DEL NORTE COUNTY TELETRANSPORTATION / TELECOMMUNICATIONS
Phase IV Planning Report

Mouth of the Klamath River

Prepared For:
Del Norte Local Transportation Commission

Date:
April 9, 2009

Prepared By:
John Irwin
J Irwin Consulting
www.jirwinconsulting.com

DEL NORTE COUNTY TELETRANSPORTATION / TELECOMMUNICATIONS
Phase IV Planning Report

Table of Contents

Table of Figures

DEL NORTE COUNTY TELETRANSPORTATION / TELECOMMUNICATIONS
Phase IV Planning Report

PREFACE

This report constitutes the fourth teletransportation / telecommunications planning effort conducted under the funding and auspices of the Del Norte Local Transportation Commission.

This report evaluates the feasibility of bringing broadband to the south Del Norte County area, even in the face of considerable challenges. It is NOT a detailed network engineering design. Yet it contains many aspects of such. It is highly suitable for use in seeking funding for the approaches described herein.

Attempts to keep the arcane telecommunications language and jargon in lay terms are possible only to a degree. Telecommunications is a rich and complex topic. It is nearly impossible to delve into any depth of discussion about telecommunications without resorting to the use of the specifics of language required in its discussion. The consultant is available to assist in the reading and use of this document.

Network engineers will find a vast amount of information in this report that will serve beyond a mere starting point for their necessary activities. Grant applicants will also find a bounty of information. This document also can serve as reference material for issuing and responding to a Request for Proposal (RFP).

It has again been an honor and privilege to serve Del Norte County. Do not hesitate to get in touch.

onward… john

John Irwin
J Irwin consulting
www.jirwinconsulting.com
john@jirwinconsulting
541.664.2456

DEL NORTE COUNTY TELETRANSPORTATION / TELECOMMUNICATIONS
Phase IV Planning Report

EXECUTIVE SUMMARY

> "Facts are stubborn things; and whatever may be our wishes, our inclinations, or the dictates of our passion, they cannot alter the state of facts and evidence."
> *John Adams, December 1770*

Even with substantial gap financing from grants, this is a very hard business case to make—even at a break-even level. That is, the ability to sustain ongoing operations solely from revenues is at high risk. The wireless backhaul option has the most promise and the least risk. All approaches to backhaul use the same robust WiFi technology for local distribution.

Aerial Financial Model with Local Distribution	
Payback period with 0% gap funding	63 years
Payback period with 40% CASF funding	41 years
Payback period with 80% BTOP funding	14 years
Traditional Trenching Financial Model with Local Distribution	
Payback period with 0% gap funding	211 years
Payback period with 40% CASF funding	127 years
Payback period with 80% BTOP funding	42 years
Micro-trenching ($20/foot) Financial Model with Local Distribution	
Payback period with 0% gap financing	68 years
Payback period with 40% CASF funding	41 years
Payback period with 80% BTOP funding	14 years
Micro-trenching ($30/foot) Financial Model with Local Distribution	
Payback period with 0% gap financing	101 years
Payback period with 40% CASF funding	60 years
Payback period with 80% BTOP funding	20 years
Wireless Backhaul Financial Model with Local Distribution	
Payback period with 0% gap financing	6 years
Payback period with 40% CASF funding	4 year
Payback period with 80% BTOP funding	1 year

Local distribution would use a robust WiFi network architecture.
BTOP = Broadband Technologies Opportunity Program
CASF = California Advanced Services Fund

This Klamath/south Del Norte County scenario is not a unique situation. The biggest challenge with this area is the lack of readily available backhaul combined with the sparseness of population in modestly challenging terrain. As we can see from this example, local distribution of suitably robust broadband can be enabled at a reasonable investment and consumer price point.

Across America we find many instances where the business case is difficult in the extreme, if not impossible. And, to date, this need for a profitable or break-even scenario is a requirement for ensuring continuance of the services. One of the rules of telecommunications infrastructure and services provision is that *someone, somewhere, some way has to pay*. Subsidization for ongoing operations from public funds has yet to take hold. Even cross-subsidization within municipal or other governmental entities does not have a record of success and meets with considerable resistance, from taxpayers and from the telecom industry. Yet, today, use of tax payer dollars to subsidize broadband may be the only way to provide continued operations in some areas.

Documenting these tough financial cases and bringing the plight of an area to policymakers may eventually have the effect of development of some funding mechanism to subsidize these ongoing operations.

The cost of providing backhaul to serve this market is what makes the overall business case very difficult. This is a large part of why we favor the building of backhaul from Crescent city to Eureka with drop-off electronics at Orick and Klamath. The ability to aggregate demand at both end points provides the backhaul necessary for investors to build out the local distribution services for the Klamath area.

Recommendations Include the Following:

Identify Opportunities for Public-private Partnerships
Public-private partnerships take many forms. In general they are the result of a negotiated agreement between the public and private sector participants.

Issue a Request for Proposal (RFP)
One way to get to the next level for implementation is to issue a Request for Proposal (RFP), using the information contained in this planning document. Outcomes from this approach are interesting, especially when we see competition to provide the requested infrastructure and services.

Pursue Grant Funding Opportunities
As demonstrated in the financial models, gap funding dramatically impacts the payback periods. Here is where a public-private partnership, albeit more complicated, may have a role.

Adopt a Del Norte County Telecommunications Ordinance/Code
A review of the ordinances and code in place in Del Norte County reveals there are no provisions relating to telecommunications or telecommunications-related facilities, such as installing conduit when the opportunity to do so emerges. Build-out costs for broadband investment are reduced when conduit is already in place.

Build and Profile Demand in Del Norte County
Demand growth for broadband services is a key driver of investment in telecommunications infrastructure and services. Perhaps, even of more importance, is that growth in demand also indicates economic and quality of life improvements.

Two of the three goals (1 & 2) of the adopted Teletransportation / Telecommunications Strategic Plan are focused on demand (see details of the Plan for a better understanding of what is entailed under each of these goals). Demand represents the answer to the *"so what…"* question as in *"so what if you have advanced broadband services?"* Let us ensure we are building and demonstrating growth in demand for services.

Standing up the recommended Information Technology Advisory Committee (ITAC, Goal 1 action item) could ensure ongoing efforts with regard to broadband (supply and demand) by taking local ownership of implementing and updating the strategic plan as well as monitoring and encouraging growth in demand.

Pursue Funding to Pursue Implementation of Planning Elements
Considerable effort has gone into four phases of planning. Now it is time to pursue implementation. The consultant strongly believes in the role of local leadership but also recognizes the value add of using of specialized expertise combined with years of field work in the county.

Sometimes… *hard is good!* This is one of those challenges.

DEL NORTE COUNTY TELETRANSPORTATION / TELECOMMUNICATIONS
Phase IV Planning Report

Introduction

To remain competitive in today's world Del Norte County businesses, institutions and residents must have available to them the most advanced telecommunications technologies and services AND the knowledge of how to use them. There is considerable opportunity to further expand the use of telecommunication-related Information Technology in the county, to integrate it more fully into daily operations and lives. Achievement of this set of goals requires forward-leaning planning accompanied by patient and persistent implementation.

Local Transportation Commission Purpose Statement[1]

> "Recognizing the physical isolation and existing broadband limitations of Del Norte County, strive to develop teletransportation as a competitive and alternative mode to conventional transportation, consistent with state and federal transportation planning requirements and conforming to guidelines established by the California Transportation Commission, and to use teletransportation to directly and indirectly promote mobility, goods movement, and overall economic vitality for the betterment of Del Norte County."

Overview of Previous Planning

Del Norte broadband planning efforts to date demonstrate forward-leaning leadership among northern California counties. The result is a Teletransportation / Telecommunications Strategic Plan, state-of-the-art broadband offerings in the northern portion of the county, planning that encourages and supports investor/provider interest in bridging the gap between Crescent City and Eureka as well as resolving the route redundancy challenge for the region.

- Phase I provided a broad assessment of the Del Norte County region's telecommunications assets and proposed a "plan for the plan" for Phase II. Phase I was completed in June, 2006.
- Phase II resulted in advances in broadband infrastructure in Del Norte (i.e., 5 Gb/Ethernet coastal connection Crescent City and north for broadband service expansion and stability) as well as a Del Norte Teletransportation / Telecommunications Strategic Plan with three broad goals accepted and adopted by Tri-Agency Economic Development Authority. Phase II was completed in June 2007.
- Phase III continued and expanded planning for southern Del Norte County initial broadband service, countywide route redundancy for telecommunications services (voice and broadband), and a high-level study of public safety related telecommunications status and opportunities. Phase III documented potential routes for expansion of broadband in the county. Two significant routes were identified: highway 101 (Eureka to Crescent City) and highway 199 (Crescent City to the I-5 corridor). The 101 route would provide backhaul services for rural southern Del Norte and northern Humboldt. This would provide for acquisition of

[1] Work Element N, Teletransportation/Telecommunications Study, Phase III, Del Norte Local Transportation Commission, 2007-08 Overall Work Program, Page 22

advanced telecommunication services for Klamath and Orick areas. Both routes could result in route redundancy for the county. The Phase III planning also surveyed public safety entities to understand the potential for integrating with their planning for broadband. Phase III was completed in May 2008.

Phase IV Planning—Overview
Phase IV continues the Del Norte teletransportation / telecommunications planning leadership in northern California, as follows:

- Additional planning is provided to pave the way to provide distribution of high speed broadband infrastructure access opportunities to residents living in the very rural south county (Klamath area). Provision of broadband in this area of the county will increase healthcare access to the statewide e-health network[2], increase access online educational opportunities (e.g., distance education and life-long learning) and pave the path to increased economic development opportunities.
- Continued efforts to create collaboration among providers and other investors by seeking and fostering partnerships where available and appropriate.
- Developed recommendations for countywide telecommunication ordinance.
- Represented Del Norte County on the Redwood Coast Connection (RCC) Broadband Demand Aggregation Pilot Project[3] (completed in February, 2009).

The Continuing South Del Norte County Challenge—Low Population Density
Today the only coastal telecommunications route is provided by Verizon microwave infrastructure. This backhaul capability is provided via microwave radio transmission that is notably out of capacity. There is no fiber-based backhaul infrastructure on the coast from Crescent City to Trinidad.

Investment in telecommunications infrastructure typically gauges homes and/or businesses passed to assess viability of a business model. The area south of Crescent City to Klamath in the 101 corridor is very sparsely populated.

[2] A Federal Communications Commission pilot project was commenced in 2007. The status of the project in California is not clear. What is clear is that as of this writing the FCC has not issued a single dollar anywhere in the U.S. under the auspices of the pilot project.

[3] The RCC pilot project was conducted under the guidelines of the California Broadband Task Force (CBTF) and funded through the California Emerging Technology Fund (CETF), Humboldt Area Foundation (HAF) and others. The Del Norte Planning Consultant authored the project concept statement and coordinated development of the project plan approved by the CETF. The project is intended to developed detailed broadband market information across four northern California counties: Del Norte, Humboldt, Mendocino and Trinity. View the final report at http://redwoodcoastconnect.humboldt.edu/?content=docs

Figure 1 -- Del Norte Census Tract Map[4]

In particular we look at census tract 2.03 (the Klamath area) with 1,203 residents and 592 households. The population density is 8.9 per square mile and 4.4 houses per square mile (see Figure 2).

Geographic area	Population	Housing units	Density per square mile of land area	
			Population	Housing units
Del Norte County	27,507	10,434	27.3	10.4
CENSUS TRACT				
Tract 1.01	3,784	1,715	3,739.4	1,694.8
Tract 1.02	3,488	1,434	396.0	162.8
Tract 1.03	8,667	3,547	607.9	248.8
Tract 2.01	6,592	1,314	183.7	36.6
Tract 2.02	3,773	1,832	4.6	2.3
Tract 2.03	1,203	592	8.9	4.4

Figure 2 -- Del Norte Population by Census Tract[5]

This is a very challenging business scenario from a broadband provider/investor point of view.

[4] U. S. Census, American FactFinder, Thematic Maps, http://factfinder.census.gov/

[5] GCT-PH1: Population, Housing Units, Area, and Density: 2000, Data Set: Census 2000 Summary File 1 (SF 1) 100-Percent Data, Geographic Area: Del Norte County, California -- Census Tract, http://factfinder.census.gov/

Klamath Area and Yurok Reservation
The Klamath area and Yurok reservation largely are without any broadband service today. Limited T-1 services are available at very high rates. Satellite provides access for scant few but it is quite expensive for many living in the region.

One possibility is for a local entity to establish itself as a wireless broadband provider. This might be an opportunity for the Yurok Tribe. With the coastal route in place they would have high quality access to backhaul to the Internet. Architecting a series of wireless hops up the river is well within technical and financial capabilities, although not without the usual challenges and requisite due diligence. Not only could the Klamath area be served but broadband services could also be provided up river into the area between Johnsons and Weitchpec, possibly beyond. These services could include broadband and VoIP.

Yurok IT staff have already explored some this option and submitted grants without success. A serious barrier is access to the Internet via a quality backhaul service. The coastal route provides that access and they become a major anchor tenant on the route. The backhaul alternatives in this plan could bring necessary backhaul to the Yurok tribe.

Discussions with Yurok Information Technology (IT) staff indicate a low level of interest in operating such a network but a high degree of interest in using these resources once available.

The Phase IV planning addresses getting broadband to Klamath. Getting up river to Weitchpec is not in the scope of this planning effort.

Potential Role for Community Service Districts
SB 1191[6] signed by Governor Schwarzenegger on July 9, 2008, authorizes community services districts (CSDs) to provide broadband services to the community they serve. CSDs provide essential services—such as water, sewer, fire and police protection, park and recreation, and more—to their local community. This bill adds the provision of broadband services and facilities to the existing list of 31 authorized services. Specifically, SB 1191:

- Amend Government Code 61105 to include broadband services in the list of authorized services a CSD may provide to its constituents until a private entity is able to maintain the operations and facilities, and offer the same quality of service and comparable cost to the district and residents of the CSD;

- Once a private entity is ready and able to take over the facilities, the CSD shall:

    - Sell its broadband facilities and services to that private entity at a fair market value; or
    - Lease the operation of the broadband facilities at a fair market value to that private person or entity.

[6] Community services districts and broadband access , Senate Bill 1191 (Alquist), http://www.csda.net/images/stories/legislative/SB1191factsheet.pdf

The following are the CSDs eligible in Del Norte (all in Klamath area, no broadband service)

Hunter Valley
Klamath
Redwood Park

Updates on Continued Collaboration Efforts with Investors/Providers
All planning results to date have been shared with Charter Communications, Broadband Associates, LS Networks and Hunter Communications. Verizon seemingly remains uninterested.

Pertinent to the delivery of broadband to the south county area in Phase III the consultant verified above ground power transmission infrastructure of 63 miles along highway 101 to which fiber might be installed. An additional 29 miles of the route (next to the National Park) appears to have buried power, most likely in conduit. The above ground distribution is readily accessible throughout the route with a couple of more difficult spans to address. The buried distribution requires additional engineering study to assess viability for pulling fiber through conduit adjacent to the National Park.

Cost of building this route is estimated at between $3.5 to 4 MM (per Charter Communications sales engineers). Included in this plan was drop-off of electronics in Klamath and Orick to provide for local distribution. The estimated cost did not provide for deployment of local distribution as the focus was on providing backhaul between Crescent City and Eureka.

This route, along with the route along highway 199, and the Phase III planning report has been shared with Charter Communications, Broadband Associates and LS Networks.

Charter Communications
Bankruptcy, re-organization and the recession have delayed their plans to pursue this route. Early planning discussions with Charter would have seen an aerial build for most of the route with use of power conduit that runs along 101 by the Park. Today Charter would be the likely candidate to provide an internet interconnect at Crescent City (access to the worldwide internet).

This alternative is likely stalled until Charter is again on solid ground.

Broadband Associates
Interest by Broadband Associates was evident in the fall of 2008. This is the company that has undertaken the build between Redding and Eureka, planning to plow fiber into the pavement in highway 299. Broadband Associates believes that micro-trenching is the best alternative for the 299 route and also see this method of installing fiber as optimal for the highway 101 route. The 101 route would be a likely candidate as a next project but no further action is underway at this time. The 299 route seemingly is demanding all of their attention at this writing.

This is an evolving longer term scenario that needs to be monitored.

LS Networks
LS is an Oregon company with an interest in closing the loop in southern Oregon that requires passing over the 199 route. Interest in including Crescent City in this route has been expressed.

Some interest in the 101 route has arisen but the likelihood is higher for the route redundancy path over 199. At an April 7, 2009, meeting LS revealed planning in the works that includes in depth evaluation of the 199 route. If LS does make the connection to Crescent City, then the competition they would provide to Charter could result in reduced or competitive rates for connecting to the Klamath feed.

This, too, is an evolving—but more promising—possibility that will require further support and encouragement.

Verizon

Verizon is not participating in these discussions of broadband expansion. Verizon holds close any of their plans in any event. Verizon capital investment tends to be more urban in its orientation and focused on its FIOS project (fiber to the premise). However, this following update (April 08, 2009) from a Verizon technical person was forwarded from Dan McCorkle, Director, County of Del Norte, Department of Information Technology.

