Broadband Assessment
Wayne County, West Virginia

Final Report

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B R A S G
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2   Executive Summary

This report documents a comprehensive needs assessment of high-speed Internet services in Wayne County, West Virginia. The study was conducted in the Winter and Spring of 2020.

This report identifies thirty-one communities in the County that need assistance in either attaining high-speed Internet service or improving the existing service. It would be natural to assume these 31 communities encompass all households to be remediated; it does not. There are certainly households in the study area that are not included in this report. We are confident that we have identified the preponderance of communities in need.

Wayne County is typical of many West Virginia counties; there is a decreasing population, and the loss of coal mining jobs has fueled the exodus of the workforce who have readily transferable skills. In total, just over 4,800 households are un-served or under-served.

Community	Status	Household Count	Net Household Count
Beech Fork Campground	unserved	35	33
Beech Fork Marina	unserved	64	60
Beech Fork/East Lynn	unserved	81	79
Cove Gap	unserved	69	69
Crum	unserved	126	123
East Lynn to Lincoln County	unserved	57	57
Fisher Bowen	unserved	66	65
Genoa	unserved	144	142
Glenhayes	unserved	118	118
Kiahsville	unserved	55	52
Laurel	unserved	52	48
Lick Creek	unserved	34	31
McComas	unserved	66	65
Patrick Creek	unserved	84	81
Radnor	unserved	83	79
Sweetwater	unserved	32	30
Upper Gragston	unserved	33	29
Wilsondale	unserved	36	33
		1,235	1,194

Community	Status	Household Count	Net Household Count
Ardel	underserved	291	285
Beech Fork/Lavalette	underserved	187	185
Buffalo Creek	underserved	994	993
Cabwaylingo SP Campground	underserved	50	49
Centerville	underserved	118	118
Dunlow	underserved	100	96
East Lynn	underserved	81	79
Fort Gay	underserved	552	551
Kermit	underserved	32	32
Prichard	underserved	256	253
Shoals	underserved	716	704
Stepptown	underserved	104	104
Whites Creek	underserved	102	95
		3,583	3,544

Our estimate of the Capital Cost to solve this problem is roughly $18 Million. $8 Million to build a fiber optic network to serve each of the 31 communities and $10 Million to build a middle mile, or backbone, network to connect each community to a Network Access Point (NAP) to provide Internet service.

The County leadership articulated four objectives for the project team:

1. Every citizen of Wayne County should have access to high-speed Internet service if they desire it.
2. The service should meet the FCC definition of minimum broadband speeds of 25 Megabits per second (Mbps) down and 3 Mbps up.
3. The service should be "always on," that is exceptionally reliable with no weather-related outages.
4. The service provider / operator of the network should be an existing regional provider. The County has no interest in operating a communications network.

There is a scarcity of fiber optic capacity in Wayne County. It is believed the only fiber is operated by Frontier and was funded by the Broadband Technology Opportunity Fund (BTOP). The $126 Million award went to Frontier Communications who used the resources to develop a fiber network to all community anchor institutions. However, the fiber was deployed in a way that it is not useable by non-Frontier service providers. Therefore, for all intents and purposes, there is no fiber capacity in Wayne County that can be leveraged to remediate the current situation.

Using a decision model with five criteria, validated by the client, the consulting team rank-ordered the 31 communities by level of need. The list at the right identifies these communities in descending order of level of need, and the total number of points each community was assigned in the decision model. The highest need community is Cove Gap.

Of course, because there is essentially no fiber backbone in the County, one must be constructed. There is no sense undertaking a build-out in any of these communities. Our plan is to start in the north and interconnect with a carrier who has access to a tier 1 Network Access Point (NAP) and wholesale Internet. The current thinking is Mountwest Community and Technical College would be the best place to begin. So, we will be building from the North to the South. The actual backbone construction could change the thinking about which communities are built-out and turned-up first.

We recommend the regional planners work aggressively to identify sources of capital to build the backbone and the 31 community networks. There are a number of service providers who have expressed an interest in operating the networks if grant funding is available to build out the communities.

We strongly encourage the regional planners to ensure the assets are community assets, not service provider assets.

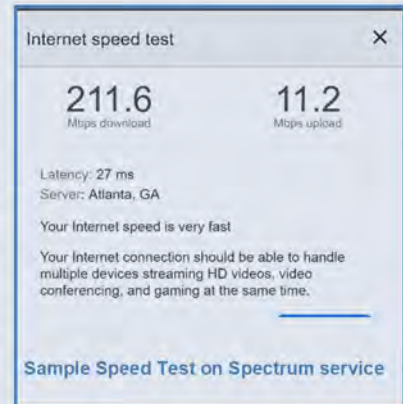| Community	Total Points
Cove Gap	77.4
Beech Fork/East Lynn	77.0
Kiahsville	76.9
Fisher Bowen	75.8
Patrick Creek	74.7
Radnor	72.7
Genoa	72.6
Laurel	70.5
McComas	69.5
East Lynn to Lincoln County	69.0
East Lynn	62.7
Wilsondale	61.2
Beech Fork Marina	59.2
Sweetwater	55.8
Lick Creek	54.1
Cabwaylingo SP Campground	49.3
Beech Fork Campground	49.3
Upper Gragston	48.4
Glenhayes	46.9
Crum	46.0
Stepptown	42.3
Shoals	40.0
Buffalo Creek	39.4
Beech Fork/Lavalette	36.8
Ardel	36.0
Prichard	35.5
Dunlow	35.3
Whites Creek	34.5
Kermit	34.2
Fort Gay	33.8
Centerville	33.8

What is Broadband and High-Speed Internet?

The definition of Broadband has been a constantly changing value as services and applications have become more sophisticated and feature-rich, requiring more and more bandwidth to deliver a satisfactory user experience.

In 1994, when the Internet was generally considered to be "born," a 56 kilobit dial-up line and phone modem were sufficient for email messages, chat rooms, message boards, and fee-based services like Prodigy and America online. At the time, 1.5 megabits per second (Mbps) was considered the threshold for broadband services. This was a business-class service and was synchronous, meaning 1.5 Mbps up and down.

The Federal Communications Commission (FCC), today considers residential broadband service to be a minimum of 23 Mbps down X 3 Mbps up.

It is quite common today to find Cable TV service offering 100 to 400 Mbps down, and 10 to 15 Mbps up. This service costs between $50 and $65 per month depending upon the local market.

Services like Netflix state they need at least a 25 Mbps down connection for users to have a quality experience with HD TV. From first-hand experience, this is an understatement; much more bandwidth is required for a satisfactory experience.

Internet speed test	×
211.6 Mbps download	**11.2** Mbps upload

Latency: 27 ms
Server: Atlanta, GA

Your Internet speed is very fast

Your Internet connection should be able to handle multiple devices streaming HD videos, video conferencing, and gaming at the same time.

Sample Speed Test on Spectrum service

Business Class Service and Residential Service.

Business Class Service is a dedicated service, meaning no other users are sharing that pipe or bandwidth. If a business subscribes to 100 Mbps, they are getting precisely that much bandwidth up and down. Dedicated service is significantly more expensive than residential service. A dedicated 100 Mbps service will cost between $600 and $1,200 per month depending upon market conditions. Residential service is "over-subscribed," meaning many people are sharing the same pipe. Depending upon network architecture, several hundred to 1,000 end users can be on the same 100 Mbps service.

Minimum Recommended Speeds for Residential Use:

| 10 Mbps	20 Mbps	50 Mbps	100 Mbps
• Email • IP Telephone • Few devices connected • One or two users	• All 10 Mbps services, plus: • Occasional Streaming video service on one device • ~ 10 Internet connected devices	• All 20 Mbps services, plus: • Daily audio streaming • ~ 20 Internet connected devices • 4k HD video stream	• All 50 Mbps services, plus: • Multi-user on-line gaming • 30 or more Internet connected devices • Four people in household watching multiple HD streams

3   Introduction

This report documents a comprehensive needs assessment of broadband services in Wayne County, West Virginia. The assessment was conducted in the Winter and Spring of 2020.

This report identifies thirty-one (31) communities in the County that need assistance in attaining high-speed Internet service or improving the existing service. It would be natural to assume these 31 communities encompass all households to be remediated; it does not. There are certainly households in the study area that are not included in this report. We are confident that we have identified the preponderance of communities in need, but there are certainly outlying households not included in this report.

3.1   Project Area

Wayne County is not unique among communities in West Virginia. The Study Area has a total population of just under 40,000 and has been experiencing a loss of population over the past decade. The citizens of the Study Area are, on average, disadvantaged relative to their peers in West Virginia. The citizens living in poverty are nearly 15% higher than the State poverty rate and nearly double the National average of persons living in poverty. Much of this malaise is due to the changing coal mining and mineral extraction business. The loss of coal mining jobs has been particularly hard on Wayne County as

Wayne County, West Virginia

those with portable skills (job skills that can be utilized in other markets and industries) have left Wayne County exacerbating the problem. It has been said that the County's greatest export is its educated youth.
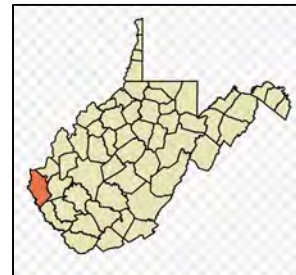
US Census Bureau People Quick Facts	Wayne County	West Virginia	United States
Population estimates, July 1, 2018, (V2018)	39,944	1,805,832	327,167,434
Population, percent change - April 1, 2010 (estimates base) to July 1, 2018, (V2	-6.00%	-2.50%	6.00%
Population, Census, April 1, 2010	42,481	1,852,994	308,745,538
Households, 2013-2017	16,305	737,671	118,825,921
Households with a broadband Internet subscription, percent, 2013-2017	62.80%	70.30%	78.10%
Median household income (in 2017 dollars), 2013-2017	$38,905	$44,061	$57,652
Per capita income in past 12 months (in 2017 dollars), 2013-2017	$20,582	$24,774	$31,177
Persons in poverty, percent	20.90%	17.80%	11.80%

The situation is not hopeless. The County is rich in recreational resources, is located adjacent to the Ohio River, has immediate proximity to the metropolitan area of Huntington and the resources of Marshall University, and a thoughtful and committed County leadership. The County recently abandoned an in-house economic development office and joined ranks with HADCO – the Huntington Area Development Corporation – which is a certified and accredited economic development organization that can bring more resources and energy to economic development efforts in Wayne County.

3.2 Deliverables

The final deliverables of this study include this written report, as well as two presentations to the County Commission and regional leadership. The first presentation was made on February 24th, 2020 when the consulting team completed the economic model and the field work. A second presentation – essentially, the final report -- was made on May 18th 2020 and was delivered via Zoom video conference (the consulting team was located in states with specific executive orders preventing meetings of more than 10 people and with 14-day quarantine restrictions upon returning to their home states). One supplemental deliverable was prepared -- an inventory of vertical assets with proximity to the proposed middle-mile / backbone network. All work products are the property of Wayne County and Region 2 Planning & Development Council.

3.3 Scope of Work and Methodology

The Blue Ridge team was tasked with the following scope of work:

- Identify the specific areas of Wayne County that are un-and-under-served.
- Identify solutions to deliver high-speed Internet service to these areas.
- Develop a preliminary capital cost estimate to remediate the problem.
- Identify the service providers who can deliver service.
- Prioritize a list of communities in greatest need.
- Identify sources of capital and prepare preliminary documentation to support application submittals.

Our methodology to accomplishing this scope of work is outlined in the following six-step process that was presented in our proposal:

To identify the specific needs of each community, Blue Ridge conducted approximately 30 diagnostic interviews with key stakeholders in the region including County and City leaders, IT directors, economic developers, educators, work force development professionals, and business leaders.

Finally, the consulting team interviewed eleven regional service providers to understand their network architecture, coverage areas, concerns, and issues with network deployment in Wayne County. Eight of the service providers expressed an interest in exploring ways to partner with the County to serve residents, two of whom were keenly interested.

4   Project Objectives

The County leadership was clear and consistent in their articulation of the goals for the project:

- **Every citizen of Wayne County should have access to high-speed Internet service if they desire it**. High-speed Internet service is not viewed as a luxury item or a discretionary service. High-speed Internet service is a "must have" to maintain a basic quality of life and to sustain a vibrant community. The consulting team was tasked with solving the un-served problem first, and then addressing the under-served communities. There was little discussion of broadband and economic development. It is understood that to attract industry there is an expectation that the work force must have connectivity at home. As a footnote, when we began this project in early January of 2020, we had little idea of what was ahead of us with the global COVID-19 pandemic. Nothing could have amplified the need for ubiquitous broadband coverage in Wayne County more than this pandemic. The need for reliable, always-on high-speed Internet service to support such applications as distance learning, telemedicine, video conferencing, and remote workplace has never been better understood than in this pandemic.
- **The service should meet the FCC definition of minimum broadband speeds of 25 Mbps down and 3 Mbps up**. We note that since 2000, when most Internet connections were 64 kilobit dial-up connections, the threshold for broadband has been constantly increasing. For this reason, we focused our attentions on solutions that would be easily scalable to meet, what we believe will be, a constantly increasing performance standard for broadband service.
- **The service should be "always on,"** that is, exceptionally reliable with no weather-related outages. Where there is high-speed Internet in Wayne County, we discovered a populace that is weary of constant outages, long duration, and service degraded by weather events.
- **The service provider / operator of the network should be an existing regional provider**. The County has no interest in operating a communications network. The County is operating under the same budget they had in 2011. The loss of revenue from the declining coal-severance tax has resulted in a $1 Million reduction in the County budget. County leaders do not wish to enter into a line of business where they have no experience and no complementing services or skills.

These four guiding principles became the mission for the project.

5   Addressable Market

Part of the Blue Ridge methodology is to develop an economic model defining how large the telecommunications market is in Wayne County. We think it is important to understand the market size and dynamics to be able to measure any impact our remedial actions have. To paraphrase the legendary management thought-leader, Peter Drucker *"you can't manage what you can't measure."*

Using public information from industry sources, government agencies, and companies' 10-K filings, we used the Wayne County demographic information to model the four principal telecommunications services:

1. Voice service (traditional circuit-switched telephony, and Voice Over Internet Protocol (VOIP)),
2. Video service (both traditional cable TV service and also Direct Broadcast Satellite Service (DBS)),
3. High-speed Internet service, and
4. Wireless services (what is traditionally called cellular service but is actually PCS or 4g LTE).

