

Useppa Island Broadband Feasibility Report

Bringing a Robust Broadband Network to Useppa Island

Prepared by

CyberStreet, Inc.
1617 Hendry Street
Suite 414
Fort Myers, FL 33901

7/12/14



Table of Contents

Overview of Project and Service Area.....	1
Requirements	1
Individual homes/business	1
Internet trunk to the island(s).....	1
Project Elements and Technologies	2
Internet trunk connection	2
Feeding the link.....	3
Equipment for link	4
Distribution to Individual homes/business.....	5
The Wireless Network.....	6
Equipment	6
Configuration	6
Secondary Tower.....	6
Cabbage Key	7
Installation of clients.....	7
Needed services to complete the network.....	7
Support and Maintenance	8
Up Front Costs	8
The Tower	8
Secondary Tower.....	8
Microwave backhaul link.....	8
Wireless distribution network	9
Client (home) Installations.....	9
Re-occurring costs (Monthly).....	9
Internet connection.....	10
Maintenance Agreement	10
A-La-Carte vs. Bulk Internet	11
Summary of costs to subscribers.....	11
Summary	12

Overview of Project and Service Area

The goal is to provide high speed Internet connectivity (Broadband) to the roughly 80+ homes and businesses located on Useppa Island.

The area that will need to be served is fairly small, as the occupied part of the island is only about 3/4 mile from end to end and around 1/4 mile wide.

A desire to provide service to nearby Cabbage Key (1/2 mile approx) has also been expressed. This island seems to comprise about 10 additional homes.

Requirements

Individual homes/business

Current Internet service and content can include HD video streams that require at least 10Mbps sustained transfer speed for maximum video quality. It is therefore desirable to have the capability to deliver this minimum speed to each residence/business. Obviously, more would be better.

Internet trunk to the island(s)

Based on current usage at other communities – such the Enclave at Cypress Lake, which comprises 54 homes – it is anticipated the aggregate bandwidth requirement would be around 100 Mbps for the 90+ homes on the island(s) at this time.

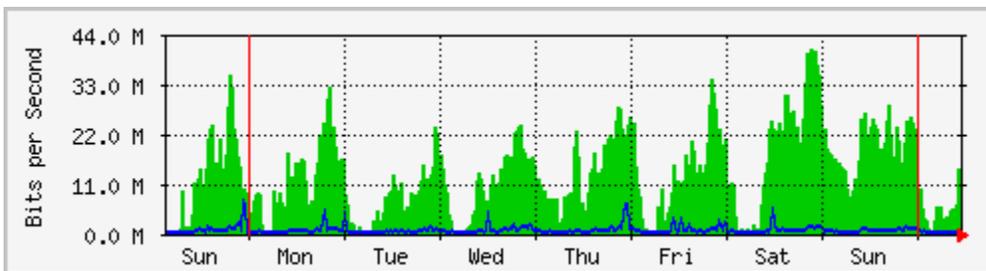


Figure 1- Bandwidth graph showing usage for the 54 units at the Enclave

Project Elements and Technologies

Internet trunk connection

The requirement for bandwidth with a minimum of 100 Mbps rules out most copper based solutions. Currently, only fiber optic cable and microwave technologies can deliver the required speed. Since the fiber option has been researched and deemed to be too expensive, the microwave method will be the only one discussed here.

This microwave link would require line of sight (no trees or buildings obstructing path). A small tower would need to be erected on the island to mount the required 4 foot diameter dish. This tower would need to be a minimum height of 80 feet. Due to the wind loading of a 4 foot diameter dish, a tower type such as Rohn 45 or heavier should be used. This is a guyed type of tower and would require a circular area of approximately 110 feet diameter for the tower and the necessary guy cables/anchors. The tower is also a good distribution structure for mounting radios/antennas for delivery to individual homes/businesses.

The photo below shows a nearly identical tower to the one needed with two dishes on it. The top dish appears to be about 4 feet in diameter, the size needed for this project. This tower is located on Pine Island.



Figure 2- Tower located at Pine Island

Feeding the link

The other end of the microwave link would need to be fed from a point where a fiber Internet connection was available and could be installed economically to a structure of sufficient height. One candidate location is a 300 foot tower on Hancock Bridge Parkway.