> Completion of the tower at the top of Requa hill which will allow Microwave Dishes to be installed. Last month 2 MW Dishes were installed in Crescent City facing Klamath and sometime this month a crew from Idaho is scheduled to be here to build a new towerat Requa Hilltop and place 3 MW Dishes on it. Then the matching Radio Equipment within the Upper Klamath and Crescent City offices can be activated which will allow 2 new DS3's to be activated from Crescent City to Eureka.
>
> New Fiber Mux equipment in Crescent City, Smith River, Hiouchi and 3 remote distributions sites along the way have all been upgraded with compatible fiber terminals. The equipment is in place. The cut over is complete in Crescent City, Hiouchi and Smith River. The driving force is Verizon Business contract with the California's Prisons to provide DS3's. The conversion to all these sites will free up fiber from Crescent City to Smith River and eventually cross the border to the rest of the world.
>
> As of Jan.09 the Brookings Verizon Central Office was upgraded to handle a new route to Crescent City. That new route is under construction and the County of Del Norte has been helpful in getting permits passed between Ship Ashore and the Stateline so Verizon can complete a fiber route from Brookings Or, to Smith River, Ca. This new route will allow VZ Buss to provide DS3 to the Prison, and Verizon Telecom to provide new services to the County. Tariff issues for Cal. State PUC and Federal PUC are involved. The County might possibly be helpful in that arena. I do not know the sequence of events but the new route has made more progress and been given more attention in one year than the Microwave system has gotten in 10 years.

This may yield additional capacity into Crescent City and provide opportunity for DSL or even a competitive interconnect for south county backhaul. But that is not clear as of this writing. This upgrade does not appear to provide south Del Norte County access to the expanded capacity. We need to watch this development for future opportunities in the south county.

Hunter Communications

Located in Klamath, Jackson and Josephine counties in Oregon, Hunter has expressed interest in the region and was conducted on a tour of the area. However, circumstances are such that Hunter

determined the need to remain focused in their current territory and to slowly move toward the coast.

Investment by this provider is a very long-term possibility at best.

Route Redundancy/Diversity Status[7]
We still do not see any immediate resolution of the route redundancy/diversity status for Del Norte. We continue to work this issue as the opportunity presents itself and see LS Networks as perhaps the best alternative as of this writing (see previous section).

BROADBAND SERVICES FOR RURAL SOUTH DEL NORTE COUNTY

Overview
Broadband services are not available in south Del Norte County. To bring these vital services requires the building of telecommunication infrastructure: backhaul (middle mile) and local distribution (last mile or first mile, depending on a point of view). A fiber route from Crescent City to Klamath is the optimal solution.

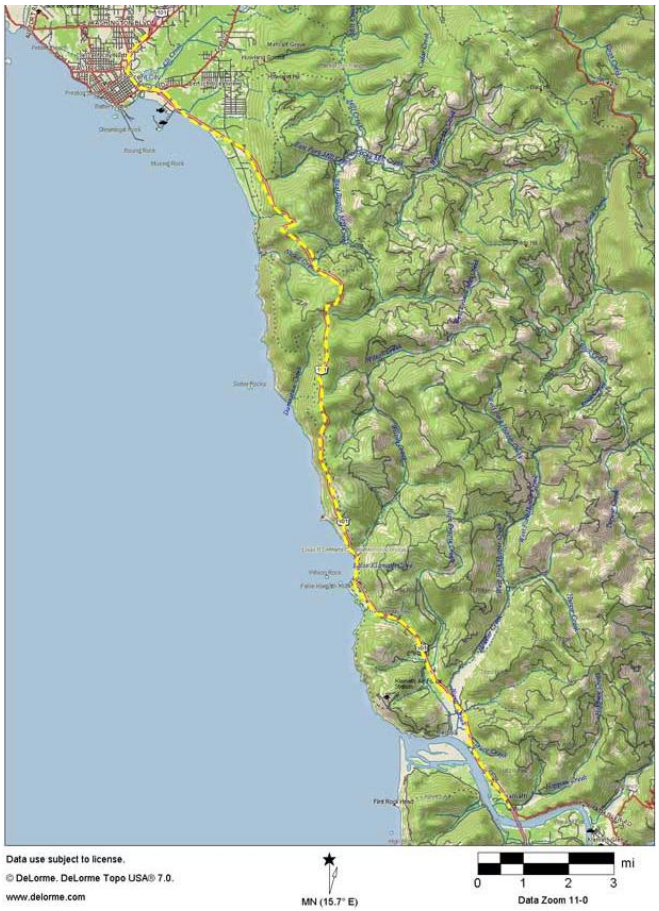


Figure 3 -- Crescent City to Klamath via Route 101 – 22 miles

[7] Route redundancy is automatic and nearly instantaneous re-routing of communications in the event of a disruption in the network. Route diversity is the availability of an alternative route but one that requires the consumer to install their own switching gear that allows for on-demand switching to use the alternate route.

The most significant barrier to distributing broadband south of Crescent City is the lack of backhaul.[8]

There are three ways to get broadband backhaul to the Klamath area.

- Aerial
- Traditional Trenching
- Micro-trenching
- Wireless

Few will question that fiber is the optimal method to future-proof networks. Demand for bandwidth is increasing at an exponential rate. Fiber is the only mode foreseen to be sufficiently scalable enough to future-proof a network infrastructure investment.

A wireless option is examined below in the context of it being an interim solution, recognizing the scalability of fiber. Yet in the absence of any broadband, wireless could be a viable approach and solution. Also, wireless technology is emerging rapidly and is proving to equally scalable, just not likely to the same extent as fiber.

Wholesale vs. Retail Business Models

While we advocate strongly for residential (retail) services, considerable best practices and results show that by first establishing anchor tenants through a wholesale offering brings the opportunity for local and regional investors to serve the retail markets. Otherwise put, getting routes in place for middle-mile and backhaul provides the opportunity for smaller markets to gain access to the outside world. Often larger companies do not see these smaller markets as opportunities due to the increased cost of serving retail customers. Also many companies serving smaller markets do not have the resources to build out long haul access to the Internet but they are very savvy in addressing their immediate community's needs.

Aggregated population for the 101 corridor makes for a more attractive investment for a wholesale business model, especially when the end-points of Eureka and Crescent City are included. In this model a large provider or investor with "deep pockets" would build the infrastructure and sell services to ISPs larger institutions and businesses along that route. Most of these wholesale customers realistically would be located in Humboldt County.

Del Norte County wholesale customers would be located along the 101 corridor and might include motels, healthcare, public safety, financial institutions, Trees of Mystery, Yurok Tribal headquarters and some professionals operating out of their homes.

Fiber Backhaul Options

Given the high likelihood of delays in pursuing the Crescent City to Eureka route any time soon, we examine three alternatives for backhauling broadband to the Klamath area.

[8] Also called 'middle mile' - a communications link from a local region to the Internet backbone

Aerial

The Phase III planning report (see http://www.jirwinconsulting.com/documents.htm) addresses bringing backhaul broadband via a route along highway 101 to link Crescent City to Eureka. This plan included drop-offs for distribution in Klamath and Orick. The build would be a combination of aerial and traditional trenching in the area of the Redwood National Park.

Micro-trenching

Traditional fiber deployments using buried conduit in rural areas have long been viewed as cost-prohibitive. Digging expense, right of way (ROW) barriers and passage through sensitive environmental areas are still enough of a barrier, even for aerial builds, to keep high-speed broadband services out of many rural, lightly populated areas. A new digging technique, known as micro-trenching, promises to help open up an avenue around these financial and environmental obstacles.

The Case for Micro-trenching

Micro-trenching fiber is quickly gaining recognition as the solution of choice because it is cost effective, provides an attractive finished result and avoids ripping up of the existing landscaping or roads.

Figure 4 -- Traditional Fiber Laying Technique

During installation After installation

Figure 5 -- Microtrenching Technique

Laying cable under a roadway through traditional means requires trenches that may be several feet wide and deep, often creating traffic detours for days, if not weeks, at a time. The cost of conventional digging methods can range from $75 to more than $100 per foot.

Micro trenching technology, however, involves the creation of a shallow trench in the street asphalt, which is typically one-quarter of an inch wide and two to six inches deep. Using this method, a crew can lay as much as a thousand feet of fiber per day.

In addition, the potential interruption of traffic flow is relatively minimal. The expense amounts to a fraction of the cost of conventional trenching techniques. Estimates range from $20 to $30 per foot including materials and depending upon the size of the project.

There are other advantages that could be even more valuable than the actual cost savings involved. Micro trenching projects eliminate considerable red tape and save significant amounts of time, when compared to traditional street trenching projects. Surveying and permitting may take 30 days for a micro trenching job, as opposed to 60 or more days for a traditional trenching project.

The difference is even more glaring when comparing the trenching work itself. A build may take as little as two days for micro trenching, but 30 or more days for conventional trenching work. From planning to completion, the build time frame for micro trenching may be 50 to 55 days, whereas the traditional approach can take 160 days, or more. Time is money.

Aerial is the least expensive method, assuming that the aerial poles already exist and access is permitted by the utility that owns the poles. If the poles are not available or affordable, the cost of construction will increase considerably. Placement of each pole costs about $1,000. The growing hurdle for this method is that local ordinances or building covenants require that utilities are buried for aesthetic purposes. Furthermore, network owners want their networks protected from storms and weather, especially in response to the damages caused by hurricanes and floods. For these reasons aerial is only deployed when cost is the driving factor.

Traditional trenching provides an aesthetically pleasing solution but is very expensive to deploy and traumatizing to existing infrastructure. The disruptive and lengthy time for trenching fiber leads to high labor and re-instatement costs.

From the carrier's perspective, successful fiber projects rely on the ability to keep the capital costs lower. Economic analysis of network construction costs demonstrate that labor is the largest expenditure in a fiber network build. Reducing labor costs requires a system that is quick and easy to deploy and extremely flexible in allowing optimal network design to traverse the routes. Minimal disruption to the environment is critical.

If aerial or existing conduit is an option, they are excellent first choices based on cost. Oftentimes, they are not options and trenching is cost prohibitive.

Micro-trenching has emerged as a viable solution for cost effective and secure fiber deployments. Not only is it quick to deploy, easy to manage but it is also less disruptive to the

existing landscape. Less disruption means non-disfiguring re-instatements, less traffic disruption and minimal inconveniences during the construction phase.

The network system requires the ability to traverse across a variety of terrains as well as the ability to transition to aerial poles or existing manholes.

Ensuring that lots of access nodes with slack cable are deployed makes future expansion of the network easy to do. Networks that can be deployed quickly means less traffic interruptions and inconveniences to the community as well as significantly reducing labor costs. Micro-trenching involves a simple slab saw cut into the asphalt or concrete or use of a small trencher in soft infrastructure. The conduit and cable are dropped into the cut and re-instatement in put in place immediately. Ideally, cuts in concrete follows the existing grout line for aesthetic purposes.

Micro-trenching is an excellent choice for fiber initiatives not only from an economic perspective, but also for safety, aesthetic, non-disruptive and customer friendly ones.

Backhaul Investment Comparisons—Aerial, Trenching and Micro-trenching

The estimated investment using micro-trenching includes materials and labor (ROW costs are potentially nil using the CalTrans ROW) for the 116,160 feet of the Crescent City to Klamath fiber route via Highway 101 is as follows:

@$20/ft	*@$30/ft*
$2,323,200	$3,484,800

Figure 6 -- Estimates for Microtrenching

Trenching	$7,434,240
Aerial	$2,340,624

Figure 7 -- Estimates for Traditional Trenching and Aerial

These estimates are for the building of the infrastructure. Included are telephone/power pole attachment rental costs (estimated at $15 each with a separation on average of 100 feet) = $17,424/year for the aerial approach. Not included here are the recurring costs of backhaul to connect to the worldwide internet, distribution (deploying to customers), optronics or ongoing operating/maintenance costs.

Optronics[9]

Fiber and wireless networks require routing switches to manage the light waves that pass through the fiber or the air and to interconnect with other backhaul access. Routers are specialized computers that send your messages and those of every other Internet user speeding to their destinations along thousands of pathways. A router is extremely useful in dealing with two or more separate networks. It joins the networks, passing information from one to the other and, in some cases, performing translations of various protocols between the networks. It also protects the networks from one another, preventing the traffic on one from unnecessarily spilling over to

[9] Optronics, or optoelectronics in its less abbreviated form, is the science and technology making use of optics and electronics. Optoelectronics is the study and application of electronic devices that source, detect and control light, usually considered a sub-field of photonics. http://en.wikipedia.org/wiki/Optronics

the other. As the number of networks attached to one another grows, the configuration table for handling traffic among them grows, and the processing power of the router is increased. Regardless of how many networks are attached, though, the basic operation and function of the router remains the same. Since the Internet is one huge network made up of tens of thousands of smaller networks, its use of routers is an absolute necessity.

The network router is quickly evolving from a device dedicated to connecting disparate networks to an integrated services device capable of multiple functions beyond routing. We now see increased deployment of integrated services routers, or sophisticated network routers that can deliver voice, video, data and Internet access, wireless, and other applications.

At least two of these routers would be required, one at each end of the network (i.e., Crescent City and Klamath) and one of which could be the wireless base station. Sizing these routers for this network is a network engineering decision and beyond the scope of this planning. The following link will take you to Cisco's comparison page where you can examine the range of options available from the preeminent manufacturer of routers:
http://www.cisco.com/en/US/products/hw/routers/products_category_buyers_guide.html

Cost varies and depends on the engineered solution. Rough estimates are in the $20,000 range. The optimal solution would be to use an existing suitable building structure to place racks versus having to build a hut or other powered enclosure.

Proposed Wireless Backhaul Option

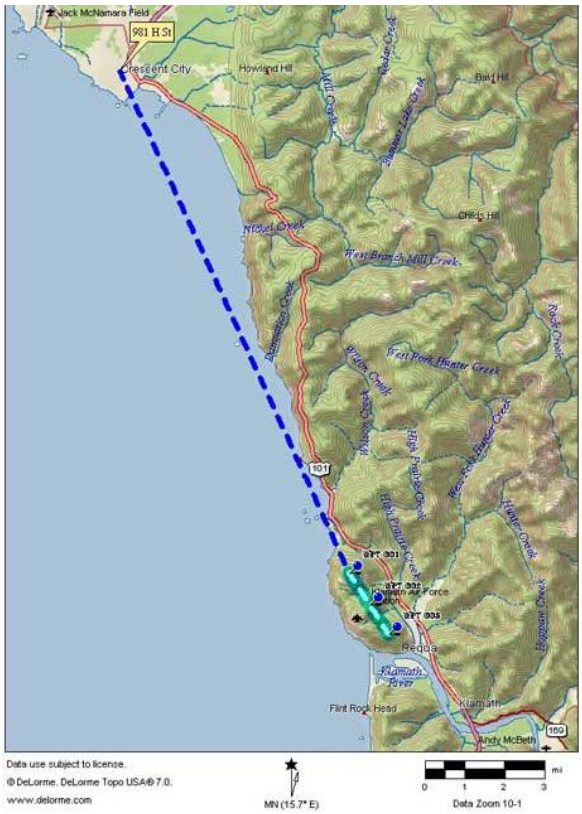
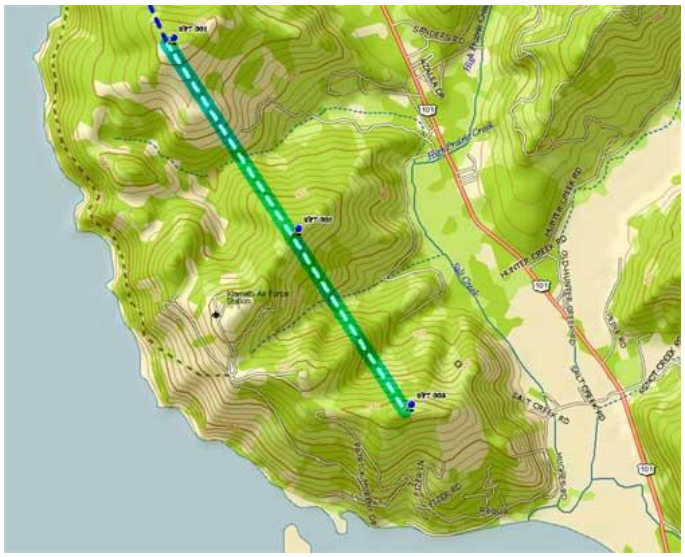


Figure 8 – Proposed Wireless Backhaul Path from Crescent City to Requa



Elev Gain:	8.3 ft
Climb Elev:	1,242.7 ft
Desc Elev:	1,234.5 ft
Avg Grade:	26
Min. Elev:	204.1 ft
Max. Elev:	815.8 ft
Lin Dist:	1.8 mi
Terr Dist:	1.9 mi
Climb Dist:	4,607.8 ft
Desc Dist:	1.0 mi

Figure 9 -- Topological Detail of Multiple Peaks in Requa Area

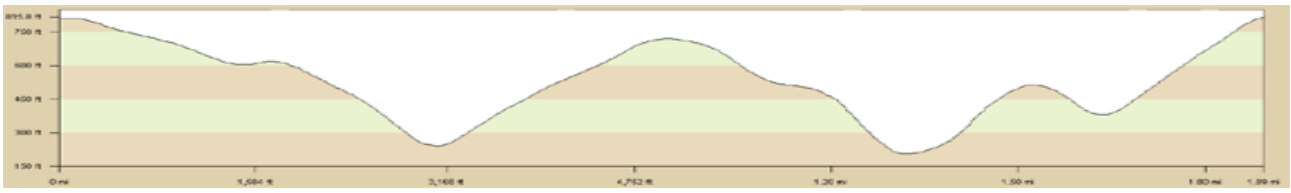


Figure 10 -- Elevation Profile of Multiple Peaks in Requa Area

Point-to-Point Backhaul (P2P)

Point to point is used where there are two points of interest: one sender and one receiver. This is also a scenario for backhaul or the transport from the data source (data center, co-lo facility, fiber POP, Central Office, etc) to the subscriber or for a point for distribution using point to multipoint architecture. Backhaul radios comprise an industry of their own within the wireless industry. As the architecture calls for a highly focused beam between two points range and throughput of point-to point radios will be higher than that of point-to-multipoint products.

