

## Middlefield Wireless Broadband Project Costs

<b>Towers &amp; poles</b>	\$	175,992
<b>Network equipment</b>	\$	138,225
<b>Customer Premises Equipment</b>	\$	64,975
<b>Network Infrastructure</b>	\$	11,662
<b>Project Management</b>	\$	79,000
<b>Total</b>	<b>\$</b>	<b>469,854</b>

<b>(Initial Pilot cost)</b>	<b>\$</b>	<b>178,008</b>
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## Middlefield Wireless Broadband Capital Budget

	Material price	Labor price	Class	Quantity	Materials	Labor	Total	Notes
Total number of 50' wood pole: (42' up)	\$1,400	\$1,800	t	5	\$7,000	\$9,000	\$16,000	Class 1 wood
Total number of 55-60' wood p (47-51' up)	\$2,400	\$2,900	t	3	\$7,200	\$8,700	\$15,900	
Total number of 70-80' wood p (56-65' up)	\$4,700	\$3,500	t	4	\$18,800	\$14,000	\$32,800	
Total number of 90' monopoles: (90' up)	\$23,000	\$74,892	t	1	\$20,000	\$74,892	\$94,892	with appurtenances
Total number of lit sites/cabinets	\$2,500	\$1,000	e	14	\$35,000	\$14,000	\$49,000	for box, switch, batteries, etc.
Sites needing power installed	\$200	\$600	t	13	\$2,600	\$7,800	\$10,400	short trench to metered pole
Total number of sites w/5GHz if A5	\$	\$	e	7	\$	\$	\$	A5-360 lights all directions, if used
Total number of sites w/TVWS	\$5,000	\$250	e	7	\$35,000	\$1,750	\$36,750	if multi-sector APs are used
Total number of 5 GHz sectors	\$600	\$150	e	11	\$6,600	\$1,650	\$8,250	ePMP 2000 (most Lite)
Total number of 2.4 GHz sectors	\$600	\$150	e	16	\$9,600	\$2,400	\$12,000	ePMP 1000 sync
Total number of 900 PMPi sectors	\$2,700	\$150	e	1	\$2,700	\$150	\$2,850	
Total number of TVWS unisectors	\$	\$	e	14	\$	\$	\$	if single sector APs are used
Total TVWS sector antennas	\$300	\$100	e	14	\$4,200	\$1,400	\$5,600	with either type of AP
Total number of backhaul radios	\$600	\$150	e	26	\$15,600	\$3,900	\$19,500	point to point, used in pairs
Total number of miniPOPs	\$950	\$475	e	3	\$2,850	\$1,425	\$4,275	fill in using CPE backhaul
fiber on CWR to River			t		\$	\$	\$	only if no fire tower
Fiber extension to transfer station	\$2,000	\$4,000	t	1	\$2,000	\$4,000	\$6,000	omit if only microwave to lbSP
<b>Total</b>					<b>\$169,150</b>	<b>\$145,067</b>	<b>\$314,217</b>	

t total	\$57,600	\$118,392	\$175,992	Towers
e network	\$111,550	\$26,675	\$138,225	Field network equipment
e total	\$156,575	\$53,625	\$203,200	Network+CPE eq. total

true or false

Use Mimosa A5-360?	FALSE	one box, four sectors, antennas (vs. ePMP)	
Use multi-sector TVWS AP?	TRUE	one box, enough sectors	
Use PMP450 for 2.4 GHz?	FALSE	(vs. ePMP)	total APs: 28
Supply home Wi-Fi?	TRUE		

### Budgetary equipment; not final choices

	Material	Installation	
Mimosa A5-360 AP	\$1,000	\$200	includes antennas
ePMP 2 GHz sync sector	\$600	\$150	includes antenna
Cambium PMP450i AP	\$1,350	\$150	includes antenna
ePMP2000 5GHz sector	\$250	\$150	includes antenna
Single sector TVWS	\$3,500	\$250	includes antenna
Multi-sector TVWS	\$5,000	\$250	antennas extra
TVWS sector antenna	\$250	\$100	(installed w/sector)
Backhaul radio	\$600	\$150	average
5G eForce200 SM	\$150	\$125	inc. mounting h/w
2.4G eForce 200 SM	\$150	\$125	inc. mounting h/w
PMP450 SM	\$375	\$125	connectorized + antenna
TVWS SM	\$300	\$150	includes external antenna
Home WiFi	\$25	\$25	

Note: Subscriber Module installation is average of low-cost "standard" and some high-cost "customized" efforts

**Planned locations**

Locations	266
Take rate	60%
Total take	160

<b>CPE by band (estimates)</b>	<b>CPEs</b>		<b>Sub per sector</b>	<b>seas. subs</b>	<b>Adj. SMs</b>	<b>Spare SMs</b>	<b>SM cost</b>	<b>Install</b>	<b>Total</b>
Subscribers on 5G	51	32%	3.6	47	3		\$8,100	\$6,375	\$14,475
Subscribers on 2G	45	28%	2.8	41	3		\$7,200	\$5,625	\$12,825
Subscribers on 900 MHz	12	8%	12.0	11	1		\$4,875	\$1,500	\$6,375
Subscribers using TVWS	50	32%	4.5	46	3		\$15,900	\$7,500	\$23,400
Home WiFi							\$3,950	\$3,950	\$7,900
<b>Total</b>	158	100%	3.9	145	10		\$40,025	\$24,950	<b>\$64,975</b>

