

CENTER FOR INNOVATIVE TECHNOLOGY

Native American Broadband GIS Feasibility Study

Final Report

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NATIVE AMERICAN BROADBAND GIS FEASIBILITY STUDY

FINAL REPORT

STUDY INTRODUCTION

Statement of Purpose: Under the ARRA grant (Award Number 51-50-M09070 for the *Virginia Broadband Mapping and Planning Project*), CIT examined the feasibility of collecting actionable broadband data serving tribal communities in order to create a GIS map national in scale. Specifically, this NTIA-administered grant allows for the identification of key findings necessary to enable actionable recommendations for decision maker consideration including the attendant risks and logistical challenges intrinsic to “Indian Country.”¹

Central Question Investigated: Is it feasible to map broadband coverage in Indian Country and to find holes within the GIS coverage map?

Purpose of Study: Anecdotal information suggests that tribal land broadband coverage is estimated at less than 10% per capita and leading tribal telecom experts indicate it may be as low as 4-8%. Simply stated, exact coverage statistics are not known and, therefore, the aim of this project is to:

- 1) Collect data and establish a preliminary baseline of the most recent known information regarding the state of Indian Country broadband;
- 2) Identify logistical and related challenges encountered and expected throughout future execution of a data collection plan;
- 3) Recommend approaches to successfully overcome these hurdles while gauging opinion leader receptiveness toward a proposed mapping initiative on a national scale.

There are many noteworthy instances of leading Native American telecom carriers distinguished by their determination, endurance and their story of overcoming large odds to enable broadband service delivery. [Note: In this Study, the term Native American includes Alaska Natives and Native Hawaiians.]

Study Structure/Methodology: This study consisted of three components:

- Assessment of the latest broadband landscape from open source literature and conferences
- Interviews of leading experts including tribal practitioners in the broadband arena
- Identification of key findings and actionable recommendations for NTIA consideration.

¹“Indian Country” is defined at 18 USC §1151; here it means Indian reservations, Alaska Native Villages, and tribally-owned lands.

Data collection centered on open source literature searches and participation in leading Indian Country conferences with telecom/broadband content and experts. Examples include Tribal Telecom February 2012 (proceedings), Native American Financial Officers Association conference in March 2012, State Broadband Initiative (SBI) Grantee Workshop in May 2012 and National Congress of American Indians in June 2012. In addition, research was enhanced by approximately 20 telephone interviews and/or meetings with a diverse expert base from a variety of tribal locations. Outreach focused on subsets of the lower 48 plus Alaska and Hawaii.

Development of this study document required extensive information synthesis and organization combined with an advisory review consisting of Indian Country experts from Native American Capital, LLC (NAC), a Native American owned and managed professional advisory services firm. Prior to NTIA distribution, this study was then readied for final internal review within the CIT.

Study Sponsor/Study Duration: Department of Commerce NTIA / April 2012 - July 2012. The GIS data collection mapping phase ends December 31, 2014. Were work to commence on this phase now, there would be ~ 2.5 years with execution of the go forward plan for data collection and data uploading for construction of an Indian Country GIS map.

BROADBAND SITUATION

The commercial Internet is entering its 19th year of existence and is widely considered a mandatory utility essential for modern businesses and households. Clearly, broadband enabled by enhanced telecommunications infrastructure has manifold benefits for business and economic development, healthcare, emergency medical and fire services, education, preservation of tribal languages, entertainment and more. The following are two instances where remotely located Native American communities were able to fully harness broadband thereby beneficially transforming their citizen's lives.

Case #1 - Unfolding Success Story in the Arctic Circle

In the Northwest Arctic Region, 10 Alaska villages rely on the town Kotzebue as the regional hub for centralized services such as healthcare and transportation and it illustrates the impact of modern broadband. Kotzebue has a population of 3,178 residents of which 2,276 are Iñupiat Eskimos currently served by satellite-based internet. Workforce unemployment is 30%. There are no roads and travel is only possible by air, snowmobile or boat depending upon the season.

A multi-phase, New Markets Tax Credit funded broadband project (over \$100M) is now underway ushering in a terrestrial-based broadband service which will enable major improvements to healthcare, education, public safety and to consumers. This new capability will enable the introduction of high definition video teleconferencing for distance learning and telemedicine reducing transportation costs while dramatically improving the availability of services. Source: Native American Capital, LLC.

Case #2 – Lifeline for a Rural Community deep down in Rugged Terrain

In 2000, when an ISP delivered service to the Havasupai tribe, it reportedly used a caravan of pack mules to transport satellite dishes down eight miles of rocky trail to the bottom of the Grand Canyon. Prior to this, the tribe located at the bottom of the Grand Canyon could not reliably receive radio, television or Internet before satellite-based Internet access.

The tribe was able to use four BIA towers on the Havasupai and Hualapai Reservations to provide broadband service and was sponsored by a 2004 USDA Rural Development Community Connect grant (~ \$1.25M). There is now a community center with 10 public computers and tribal members take distance learning college courses from home. Moreover, the Internet enables tribal members to stay in contact with family located off the reservation. Most importantly, this broadband enables Supai Village with emergency communications during natural disasters as was the case with a recent flood. Sources: Huffington Post and USDA

While these examples may seem extreme, less than 10% of homes on all tribal lands have broadband service – a rate that is lower than in some developing countries. Approximately 2.9M people live on tribal lands and are experiencing a 39% growth rate since 2000 Census. By contrast, over half of the African Americans and Hispanics and roughly three-fourths of whites have high speed access at home (source: Department of Commerce).

Native Americans are indigenous, culturally-diverse communities consisting of varied levels of societal and economic development. Across Indian Country there are an estimated 200 viable languages with many communities taking concerted measures to preserve and hand down linguistic knowledge to younger generations. Every tribe is different and holds deep personal connections to the past.

KEY FINDINGS

1. The *Digital Divide* is real and the extent wide-scale

There is no dynamic broadband data collected and/or published at the moment. Instead, there is anecdotal, static information published by Agencies with limited amounts of carrier furnished data reported so far.

The key problem is that there simply is no meaningful data on precisely what is going on in Indian Country broadband – it is not that there are small carriers; rather, in most locales there is nothing. Furthermore, some of the largest carriers have inaccurate data—assuming they would even release it without a mandate.

2. Tribes continue to encounter real barriers accessing broadband

In 2006, a GAO report identified major barriers across the board including: 1) rural location, 2) lack of financial resources, 3) technical training shortage and 4) complex, costly ROW process. According to a IPUMs American Community Survey 2010, 13% of all Native Americans attain a bachelors degree or above. These and other barriers remain an enduring obstacle impinging on near-term tribal access to broadband service. Abridged discussions of obstacles appear below.