Below is a photograph of Christo Tower:



Figure 3- Christo Tower

Below is displayed a plot of both ends of this link, giving a signal path of about 18 miles:

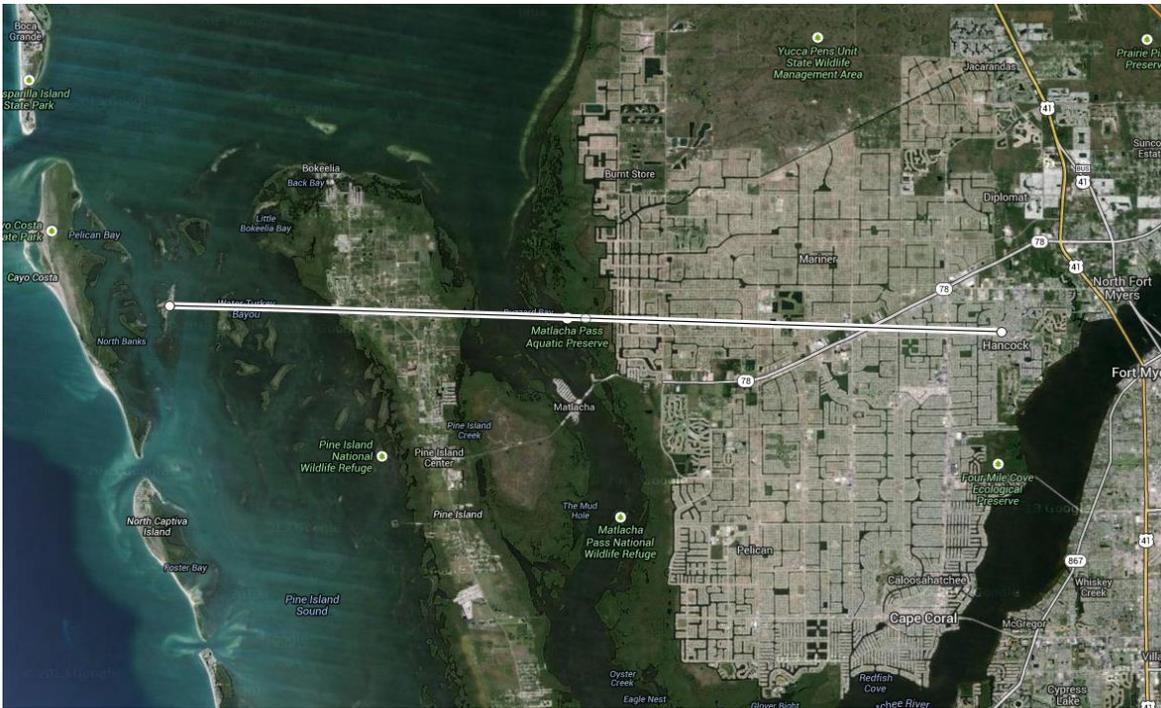


Figure 4- Signal path

Equipment for link

The selected equipment is a TrangoSystemsGigalynxLicenced Microwave backhaul system. Data sheets for this equipment are attached, as is a quote for the equipment from Trango Systems. I had their engineer run an analysis which accounted for antenna height, terrain and climate. Results show that this link should be quite solid, delivering over 200 Mbps bandwidth 99.9999 percent of the time and remaining up 100% of the time. Heavy rain may degrade the link – potentially slowing it to as little 100 Mbps -- but would not bring it down. The complete link analysis report is included in an addendum.

Distribution to Individual homes/business

The speed requirement for each residence/business could be achieved with landline technologies such as VDSL (Very High Speed Digital Subscriber Line). These could deliver the needed 10Mbps, as VDSL is capable of delivering 14 Mbps through as much as 3500 feet of standard copper phone cable. This is one option, providing that the required copper cable is present and available (not owned by the local Telco company). This option has the advantage of not needing any outside radios/antennas, as would be the case with the next option.

The next option would be a wireless solution, such as the one our company currently employs to deliver service to residents and businesses in Cape Coral and Fort Myers. The wireless technology has demonstrated the capability to deliver up to 30Mbps to individual homes/businesses. This would require each home/business to run CAT 5E between a small radio mounted outside (slightly smaller than the size of a one dozen egg carton) to the inside, where the high speed connection would be utilized. A few homes that are obstructed by a large amount of foliage may require a small dish about 11 inches in diameter. Photographs of such installations are below.



Figure 5- Examples of wireless installations

The Wireless Network

Equipment

The most likely candidate to provide the wireless distribution is Ubiquiti M-Series AirMax radios. These are low cost and can provide up to 30Mbps to subscribers. We have a great deal of experience using this equipment to provide our subscriber base with high speed Internet connectivity. Information on the AirMax radios and antennas is included with this report. In addition, an Ethernet switch and router will be needed to connect everything together.