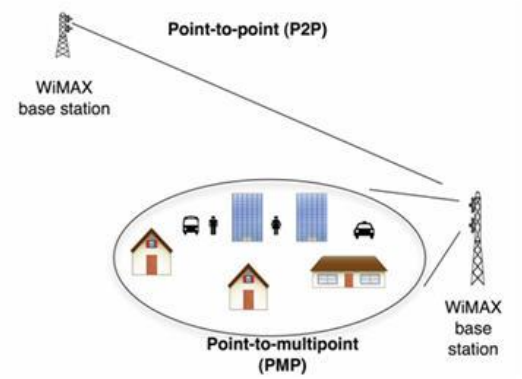


Figure 11 -- Point-to point and point-to-multipoint configurations

Point-to-Multipoint (PMP)—Distribution

As seen in the figure above, point-to-multipoint is synonymous with distribution. One base station can service hundreds of dissimilar subscribers in terms of bandwidth and services offered. This will be discussed further in the section on Wireless Broadband Distribution in South Del Norte County.

Line of sight (LOS) or Non-line of sight (NLOS)?

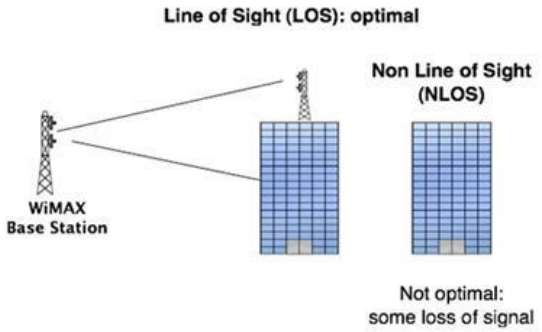


Figure 12 -- The difference between line of sight and non-line of sight

WiMAX point-to-point[10]

Earlier wireless technologies were unsuccessful in the mass market as they could not deliver services in non-line-of-sight scenarios. This limited the number of subscribers they could reach and, given the high cost of base stations and customer premise equipment (CPE), those business plans failed. WiMAX[11] functions best in line of sight situations and, unlike those earlier technologies, offers acceptable range and throughput to subscribers who are not line of sight to the base station. Buildings between the base station and the subscriber diminish the range and throughput, but in an urban environment, the signal will still be strong enough to deliver adequate service. Given WiMAX's ability to deliver services non-line-of-sight, the WiMAX service provider can reach many customers in high-rise office buildings to achieve a low cost per subscriber because so many subscribers can be reached from one base station.

As seen in the map above, most of this backhaul route would be over the ocean and would be a line-of-sight path. However, there is the possibility of some diminished signaling depending on the location of the Crescent City antenna.

At the core of WiMAX is the WiMAX radio. A radio contains both a transmitter (sends) and a receiver (receives). It generates electrical oscillations at a frequency known as the carrier frequency (in WiMAX that is usually between 2 and 11 GHz). A radio might be thought of as a

[10] This section quotes liberally from "Wireless Education: WiMAX," http://www.wimax.com/education/wimax/wireless_architectures

[11] The Worldwide Interoperability for Microwave Access, is a telecommunications technology that provides wireless data in a variety of ways, from point-to-point links to full mobile cellular type access. It is based on the IEEE 802.16 standard, which is also called WirelessMAN. The name WiMAX was created by the WiMAX Forum, which was formed in June 2001 to promote conformance and interoperability of the standard. The forum describes WiMAX as "a standards-based technology enabling the delivery of last mile wireless broadband access as an alternative to cable and DSL."

networking device similar to a router or a bridge in that it is managed by software and is composed of circuit boards containing very complex chip sets.

WiMAX architecture, very simply put, is built upon two components: radios and antennas. Most WiMAX products offer a base station radio separate from the antenna. Conversely, many CPE devices are also two piece solutions with an antenna on the outside of the building and subscriber station indoors as illustrated in the figure below.

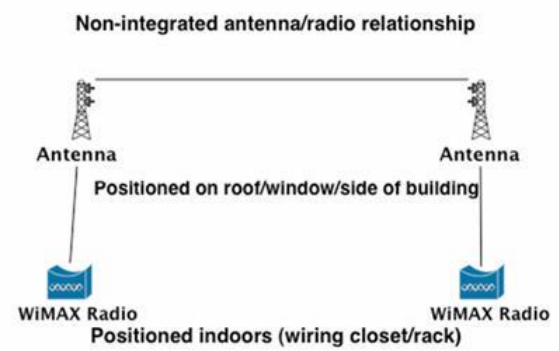


Figure 13 -- Most WiMAX solutions use radios separate from antennas

The chief advantage of this is that the radio is protected from extremes of heat cold and humidity all of which detract from the radio's performance and durability. In addition, having the antenna outdoors optimizes the link budget (performance of the wireless connection) between transmitter and receiver especially in line of sight scenarios. The antenna is connected to WiMAX radio via a cable known as a "pigtail". One simple rule for wireless installations: keep the pigtail as short as possible. Why? The longer the pigtail the more signal is lost between the antenna and the radio. The popular LMR-400 cable, for example will lose about 1 dB (pronounced "dee-bee" for decibel, a measure of signal strength) for every 10 feet of cable. Very simply put, if an antenna is placed at the top of a 20-story building and the radio in the wiring closet on the ground floor, one may lose all signal in the cable.

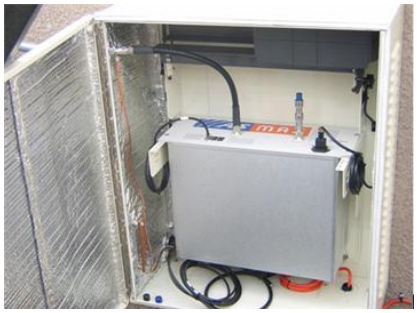


Figure 14 -- WiMAX performance can be optimized …

The photo above shows the WiMAX radio deployed in an enclosure. Note from left to right: a) copper grounding cable on the inside of the enclosure b) Ethernet connection to the data source c) Heliax "pigtail" to the antenna (Heliax is a heavy duty, lightning resistant cable) d) 110v power via an APC UPS (note black box in top right hand corner of enclosure.

What are some strategies to ensure the antenna can be as high as possible to take advantage of line-of-sight topologies where ever possible while keeping the pigtail as short as possible? One

approach is to co-locate the radio on or near the roof with the antenna in an enclosure. Considerations for enclosures include: a) security and b) weather resistance-how hot or cold can your radio gets and still function?

Sheet metal or fiberglass enclosures with a lock provide security. Next, it is necessary to determine how well suited the radio is for local atmospherics (hot or cold). Most Wi-MAX radios are rated as operating between -20 degrees Fahrenheit to 120 degrees F at the upper end. If you will be operating in locations that will exceed those parameters you need an enclosure that will shield your radio form those extremes. As the radio will generate its own heat, surrounding it with insulation will ensure the temperature of the radio will not suffer from sub-zero temperatures.

WiMAX Antennas

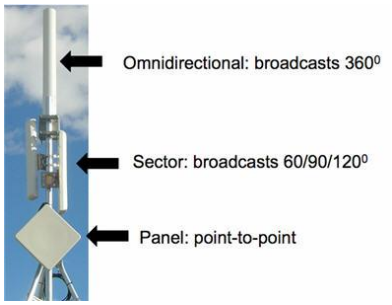


Figure 15 -- Different antenna types are designed for different applications

WiMAX antennas, just like the antennas for car radio, cell phone, FM radio, or TV, are designed to optimize performance for a given application. The figure above illustrates the three main types of antennas used in WiMAX deployments. From top to bottom are an omni directional, sector and panel antenna each has a specific function.

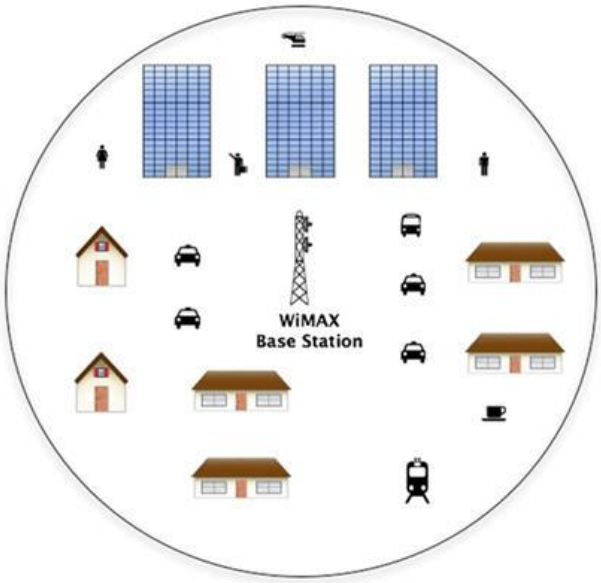


Figure 16 -- An omni-directional antenna broadcasts 360 degrees from the base station

Omni directional antennas are used for point-to-multipoint configurations. The main drawback to an omni directional antenna is that its energy is greatly diffused in broad-casting 360 degrees. This limits its range and ultimately signal strength. Omni directional antennas are good for situations where there are a lot of subscribers located very close to the base station. An example of omni directional application is a WiFi hotspot where the range is less than 100 meters and subscribers are concentrated in a small area.

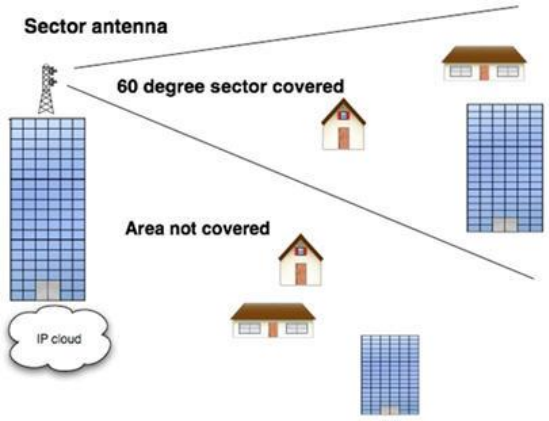


Figure 17 -- Sector antennas are focused on smaller sectors

A sector antenna, by focusing the beam in a more focused area, offers greater range and throughput with less energy. Many operators will use sector antennas to cover a 360-degree service area rather than use an omni directional antenna due to the superior performance of sector antennas over an omni directional antenna.

Figure 18 -- Panel antennas are most often used for point-to-point applications

Panel antennas are usually a flat panel of about one foot square. They can also be a configuration where potentially the WiMAX radio is contained in the square antenna enclosure. Such configurations are powered via the Ethernet cable that connects the radio/antenna combination to the wider network. That power source is known as Power over Ethernet (PoE). This streamlines deployments as there is no need to house the radio in a separate, weatherproof enclosure if outdoors or in a wiring closet if indoors. This configuration can also be very handy for relays.

The technical term for customer premise equipment (CPE) is subscriber station. The generally accepted marketing terms now focus on either "indoor CPE" or "outdoor CPE". There are advantages and disadvantages to both deployment schemes as described below.

Figure 19 -- An outdoor CPE device.
Note: mounting brackets for outdoor mounting on roof or side of building

Outdoor CPE, very simply put, offers somewhat better performance over indoor CPE given that WiMAX reception is not impeded by walls of concrete or brick, RF blocking glass or steel in the building's walls. In many cases the subscriber may wish to utilize an outdoor CPE in order to maximize reception via a line of sight connection to the base station not possible with indoor CPE. Outdoor CPE will cost more than indoor CPE due to a number of factors including extra measures necessary to make outdoor CPE weather resistant.

Figure 20 -- Indoor WiMAX CPE
Note: Antenna is the object on left with telephone handset and VoIP adapter

The most significant advantage of indoor over outdoor CPE is that it is installed by the subscriber. This frees the service provider from the expense of "truck roll" or installation. In addition, it can be sold online or in a retail facility thus sparing the service provider a trip to the customer site. Indoor CPE also allows a certain instant gratification for the subscriber in that there is no wait time for installation by the service provider. Currently, many telephone companies require a one month wait between placement of order and installation of T1 or E1 services. In addition, an instant delivery of service is very appealing to the business subscriber in the event of a network outage by the incumbent service provider.

Site Survey

Before any equipment is deployed, there must be a site survey to determine what is needed in order to have a successful wireless operation. This is a detail of the requisite network engineering task. By understanding the dynamics of the market where the deployment will take place and planning accordingly, the service provider can ensure success on Day One of operations.

Frequency Plan

Part of the site survey process is to determine a viable frequency plan. The wireless operator must make maximum use of limited spectrum assets. How does one do that?

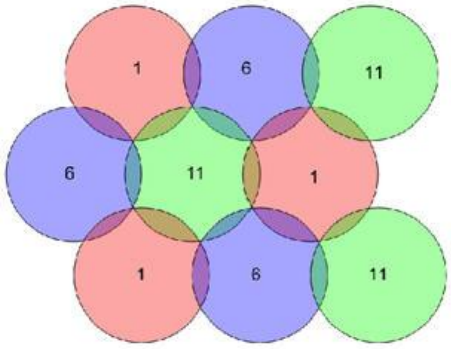


Figure 21 -- A WiMAX operator can avoid interference from their own network
By reusing frequencies at different base stations

The diagram above illustrates how a wireless operator (cellular, WiMAX, etc) uses their limited spectrum allocation to deliver the best service possible while avoiding interfer-ence between their base stations. Note there are nine different base stations with three different frequencies but no similarly shaded circle touches another. If they did touch, there would be interference between base stations because they would be operating on the same frequency. This assessment requires a detailed network engineering plan.

Estimated Backhaul Investment Costs

Three equipment manufacturer's investment costs follow as well as antenna estimates. A detailed network engineering assessment will be required to determine the appropriate equipment to be acquired (includes sizing the antenna for soil and wind conditions).

Please Note: The consultant is NOT a network engineer. Actual equipment can only be determined on development of a detailed network engineering analysis and plan.

Proxim Tsunami

Proxim Tsunami GX 32 24 or 32Mbps, 5.8GHz
Complete package to setup wireless Point-To-Point link.
Main features:
- 5.8GHz Frequency band, 22MHz bandwidth
- 24Mbps or 32Mbps maximum wireless data rate (24 or32Mbps maximum data throughput)
- Distance up to **42** miles or up to **44** miles with 24Mbps capacity
- 12 character Link ID (48 bits), VLAN passthrough, SNMP support, HTML management server
- FDD technology. Works as Ethernet Bridge
- MSRP price starts from **$16,199** per complete link

Proxim Tsunami.GX 90, full-duplex point-to-point wireless Ethernet bridge
Complete package to setup wireless Point-To-Point link. Split architecture radio with outdoor ODU units.
Main features:
- 5.8 GHz Frequency band, 27 MHz Bandwidth, Tx/Rx Spacing 85 MHz
- 106 Mbps aggregate Data Rate. (around 44 Mbps full duplex data throughput)
- Distance up to **33.7** miles
- 12-character Link ID code, VLAN pass-through, SNMP support, HTML management
- FDD technology, QPSK modulation, C/I - 7dB
- MSRP: **$22,798** for complete link, antennas and cables are not included

Proxim Tsunami.GX 200, full-duplex point-to-point wireless Ethernet bridge
Complete package to setup wireless Point-To-Point link. Split architecture radio with outdoor ODU units.
Main features:
- 5.8 GHz Frequency band, 27 MHz Bandwidth, Tx/Rx Spacing 85 MHz
- 216 Mbps aggregate Data Rate. (around 102 Mbps full duplex data throughput)
- Distance up to **20** miles
- 12-character Link ID code, VLAN pass-through, SNMP support, HTML management
- FDD technology, QPSK modulation
- MSRP: $**30,000** for complete link, antennas and cables are not included

Trango

TrangoLINK-45® - 5 GHz Wireless Ethernet Bridge Multi-band 5.x GHz High-Speed OFDM IP-Native Outdoor Radio

- Outdoor IP-Native Wireless Bridge
- Multi-band 5.x GHz versatility in the convenience of one radio: 5.2 GHz, 5.3 GHz, 5.4 GHz, 5.8 GHz
- Supports ETSI, ANSI (FCC), and IC standards
- Up to **45 Mbps** of sustained throughput
- Quality of Service (QoS) & VLAN support
- Auto RF RX Threshold for superior interference mitigation
- Up to **45 mile** range (72 km)
- Dynamic Frequency Selection (DFS)
- OFDM: Orthogonal Frequency Division Multiplexing
- Adaptable Rate Modulation
- IP native, optimized for fast Ethernet services
- $4,000 each

Figure 22 – Example of Antenna Placement for TrangoLINK-45

Motorola

Motorola's PTP 600 Series Point-to-Point Wireless Ethernet Bridges at $20,000 Per Hop can seamlessly carry WiMAX traffic from cell sites to the wider area network. Operating at speeds up to 300 Mbps and distances up to 124 miles (200 km), the bridges meet a number of key requirements for operators who need to backhaul WiMAX traffic, including reliability, high capacity, low latency and ease of installation and use. Motorola's PTP 600 Series bridges can deliver up to 99.999% availability in non-line-of-sight environments, across long-distance line-of-sight paths, over water and open terrain, even in extreme weather conditions, due to the unique combination of technologies included in every system. NOTE: 2 hops required.

Antennas

Antennas come in a range of styles and sizes. A detailed field engineering survey is required and beyond the scope of this planning effort. Details such as wind load, height, soil and other factors need to be evaluated.

One resource for antennas is found at www.tessco.com. A quick look at that website will reveal the many facets of antenna engineering that need to be addressed.

A rough estimate for the monopole antenna(s) to be placed at the Requa site would be $40,000 each (does not include power or other associated installation costs). See http://www.tessco.com/products/displayProducts.do?groupId=447&subgroupId=10 for more information.

