

# Liberia Broadband Technical Assessment (Components 2 & 3)

## Backbone & Last Mile Details (new June 4) & Interim Findings (updated June 4)

NetHope  
Global Broadband and Innovations Alliance  
June 4, 2015

# Backbone Infrastructure Costing

## Assumptions:

- A new submarine cable/landing station would cost > \$40M i.e international redundancy best served by terrestrial backbone with a cross-border route to Cote d'Ivoire backbone which has access to ACE, WACS, SAT-3 and MainOne sub cables
- Rail links will include fiber at low cost during refurbishment
- Planned power grid from Zwedru to Tapeta will include fiber in required time-frame
- WAPP will include fiber but may only come later – will ultimately provide X-border links to Sierra Leone, Guinea
- Existing ducts & fiber laid by Libtelco can be used for the backbone
- Festoon system could be added at a later stage for additional redundancy but would not serve significant population base - coastal areas are mainly marsh with high Malaria
- DWDM fiber costs/km range from \$10K/km for OPGW to \$50K/km for MAN and rock digs

## Cost Estimates:

Monrovia MAN - 12.5K now complete, 30km more required for basic two-loop system: \$1.5M.

Cost reduced if the JICA funded ring road return loop can include ducts, LEC poles used.

Backbone: between \$60-\$100M for 4,000km in total (3,300kms plus 20% contingency).

Phase 1 includes 700kms of Libtelco plans, power-grid, and rail lines.

Phase 2 on arrival of WAPP for remainder of links and additional adjustments.

# Last Mile Infrastructure Costing

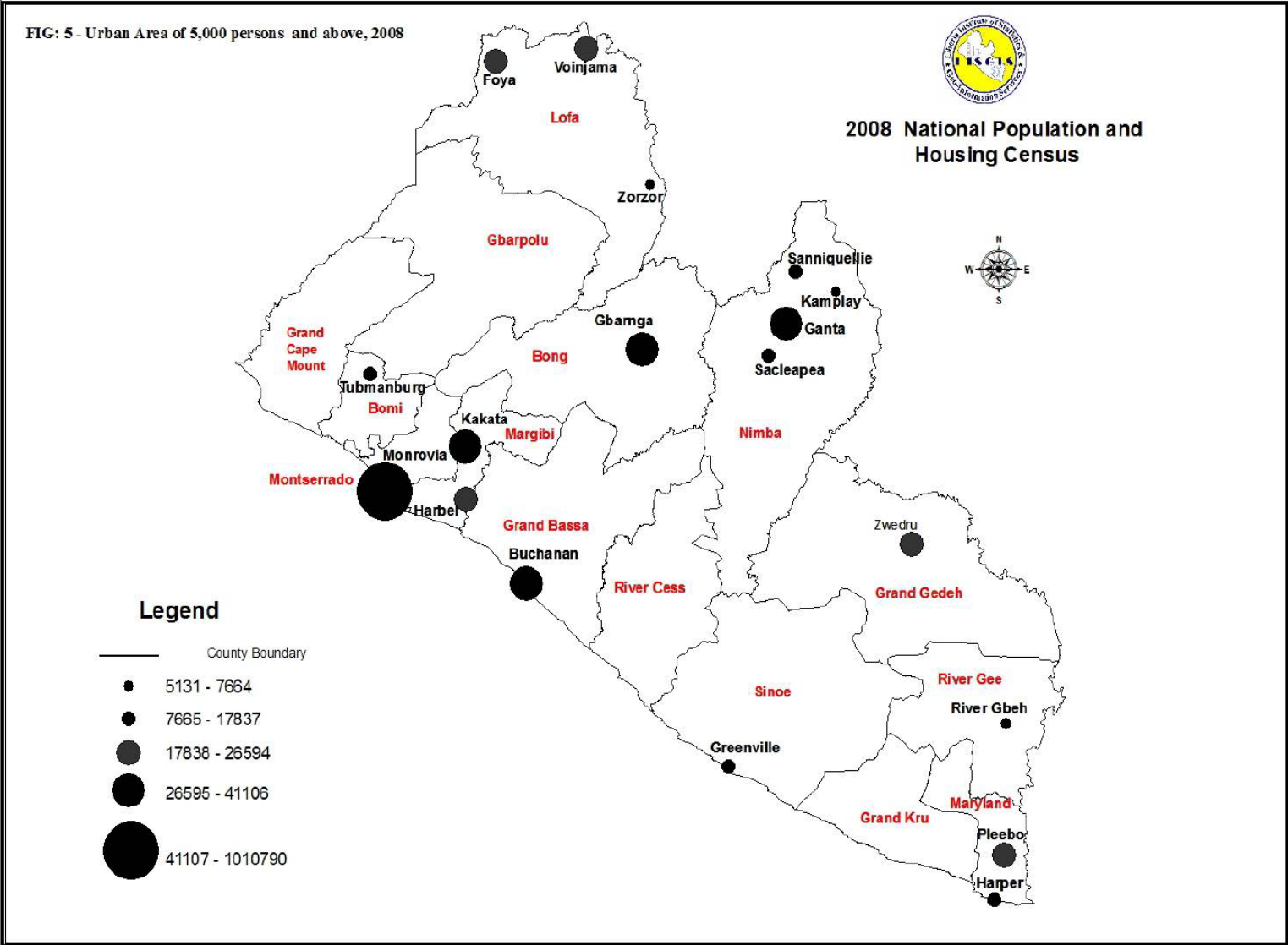
## Assumptions:

- Predicated on a successful roll-out of a national fiber backbone
- Use of Digital Dividend 700MHz spectrum to maximize rural coverage
- Single-operator PPP wholesale network model assumed
- All cities with greater than 5000 people should be covered
- Coordination of fiber Points of Presence (PoPs) with tower deployment
- There may be potential costs savings through sharing of existing towers but there is insufficient data at this point. Not assumed.

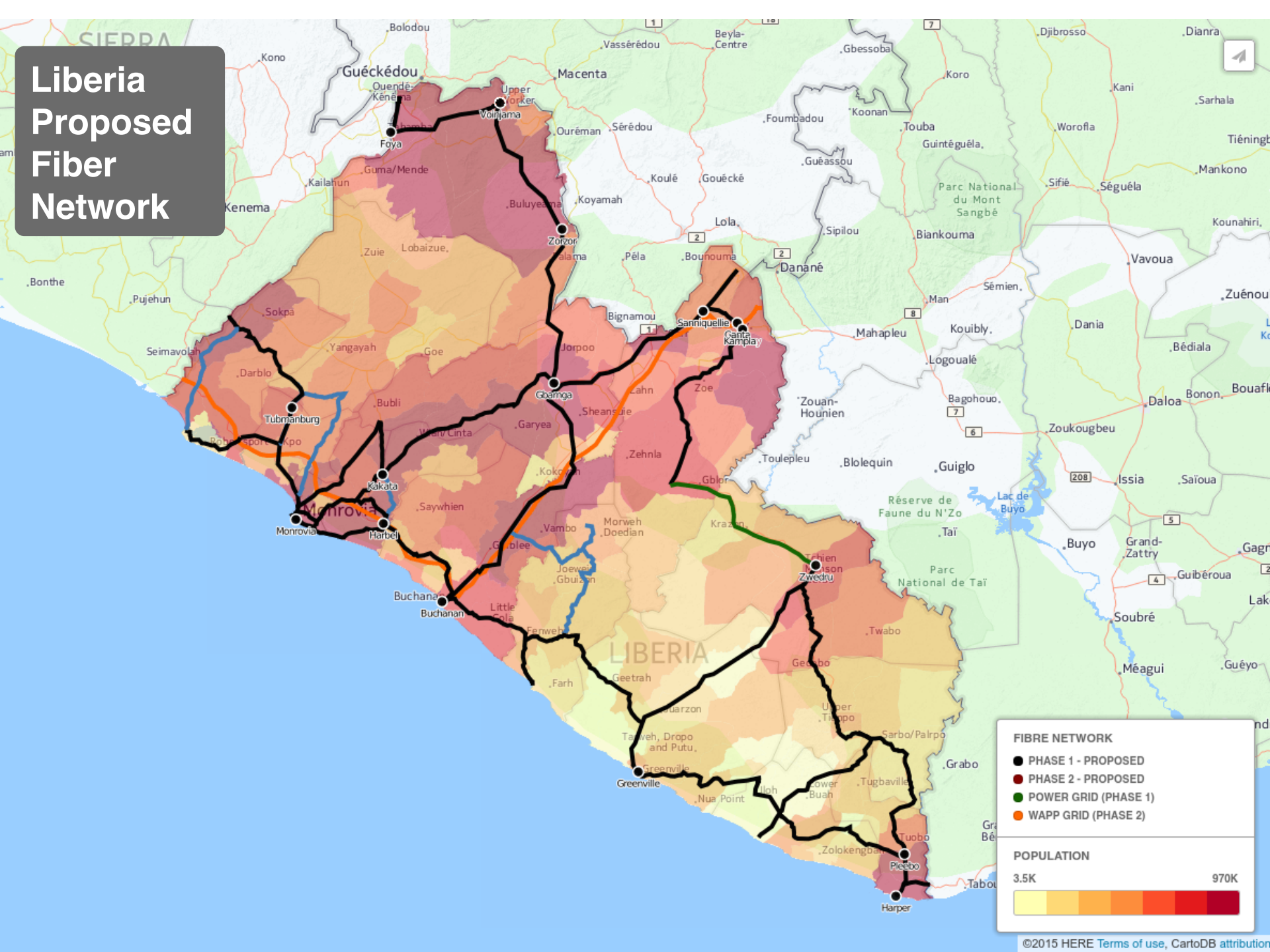
## Cost Estimates:

- Single base station cost. According to Novafone, tower construction costs in Liberia are \$60-80K. Allowing for land acquisition and related fees, we estimate \$100K per base station
- Assuming a radius of 30km coverage per base station with variance according to geography. No detailed analysis of terrain propagation has yet been undertaken.
- 45 base stations will offer coverage along all fiber routes
- Ballpark network roll-out cost \$4.5M

# Liberia Population Distribution



# Liberia Proposed Fiber Network



**FIBRE NETWORK**

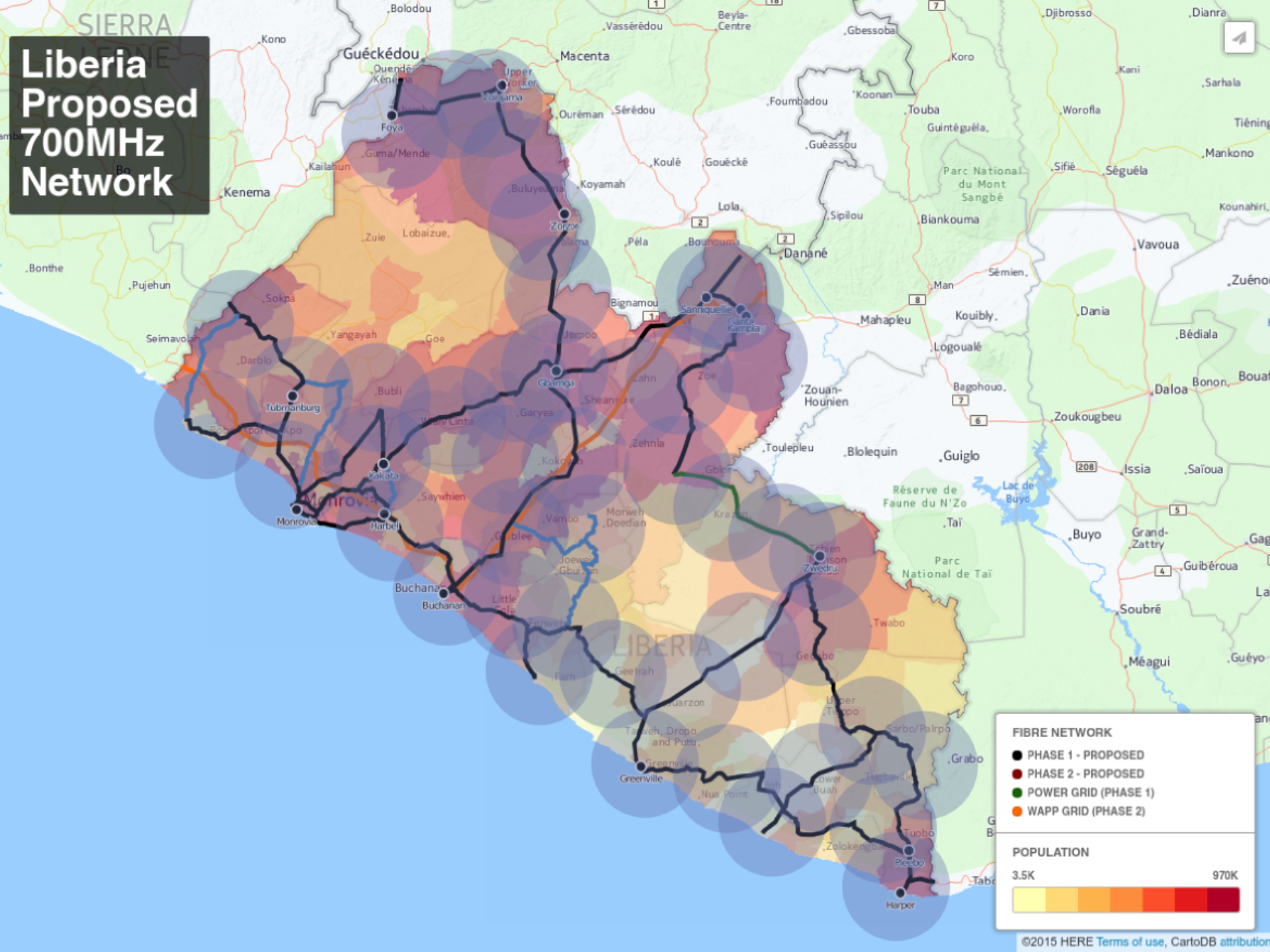
- PHASE 1 - PROPOSED
- PHASE 2 - PROPOSED
- POWER GRID (PHASE 1)
- WAPP GRID (PHASE 2)

