Leandro (LSL), a private company that will manage the fiber and offer lit services to local businesses. The initial investment--\$3 million--is provided by Dr. Kennedy himself, with OSISoft paying for the main switch as LSL's first client. Working with the city has reduced administrative barriers to entry, particularly in the permitting process. The City leases conduit space to Dr. Kennedy and LSL on a sliding scale over 20 years. For the first 10 years, the rate is set at \$1/year, after which payments will be based on LSL's profit, with the goal of reaching market rate by the 20th year. In exchange for conduit space, the City gets own-

ership of a dozen strands¹⁸. The strategy behind this rate schedule is that the possible revenue the City could generate, tens of thousands, is not significant to the City, but very difficult for a single businessman. Moreover, the City is more interested in growing the tax base that LSL should attract. No city funds are used in this project.

#2: City-owned, City-managed conduit & fiber

Seattle and Palo Alto are two examples of cities that have built out their own fiber loop. Seattle currently owns and manages over 500 miles of fiber throughout the city (which is 83.9 square miles) and to a few other counties in the state of Washington. The City initially installed fiber under the direction of Department of Information Technology Director Stan Wu for city department use only. The initial installation in 1986 was financed using the funds that the City was allocating to pay Qwest for leasing fiber strands, which is what Santa Cruz is currently doing with Comcast. According to the City, the installation costs were recovered in 7 years. The city has continued to grow their fiber infrastructure through an agreement signed in 1996 with six other government agencies, the University of Washington, Seattle Community Colleges, King County libraries, and the General Services Agency (federal). The cost of the build-out was shared amongst each of these partners, with cost dependent on the number of strands owned in the conduit. Seattle does not currently lease fiber to private companies.

Palo Alto's fiber network, built in 1997, is 44 miles long in a city that is 25.7 square miles. Of the 288 strands the City installed, 8 are used by the City, and the rest are leased out to local businesses, which has significantly stimulated economic development in the area. According to Joshua Wallace, account manager with City of Palo Alto Utilities, being able to offer this boutique service plays a huge role in keeping businesses local, especially in light of the high rents and intensive entitlement process for new construction / expansion. Moreover, the service the City offers can be customized to business' needs, whereas leasing fiber from an incumbent provider does not allow for any tailoring or flexibility.

¹⁸ According to Steve Blum of Tellus Ventures, it is often prudent for cities to own fiber strands in order to act as competition to ISPs in order to lower prices.

Advanced Policy Analysis, 2012

The idea to build the city's own fiber infrastructure arose in the early 90s when the City was faced with expiring hydroelectric power contracts. A number of factors led to the decision to build-out fiber: the City wanted to connect eight electric substations, local businesses were interested in fiber to connect to the internet and between their build-ings, and the establishment of the Palo Alto Internet Exchange in 1986-87¹⁹. Palo Alto had two major advantages when building out their infrastructure. First, the City owns all of their own utilities, which has given them great flexibility while also being quite lucrative. Because they owned their utilities, the City had full information on where all the conduits were in the area and had the permission to access these conduits. Thus, they were able to minimize street excavations and install fiber in existing conduit. Secondly, because they owned their electrical utility and fiber installation was an electrical project, they were able to finance the project by taking out a \$2 million loan from the electrical utility.

#3: City-owned, Utility-managed conduit & fiber

Silicon Valley Power (SVP), Glendale Water and Power (GWP), and Burbank Water and Power (BWP) represent cases of city-owned, utility-managed fiber. Each of these municipalities own their own electric and/or water utility, and built out their fiber infrastructure initially as part of an electrical systems upgrade and/or to connect electrical substations. Eventually, these systems have been expanded to provide fiber connection to city departments and fiber leases to local businesses. Though the details vary by city, each city has noted that a major benefit of being able to offer dark (or lit, in the case of BWP) fiber has been a boon for economic development.

Silicon Valley Power owns and operates 57 miles of conduit, and 144-288 strands of fiber in four rings around the City of Santa Clara (which is 18.4 square miles). The original loop was designed to connect some electrical substations, and City Council approved

¹⁹ The Palo Alto Internet Exchange (PAIX) is an internet exchange point. PAIX is a physical location where internet service providers can directly exchange traffic, which has three benefits. First, by directly exchanging traffic, ISP's do not have to pay to send data upstream to get to the proper network. Secondly, traffic is reduced because information can be exchanged directly and doesn't have to be sent to other cities in order to get to the correct network. Lastly, internet exchange points allow ISPs to send data much more quickly.