It may be necessary to build more than one antenna at the Requa site to gain a line of site into the proposed local distribution area. This is due to the configuration of the multiple heights at the Requa site (see Topological Detail of Multiple Peaks in Requa Area).

An optimistic option is to be able to place a Crescent City directed antenna as well as the Klamath distribution antenna on the very large structure at the top of Requa (old air force station).

Figure 23 -- Requa Antenna Structure

Paul Romero, Yurok Tribe Information Technology, has made inquiry into the cost per month to hang the two aforementioned antennas and found that the monthly attach costs would be $800 per antenna. Two would be required for an annual cost of $19,200/year. Even so, it appears that this approach would require yet another antenna closer to the Klamath side of the hills for local distribution.

The Crescent City end of the point-to-point backhaul could be placed on the county building. Roof mount antennas are considerably less expensive (Note: Del Norte County IT has not been directly approached on this but a previous discussion with a county supervisor has indicated this is a possibility to consider). Prices range from less than $1,000 to $2,000 (uninstalled). See http://www.tessco.com/products/displayProducts.do?groupId=341&subgroupId=50.

Wireless Broadband Distribution in South Del Norte County
Aerial Views Showing Details of Terrain

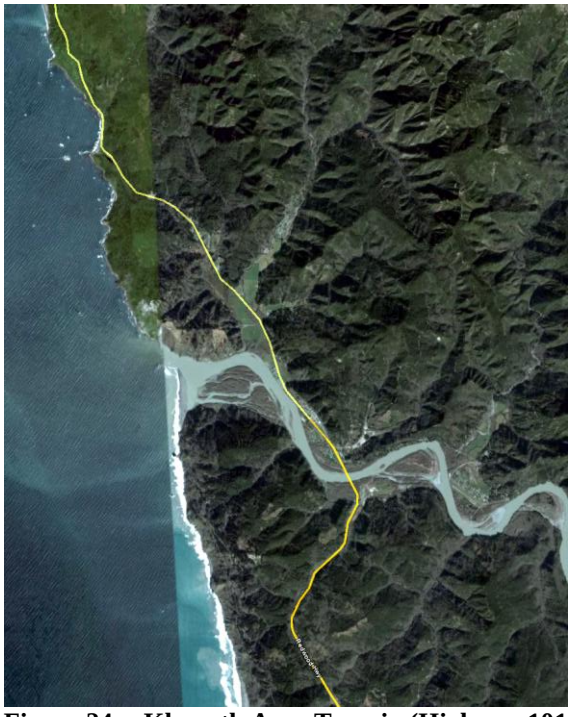


Figure 24 -- Klamath Area Terrain (Highway 101 in yellow)

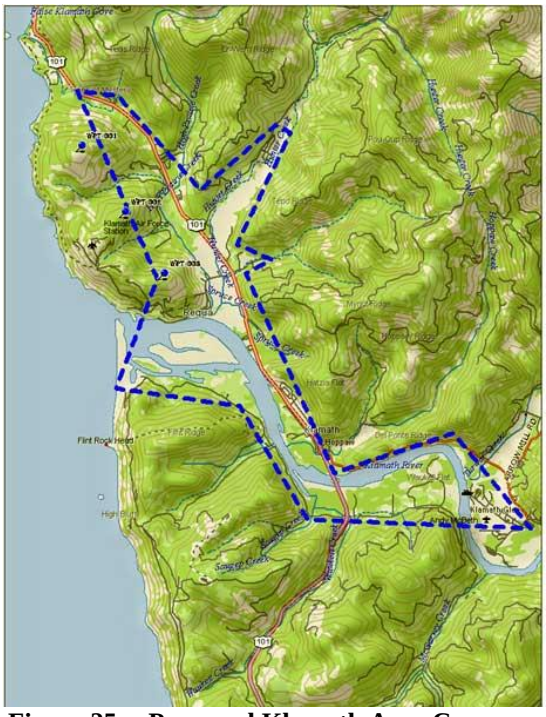


Figure 25 -- Proposed Klamath Area Coverage

Figure 26 – Rest Area and Trees of Mystery

Figure 27 -- Aerial View of Trees of Mystery

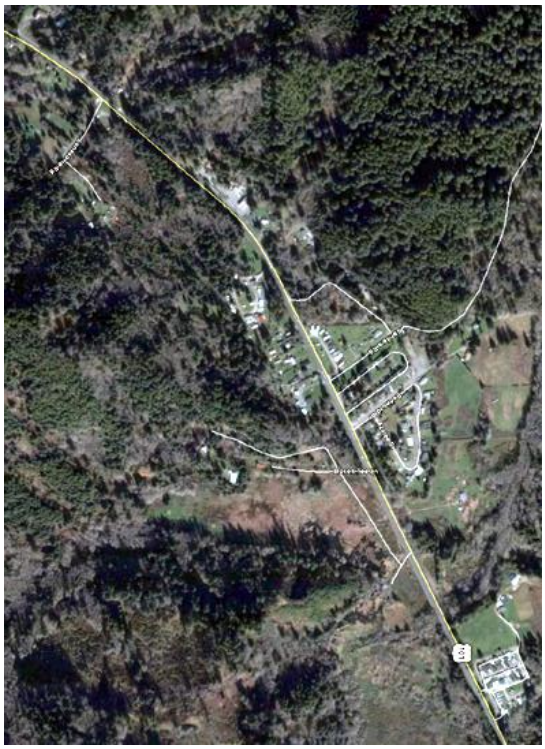


Figure 28 -- Aerial View of Sanders Road

Figure 29 -- Aerial View of Hunter Creek Road

Figure 30 -- Aerial View of Requa Road/Minot Creek and 101

Figure 31 -- Aerial View of Requa

Figure 32 -- Aerial View of Klamath

Figure 33 -- Aerial View of Klamath Glen

Elevations and Profiles of Routes

Elev Gain:	-18.3 ft
Climb Elev:	366.5 ft
Desc Elev:	384.8 ft
Avg Grade:	2
Min. Elev:	10.0 ft
Max. Elev:	79.5 ft
Lin Dist:	6.6 mi
Terr Dist:	6.6 mi
Climb Dist:	3.2 mi
Desc Dist:	3.1 mi

Figure 34 -- Map Showing Trees of Mystery to Klamath

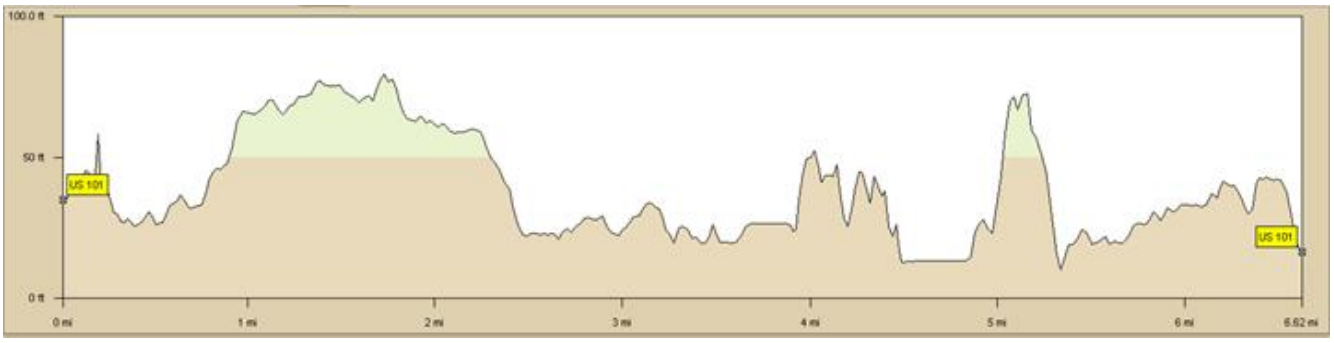


Figure 35 -- Elevation Profile from Trees of Mystery to Klamath on Highway 101

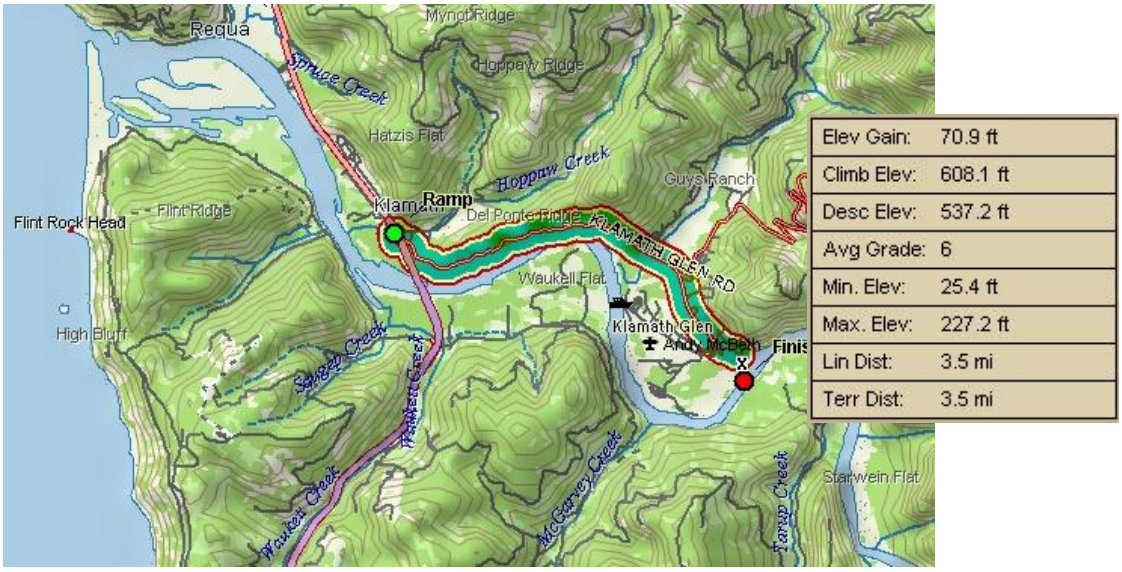


Figure 36 -- Map Showing Klamath to Klamath Glen

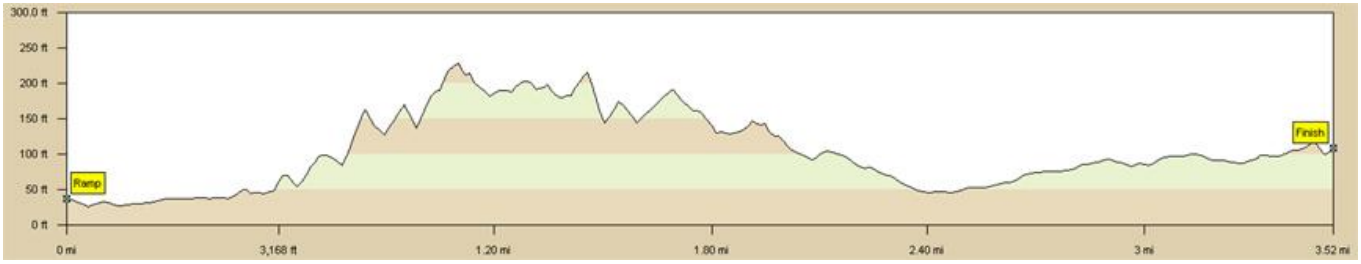


Figure 37 -- Elevation Profile from Klamath to Klamath Glen on Klamath Glen Road

Implications of Topology for Distribution Area

By and large, it is good news as the terrain for the proposed distribution largely is contained at approximately the same elevation and favorable to WiMAX or WiFi distribution with few exceptions. These exceptions will arise depending on the location of the main antenna. WiFi distribution can also be enhanced using a *mesh* network approach.

Mesh networking[12] is a way to route data, voice and instructions between nodes. It allows for continuous connections and reconfiguration around broken or blocked paths by "hopping" from node to node until the destination is reached. A mesh network whose nodes are all connected to each other is a fully connected network. Mesh networks differ from other networks in that the component parts can all connect to each other via multiple hops, and they generally are not mobile. Mesh networks can be seen as one type of ad hoc network. Mobile ad hoc networks (MANET) and mesh networks are therefore closely related, but MANET also have to deal with the problems introduced by the mobility of the nodes.

Mesh networks are self-healing: the network can still operate even when a node breaks down or a connection goes bad. As a result, this network is very reliable. This concept is applicable to wireless networks, wired networks, and software interaction. Wireless mesh originally was developed for military applications but has undergone significant evolution in the past decade. As the cost of radios plummeted, single radio products evolved to support more radios per mesh node with the additional radios providing specific functions- such as client access, backhaul service or scanning radios for high speed handover in mobility applications.

Wireless Broadband Distribution Equipment (Radios)

Comparative base station costs of WiMAX and WiFi[13] are among the compelling arguments in favor of WiFi usage in certain environments. A WiMAX station typically costs in the region of $35,000 while the accompanying CPE is priced at $350. Compare this with a WiFi base station which costs $2,500 and the accompanying CPE price of $250.

Other advantages of WiFi for distribution over WiMAX include:

1. Outdoor WiFi solutions are tried, proven, tested and stable.
2. WiMax equipment, both network backbone equipment and end user devices, are significantly more expensive than WiFi equipment.
3. WiMax is not built into consumer devices, and won't be for a sometime. WiFi rapidly is being incorporated into more and more mobile devices, mobile phones and even the new iPods.
4. WiMax frequency spectrum is much more regulated by governments, very expensive and usually only available to a small number of incumbent telecoms operators.
5. The new WiFi standard 802.11n has a better data-rate per frequency density ratio than WiMax.
6. WiMax deployments in the Far East have shown that the WiFi business model is superior to the WiMax model.

[12] Mesh networking, http://en.wikipedia.org/wiki/Mesh_networking

[13] Trade name for a popular wireless technology used in home networks, mobile phones, video games and more. WiFi is supported by nearly every modern personal computer operating system and most advanced game consoles. WiFi networks have limited range. A typical WiFi home router using 802.1 1b or 802.11 g with a stock antenna might have a range of 32 m (120 ft) indoors and 95 m (300 ft) outdoors. Range also varies with frequency band. WiFi in the 2.4 GHz frequency block has slightly better range than WiFi in the 5 GHz frequency block. Outdoor range with improved (directional) antennas can be several kilometers or more with line-of-sight.

As such we opt for the use of a WiFi mesh network for local distribution. WiMAX is starting to prove itself but it is still early in the adoption curve. Consequently, CPE and base station costs have yet to see the benefit of competition of pricing.

Estimated Investment for Wireless Distribution Option

Meraki (http://meraki.com/) is a network equipment manufacturer that provides hardware and software for wireless mesh networks. It creates a wireless network that coordinates with Meraki servers to distribute Internet bandwidth. For purpose of this planning document we will use their hardware and equipment to estimate local distribution network costs. The information listed in this section is from the Meraki website.

Disruptively Low Cost

Meraki networks are disruptively economical. They make it simple to deploy a network of any size, at an unparalleled low cost per user. Their development model shrinks the initial investment and total cost of ownership.

Proven Worldwide

With thousands of networks in more than 120 countries, more people use Meraki to build and manage large mesh networks than any other vendor (note: their claim). You know you've got the most integrated mesh solution on the market.

Easy and Super-fast to Deploy

Meraki is the fastest and simplest way to deploy wireless over a large area. And because their products are designed to work together, one can have large networks up and running in hours or days instead of weeks or months.

Flexibility and Scalability

Whether you're connecting 20 people or 20,000, Meraki has a scalable solution to fit requirements.

MR 58 Routers

Deployed in a mesh with other MR58s, or as a system with other Meraki devices, the Meraki MR58 can extend Wi-Fi coverage across campuses, cities, or other large outdoor areas for a fraction of the cost of traditional infrastructure. The MR58 can also be used to create long distance mesh links as far as 20 km with optional antennas (note: beyond the reach of the proposed wireless backhaul path). Designed for rugged deployments in outdoor or industrial settings, the MR58 is also the right solution for large indoor areas with heavy demand for bandwidth.

Technical Specifications

Typical Outdoor Range

- Point to Point: up to 12 miles (20 km) with directional antennas
- Point to Multi-Point: up to **0.9 miles** (1.5 km) with 7 dBi omni antennas
- Range depends on antenna type; antennas sold separately

Mounting

- Mounts to walls and horizontal, vertical, and angled poles
- Mounting hardware included

Physical Dimensions (without antenna)

- 9.8" x 10" x 3.1" (250 mm x 260 mm x 80 mm) not including mounting

Radios
- Three 802.11a/b/g/n radios (2 x 2 MIMO)
- Auto-selection of optimal 2.4 GHz or 5 GHz frequencies
- Max radio rate 300 mbit/s
- Concurret transmit and receive on all three radios
- 2.4 GHz 22 dBm peak transmission power 5 GHz 21 dBm peak transmission power *

Power
- Power over Ethernet: 12 – 48 V (802.3af compatible)
- Power consumption: 12.8 W max; 7.5 W typical
- Power over Ethernet adapter available separately

Environment
- Operating temperature: -4° F – 122° F (-20° C – 50° C)
- IP-65 environmental rating (sealed against water and dust)
- Weight: 3.8 lb (1.7 kg)

Interfaces:
- Two 10/100 Mbps auto-crossover Ethernet ports
- Six external N-type connectors
- Signal strength LEDs
- Regulatory

FCC (USA)
- IC (Canada)

Warranty
- 1 year hardware warranty included

Cost
- **$1,499**
- * Max transmission power is decreased for certain geographies to comply with regulatory requirements

Backhaul enhancement for large networks

The MR58 can improve the performance of large Meraki networks by providing high-capacity backhaul to aggregate bandwidth and reduce the number of wired Internet connections.

