



OHIO
UNIVERSITY



Cracking the Broadband Puzzle in Appalachia

Misty Crosby

Executive Director

MCrosby@BuckeyeHills.org

Tom Reid

Broadband Consultant

Tom@ReidConsultingGroup.com

11 December 2019



Agenda

- What we found regarding broadband
- Review of network architecture options
- Magnitude of funding required and possible sources
- Long road – we need a unified voice

In the digital desert... McDonalds as Study Hall

- Even more prevalent today than when published in the [Wall Street Journal on Jan 28, 2013](#)
- More schools assume home broadband in types of assignments
- Snow-day e-school becoming common
- Huge handicap for job seekers as well
- Precludes remote work opportunities



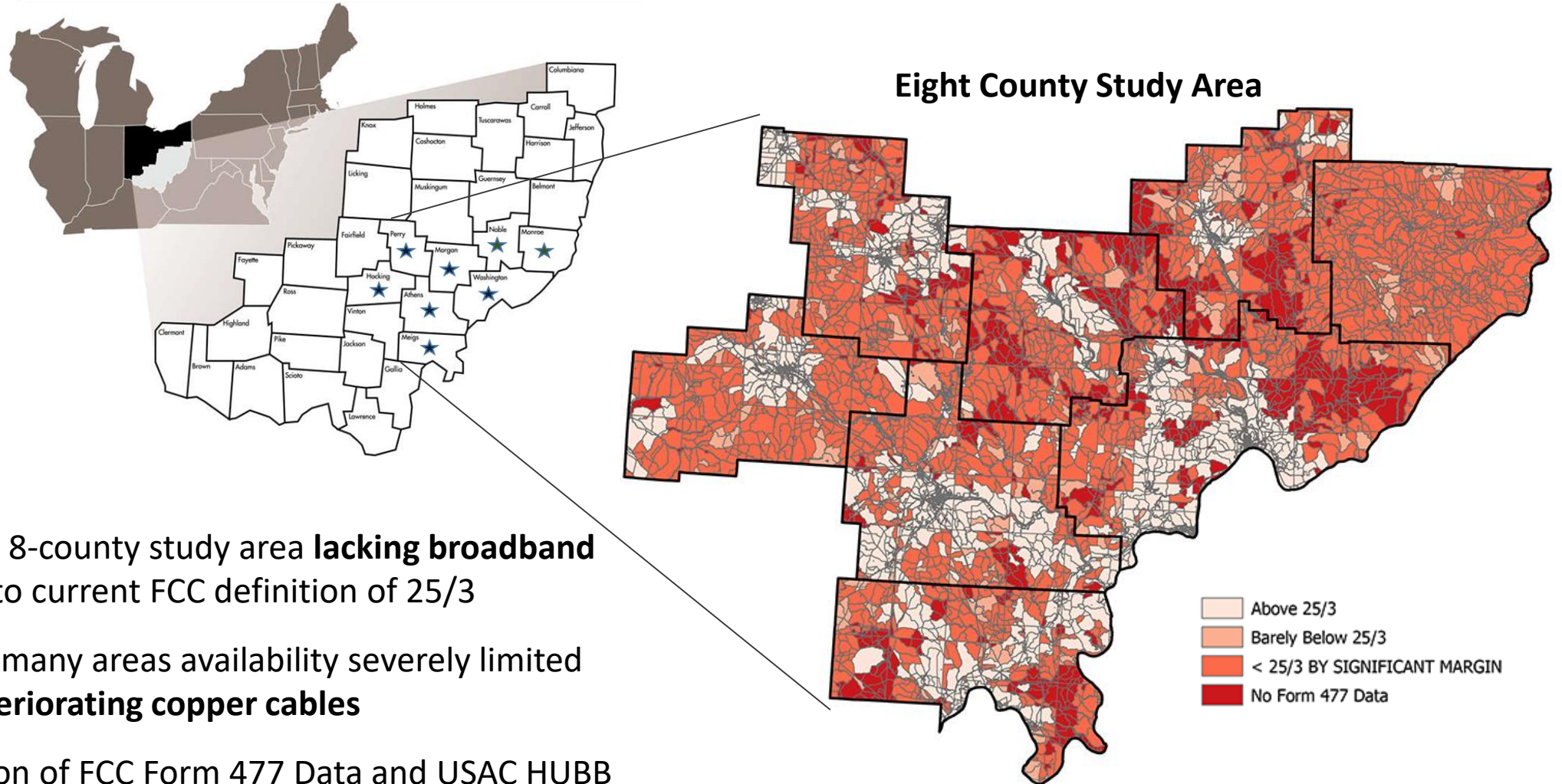
The [recent follow-up story](#) published on November 11, 2019, captures the lack of progress.

Why is broadband still an issue?

	City or Area of Ohio	Households per Square Mile	Median Household Income	Density Compared to Columbus
Cities and Towns	Columbus	1,510	\$49,478	100%
	Marietta	693	\$35,556	46%
	Logan	604	\$29,691	40%
	McConnelsville	486	\$25,563	32%
Rural Expanse	Entirety of Meigs County	26	\$33,407	1.7%
	Carthage Township, Athens County	17	--	1.1%
	Monroe Township, Perry County	12	--	0.8%

No terrestrial provider can serve 100% of the “rural expanse” without ongoing subsidy

Digital Desert Persists



- **75%** of the 8-county study area **lacking broadband** according to current FCC definition of 25/3
- Further, in many areas availability severely limited due to **deteriorating copper cables**
- Combination of FCC Form 477 Data and USAC HUBB Data reveals a stark image of the digital desert

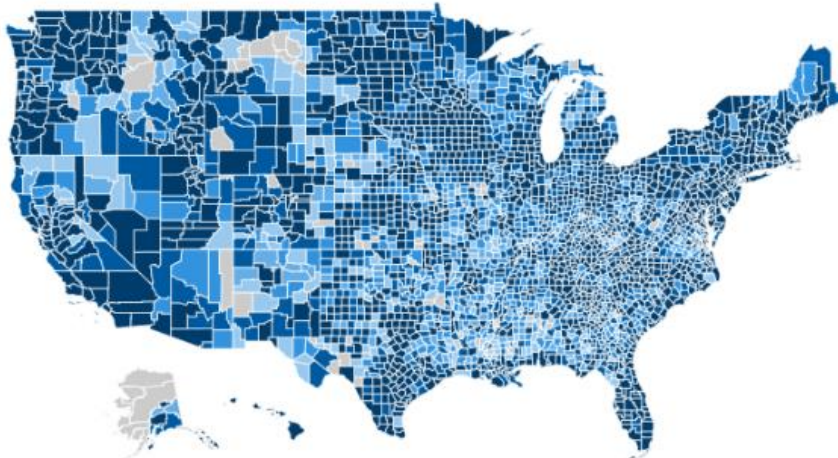
Reality Even Worse

Any 100,000 households in rural expanse*			
5,000 to 8,000 square miles			
	FCC Form 477 Trusted, not verified	Range of Research-Informed Corrections	
10/1 Broadband Availability	62%	21%	10%
Unserved	38%	79%	90%
Unserved Households	38,000	79,000	90,000