Varied, Predominantly Remotely Located Landscape – Indian Country can be described as a geographically distributed archipelago overlaid onto CONUS (Continental US). There are now 566 federally recognized Indian Tribes with 231 of them in Alaska, mostly small, isolated Native villages. Within that footprint, 56.2 million acres are held in trust by the United States, 326 land areas administered as federal Indian Reservations.

The terrain is ecologically diverse spanning deserts, canyons, forests, mountains, plains, rural and urban locations. Geography and climate drive the telecom access strategy – wireless (unlicensed and licensed spectrum), cable, fiber, microwave, satcom and/or hybrid fabric as well as enabling power.

When cutting trenches in bedrock 3 feet down to lay down fiber, rock cutting operations can cost from \$60,000-\$80,000 per mile illustrating the magnitude of provisioning broadband capacity in hard-to-access locations. This was the situation described by the GM of Mescalero Apache Telecommunications, Inc. (MATI) Godfrey Enjady.

In other cases, the rollout of broadband services is intertwined with acquisition and deployment of power equipment including alternative sources where grid access is largely unavailable. Matt Rantanen, Director of Technology for the Southern California Tribal Chairmen's Association and a member of the FCC's Native Nations Broadband Task Force, spoke about having to hire a helicopter for \$1,400 per hour in order to haul power equipment in place at 6,379 feet.

Deploying telecom infrastructure goes hand-in-hand with power generation and access. The absence of available power means an added capital expenditure on top of the telecom/broadband investment. In some cases, remote and/or difficult to access off-grid locations may drive decisions to seek alternative power generation such as wind or solar.

Steep Economic Slope to Climb – Remote, more desolate locations tend to present significant financial and logistical challenges to service delivery both from larger service providers as well as organically-grown tribal providers. Relatively wealthy tribes, such as the Seminole Tribe of Florida, tend to have proximity access to major metro infrastructure along with the financial resources necessary to obtain state-of-the-art broadband services. Conversely, the Oglala Sioux

located on the Pine Ridge Indian Reservation, South Dakota, experience some of the highest poverty rates in North America and lag in both economic development and service offerings readily available in urban settings.

To further illustrate the point, one California tribe uses one plain old telephone (POTS) line shared by its nearly 400 residents including basic 911 services. (Source: a member of PUC data collection team. Note - CPUC and Cal State University Chico are currently collecting broadband data on all 111 CA-based federally recognized tribes; refer to Appendix – Sample Interviews with Yvonne Ned). By way of contrast, Saddleback Communications, an enterprise of the Salt River Pima-Maricopa Indian Community, located in Scottsdale, underwrites \$25 per month per subscriber in addition to Lifeline and Life Link subsidies (currently only voice).

Residential Services Appear to be Most Severely Impacted - There is not necessarily uniformity of broadband service within tribal lands. A service chasm exists between institutional anchors and residential users. Most Indian casinos/destination resorts and many tribal governments have “fat pipes” from large providers to support mission critical business operations. Examples of institutional users also may include community/wellness centers, Indian health clinics, libraries, commercial buildings and tribal colleges.

Such access rarely is available to ordinary tribal households. Households often lag larger institutional users’ access to broadband and/or quality. According to the same GAO report mentioned earlier, only about 69% of households on tribal lands had telephone service versus the national rate of 98% in 2000, reinforcing the imperative to accelerate broadband service to residential of communities.

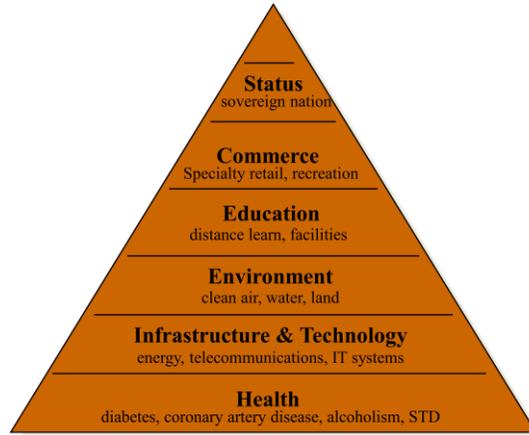
In one instance, the head of a tribal telecom indicated he did not want to have the added responsibility of managing the casino’s IT/broadband operations given the performance required in the Service Level Agreement (SLA). That responsibility lay with larger providers, Note - there are ~ 190 carriers who service tribal lands according to FCC ONAP (Office of Native Affairs and Policy). Most of these are smaller carriers with neither the technical capacity nor the capital resources to rival the relatively few major carriers that service primarily the Indian casino and hospitality industry and not with the capacity of the large carriers. In addition to other difficulties between tribal residential users and providers, it may be inferred that these larger providers are financially motivated by the business case involving multiyear casino contracts than serving lesser economically valued tribal subscribers.

3. Yet broadband remains a strategic ingredient to tribal sovereignty and nation building mix

The decision to build a green field broadband capability is as much about sovereignty as it is about being the carrier of last resort. Adapted from Maslow’s Hierarchy, the following diagram

illustrates and perhaps oversimplifies the many complex layers involved in the evolution and strategic planning of tribal nation building.

EXHIBIT – Nation Building Model



Source – Native American Capital, LLC

Many hurdles need to be cleared to reach initial operating capability and, as mentioned earlier, rural deployments can prove to be even more costly, complex endeavors than urban counterparts. In particular, there is an especially steep learning curve for new Native American (NA) providers, one in which avoidable failures in planning and execution occur regularly. For example, there is at least one instance where a tribe acquired state-of-the-art telemedicine equipment for its clinic but lacked broadband required to make it fully functional.

Under ordinary circumstances, these NA providers can prove to be complex endeavors compounded by a perpetual shortage of expert professionals and technicians with the know-how as they can prove hard to recruit into more rural locations. Further, there are many complex, strategic decisions inherent in the planning process such as the decision to self-regulate versus seeking licensure (Eligible Telecom Carrier or ETC).

Many tribes historically had difficult, strained relationships with their State government counterparts and that fractious history may prove a deciding factor in the decision to self-regulate (note - only 10 Native American ETC exist and 8 of those 10 are rate of return carriers). For a cross-sectional illustration of the multitude of issues involved in formation of a green field provider refer to the Appendix – Native American Carrier Blueprint.