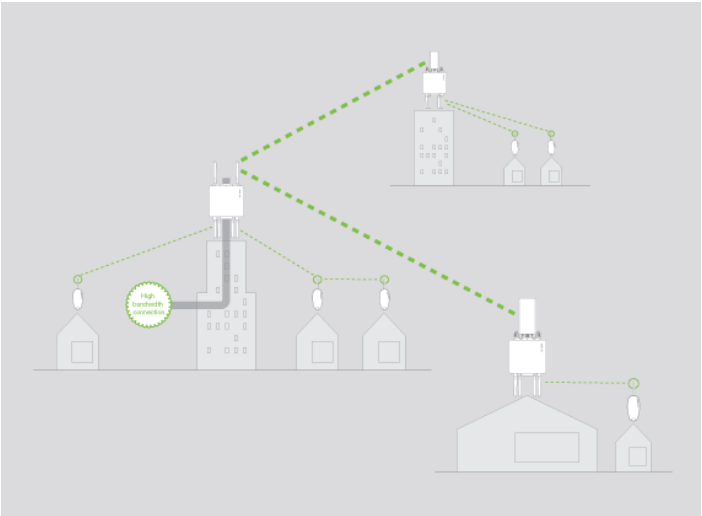


Figure 38 -- Backhaul enhancement for large networks

State-of-the-art, solar-powered repeater

The Meraki Solar mesh repeater enables you to provide wireless coverage over large outdoor areas quickly, and without the expense associated with running power cables. It is also integrated

with Meraki Dashboard, enabling you to monitor and configure your solar unit remotely. Each unit is completely self- contained and ready to mount on roofs, poles, or anywhere else the sun shines. The Solar is completely energy independent and runs on its own state-of-the-art solar-charged battery.

Based on recommendations for the Del Norte area, the 40 Watt SolarWall/Roof Mount Package or the Pole Mount Package looks to be the appropriate alternative. The package includes:

- Meraki Solar Radio
- Meraki Solar 20W Panel
- Meraki Wall/Roof Mount or Solar 40W Pole Mount

Cost: $1,297

Radio

- 200 mW (23 dBm) peak transmission power*
- Enhanced receive sensitivity
- External RP - SMA connector
- 802.11 b/g (1 - 54 Mbps)
- 2 dBi omni-directional antenna included

Typical Coverage Area

- Outdoors with stock 2 dBi antenna:
- 500 - 1,000 ft (150 - 350 m)
- Outdoors with high-gain antennas: 0.5 - 5 mi (1- 8 km)
- Power
- Power consumption: 7 W max; 2 W typical
- Max power input 20 V DC/4 A from solar panel
- Integrated battery and charge controller
- Solar panel sold separately. Choose from Meraki's 20 W
- or 40 W panel, depending on your geographical location

Physical and Environment

- 12.2" x 6.2" x 3.6" (312 mm x 158 mm x 92 mm)
- Weight: 6.3 lb (2.9 kg)
- Operating temperature: 14° F – 122° F (-10° C – 50° C)**
- IP-65 environmental rating

Mounting

- Attaches to walls and vertical poles with
- diameter 2.0 - 4.5" (5.1 - 11 cm)
- Mounting hardware for 2.5" (6.4 cm) vertical poles included

Interfaces / Ports

- Signal strength and power LEDs
- External power switch
- 2-pin circular power connector
- Note: No external Ethernet ports; Meraki Solar is not

- designed to be a gateway Warranty
- 1 year hardware warranty included

Regulatory

- FCC (USA)
- CE (EU)
- IC (Canada)
- C-Tick (Australia & New Zealand)

Ordering Information

* Max transmission power is decreased for certain geographies to comply with regulatory requirements

** Recommended operating temperature for 24 hr uptime: 32° F – 122° F (0° C – 50° C).

CPE

The Meraki Indoor is a wireless mesh access point, gateway and repeater. Small, sleek, and packed with new features, the Indoor is the central building block for any Meraki network.

Cost: $149

Use the Meraki Wall Plug to cover large indoor areas with unparalleled speed. Simply plug it in to existing wall outlets to expand your network. Securely mount it to the wall with our innovative brackets.

Cost: $179

The Meraki Outdoor is a weather-proof and UV-protected wireless access point, gateway and repeater, designed to boost your network's range out of doors. Built to withstand everything from hackers to extreme temperatures, water, sand, and dust. The Outdoor contains a high- powered radio and long-range antenna for a robust, worry-free plug-and-play deployment on building exteriors. The Outdoor goes anywhere, from a rooftop to a window sill, even those hard-to-reach places where a power outlet is hard to come by. With Power over Ethernet support, you can deploy it with minimal cabling and maximum access. LED signal-strength indicators help you pinpoint the best install location to maximize your signal's strength.

Cost: $199

Financial Models—Investment, Customers and Revenues

Financial Model 1: Crescent City to Eureka Backhaul with Klamath and Orick Wireless
The RCC project came up with the following broad estimates for the Klamath/Orick Corridor.

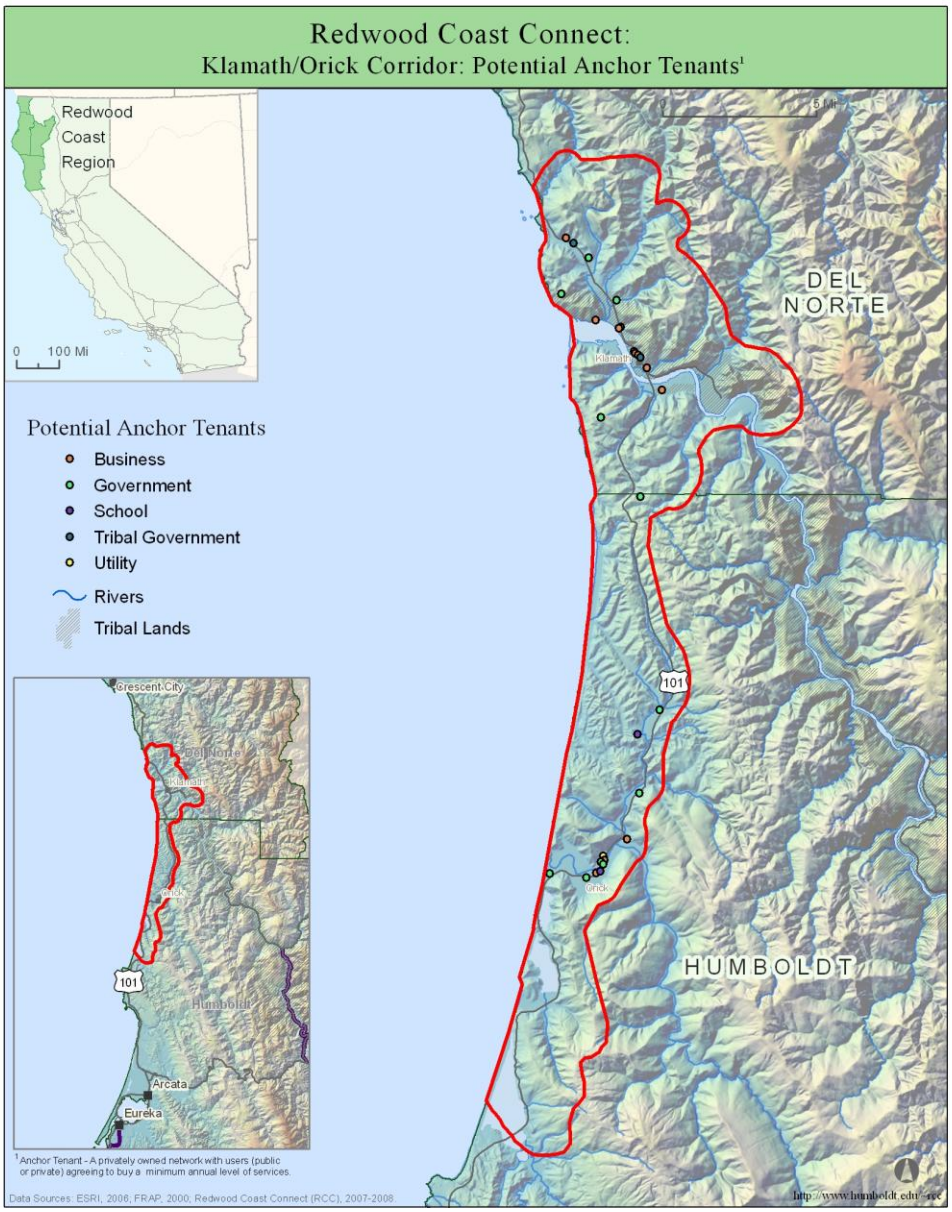


Figure 39 -- RCC: Klamath/Orick Corridor—Potential Anchor Tenants

Revenue per year assumptions[14]	
Residential (880 residences)	$139,392 revenue/yr (40% take rate, $33/mo.)
Business (7)	$4,347 revenue/yr (69% take rate, $75/mo.)
Public Agencies (10)	$60,000 revenue/yr 100% take rate, $500/mo. dedicated line
Total Yearly Projected Revenue	$203,739
Estimated Capital Costs	$5.5m (range of $4-7m)
Payback period, excluding operating costs	
With public sector included	27 years
Without public sector included	38 years
Normal payback period	15 years
Subsidy required to get to 15 year payback	
With public agencies	$1-4m
Without public agencies	$2-5m

Figure 40 -- Financial Model 1: CC to Eureka Backhaul with Klamath and Orick Wireless

Note that there is no inclusion of the impact of operating costs and the effect that has on revenues used to pay off the investment. As such the calculations for the payback period are far from accurate.

Financial Model 2: Crescent City to Klamath Backhaul with Klamath Distribution

In this section we take another approach to estimating the financial model but just for the south county approach. Until a detailed engineering study and design evaluating the myriad possibilities for network architecture is completed, what we can deliver here are estimates that gauge the magnitude of the investments and approximate payback periods.

Revenue

We will continue the use of the take rates (40% for residential) but will change the monthly residential rate to $40. The census tract data will still be applied as well (592 households[15] but rounded up to 600) for these estimating purposes. The calculation is

600 households x 40% x $40/month x 12 months = $115,200/year.

[14] These calculations are based on assumptions developed from the RCC survey returns and some "educated" guesses. As such their accuracy is in question.

[15] GCT-PH1: Population, Housing Units, Area, and Density: 2000, Data Set: Census 2000 Summary File 1 (SF 1) 100-Percent Data, Geographic Area: Del Norte County, California -- Census Tract, http://factfinder.census.gov/

The number of businesses and public agencies of various sizes in the area are estimated at 60. Many of these (estimate 40) would be served at the same level broadband capacity as a residence. The calculation for this segment is

40 businesses x $40/month x 12 months = $19,200.

The remaining businesses and public agencies would be estimated at 20. This segment likely would receive a higher rate of service and be charged accordingly at $75/month. The calculation for this segment is

20 x $75/month x 12 months = $18,000.

Each of the approaches was estimated with a 10 Mbps interconnect to the internet. Each of the approaches is scalable. But this serves as an apples-to-apples approach to gauge feasibility of each approach.

Components of Financial Model 2

Revenue per year estimates	
• Residential	$115,200
• Small Businesses	19,200
• Businesses and Public Agencies	18,000
Total Yearly Projected Revenue:	**$152,400**
Operating Costs	
• Staff (2 FTE with benefits)	$100,000/year
• 10 Mbps interconnection	$16,800/year
Net Operating Income:	**$35,600**
Network Components	
Backhaul	
• Aerial	$2,340,624
• Traditional Trenching	$7,434,240
• Micro-trenching	$2,323,200 - 3,484,800
Point-to-point Wireless	
• P2P Wireless Radio (1 @ each end)	$8,000 – 60,000
• Routing switch	$20,000
• Antenna Structure (mono pole)	$40,000
• Antenna Structure (roof mount)	$2,000
P2P Wireless Backhaul Total:	$70,000 – 122,000
•	
Local distribution	
• Base Station (MR 58 Routers, 2 - 3)	$1,500
• Solar Powered Mesh Repeater(s) (3-5)	$1,300
• Roof Mount Antenna	$1,000 – 2,000
Customer Premise Equipment (CPE)	
• Indoor access point, gateway and repeater	$149
• Wall Plug	$179
• Outdoor access point, gateway and repeater	$199
Operations	
• Staff (2 FTE with benefits)	$100,000/year

Not all of the components are applied in each of the network architectures. Detailed engineering of the network may reveal the need for additional or other components. As such payback periods will vary based on the components assembled for each of the representative architectures discussed.

Note that we build this set of financial models using bandwidth at 10 Mbps. This likely is less than what we would like for the growing needs of the area. But on the whole it is way better than the existing dialup connections. Also, as not everyone is on the network at the same time, this may actually work until the network can become more profitable. The network architecture recommended is scalable to a much higher level of capacity.

The Operations cost estimates are just that, estimates. Admittedly, this is a narrow view of operating costs. Until a more detailed engineering analysis and design can be completed, costs such as power consumption, truck rolls, customer service and other related matters are unavailable. For purposes of this analysis we estimate the cost of staffing the operation at 2 full time equivalents (FTE). One FTE would be at the level of a network operations engineer.

We also estimate a unique financial model for each of the backhaul approaches. Annual operating cost estimates were not included. Lastly, calculations of payback periods are estimated with consideration for gap financing received from Broadband Technologies Opportunities Program (BTOP) at 80% and California Advanced services Fund (CASF) at 40% is applied.

Aerial Financial Model with Local Distribution

Net Revenue per year estimate	**$35,600**
Estimated Capital Costs (Aerial)	
Aerial fiber build	$2,340,624
Switch	20,000
Annual recurring interconnect charge	16,800
Local distribution equipment	
Antenna Structure(s) – assumes rooftop mounts available (5)	$7,500
Base Station (MR 58 Routers, est. 5)	$7,500
CPE (est. 240 – 40% take rate, average cost of devices @$175)	$42,000
Total Aerial Investment:	**$2,434,424**
Payback period with 0% gap funding	**68 years**
Payback period with 80% BTOP funding	**14 years**
Payback period with 40% CASF funding	**41 years**

Figure 41 -- Aerial Financial Model with Local Distribution

Traditional Trenching Financial Model with Local Distribution

Net Revenue per year estimate	**$35,600**
Estimated Capital Costs (Traditional Trenching)	
Trenched fiber build	$7,434,240
Switch	20,000
Annual recurring interconnect charge	16,800
Local distribution equipment	
Antenna Structure(s) – assumes rooftop mounts available (5)	$7,500
Base Station (MR 58 Routers, est. 5)	$7,500
CPE (est. 240 – 40% take rate, average cost of devices @$175)	$42,000
Total Traditional Trenched Investment:	**$7,528,040**
Payback period with 0% gap funding	**211 years**
Payback period with 80% BTOP funding	**42years**
Payback period with 40% CASF funding	**127 years**

Figure 42 -- Traditional Trenching Financial Model with Local Distribution

Micro-trenching ($20/foot) Financial Model with Local Distribution

Net Revenue per year estimate	**$35,600**
Estimated Capital Costs (Micro-trenching)	
Microtrenched fiber build	$2,323,200
Switch	20,000
Annual recurring interconnect charge	16,800
Local distribution equipment	
Antenna Structure(s) – assumes rooftop mounts available (5)	$7,500
Base Station (MR 58 Routers, est. 5)	$7,500
CPE (est. 240 – 40% take rate, average cost of devices @$175)	$42,000
Total Micro-trenching Investment:	**$2,417,000**
Payback period with 0% gap financing	**68 years**
Payback period with 80% BTOP funding	**14 years**
Payback period with 40% CASF funding	**41 years**

Figure 43 -- Micro-trenching ($20/foot) Financial Model with Local Distribution

Micro-trenching ($30/foot) Financial Model with Local Distribution

Net Revenue per year estimate	**$35,600**
Estimated Capital Costs (Micro-trenching)	
Microtrenched fiber build	$3,484,800
Switch	20,000
Annual recurring interconnect charge	16,800
Local distribution equipment	
Antenna Structure(s) – assumes rooftop mounts available (5)	$7,500
Base Station (MR 58 Routers, est. 5)	$7,500
CPE (est. 240 – 40% take rate, average cost of devices @$175)	$42,000
Total Micro-trenching Investment:	**$3,578,600**
Payback period with 0% gap financing	**101 years**
Payback period with 80% BTOP funding	**20years**
Payback period with 40% CASF funding	**60years**

Figure 44 -- Micro-trenching ($30/foot) Financial Model with Local Distribution

Wireless Backhaul Financial Model with Local Distribution

Net Revenue per year estimate	**$35,600**
Estimated Capital Costs (Wireless)	
P2P backhaul	$122,000
Switch	20,000
Annual recurring interconnect charge	16,800
Local distribution equipment	
Antenna Structure(s) – assumes rooftop mounts available (5)	7,500
Base Station (MR 58 Routers, est. 5)	7,500
CPE (est. 240 – 40% take rate, average cost of devices @$175)	42,000
Total Wireless Investment:	**$215,800**
Payback period with 0% gap financing	**6 years**
Payback period with 80% BTOP funding	**1 year**
Payback period with 40% CASF funding	**4 year**

Figure 45 -- Wireless Backhaul Financial Model with Local Distribution

Sustainability
Even with substantial gap financing from grants, this is a very hard business case to ensure profitability—even at a break-even level—or solvency. That is, the ability to sustain ongoing operations solely from revenues is at high risk. The wireless option has the most promise.

This is not a unique situation. The biggest challenge with this area is the lack of readily available backhaul combined with the sparseness of population in modestly challenging terrain. As we can see from this example, local distribution of suitably robust broadband can be enabled at a reasonable investment and consumer price point.