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**POPULATION**

3.5K 970K

# Liberia Proposed 700MHz Network



**FIBRE NETWORK**

- PHASE 1 - PROPOSED
- PHASE 2 - PROPOSED
- POWER GRID (PHASE 1)
- WAPP GRID (PHASE 2)

**POPULATION**

3.5K 970K

# Status of Remaining NetHope Activities

Component Number	Status	Completion Date
1. Policy	Iftikhar USF completed. 2 <sup>nd</sup> policy round being scoped	Scope to follow Parvez's report
4. Spectrum Management	RFQ for Equipment and TA being scoped	RFQ to USAID 6/9/15
5. eGovernment Design	Revised SOW to USAID 6/5/15	Request approval on 6/8/2015
6. Private Sector Human Capacity Development	On-Hold	
7. 3-Country Assessment	USAID revising data and mobile money	Expect revisions by COB 6/5/15

# Liberia Broadband Technical Assessment (Components 2 & 3)

## Interim Findings

NetHope  
Global Broadband and Innovations Alliance  
June 4, 2015



# Background and Purpose

Post-Ebola crisis, the GoL and USAID agreed to work with Internet broadband experts from Liberia, South Africa, Brazil, Pakistan, Canada and US to conduct a rapid assessment of the barriers to, prospects for, and opportunities available to rapidly build out affordable broadband for the government, businesses and people of Liberia. The team examined:

1. Key policy, legal and regulatory issues required to facilitate the rapid proliferation and adoption of broadband access
2. Current and planned investments in broadband and telecommunications infrastructure
3. The national broadband and telecommunications infrastructure strategy and plan

The following pages summarize the team's findings.



# Technical Team and Roles

- **Mike Jensen:** International and national backbone
- **Steve Song:** Last mile
- **Nishal Goburdhan:** IXP and Internet growth
- **Parvez Iftikar:** Telecom policy/USF
- **Anthony Waddell:** eGovernment and Liberia context
- **Eden Reeves:** Local telecom context
- **Lane Smith:** Home office and technical assistance
- **Jonathan Metzger:** NetHope lead

The team provided assistance to:

- **Dalberg** PDWA study
- Served as **A4AI** co-host at broadband roundtable



# Liberia Telecom At-A-Glance

- **Population:** ~4 Million.
- **Per Capita Income:** \$350/year.
- **3 Million Mobile Subscribers:** 75% penetration.
- **400k Internet Subscribers:** 10% penetration, limited mostly to costly, low bandwidth 2.5/3G in Monrovia.
- **3 MNOs:** LoneStar MTN (60%) & CellCom (45%) dominate market share; Novafone (8%). Libtelco Fixed, <1% - for practical purposes not included.
- **3 significant ISPs:** Down from 17 in 2010.
- **Single International Fiber Link:** ACE Cable Landing, managed by CCL, a public-private consortium. Service has already gone offline twice.
- **Fiber:** No capital city metro ring; no national fiber connecting key cities.
- **Significant Material Externality:** National Elections in 2 years.