Advanced Policy Analysis, 2012

building out this loop to include all electrical substations, connect government facilities, and overbuild in order to lease fiber in 1994. The cost of each of these segments was \$3 million, \$600,000, and \$1.4 million, respectively. Initially, fiber leases generated about \$350,000 in revenue the first year and has grown to \$2.13 million in 2012 with 18 fiber customers. The fiber program contributes \$110,000 to the City's General Fund annually. Debby Barry, program manager of SVP Fiber Enterprise, states "Dark Fiber lease services attract new businesses and spur economic development. In addition, the availability of a fiber network enriches community services – for instance, schools now use flat screen computers, video conferencing, wi-fi and virtual classrooms.²⁰"

Glendale Water and Power own a 50 mile loop around the city, which is about 30.5 square miles. GWP installed the fiber to replace existing copper cables as part of an upgrade to a new electrical system. The project was funded through water and electrical revenue and cost about \$4 million. GWP currently makes \$200,000/year in revenue from leases, and expects this figure to increase as they improve their marketing campaign. The project manager in charge of the fiber program, Vishwa Tiwari, also has significant background knowledge on this topic as he has led other utilities through this effort.

Burbank Water and Power own an extensive 144 strand fiber backbone that runs throughout the city, which is 17 square miles. Of the 144 strands, only about 50% are being used, 15% by the city, and 35% by businesses. The installation occurred in 1997, when fiber was used to connect all electrical substations and cost about \$7 million. Like SVP and GWP, the money used as already allocated towards replacing copper cables and additional funding was authorized by the City Council as an investment in the future. BWP continues to work closely with other departments (water, electric, traffic, and sewer) to coordinate street excavation and piggy-back efforts to minimize/share costs. Unlike any of the other case studies in this section, BWP is the only municipality that offers lit services, primarily due to the demand of local businesses, which are typically post-production studios. Robert Deleon, [title], notes that their fiber offerings have at-

²⁰ Barry, Debby. "Questions about SVP Fiber." Message to Linh Vuong. 27 Apr. 2012. Email. Advanced Policy Analysis, 2012

tracted a number of new businesses to town. BWP makes enormous profit, about \$2.5 million annually in leases and continues to upgrade their infrastructure with this money. It is worth noting that BWP is not competing with local ISPs, as they typically only offer low-bandwidth internet access.

City/Utility	Contact Person	Contact
San Leandro	Steve Blum, Consultant	steveblum@tellusventure.c
		<u>om</u>
Seattle	Kristine Henry-Simmons,	Kristine.Henry-Simmons@
	Fiber Program Manager	<u>seattle.gov</u>
Palo Alto	Joshua Wallace, Key Ac-	joshua.wallace@cityofpaloa
	counts	lto.org, (650) 329-2275
Silicon Valley Power	Debby Barry, Program	DBARRY@santaclaraca.go
	Manager	v, (408) 261-5486
Glendale Water & Power	Vishwa Tiwari, Project	VTiwari@ci.glendale.ca.us,
	Manager	(818) 551-6900
Burbank Water & Power	Robert Deleon	(818) 238-3657

Table 1: Contact information for each case study

Street Cut Policies

One of the major costs in building out the middle mile is associated with street cuts. This policy area is emerging as an area of concern for municipalities across the nation. Driven by the national broadband plan as well as unique economic conditions, a number of communities have developed polices that encourage the gradual development of better internet infrastructure for their residents. The cities of Boston, San Francisco, and Seattle have each adopted progressive city-wide policy regarding street cuts.

For reference, the City of Santa Cruz has a population of 59,946. It spans 12.74 square miles and has a population density of 4,705 persons per square mile. In relative terms, it is significantly smaller in physical area than the three cities whose policies have been discussed with a much smaller population density. These factors must be considered when discussing the recommendations taken from this section.

San Francisco: 5-Year Excavation Policy (DPW Order 178,940)

The City and County of San Francisco has a population of 805,235. It has an area of 46.87 square miles with 17,179 persons per square mile.