4. Prior attempts to collect data have fallen short and are not compatible with protocols

Conventional data collection strategies tend to fail in Indian Country. To be effective, it is critical to have relationships and access on the ground so as to build trust with the community. Skipping this step is likely terminal.

Intensive consultation with informed opinion leaders reinforces the belief that a truly effective data collection plan requires a mode of operation not necessarily obvious to those unfamiliar with Indian Country unspoken rules of the road. On multiple occasions, several experts mentioned how research institutions, for instance, contact tribes to complete survey forms only to discover that there is no data coming at the end of a phone call despite commitments.

The first step that is skipped is the need to build a critical mass of tribal buy-in and cooperation as a prerequisite to any data collection request. Tribes might chose to not cooperate either because trust has not been established, and/or they may be new to the broadband topic and are too embarrassed to ask questions. In some instances, the tribe may be genuinely angry about a past betrayal or failed business transaction and might be unwilling to cooperate under any circumstances.

Some suggested trust building measures include getting involved locally at either the tribal level and/or with regional tribal organizations. In one instance, a suggestion was given to bring food as a welcoming gift prior to beginning a meeting. Another suggestion during the trust building phase is simply to listen and observe and not talk. In general, Native Americans are a quiet culture so it is important to know when to talk less depending upon the tribe.

A second step is to have a clearly articulated value proposition in easy-to-understand terms for non-technical people new to broadband. It is important to speak in plain English and discuss in lay terms to build trust.

Emerging Leaders In the Ecosystem - There are many examples where tribes successfully surmounted these obstacles albeit at great expense and difficulty. Leaders include Mescalero Apache Telecom Inc., Saddleback Communications, Gila River Telecommunications, Inc., Hopi Telecommunications, Inc., Fort Mojave Telecommunications, Inc., Cheyenne River Sioux Telephone Authority, Tohono O'odham Utility Authority, Native American Telecom Crow Creek and Coeur d'Alene's Red Spectrum Communications to mention a few. At a recent NCAI telecom panel, several participants expressed interest to share their growing pains and lessons learned with other tribal upstarts ("Broadband University").

When overlaid onto a map, many tribal communities in Indian Country look like a checkerboard as is the case with Mescalero Apache Telecommunications, Inc. (MATI) based in south central New Mexico near Ruidoso. MATI encapsulates many of the challenges facing other emerging Native American carriers and how those barriers might be overcome: 1) PUC-FCC regulated tribally chartered corporation, 2) GM Godfrey Enjady has prior telecom experience and resumed control of GTE legacy assets, 3) carrier of last resort purchased legacy telecom assets; 4) one exchange with 1,156 access line; VOIP, Class 5 Switch in a box make for a scalable architecture; 5) tribal area covers .5 million acres and an ~ 12,003 feet Sierra Blanca mountain.

EXHIBIT – MATI located in Mescalero Apache Indian Reservation



RECOMMENDATIONS

What is needed and what is being proposed is a different methodology for Indian Country – an approach tailored to the ways knowledge is collected and shared, and that meaningfully documents on-the-ground reality rather than "official" statistics that are known to often be highly inaccurate. The proposed multi-prong strategy appearing below is required and would be conducted synchronously:

1.0 Build a “quick & dirty” broadband snapshot with available map data – merge data from National Broadband Map and overlay known Native American telecom provider information from this data gathering effort to obtain a starting inventory. Poll California PUC as well as other SBI grantees serving ANAI communities to share GIS data from live data collection. A series of maps appear in the Appendix titled Broadband Coverage Maps *Working Draft*.

2.0 Leverage multiple approaches – leverage innovative technologies and approaches in the data collection effort to increase likelihood of success including: 1) use of downloadable open source software such as Accelerate Virginia Speed Test (or M-Lab) to measure line speed (requires simple installation by a tribal user for instant results), 2) leverage California PUC approach to field teams to collect publicly *available* wireless data with an Air phone as well as reuse of their investment in Android Phone app which may become publicly available beyond California by end of the 2012 calendar year. This will not yield comprehensive coverage information; however, and may require cooperation and access

when on tribal lands. 3) Add GIS layer onto advanced tribally-based GIS build outs such as the Coeur d'Alene Tribe's investment.

3.0 Establish direct, constant contact primarily with stakeholders on the ground – create trust-based relationships instead of transactional approaches which alone produce less effective outcomes. Engage trusted people capable of interoperating between the tribal, Indian Country opinion leaders and governmental level required. A command and control type strategy based on conduct of remotely managed data call style surveys without prerequisite relationship building will likely prove counterproductive.

4.0 Build credibility via Native American opinion leader-centered channels – gain buy-in from NCAI, NFOA, AIHEC, NAC, RES leadership et al with sustained presence at conference panels. This approach is one way to build credibility within the tribal ecosystem - and - is a more effective method than starting with each and every tribe first. Establish leadership opportunity for the *NA Broadband University* concept and novel business practices to encourage/accelerate self-reliance thesis as well as trust.

5.0 Establish operating alliances including Agency partnering – piggyback off of FCC-sponsored *Telecom and Broadband 101* training program at the state/regional level. FCC ONAP Chief Geoffrey Black (Creek) is receptive to collaboration – recognition and trust being built by his organization. USDA RUS people are also prevalent in Indian Country. The opportunity to clarify federal roles with tribal leaders will help with the understanding of how Indian Country will benefit from GIS data call cooperation (while avoiding multiple, uncoordinated contacting of tribes). Also enlist agencies supporting tribal anchor tenants such as land-grant schools by the USDA and health clinics by DHHS (Indian Health Service - Information Technology Tribal Shares Workgroup).

6.0 Lead with a multi-prong data collection plan – prioritize regions for more productive project outcomes (top 10 states with greatest NA population); leverage and/or build upon existing momentum in the community (CA PUC); deepen alliances at the KOL, tribal level and incumbent broadband providers; launch NA sensitivity training for the data collection teams and managers so that the back office team such as the maps builders are steeped in this knowledge; and build significant schedule slack to make allowances for delays.

7.0 Create Indian Country identity with clearly branded messaging – develop unique Indian Country-facing identity for the data collection phase of this project with a branded booth containing culturally sensitive collateral including hiring Native American consultants to lead with credible, advantaged access.

Clear messaging regarding the benefits of broadband GIS is crucial – need the value proposition stated in easy-to-understand terms given varying grades of understanding with telecom (note - quiet culture and learn to listen closely). Also explain the data collection and uploading process end-to-end (will require creation of presentation deck which also clarifies this story and this data collection initiative is NOT a new source of federal funding).