The total addressable market for all communications services in both the residential and commercial markets is about $45 Million, annually. If the current trends in demographics continue, and broadband is expanded from its current level – estimated at 60% -- to all those who desire it, the total communications market will grow to about $60 Million in the next ten years.
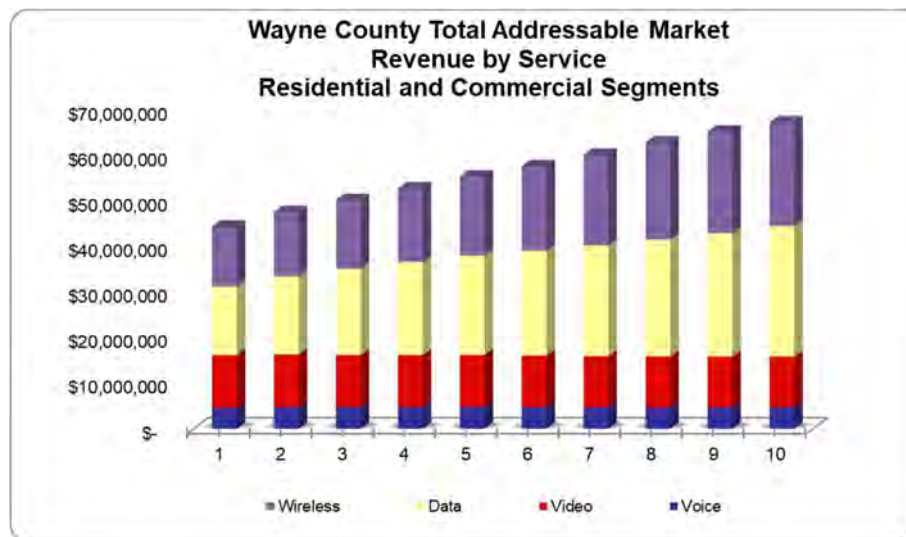

The consulting team's charter was to concentrate on the residential market, and within that market focus on high-speed Internet service.

Within the residential market there are some important trends occurring.

- First, is the migration away from circuit-switched telephony and migrating toward wireless telephony as the principal voice service – so-called "cord cutting." Of course, this requires a stable and reliable wireless network. We understand from the emergency-services professional in Wayne County that over 16,000 landlines have been terminated. We assume this is principally in the northern part of Wayne County where wireless networks are the most robust. Today, 51% of American households are wireless only. Of the remaining 49% with a landline, 40% have both a wireless subscription and landline. These customers must be assumed to be potential cord cutters in the future. This trend results in less and less revenue for traditional phone companies like Frontier, the Incumbent Local Exchange Carrier (ILEC) in Wayne County. Fewer access lines, fewer revenues, and fewer customers result in diminished resources to maintain and operate the network. This vicious downward spiral has presented a particularly challenging business environment for companies like Frontier, and the problem is heightened in Wayne County where there a low-density customer base.
- Much of the video content for entertainment is migrating to an Internet Protocol (IP) service, often referred to as a "streaming service." This has resulted in a migration away from traditional multi-channel cable TV service. This trend is called "cable cutting." Some interesting statistics about cable-cutters:
  - In 2019, there were 39.3 Million cable-cutters in the United States,
  - 24% of TV viewers under 35 do not subscribe to traditional pay TV; half of those have never had cable TV in their lives,
  - The biggest cable TV provider, Comcast, has 22 Million subscribers; Netflix has 182 Million users as of June 2020, and
  - Subscription TV providers (CATV and Satellite) lost 5.8 Million subscribers in 2019.

The take-away from this analysis is that voice services are migrating to wireless. Video service is becoming a data service. Wireless and Internet service are the two growth markets for the future of
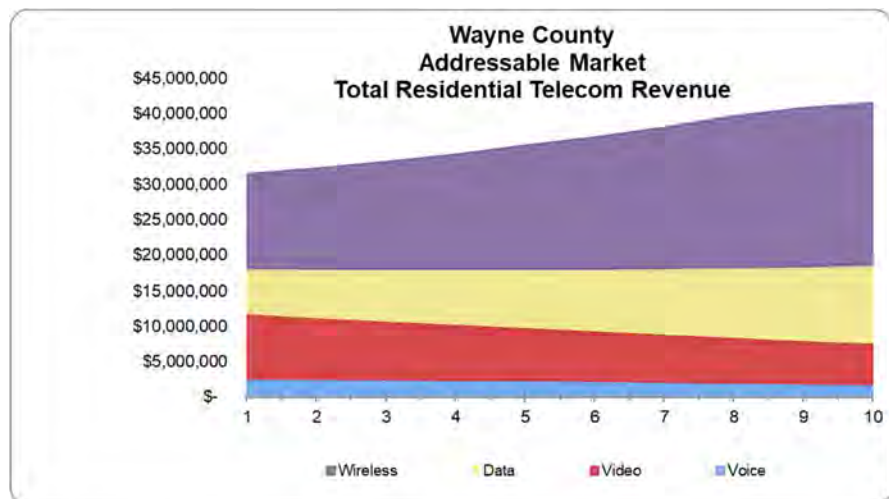
communications services. Currently, this is about a $7 Million market, annually. The potential for this market is to grow to about $12 Million in 10 years as broadband availability is expanded.

6   Identification of Communities

Thirty-one (31) communities were identified as needing improvement in high-speed Internet. Eighteen (18) communities are unserved by high-speed Internet service. The only alternative they may have is satellite-based Internet service. These 18 communities represent an estimated 1,279 homes in Wayne County. Nationally, about 6% of households are un-served with high-speed Internet. This level of unserved homes represents about 8% of the housing units in Wayne County – slightly higher than the national average. To validate these findings, we visited several communities and conducted person-on-the-street discussions to confirm the assessment.

	Un-Served Communities	Households
1	Beech Fork Campground	46
2	Beech Fork Marina	60
3	Beech Fork/East Lynn	64
4	Cove Gap	74
5	Crum	122
6	East Lynn to Lincoln County	57
7	Fisher Bowen	66
8	Genoa	169
9	Glenhayes	121
10	Kiahsville	55
11	Laurel	69
12	Lick Creek	39
13	McComas	64
14	Patrick Creek	86
15	Radnor	85
16	Sweetwater	33
17	Upper Gragston	33
18	Wilsondale	36
	Total	**1,279**

The balance of the 31 communities identified for remediation have some level of [High Speed Internet](#); however, it is either too slow to meet current and emerging bandwidth demands, or is unreliable in its system availability. Typically, this is a DSL (digital subscriber line) with aspirational service of 3 Mbps downstream speed and .5 Mbps upstream. These 13 communities are identified in the table to the right. There are an estimated 3,526 households in this under-served group.

	Under-Served Communities	Households
1	Ardel	226
2	Beech Fork/Lavalette	133
3	Buffalo Creek	1,060
4	Cabwaylingo SP campground	50
5	Centerville	142
6	Dunlow	100
7	East Lynn	83
8	Fort Gay	556
9	Kermit	30
10	Prichard	263
11	Shoals	675
12	Stepptown (Stonewall)	108
13	Whites Creek	100
	Total	**3,526**

It should be noted that there are almost certainly some households in Wayne County, either un-or-under served with high-speed Internet, that were not identified. The consulting team is confident that we have identified the preponderance of households in need of remediation, and there are probably less than 5% of homes in need that were not identified. Based upon previous projects, possibly as low as 2%. These are households that are typically not in a defined community and are in remote, outlying, areas. This is not to say they should be overlooked, but they will have to be addressed on an individual-case basis as they are identified.

6.1 Prioritization of Communities

Methodology

Using the objectives identified early in the project, and working with regional planners, we developed a ranking model to prioritize each of the 31 communities.

1. A completely unserved community received 25 points; an under-served community received no points.

2. 25 points were allocated to communities with the lowest capital cost (CAPEX) estimate per household. CAPEX is driven by the length of the fiber drop from the street to the home and the density of a community -- the denser the housing units, the lower the CAPEX per household.

3. 25 points were allocated to households with an LMI level (low- and moderate-income) of greater than 51%. There are 18 communities in the study that meet this criterion. The highest LMI is 73%; the lowest is 51%. The logic in using this criterion is that communities with an LMI > 51% will have greater eligibility for grant funding to address the need.

4. As noted earlier, there is little fiber optic capacity in Wayne County. A middle-mile backbone system will be required to serve these communities. The initial thinking is that the network will be built from the north to the south. This is explained in more detail later in this report. 15 points were allocated to the most northern communities and zero to the most southern. Points allocation was scaled for the balance of communities.

5. Finally, there is an important initiative being deployed in Wayne County. The Hatfield McCoy Trail is a 700+ mile system of off-road trails for recreational vehicle use. In 2020 the trail systems is being expanded into Wayne County. This attraction brings over 56,000 visitors to the trail system each year. The Hatfield McCoy Trail is an important part of Wayne County's economic-development tourism strategy. Visitors will expect to have access to high-speed Internet when they use the campgrounds along the trail. Communities affected were allocated an additional 15 points.

Criterion	Maximum Points	Minimum Points
Un-or-under-served Community	25 Points: Un-served	0 Points: Under-served
Cost per Household and Scale	25 Points: Lowest cost-per-home, highest density	0 Points: Highest cost-per-home, low density
Is the Community a HUD Distressed Community? LMI>51%	25 Points: Yes	0 Points: No
Proximity to NAP	15 Points: Northern most community	0 Points: Southern most community
Hatfield McCoy Trail Impact	10 Points: This community is important for the Hatfield McCoy Trail	0 Points: The community has no impact on the Hatfield McCoy Trail
Total Possible Points	**100**	

Using this ranking methodology, the team developed a model that evaluates and ranks all 31 communities of interest. The community that generates the highest overall score should, theoretically, be the one that is addressed first. Of course, in network deployments there are always additional circumstances to consider – a new trench may be opening for a water project that would provide more cost-effective network deployment, or a unique grant may become available for a certain condition that changes the order of communities. In the case of Wayne County, because there is essentially no fiber middle-mile in the County, the topology of how the backbone is deployed will have a great impact on which communities are turned up first.

This prioritization is a guideline only to be used to prioritize focus.

Community	Status	Net Household Count	Cost per Home at 60% penetration	Un-served or Under-served. 25 points or 0	Cost to serve: 25 points for lowest cost	LMI Allocate 25 points for communities over 51%	Northern-most 15 points	Hatfield McCoy Trail. 10 Points	Total Points
Cove Gap	unserved	69	$ 3,478	25	18.8	24	10	0	77.4
Beech Fork/East Lynn	unserved	79	$ 3,533	25	18.6	21	12	0	77.0
Kiahsville	unserved	52	$ 3,639	25	18.2	24	10	0	76.9
Fisher Bowen	unserved	65	$ 4,331	25	15.9	21	14	0	75.8
Patrick Creek	unserved	81	$ 3,522	25	18.6	19	12	0	74.7
Radnor	unserved	79	$ 3,833	25	17.6	20	10	0	72.7
Genoa	unserved	142	$ 4,000	25	17.0	21	10	0	72.6
Laurel	unserved	48	$ 4,161	25	16.5	19	10	0	70.5
McComas	unserved	65	$ 4,748	25	14.5	25	5	0	69.5
East Lynn to Lincoln County	unserved	57	$ 4,614	25	15.0	19	10	0	69.0
East Lynn	underserved	79	$ 3,589	0	18.4	24	10	10	62.7
Wilsondale	unserved	33	$ 5,312	25	12.7	24	0	0	61.2
Beech Fork Marina	unserved	60	$ 3,057	25	20.2	0	14	0	59.2
Sweetwater	unserved	30	$ 8,431	25	2.3	24	5	0	55.8
Lick Creek	unserved	31	$ 9,114	25	0.0	19	10	0	54.1
Cabwaylingo SP Campground	underserved	49	$ 5,873	0	10.8	24	5	10	49.3
Beech Fork Campground	unserved	33	$ 6,021	25	10.3	0	14	0	49.3
Upper Gragston	unserved	29	$ 5,693	25	11.4	0	12	0	48.4
Glenhayes	unserved	118	$ 4,040	25	16.9	0	5	0	46.9
Crum	unserved	123	$ 2,808	25	21.0	0	0	0	46.0
Stepptown	underserved	104	$ 2,061	0	23.5	19	0	0	42.3
Shoals	underserved	704	$ 1,605	0	25.0	0	15	0	40.0
Buffalo Creek	underserved	993	$ 1,798	0	24.4	0	15	0	39.4
Beech Fork/Lavalette	underserved	185	$ 2,259	0	22.8	0	14	0	36.8
Ardel	underserved	285	$ 2,519	0	22.0	0	14	0	36.0
Prichard	underserved	253	$ 2,042	0	23.5	0	12	0	35.5
Dunlow	underserved	96	$ 5,612	0	11.7	19	5	0	35.3
Whites Creek	underserved	95	$ 2,953	0	20.5	0	14	0	34.5
Kermit	underserved	32	$ 4,505	0	15.3	19	0	0	34.2
Fort Gay	underserved	551	$ 1,958	0	23.8	0	10	0	33.8
Centerville	underserved	118	$ 3,166	0	19.8	0	14	0	33.8

7   Capital Cost Estimate

It is impossible to precisely forecast the Capital Expenditure (CAPEX) to solve all problems, without a network-design basis to use for cost estimating. However, there is a sufficiently large frame-of-reference with other projects that a credible cost estimate can be developed. A general cost estimate will be a useful tool for regional planners, but this should be considered a Preliminary Engineering Report (PER), not an actual designed and permitted cost estimate.

Cost Estimating Assumptions:

The following assumptions were used for developing the frame-of-reference for both a Fiber to the Home (FTTH) and a wireless deployment:

Base-case Planning assumptions for Wayne County projects:		
Backbone Aerial:		
Cost per mile to Engineer, Design, and Permit a BACKBONE network	$	3,000
Cost per mile for Aerial backbone build	$	30,000
Cost per mile for make-ready on existing poles	$	18,900
Neighborhood Setup		
288 PON cabinet	$	5,000
1:32 splitter	$	600
PON Blade	$	9,500
Emerson Cabinet for neighborhood, with battery and dist. Panel	$	10,000
Optics for cabinet	$	5,600
Chassis	$	800
Central Office Optics	$	1,500
Fiber Drop:		
Cost per foot for aerial drop to premises	$	2.30
Cost per foot for UG drop to premises	$	4.00
Survey	$	75
NID	$	165
ONT	$	176
Cables	$	6
Inside installation	$	300
Wireless:		
Cost to turn up a Wireless backbone site	$	2,000
Cost to turn up a Wireless customer	$	300
Shelter and Electronics if needed		
Cost of electronics set for POP	$	25,000
POP shelter building without generator	$	20,000

Housing density is a major factor for FTTH deployments. The length of the fiber drop from the backbone to the residence is the single largest variable cost in the overall

deployment. The length of fiber extension from the existing backbone to the community to be served is also a density-driven variable. All other costs are fixed costs and do not vary with density: The Optical Network Terminating (ONT) device, the Network Interface Device (NID), etc., are all fixed costs.