San Francisco's street cut policy is housed within the Department of Public Works. DPW is responsible for coordinating street excavation, utility work, paving and other construction projects in the public right of way.²¹ Additionally, the Committee for Utility Liaison on Construction and Other Projects (CULCOP) is a subcommittee that meets monthly to discuss and coordinate such projects.²² Broadly speaking, San Francisco's street cut policy only allows a street to be cut once every five years.²³ Those cutting streets, typically utilities²⁴ and municipalities²⁵, are given an opportunity twice a year to

23 SF Public Works Code specifically allows for an exception for new technology, under Article 2.4 Section 21 24 Utility is defined as a provider of "electricity, gas, information services, sewer service, steam, telecommunications, traffic controls, transit service, video, water, or other services to customers regardless of whether such Owner is deemed a public utility by the California Public Utilities Commission." (DPW ORDER 178,940) 25"Municipal excavator shall mean any agency, board, commission, department, or subdivision of the City that owns, installs, or maintains a facility or facilities in the public right-of-way." (DPW ORDER 178,940)

Advanced Policy Analysis, 2012

²¹ http://sfdpw.org/index.aspx?page=370

²² All utilities and municipalities with upcoming projects are required to attend these meetings.

submit 5 year plans to DPW, who requires that those excavating streets be registered. Registration requires a number of documents including authorization to use the public right-of-way, insurance, Business Tax Registration Certificate, contact information. Additionally, the City requires a \$25,000 deposit and written confirmation that construction will not be delayed. Excavation permits can be obtained once registered, and detailed plans including maps showing location and conduit location, trench cross-section, and other relevant details must be submitted and stamped by a licensed civil engineer.

DPW reviews all 5-year plans, identifies conflicts and coordinates joint excavation projects. Excavators are required to coordinate when their plans overlap in a 5-year period. Four months before a street is paved, utilities and municipalities are notified and given another opportunity to coordinate excavation. In the case of multiple applicants, utility excavators will be grouped into one category and municipal excavators into another; one agency is responsible for the work. When applicants coordinate, DPW will try to schedule repaving and waive the damage restoration fee, when possible.

A number of useful tools can be found on the DPW website, including a database useful for tracking, planning, and coordinating all projects, a contact list for utility and municipal excavators, a notice of intent distribution list, as well as a five year plan/map, and a list of active permits.

Excavation permits are not always required, and emergency situations are granted some flexibility.²⁶

Boston: Shadow Conduit Policy

The City of Boston has a population of 617,594. It has an area of 48.3 square miles with a population density of 12,792 persons per square mile.²⁷

²⁶ Permits not required for work that can be completed in 24 hours (parking meters, street lights, traffic signs/ signals, trees, utility poles), sub-sidewalk basement work, sidewalk repair, sidewalk utility box repairs, or pothole repairs.

²⁷ US Census Bureau. 2010. State and County Quickfacts. http://quickfacts.census.gov/qfd/states/25/2507000.html
Advanced Policy Analysis, 2012
Install Conduit

Two agencies are involved in Boston's policy: the Public Improvement Commission (PIC) and the Office of Telecommunications (OT). OT is the main point of contact between the city and telecoms providers, and is responsible for the certification process required of telecoms to do business in the city. The process requires providers to submit information regarding experience, existing customer base, and a map of all existing conduit routes. Additional information including annual reports may be required. The process takes no more than 60 days, during which both parties can communicate regarding questions.

Once certified, OT is in charge of reviewing construction plans (maps, routes, and engineering drawings, etc.) before telecoms can get on the Agenda at the Public Improvement Commission. The Office of Telecommunications is also responsible for research and information gathering on telecoms systems and services, in order to assist other city departments.

As stated in their "Lead Company Policy", PIC states four objectives when considering the construction, installation, and maintenance of new conduit:

- 1. Minimize disruption to the City's public ways,
- 2. Allow the planned development of telecommunications facilities within the City to benefit Boston's economy,
- 3. Provide future Network applicants reasonable and timely access to City streets, and,
- 4. Facilitate the timely construction of all such Networks.

In practice, the City allows one grant of location for installation of new conduit at each downtown street. The first applicant, aka the "Lead Company", is responsible for notifying all companies whose names are on file with the PIC in order to coordinate other firms interested in placing conduit on that street; the cost is shared.²⁸ All interested parties coordinate together to submit one plan to the PIC. Most importantly, the City will

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²⁸ Must be done within 5 days. After notification, interested parties have 10 days to respond. Construction must begin within 90 days.

install a spare conduit alongside any new conduit. This cost is shared among all licensees but owned and maintained by the City for future use.

