

Middlefield Wireless Broadband Project Costs

Towers & poles	\$	113,100
Network equipment	\$	138,225
Customer Premises Equipment	\$	78,675
Network Infrastructure	\$	11,662
Project Management	\$	79,000
Total	\$	420,662

(Initial Pilot cost)	\$	112,116
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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' guyed tow (90' up)	\$14,000	\$18,000	t	1	\$14,000	\$18,000	\$32,000	Rohn 55G 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
Total					\$163,150	\$88,175	\$251,325	

t total	\$51,600	\$61,500	\$113,100	Towers
e network	\$111,550	\$26,675	\$138,225	Field network equipment
e total	\$156,575	\$67,325	\$216,900	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	\$250	includes antennas	Price of Mimosa A5-360 AP
ePMP 2 GHz sync sector	\$600	\$250	includes antenna	Price of ePMP 2 GHz sync sector
Cambium PMP450i AP	\$1,350	\$250	includes antenna	Price of Cambium PMP450 AP
ePMP2000 5GHz sector	\$250	\$250	includes antenna	Price of 5GHz ePMP2000 sector
Single sector TVWS	\$3,500	\$300	includes antenna	Price of single sector TVWS
Multi-sector TVWS	\$5,000	\$300	antennas extra	Price of multi-sector TVWS
TVWS sector antenna	\$250	\$125	(installed w/sector)	Price of TVWS sector antenna
Backhaul radio	\$600	\$250	average	Price of backhaul radio
5G eForce200 SM	\$150	\$200	inc. mounting h/w	Price of 5GHz Force 200 SM
2.4G eForce 200 SM	\$150	\$200	inc. mounting h/w	Price of 2.4GHz Force 200 SM
PMP450 SM	\$375	\$250	connectorized + antenna	Price of PMP450i -900 MHz SM
TVWS SM	\$300	\$250	includes external antenna	Price of TVWS SM
Home WiFi	\$25	\$25		Price of home Wi-Fi demarc box
				Price of TVWS SM

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

Price of 900 MHz PMP450i SM
Tower climber fees man/day

Planned locations

Locations	266
Take rate	60%
Total take	160

CPE by band (estimates)	CPEs		Sub per seas. Adj.		Spare	SM cost	Install	Total
			sector	subs	SMs			
Subscribers on 5G	51	32%	3.6	47	3	\$8,100	\$10,200	\$18,300
Subscribers on 2G	45	28%	2.8	41	3	\$7,200	\$9,000	\$16,200
Subscribers on 900 MHz	12	8%	12.0	11	1	\$4,875	\$3,000	\$7,875
Subscribers using TVWS	50	32%	4.5	46	3	\$15,900	\$12,500	\$28,400
Home WiFi						\$3,950	\$3,950	\$7,900
Total	158	100%	3.9	145	10	\$40,025	\$38,650	\$78,675

Network Infrastructure

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

Project Management

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

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

Total initial project including pilot	\$420,662
Total CapEx/subscriber	\$2,662

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
Total	\$	1,025

Other Expenses

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

Depreciation

Electronics	\$	2,610
Tower/pole	\$	143
Total	\$	2,753

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	\$ 9,330
50% take	\$ 7,037	\$ 8,765
60% take	\$ 7,487	\$ 10,240
70% take	\$ 7,962	\$ 10,715

Subscribers (% of seasonally adj)

40%	50%	60%	70%
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	98	122	146	171
"Cash" internet break even	\$67.12	\$57.68	\$51.28	\$46.56
"Fiscal" internet break even	\$95.21	\$71.85	\$70.14	\$62.66

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
Tower		
Tower	\$30,000	Rohn 55G guyed steel tower, 55G110R90, with TA55 Torque Arm Stabilizer Assemblies for dual guy wire attachments
Excavation		Included in tower price
Antenna mounts	\$2,000	
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	
Fiber & power		
Fiber	\$4,000	Fiber from firehouse to tower
Power	\$2,000	Power from transfer station to tower
Tower radio gear		
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	
Cabinet electronics		
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
5 GHZ CPE		
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
2 GHz CPE		
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
TVWS		
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
Network Infrastructure		
Core routing	\$1,500	Most is for expert installation configuration (\$400 for the box)
Spare	\$0	
Project Management		
Design/engineering	\$12,000	
Administration	\$25,000	
CapEx Total		
	\$108,896	
OpEx		
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
OpEx Total	\$3,220	
Total Pilot	\$112,116	

Middlefield Wireless Pilot Monthly Operating Expenses

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

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.