Estimate of CAPEX per Community:

Using the methodology described above, we formulated the CAPEX estimates for an FTTH deployment for each of the 31 communities. We did not evaluate fixed-wireless technology as an option. We are concerned that given the mountainous terrain of Wayne County, the dense deciduous forests, and the limitations of wireless networks, it was not an optimal long-term solution for Wayne County. Fiber-to-the-Home is the gold standard for network deployment and will result in a scalable, evolvable, and future-proofed network that provides a long-term solution.

For planning purposes, penetration rates of 50%, 60%, and 70% were modeled. The greater the take rate, or penetration, the lower the cost per home, as there are certain fixed costs that will be spread out among more households. The estimate of the total CAPEX should be looked at in terms of community build out and backbone costs – two discrete cost components. This is noted because there are two potential middle-mile projects in the planning stages that could reduce the need to develop a unique Wayne County backbone.

If these other projects do not develop, then Wayne County must develop a backbone – or middle-mile fiber network – to connect each of the 31 communities to a transport network that provides wholesale Internet and connectivity to a Tier 1 Network Access Point.

Within each community a fiber network deployment was planned. These network plans can be viewed in the attachments to this report. There are some homes within each community that are simply too far off the main roads to be addressed at this time. In total there are 4,805 homes in the 31 communities. When the 31 communities were laid out, there were 80 homes that fell into this category – about 1.6% of the total. The consulting team is not advocating abandoning these households, but rather evaluate them on an individual-case basis after the core community network is built. On average each of these 80 homes would add one mile of fiber cable to the deployment; several homes would add multiple miles. For now, the recommendation is to strive to make an immediate impact to display early success.

In total, the cost to deploy these 31 community networks is estimated at just under $8 Million. The following table identifies the cost estimate per community as well as the average CAPEX per household.

CAPEX Community Cost and Cost per Household

Community	Status	Net Household Count	Community Total Cost at 60% penetration	Average Cost per Household at 60% penetration
Ardel	underserved	285	$ 430,705	$ 2,519
Beech Fork Campground	unserved	33	$ 119,224	$ 6,021
Beech Fork Marina	unserved	60	$ 110,040	$ 3,057
Beech Fork/East Lynn	unserved	79	$ 167,442	$ 3,533
Beech Fork/Lavalette	underserved	185	$ 250,734	$ 2,259
Buffalo Creek	underserved	993	$ 1,071,216	$ 1,798
Cabwaylingo SP Campground	underserved	49	$ 172,674	$ 5,873
Centerville	underserved	118	$ 224,118	$ 3,166
Cove Gap	unserved	69	$ 143,996	$ 3,478
Crum	unserved	123	$ 207,244	$ 2,808
Dunlow	underserved	96	$ 323,261	$ 5,612
East Lynn	underserved	79	$ 170,130	$ 3,589
East Lynn to Lincoln County	unserved	57	$ 157,809	$ 4,614
Fisher Bowen	unserved	65	$ 168,906	$ 4,331
Fort Gay	underserved	551	$ 647,332	$ 1,958
Genoa	unserved	142	$ 340,838	$ 4,000
Glenhayes	unserved	118	$ 286,054	$ 4,040
Kermit	underserved	32	$ 86,486	$ 4,505
Kiahsville	unserved	52	$ 113,544	$ 3,639
Laurel	unserved	48	$ 119,837	$ 4,161
Lick Creek	unserved	31	$ 169,511	$ 9,114
McComas	unserved	65	$ 185,178	$ 4,748
Patrick Creek	unserved	81	$ 171,157	$ 3,522
Prichard	underserved	253	$ 310,035	$ 2,042
Radnor	unserved	79	$ 181,695	$ 3,833
Shoals	underserved	704	$ 677,855	$ 1,605
Stepptown	underserved	104	$ 128,621	$ 2,061
Sweetwater	unserved	30	$ 151,764	$ 8,431
Upper Gragston	unserved	29	$ 99,066	$ 5,693
Whites Creek	underserved	95	$ 168,294	$ 2,953
Wilsondale	unserved	33	$ 105,174	$ 5,312
		4,738	**$ 7,659,940**	**$ 2,695**

Estimate of Middle-Mile CAPEX:

As noted earlier in this report – there is no benefit to build a communication network in any of the 31 communities without having the ability to connect that community to the public Internet -- global system of interconnected computer networks that uses the Internet protocol suite to communicate. The consulting team evaluated multiple alternatives to accomplish this. The scarcity of fiber optic capacity in Wayne County results in concluding that for the maximum benefit of the County and the long term needs of citizens, businesses, and County services a fiber optic backbone network will be required.
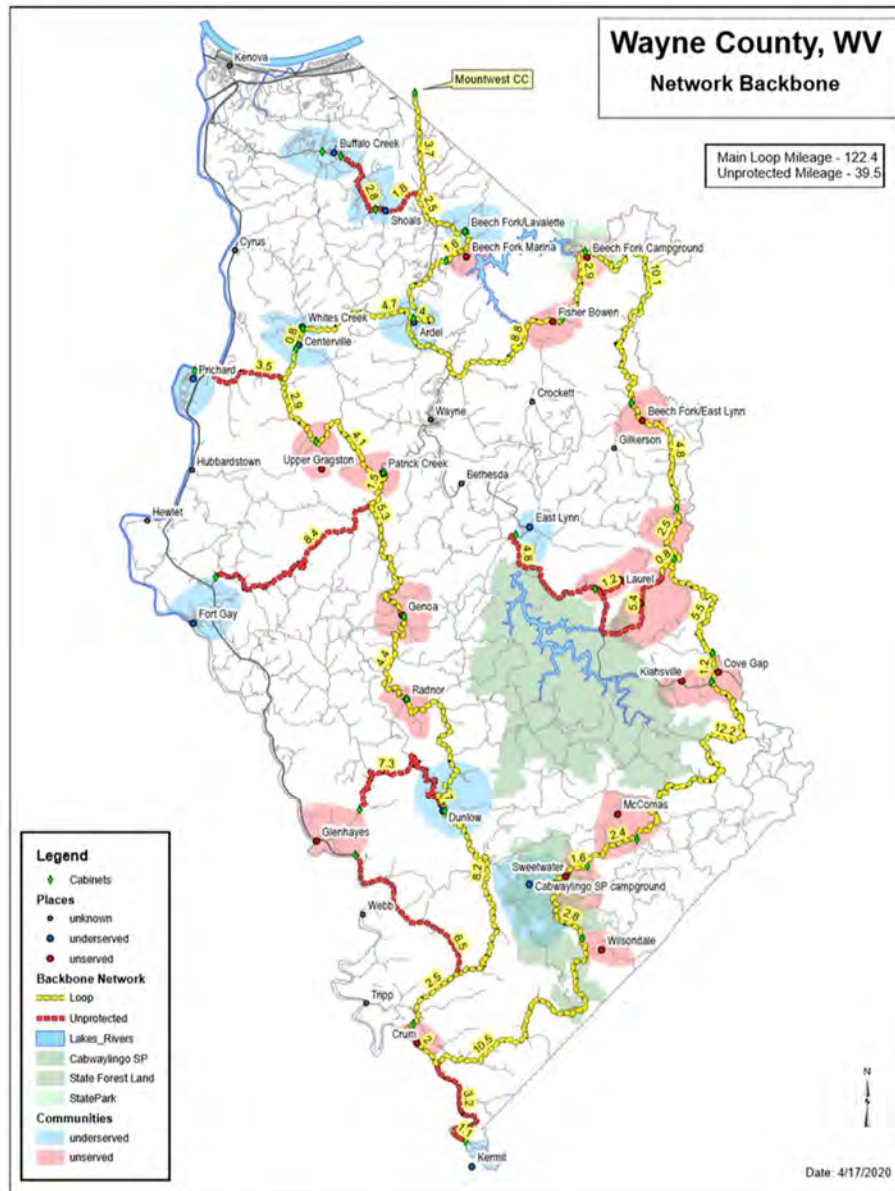
This backbone plan calls for a fiber optic interconnection (a network-to-network interface NNI) at Mountwest Community and Technical College on the border of Wayne and Cabell Counties. The interface will be with a carrier-grade network operator who can provide direct fiber connection to the major data centers on the East Coast or Midwest. These so-called Network Access Points (NAPs) are public Internet connection facilities where Internet Service Providers (ISPs) connect with one another in peering arrangements.

The backbone will require about 175 miles of new fiber optic network, built in a ring configuration to provide for network resilience and protection. The general network diagram (above) outlines the ring, the unprotected laterals, and a few options for the laterals.

It is estimated this backbone ring will require a CAPEX of approximately $10 Million.

There are other options to provide the Internet connection from a single community network to the public Internet. Microwave could provide a single point-to-point path for an interim or start-up solution. Microwave will not provide the same level of quality, capacity, or resilience as a fiber ring, and an NNI to a carrier will still be required. However, if funding is available to build out a single community network before the backbone can be funded, microwave should be used for a start-up solution. Any incremental improvement, no matter the deficiencies, should be pursued.

It was mentioned earlier in this report that there were two alternative solutions which could provide a partial or complete backbone solution for Wayne County.

1. Appalachian Power Company (APCo) has conducted and presented its Broadband Feasibility Study to the West Virginia Broadband Enhancement Council pursuant to West Virginia Code Sec. 31G-4-5 for a proposed project in portions of Logan and Mingo Counties. https://broadband.wv.gov/news/broadband-feasibility-study-submitted-to-the-wvbec-by-appalachian-power-company-and-wheeling-power-company/   This network could provide an interconnection point in the southern-most part of Wayne County near Kermit. This would change the order of the buildout and allow us to avoid about 7 miles of backbone buildout – not a material amount.

2. There is a middle mile initiative being evaluated by the Center for Business and Economic Research at Marshall University. The project is a middle-mile network that would traverse eight counties including Wayne. The project is in the early planning stages, but ThunderCloud could potentially supplant over half of the proposed backbone presented in this report. Additionally, ThunderCloud would provide connectivity to the necessary NAPs.

8 Service Providers

The County Commission has clearly stated they do NOT desire to take an active role as a service provider. The Commission is operating under a restrictive budget that has been reduced by the loss of coal severance revenue. Wayne County is operating under the same budget they had in 2011; this is not the time to take on a new line of business with unknown risks. The County would like to see a market-based solution where an existing service provider -- with skills, competencies, and operational support systems in communications service -- step into a partnership role with the County to address the need.

There are no ISPs, CLECs, or alternative providers in Wayne County. There are a number of cable TV operators, principally in the northern region of the County. The Incumbent Local Exchange Carrier is Frontier.

The consulting team engaged in discussion with every regional provider that could be identified and queried them about possibly partnering with the County.

Provider	Technology	Willingness to Partner	Comments
Agile Networks	Wireless	Yes (cautiously)	Ohio based. Started out a first-responder service provider. Emerged recently into a residential service provider. Using multiple towers in Wayne Co.
ARX Technology	Wireless	Yes	Cabell Co. based, service provider. Currently along Ohio River corridor Kenova to Hurricane. Serves residential and commercial.
Gigabeam Networks	Wireless	Yes (cautiously)	Southern WV based. Current plans to expand in WV. Partnered w/ APCo in Virginia.
Micrologic	Wireless	Yes (cautiously)	Buchannan based. Currently in 9 counties. Has agreement w/ WV for BTOP towers.
Altice (Suddenlink)	Cable	Yes	Serves a dozen Wayne communities with 4,500 customers.
Armstrong	Cable	Yes, keenly interested	Recently partnered with NY State to expand Broadband with fiber to the Home. Claims density as low as 5 customers per mile can work.
Comcast	Cable	Yes	Northern portion of County. Partnership in Mercer Co.
Frontier Communications	Cable	Unknown	Responsiveness has signaled a very low level of interest
Lycom (Foothills Communication)	Cable	Unknown	Currently in Fort Gay and Prichard.
Alpha Technologies (ThunderCloud)	Fiber	Yes, keenly interested	ThunderCloud is an important middle-mile initiative for the region being promoted by Alpha Technologies.
Segra (Middle-mile)	Fiber	Yes, Commercial	Formerly LUMOS. Bandwidth provider to a number of ISPs in the region. Could play an important role.

The consultant team cast a broad net and spoke to eleven different service providers about the prospects of applying for grant funding in a collaboration with the County to address the 31 communities. Some were more cautious than others and it was clear they had little or no experience with public-private partnerships of this nature. Some, who have

experience with public-private partnerships, were interested in the possibility but are cautious because they do not have a base of operations near Wayne County. Of those we spoke to, two were "keenly" interested. Of all service providers, the consulting team ranks five of these companies as high-potential operators for either being a co-applicant for grant funding, or for being the contract operator for the County.

Every service provider in the communications-services business has heard dozens of proposals and pitches that never materialized. In many ways, communications services is a" field of dreams." That the team was able to garner this much interest from service providers when there is no definitive funding or plans to build a network is a positive indication that we will be successful in identifying a partner when the funding is available.

9   Recommendations and Next Steps

Beyond creating an inventory of communities-in-need of high-speed Internet service, there are several recommendations the consulting team formulated, stemming from our interaction with community leaders, stakeholders, and service providers. These recommendations are presented in descending order of importance, or urgency, and are presented in a general timeframe for implementation.

1. Currently, there is much interest and energy in improving broadband in Wayne County. After the consulting team's final presentation to the County Commission on May 18th, a number of emails came in through the Blue Ridge's web site general mailbox from Wayne County citizens. Citizens asked – What was my community's ranking? When will broadband be available to us? What can be done to help our situation, now? It is clear that citizens want action. We recommend the County organize some form of task force or working group to keep the attention on broadband for all residents. We recommend the task force include representatives of HADCO (ubiquitous broadband is important to economic development), the County Administrator, and Region 2 Planning & Development Council.

2. The County should develop some form of feedback link on its web site. It will be important to have subjective evidence of lack of broadband when applying for grant funding. While it may seem counter intuitive to use an Internet-based tool to collect data from households who have no high-speed Internet, they will find a way, using either library resource, mobile devices, or Internet connections at work.

3. When opening a trench for any reason, consider installing telecommunications conduit in the trench for future use. The incremental cost of deploying telecommunications conduit in an open trench is exceedingly small. While it may not be used and useful immediately, it could have great benefit down the road.

4. The consulting team has been asked to comment on public-private partnerships and the control or ownership of the assets. First, if the assets are grant funded, they are considered restricted assets. They are typically assets held in trust for the grantor. The assets typically have restrictions forbidding the pledging, collateralizing, or selling the assets. However, we have seen network operators comingle their assets with the grant assets and create a quagmire of uncertainty resulting in the loss of the assets. We strongly recommend the assets be held in trust by the County.

Whatever the final structure of the public-private partnership, we strongly recommend crafting an operating agreement that contemplates disagreements among the partners and codifies a breach-and-cure process and an exit plan.