Seattle: Planning Analysis Coordination Tool (PACT)

The City of Seattle has a population of 608,660. The City spans 83.94 square miles and has a population density of 7,250 persons per square mile.

Seattle's street cut policy is housed within the Street Use division of the Department of Transportation (SDOT). Specifically, the Franchise and Utility Permit Section manages telecommunications installations (among others) and requires an application and detailed plans to be submitted prior to issuance of a permit. Unlike San Francisco and Boston, there is no limit to the number of times a street can be excavated. However, the Planning Analysis Coordination Tool (PACT) is (now) an online database that facilitates the coordination of utility projects in the City's Right-of-Way. According to the SDOT website, PACT allows for the following:

- 1. Provides public and private utilities, and SDOT divisions with information in regards to planned construction work
- 2. Identifies coordination opportunities and shows projects that have been coordinated
- 3. Identifies street moratoriums

The city requires that utilities update the database at least once a year, with capital improvement projects for the next three years. A map of planned construction is also available, broken into 4 quarters of the year, and type of construction (e.g. full/partial street closure, detour route, etc). Permits can be applied and paid for using Seattle's Online Permitting System. The permitting process has been integrated such that multiple permits can be applied for without having to wait for one to be entirely completed before the next can be attempted. Like San Francisco's DPW, Seattle's DOT provides repaving services for a fee.

Recommendations

As Santa Cruz continues to develop their broadband master plan, there are several clear recommendations for next steps. These recommendations have been chosen for their strength in achieving the pre-described goals (detailed on pages 6-7). An analysis based on the goals is given in the next section.

- 1. Adopt broadband as a key component in the City's economic development strategy.
- 2. Determine if there is existing conduit in the proposed conduit routes.
- 3. Adopt street excavation policies / Streamline internal processes.
- 4. Determine if there is overlap between the city's proposed conduit route and AT&T's build-out for Santa Cruz City Schools.
- 5. Perform a break-even analysis.

Analysis

The recommendations above are described below in greater detail. They are then evaluated based on the goals stated on pages 6-7. It is important to note that this entire report is based on the assumption that increasing access to broadband will lead to positive economic impacts. The recommendations developed were done so in order to increase broadband access, which in turn assumes positive economic impacts. While interviews with other municipalities have indicated that having their own fiber network has stimulated local economy, this report is focused instead on how to increase access to broadband. With the exception of Recommendation *#*5, positive economic impacts is not included in the discussion below.

Each recommendation meets the goal based on 4 levels: N/A, Minimal, Fair, Strong.

#1: Adopt broadband as a key component in the City's economic development strategy.

As a key economic development strategy, City Council should adopt an ordinance for broadband to be a DPW responsibility. Street excavations along the designated conduit route should have pre-approval from City Council in order to shorten the permitting process. Additionally, funds should be set aside to incorporate broadband into future Capital Improvement Projects (see Recommendation 5).

Increase Access and Competition: Strong. By placing broadband as an economic priority, the City will likely be able to expand access to high speed connectivity. It is less clear whether municipal investment will serve as enough competition to attract telecoms. Although Santa Cruz remains a tertiary market, there have been some cases where telecoms will enter a market after municipalities initiate investment in order to reclaim the market share.

<u>Maximize value of CIP investments:</u> Strong. Incorporating broadband as a DPW responsibility and pre-approving encumbrance permits along the proposed conduit path will maximize the value of CIP investments, as multiple projects can be executed at once. <u>Minimize administrative and fiscal barriers to entry</u>: Strong. Some administrative barriers to entry will be removed by prioritizing broadband, such as pre-approving encumbrance permits along proposed conduit route.

#2: Determine if there is existing conduit in the proposed conduit routes.

The most efficient way to accomplish this would be to request conduit maps from city departments: water, sewer, transportation, wastewater. Electrical conduit maps would also be helpful, but it is unclear if it is more efficient to request this from PG&E or DPW²⁹. Alternatively, a list of streets/blocks could be generated using the map on page 14 and given to DPW or each individual department to determine which of these routes have conduit. However, DPW's resources are limited, and it may be more feasible to approach individual departments.