- Research utilized combination of FCC Form 477 and USAC HUBB data
- Helps in understanding the magnitude of the broadband availability problem
- Does **not** identify defensibly unserved areas to escape “carve-outs” meant to prevent over-building

FCC vs Microsoft Data

FCC indicates broadband is not available to 24.7M people

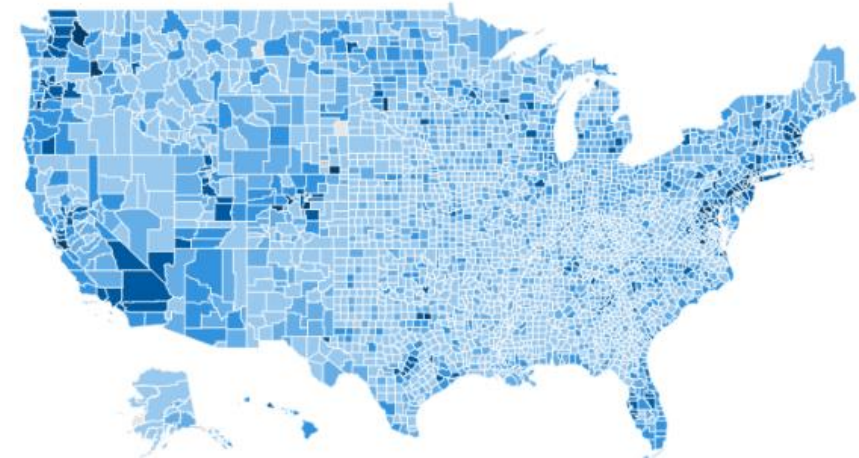


* FCC fixed broadband has or "could" provide greater than or equal to 25Mbps / 3Mbps



Data sources: FCC 2018 Broadband Report based on Form 477 data from December 2016 and M

Microsoft data indicates 162.8M people do not use the internet at broadband speeds



Broadband speed greater than or equal to 25Mbps



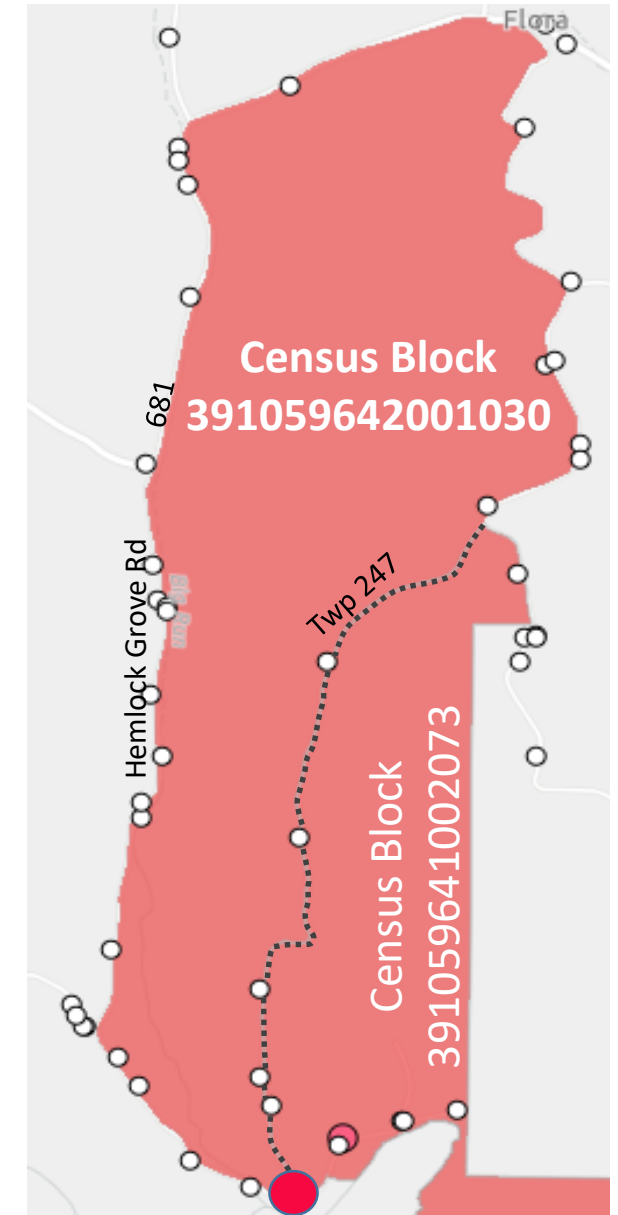
Microsoft data from September 2018

7:1 Over-Estimation of Coverage

De Minimis Deployments Leave Many Households Unserved

- Typical Example
 - Census Block 391059642001030 in Meigs County, Ohio
 - 740 Acres
 - 12 households per square mile
 - 14 Households in block, many others adjacent (white dots)
- Funded under CAF II
 - Frontier deployed broadband to one household (pink dot in far south of block)
 - Entire census block mapped as served by FCC
 - Thus blocked from receiving funding from other programs