10 Attachments and Appendices

10.1 Community Network Plans

Ardel
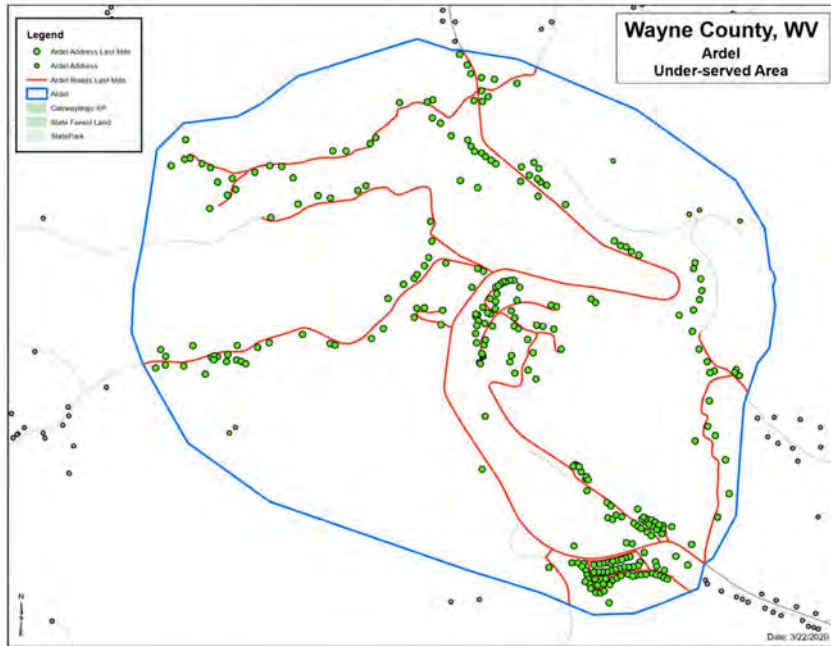
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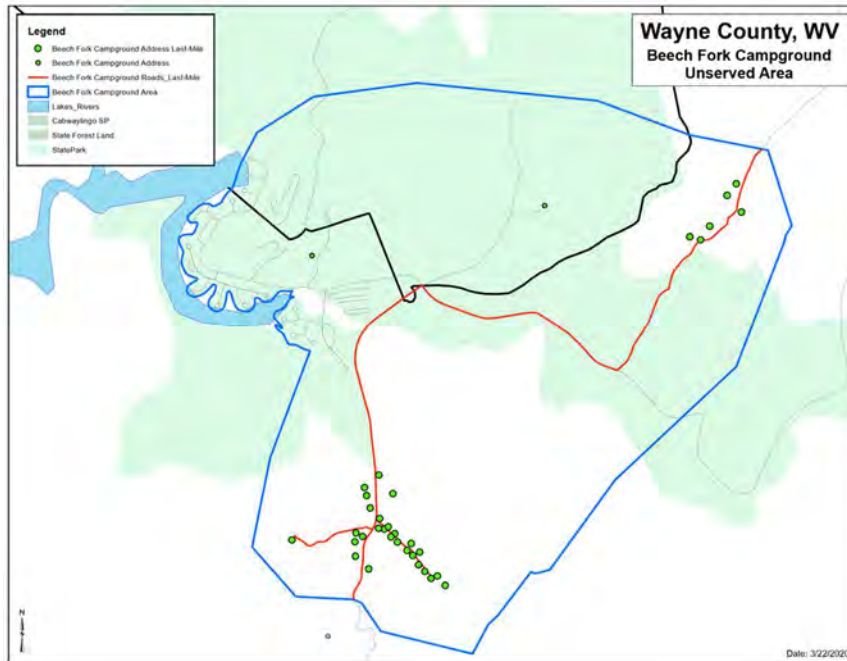
Beech Fork Marina
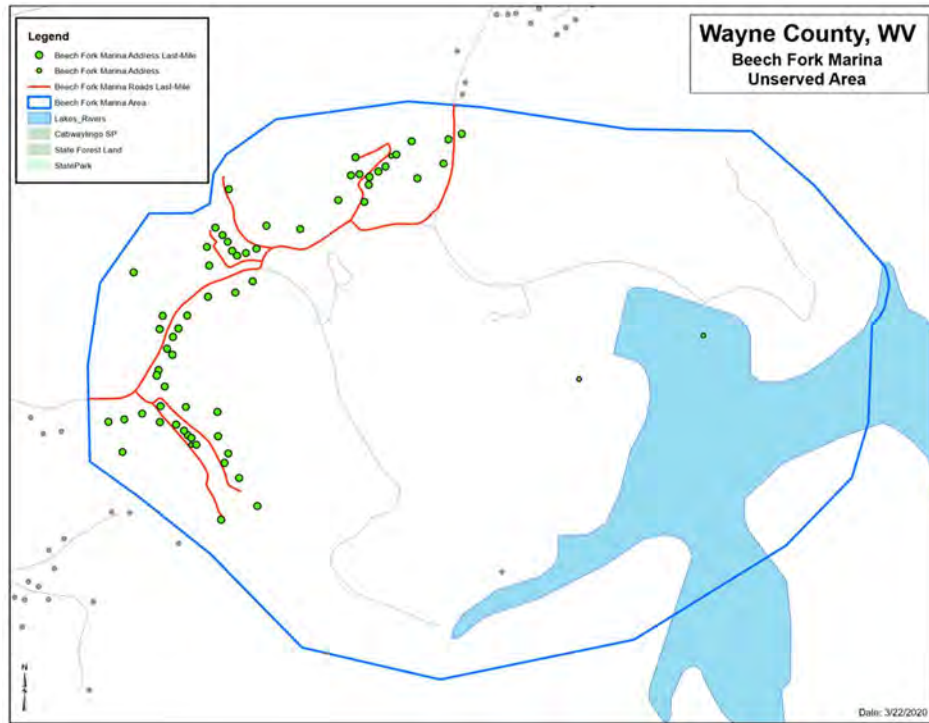
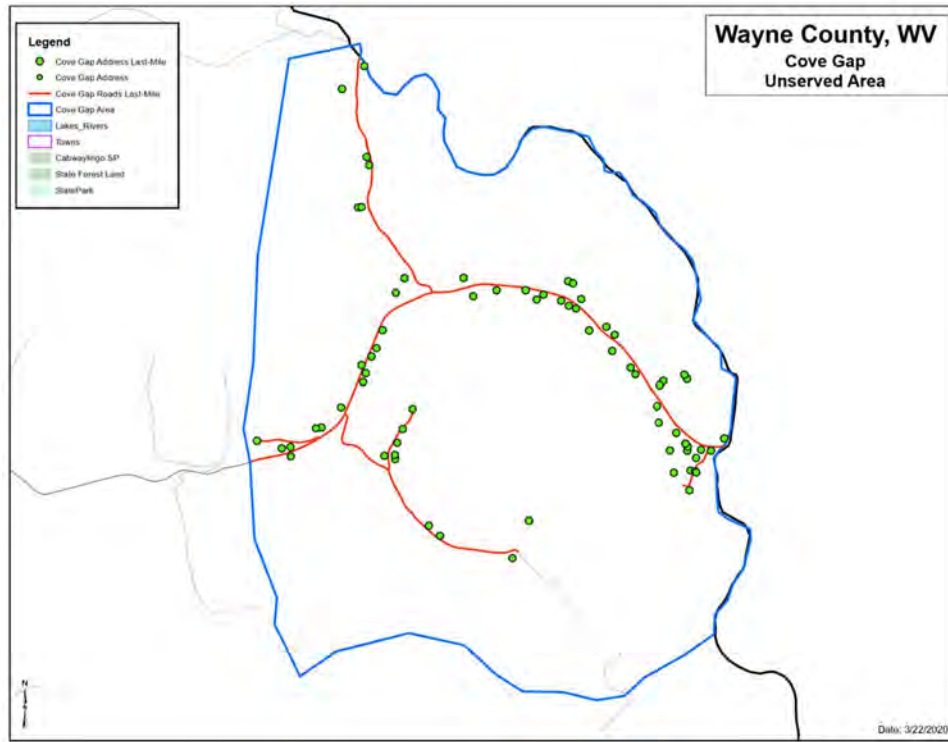**Beech Fork/East Lynn**
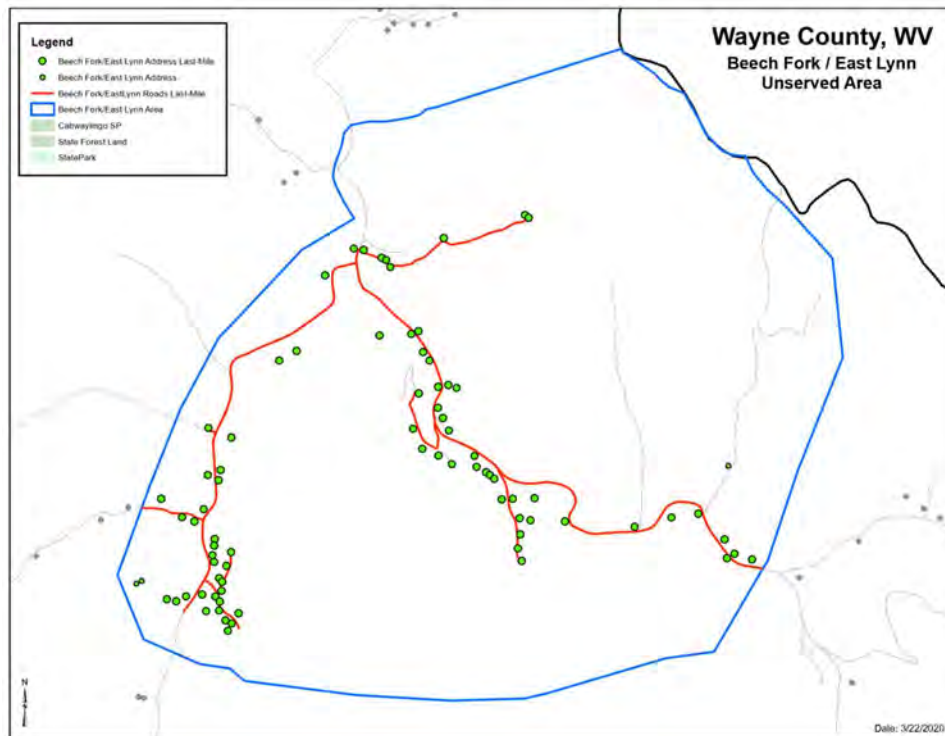
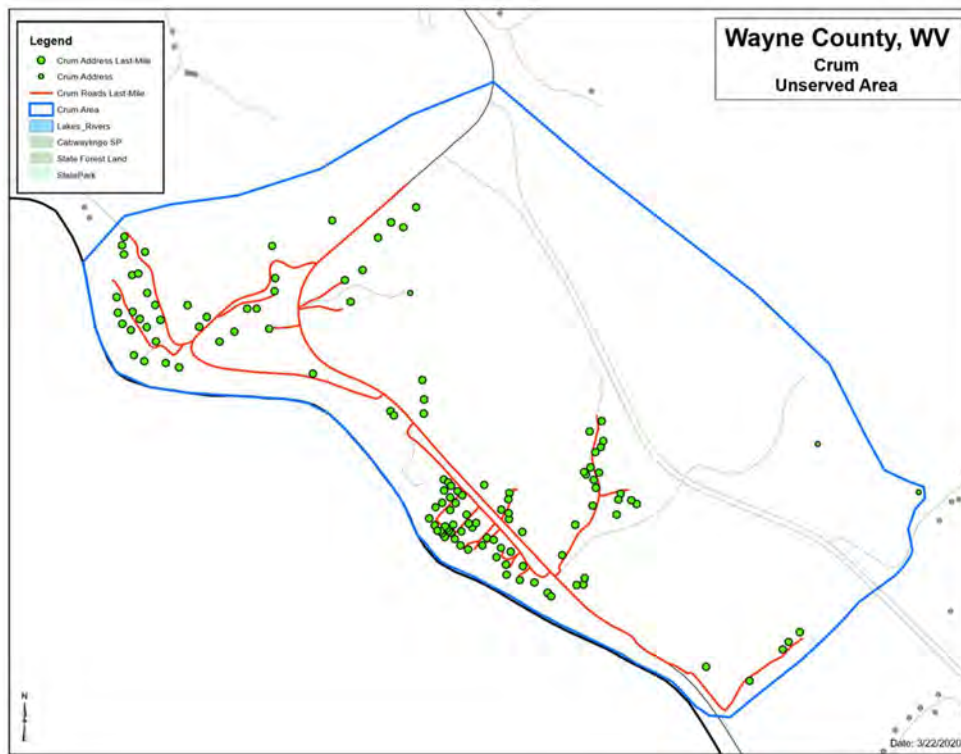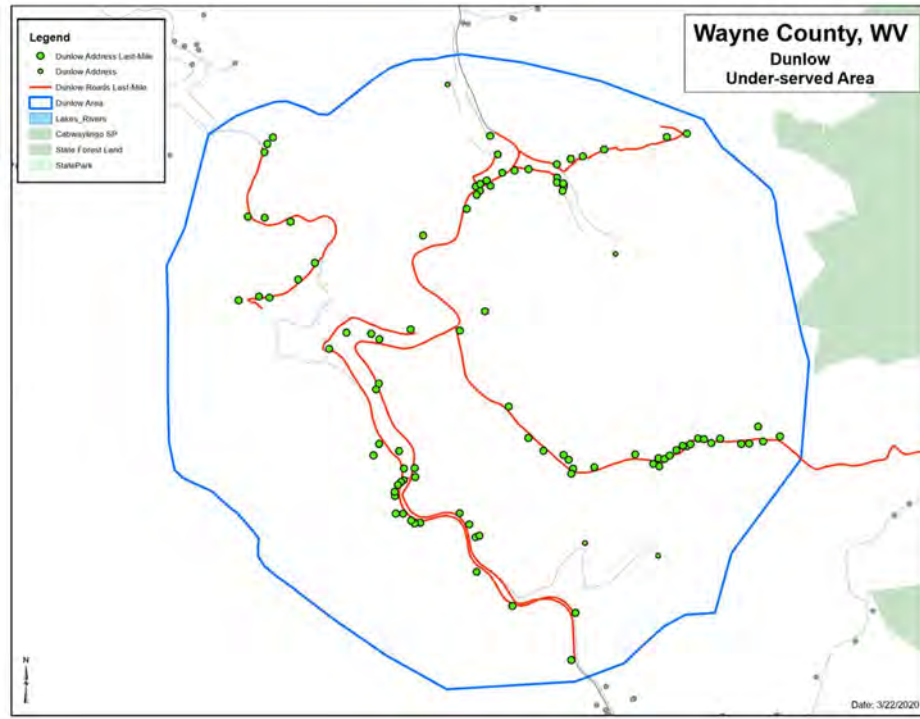## Beech Fork/Lavalette
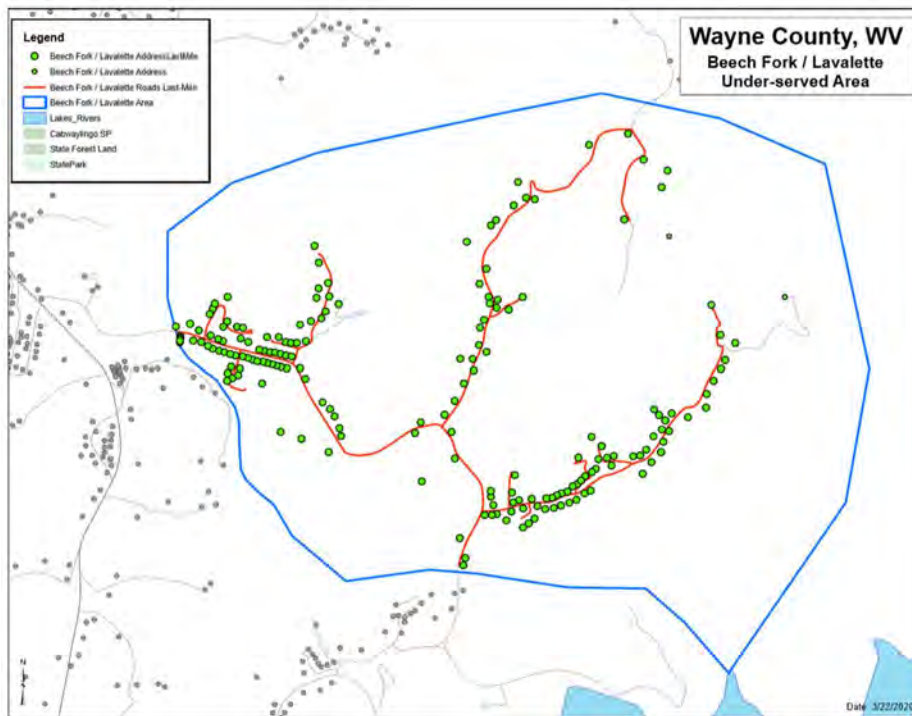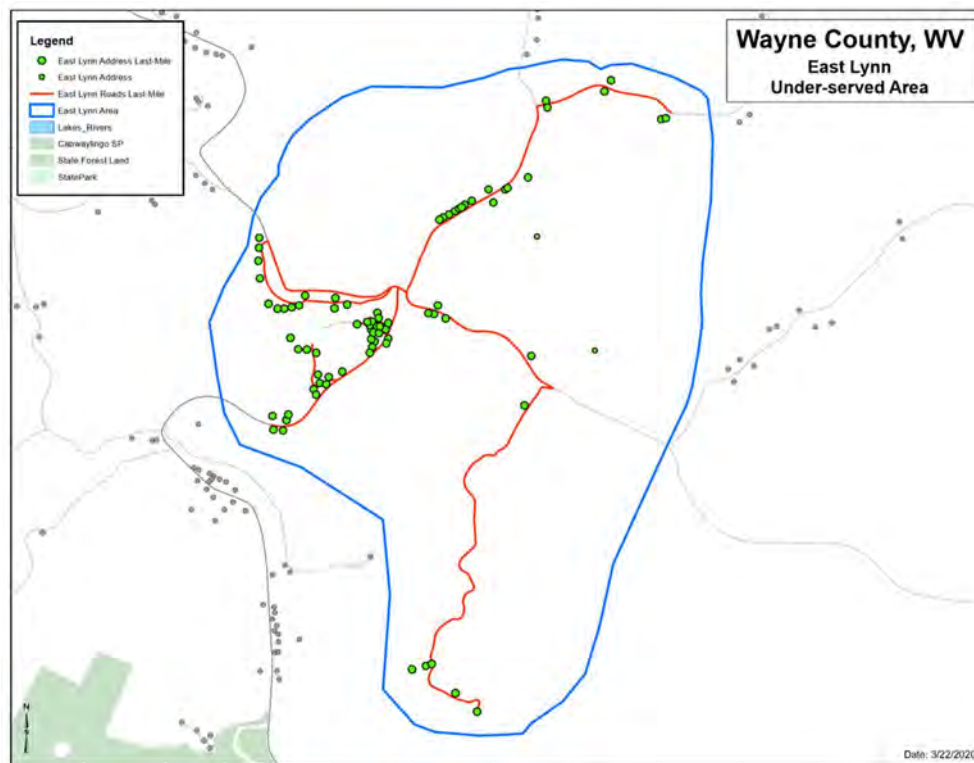

