			Town Owned with Contracted Operator	Matrix Owned & Operated	Comcast Owned & Operated
Highlights	1	Cost to Town	$1.79 million	$0 or $926,250. We expect the Town costs to be fully reimbursed by the State.	$571,905
	2	Cost to Subscribers	$75 - $125 per month, depending on a large number of factors, plus a one time $125 signup fee. This would be for internet only, and does not include taxes and fees.	$101 - $141 per month depending on level of service, plus a one time $250 signup fee, $125 of which can be paid over the first year of service. This would be for internet only, and does not include taxes and fees.	For internet only service, the price starts at $50/m (plus installation) and goes up. Service equivalent to Matrix would range from $60-$93 per month.
	3	Control	The town has complete control over design and operations.	Matrix has complete control over design and operations. The pricing is locked in for 2-years and the town (ML Board) must approve Standard Internet rate increases over Consumer Price Index increases thereafter	Comcast has complete control over design and operations, including pricing and service offerings.
	4	Bandwidth	Shared 2Gbps backhaul Single or multiple tiers of service	Shared 2Gbps backhaul Standard tier limited to 50 Mbps Enhanced tier limited to 100 Mbps; 100 Mbps customers would have priority traffic	Comcast offers between 15Mbps and 2Gbps. All traffic would go over Comcast's internal network infrastructure.
Construction	5	Total Cost	Estimated by the Massachusetts Broadband Institute (MBI) to be $2,860,000	Estimated by Matrix to be $3,170,000	Estimated by Comcast to be $2.883,889
	6	Cost to the Town	Estimated by the MBI to be $1,790,000.	Estimated by Matrix to be $926,250 which should be covered by the State Last Mile Funds allocated to Worthington of $1.07 million.	$571,905. This is not an estimate but a fixed price and is in addition to the State's allocation of $1.070,000 as well as an additional state contribution of $571,905 which can only be used for the Comcast proposal. Comcast would contribute the remaining $670,080.
	7	What does the cost cover?	The town would own the entire network - the fiber on the poles, the electronics required to transmit data over the fiber, both at the subscribers' premises and in the "hut". It would also own a right of way on all the utility owned poles used by the network and any additional poles required would be owned outright.	The town would own a right of way on all the poles used in the network, as well as any additional poles required by the network. It would also own the "hut" which would house the network electronics needed to operate the network. Finally, it would own electronics at each subscriber's premises.	The payment from the Town and the State (totalling $2.213,809) would allow Comcast to build the network. Comcast would retain ownership over all assets.
	8	Financing Options	The $1.8 million would need to be borrowed, plus some contingency. We recommend a total debt authorization of $2.1 million. The Worthington Municipal Light (ML) Board and Broadband Committee have decided that the debt service should ultimately be the responsibility of the subscribers, but that for the first five years, upto 50% of the debt service may be passed onto the taxpayers. After five years, the entire debt service would fall on the subscribers. However, this is a policy decision. Legally, the town will hold the debt and be responsible for repayment. If, for example, there were not enough subscribers to cover the cost of the debt service, the town would be required to make the payments.	The town will need to authorize borrowing up to $1.07 million in order to cover the initial costs. The State has allocated $1.07 million to Worthington for "last-mile" broadband, but certain conditions must be met prior to reimbursement under this proposal. Once those conditions have been met and the money has been reimbursed there would be little or no tax implications for the town. The town would issue short term notes for two years which would be paid off when the state reimbursement is received. Assuming the conditions are met, the ultimate cost to the taxpayer would be a minimal amount of interest paid over those two years.	The State would pay the Town's share directly to Comcast and allow the Town to pay back the State over 15 years which comes to approximately $38 thousand a year. The town would not have to authorize borrowing and would only pay minimal interest.

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Construction	9	What conditions are placed on receiving the state funds?	Under this proposal, state funds would be made available through a grant program overseen by the Executive Office of Housing and Economic Development (EOHED).This program is being used by many of the surrounding towns. Payments would be made when certain milestones are met, but generally are aimed to cover the "make-ready" costs.	Under this program, state funds would be made available through a reimbursement program. In order to receive reimbursement, the town must certify to the MBI that a number of conditions have been met, including that the network is complete and functioning as desired.	The state funds would be delivered directly to Comcast, in exchange for which Comcast would agree to an initial 15 year contract to operate the network and to provide the same services at the same prices as were available in a 100 mile radius.
	10	Who would decide what kind of network was built?	The ML Board would ultimately decide, presumably with input from the residents. While the ML Board is responsible for the network, town meeting is the enity that authorizes debt for the town. Therefore, the two bodies must work together.	Matrix proposes to design, build and maintain a standards based GPON Fiber-To-The-Home (FTTH) network. The network would be built in accordance to the industry manual of construction known as Telcordia SR-1421 and according to accepted industry best practices. (GPON: Gigabit Passive Optical Network)	Comcast
	11	Who would manage the construction?	Ultimately the town's ML Board would be responsible for ensuring the job was done well. We expect to hire a firm, such as Westfield Gas & Electric, to provide construction management services.	Matrix would manage the construction of the network but the Town would have the right to inspect the construction to insure the network is being built according to Telcordia SR-1421 and according to accepted industry best practices.	Comcast
	12	Who would do the construction?	We expect an outside firm would be hired to construct the network, including both along the roads and running fiber to each house. This company would be selected through a typical municpal bidding process, possibily with the assistance of Westfield Gas & Electric.	Matrix would do its own construction, although they may use subcontractors for portions.	Comcast
	13	What experience does this company or group of companies have to offer?	We expect to contract with an experienced network design firm to oversee the design and construction of a town owned network. Westfield Gas & Electric has emerged as a likely candidate for many towns in the region. We may collaborate with other towns which would reduce the load on Westfield Gas & Electric. Westfield Gas & Electric has designed and built fiber networks for 20 years and is in the process of building a fiber to the home (FTTH) network serving 70% of Westfield as well as designing and building a FTTH network in Otis and about 20 other towns, including our neighbors in Chesterfield, Cummington, WIndsor, Goshen & Plainfield. They have relationships with vendors and subcontractors which would be useful to Worthington.	Matrix Design Group and Millennium Construction are privately held sister companies. They have significant experience designing and building fiber optic networks for a range of institutions from FiOS networks for Verizon to municipal fiber in Vermont for ECFiber to colleges and universities and military networks. They are also building a network for the Town of Petersham under the same terms.	Comcast is a nationwide cable provider with a great deal of experience in this area.