The Klamath/south Del Norte County scenario is not unique. Across America we find many instances where the business case is difficult in the extreme, if not impossible. And, to date, this is a requirement for ensuring continuance of the services. One of the rules of telecommunications infrastructure and services provision is that *someone, somewhere, some way has to pay*. Subsidization for ongoing operations from public funds has yet to take hold. Even cross-subsidization within municipal or other governmental entities does not have a record of success and meets with considerable resistance, from taxpayers and from the telecom industry. Yet use of tax payer dollars to subsidize broadband may be the only way to provide continued operations in some areas.

Documenting these tough financial cases and bringing the plight of an area to policymakers may eventually have the effect of development of some funding mechanism to subsidize these ongoing operations.

The cost of providing backhaul to serve this market is what makes the overall business case very difficult. This is a large part of why we favor the building of backhaul form Crescent city to Eureka with drop-off electronics at Orick and Klamath. The ability to aggregate demand at both end points provides the backhaul necessary for investors to build out the local distribution services.

Funding Sources

American Recovery Act of 2009 and other Funding Sources[16][17]
The American Recovery and Reinvestment Act of 2009 (ARRA), a massive spending bill signed by President Obama on February 17, 2009, represents perhaps the largest federal government economic stimulus effort since the New Deal. Allocated among an array of investment priorities and tax credits, with the near-term objective of creating jobs and a longer-term objective of improving national infrastructure, the Act provides for $789 billion of new direct expenditures by the federal government.

[16] "OPPORTUNITIES FOR FEDERAL GRANTS, LOANS AND OTHER SUPPORT FOR BROABAND PROJECTS," Baller Herbst Law Firm, February 19, 2009, www.Baller.com
[17] Also, see the summary of the ARRA by the Benton Foundation, http://benton.org:80/node/20455?utm_campaign=Benton%27s+Headlines&utm_source=newsletter&utm_medium=email&utm_content=2009/04/08/nid-24214&

Of that $789 billion, $7.2 billion was allocated for grant and loan programs to stimulate the development of broadband infrastructure and services, to be administered by two federal agencies: The **National Telecommunications and Information Administration** (NTIA), an agency within the U.S. Department of Commerce, was appropriated $4.7 billion, with the **USDA's Rural Utilities Service** (RUS) receiving $2.5 billion. Most of these funds will be made available in the form of competitive grants to qualifying government, nonprofit, and private-sector entities across the nation.

In addition to the amounts dedicated specifically to broadband, other provisions in the Act may present substantial opportunities for indirect broadband-related partnerships. For example, a significant amount of funding is devoted to improvements for transportation infrastructure, including highways and rail improvements. If effectively coordinated ahead of time, this work could enable further improvement to broadband infrastructure through use of associated rights of way and other means. Other provisions of the Act, such as electricity grid upgrades, may present similar opportunities.

The $7.2 billion dedicated directly to broadband represents less than one percent of the stimulus bill's total appropriation, and falls well short of what some broadband advocates were hoping for. It is, however, a productive first step, and the Obama Administration has made clear that the nation's broadband future will require much more than what the ARRA provides. (As described below, the final bill calls for the FCC, within one year, to produce a report on a national broadband plan.)

In the meantime, the ARRA provides local and state governments, nonprofits, broadband advocates, and private- sector providers an opportunity to receive substantial federal funding to hasten the deployment of broadband. This memorandum is intended to provide such entities with the basic information necessary to take advantage of the opportunity and begin structuring proposals, outlining the key requirements of the NTIA and RUS broadband programs (so far as they are currently known) and other important aspects of the American Recovery and Reinvestment Act.

The ARRA appropriates $7.2 billion for broadband grant and loan programs, including $4.7 billion to NTIA for competitive grants, and $2.5 billion to the RUS for rural broadband grants and loans. Note that a particular project is not permitted to receive funds from both NTIA *and* RUS.

In addition to the ARRA's provisions that provide direct opportunities for funding of broadband projects, the Act includes a vast amount of funding in areas that may produce opportunities for creative partnerships to facilitate broadband development:

Transportation infrastructure funds: (approx. $46.5B) Highway/rail/transit infrastructure improvements may provide fresh opportunities to deploy broadband facilities in rights of way. Significant funding for high speed rail and intercity rail projects. Generally administered by state Departments of Transportation.

Public housing infrastructure: (approx. $1 2B) Funds to local public housing agencies to rehabilitate public housing, and neighborhood stabilization, could provide opportunity to address connectivity issues, community computing centers, etc.

Energy efficient housing retrofits: ($0.25B) Competitive grants to upgrade HUD low-income housing to increase energy efficiency. Broadband could enable smart meters and smart homes.
School construction: ($2 1B) For renovation, modernization, energy efficiency, and technology improvements. Includes $6B for higher education institutions.

Smart Grid Investment Program: ($1 1B) For R&D and pilot projects to modernize electricity grid.

Health Information Technology: ($1 9B) For widespread adoption and use of interoperable health information technology, including e-health records, etc.

While details on how to apply for funds under the particular NTIA and RUS broadband programs are not yet be available as of this date, enough information is available to enable potential applicants to begin structuring a grant or loan proposal, addressing the details of basic topics such as:

1. Who will be participating in the project? Is it, or can it be, a coalition or public-private partnership? What legal entity will receive funds and distribute them to other partners?
2. What services are proposed? Do they correspond well to the objectives of the program under consideration? Who will be served? How is broadband service currently lacking?
3. Can other funding programs be leveraged in the effort (such as transportation infrastructure, electricity grid upgrades, etc)?
4. What is the expected cost and timeframe of the project? How will it be sustained after federal funding expires?
5. Who will provide service? Are service contracts or negotiations required? Who will staff the project?

Please note that the information provided above is subject to change as the details of ARRA-funded programs become clearer. Potential funding applicants need to closely track these developments to ensure that potential opportunities will not be missed, and that any proposal will have the greatest chance of success.

California Advanced Services Fund (CASF)[18]

An allocation of $100 million is designated for support of broadband deployment projects in accordance with the principles and processes under the "California Advanced Services Fund" (CASF) program and will be set initially at $50 million per year. A process is in place for the submission of proposals by qualified telephone corporations to seek funding available through the CASF. Deadline for the first round of proposals is July 3, 2008 (modified from the order).

[18] California Advanced Services Fund (CASF), http://www.cpuc.ca.gov/PUC/Telco/Information+for+providing+service/announcingcasf.htm

A separate showing is required for each proposed broadband project. For this purpose, a single broadband project is defined as deployment encompassing a single contiguous group of CBGs (or portions of CBGs, as applicable). The following definition is reasonable to adopt as the benchmark for evaluating applications, and as a threshold for defining whether an area is unserved or underserved by broadband facilities.

> If an area is not served by any form of broadband, such that internet connectivity is available only through dial-up service, that area is unserved. Where area is served by broadband, but where no facilities-based provider offers service at speeds of at least 3 MBPS download and 1 MBPS upload, that area is considered underserved.

Parties may seek funding for more than one project within a single submission, but must provide separate supporting documentation for each project. The scoring criteria shall include consideration of ranking for "uneconomic" areas that are less likely to be served without public funds.

These funds could be a resource to provision of broadband services to Klamath and Orick communities with implications for Yurok Tribe populations up to the Weitchpec area. To enable such connectivity middle-mile connectivity would need to be put in place. This would be the Crescent City to Eureka route.

MODEL TELECOMMUNICATIONS INFRASTRUCTURE ORDINANCE

Digital Infrastructure and Video Competition Act of 2006 (DIVCA)
On September 29, 2006, the Legislature passed, and Governor Schwarzenegger signed into law Assembly Bill 2987,[19][20] the Digital Infrastructure and Video Competition Act of 2006 (DIVCA). Prior to DIVCA, cable television franchises were issued by cities and counties. DIVCA replaces that system with one in which video franchises are now issued by the CPUC, rather than these local entities. DIVCA's goals, which the CPUC and its Communications Division staff implement, deal not only with video franchises, but with increasing the deployment of broadband infrastructure within California, particularly to unserved and underserved areas. These goals are the following:

1. Create a **fair and level playing field for all market competitors** that does not disadvantage or advantage one service provider or technology over another
2. Promote the **widespread access to the most technologically advanced cable and video services** to all California communities **in a nondiscriminatory manner** regardless of socioeconomic status
3. **Protect local government** revenues and their control of **public rights-of-way**

[19] AB2987, http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_2951-3000/ab_2987_bill_20060929_chaptered.html
[20] Video Franchising, http://www.cpuc.ca.gov/PUC/Templates/Default.aspx?NRMODE=Published&NRNODEGUID=%7b7F8DB3C8-C109-46E4-8008-33D1E35EC304%7d&NRORIGINALURL=%2fPUC%2fTelco%2fInformation%2bfor%2bproviding%2bservice%2fvideofranchising%2ehtm&NRCACHEHINT=Guest#apply

4. Require market participants to comply with all applicable **consumer protection laws**
5. Complement efforts to **increase investment** in broadband infrastructure and **close the digital divide**

The third goal referenced above would seem to continue the oversight of right of ways (ROW) by local authorities.

Introduction to the Proposed Model Ordinance
The installation of conduit is a relatively simple way to reduce barriers to entry in the telecommunications market, significantly reducing the capital commitments of new operators, and keeping poles and cables from cluttering up the landscape. Conduits are tubes buried in the ground through which telecommunications cables and power lines are pulled. They are an essential part of modern life, linking together almost every building on the planet with a telephone, broadband or power. The telecommunications cables running in conduit can be copper wires or optical fibers.

Pulling cables through existing conduit reduces the investment cost versus aerial builds using poles. The impact on new operators can be profound, allowing low-risk roll-out of new networks and making the provision of new types of service more affordable. For existing operators, the impact is relatively small but can allow them to reduce their costs.

In many locations the only way to get access to conduit is to build them yourself. This creates a substantial barrier to entry in telecommunications infrastructure, irrespective of the particular access technologies used, because they all ultimately require dark fiber. It also means that far more conduits are built than are necessary, which is bad for the environment.

Another alternative is to require placing of conduit any time a roadway is opened or a new development (commercial or housing) is built. Of course some allowances will need to me made but these are generally few as just about anywhere you travel on a road, it leads to some destination where you will find people.

The installation of conduit whenever a roadway is opened or a new building development occurs provides at least two benefits:

- The amount of digging required for conduit overbuilds is reduced substantially.
- Where conduit already exists, the reduction in the cost base for operators may lead to price reductions, improved service innovation and better service availability.

A review of the ordinances and code in place in Del Norte County reveals there are no provisions relating to telecommunications or telecommunications-related facilities, such as installing conduit when the opportunity to do so emerges.

Highway and road construction, development build-out and broadband investment are facilitated when the rules (codes and ordinances) are known and readily available. Research of the ordinances relating to telecommunication infrastructure for other cities and counties revealed a

wide variety of approaches. An attempt to synthesize the best of several sources into a Model Ordinance follows.

The consultant is *not* a lawyer. As such this proposed ordinance needs to be carefully reviewed for accuracy, pertinence and completeness. It may very well be that this proposal may be construed as too complex. However, in the interest of completeness we brought in many facets related to the topic. It is also written from the perspective of a county and may need further modification to meet the needs of cities.

It may very well be that a more straight-forward approach is all that is necessary. That is to say, enact a provision that states:

"Anytime construction or repair of a roadway or utility easement occurs, conduit will be installed."

Model Ordinance

Section I: Purpose and intent

A. Purpose. The purpose and intent of this chapter is to:
    1. Comply with the provisions of the 1996 Telecommunications Act as they apply to local governments, telecommunications carriers and the services those carriers offer;
    2. Promote competition on a competitively neutral basis in the provision of telecommunications services;
    3. Encourage the provision of advanced and competitive telecommunications services on the widest possible basis to businesses, institutions and residents of the county;
    4. Permit and manage reasonable access to the public rights-of-way of the county for telecommunications purposes on a competitively neutral basis and conserve the limited physical capacity of those public rights-of-way held in trust by the county;
    5. Assure that the county's current and ongoing costs of granting and regulating private access to and the use of the public rights-of-way are fully compensated by the persons seeking such access and causing such costs;
    6. Secure fair and reasonable compensation to the county and its residents for permitting private use of the public right-of-way;
    7. Foster the deployment of subterranean conduit whenever a roadway or development is undertaken;
    8. Assure that all telecommunications carriers providing facilities and/or services within the county, or passing through the county, register and comply with the ordinances, rules and regulations of the county;
    9. Assure that the county can continue to fairly and responsibly protect the public health, safety and welfare of its citizens;
    10. Enable the county to discharge its public trust consistent with the rapidly evolving federal and state regulatory policies, industry competition and technological development.
B. Jurisdiction and Management of the Public Rights-of-Way.
    1. The county has jurisdiction and exercises regulatory management over all public rights-of-way within the county under authority of the county charter and state law.

2. Public rights-of-way include, but are not limited to, streets, roads, highways, bridges, alleys, sidewalks, trails, paths, public easements and all other public ways or areas, including the subsurface under and air space over these areas.
3. The county has jurisdiction and exercises regulatory management over each public right-of-way whether the county has a fee, easement, or other legal interest in the right-of-way. The county has jurisdiction and regulatory management of each right-of-way whether the legal interest in the right-of-way was obtained by grant, dedication, prescription, reservation, condemnation, annexation, foreclosure or other means.
4. No person may occupy or encroach on a public right-of-way without the permission of the county. The county grants permission to use rights-of-way by permits.
5. The exercise of jurisdiction and regulatory management over each public right-of-way by the county is not official acceptance of the right-of-way, and does not obligate the county to maintain or repair any part of the right-of-way.
6. The county retains the right and privilege to cut or move any telecommunications facilities located within the public rights-of-way of the county, as the county may determine to be necessary, appropriate or useful in response to a public health or safety emergency.

C. Regulatory Fees and Compensation not a Tax.
1. The fees and costs provided for in this chapter, and any compensation charged and paid for use of the public rights-of-way provided for in this chapter, are separate from, and in addition to, any and all federal, state, local, and city charges as may be levied, imposed, or due from a telecommunications carrier, its customers or subscribers, or on account of the lease, sale, delivery, or transmission of telecommunications services.
2. The city has determined that any fee provided for by this chapter is not subject to the property tax limitations. These fees are not imposed on property or property owners, and these fees are not new or increased fees.
3. The fees and costs provided for in this chapter are subject to applicable federal and state laws.

Section II: Definitions

For the purpose of this chapter the following terms, phrases, words and their derivations shall have the meaning given herein. When not inconsistent with the context, words used in the present tense include the future, words in the plural number include the singular number and words in the singular number include the plural number. The words "shall" and "will" are mandatory and "may" is permissive. Words not defined herein shall be given the meaning set forth in the Communications Policy Act of 1984, the Cable Television Consumer Protection and Competition Act of 1992, and the Telecommunications Act of 1996. If not defined there, the words shall be given their common and ordinary meaning.

“Aboveground Facilities.” See "Overhead facilities."

"Affiliated interest" shall have the same meaning as [?ORS 759.010?].

"Cable Act" means the Cable Communications Policy Act of 1884, 47 U.S.C. subsection 521, et seq., as now and hereafter amended.

"Cable service" is to be defined consistent with federal laws and means the one-way and two-way transmission to subscribers of video programming, or other programming service; and

subscriber interaction, if any, which is required for the selection or use of such video programming or other programming service.

"California Public Utilities Commission" or "CPUC" means the statutorily created state agency in the state of California responsible for licensing, regulation and administration of certain telecommunications carriers as set forth in California Law, or its lawful successor.

"Conduit" means any structure, or portion thereof, containing one or more ducts, conduits, manholes, handholes, bolts, or other facilities used for any telegraph, telephone, cable television, electrical, or communications conductors, or cable right-of-way, owned or controlled, in whole or in part, by one or more public utilities.

"Construction" means any activity in the public rights-of-way or utility easements for telecommunication infrastructure access on private land resulting in physical change thereto, including excavation or placement of structures, but excluding routine maintenance or repair of existing facilities.

"Control" or "controlling interest" means actual working control in whatever manner exercised.

"County" means the county of Del Norte, a California and individuals authorized to act on the county's behalf.

"County Supervisors" means the elected governing body of the county of Del Norte, California

"County Property" means and includes all real property owned by the county, other than public rights-of-way and utility easements as those are defined herein, and all property held in a proprietary capacity by the county, which are not subject to right-of-way franchising as provided in this chapter.

"Days" means calendar days unless otherwise specified.

"Duct" means a single enclosed raceway for conductors or cable.

"Emergency" has the meaning provided for in California state law.

"Federal Communication Commission" or "FCC" means the federal administrative agency, or its lawful successor, authorized to regulate and oversee telecommunications carriers, services and providers on a national level.

"Franchise" means an agreement between the county and a grantee which grants a privilege to use public right-of-way and utility easements within the county for a dedicated purpose and for specific compensation.

"Grantee" means the person to which a franchise is granted by the county.

"Overhead or aboveground facilities" means utility poles, utility facilities and telecommunication facilities above the surface of the ground, including the underground supports and foundations for such facilities.

"Person" means an individual, corporation, company, association, joint stock company or association, firm, partnership, or limited liability company.

"Private telecommunication network" means a system, including the construction, maintenance or operation of the system, for the provision of a service or any portion of a service which is owned or operated exclusively by a person for their use and not for resale, directly or indirectly. "Private telecommunications network" includes services provided by the state of California.

"Public rights-of-way" include, but are not limited to, streets, roads, highways, bridges, alleys, sidewalks, trails, paths, public easement, and all other public ways or areas, including the subsurface under and air space over these areas. This definition applies only to the extent of the county's right, title, interest or authority to grant a permit to occupy and use such areas for

telecommunications facilities. "Public rights-of-way" shall also include utility easements as defined below.