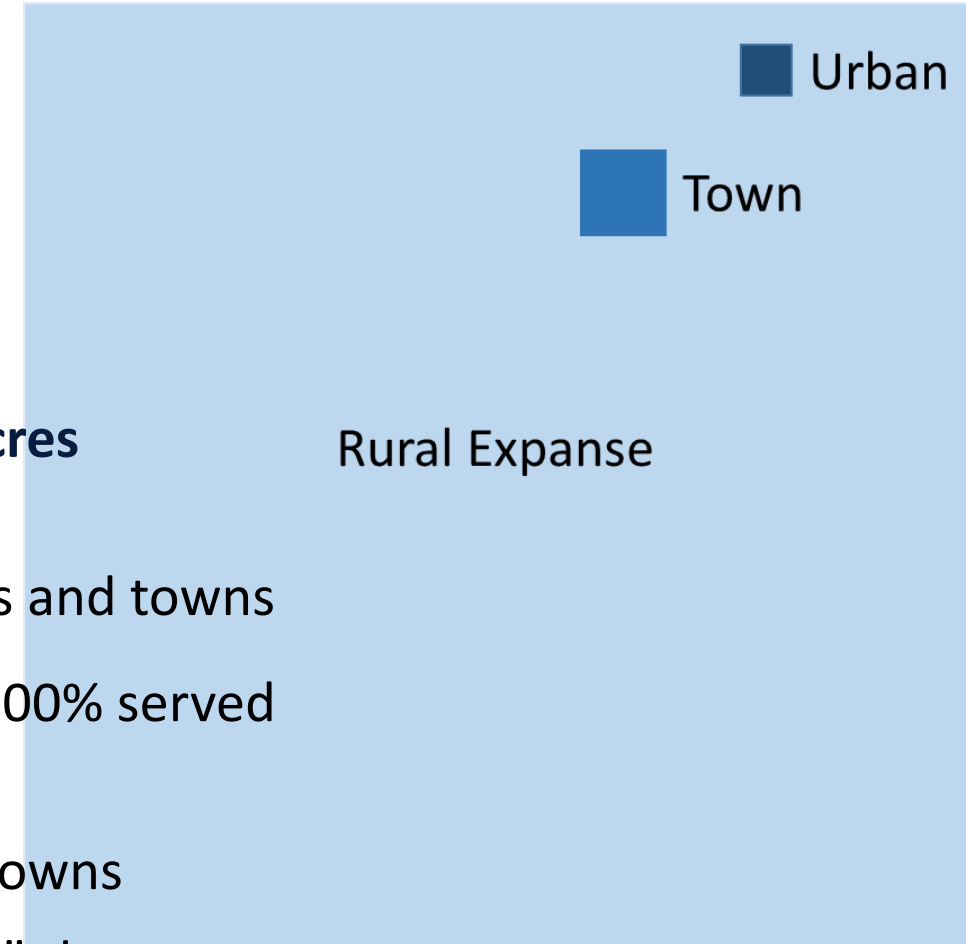
13:1 Over-Estimation of Coverage



Census Blocks

Urban-Rural Differences

- Census blocks sizes
 - As small as 0.7 acres, no maximum size
 - Cities = 2 acres on average
 - Small town = 6 acres on average
 - Southeastern Ohio rural expanse = **250 to 3,500 acres** (750 in illustration)
 - **40 to 1,500 times the size** of census blocks in cities and towns
- A single served location marks entire census block as 100% served in current FCC approach
 - May offer an acceptable assumption in cities and towns
 - In rural areas leaves large areas marked as “served” that are not and will not be served



De Facto Cooper Abandonment Exacerbates Issues

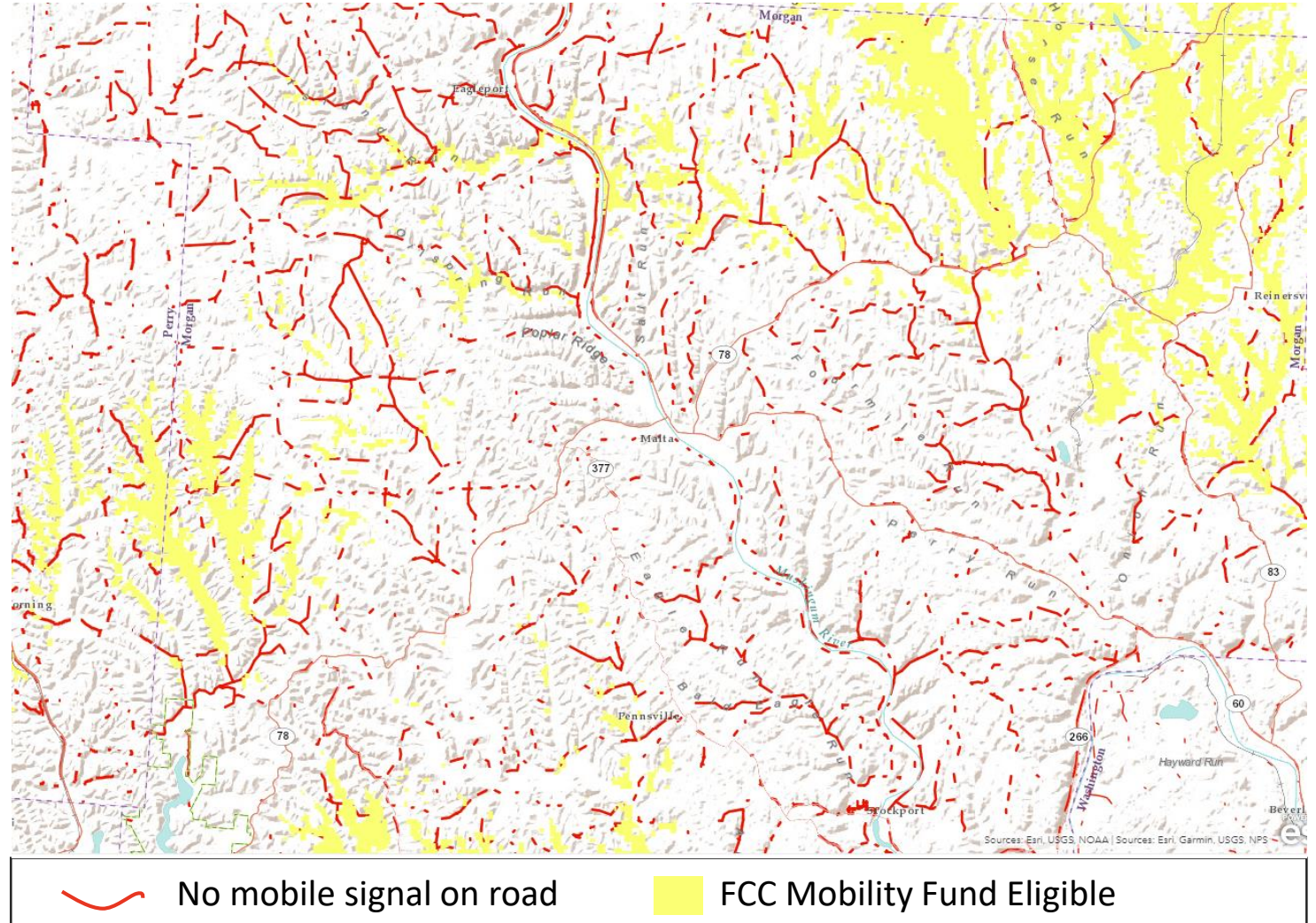
- Large incumbent telcos petitioning to abandon aged copper cables – **doing it de facto now**
- Allowed to deteriorate in place
- Insufficient to provide reliable telephone service let alone broadband
- Staffing so low that restoration takes multiple weeks
- Poses life/safety risks, particularly in areas also lacking cell service (**much more prevalent than maps indicate**)