Configuration

The primary wireless distribution point will be the tower on which the backhaul discussed previously is mounted. This tower is centrally located on the island and would provide a good location for distribution. This would comprise three Ubiquiti Rocket radios with three 120 degree sector antennas.

Secondary Tower

In addition, we recommend that a second tower be mounted with both a rocket radio with omni antenna and a point-to-point connection back to the primary tower. This would provide a closer location for homes located on the extreme north end of the island, which has a lot of very dense foliage. Below is a satellite photograph of the island showing these two locations. There is currently a tower at this location mounted to the top of a building. Although it is possible to use this tower, its location makes access more difficult than if a tower were mounted to the side of this same building. Rohn 25G tower would be adequate for this.

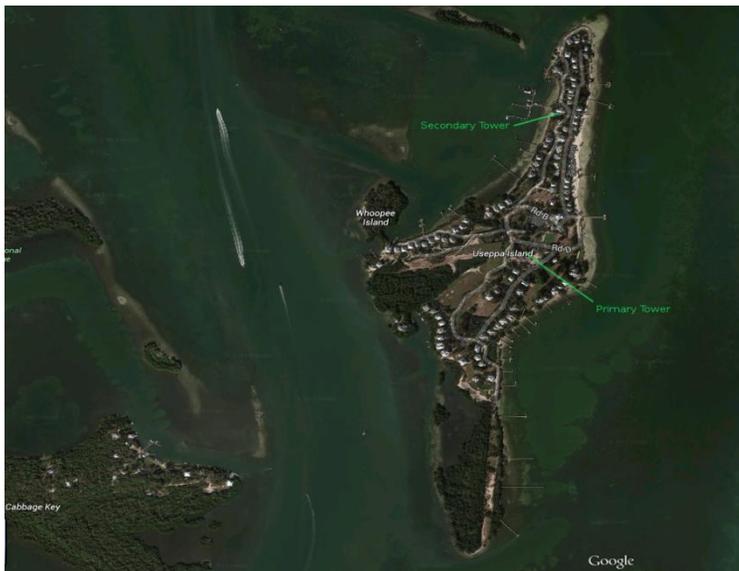


Figure 6- Map showing proposed tower locations

Cabbage Key

The majority of the residents on Cabbage Key most likely would be able to connect their client radios (NanoBridge or Nanobeam) directly to the main tower located near the center of Useppa Island. Alternately, if this does not provide an adequate connection, a small tower could be mounted with a backhaul to the main tower. This tower would have a rocket radio and an omni antenna, just as with the secondary Useppa tower.

Installation of clients

Client radios will need to be mounted on the outside of the houses/buildings that will receive service. In most cases, mounting will need to be on the side of the building facing the tower that provides the connection. A standard Cat 5E cable (shielded would be preferred) will need to be run from the radio to the location inside where service is to be installed.

Due to the fact that access is limited to boat only as well as our limited manpower, CyberStreet will most likely be unable to perform a majority of the installations. This would mean a subcontractor will need to do most of these installations. We can provide training as well as perform the first several installations with the contractor personnel, assisting them so that they can gain the necessary knowledge to perform the majority of the installations without any other on-site help.

Needed services to complete the network

There are some basic services that need to be provided in order to have a fully functioning Internet connection. The server(s) required could be located off the island. CyberStreet could provide all the required services from its data center located in Downtown Fort Myers.

IP Addresses – An Internet routable IP address for each client will be needed in most cases. Although a large NAT routed setup allowing a private IP pool could be used, many Internet services will not function correctly with such a setup. Nearly all Internet service providers currently provide at least 1 publicly routed IP address per client. CyberStreet has sufficient IP resources to meet this need. If you wish to obtain your own IP address pool, they can still be obtained from ARIN (American Registry for Internet Numbers); however this would need to be done soon as ARIN has nearly exhausted its assignable IP address pool.

DHCP – This service gives out IP (Internet protocol) address to clients, eliminating the need to manually configure each client's computers/router.

DNS – This is what translates names such as www.google.com into IP addresses. This is required for normal Internet use.

Email – Many clients may wish to simply use a Gmail, Hotmail, or other free service. For those who don't wish to do so, an email server will be required to provide the needed email services.

Support and Maintenance

As is true with any network, problems will arise that will require troubleshooting and service to resolve. These problems can at times require a high degree of technical knowledge and skill. CyberStreet can provide the monitoring/troubleshooting/service necessary to keep the network running as designed.