Buffalo Creek
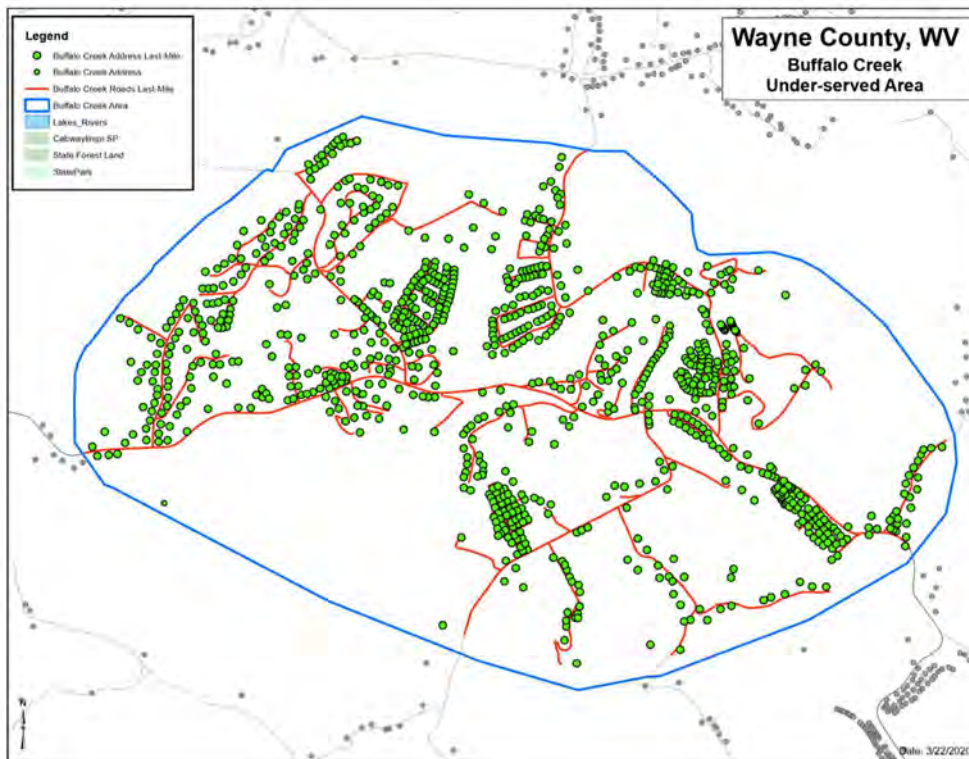
Cabwaylingo SP Campground
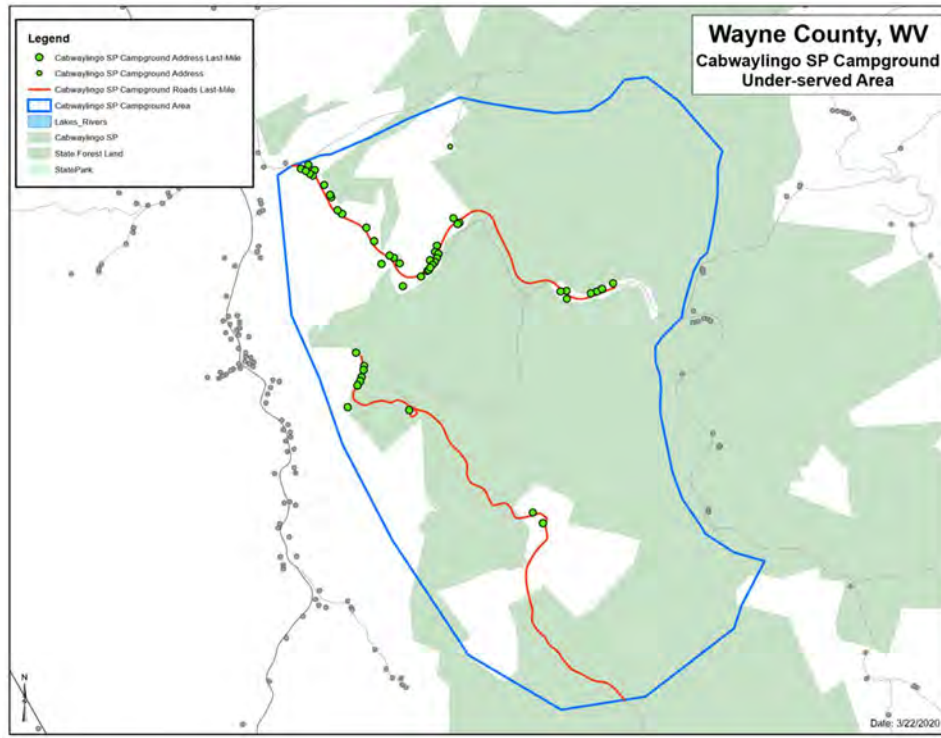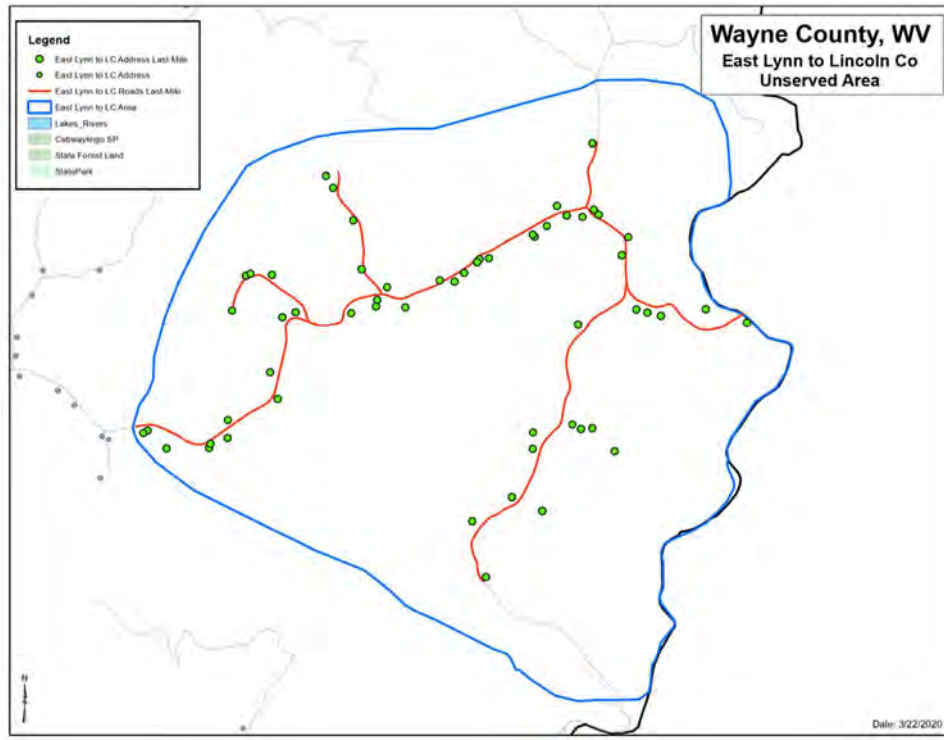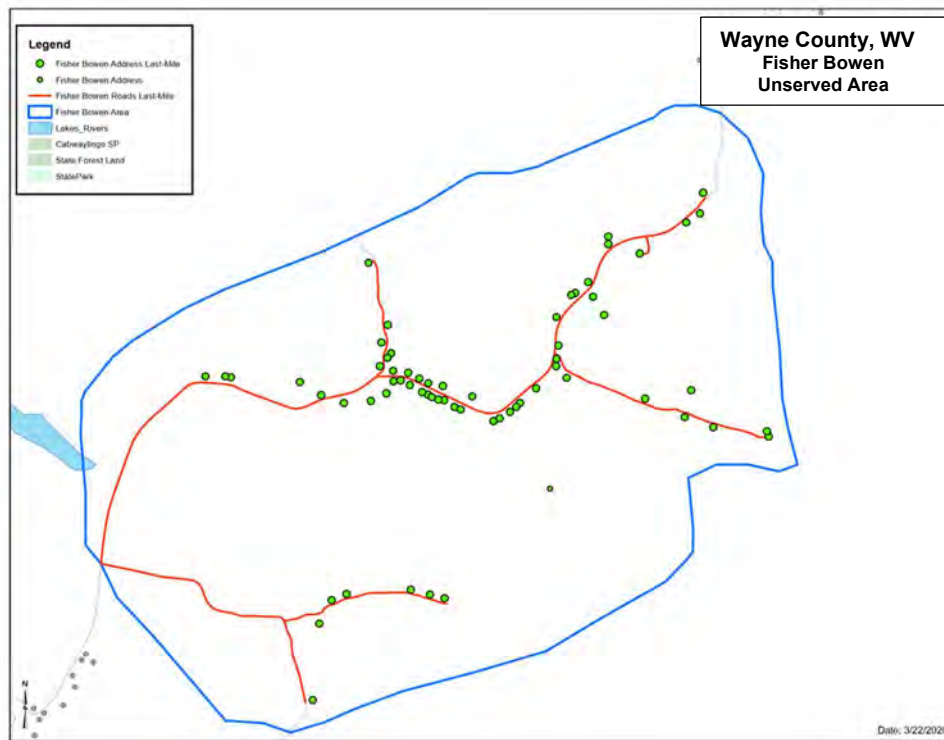