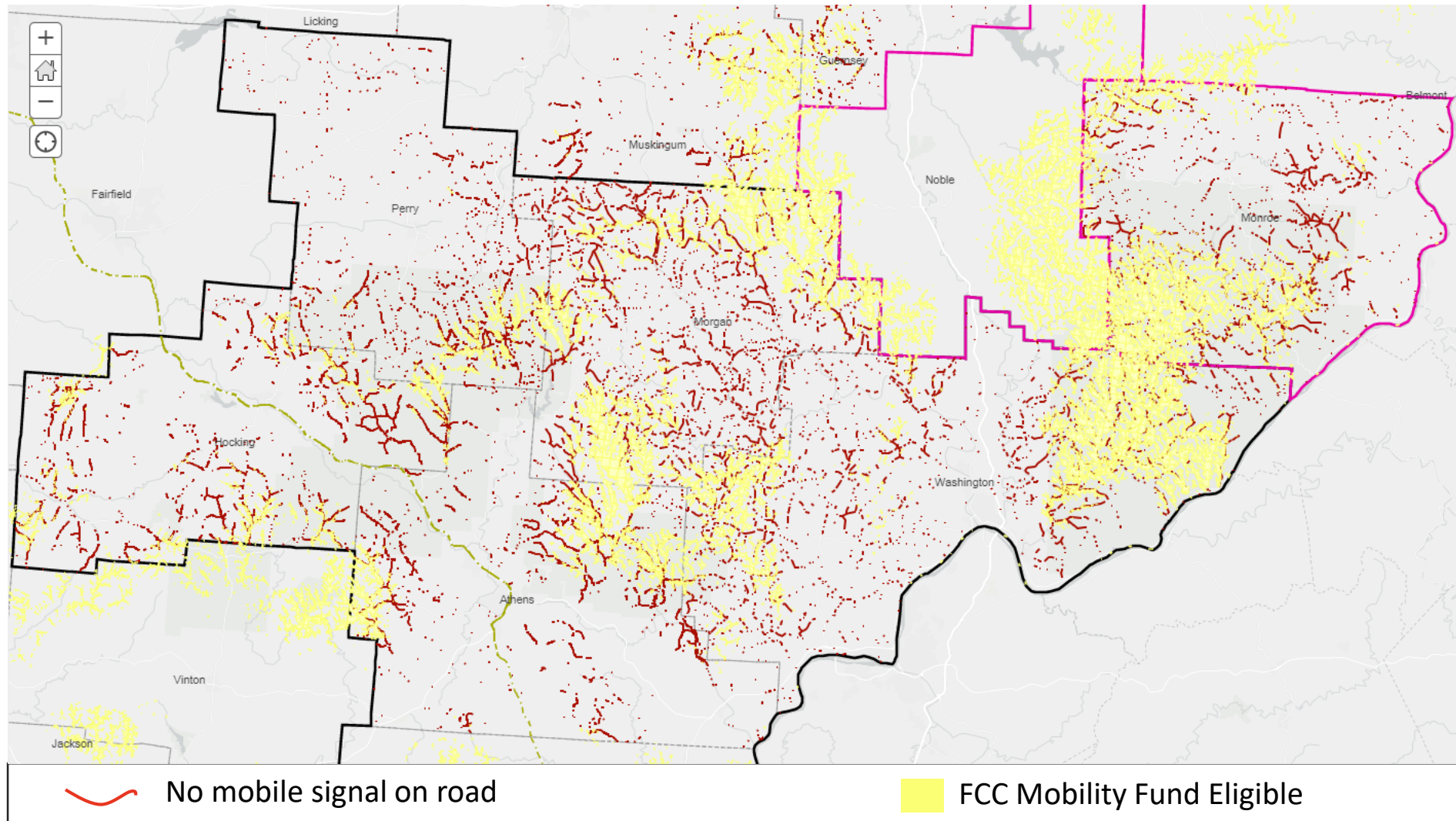
Mobile Services Overstated as Well

- Mobile services also dramatically overstated in our region
- Further diminishes opportunity for broadband services
- Exacerbates the life/safety issues from de facto copper abandonment
- Red lines shows lack of coverage on roads from:
 - AT&T,
 - Verizon,
 - T-Mobile, or
 - Sprint

Source: Ohio Department of Transportation,
2017 drive study conducted by
ConnectedNation



Mobile Services Overstated as Well



Gaslight Experience

“But dear..., the maps say you have both fixed broadband and mobile services”



Overarching Architecture

- Select representative study areas based on business and population density plus terrain
- Model technology options for feasibility
- Determine realistic cost estimates for 100% coverage
- Extrapolate architecture across service area
- Generate financial pro forma to determine magnitude of subsidy required