8.0 Pursue opportunistic data collection approach – NDAs are a necessary but insufficient instrument to gain access to data. As has been described previously, Indian Country consists of diverse communities with wide ranges of broadband expertise and data. When it is known to exist, data is often not accessible much less organized in a homogenous, straightforward fashion. For instance, it is not clear to what extent carriers serving Indian Country either have information and/or are voluntarily willing to furnish middle mile and last mile performance data. That said, the FCC is enacting rule making to compel carriers to substantively cooperate with tribal entities.

9.0 Expect timelines to be highly elastic during collection period - Within this community, the process of collecting information may require additional time and patience and does not necessarily follow a linear, precisely predictable timeline, e.g., tribal governments may require a board resolution to allow for the release. No one size fits all approach works because every tribe is different.

Moreover, it is not yet clear how many of the estimated 190 providers serving tribal lands will voluntarily share broadband data for GIS mapping purposes. An added leverage point may be available with new FCC rule making details expected in the fall 2012 requiring improved carrier cooperation with their tribal counterparts.

A more viable data collection outlook combines the above strategy elements along with the patience and availability when the tribal partner decides and/or is in the position to disclose sensitive information. At the project level, build ample slack into schedules/PERT charts.

RISK MANAGEMENT

Indian Country is a large and complex tapestry – lots of people are attacking the broadband problem via investment and know-how from federal agencies, state governments, academia, associations, telecom and broadband service providers, financiers and consultants. A large amount of organizational complexity is directed towards 5.2M people on and off tribal lands.

With all this effort, why is there so little progress and what is getting implemented at the end of the day? The unfolding data collection picture is far from desirable with singular reliance on

conventional data collection such as surveys proving other than effective unless there is a direct understanding of the terrain as portrayed in the following Exhibit.

EXHIBIT – Mitigation Measures

Category	Challenge	Fact(s)	Risk(s)	Countermeasure(s)
1.0 Scope of data collection effort	2.5 year remaining grant window to collect sufficient amount of broadband data to map build; limited data availability in the first place given pace of build out.	Official records shows 566 fed recognized Tribes are widely distributed usually rural; 400 non-federally recognized as well.	Travel logistics and/or compressed timeline to collect meaningful data for each tribe may be ineffective. Cooperation not possible until trust established.	1) Build proxy alliances with NA associations, fed agencies and regional tribal organizations* to establish credentials. 2) Leverage alt. technology to initiate GIS map formation.
2.0 Degree of carrier/ISP cooperation serving tribal lands	Indications are that cooperation may vary dramatically by specific co. (large or small) and by location.	Number of carriers serving tribal lands est. at 190 entities. Incumbent services may be a company, a coop or tribally owned.	Operators may have limited incentive to share data voluntarily. Each state has different regulatory rules.	1) Emerging FCC rule making may aid in carrier cooperation with tribes. 2) Tribes may compel captive carriers to participate when they see value. 3) Leverage alt. tech. 4) Exert influent via regional tribal orgs.*
3.0 Tribal council permission	Individual turnover may cause continuity challenges for new initiative collaboration.	Fluid tribal governance is a reality in Indian Country; not unique to telecom/broadband topic.	Ability to maintain ongoing buy in on the vision. Decisions to spend scarce \$1 on propane over telecom.	1) Board resolutions may be required by fed. recognized tribe; 2) Maintain leadership buy-in given magnitude CAPEX/OPEX outlays.
4.0 Pace of broadband deployment	Carriers might not see business case to rollout service. Terrain, rural location, ROW, weather, steep investment, and learning curve also deter organic service creation.	Fed \$ incents 3 rd party provision; tech types required (unlicensed spectrum) and build out (trench, energy); strongest when framed as sovereign issue or future generation.	Uncertain timeline for carrier rollout and/or new formation of Native American providers so data may not be available.	1) Encourage pooling of resources to support common requirements spanning 1+ tribes while preserving tribal uniqueness; 2) Sharing of lessons learned through “Broadband University” concept.

*Examples of regional tribal organizations include United South & Eastern Tribes, Inc., Great Lakes Inter-Tribal Council, Alaska Federation of Natives, Bristol Bay Native Association, Montana Wyoming Tribal Leaders Council, Southeast Association of Indian Tribes, All Indian Pueblo Council, Affiliated Tribes of Northwestern Indians, California Association of Tribal Governments, and Indian Nations Council of Governments.

While planned progress comes at a much slower than desired pace, encouraging signs are evident. Formative efforts are already underway to patch together segments of Indian Country broadband data.

Within the SBI framework, partial broadband data collection within Indian Country appears to be conducted by some parties. Any go forward work should avoid duplication of efforts by harnessing existing data where known to occur as was discussed over multiple conference calls (note - outreach efforts were initiated by the CIT with California PUC as well as Connection Nation on May 5, 2012 and June 4, 2012, respectively).

As a point of reference, Virginia processes broadband data from 30-35 providers every six months for the National Broadband Map. There is a large disparity in the size and technology expertise of the providers which requires the mapping team to use a variety of methods to assist them and process the data. VGIN approaches each provider on a separate basis to work with them at a level they are comfortable with whether it be tabular data, GIS data or highlighting a paper map.

In conclusion, there is an historic opportunity but with clear attendant risks to precisely map dynamic broadband coverage along with what is presumed to be predominantly large scale service coverage gaps in Indian Country owing to severely underdeveloped infrastructure.

APPENDIX – Reference Materials

Aaseng, Nathan, 1992, Navajo Code Talkers, New York, NY

Buelow, Tedd, USDA Rural Development (NAFOA's 30th Anniversary Conference, March 20-12, 2012), *Sustaining Relationships throughout Indian Country* (Presentation), New Orleans, LA

Duval, Chad, (NAFOA's 30th Anniversary Conference, March 20-12, 2012), *Sustaining Relationships throughout Indian Country, Tribal Telecommunications – Regulation, Cost Recovery and Opportunities* by Moss Adams, LLP, New Orleans, LA

Mercer, Bob (April 25, 2012), *Hearing Set to allow Native American Telecom to operate at Fort Thompson*, The Daily Republic, Pierre, SD

Morris, Traci; Meinrath, Sascha (November 19, 2009), *New Media, Technology and Internet Use in Indian Country – Quantitative and Qualitative Analyses*, Washington, DC

Smith, Gerald (April 20, 2012), *On Tribal Lands, Digital Divide Brings New Form of Isolation*, The Huffington Post, Los Angeles, CA