Centerville
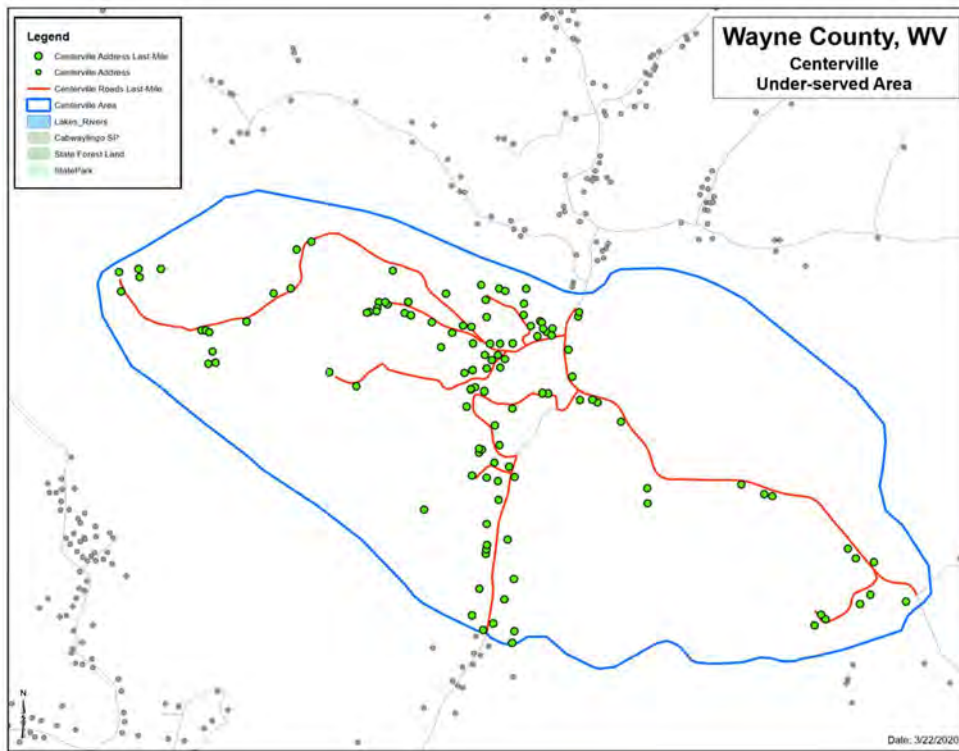
Cove Gap
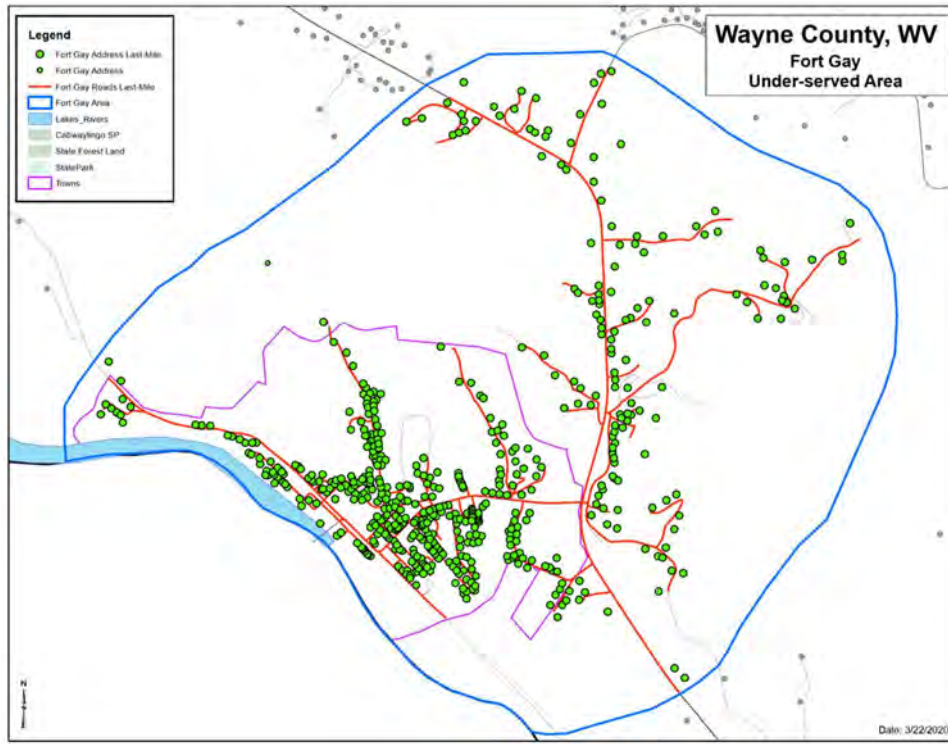