Increase Access and Competition: Fair. By determining where existing conduit lays, there is greater likelihood of increasing access to high-speed connectivity. It is also likely that if the city and telecoms knows where the conduit is, that they are more likely to invest in the market.

<u>Maximize value of CIP investments:</u> Strong. This information should be extremely useful in planning CIP investments. The City will greater information about where its assets exist, allowing it to better plan future projects and more efficiently execute them.

Minimize administrative and fiscal barriers to entry: Strong. This will minimize both administrative and fiscal barriers. If the City can begin to document its assets, entities will not need to learn each time what assets are in their path, thus reducing administrative barriers. Also, by knowing where existing conduit lays, it's possible to maximize the use of existing conduit, thus minimizing fiscal barriers to entry.

²⁹ The City may not have access to PG&E conduit, but should have access to conduit installed by other city departments.

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#3: Adopt street excavation policies / Streamline internal processes.

In order to expand broadband infrastructure, the City will need to adopt policies regarding street excavations. First, in order to begin inventorying the city's underground assets, the city should require anyone applying for a street excavation or encumbrance permit in the future to submit maps/plans in GIS or CAD. Second, DPW should maximize coordination between underground utilities. This requires some ability to plan ahead either by DPW or by the utilities themselves. If the responsibility is given to DPW, then some kind of tool or database will be required (as well as additional staff). Seattle's PACT tool and San Francisco's database are good starting options. If the burden is placed on utilities, then DPW should notify underground utilities with enough time to allow for coordination. Currently, utilities are only notified so they can mark their conduits, but aren't allowed enough time for coordinated efforts. Thirdly, coordination of street cuts should then allow the City to adopt policies to minimize the number of street cuts. Boston's shadow conduit policy implies that streets are only cut once, but it is likely that Boston receives more requests for street cuts than Santa Cruz. Seattle and San Francisco places a time moratorium on frequency of street cuts, which may be a better policy for Santa Cruz. San Francisco's five-year moratorium may also be too stringent considering the few requests Santa Cruz receives, but Seattle's approach of selectively placing time moratoriums may be a more appropriate option. The City should consider placing a time moratorium on the busiest streets, or streets essential to local businesses, such as in tourist areas. If these routes coincide with City's potential conduit routes, it is imperative that the City install conduit during the initial street cut.

<u>Increase Access and Competition:</u> Fair. By encouraging coordination in street cuts, the City could incentivize competition and thus increase access. Moreover, by limiting the number of times major routes can be cut, the City is essentially forcing telecoms to decide if they are going to invest in the area.

<u>Maximize value of CIP investments:</u> Strong. Particularly by requiring maps to be submitted in a standard electronic format, the City should be able to use a software program to better understand the City's assets and thus maximize the value of future in-

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vestments. Coordinating street cuts among utilities, either through DPW or by the utilities themselves, should also maximize future CIP investments by reducing the number of projects. Minimizing street cuts will also increase the value of CIP investments by limiting capital expenditures.

<u>Minimize administrative and fiscal barriers to entry</u>: Strong. Like Recommendation 3, documenting assets will minimize administrative and fiscal barriers to entry. Depending on the new process, coordinating street cuts will also remove administrative and some fiscal barriers to entry for private entities. For example, if all utilities can apply under one permit, then both administrative and fiscal barriers are reduced.

#4: Determine if there is overlap between the city's proposed conduit route and AT&T's build-out for Santa Cruz City Schools.

In February/March 2012, Santa Cruz City Schools approved a bid from AT&T to build out a fiber optic network for increased bandwidth. City should take immediate action to determine if there is overlap between AT&T's planned route and the City's potential conduit routes. If there is, then the City can adopt one of two strategies: 1) require AT&T to install a shadow conduit or 2) allow access to the public right of way or conduit space (if it exists) in return for ownership of some number of fiber strands. Coordination between Economic Development Agency, DPW, and City Council will be required.

Increase Access and Competition: Strong. If there is overlap between the routes, there is great potential to increase access to broadband. Due to the time frame--fiber network to be functional by 2013 and plans not yet at DPW--this is the City's most timely strategy for increasing broadband access. Moreover, the City may be able to attract further AT&T investment under the right political context.