"State" means the state of California.

"Telecommunication" means the transmission between and among points specified by the user, of information of the user's choosing.

"Telecommunications Act" means the Communications Policy Act of 1934, as amended by subsequent enactments including the Telecommunications Act of 1996 (47 U.S.C. subsection 151 et seq.) and as hereafter amended.

"Telecommunications carrier" means any provider of telecommunications services and includes every person that directly or indirectly owns, controls, operates or manages telecommunications facilities within the county.

"Telecommunications facilities" means the plant and equipment, other than customer premises equipment, used by a telecommunications carrier to provide telecommunications services.

"Telecommunications service" means two-way access and transport of data, voice and/or video communications but does not include: (a) services provided by radio common carrier; (b) one-way transmission of television signals; (c) surveying; (d) private telecommunications networks; or (e) communications of the customer which takes place on the customer side of on-premises equipment.

Telecommunication System. See "Telecommunications facilities."

"Telecommunication utility" has the same meaning as California Public Utililty Code §§ 216.

"Underground facilities" means utility and telecommunications facilities located under the surface of the ground, excluding the underground foundations or supports for "overhead facilities."

"Usable space" means all of the space on a pole, except the portion below ground level, the twenty feet of safety clearance above ground level, and the safety clearance space between communications and power circuits. There is a rebuttable presumption that six feet of a pole is buried below ground level.

"Utility easement" means any easement granted to or owned by the county and acquired, established, dedicated or devoted for public utility purposes.

"Utility facilities" means the plant, equipment and property, including but not limited to the poles, pipes, mains, conduits, ducts, cable, wires, plant and equipment located under, on, or above the surface of the ground within the public right-of-way of the city and used or to be used for the purpose of providing utility or telecommunications services.

Section III: Registration of telecommunications carriers

A. Purpose. The purpose of registration is:
   1. To assure that all telecommunications carriers who have facilities and/or provide services within the county comply with the ordinances, rules and regulations of the county;
   2. To provide the county with accurate and current information concerning the telecommunications carriers who offer to provide telecommunications services within the county, or that own or operate telecommunications facilities within the county;
   3. To assist the county in the enforcement of this chapter and the collection of any county fees or charges that may be due the county.

B. Registration Required. Except as provided in subsection D of this section, all telecommunications carriers having telecommunications facilities within the corporate

limits of the county, and all telecommunications careers that offer or provide telecommunications service to customer premises within the county, shall register. The appropriate application and license from: (a) the California Public Utility Commission (CPUC); or (b) the Federal Communications Commission (FCC) qualifies as necessary registration information. Applicants have the option of providing the following information:

1. The identity and legal status of the registrant, including the name, address, and telephone number of the duly authorized officer, agent, or employee responsible for the accuracy of the registration information;
2. The name, address, and telephone number for the duly authorized officer, agent or employee to be contacted in the case of emergency;
3. A description of the registrant's existing or proposed telecommunications facilities within the county, a description of the telecommunications facilities that the registrant intends to construct, and a description of the telecommunications service that the registrant intends to offer or provide to persons, firms, businesses, or institutions within the county;
4. Information sufficient to determine whether the transmission, origination or receipt of the telecommunication services provided, or to be provided by the registrant constitutes an occupation or privilege subject to any business license requirements. A copy of the business license or the license number must be provided.

C. Registration Fee. Each application for registration as a telecommunications carrier shall be accompanied by a nonrefundable registration fee in an amount to be determined by resolution of the County Supervisors.

D. Exceptions to Registration. The following telecommunications carriers are excepted from registration:

1. Telecommunication carriers, including internet service providers, that are owned and operated exclusively for its own use by the state or a political subdivision of this state;
2. A private telecommunications network. Provided that such network does not occupy any public rights-of-way of the city

Section IV: Construction standards

A. General. No person shall commence or continue with the construction, installation or operation of telecommunications facilities within a public right-of-way or utility easement except as provided in subsections D through O of this section and Section V, and with all applicable codes, rules, and regulations.

B. Construction Codes. Telecommunications facilities shall be constructed, installed, operated and maintained in accordance with all applicable federal, state and local codes, rules and regulations including the National Electrical Code and the National Electrical Safety Code.

C. Construction Permits. No person shall construct or install any telecommunications facilities within the county of Del Norte without first obtaining a construction permit, and paying the construction permit fee established in subsection G of this section. No permit shall be issued for the construction or installation of telecommunications facilities:

1. Unless the telecommunications carrier has first filed a registration statement with the city pursuant to Section III; and if applicable;

2. Unless the telecommunications carrier has first applied for and received a telecommunications facilities permit pursuant to Section VI;
3. Unless the telecommunications carrier has satisfied the requirements of the Del Norte County Code.

D. Permit Applications. Applications for permits to construct telecommunications facilities shall be submitted upon forms to be provided by the county and shall be accompanied by drawings, plans and specifications in sufficient detail to demonstrate:
   1. That the facilities will be constructed in accordance with all applicable codes, rules and regulations;
   2. That the facilities will be constructed in accordance with the telecommunications facilities agreement;
   3. The location and route of all facilities to be installed aboveground or on existing utility poles;
   4. The location and route of all new facilities on or in the public rights-of-way or utility easements to be located under the surface of the ground, including the line and grade proposed for the burial at all points along the route which are within the public rights-of-way. Existing facilities shall be differentiated on the plans from new construction;
   5. The location of all of applicant's existing underground utilities, conduits, ducts, pipes, mains and installations which are within the public rights-of-way or utility easement along the underground route proposed by the applicant. A cross-section shall be provided showing new or existing facilities in relation to the street, curb, sidewalk or right-of-way;
   6. The construction methods to be employed for protection of existing structures, fixtures and facilities within or adjacent to the public rights-of-way, utility easements, and description of any proposes to temporarily or permanently remove or relocate.

E. Applicant's Verification. All permit applications shall be accompanied by the verification of a registered professional engineer, or other qualified and duly authorized representative of the applicant, that the drawings, plans and specifications submitted with the application comply with applicable technical codes, rules and regulations.

F. Construction Schedule. All permit applications shall be accompanied by a written construction schedule, which shall include a deadline for completion of construction. The construction schedule is subject to approval by the planning, building and public works departments.

G. Construction Permit Fee. Unless otherwise provided in a telecommunications facilities agreement, prior to issuance of a construction permit, the applicant shall pay a permit fee in an amount to be determined by resolution of the city council. Such fees shall be designed to defray the costs of city administration of the requirements of this chapter.

H. Issuance of Permit. If satisfied that the applications, plans and documents submitted comply with all requirements of this chapter and the telecommunications facilities agreement, the planning, building and public works departments shall issue a permit authorizing construction of the facilities, subject to such further conditions, restrictions or regulations affecting the time, place and manner of performing the work as they deem necessary or appropriate.

I. Notice of Construction. Except in the case of an emergency, the permittee shall notify the public works department not less than two working days in advance of any excavation or construction in the public rights-of-way. Utility locates shall be completed prior to notification of the public works department.

J. Compliance with Permit. All construction practices and activities shall be in accordance with the permit and approved final plans and specifications for the facilities. The planning, building and public works departments and their representatives shall be provided access to the work site and such further information as they may require to ensure compliance with such requirements.

K. Noncomplying Work. Subject to the notice requirements in subsection D of Section, all work which does not comply with the permit, the approved or corrected plans and specifications for the work, or the requirements of this chapter, shall be removed at the sole expense of the permittee. The county is authorized to stop work in order to assure compliance with the provisions of this chapter.

L. Completion of Construction. The permittee shall promptly complete all construction activities so as to minimize disruption of the county's rights-of-way and other public and private property. All construction work within county rights-of-way, including restoration, must be completed within one hundred twenty days of the date of issuance of the construction permit unless an extension or an alternate schedule has been approved by the appropriate county official as contemplated by subsection F of this section.

M. As-Built Drawings. If requested by the city, the permittee shall furnish the county with two complete sets of plans drawn to scale and certified to the county as accurately depicting the location of all telecommunications facilities pursuant to the permit. These plans shall be submitted to the public works director or designee within sixty days after completion of construction, in a format mutually acceptable to the permittee and the county.

N. Restoration of Public Rights-of-Way and City Property.
   1. When a permittee, or any person acting on its behalf, does any work in or affecting any public rights-of-way or county property, it shall, at its own expense, promptly remove any obstructions therefrom and restore such ways or property to good order and condition unless otherwise directed by the county and as determined by the public works director.
   2. If weather or other conditions do not permit the complete restoration required by this subsection N, the permittee shall temporarily restore the affected rights-of-way or property. Such temporary restoration shall be at the permittee's sole expense and the permittee shall promptly undertake and complete the required permanent restoration when the weather or other conditions no longer prevent such permanent restoration. Any corresponding modification to the construction schedule may be subject to approval by the county.
   3. If the permittee fails to restore rights-of-way or property in good condition, the county shall give the permittee written notice and provide permittee a reasonable period of time not exceeding thirty days to restore the rights-of-way or property. If, after said notice, the permittee fails to restore the rights-of-way or property to as good a condition as existed before the work was undertaken, the county shall cause such restoration to be made at the expense of the permittee.
   4. A permittee or other acting in its behalf shall use suitable barricades, flags, flagging attendants, lights, flares and other measures as required for the safety of all members of the general public and to prevent injury or damage to any person, vehicle or property by reason of such work in or affecting such rights-of-way or property.

O. Performance and Completion Bond. Unless otherwise provided in a telecommunications facilities agreement, a performance bond or other form of surety acceptable to the county

equal to at least one hundred percent of the estimated cost of constructing permittee's telecommunications facilities within the public rights-of-way of the county, shall be provided before construction is commenced.

1. The surety shall remain in force until sixty days after substantial completion of the work, as determined in writing by the city, including restoration of public rights-of-way and other property affected by the construction.
2. The surety shall guarantee, to the satisfaction of the city:
    a. Timely completion of construction;
    b. Construction is in compliance with applicable plans, permits, technical codes and standards;
    c. Proper location of the facilities as specified by the city;
    d. Restoration of the public rights-of-way and other property affected by the construction; and
    e. Timely payment and satisfaction of all claims, demands or liens for labor, material, or services provided in connection with the work.

Section V: Location of telecommunications facilities

A. Location of Facilities. Placement of telecommunication facilities within the county shall be dictated by zoning. All facilities located within the public right-of-way shall be constructed, installed and located in accordance with the following terms and conditions, unless otherwise specified in a telecommunications facilities agreement:
    1. Whenever all new or existing electric utilities, cable facilities or telecommunications facilities are located or relocated underground within a public right-of-way of the county, a grantee with permission to occupy the same public right-of-way must also locate its telecommunications facilities underground.
    2. Whenever all new or existing electric utilities, cable facilities or telecommunications facilities are located or relocated underground within a public right-of-way of the county, a grantee that currently occupies the same public right-of-way shall relocate its facilities underground concurrently with the other affected utilities to minimize disruption of the public right-of-way, absent extraordinary circumstances or undue hardship as determined by the city and consistent with applicable state and federal law.
    3. Interference With the Public Rights-of-way. No grantee may locate or maintain its telecommunications facilities so as to unreasonably interfere with the use of the public rights-of-way by the city, by the general public or by other persons authorized to use or be present in or upon the public rights-of-way. All use of public rights-of-way shall be consistent with city codes, ordinances and regulations.

B. Relocation or Removal of Facilities. Except in the case of an emergency, within ninety days following the written notice by the county, a grantee shall, at no expense to grantor, temporarily or permanently remove, relocate, change or alter the position of any telecommunications facilities within the public rights-of-way whenever the county shall have determined that such removal, relocation, change or alteration is reasonably necessary for:
    1. The construction, repair, maintenance or installation of any county or other public improvement in or upon the public rights-of-way;
    2. The operations of the county or other governmental entity in or upon the public rights-of-way;

4. The public interest.

C. Removal of Unauthorized Facilities. Within thirty days following written notice from the county, any grantee, telecommunications carrier, or other person that owns, controls or maintains any unauthorized telecommunications system, facility or related appurtenances within the public rights-of-way of the county shall, at its own expense, remove such facilities and/or appurtenances from the public rights-of-way of the county. A telecommunications system or facility is unauthorized and subject to removal in the following circumstances:
   1. One year after the expiration or termination of the grantee's telecommunications facilities agreement;
   2. Upon abandonment of a facility within the public rights-of-way of the county. A facility will be considered abandoned when it is deactivated, out of service, or not used for its intended and authorized purpose for a period of ninety days or longer. A facility will not be considered abandoned if it is temporarily out of service during performance of repairs or if the facility is being replaced;
   3. If the system or facility was constructed or installed without the appropriate prior authority at the time of installation;
   4. If the system or facility was constructed or installed at a location not permitted by the grantee's telecommunications facilities permit or other legally sufficient permit.

D. Coordination of Construction Activities. All grantees are required to make a good faith effort to cooperate with the county.
   1. By January 1st of each year, grantees shall provide the county with a schedule of their proposed construction activities in, around or that may affect the public rights-of-way.
   2. If requested by the county, each grantee shall meet with the county annually or as determined by the county, to schedule and coordinate construction in the public rights-of-way. At that time, the county will provide available information on plans for local, state, and/or federal construction projects.
   3. All construction locations, activities and schedules shall be coordinated, as ordered by the public works director or designee, to minimize public inconvenience, disruption or damages.

Section VI: Telecommunications facilities agreement

1. Telecommunications Facilities Agreement. A telecommunications facilities agreement shall be required of any telecommunications carrier who desires to occupy public rights-of-way of the county.

   A. Application. Any person that desires a telecommunications facilities agreement must register as a telecommunications carrier and shall file an application with the Del Norte planning department which includes the following information:
      1. The identity of the applicant;
      2. A description of the telecommunications services that are to be offered or provided by the applicant over its telecommunication facilities;
      3. Engineering plans, specifications, and a network map in a form customarily used by the applicant of the facilities located or to be located within the public rights-of-way in the county or utility easements, including the location and route requested for applicant's proposed telecommunications facilities;

4. The area or areas of the county the applicant desires to serve and a preliminary construction schedule for build-out to the entire telecommunications facilities agreement area;
5. Information to establish that the applicant has obtained all other governmental approvals and permits to construct and operate the facilities and to offer or provide the telecommunications services proposed;
6. An accurate map showing the location of any existing telecommunications facilities in the county that applicant intends to use or lease.

B. Application and Review Fee.
1. Subject to applicable state law, applicant shall reimburse the county for such reasonable costs as the county incurs in entering into the telecommunications facilities agreement.
2. An application and review fee of one thousand dollars shall be deposited with the county as part of the application filed pursuant to subsection B of this section. Expenses exceeding the deposit will be billed to the applicant or the unused portion of the deposit will be returned to the applicant following the determination granting or denying the franchise. Additional building, public works and planning department fees may be required by the Del Norte Code.

C. Determination by the county. The county shall issue a written determination granting or denying the application in whole or part. If the application is denied, the written determination shall include the reasons for denial.

D. Rights Granted. No telecommunications facilities agreement granted pursuant to this chapter shall convey any right, title or interest in the public rights-of-way, but shall be deemed a grant to use and occupy the public rights-of-way for the limited purposes and term, and upon the conditions stated in the franchise agreement.

E. Term of Grant. Unless otherwise specified in a telecommunications facilities agreement, a telecommunications facilities agreement granted hereunder shall be in effect for a term of five years.

F. Telecommunications Facilities Agreement Territory. Unless otherwise specified in a telecommunications facilities agreement, a telecommunications facilities agreement granted hereunder shall be limited to a specific geographic area of the county to be served by the telecommunications facilities agreement grantee, and the public rights-of-way necessary to serve such areas, and may include the entire county.

G. Telecommunications Facilities Agreement Fee. Each telecommunications facilities agreement granted by the county is subject to the county's right, which is expressly reserved, to fix a fair and reasonable compensation to be paid for the privileges granted; provided, nothing in this chapter shall prohibit the county and a grantee from agreeing to the compensation to be paid. The compensation shall be subject to the specific payment terms and conditions contained in the franchise agreement and applicable state and federal laws.

H. Amendment of Grant. Conditions for amending a telecommunications facilities agreement:
1. A new application and grant shall be required of any telecommunications carrier that desires to extend or locate its telecommunications facilities in public rights-of-way of the county which are not included in a telecommunications facilities agreement previously granted under this chapter.

2. If ordered by the county to locate or relocate its telecommunications facilities in public rights-of-way not included in a previously granted telecommunications facilities agreement, the county shall grant an amendment without further application.
3. A new application and grant shall be required of any telecommunications carrier that desires to provide a service which was not included in a franchise previously granted under this chapter.

I. Renewal Applications. A grantee that desires to renew its telecommunications facilities agreement under this chapter shall, not less than one hundred eighty days before expiration of the current agreement, file an application with the county for renewal of its franchise which shall include the following information:
   1. The information required pursuant to subsection B of this section;
   2. Any information required pursuant to the telecommunications facilities agreement between the county and the grantee.

J. Renewal Determinations. Within ninety days after receiving a complete application under subsection J of this section, the county shall issue a written determination granting or denying the renewal application in whole or in part, applying the following standards. If the renewal application is denied, the written determination shall include the reasons for nonrenewal.
   1. The financial and technical ability of the applicant;
   2. The legal ability of the applicant;
   3. The continuing capacity of the public rights-of-way to accommodate the applicant's existing and proposed facilities;
   4. The applicant's compliance with the requirements of this chapter and the telecommunications facilities agreement;
   5. Applicable federal, state and local telecommunications laws, rules and policies;
   6. Such other factors as may demonstrate that the continued grant to use the public rights-of-way will serve the community interest;

K. Obligation to Cure as a Condition of Renewal. No telecommunications facilities agreement shall be renewed until any ongoing violations or defaults in the grantee's performance of the agreement, or of the requirements of this chapter, have been cured, or a plan detailing the corrective action to be taken by the grantee has been approved by the county.