Crum
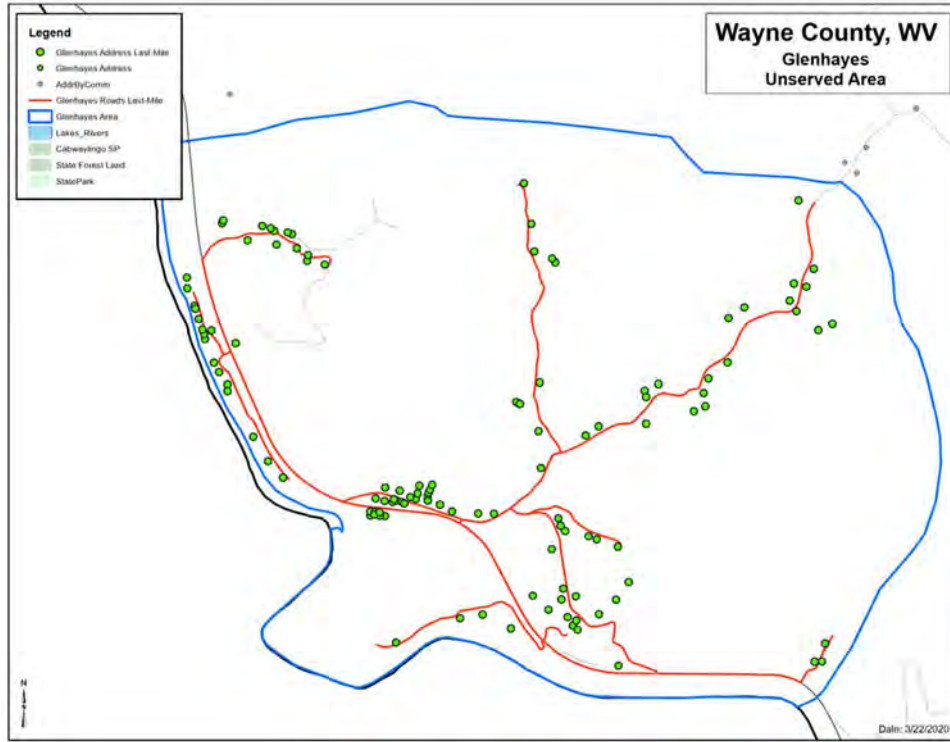
Dunlow

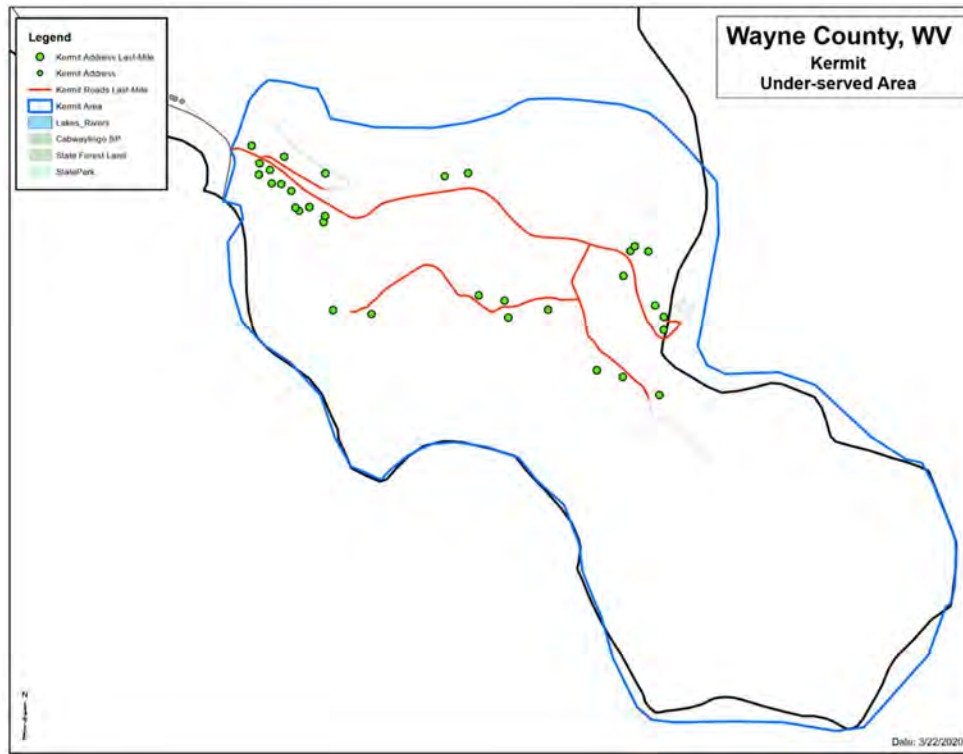

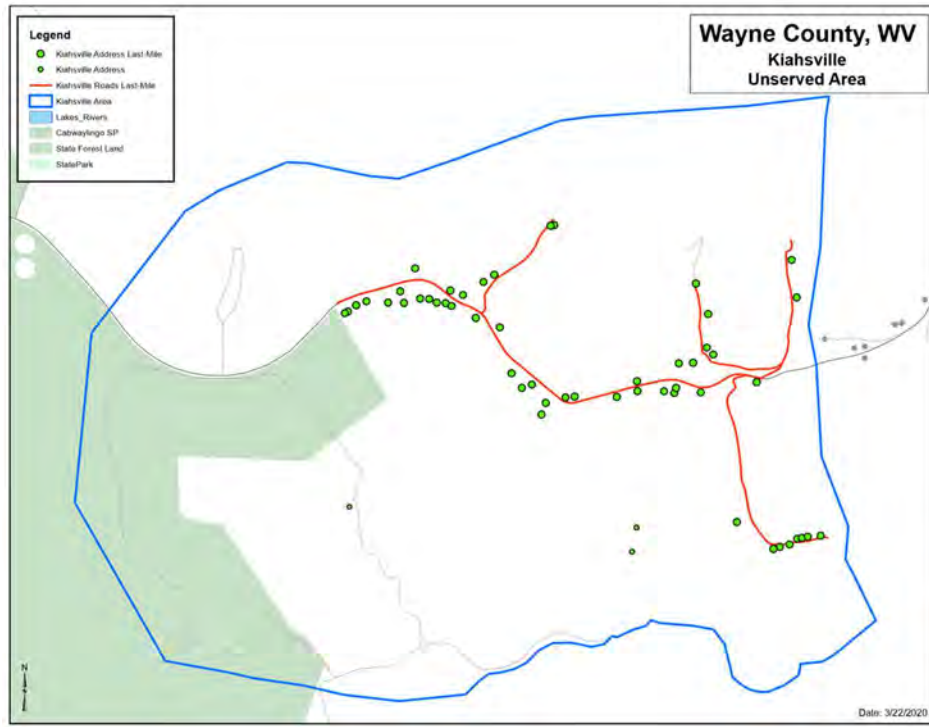**East Lynn**

East Lynn to Lincoln County

Fisher Bowen

Fort Gay

Genoa
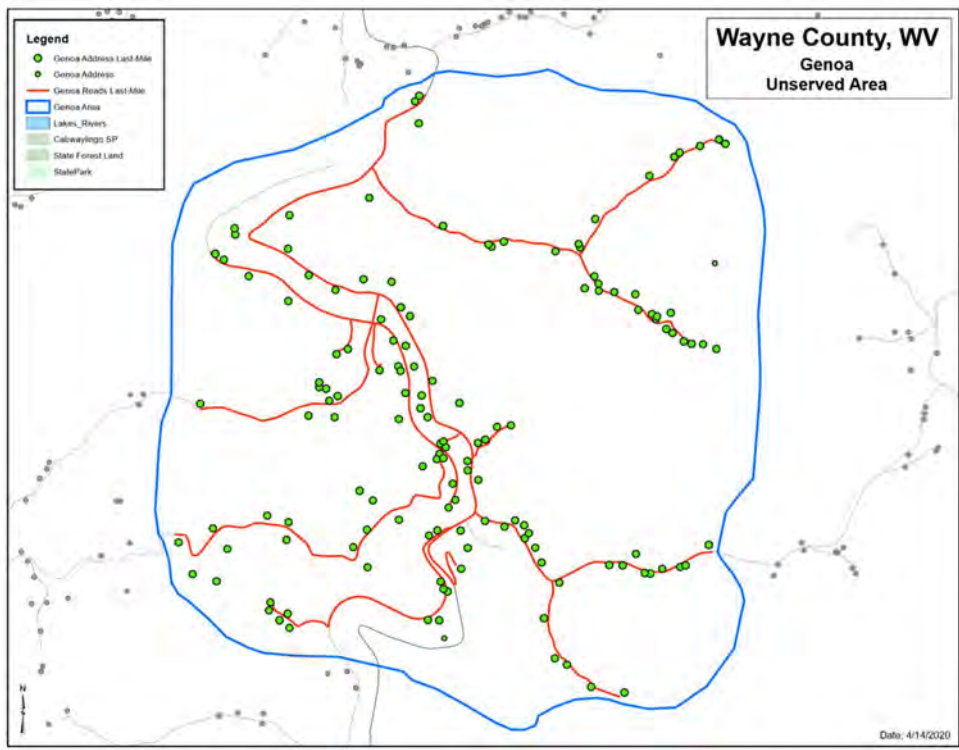
Glenhayes

Kermit

Kiahsville

Laurel
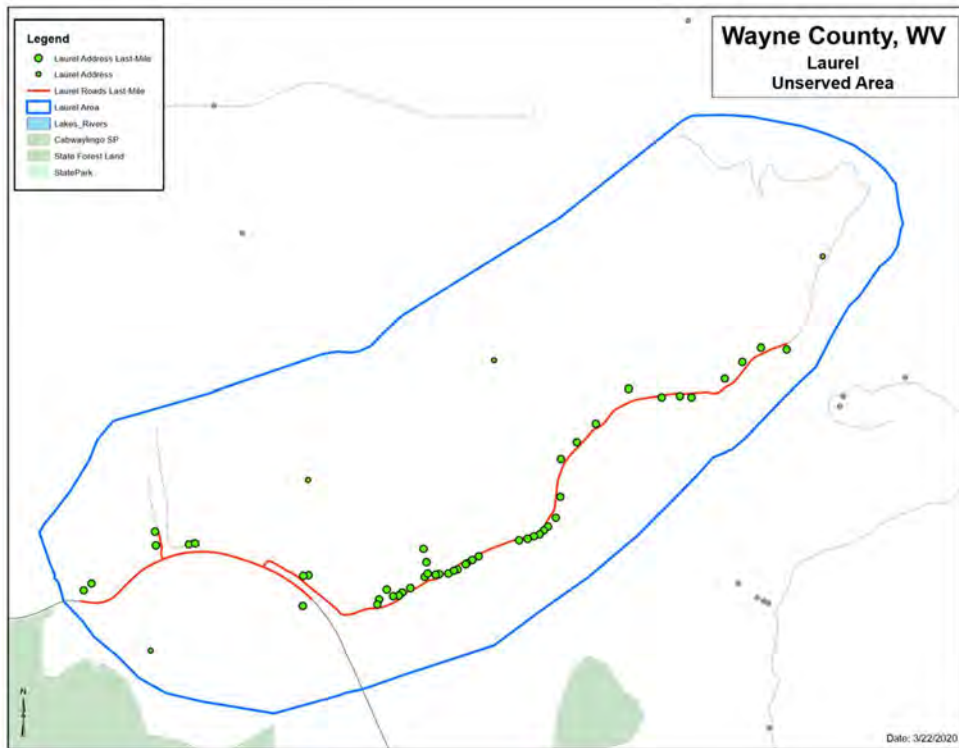
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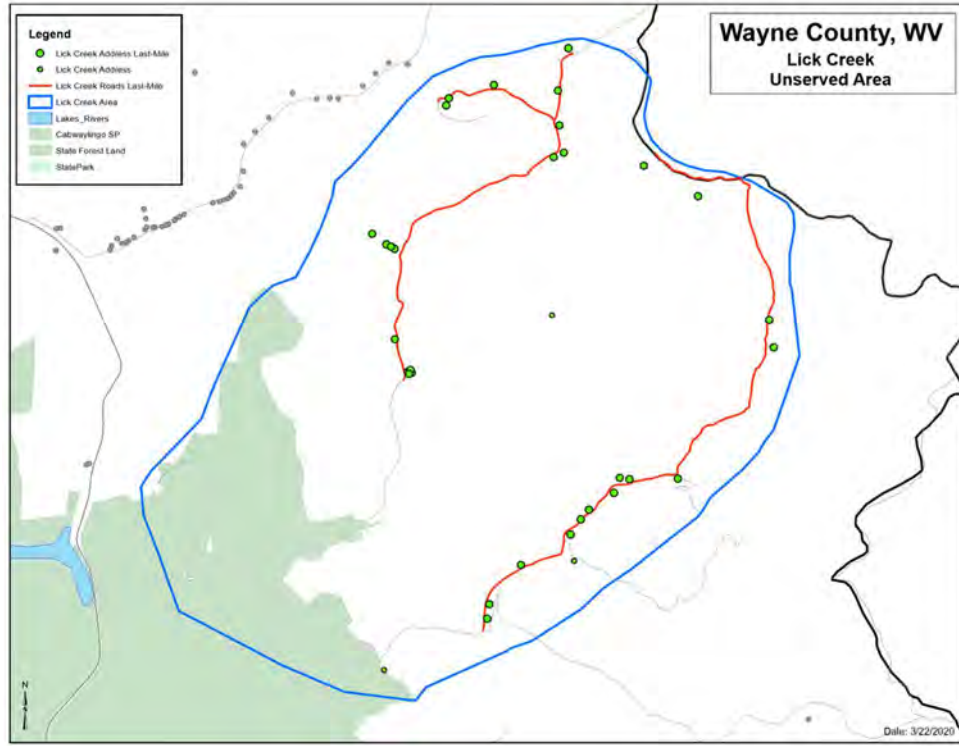
McComas
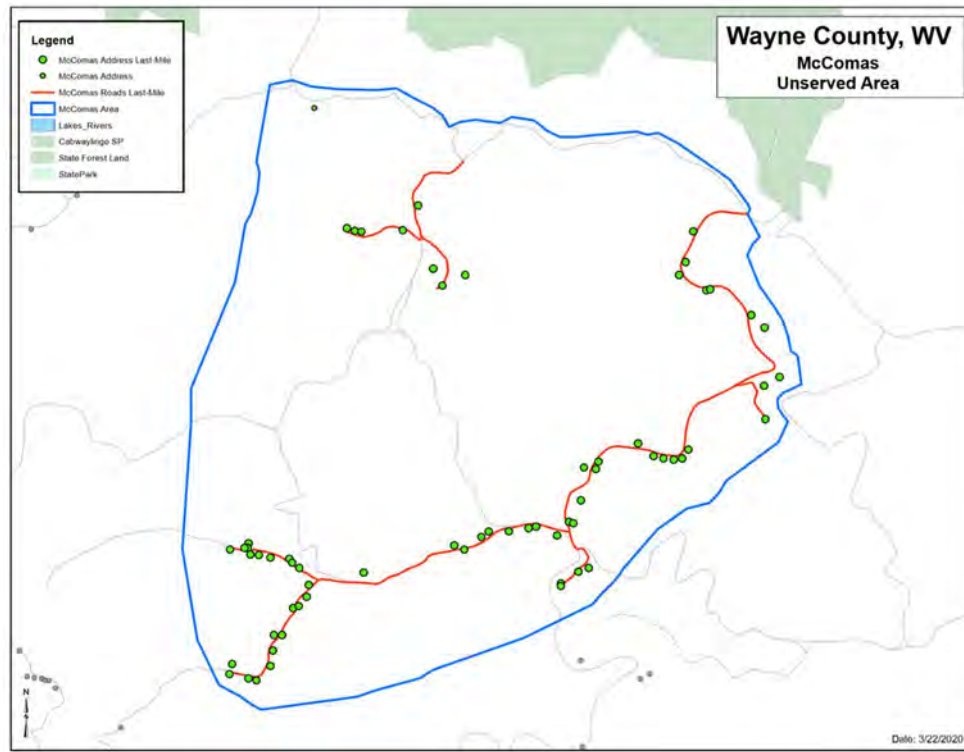
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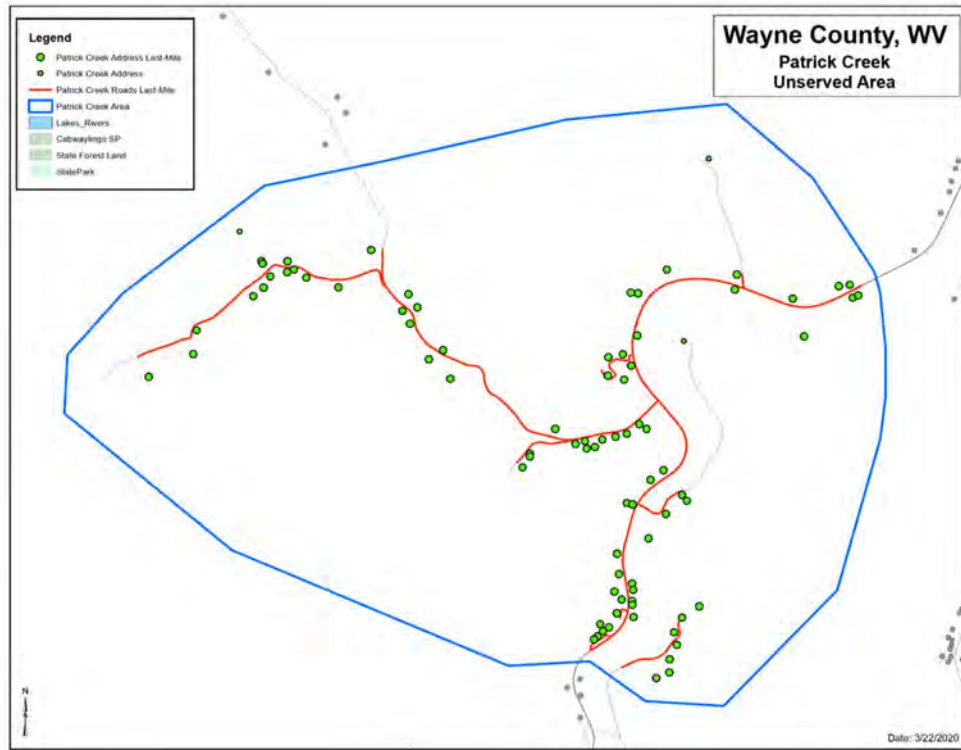
Prichard
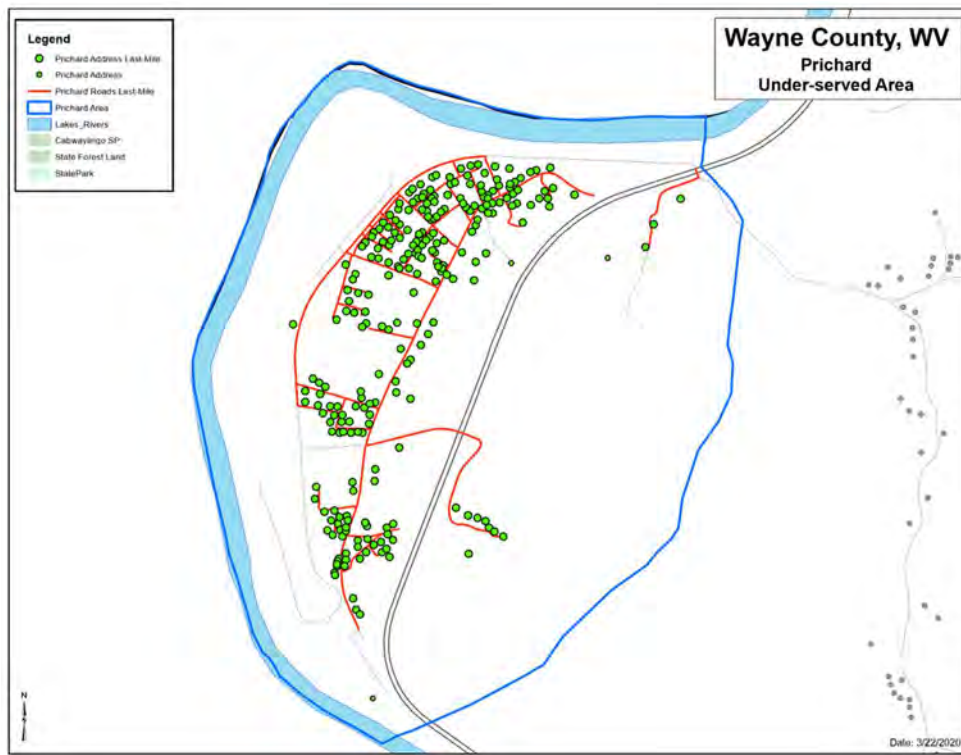
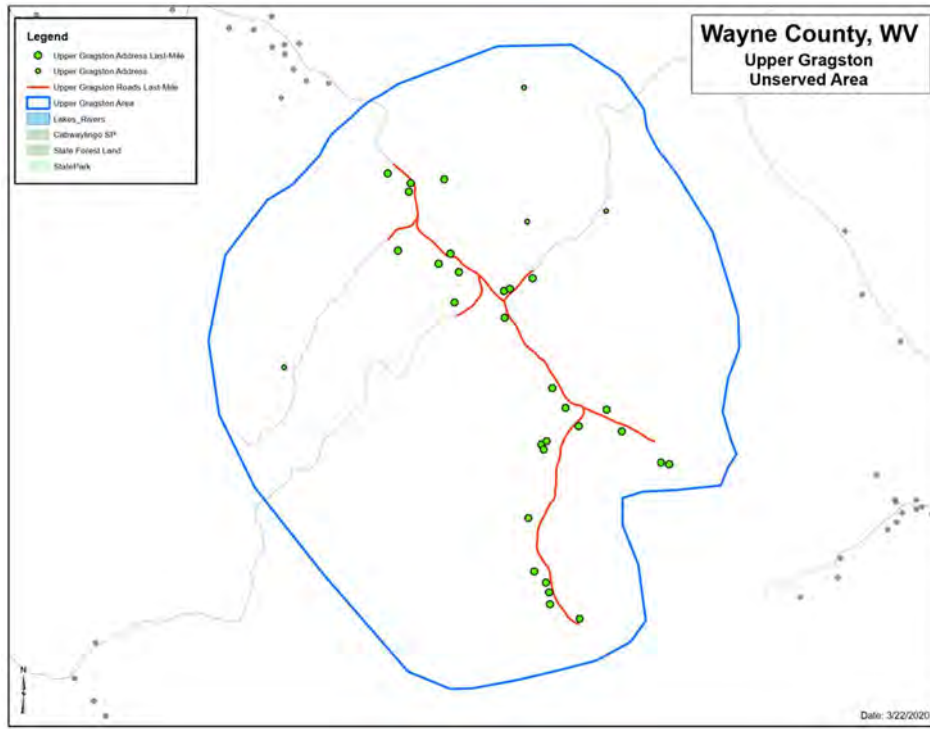## Radnor
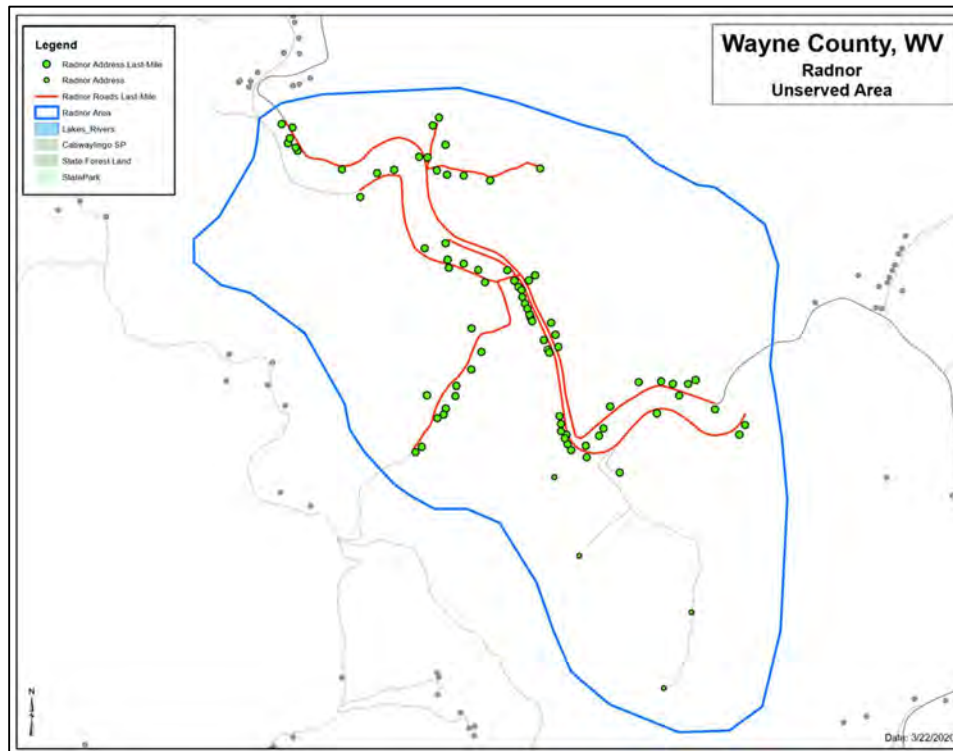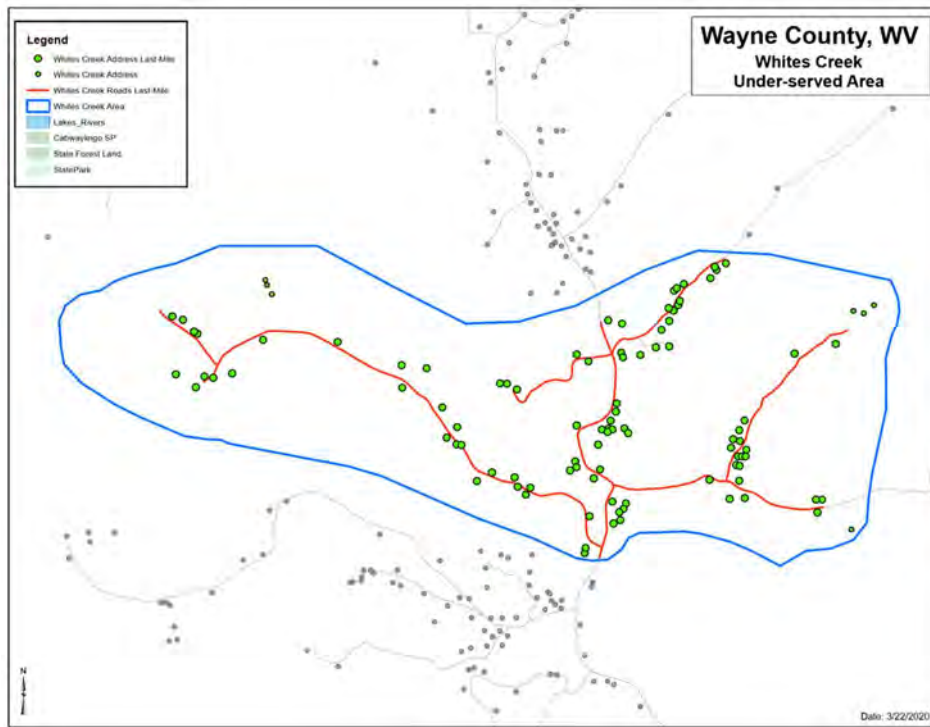