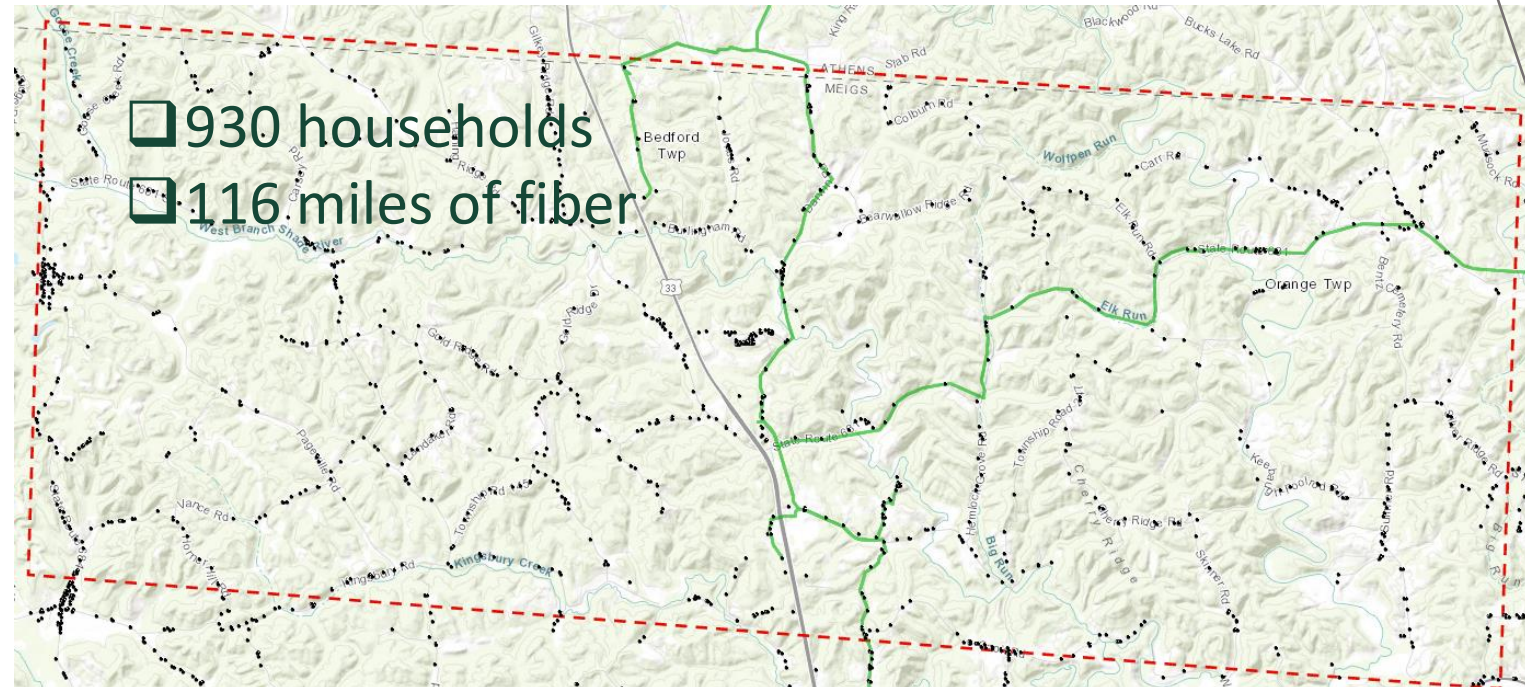
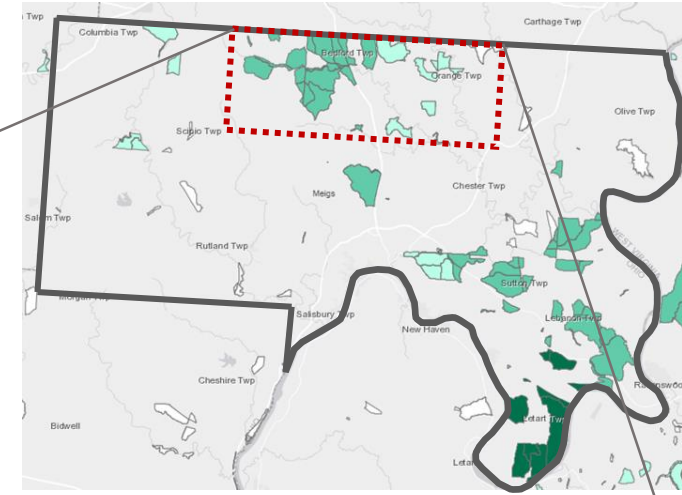


Three Options

1. Satellite
2. Hybrid Wireless and Fiber
3. Fiber-to-the-Premise

Engineering Zone A Meigs County

- Terrain typical of broader service area
- Population density below 20 households per square mile
- Scattering of businesses across the study area
- Significant foliage cover
- Pre-existing middle mile fiber
- 45 square miles



Satellite Woes

- Round-trip creates signal delays (latency) that hamper video/web/audio conferencing
- Data caps and subsequent “throttling” reduce effectiveness for streaming services
- Many potential sources of interference of the low strength signals
- New low-orbit satellites face daunting technical challenges for the frequent hand-offs
- Rugged terrain and heavy foliage limits reach of satellite services



Worst-case option for our region

Wireless Limitations

Flatlands



Wireless signals travel unobstructed across flat farmland, a feasible solution in these types of areas