L. Assignments or Transfers of System or Telecommunications Facilities Agreement. Ownership or control of a majority interest in a telecommunication franchise may not, directly or indirectly, be transferred, assigned or disposed of by sale, lease, merger, consolidation or other act of the grantee, by operation of law or otherwise, without the proper consent of the county, which consent shall not be unreasonably withheld or delayed, and then only on such reasonable conditions as may be prescribed in such consent.
   1. Grantee and the proposed assignee or transferee of the telecommunications facilities agreement or system shall agree, in writing, to assume and abide by all of the provisions of the franchise.
   2. No transfer shall be approved unless the assignee or transferee has the legal, technical, financial and other requisite qualifications to own, hold and operate the telecommunications system pursuant to this chapter.
   3. Unless otherwise provided in a telecommunications facilities agreement, the grantee shall reimburse the county for all direct and indirect fees, costs and expenses

reasonably incurred by the county in considering a request to transfer or assign a telecommunications facilities agreement.

4. Any transfer or assignment of a telecommunications facilities agreement, system or integral part of a system without prior approval of the city under this section or pursuant to a telecommunications facilities agreement shall be void and is cause for revocation of the telecommunications facilities agreement.

M. Revocation or Termination of Telecommunications Facilities Agreement. A telecommunications facilities agreement to use or occupy public rights-of-way of the county may be revoked for the following reasons:
   1. Construction or operation in the county or in the public rights-of-way of the county without a construction permit;
   2. Construction or operation at an unauthorized location;
   3. Failure to comply with subsection M of this section with respect to sale, transfer or assignment of a telecommunications system or franchise;
   4. Misrepresentation by or on behalf of a grantee in any application to the county;
   5. Abandonment of telecommunications facilities in the public rights-of-way;
   6. Failure to relocate or remove facilities as required in this chapter;
   7. Failure to pay taxes, compensation, fees or costs when and as due the city under this chapter;
   8. Insolvency or bankruptcy of the grantee;
   9. Violation of material provisions of this chapter;
   10. Violation of the material terms of a franchise agreement.

N. Notice and Duty to Cure. In the event that the county believes that grounds exist for revocation of a telecommunications facilities agreement, the county shall give the grantee written notice of the apparent violation or noncompliance, providing a short and concise statement of the nature and general facts of the violation or noncompliance, and providing the grantee a reasonable period of time, not exceeding thirty days, to furnish evidence that:
   1. Corrective action has been, or is being actively and expeditiously pursued, to remedy the violation or noncompliance;
   2. Rebuts the alleged violation or noncompliance; and/or
   3. It would be in the public interest to impose some penalty or sanction less than revocation.

O. Public Hearing. In the event that a grantee fails to provide evidence reasonably satisfactory to the county as provided in subsection O of this section, the county administrator may refer the apparent violation or noncompliance to the board of supervisors. The board of supervisors shall provide the grantee with notice and a reasonable opportunity to be heard concerning the matter.

P. Standards for Revocation or Lesser Sanctions. If persuaded that the grantee has violated or failed to comply with the material provisions of this chapter, or of a telecommunications facilities agreement, the board of supervisors shall determine whether to revoke the telecommunications facilities agreement, or to establish some lesser sanction and cure, considering the nature, circumstances, extent, and gravity of the violation as reflected by one or more of the following factors. Whether:
   1. The misconduct was egregious;
   2. Substantial harm resulted;
   3. The violation was intentional;

4. There is a history of prior violations of the same or other requirements;
5. There is a history of overall compliance;
6. The violation was voluntarily disclosed, admitted or cured.

Q. Other County Costs. All grantees shall, within thirty days after written demand therefore, reimburse the county for all reasonable direct and indirect costs and expenses incurred by the county in connection with any modification, amendment, renewal or transfer of the telecommunications facilities agreement or any telecommunications facilities agreement consistent with applicable state and federal laws.

Section VII: General telecommunications terms

A. Facilities. Upon request, each grantee shall provide the county with an accurate map or maps certifying the location of all telecommunication facilities within the public rights-of-way. Each grantee will provide updated maps annually.

B. Damage to Grantee's Facilities. Unless directly and proximately caused by willful, intentional or malicious acts by the county, the county shall not be liable for any damage to or loss of any telecommunications facility within the public rights-of-way as a result of or in connection with any public works, public improvements, construction, excavation, grading, filling or work of any kind in the public rights-of-way by or on behalf of the county, or for any consequential losses resulting directly or indirectly therefrom.

C. Duty to Provide Information. Within ten business days of a written request from the county, each grantee shall furnish the city with the following:
   1. Information sufficient to demonstrate that grantee has complied with all requirements of this chapter;
   2. All books, records, maps, and other documents, maintained by the grantee with respect to its facilities within the public rights-of-way shall be made available for inspection by the county at reasonable times and intervals.

D. Service to the County. If the county contracts for the use of telecommunication facilities, telecommunication services, installation, or maintenance from the grantee, the grantee shall charge the county the grantee's most favorable rate offered at the time of the request charged to similar users within California for similar volume of service, subject to any of grantee's tariffs or price lists on file with the CPUC. With the county's permission, the grantee may deduct the applicable charges from fee payments. Other terms and conditions of such services may be specified in a separate agreement between the county and grantee.

E. Compensation for County Property. If any right is granted, by lease, telecommunications facilities agreement, or other manner, to use and occupy county property for the installation of telecommunications facilities, the compensation to be paid for such agreement and use shall be fixed by the county.

F. Leased Capacity. A grantee shall have the right, without prior county approval, to offer or provide capacity or bandwidth to its customer; provided that the grantee shall notify the county that such lease or agreement has been granted to a customer of lessee.

G. Grantee Insurance. Unless otherwise provided in a telecommunications facilities agreement, each grantee shall, as a condition of the grant, secure and maintain the following liability insurance policies insuring both the grantee and the county, and its elected and appointed officers, officials, agents and employees as coinsured:
   1. Comprehensive general liability insurance with limits not less than:
      a. Three million dollars for bodily injury to death to each person,

b. Three million dollars for property damage resulting from any one accident, and
c. Three million dollars for all other types of liability;

2. Automobile liability for owned, non-owned and hired vehicles with a limit of one million dollars for each person and three million dollars for each accident;
3. Worker's compensation within statutory limits and employer's liability insurance with limits not less than one million dollars;
4. Comprehensive form premises-operations, explosions and collapse hazard, underground hazard and products completed hazard with limits not less than three million dollars;
5. The liability insurance policies required by this section shall be maintained by the grantee throughout the term of the telecommunications facilities agreement, and such other period of time during which the grantee is operating without a franchise hereunder, or is engaged in the removal of telecommunications facilities. Each such insurance policy shall contain the following endorsement:

   "It is hereby understood and agreed that this policy may not be canceled nor the intention not to renew be stated until 90 days after receipt by the county, by registered mail, of a written notice addressed to the County Administrator of such intent to cancel or not to renew."

6. Within sixty days after receipt by the county of such notice and in no event later than thirty days prior to such cancellation, the grantee shall obtain and furnish to the county evidence that the grantee meets the requirements of this section.
7. As an alternative to the insurance requirements contained herein, a grantee may provide evidence of self-insurance subject to review and acceptance by the city.

H. General Indemnification. Each telecommunications facilities agreement shall include, to the extent permitted by law, grantee's express undertaking to defend, indemnify and hold the county and its officers, employees, agents and representatives harmless from and against any and all damages, losses and expenses, including reasonable attorney's fees and costs of suit or defense, arising out of, resulting from or alleged to arise out of or result from the negligent, careless or wrongful acts, omissions, failures to act or misconduct of the grantee or its affiliates, officers, employees, agents, contractors or subcontractors in the construction, operation, maintenance, repair or removal of its telecommunications facilities, and in providing or offering telecommunications services over the facilities or network, whether such acts or omissions are authorized, allowed or prohibited by this chapter, or by a telecommunications facilities agreement made or entered pursuant to this chapter.

I. Performance Surety. Before a telecommunications facilities agreement granted pursuant to this chapter is effective, and as necessary thereafter, the grantee shall provide a performance bond, in form and substance acceptable to the county, as security for the full and complete performance of a telecommunications facilities agreement granted under this chapter, including any costs, expenses, damages or loss the city pays or incurs because of any failure attributable to the grantee to comply with the codes, ordinances, rules, regulations or permits of the county. This obligation is in addition to the performance surety required by subsection O of Section IV for construction of facilities.

Section VII: General provisions

A. Governing Law. Any telecommunications facilities agreement granted under this chapter is subject to the provisions of the Constitution and laws of the United States, and the state of California and the ordinances and charter of the county.

B. Written Agreement. No telecommunications facilities agreement shall be granted hereunder unless the agreement is in writing.

C. Nonexclusive Grant. No telecommunications facilities agreement granted under this chapter shall confer any exclusive right, privilege, license or franchise to occupy or use the public rights-of-way of the county for delivery of telecommunications services or any other purpose.

D. Severability and Preemption. If any article, section, subsection, sentence, clause, phrase, term, provision, condition, covenant or portion of this chapter is for any reason held to be invalid or unenforceable by any court of competent jurisdiction, or superceded by state or federal legislation, rules, regulation or decision, the remainder of the chapter shall not be affected thereby but shall be deemed as a separate, distinct and independent provision, and such holding shall not affect the validity of the remaining portions hereof, and each remaining section, subsection, sentence, clause, phrase, provision, condition, covenant and portion of this chapter shall be valid and enforceable to the fullest extent permitted by law. In the event that federal or state laws, rules or regulations preempt a provision or limit the enforceability of a provision of this chapter, then the provision shall be read to be preempted only to the extent required by the law. In the event such federal or state law, rule, or regulation is subsequently repealed, rescinded, amended or otherwise changed so that the provision hereof that had been preempted is no longer preempted, such provision shall be thereupon return to full force and effect, and shall thereafter be binding, without the requirement of further action on the part of the county.

E. Penalties. Any person found guilty of violating, disobeying, omitting, neglecting or refusing to comply with any provisions of this chapter shall be fined not less than one hundred dollars nor more than one thousand dollars for each offense. A separate and distinct offense shall be deemed committed each day on which a violation occurs.

F. Other Remedies. Nothing in this chapter shall be construed as limiting any judicial remedies that the county may have, at law or in equity, for enforcement of this chapter.

G. Captions. The captions to sections throughout this chapter are intended solely to facilitate reading and reference to the sections and provisions contained herein. Such captions shall not affect the meaning or interpretation of this chapter.

H. Compliance with Laws. Any grantee under this chapter shall comply with all federal and state laws and regulations, including regulations of any administrative agency thereof, as well as all ordinances, resolutions, rules and regulations of the county heretofore or hereafter adopted or established during the entire term of any franchise granted under this chapter, which are relevant and relate to the construction, maintenance and operation of a telecommunication system.

I. Consent. Whenever the consent of either the county or of the grantee is specifically required by this chapter or in a telecommunications facilities agreement granted, such consent will not be unreasonably withheld.

J. Application to Existing Ordinance and Agreements. To the extent that this chapter is not in conflict with and can be implemented with existing ordinance and telecommunications facilities agreement, this chapter shall apply to all existing ordinance and

telecommunications facilities agreement for use of the public right-of-way for telecommunications.

K. Confidentiality. The county agrees to use its best efforts to preserve the confidentiality of information as requested by a grantee, to the extent permitted by California Public Records Law.

Disclaimer

The consultant is many things but he is not a legal expert in these matters. As such the Model Ordinance should be taken as a starting point for someone with sufficient legal credentials and background.

RECOMMENDATIONS

Identify Opportunities for Public-private Partnerships

Public-private partnerships take many forms. In general they are the result of a negotiated agreement between the public and private sector participants.

Participation from the public sector can take the form of obtaining funds from sources not open to private sector players. Other public sector contributions can include waiving ROW fees, providing site locations a little or no cost, sharing in operations management and other opportunities that may present themselves.

In this planning document we suggest placement of a roof antenna structure on the county building. This also would include co-location of switch electronics and provision of poser in the county building.

Among the considerations for the private sector are the building and subsequent operation of the network.

Issue a Request for Proposal (RFP)

One way to get to the next level for implementation is to issue a Request for Proposal (RFP) using the information contained in this planning document. Outcomes form this approach are interesting, especially when we see competition to provide the requested infrastructure and services. Often we see partnerships develop. For example one entity may build the network or components of the network (backhaul and/or distribution) and another may operate the network.

Only by testing the waters with an RFP can we test these waters.

Pursue Grant Funding Opportunities

As demonstrated in the financial models, gap funding dramatically impacts the payback periods. Here is where a public-private partnership, albeit more complicated, may have a role.

Adopt a Del Norte County Telecommunications Ordinance/Code

A review of the ordnances and code in place in Del Norte County reveals there are no provisions relating to telecommunications or telecommunications-related facilities, such as installing conduit when the opportunity to do so emerges.

Highway and road construction, development build-out and broadband investment are facilitated when the rules (codes and ordinances) are known and readily available.

The consultant is *not* a lawyer. As such this proposed ordinance needs to be carefully reviewed for accuracy, pertinence and completeness. It may very well be that this proposal may be construed as too complex. However, in the interest of completeness we brought in many facets related to the topic. It is also written from the perspective of a county and may need further modification to meet the needs of cities.

Build and Profile Demand in Del Norte County
The adopted strategic plan (see http://www.jirwinconsulting.com/documents.htm) included non-infrastructure recommendations. These elements are critical to building demand factors that help to grow additional infrastructure and services.

Here we revisit the three goals from the adopted strategic plan and make note of those concerned with supply versus demand.

> **Goal 1 (Supply): Del Norte County's Telecommunication Infrastructure and Services Match 21st Century Demands**
> *Encourage and support the continued growth of the Del Norte County telecommunications infrastructure so that employees can be as efficient as possible, healthcare providers can provide the highest levels of care for patients, businesses and all organizations can be competitive as they see fit in the global economy, and residents can have every access to education, information and services.*
>
> - Establish a Standing Information Technology Advisory Committee
> - Support and Facilitate Availability of Broadband (90% coverage plus conduit ordinances)
> - Support and Facilitate Availability of Quality Cellular Phone Service (100% coverage on major travel routes)
> - Support and Facilitate Regional Route Redundancy
> - Support the efforts of the California Broadband Task Force
> - Establish a regional exchange point
> - Identify funding to support continued planning efforts
>
> **Goal 2 (Demand): Del Norte County's Workforce Is 21st Century Ready**
> *Ensure that all Del Norte County workers have the opportunity to equip themselves with the necessary tools to succeed in their careers and in whatever field they choose in this new and dynamic global digital economy. Encourage entrepreneurship, provide for life-long learning and promote growth of existing businesses. Build on existing programs and relationships.*
>
> - Ensure development of a 21st Century Digital Economy Prepared Workforce
> - Promote and Support Small Business Growth
> - Develop Programs to Ensure Adequate Supply of Trades Workforce

- Evaluate the Potential for Community Development Resource Centers

Goal 3 (Demand): Del Norte County Is A Full Participant in the 21st Century Economy and *the World Knows It!*
A knowledge-based digital economy will be a significant component of the 21st century economy and serve as an added dimension for promoting economic opportunities in Del Norte County.

- Promote Del Norte County's Telecommunication Assets
- Include 21st Century Factors In Economic Development Policy
- Continue the Regional Approach to Economic Development
- Develop an "Independent Living" Pilot Project
- Promote Increased Telework/Telecommuting Opportunities
- Promote expanded use of telehealth/telemedicine technologies

Note that 2 out of the 3 goals are focused on demand. Building demand is a key driver of investment in telecommunications infrastructure and services. Demand growth, like nothing else, drives investment in telecommunications infrastructure and services. Perhaps, even of more importance, is that growth in demand also indicates economic and quality of life improvements.

Standing up the Information Technology Advisory Committee could ensure ongoing efforts with regard to broadband (supply and demand) by taking ownership of implementing and updating the strategic plan as well as monitoring and encouraging growth in demand. It is very important for a community to take ownership of the responsibility for advancing broadband related matters of importance to the county's economic development future. Consultants can help and advise but it remains the responsibility of the community to act on recommendations.

Key to formation of the ITAC would be the identification of a local leader. Circumstances have left this role unfilled. In early 2009 a new TAEDA economic development director came on board. This would seem to be a great opportunity to move ahead with this step of ensuring community ownership of the future for teletransportation / telecommunications in Del Norte County.

The consultant is available to assist anywhere in the county with entities seeking consultation on demand side matters (i.e., education programs, workforce skills development, etc.—please refer to the Strategic Planning document).

Del Norte's demonstration of leadership will serve as a key inducement for investment in telecommunications infrastructure and services. Focus solely on infrastructure matters is insufficient to drive additional investment in broadband supply. Let us ensure we are building and demonstrating growth in demand for services.

Pursue Funding to Ensure Continuation of Consulting Services
Considerable effort has gone into preparing four phases of planning. Now it is time to pursue implementation. The consultant strongly believes in the role of local leadership but also recognizes the value of specialized expertise combined with years of field work in the county.

Over the planning efforts the consultant has on many occasions gone beyond the planning function and at his own expense engaged in implementation related matters. In addition the consultant has represented Del Norte to the RCC project over its 2 year life without compensation from Del Norte.

The consultant commits to even more pro bono work but requires compensation to cover the growing cost of expenses. This request for compensation seems reasonable and to that end at the request of the TAEDA as scope of work covering a period of six months at $15,000 has been submitted.