Walker, Richard, (April 23, 2012) *High-Speed Broadband Expansion Connects Jamestown S'Klallam*, Indian Country Today, New York, NY

Wertz, Jay (2009), The NATIVE AMERICAN Experience, Guilford, CT

Commonwealth of Virginia, NTIA State Broadband Data Development, Round 5 – Spring 2012 Submission, Richmond, VA

Federal Communications Commission (Released June 23, 2000), *State of Policy on Establishing a Government-to-Government Relationship with Indian Tribes*, Washington, DC

Federal Communications Commission (Released March 3, 2011), *Chairman Genachowski Names Members to the FCC-Native Nations Broadband Task Force*, Washington, DC

Federal Communications Commission (Released October 6, 2011), Statement of Geoffrey C. Blackwell, Chief, Office of Native Affairs and Policy, FCC, *"Internet Infrastructure in Native Communities: Equal Access to E-Commerce, Jobs and the Global Marketplace"*, Washington, DC

Federal Communications Commission Consumer Facts Newsletter (Obtained at NAFOA's 30th Anniversary Conference, March 20-21, 2012), *Promoting Telephone Subscribership on Tribal Lands*, New Orleans, LA

Federal Communications Commission Public Notice (Released May 2, 2011), *Mobility Fund Phase I Auction Scheduled for September 27, 2012*, Washington, DC

Federal Reserve System (Published by the Board of Governors), *Growing Economies in Indian Country: Taking Stock of Progress and Partnerships, A Summary of Challenges, Recommendations, and Promising Effort*, April 2012, Minneapolis, MN

Department of Commerce, Economics and Statistics Administration, US Census Bureau, *The American Indian and Alaska Native Population: 2010, 2010 Census Briefs*(Issued January 2012), Washington, DC

Department of Commerce, National Telecommunications and Information Administration, Broadband USA: Navajo Tribal Utility Authority (Oct 18, 2011), Washington, DC

Department of Commerce, National Telecommunications and Information Administration (May 22, 2012), *FirstNet Board of Directors Recruitment Prospectus*, Washington, DC

Department of Commerce, National Telecommunications and Information Administration (May 1, 2012), OTIA Staff Directory, Washington, DC

Government Accounting Office (Released March 7, 2006), Telecommunications – Challenges to Assessing and Improving Telecommunications for Native Americans on Tribal Lands, Washington, DC

Government Accounting Office (Released April, 2012), Indian Issues – Federal Funding for Non-Federally Recognized Tribes, Washington, DC

IPUMs American Community Survey (2010), Minneapolis, MN

Native Nations – National Broadband Map (May 11, 2012), Washington, DC

Office of Technology Assessment, Congress of the United States, Telecommunications Technology and Native Americans: Opportunities and Challenges, (August 1995), Washington, DC

Conference and Workshop Proceedings:

- Native American Broadband Association’s Progress and Planning Teleconference – Broadband in Indian Country recorded audio (August 26, 2010), New York, NY
- Tribal Telecom 2012 conference proceedings (February 1-3, 2012) Mesa, AZ
- Native American Financial Officers Association (NAFOA’s) 30th Anniversary Conference (March 20-21, 2012), New Orleans, NO
- State Broadband Initiative Grantee Workshop (May 22-23, 2012), Arlington, VA
- National Congress of American Indians Midyear Conference (June 17-19, 2012), Lincoln, NE

APPENDIX – Acronyms

3G – Third-Generation
4G – Fourth-Generation
AIAN – American Indian and Alaska Native
AIHEC – American Indian Higher Education Consortium
ANC – Alaska Native Corporation
ARRA – American Recovery and Reinvestment Act
ATNI – Affiliated Tribes of Northwest Indians
BIA – Bureau of Indian Affairs
BIP – Broadband Initiatives Program
BTOP – Broadband Technology Opportunities Program
CAF – Connect America Fund
CAPEX – Capital Expenditure
CCN – Certificate of Convenience and Necessity
CDFI – Community Development Financial Institution
CIT – Center for Innovative Technology
CLEC – Competitive Local Exchange Carrier
CMA – Cellular Market Area
CONUS – Continental US
CTGA – California Tribal Governments Association
DHHS – Department of Health and Human Services
DLT – Distance Learning & Telemedicine
DOC – Department of Commerce
DSL – Digital Subscriber Lines
ECB – Eligible Census Blocks
ETC – Eligible Telecommunications Carrier
FCC – Federal Communications Commission
FTTP – Fiber to the Premises
GAO – Government Accountability Office
GFR – General Field Representative
GIS – Geographic Information System
GLTC – Great Lakes Inter-Tribal Council
GRTI – Gila River Telecommunications, Inc.
HCLS – High Cost Loop Support
HTI – Hopi Telecommunications Inc.
IBA – Indian Business Alliances
ICLS – Interstate Common Line Support
IHS – Indian Health Service
ISP – Internet Service Provider
IT – Information Technology
KOL –Key Opinion Leader
LEC – Local Exchange Carrier

LSS – Local Switching Support
MATI – Mescalero Apache Telecom, Inc.
NA – Native American
NAC – Native American Capital, LLC
NAFOA – Native American Financial Officers Association
NCAI – National Congress of American Indians
NCAIED – National Center for American Indians Enterprise Development
NDA – Non-Disclosure Agreement
NEPA – National Environment Policy Act
NIGA – Native Indian Gaming Association
NITA – National Intertribal Tax Alliance
NMTC – New Markets Tax Credit
NNTRC – Navajo Nations Telecommunications Regulatory Commission
NOFA – Notice of Funds Availability
NPM – Native Public Media
NPRM – Notice of Proposed Rule Making
NPS – National Park Service
NTIA – National Telecommunication and Information Administration
ONAP – Office of Native America Affairs and Policy
OPEX – Operational Expenditure
OTA – Office of Technology Assessment
PERT – Program Evaluation and Review Technique
PUC – Public Utility Commission
RES – Reservation Economic Summit
ROR – Rate of Return
ROW – Rights of Way
RUS – Rural Utilities Service
SAC – Study Areas Code
SBA – Small Business Administration
SBI – State Broadband Initiative
SCTDV – Southern California Tribal Digital Village
SEC – Securities and Exchange Commission
SLA – Service Level Agreement
STD – Sexually Transmitted Disease
SUTA – Substantially Underserved Tribal Areas
TANF – Temporary Assistance for Needy Families
TBLC – Tribal Lands Bidding Credit
TCP – Traditional Cultural Property
TEDB – Tribal Economic Development Bond
USET – United South & Eastern Tribes, Inc.
USF – Universal Service Fund
VGIN – Virginia Geographic Information Network
VITA – Virginia Information Technology Agency
VPN – Virtual Private Network