# Broadband Challenges

- **International Fiber:** ACE only, no redundancy; \$25M World Bank loan due in 5 years.
- **Metro Fiber Network and National Backbone:** Neither built. Libtelco, a GoL parastatal, is responsible for this. They have strong connections to Head of State and Minister of Finance. Limited resources for roll-out.
- **Assets:** Currently only some masts, ducts, and 25km of fiber in Monrovia; 20% shareholding in Cable Corporation of Liberia (CCL) and some 800MHz spectrum.
- **Policy:** Libtelco has monopoly over installing ducts; is parlaying this plus 'free bandwidth' via its CCL share to undercut private sector provision of broadband.
- **Libtelco Next Steps:**
  - Libtelco to privatize – stated end goal is 6/30/2016
  - Libtelco is rapidly laying substandard ducts in Monrovia, with funded plans to extend 150km to Buchanan, a major port city

# Broadband Challenges (Cont.)

- **Monopoly Pricing**
  - Libtelco charges \$2.50/Meter/month for local access to Cable Landing, 3 times greater than Africa benchmarks. Hence, MNOs (2 major, 1 minor) and all 3 wireless ISPs back-haul to Cable Landing via microwave.
  - Libtelco and most providers charge retail \$1,000/meg (although down from \$4,000 in 2009). Libtelco is charging 'as little' as \$700 to select clients.
- **National Fiber Infrastructure:** No concrete plan despite many studies since 2010.
  - Roads still being built without ductwork.
  - Very limited power grid options and lack of power for equipment. VSAT operations still required for Internet access in *large* areas of the country.
  - Limited power outside Monrovia – fuel, etc. = 30% of MNO OPEX.
- **Limited Domestic Purchase Capacity:** ARPU from rural users is <\$5/month.
- **HIPC Status:** GoL borrowing is severely constrained.
- **LTA Moving to a New License Structure:** LTA considering moving ISPs from unlicensed to licensed bands, thereby increasing their costs.

# Broadband Opportunities

- **Policy:** MoPT and LTA are receptive and eager for USAID assistance:
  - MoPT wants to update 2011 National ICT Policy
  - MoPT and LTA know they need national broadband strategy
- **High-Level Awareness:** Presidential Delivery Unit saw first-hand the paucity of rural coverage during recent field visit.
- **Private Sector Appetite:** MNOs and ISPs want national backbone and cheap broadband/backhaul and will gladly pay their way.
- **Win-Win:** New national roads and power grids being planned for can carry fiber, thereby reducing national backbone costs and offer international alternatives via neighbors such as Cote d'Ivoire.
- **Positive Policy Moves:** LTA moving to technology-agnostic, unified spectrum licenses on July 1, allowing operators to deploy the technology of their choice, e.g., LTE

# Broadband Opportunities: Financing and Partnerships Considerations

During the time in country, it was reported that there is interest from:

- **World Bank:** Supporting further divestiture of CCL and refining strategy for national backbone connectivity through consultancies.
- **ECOWAS Bank:** Established a fund to assist HIPC nations in the region meet their interest rate requirements in new loans.
- **AfDB:** Ready to co-invest in backbone infrastructure as part of commitment to Mano River Union connectivity and ECOWAN.
- **Co-Investing:** JICA, EU, Kuwait Fund are financing major road projects, during which backbone ducting would be cheap to install.

# Biggest Threat to Affordable Broadband

- **GoL Plans to Privatize Libtelco, Before the Next Election:** Having retired its old CDMA network, Libtelco has valuable 800MHz spectrum, a few masts and limited fiber in Monrovia, for which it charges excessively due to its market position. *No private operator has the right-of-way to lay fiber in Monrovia.*
- **Result – Monopoly Pricing:**
  - \$1,000/Mb/Month for Internet access vs. ~\$250/Mb/month for dedicated capacity on ACE
  - Cost of Libtelco local fiber links in Monrovia is ~\$2.50/meter/month vs less than \$1 elsewhere in Africa
- **Coming – A Worse Private Monopoly?** GoL has appointed ex-Dept of Finance executive to restructure Libtelco so that it, by the time of the national elections, is attractive to private investors.
- **Immediate Next Step!** Support GoL to develop a “consortium” business and privatization strategy for Libtelco—already proven by the CCL consortium model—to become an “equal access” wholesale national carrier-of-carriers, owned by willing retail operators. This is a high political stakes move, but necessary if Liberia will achieve telecom build-out at affordable rates.