Maximize value of CIP investments: N/A. This is not a CIP investment.

<u>Minimize administrative and fiscal barriers to entry</u>: N/A. This must be initiated by the City and not a process that touches on administrative or fiscal barriers to entry.

#5: Perform a break-even analysis and identify funding.

The City is currently paying \$1/year for fiber strands for government communication purposes³⁰. When the franchise agreement with Comcast ends in 2021, Comcast will be able to set a new rate at their discretion. With little to no competition for commercial fiber in the area, the City will be at the mercy of Comcast. Many cities, such as Monterey and Seattle, have used I-Net rates to justify building out their own infrastructure. The City should perform a break-even analysis to determine the price point at which the City be leasing fiber versus building out their own infrastructure. Appendix C contains construction cost estimates from Silicon Valley Power. While it is good business practice for the City to be aware of their break-even point, it is also important to note that without their own infrastructure and with little competition in the area, the City will constantly have the lower hand in negotiating fiber leases with telecoms. Thus, even if the City is able to negotiate an acceptable rate, there is no guarantee that the rate will always be acceptable and the City must plan for such an event. Leasing fiber in perpetuity is likely a poor budgetary decision.

If the city decides that one-time costs for broadband infrastructure is more prudent than continued leasing, then steps need to be taken to identify possible funds. As a result of AB 2987, cable providers are required to pay a franchising fee to each city that is at most 5% of gross revenue.³¹ It is unclear how the City has allocated these funds, but Economic Development Agency should determine if these funds can be used to incorporate broadband into Capital Improvement Projects, such as for conduit runs. The city could also conduct a survey to determine the number of local businesses who would be interested in leasing dark fiber. With high demand, there may be more motivation to set aside necessary funds.

³⁰ Also called I-Net, or institutional internet.

³¹ Another fee, the PEG fee, is earmarked for PEG channels. It does not appear that franchising fees have similar restrictions.

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<u>Positive Economic Impacts</u>: Strong. While this recommendation doesn't directly lead to economic impacts, the results from it will allow the City to better understand where to allocate funds. Ideally, it will allow the City to make better decisions on how the money allocated to leasing fiber or building out infrastructure can be used to improve economic development.

Increase Access and Competition: N/A.

Maximize value of CIP investments: N/A.

Minimize administrative and fiscal barriers to entry: N/A.

Conclusion

Given the background of Santa Cruz and the future it hopes to build for its community, investing in high-speed internet access is key. However, overcoming the middle mile problem in Santa Cruz remains the biggest challenge and and investment from telecoms is unlikely. Even if telecoms decide to invest, the city will still have a lower hand in negotiating rates as they are not considered a profitable market, leading to little competition in the area. At the very least, the City should adopt policies that makes telecom investment easier. Ideally, the City should install its own conduit.

The City can take a number of intermediary steps towards both of these goals. Adopting broadband as a City priority will clear a number of administrative barriers for telecom investment, as will adopting street cut policies and streamlining internal processes. Determining where conduit exists, particularly if it does along the proposed conduit path, is essential if the City wants to install its own conduit, and AT&T's proposed build-out may be the City's first opportunity for joint excavation. However, certain city processes should be streamlined in this time: reducing the turnaround time of permitting, increasing planning to coordinate and minimize street cuts, and inventorying existing underground assets.

A number of findings lead to the primary conclusion that the City should install their own conduit. Preliminary interviews with other municipalities strongly indicate that city-owned conduit and fiber is a major factor in economic growth. Telecoms are unlikely to invest to a satisfactory degree in the City. And in 2021, the City will be forced to consider this issue as the I-Net rate will likely increase. This deadline is perhaps a blessing in disguise; the City has 9 years to plan and invest in their own infrastructure, in their own future.

Appendix A

Workers Commuting from Santa Cruz to Other Counties



Total Workers That Live And Work In Santa Cruz 93,084

Data Source: U.S. Census 2000

Cartography by Current Economic Statistics Group Labor Market Information Division California Employment Development Department www.labormarketinfo.edd.ca.gov

Appendix B

Analysis of Conduit Lease Structures

This appendix summarizes some of the leases found on Tellus Ventures website and examines common themes that the City of Santa Cruz should consider when creating their own conduit lease.