Shoals
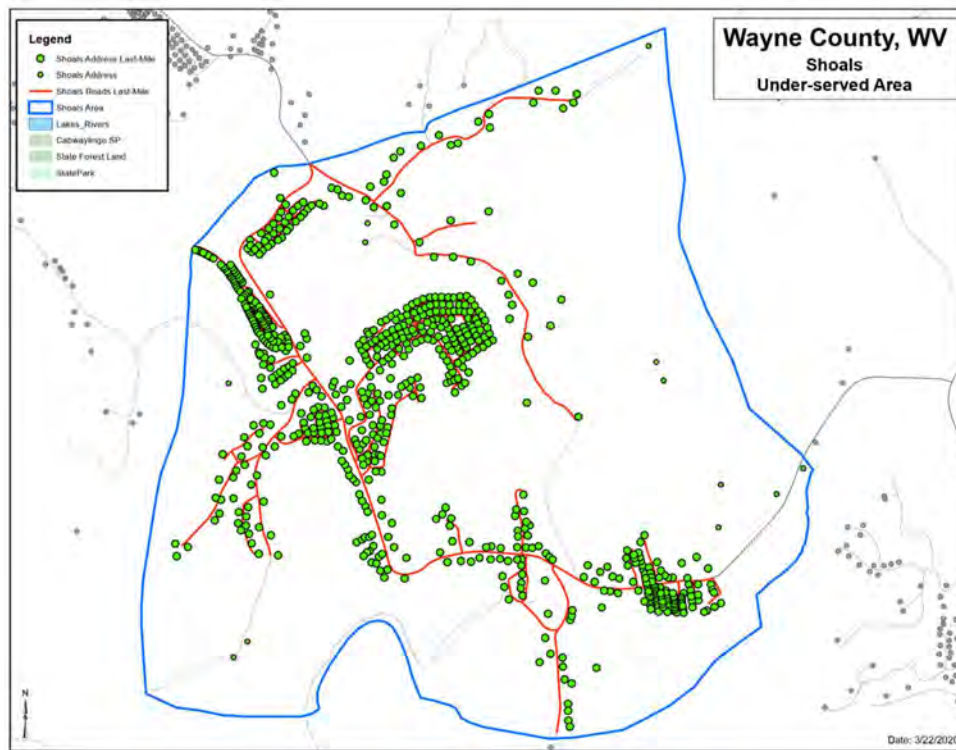
Stepptown
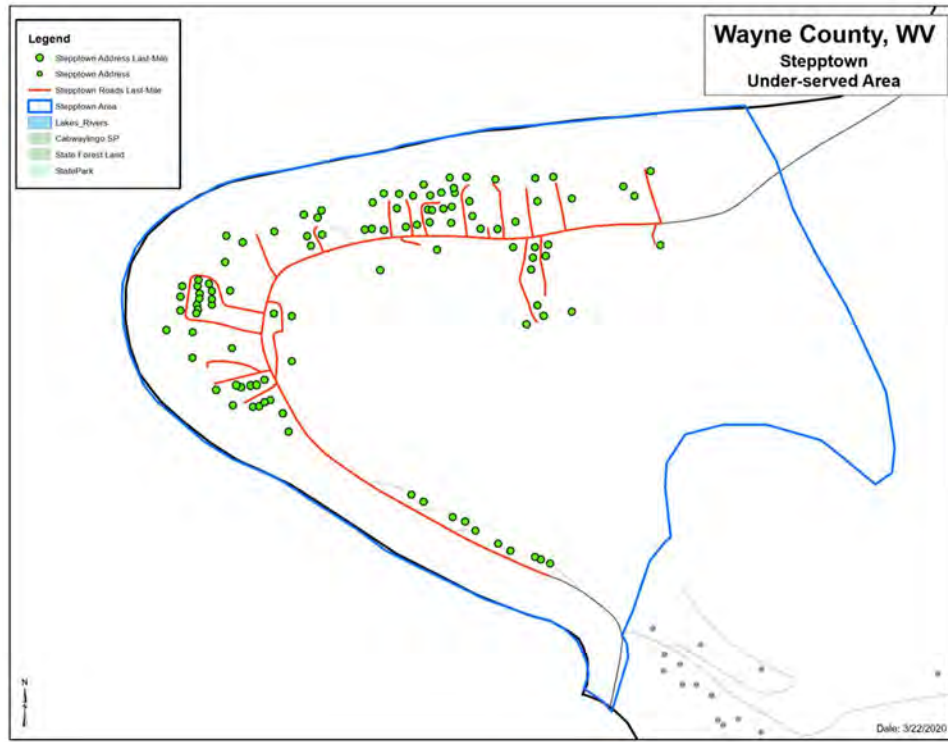
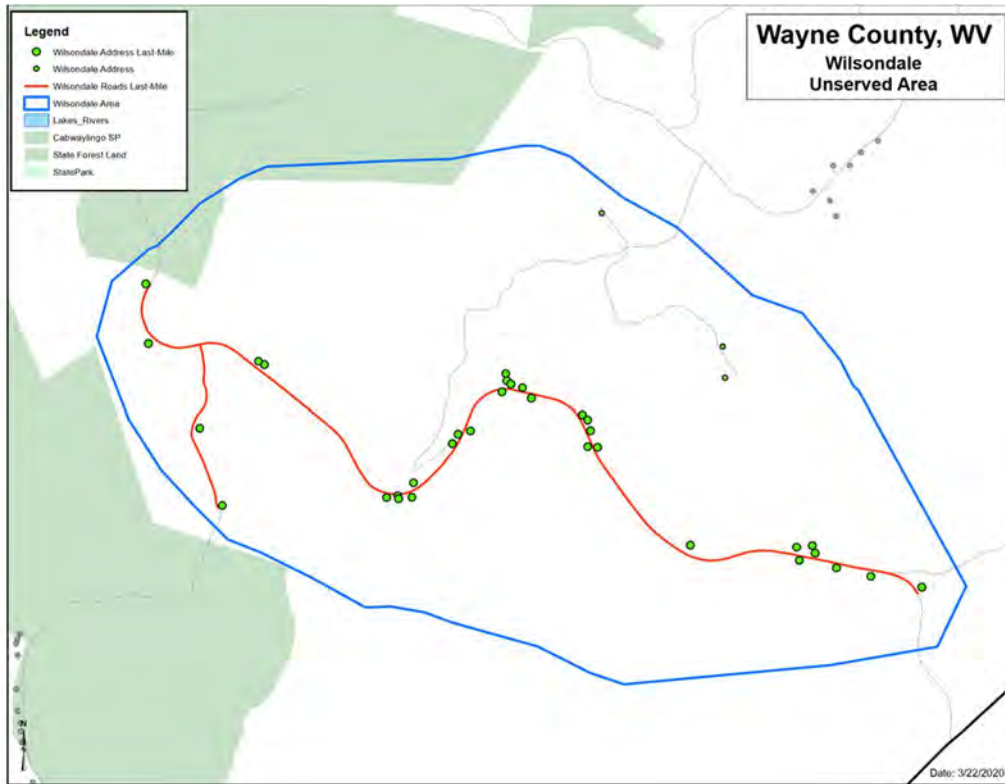
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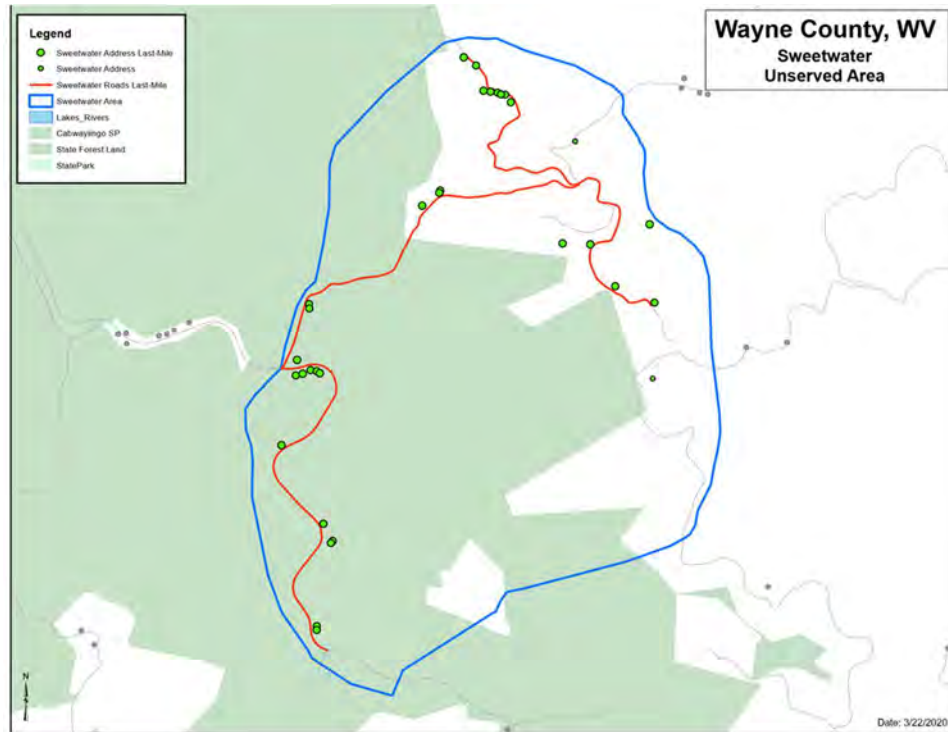
Upper Gragston

Whites Creek

Wilsondale

Community Data

Community	Status	Square Miles of area in Community	Mileage of All Last-Mile Named Roads	Total Distance (feet) of adjusted households from the named road (straight line)	Avg Distance from Named Road (straight line)	Household Count	Net Household Count	Total Community Cost at 60% Penetration	Average Cost per Household at 60% Penetration
Ardel	underserved	3.2	12.0	9,909	35	291	285	$ 430,705	$ 2,519
Beech Fork Campground	unserved	2.5	3.4	1,418	39	35	33	$ 119,224	$ 6,021
Beech Fork Marina	unserved	1.4	2.3	2,393	38	64	60	$ 110,040	$ 3,057
Beech Fork/East Lynn	unserved	2.7	4.6	2,482	32	81	79	$ 167,442	$ 3,533
Beech Fork/Lavalette	underserved	2.8	5.9	6,812	36	187	185	$ 250,734	$ 2,259
Buffalo Creek	underserved	3.9	24.6	29,996	30	994	993	$ 1,071,216	$ 1,798
Cabwaylingo SP Campground	underserved	5.9	5.6	1,320	27	50	49	$ 172,674	$ 5,873
Centerville	underserved	2.3	6.2	5,459	46	118	118	$ 224,118	$ 3,166
Cove Gap	unserved	1.9	3.7	2,476	36	69	69	$ 143,996	$ 3,478
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East Lynn	underserved	1.9	4.8	1,886	24	81	79	$ 170,130	$ 3,589
East Lynn to Lincoln County	unserved	2.5	4.6	2,483	44	57	57	$ 157,809	$ 4,614
Fisher Bowen	unserved	2.5	5.0	2,149	33	66	65	$ 168,906	$ 4,331
Fort Gay	underserved	3.8	16.3	14,285	26	552	551	$ 647,332	$ 1,958
Genoa	unserved	3.7	11.2	5,331	38	144	142	$ 340,838	$ 4,000
Glenhayes	unserved	3.7	9.1	5,316	45	118	118	$ 286,054	$ 4,040
Kermit	underserved	0.7	1.9	1,040	33	32	32	$ 86,486	$ 4,505
Kiahsville	unserved	2.0	2.7	1,660	32	55	52	$ 113,544	$ 3,639
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Lick Creek	unserved	5.6	5.8	1,511	48	34	31	$ 169,511	$ 9,114
McComas	unserved	4.3	5.8	1,903	29	66	65	$ 185,178	$ 4,748
Patrick Creek	unserved	2.5	4.7	2,902	35	84	81	$ 171,157	$ 3,522
Prichard	underserved	2.1	7.4	6,654	23	256	253	$ 310,035	$ 2,042
Radnor	unserved	2.2	5.3	2,304	29	83	79	$ 181,695	$ 3,833
Shoals	underserved	3.1	13.2	18,463	26	716	704	$ 677,855	$ 1,605
Stepptown	underserved	0.4	2.3	2,089	20	104	104	$ 128,621	$ 2,061
Sweetwater	unserved	3.4	5.0	1,321	44	32	30	$ 151,764	$ 8,431
Upper Gragston	unserved	2.5	2.5	1,541	53	33	29	$ 99,066	$ 5,693
Whites Creek	underserved	1.3	4.2	3,555	37	102	95	$ 168,294	$ 2,953
Wilsondale	unserved	1.7	2.8	740	22	36	33	$ 105,174	$ 5,312
			203.0			4,818	4,738	$ 7,659,940	$ 2,695