# Framing the Recommendations

## Follow the USAID Africa Bureau's Proven 3 Ps Approach:

- Policy
- Pipes
- People

## Essential Precursors for Successful USAID Investment:

- In-house champions within GoL and USAID/Liberia.
- Trust must be nurtured among all parties. Otherwise it becomes a high-stakes gamble.

# Biggest Hurdle – Biggest Reward


- **Recognized Need:** A low cost **national fiber backbone** is seen by all stakeholders as they key to unlocking better connectivity in Liberia.
- **Multiple International Routes:** Backbone can also provide better int'l connectivity - can be used to connect to other submarine cables in neighboring countries (e.g., Cote d'Ivoire has WACS, MainOne, ACE, & SAT-3. If Liberia had a new cable landing, would cost \$40-50M). Interim microwave link may be needed also.
- **Building Backbone:** A nat'l backbone with resilient loops covering @90% of the population (roughly 4000km) will cost \$60-100M depending on the extent to which utility infrastructure (roads, rail & power grids) can be used to cut the cost of civil works (80% of the cost of a fiber lay). Neighboring example- the new 600km cable in Sierra Leone cost \$28M (roughly \$47K/km) – all new dig. A phased approach will be needed to take advantage of ongoing and planned utility infrastructure projects particularly West African Power Pool (WAPP) and road building.

# Support a National Backbone

\* This recommendation has been separated out to highlight the critical nature of having a national backbone. Recommendations will be repeated throughout the subsequent slides.

- Work with key GoL decision makers to prioritize *national* backbone as *national* priority.
- Support co-investment in shared backbone capacity and nat'l investment in rights-of-way opportunities (e.g., install fiber ducts in all new roads, string fiber along new power lines).
- Create Open Access Strategy to enable management by neutral operator and include cost-based pricing approach. [Current operator, Libtelco, has not be able to build-out metro fiber ring or national backbone and pricing is significantly higher than comparative African examples].

# Near-Term Policy Recommendations

- **USAID Leadership:** Continue bringing stakeholders together, including sharing a vision of why broadband everywhere should be a national imperative.
- **Ride Momentum and Launch Incremental Actions Now:** Work with GoL on 'no-brainer' components of the national backbone build-out, e.g., redundancy via connections and upstream int'l capacity through Cote d'Ivoire. Advocate that the 3 main operators, via CCL, share connection to CI, including for low-cost transit backhaul from the border to the CI IXPs/Landing Stations.
- **Support LTA:** Provide STTA to LTA to build capacity and provide spectrum equipment.
- **World Bank Re-Start:** It appears that WB agreed in May to re-start the national backbone network study.
- **Strengthen CCL:** Provide TA to build administrative capacity; provide billing software and other support.
- **Ducting Policy:** Mandate fiber ducts in all new and refurbished roads and along power grids.
- **USF:** Push WB to re-engage and/or USAID adopt USF; otherwise it'll be 3 years before ROI!
- **Learn from Others:** Share national broadband plans from 4 or more countries and send key stakeholders to conferences to build partnerships and observe best practices in action.
- **Choked Pipe:** Examine the feasibility of restructuring Libtelco along the lines of CCL, 

# Near-Term 'Pipes' Recommendations

- **Rural Pilots:** “Push” rural roll-out through pilots.
  - Use mGSM/ TVWS/other models. Create a pilot 30kms from the Backbone, requiring only investment in a point-to-point backhaul. Target up to 10 towns in Ebola areas.
  - Partner with Power Africa for small scale (<1Megawatt) rural electricity solutions.
  - Provide connectivity for K-12 schools during class hours; community WiFi afterwards.
- **Strengthen Advocacy Network:** Support a Network Operating Group (NOG) with TA
- **Launch IXP:** Provide two more visits by Nishal.
  - **Connect:** 1<sup>st</sup> visit to link everyone and peer locally.
  - **Caching:** 2<sup>nd</sup> TA to the IXP to provide FB, Google Cache & other Content Distribution Networks. Google cache alone will save >\$1.5m/year on int'l bandwidth costs.
- **MoH Support:** Begin with MoHealth as a flagship in light of Ebola response but do not stop there.
- **Spectrum Equipment and Training:**
  - Provide spectrum monitoring equipment and spectrum management software.
  - Provide technical training on deploying and using the equipment.
- **Demux:** Buy spares for the Demux.