**Network Infrastructure**

		<b>h/w</b>	<b>labor</b>	<b>total</b>
Core routing/switching		\$5,000	\$2,000	\$7,000
Spare common equipment	4%	\$4,662		\$4,662
<b>Total</b>				<b>\$11,662</b>

**Project Management**

Design/engineering/integration	\$25,000
Administrative[1]	\$50,000
Upstream ISP installation	\$4,000
<b>Total</b>	<b>\$79,000</b>

[1] Includes oversight, RFPs, MLP operation, project management, tower siting paperwork, marketing, etc.

Total initial project including pilot	<b>\$469,854</b>
Total CapEx/subscriber	\$2,974

## Middlefield Wireless Broadband Monthly Operating Costs

Operator subscriber fees @ \$25	Quantity	Total
40% take	98 \$	2,450
50% take	122 \$	3,050
60% take	146 \$	3,650
70% take	171 \$	4,275

Operator AP fees @\$25:		Total
Per access point	28 \$	700
Per backhaul link	13 \$	325
<b>Total</b>	<b>\$</b>	<b>1,025</b>

### Other Expenses

Insurance	\$500	
Upstream ISP	\$1,290	(150 Mbps)
MLP Manager	\$1,000	
Electricity	\$250	
Break/fix replacements	\$652	
<b>Total</b>	<b>\$3,692</b>	

### Depreciation

Electronics	\$	2,610
Tower/pole	\$	160
<b>Total</b>	<b>\$</b>	<b>2,770</b>

Phone Revenue @60% of subs * \$10	Quantity	Total
40% take	59 \$	590
50% take	73 \$	730
60% take	88 \$	880
70% take	103 \$	1,030

Net Operating Expenses	Cash	Fiscal
40% take	\$ 6,577	\$ 9,347
50% take	\$ 7,037	\$ 8,782
60% take	\$ 7,487	\$ 10,257
70% take	\$ 7,962	\$ 10,732

### Subscribers (% of seasonally adj)

<b>40%</b>	<b>50%</b>	<b>60%</b>	<b>70%</b>
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	98	122	146	171
"Cash" internet break even	\$67.12	\$57.68	\$51.28	\$46.56
"Fiscal" internet break even	\$95.38	\$71.98	\$70.25	\$62.76

**Number of Premises**

Total premises	273
Habitable premises	266
Seasonal premises (6 mo avg)	44
Seasonally adjusted habitable	244

Electronics depreciation months	60
Infrastructure depreciation months	360
Break/fix % per year of capex	5%