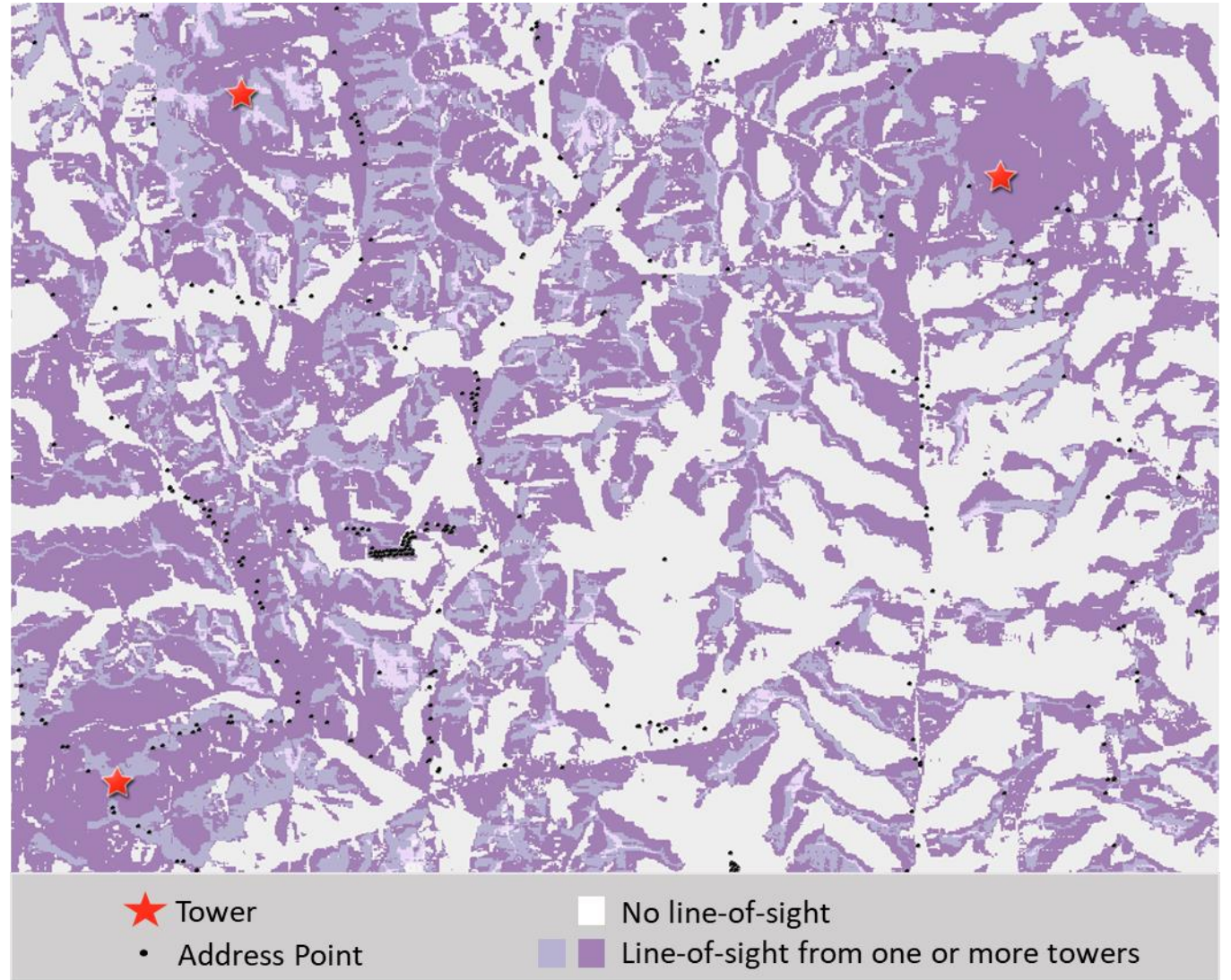
Appalachia



In our region, the combination of rugged terrain and heavy foliage cover severely limit both coverage and capacity

Wireless Propagation Challenges Engineering Zone A

- 4 towers on high points, each 300' tall (3 shown)
- >\$1.5 million in infrastructure for just 60 square miles
- Many locations still unreachable
- High winds cause dish misalignments
- Lightning takes out entire tower's worth of electronics



TV White Spaces

Disadvantaged Reality

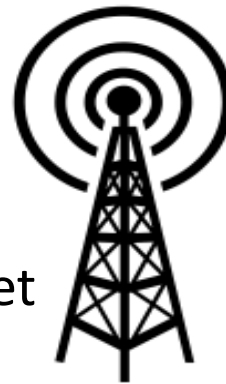
Specifications	TV White Space		When Broadcasters Use
	“Congested”	“Uncongested”	
Transmitter Height	100 feet	300 feet	Up to 1,800 feet
Transmit Power	4 Watts	10 Watts	Up to 50,000 Watts



100 feet



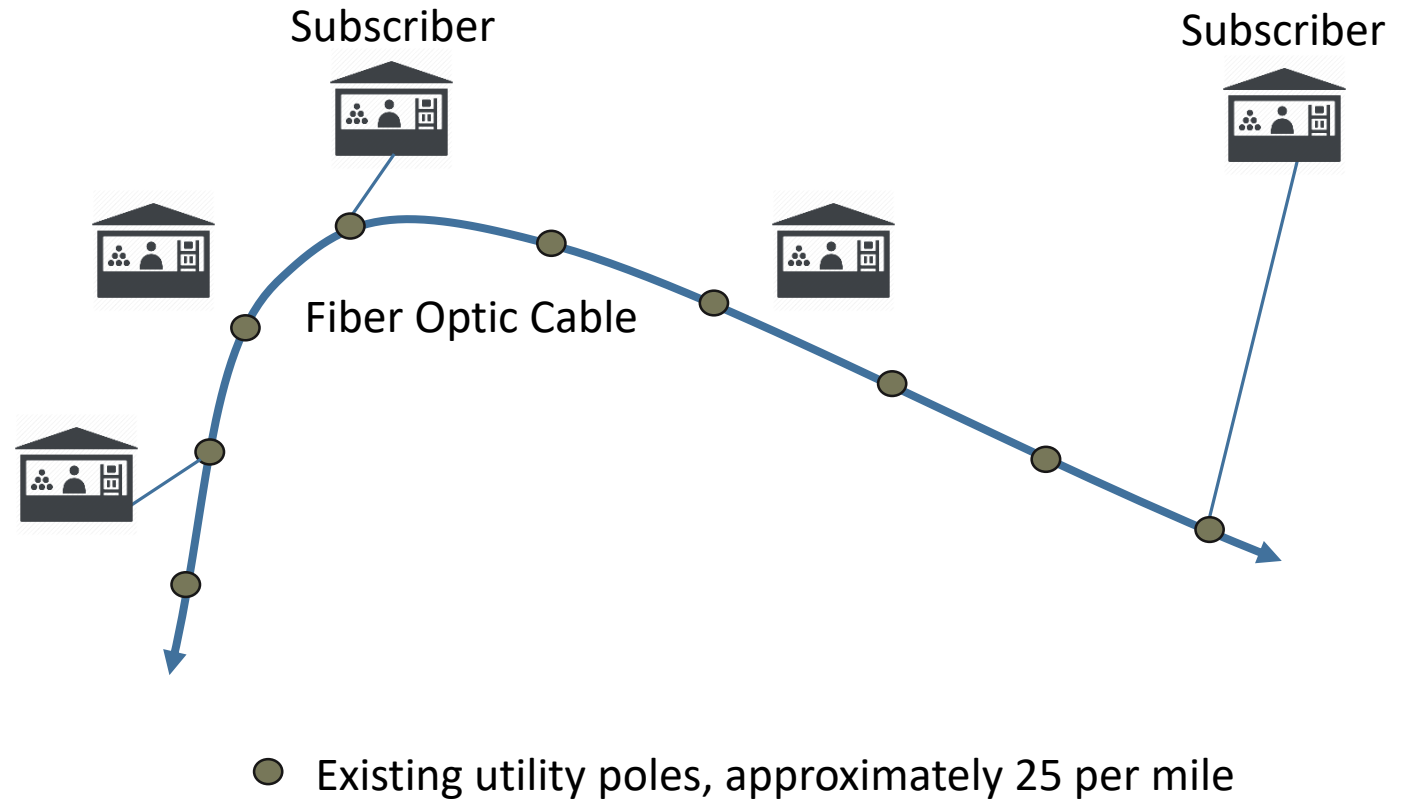
300 feet



1,000 feet

Fiber-to-the-Premise Only option for 100% Coverage

- Tremendous capacity, initial and for growth over time
- Stable services
- High capital costs, low operating costs
- 30+ year lifetime
- Foundation required for other services including mobile
- Would leapfrog the region
- Efficient use of investment