# Near-Term ‘People’ Recommendations

- **HCD Needs:** While not the focus of this assessment, the team recognizes the extreme shortage of well trained talent at all levels. Accordingly, the team recommends:
  - Re-activate Component 6 in the NetHope SOW, to assess Liberia’s need for a modern technology workforce, and prepare a national strategy.

# Med/Long-Term Policy Recommendations

- **Getting the Prices Right:**

Provide TA to LTA to:

- Introduce cost-based tariffing
- Get Libtelco, CCL, MNOs, and ISPs to work in sync and drive prices down to affordable levels.

- **Taxes:** Provide TA to GoL and Consumer Groups to determine incentive to:

- Reverse recent doubling of value-added tax on telecom services;
- More broadly, reduce high tax burden on ICTs.

- **Broadband Plan:** TA to support the development and adoption of national BB plan, including time-bound targets for completion.

- **ISP:** Support an ISP Association.

- **Neutrality:** Support legislation

ensuring technology neutrality and ICT infrastructure sharing.

- **TLD:** Repatriate TLD from Ms. Mai Urey.

- **eGov Strategy:** Support the development of a strategy for the government to minimize its connectivity costs.

- **Cybersecurity:** Support cybersecurity coordination, incorporate private sector into discussions and ensure CERT is a public-private consortium.

- **Support USF:** Seed fund USF beyond its 2 pilot projects and provide longer-term TA on USF operations.

- **Travel:** Send LTA, MoPT and

others to Intel USF/BB, the Global IGF, USTTI Training courses, Macedonia to MK Connects, and DSA Conf. Leverage Telecom Leadership Program.

- **Tower Sharing:** Broker tower sharing agreement among operators.

- **Wholesale 700MHz Network:** Explore feasibility of wholesale 700MHz LTE network based on single-operator PPP

# Med/Long-Term 'Pipes' Recommendations

- **Metro WiFi:** Conduct a technical and economic feasibility study for establishing a metro WiFi service (business).
- **GIS:** Design and support a GIS database of public linear infrastructure, e.g., roads, pipes, ducts, power lines, etc.
- **Surplus Equipment:** Explore the feasibility of providing surplus NTIA LTE equipment (circa 2011) to an MNO.
- **Connect GoL MACs:** Support broadband connectivity to the e-Liberia platform for the remaining GoL Ministries (~10), agencies and commissions. Further, support GoL decentralization efforts.
- **Tertiary Institution Support:** Support ICT education broadly, and cyberlaw specifically, and facilitate Univ. engagement in the debate on cyber issues.
- **CERT:** Support the establishment of a CERT.
- **Affordable Power:**
  - Collaborate with Power Africa and other appropriate entities to engineer a cost-effective way to power remote base stations and end-user equipment.
  - Ensure Power Africa infrastructure build-out includes fiber cables!



# Med/Long-Term 'People' Recommendations

- **Anchor Tenants and Anchor Usages:** Tie USAID program support to traditional partners such as secondary school/health clinics, campus fiber network, government facilities & also support with anchor usages such as mobile money, eGov, and big (and little) data.
- **Zero Rating:** Work with Facebook/Google as well as independent researchers to better understand the impact of zero-rating on data consumers (from users to government), especially literacy, demand for data and uptake of Internet in general.
- **Affordable Computers:** Look into Intel's program & USF – as in Senegal, Zimbabwe, Malaysia, Costa Rica, etc.

# Remaining Steps of Technical Assessment

- **Reporting:** Interim technical report due in 3 weeks; final report due two weeks after USAID comments.
- **Spectrum Management:** Price out equipment, software and training package.
- **Demux:** Determine if Demux is on order and with spares. If not, price it out.
- **MoPT and LTA Capacity:**
  - Provide technical materials
  - Arrange and facilitate invitations to suitable international events