APPENDIX – Demographic Snapshot**

<u>Type</u>	<u>Detail</u>	<u>Source</u>
No. of federally recognized tribes (total)	566	GAO 2012
No. of federally recognized Alaska tribes	231	
No. of non-fed recognized tribes	400	2012 GAO Report
American Indian/Alaska Native (US)	5.2M	2010 Census briefs
AI/AN Alone	2.9M	
Combined with other races	2.3M	
Growth rate since 2000	39%	2010 Census briefs
Majority in ten states	CA OK AZ TX NY NM WA NC FL MI	2010 Census briefs
Basic telephony - tribal lands	67.90%	2006 GAO Report
Basic telephony - national average	98%	2006 GAO Report
Estimated tribal broadband penetration	2-8%	Native American Task Force Members at NCAI
Total number of carriers serving tribal lands (non native and native)	190	Geoff Blackwell, ONAP, FCC
Acres held in trust for tribes/individuals	56.2M	Open Source
Land areas administered as fed. Reservations	326	Open Source
Largest is the Navajo Nation Reservation	16M acres	Open Source
Smallest is a parcel in CA (Pit River cemetery)	1.32 acres	Open Source
Number of reservations in Alaska	1	Open Source
Estimated number of viable languages	200	Open Source

**Compiled by Exoventure Associates, LLC

APPENDIX – SAMPLE INTERVIEWS

Meeting Report – Michael Morris

California PUC 5/11/12 (conference call)

1. Finished a second round of conversations with the California PUC (Public Utility Commission) representatives this time with Michael Morris.

Within the state of CA, they are just now starting a data survey of all CA-based tribal reservations collecting broadband availability, usage and speed data. They'll be doing a thorough testing of signals in every Rancheria site.

In addition, they have engaged California State U Monterrey Bay to build an Android app to measure this data and are using it now (starting this week) throughout the state (for us iPhone users there is no iOS version yet). Eight teams are driving around doing the onsite 3G data collection and will publish ~ one month from now if all goes according to his timeline.

They'll do a data refresh every 6 months thereafter to keep the information current. Also, they'll publish and update a blog as they do the data collection.

This app - as well the underlying data collected (also using an air phone + air card in the collection effort) - will be available for others. So I am now trying to track down that app (will pass along once I do).

2. There is a Native American broadband and training event for tribal representatives May 23/24 on the Pala Reservation Indian Tribe location. Take a look at this link from the Pala telecom trainer:

<http://www.youtube.com/watch?v=OMjMC8odwRU&feature=youtu.be>

Meeting Report – Yvonne Ned

Project Specialist Cal State University Chico 5/18/12 (conference call)

I just completed a conversation with Yvonne Ned regarding her findings with respect to effective data collection strategies with Indian Tribes.

She is working under a CPUC funded grant to survey broadband Indian Country in the State of California. There are 111 federally recognized tribes in this state as part of the larger 566 tribes. 50% of these 111 tribes have little or no broadband.

There are extreme ranges of broadband availability from the Casino tribes with “big pipes” to the other end of the spectrum including one tribe with only one phone line serving the entire reservation. In one case, a particular tribe has telemedicine equipment in the tribal clinic but no broadband connectivity.

More than just an economic development issue or the occasional mismanagement, this presents safety and logistical challenges to tribal members in this particular instance.

They are in year one of a four year project and she is also generating a written summary. As mentioned by Michael Morris (CPUC sponsor), they'll do a data refresh every 6 months thereafter to keep the information current. Yvonne goes to tribal events to ask for permission to go on site.

Findings:

- Some tribes are very free with the information sharing whereas others might require a tribal government resolution to cooperate (sovereignty issue).
- To be effective, trust needs to be established at the tribal level as a prerequisite for data collection. When this is done correctly, doors will open.
- Bring in individuals long-known to the tribes.
- Most states have tribal consortiums who meet every 3 months, e.g., CA tribal governments. Find these meetings dates/locations and go there to get the word out about the project.

- Because tribal members are related and the level of education tends to be low, complex terminology and concepts needs to be made understandable to get buy- in.
- Communicate clearly, simply and be ready to provide hands-on assistance to the tribes to explain what's going on in understandable terms.
- Get on a panel at RES or NCAI to spread the word and gain consensus at the national level.
- Data collection timelines must reflect the reality of dealing with the tribes. Some are very prompt and others no show meetings. Need to be patient and factor in elastic time into the schedule so as to be realistic when data dependencies are concerned.

Meeting Report – Walter Hillabrant, PhD

Native American Capital LLC 5/21/12 (meeting including Caroline Stolle)

Acting in an informal advisory board capacity, provided Walter with project approach and data collected thus far. Below are his thoughts/comments/trends:

- Many examples of disparate telecom value chain across Indian Country, e.g., call center such as the Northern Arapahoe Tribal Industries (NATI) as well as provider services at Gila River (AZ).
- Look at infrastructure coverage, i.e., investigate legacy coverage from providers such as Verizon and Century Link.
- Multi-user approaches, e.g., multiple antenna types on towers for instance to expand versatility of the communications platform.
- Cellular continues to have new tech emerging, e.g., T-Mobile VP Engineering technical insights about extending fast moving, lower cost technologies such as Wi-Fi.

- Navajo Nation has the surface area the size of West Virginia where 120,000 people live with ~ 100,000 of those living in hogans (traditional home of the Navajo). Some tribal members carry two cell phones to have complete coverage. Need to make the technology better benefit and suit the tribes.
- Research the emerging energy sector in Indian Country for lessons. It too is lagging infrastructure but could be used/leverages as a potential carrier. An idea whose time has come such as broadband over power lines.
- Become an exhibitor at these conferences as well as a speaker to raise awareness of the Broadband mapping effort.
- Consider non-proprietary use of infrastructure, e.g., hospitals.
- Be sure to further research sources - Bureau of Indian Affairs (BIA), Office of Indian Education (OIE) in the Education and Interior Departments · Administration for Native Americans (ANA) in DHHS. Data collection challenges compounded by 1) large surface area, 2) weather/seasonality all will impact the timeline.
- Native peoples are understandably distrusting given the legacy of the past; also tensions with the States, e.g., Article 1 Section 8 of the Constitution; Non-Intercourse Act of 1790, as amended.