Subsidy Required

Fiber-to-the-Home Financials – 10 Year Lifecycle – Total Replacement of Existing Copper				
	8-County Study Area		34-County Extrapolation	
	Rural Expanse Only	All Areas Below 25/3	Rural Expanse Only	All Areas Below 25/3
Square Miles	1,995	2,683	9,164	12,324
Households	20,139	57,873	92,506	265,831
Households per Sq Mi	10.1	21.6	10.1	21.6
Total Fiber Network Costs	\$366 million	\$492 million	\$1.68 billion	\$2.26 billion
Less Projected Revenue	\$ 96 million	\$129 million	\$ 440 million	\$ 592 million
Required Subsidy*	\$270 million	\$363 million	\$1.24 billion	\$1.67 billion
Average Per Household	\$13,416	\$6,279	\$13,416	\$6,279
<p>“Required Subsidy” covers the capital and operating costs of the base fiber infrastructure. 8-county study total = 3,600 square miles; 34-county total = 16,400 square miles</p>				

Last Mile Funding Opportunities

Source	Total Funding	Distribution
FCC Rural Digital Opportunity Fund	\$20 billion in subsidy	Reverse auction
FCC Rural 5G Fund	\$9 billion in subsidy	Reverse auction
USDA ReConnect	\$300 million in grants, \$300 million in loans	Competition
Appalachian Regional Commission	\$25 million in grants	Competition
State of Ohio Broadband Fund	TBD	TBD
Federal Infrastructure Fund	TBD	TBD

Combined are 97x the size of next largest program

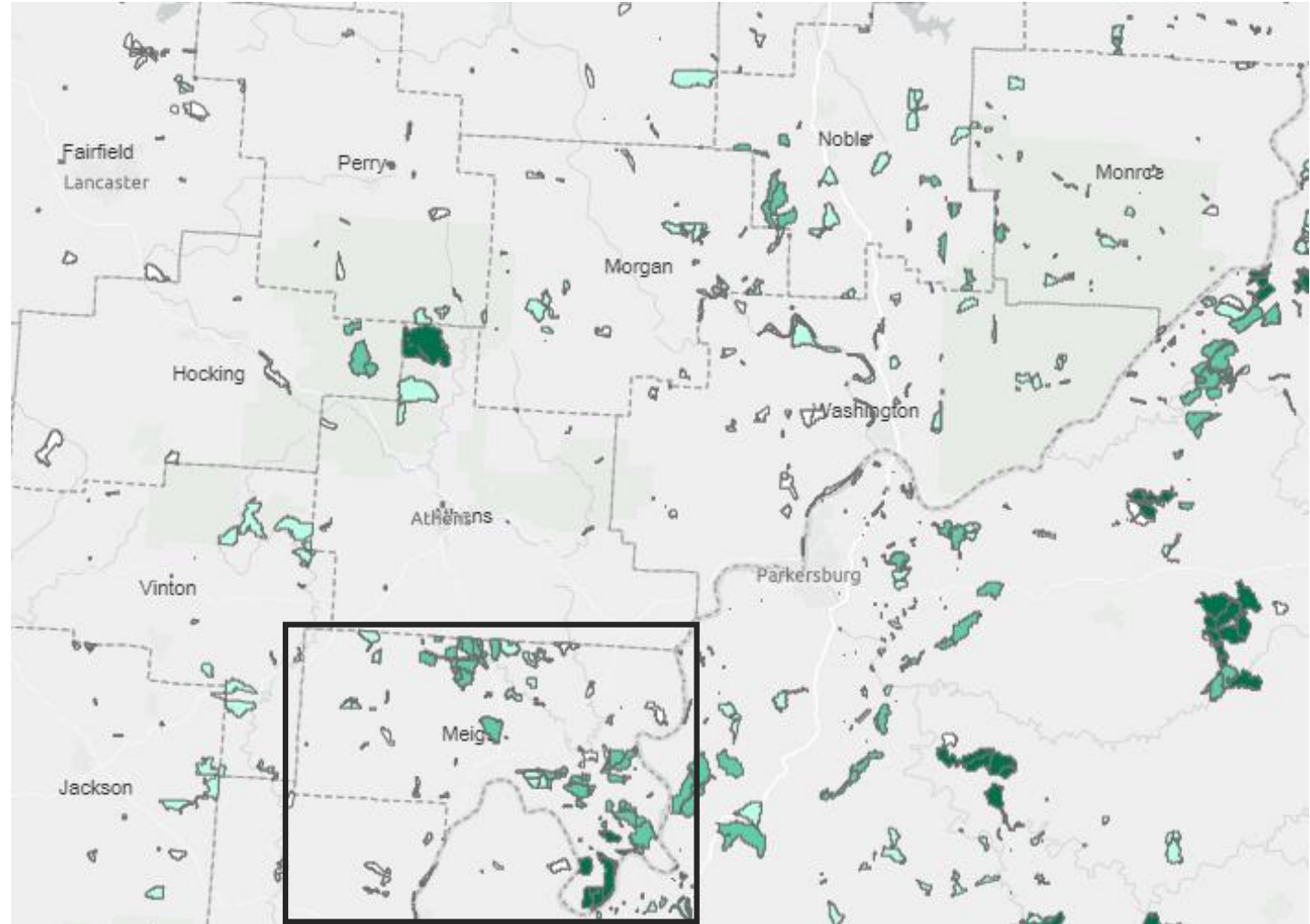
The FCC programs draw monies from the Universal Service Fund, established in 1934 by the US Congress to equip rural America with telecommunications services, paid for by surcharges on telephone bills

Do Not Want to Repeat FCC Auction 903 in 2018

- The scattered teal-shaded census blocks were identified by FCC as unserved
- Ten-year subsidy offered
- In Meigs County, Ohio, the FCC funding totaled \$3.3 million