Damage to equipment resulting from weather – primarily lightning – will require rapid replacement to restore service. It is recommended that spare radios be kept on hand to lessen downtime due to these events.

Also, clients will at times have issues with their devices/services that require trained technical support personnel to be available. Our current customer base generates about 6-10 calls per day. Most issues are resolved over the phone with only occasional on-site visits required. Due to the remoteness of this site and the difficulty in reaching it in a timely manner one or more persons resident on the island will need to be trained to deal with minor issues as needed.

CyberStreet can provide the above services at a fixed monthly rate with a service agreement.

Up Front Costs

A complete list of all costs is difficult to compile. Some costs are only approximate.

The Tower

Rohn 45 tower comes in 10 foot sections. Each section costs approximately \$280. Nine will be required. Also required will be 4 guy mounts at approximately \$160 each and 3 guy anchors with equalizer plates at \$140 each, as well as cable for guying and concrete and other hardware for bases/anchors. The cost of installing the tower will depend on the amount of work that can be completed that does not require a specialized tower contractor, such as installation of dead man anchors for guy attachment and a cement base. Current estimates run from \$1800 to \$3500 dollars. Total cost of the tower with installation should be under \$7,000. These costs are rough estimates only. Shipping charges in particular are unknown.

Secondary Tower

Rohn 25 tower can be used for this. 5 sections will be needed. This tower will be mounted to the side of a two story building, so no guy cabling will be required. Dynamic South in St. James City has used Rohn 25 sections they will sell for \$50 a section. Two standoff brackets may also be needed at approximately \$150 each. The approximate cost of hardware is \$550; installation \$700. These costs are rough estimates only.

Microwave backhaul link

The quote from Trango Systems came in at \$11,878.85. There will be some additional expense, as this does not include the cost of cabling. Approximately 250 feet of LMR-400 or Beldon 9913 coax cable will be needed. This will cost approximately \$200 extra. Installation will take about 2 to 3 hours for mounting the 4 foot dish on Christo. A second climb will most likely be needed to fine tune the dish aiming. Cost would be approximately \$700. Cost for the Useppa end will be approximately \$60 for cable and \$400 for install/aiming.

Licensing cost will be \$470 for each end (Total of \$940) and it's good for 10 years. I am still researching other company's products for possible use.

Wireless distribution network

The primary tower will house three Ubiquiti Rocket radios paired with sector antennas. These will also require shield kits due to the close mounting. The second tower will be connected to the main tower via two NanoBridge or NanoBeam radios. These will also require shield kits (two NanoBeam/NanoBridge radios with shield kits will be needed). The secondary tower will require a Ubiquiti Rocket radio mounted to an AirMax omni, also with shield kit.

Summary of costs below:

4 Rocket Radios \$90 each -- Total \$360
3 Rocket Sector Antennas \$90 each -- Total \$270
1 AirMax Omni antenna \$125
3 Rocket Sector shields \$100 each -- Total \$300
2 NanoBeam NBE-M5-300 Radios \$90 each -- Total \$200
2 NanoBeam shield kits \$50 each -- Total \$100
6 MagicBullet Plus surge protectors \$65 each -- Total \$390
1 Cisco 3550 Layer 3 switch \$100
1 500 watt UPS \$100
Labor \$700
Total = \$2645.00

Client (home) Installations

NanoStation, NanoBridge or NanoBeam, cost \$90 each
MagicBullet surge protectors, cost \$45 each
Cable and connector cost is approximately \$30 for most installations.
Labor, \$150*

Re-occurring costs (Monthly)

In addition to the upfront costs there is also the monthly cost of keeping the network running and feeding it with the Internet bandwidth required for smooth operation. Some costs are fixed, regardless of network usage or number of subscribers. These include electricity to operate the equipment on the island and the rental fee for use of Christo Tower for the other end of the Internet backhaul link. Others are usage based and will vary with usage and the number of subscribers served.

The power requirement is estimated at less than 400 total watts. Current electricity costs are in the range of \$0.11 per kilowatt hour. This would yield a total monthly electric cost in the range of \$35 - \$55. I have already spoken to the owner of Christo Tower and we have agreed on \$200 monthly fee for the use of the tower.