Meeting Report – Traci Morris

Director of Operations, Native Public Media 5/22/12 (conference call)

Below are Traci's comments to the need/argument for conducting a National Broadband data collection effort in Indian Country.

- Question is not whether to do it but why not do it?
- Bias – tribes don't deal well with the states, that is, there is the state-vs.-federal jurisdiction matter.

- Census-based data is marginal – inaccurate and lacking in granularity.
- Net is that Indian country broadband data does NOT exist. Vast expanses and often no cell or landline service.
- So far, all we have is anecdotal – prevalent in Indian Country.
- Contact Sascha Meinrath – Open Tech Institute who lead the statistical part of the study for the NPM 2009 report. Also reach Geoffrey Blackwell (FCC) and Loris Taylor (NPM) as other leaders in this field.
- In closing, no baseline exists on Indian Country broadband and there is merit in pursuing this research.

Meeting Report – Matthew Rantanen

Director of Technology for the Southern California Tribal Chairmen's Association

5/16/12 (conference call)

1. Finished a second round of conversations with the Pala Tribal member Matthew Rantanen.

I just completed a detailed phone call with Matthew Rantanen, of the Pala Tribe near San Diego. Very helpful and quite impressive command of both the technical aspects as well as the larger cultural issues vis-a-vis prior data calls in Indian Country (especially GIS). He also introduced me to Yvonne Ned of CSU Chico doing a broad band initiative in California for their Indian tribes.

Below are the notable comments:

- Need tribal buy in/cooperation to be successful with data collection.
- Don't expect data at end of a phone call with a tribe. Need to meet people.
- Need elevator speech - why helping the tribes can make a difference for their community.
- Tribes not cooperating - either too embarrassed about lack of infrastructure or really angry about this.

2. There is an NCAI bi-annual event on June 17/18 in Lincoln, NE with substantial broadband/telecom content and leading broadband experts expected in attendance.
<http://www.ncai.org>

Meeting Report – Patrick Borunda

Managing Principal, The Navigator Group, LLC 6/13/12 (conference call)

I just completed a conference call with Patrick Borunda regarding a novel strategy to bring broadband to Indian Country.

Patrick is an enrolled member of the Mescalero Apache and works primarily with the Pacific Northwest-based tribes. He is currently rolling out a for-profit wellness center jointly serving a community of five tribes which is being funded in part by a municipal bonding authority.

Nearby is a non-native gold mining operation (~ 75% of the gold extracted from the US comes from this mine) and those employees will be paying for and receiving access to this shared wellness center. This business community will increase the likelihood of this health enterprise's financial viability. While the wellness center is being completed, they will be working with state broadband counterparts in Idaho, Nevada, and Utah to apply for assistance.

Below are the findings according to Patrick:

- Each of the tribes has a different type of telecom backbone.
- Using case load management software.
- He believes it would be a failure of planning by tribes to build a business without recognition of the need for broadband beforehand.
- Tribes are culturally unique but are NOT economically unique and must begin to think in terms of combining economic interests among geographically proximate tribes.

- Thinly populated, underserved tribes might benefit from the wellness model by pooling their shared resources into one combined set of requirements (each group gains unique benefits even though the asset is common).
 - Doing so may weaken the vendor argument that the size and attractiveness of investing assets in tribal locations are too small to be of interest.
 - Patrick believes that tribes are in a unique situation to serve as intermediaries between multiple markets sometimes spanning state boundaries.
 - He further believes that rural areas do offer some advantages to carriers/providers over urban areas including availability of infrastructure without restriction. Build out will prove easier, less complex and could become more suitable for a business case provided tribes can pool their interests into a common basket shared by all local contributors.
-

**Meeting Report – Tom Glaysier, GIS Expert Specialist New America Foundation's
Open Technology Institute 6/28/12 (conference call)**

I completed a conversation with Tom Glaysier regarding his findings with respect to a non-conventional GIS creation strategy for Indian Country.

For data collection to be successful, you will need relationships with carriers for this approach to be meaningful. GIS map creation is only as good as the data that has been provided.

But there may be an alternative and/or complete to the classic, voluntary data collection strategy. [Http://www.measurementlab.net/](http://www.measurementlab.net/). Alternative strategy to gathering *speed* data which would require an individual to connect and test. Put this tool on the individual user's site (platform open source). Put the experiment in the hands of the tribal user to collect data in a more efficient and effective manner.

For instance, individual Indian Country users offered can be given the above link to arrive at a speed test (incentives coupon to motivate users). Incumbent carriers may not prove to be fully cooperative.

Note that New America Foundation is one of a consortium of organizations in the development of this tool including Google and others.

Tom made email introductions within his organization to offer expert on a more effective strategy than the manual approach.

Meeting Report – compiled information in lieu of call with Valerie Fast Horse Director of IT

Coeur d'Alene Tribe 7/3/12

(Information collected further enhanced via tribal website)

Below are Valerie's comments regarding and GIS initiatives as well as broadband competencies.

- Coeur d'Alene Tribe has had an active Geographic Information System (GIS) program since '92. A wide variety of applications including forestry, wildlife/fishing and forest fire prediction etc.
- Tribe uses GIS technology to collect, store, and analyze information about the lands it has traditionally used including safety. Information is collected for environmental, social, and cultural geographic features.
- Tribe uses ArcGIS but could also use Google Maps.
- Over 3,000 different GIS databases are stored on the GIS server. Layers used by many disciplines and many departments then integrated in the best way possible.
- Collaborating with NIST on fire models, where it will spread and notify residents with forecast. Layers and steepness of slopes are examples where they can predict where and how fast the fire will spread. Another illustration is the presence of logs at Lake Bottom. Have big printer plotters to make paper maps as well as online and external maps/tools.
- Tribal GIS Goals:
 - Provide info to Tribal Council/Managers to make decisions for future generation.
 - Create a central location for Tribal information/make that information more accessible to the Tribe.
 - Provide the Tribe with accurate information about their resources.
 - Preserve information about history that occurred on aboriginal territory.
- Long history of telecom accomplishments:

- Eliminated the 400 + phone company owned phone lines; replaced with tribally owned and operated VoIP lines reducing Tribe's annual phone bills from \$132,000 to \$32,400.
- Broadband project was a \$2.8 million USDA-RUS broadband grant to develop a state-of-the-art Tribal Community Technology Center and deploy a wireless broadband ISP (Red-Spectrum Communications) to serve tribal residents.
- Fiber to the home - \$12.5M project funded through RUS's Broadband Incentive Program. The BIP Award is an ARRA funded 50/50 Grant/Loan award. Deploy 275 route miles of fiber on the reservation, which will allow existing wireless ISP, Red-Spectrum Communications, to expand and improve service offerings to at least 3,500 households. URL is gis.cdatribe-nsn.gov.