Leases

Between the **City of Milpitas and XO Services**, the lease covers 17,861 linear feet at \$0.10/ft, paid in-kind through 2013. After 2013, the City will receive \$1/foot/year.

The **City of Seattle** has released an RFP to lease excess capacity in Pioneer Square for five years in city-installed conduit. There is a one time cost of \$42,000 to cover the cost of the conduit and \$36,000 to cover the cost of pulling ducts into the conduit. Annual costs at \$4.98/linear foot and \$18.91/sq.ft. (vault space) generate \$4,057 in revenue for the city.

The lease agreement between the **Boulder Valley School District (BVSD) and the City of Boulder** amends a 2008 agreement that allows the City to use BVSD's infrastructure to build out high-speed internet access to city facilities. The agreement is done in two parts. BVSD and the City will exchange with each other 4 additional strands in different locations. Additionally, acting on behalf of **BRAN** (a telco in which the City acts as managing partner), BVSD will provide 20 fiber strands in exchange for a fixed cost of \$200,000 and an annual cost of \$15,000. No use of city funds.

The lease between the **City of Tumwater and CenturyLink** reflects an increasing rate structure and builds upon previous leases between the parties. CenturyLink will install and have access to 4" conduit with 48 strands of fiber that will become city property. The rate starts at \$2.05/linear foot and increases by 2% each year until the end of the lease term. The lease between the **Delaware River and Bay Authority and Fi**-

ber Technologies Network also has an increasing rate structure starting at \$3/ft in 2009 and increasing to \$7/ft in 2012.

Considerations

In California, the CPUC set rates for pole attachments and conduits for Investor Owned Utilities, such as PG&E. The rate set by the CPUC is \$2.50/pole. Attachment rates are charged as a percentage of ownership costs.32 [Similar rates apply for conduit PLEASE CITE] Should the fiber route chosen by City of Santa Cruz be partially aerial [or be based off IOU's infrastructure], these are the rates that would apply. However, the CPUC has no authority over municipal owned utilities and cities/municipalities who own their own conduit have the liberty to choose rates as they see fit.

Rates & Term

Generally, conduit leases do not create significant revenue for municipalities, but can accumulate over time. Revenue generated from these leases are used to recover costs, continue the operation, or may feed into the general fund. According to Tellus Ventures, cities should be able to lease conduit at fair market prices when working with private companies. The leases reviewed above range from \$1-7/linear foot over periods of 1-30 years. Increasing rates, such as those in the Delaware, Tumwater, and San Leandro cases are meant to reach fair market price after a certain number of years. In the instance of San Leandro, the cost starts out low because the lessee is a private businessman, and not a large telecom.

Responsibilities

In some cases, the city has preemptively installed fiber and sought lessees after the fact (such as establishing a conduit utility), and in other cases, the leases permit telecoms to install and have access to the conduit. In all cases, the telecom is responsible for maintenance and the conduit is owned by the city. Cities have chosen to either provide lit or

32 This is computed by dividing the volume or capacity rendered unusable by the telecommunications carrier's equipment by the total usable volume or capacity. (CA PU Code 767.5(c)(2))

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dark fiber services, or not provide services at all and simply hold the fiber33. In the case of Santa Cruz, the lease agreement between Boulder Valley School District and the City may be most relevant. With the County Office of Education expanding their broadband infrastructure, there may be an opportunity for the city to build out to city facilities and commercial and industrial zones.

³³This can happen for a variety of reasons, including leverage against telecoms whose prices are too high in a particular community or to reserve for future needs.

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Appendix C

Cost Estimate from Silicon Valley Power

According to Debby Barry of Silicon Valley Power: "For example, to install 1-mile of underground, trenched, 4-inch conduit, fiber, vaults, splicing, and termination is an estimated \$1.0 million (includes labor, permits, materials and equipment). Once the underground trench and conduit is in place, to overbuild with additional fiber is only about a third or less of the overall cost. Cities that do not have an electric utility --that requires a fiber communication as part of doing business-- might consider installing one underground fiber optic ring (example: City of San Leandro). The ring could be used to support City communication and IT needs, and then, overbuilt to lease out dark fiber to 3rd parties (fiber carriers, schools, and businesses)."³⁴

34 Barry, Debby. "Questions about SVP Fiber." Message to Linh Vuong. 27 Apr. 2012. Email. Advanced Policy Analysis, 2012