Middlefield Wireless Broadband Itemized Pilot Budget		
Infrastructure	Est. Cost	Notes
<b>Tower</b>		
Tower	\$97,892	Engineered and bid, no specific manufacturer. A 90 foot monopole tower using a 13x13x4' or similar concrete base. Wind load should support 45 square feet with 70% on top and 30% between 20' and 30' lower, using 90 MPH wind and 110 MPH maximum gust and a 3 degree sway limit. Accessories include step bolts, lightning rod, safety cable system, and 4-rod grounding with buried halo.
Excavation		Included in tower price
Antenna mounts		12'-6" Vented - 12'-6" Co-Location Platform Kit w/ 9 60" pipes (\$2973) + ring mounts (\$593). Alternative: Two sets chain or ring mounts, each with three tower-offset brackets, offset from the tower, with pipe mounts at both ends. E.g., Commscope Monopole Dual Pipe Mount Kit (\$3,502).
Install platform mount		mounts included in tower price
Tower base equipment	\$3,450	AmProd 36RU modular enclosure (\$2552) 68"H 25"D 26"W with fan (\$370), insulation (\$152), 4" mounting base (\$141), interior light (\$92), tray (\$143).
Batteries	\$950	4 12V 75AH AGM batteries
Rectifier set	\$2,000	Redundant 54V 10A rectifiers, shelf, breakers.
Install base equipment	\$1,000	
<b>Fiber &amp; power</b>		
Fiber	\$4,000	Fiber from firehouse to tower
Power	\$2,000	Power from transfer station to tower
<b>Tower radio gear</b>		
5GHz connectorized	\$1,290	3x Cambium C058900A112A ePMP 1000 5GHz Connectorized Radio with GPS Sync (FCC, US version) (\$430 each).
5GHz 90 degree sector	\$444	3x Cambium C050900D003A - ePMP 1000 5GHz 90 Degree Sector Antenna (\$148 each).
5GHz installation	\$450	3 x \$150
Integrated 5GHz AP	\$911	Mimosa A5-360-18 integrated access point system.
Mimosa installation	\$200	
2.4GHz connectorized	\$1,290	3x Cambium C024900A011A - ePMP 1000 2.4GHz Connectorized Radio GPS Sync (FCC, US/CA version) (\$430 each).
2.4GHz sector antennas	\$783	3x Cambium C024900D004A - ePMP 1000 2.4GHz 90/120-deg Dual-Pol Sector Antenna (\$261 each).
2.4Ghz installation	\$450	
3G TVWS AP	\$5,000	1 Carlson Wireless 3G TVWS access point prototype. (Production price around \$5000.)
TVWS sector antennas	\$800	2 Carlson Wireless TVWS sector antennas (to be specified by Carlson).
TVWS installation	\$450	
<b>Cabinet electronics</b>		
PoE	\$398	Netonix WS-12-250-DC 12-port 250-watt power over Ethernet / switch (\$380) with RMK-250 rack ears (\$18).
Installation	\$150	Including software
<b>5 GHz CPE</b>		
Cambium dish	\$565	5x Cambium C058900C062A - ePMP Force 200 5GHz Dish Antenna w Integrated High Gain Radio (FCC, US version). (\$113 each).
Cambium radio	\$255	3x ePMP Force 180 5GHz Integrated Radio (FCC, US version) (\$85 each)
Mimosa C5	\$400	4 x \$100
Mimosa C5c	\$480	4 x \$120
Antennas	\$480	4x 5 GHz dish antennas to be identified for the Mimosa C5c's (around \$120 each installed)
5 GHz installation	\$1,650	11 x \$150
<b>2 GHz CPE</b>		
Cambium dish	\$1,350	9x Cambium C024900C161A - ePMP Force 200 2.4GHz Dish Antenna w Integrated High Gain Radio (FC9C, US version) (\$150 ea.)
Cambium dish	\$300	2x Cambium C024900C031A - ePMP 1000 2.4GHz Integrated Radio (FCC, US/CA version) (\$150 ea.)
2GHz installation	\$1,650	11 x \$150
<b>TVWS</b>		
CPE	\$2,500	Up to 10 TVWS "3G" CPE prototypes, retail price est. around \$250; may be divided between indoor and outdoor versions.
CPE antennas	\$1,000	Up to 10 matching CPE antennas to be determined by Carlson, retail price est. around \$100 each.
TVWS installation	\$1,750	10 x \$175
<b>Network Infrastructure</b>		
Core routing	\$1,500	Most is for expert installation configuration (\$400 for the box)
Spare	\$0	
<b>Project Management</b>		
Design/engineering	\$12,000	
Administration	\$25,000	
<b>CapEx Total</b>	<b>\$174,788</b>	
<b>OpEx</b>		
Subscriber fees	\$1,600	32 x \$25 x 2 mo
AP fees	\$450	9 x \$25 x 2 mo
Upstream ISP	\$1,100	\$550 x 2 mo (50 Mbps)
Electricity	\$70	\$35 x 2 mo
<b>OpEx Total</b>	<b>\$3,220</b>	
<b>Total Pilot</b>	<b>\$178,008</b>	

## Middlefield Wireless Pilot Monthly Operating Expenses

<b>Operator fees:</b>		<b>Fee</b>	<b>Quantity</b>	<b>Total</b>
Per subscriber		\$25	32	\$800
Per access point		\$25	9	\$225
<b>Total</b>	\$1,025			
<b>Upstream ISP</b>	\$550	50 Mbps		
<b>Electricity</b>	\$35			
<b>Total</b>	<b>\$1,610</b>			

## Middlefield Wireless Broadband Access Sectors

Enabled sites	Lat (°)	Long (°)	Elev (m)	Ht (ft)	Access sectors				Total	Notes
					5 GHz	2 GHz	TVWS	900 Backhl		
Transfer Station		42.34972	-73.0119	90	1	2	3		5	
Arthur Pease		42.34861	-72.9986	47	3	3	2		3	
BCKT:Surriner W		42.31	-73.0411	42		1			1	
Blush Hollow (THR)		42.33611	-73.0306	42		1	1		1	
Chester Rd.		42.32778	-72.9989	65		2			1	
Chipman N of Root		42.36333	-72.9953	51	2	2	2		1	
CHST:Holcomb Hill FT		42.32472	-72.9575	existing			1	1	4	
East River bend		42.37111	-72.9664	56	2				1	
HPease&TownHill		42.34806	-73.0233	42		2			1	
Reservoir Rd		42.35694	-73.0525	51	2				1	
River S of 149		42.35611	-72.9639	42	2				1	
Skyline		42.36194	-73.0319	56		1	1		3	
Smith Hollow		42.38028	-72.9778	65	2	1			1	
[Contingency pole for budget]				42		1	1		2	

### Relay-only sites:

WRTH: Old North@River      42.4236   -72.9864      457      Redundant MBI access

**Total Sectors**  
**(Subscriber sectors)**

**41**

**14      16      11      1      26**

### Pole descriptions:

42/47-foot wood utility poles are 50/55-foot poles, planted 8'. A mast can raise a small antenna to the 52-55 foot level.

65-foot wood utility poles are 80-foot poles, planted 15'.

90-foot (above ground) monopole. Antennas generally attach to mounting hardware offset from the sides, below the top.