Internet connection

The cost of providing the needed Internet connection will vary depending upon several factors. The number of subscribers is the biggest factor. If all of the approximately 90 homes on Useppa and Cabbage Key are connected, it is anticipated that a minimum of 100 Mbps with a burst to at least 200Mbps of Internet bandwidth will be needed. The cost of this varies depending on from whom this bandwidth is purchased and its method of delivery. A connection delivered directly to Christo Tower via Fiber with FPLFiberNet would cost \$1803/month with a 24 month agreement and a \$500 installation fee. CyberStreet could deliver the same bandwidth to Christo Tower with a microwave link similar to the one used to get the connection to Useppa Island for approximately \$1100/month and a \$1000 installation fee.

Extended Warranty for GigaLinx radios - \$2500 for an additional three years.

Maintenance Agreement

As mentioned earlier, from time to time problems will arise that will need to be addressed. Problems with client devices such as computers, tablets, smart phones, and other Internet connected devices will occur. The client will need the assistance of skilled technical persons to help resolve them. This means telephone technical support for providing this assistance. Failure of hardware due to age and weather events such as lightning will require repair/replacement. CyberStreet can provide the needed services for a fixed cost of \$950/month. This would include at a minimum the following:

- Publicly routable IP addresses such that each subscriber gets their own unique, publicly routed IP address
- DNS and other servers required to operate the network
- Up to 5 email address/boxes per subscriber
- Up to two monthly visits by CyberStreet personnel for the purpose of resolving troubles mentioned above
- Telephone technical support during the hours of 9:00am to 8:00pm on weekdays and 10:00am to 2:00pm on Saturday
- The period during the network build out and growth

All the above assumes that all 90 homes/business are connected to the network and using the provided Internet connection. Since getting the individual homes hooked up will take an estimated 6 to 12 months, this will not be true at the beginning. A prorated fee for bandwidth (provided CyberStreet is providing the Internet connection) and maintenance could be applied during the build out phase. The following schedule is proposed for this period:

1st month 1 to 15 subscribers connected -- Internet bandwidth \$250 maintenance \$300.
2nd month 16 to 30 subscribers connected -- Internet bandwidth \$350 maintenance \$500.
3rd month 31 to 45 subscribers connected -- Internet bandwidth \$600 maintenance \$600.
4th month 46 to 60 subscribers connected -- Internet bandwidth \$750 maintenance \$750.
5th month 61 to 75 subscribers connected -- Internet bandwidth \$950 maintenance \$850.

6th month 76 to 90 subscribers connected -- Internet bandwidth \$1100 maintenance \$950.

A-La-Carte vs. Bulk Internet

So far we have assumed that over the above timeframe or slightly longer that all homes/businesses would be connected to the network as their primary means of Internet access. Another possibility exists, although it may be deemed impractical due to the high fixed costs of building the network. This consists of providing only those homes and businesses that desire hookup be attached and billed for the service.

The first way this could be billed would be to charge each subscriber an individual fee for connection. For instance, we could take each one on as a subscriber just like any other of our subscribers here in Cape Coral. This option would entail no bandwidth or maintenance fees as they would be rolled into the cost of providing this service to each individual subscriber. The fee would be the same as our existing customer base but with a \$150 installation fee due to the increased difficulty of performing the installations, as we would need to travel by boat. Since we would be performing all the installations ourselves, we would be limited to performing approximately 2 installations per week (much less aggressive than the above schedule) and repairs would also take longer.

The second would be to simply apply the above billing schedule to the actual number of subscribers connected.

Summary of costs to subscribers

Total cost* building the network and connecting all of the approximately 90 homes/businesses on Useppa and Cabbage Key:

Trango Systems Gigalinx \$11,878.85
Cabling connectors for Gigalinx \$260
Installation of Gigalinx \$1100*
Licensing costs \$940
Main tower \$7000*
Secondary tower \$1250*
Wireless networking equipment installed \$2645.00*
Client hardware + installations = \$315 each X 90 = \$28,350*
Total upfront costs = \$52,173.85*

Total upfront costs divided by 90 = \$579.70* per subscriber
Amortized over two years = \$24.15* / month per subscriber

Costs of running the network:

Internet bandwidth costs \$1100 / month
Christo Tower rental \$200/month
Gigalinx Extended Warranty \$2500
Maintenance and support agreement \$950 /month
Costs per subscriber \$25.00 / month per subscriber

(* = costs are estimates)

Summary

While there is a significant upfront cost associated with this project, when broken down the cost becomes comparable, or even substantially less, than most other high speed Internet options. We believe that implementing this proposal will present a fast, affordable and reliable solution for providing high speed Internet access to the residents of Useppa Island as well as Cabbage Key. We would look forward to assisting you in bringing a robust broadband network to your community.