APPENDIX – Native American Carrier Blueprint**

<u>FUNCTION AREA</u>	<u>EXAMPLES</u>	<u>CONSIDERATIONS</u>
Planning		
Needs assessment	Target users/uses; 3G vs. 4G	Carrier of last resort; tribal lands/neighbors; E911
Reg. vs. unregulated	Navajo self regulated vs. MATI inc. model	Sovereignty issue; tribal chart. corp.? PUC relation?
Terrain type	Mountains, canyons, forests, deserts, weather, area	Site; mapping; central location vs. archipelago
Architecture	wireless, wire line, sat com, microwave; hybrid	Shelf life; spectrum; reliability; tower-ht./light/pwr
Utility access	Grid/off-grid alternative energy devices and storage	Available low cost power? Organic power gen?
Telco access	Proximity to tribal lands	Availability to tribal lands; complex, costly ROW
Subscriber subsidies	Government and/or tribal underwriting remittance	
Total cost of owner	Pooling with co-located tribes; job # expectations	Capital intensive; CAPEX/OPEX
Tribal Council buy in	Ongoing governmental consensus building	Long-view when delays happen; tribal council churn
Infrastructure/Ops		
Vendor selection		Vetting 3rd party; requirement inc. air transport
Technology purchase		
Deployment	ROW; permits; rock saws at 4 ft ~ \$60K-\$100K/mile	BIP; provision; easement/NPS; historic 12 spots
Maintenance	Continuity of operations?	Vehicles and tools to service truck rolls; MTBF?
Front/Back Office		
Sales and marketing	Outreach; culturally sensitive customer contact	BTOP? Website (if broadband available)
Billing/settlement		
Reporting	Corporate; tribal	
Repairs/maintenance	Trouble tickets; truck rolls	Compliance
Training	Tech training shortage	Build tribal competencies
Recruitment		
CEO	Long process to find and recruit leader + team	Incentives if remotely located?
Tech	Shadow projects for many youths; build a farm team	Incentives if remotely located?
Financing		
Federal sources	USF, CAF (\$350M) \$50M for tribal lands; HCLS, USDA, Treasury	NMTCs, grants
Commercial sources	Equity, Bank Debt	RAP underwriting if a casino exists
Cost of capital	1 FTE to complete RUS reports for instance	
Regulatory/Licensure		
FCC	CLEC status off tribal lands requires regulation	Eligible telecom carrier (ETC)
FAA	Towers sited on mountains; proximity to airports	Migratory birds are an issue for wind power
DHS		US border issues?

**Compiled by Exoventure Associates, LLC

APPENDIX – Broadband Survey Instrument (Tribal Facing) Working Draft Only

Adaptation from CA and OTA Survey Instruments

1. **Tribe Name:** _____

2. **Person(s) Name Responding to this Survey:** _____

Address: _____

3. **Tribal Leadership Names/Titles:**

Tribal Administrator: _____

Email: _____

4. **Contact Information:**

a. Address: _____

b. Phone: _____

c. Fax: _____

d. Email: _____

e. Website: _____

5. **Federally Recognized Tribe?**

a. Yes

b. No

6. Does Tribe have a Casino and/or Resort Destination?

- a. Yes Name: _____
- b. No

7. Total Membership: _____

- a. Male: _____
- b. Female: _____
- c. Under 18: _____
- d. 18-24: _____
- e. 25-34: _____
- f. 35-44: _____
- g. 45-54: _____
- h. 55 or above: _____

Members living on Tribal Lands: _____

Members living off Tribal Lands: _____

8. Tribal Land:

- a. Total acres: _____
- b. How many parcels _____
- c. Other (ROW, easement) _____

9. Does the Tribe have a map of the Tribal Lands?

- a. Yes
- b. No

10. How many houses located on Tribal Land? _____

11. How many buildings located on Tribal Lands? (Tribal admin) _____

12. Does your Tribe have broadband? (Internet, Wireless)

- a. Yes Wireline Wireless Satellite Microwave Speed? : _____
- b. No

13. Does your Tribe know of all the providers/carriers serving your tribal land?

- a. Yes
- b. No

If so name/contact information: _____

14. Does the Tribe have a Service Level Agreement with providers?

- a. Yes
- b. No

Guaranteed items such as speed of service, quality of service, e.g. maximum downtime, etc.?

15. Does the Tribe have Indian Health clinic?

- a. Yes Name: _____ Telemedicine? Yes or No
- b. No

16. What grants/programs does the Tribe currently operate especially broadband related?

17. Does Tribe have an Educational Program (tribal college, distance learning, afterschool etc.?)

- a. Yes
- b. No

If yes, please list _____

18. Does the Tribe have an Economic Development Plan?

- a. Yes
- b. No

19. Please list additional comments/concerns/questions the Tribe would like addressed regarding Tribal Broadband within the community.

APPENDIX – Broadband Coverage Maps *Working Draft*

The three preliminary maps developed by CIT and VITA include American Indian, Alaskan, and Hawaiian Lands 1) Wireline Availability, 2) Wireless Availability, and 3) Wireless Coverage, which showcase the areas Broadband service from available data ranging from poor (red) to good (green).

Given the prohibitively large size of the files involved, the following links have been provided as an alternative access method to those maps:

http://gismaps.virginia.gov/ftpfiles/downloads/CIT/USA_CBIL_BB_WLS_Map.pdf

http://gismaps.virginia.gov/ftpfiles/downloads/CIT/USA_CBIL_BB_WLSCOV_Map.pdf

http://gismaps.virginia.gov/ftpfiles/downloads/CIT/USA_CBIL_BB_WLN_Map.pdf

The source data for these maps included 2000 Census American Indian Lands, Alaskan Native Areas, and Hawaiian Homelands, as well as the US Dept of Commerce, National Telecommunication and Information Administration, State Broadband Initiative (June 30, 2011) Service Areas.

For this report, availability was accessed as count of Providers from a geographic intersection of Broadband Provider Footprints with each Indian Land Area, while coverage was a percentage of the Indian Land Area served by any Wireless Broadband Service Area.

These models could be greatly improved with better data – including Indian Lands’ specific Broadband Footprints/Coverage, road centerlines/rights of way, and (optionally, for wireless propagation) topographic surface data.