\$1.5 billion awarded nationwide

- **No one bid on any of the census blocks in Appalachian Ohio**
- The subsidy offered in these areas was too low to attract bidders



Fiber-to-the-Premise Determining FCC Reserve Price

Connect America Cost Model (CAM)

Pass the House

Connect to the Subscribers

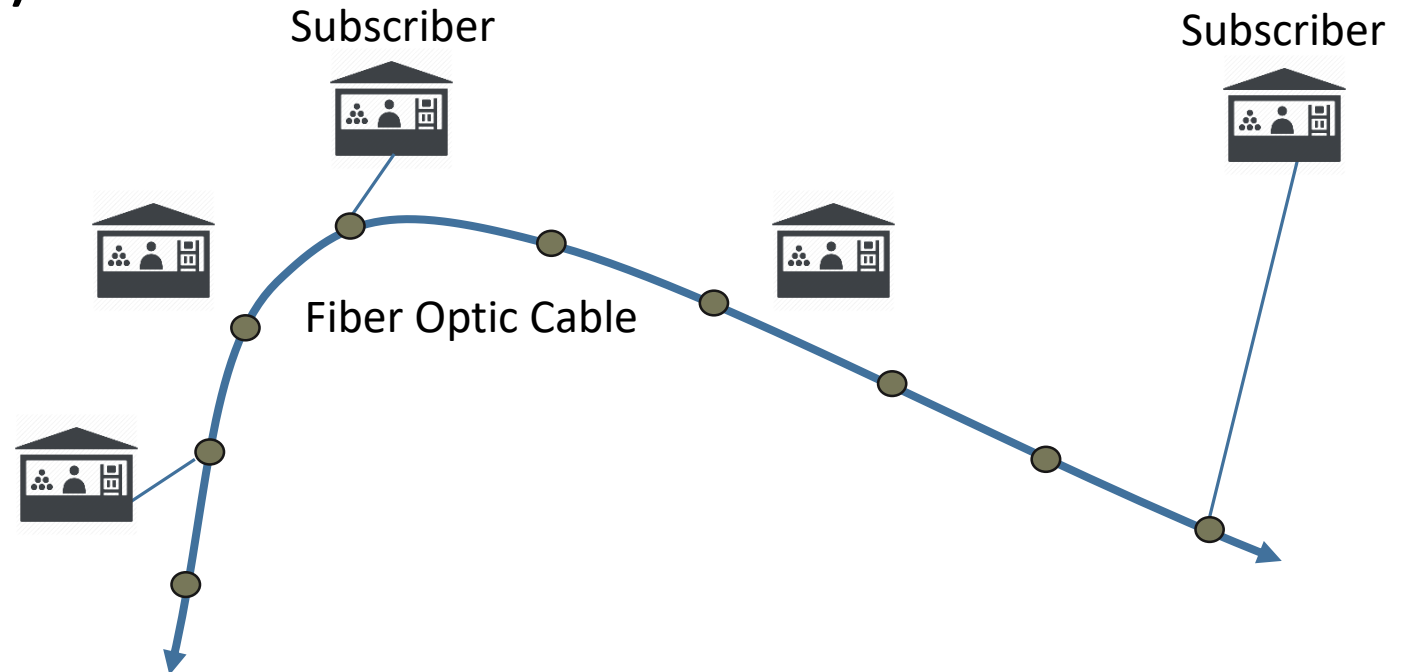
Operate and Maintain the Service

Less Projected Revenue

% Market Penetration

\$ of Average Bill

Equals the **Reserve Price**
offered in reverse auction



● Existing utility poles, approximately 25 per mile

Costs and Reserve Requirements

Cost Element	Per Mile	Per Household	Monthly	
			BHRC "Mini-CAM"	FCC CAM, Auction 903
Base Fiber Infrastructure to Pass	\$30,432	\$3,900	\$33	Calculated based on FCC Connect America Fund Model (CAM)
Base Make-Ready to Pass	\$25,080	\$3,200	\$27	
Base Operations and Maintenance			\$24	
Subscriber Costs – Allocated*		\$731	\$25	
Monthly Costs = Connect America Fund Model			\$109	\$87 to \$116
Average Revenue per Subscriber			\$50	\$75
Market Penetration in First Six Years			x 40%	x 70%
Less Subscriber Revenue Offset			- \$20	- \$53
Reserve Price in RDOF Auction			\$89	\$34 to \$63

CAM may underestimate make-ready costs in Appalachia

* Subscriber costs of \$2,200 plus \$34 per month for the projected 40% take-rate extended across the entire base of eligible premises

FCC Rural Digital Opportunity Fund

- **\$20 billion, 10-Year Program**
 - FCC [Notice of Proposed Rule Making](#) and [Our Filed Comments](#)
 - By far the largest source of last mile funding on the horizon
- Crucial modifications to deliver higher subsidy per household
 1. **Strongly favor gigabit speeds in auction weighting**
to incentivize long-term investments, e.g. fiber-to-the-premise
 2. **Lower market penetration assumption to 40%**
from the current FCC assumption of 70%
 3. **Lower the average revenue per household to \$50**
from the current FCC assumption of \$75



Nationwide only 45 entities filed reply comments in October regarding the program
19 of which came from Appalachian Ohio in support of Buckeye Hills comment filing

Infrastructure Takes Time

Rural Digital Opportunity Fund (RDOF) Example

Event	Year – Quarter
FCC Issues RDOF Order (after considering all comments received in 2019)	2020 - Q1
FCC Issues List of Eligible Census Blocks and Conducts Challenge Process	2020 – Q2
FCC Conducts Phase 1 Auction	2020 – Q4
FCC Releases Funding After Due Diligence of Auction Winners	2021 – Q4
Auction Winners Reaches 40% of Homes (Year 3)	2024 – Q4
Auction Winners Reaches 95% to 100% of Homes (Year 6)	2027 – Q4
RDOF Funding Expires	2031 – Q4

- **This example illustrates the long duration of infrastructure projects**
- Other funding programs such as ReConnect will incur similarly long processes
- Actual dates for FCC actions remain indeterminant

Suggested Next Steps

- Continue voicing your concerns to State and Federal legislators
- Apply for planning grants to prepare applications for implementation grants
- Support efforts by electric companies and co-ops to participate in fiber to the home deployments

The region needs to speak with a unified message!