	14	Are there any triggers to starting construction?	The town must vote at town meeting to authorize borrowing the money to build this network, and further must vote at an election to exclude this borrowing from the provisions of Proposition 2½. In addition, we will require 280 people to commit to taking service and pay a $125 sign up fee during a 90 day signup campaign before we start the build process.	The town must vote at town meeting to authorize borrowing up to $1.07 million, and further must vote at an election to exclude this borrowing from the provisions of Proposition 2½. Matrix requires 365 people to pay $125 (half of the $250 signup fee), and agree to a 24 month contract, before they will start construction.	The select board must negotiate and sign a Cable Franchise agreement with Comcast. This agreement is required by law but only covers the television services which Comcast will provide. Comcast and the State must sign an agreement in regards to financing (which has already been negotiated). This agreement places some conditions on the internet service.

			Town Owned with Contracted Operator	Matrix Owned & Operated	Comcast Owned & Operated
Construction	15	How soon would this network be built?	We cannot start designing a network until the debt has been authorized and excluded, and 280 people have signed up. Once that is complete, pole surveys and design should take at most 3 months followed by "make-ready" for which Verizon and Eversource have 6 to 9 months. Construction would then begin and is expected to take 3 to 9 months. All told, a fully operational network should be ready in 18 to 24 months from the sucessful signup campaign.	Matrix estimates 18-24 months to complete the design and build. However they can start serving subscribers as the network is built and they expect the first subscribers to have access in as little as 10 months from a successful signup campaign.	Comcast has said that it could take as little as 6 months after "make-ready" was complete.
	16	What kind of network would be built?	We expect it to be a fiber to the home network. While it is our opinion that a GPON network with splits in the "hut" would be superior to a GPON network with splits in the field, the differences would be relatively minor and both could be expected to serve the town well for many years.	They are proposing a GPON network with splits in the field, similar to how Verizon has built its FiOS network.	Comcast would build a fiber to the node network which is a hybrid fiber-coaxial network, as it has across the country and in neighboring towns, meeting the standards of the Data Over Cable Service Interface Specification (DOCSIS 3.1). In this model fiber is used on the "backbone" but each house is served by copper-based coaxial cable. This model has been shown to provide very high throughput. Comcast is obligated to provide service competitive with that available in communities upto 100 miles away for 15 years. We are confident that they can do that using this technology.
	17	How would the network be connected to the broader internet?	There are a range of options. The simplest would be a single connection to the MBI Middle Mile network to Springfield. A more robust solution may be available by cooperating with other towns either formally through Wired West or more informally. To achieve multiple interconnections with the broader internet would probably require additional cost.	This is yet to be determined. Matrix would prefer to have multiple connections to avoid potential single points of failure. The choice will be determined by available facilities and costs.	Comcast expects to connect to their existing infrastructure and use that to connect to the broader internet.
	18	How much of the town would be covered?	Our goal is to pass at least 96% of all premises in town, and we hope it would pass 100%.	Matrix expects to pass 100% of the premises which have existing poles. Where the fiber is built is determined by the Town providing the right of way (even for homes served by utilities from another Town).	At least 96%.
	19	Would there be a sign up fee?	Yes. $125 would be due at signup. Money raised through the signup campaign would be used for startup costs and/or operational contingenecies. This fee would be refundable if we did not reach our goal of 280 subscribers and therefore did not build the network.	Yes. $250 would be due in two installments. The first installment would be due at signup, the second at the start of construction. The first $125 would be refundable. The second could be spread out over the first year of service.	For subscribers whose drop length iss less than 250' there would be no signup cost with a "do it yourself" installation kit from Comcast. Professional Installation would be available starting at $80. There are often promotional offers to which might bring this cost down.
	20	Will I have to pay for the fiber running down my driveway?	Aerial installations, or installations in usable conduit, of less than 300' will have no additional costs. This covers approximately 70% of the driveways in town. Any distance over 300', or if new underground conduit is required, the additional costs will be the responsibility of the homeowner We estimate this additional cost to be about $1 / foot for an aerial installation. For example, if your driveway is 500' and your electrical or telephone service is delivered on poles, you could expect to pay about $200 for installation. Costs for underground service are much harder to predict.	Matrix will run aerial fiber or fiber in usable conduit up to 300' at no additional cost. Any distance over 300', or if new underground conduit is required, the additional costs will be the responsibility of the homeowner. Matrix expects it to cost about $1 / foot for aerial installations over 300'. Underground installations are much less predictable. They have expressed openness to spreading those costs out over time. Estimates of any expected additional costs will be made prior to installation.	Comcast will install up to 250' of wire for no additional cost. Over 250' will be handled on a case by case basis and be billed at the actual cost, less a "construction credit" which is currently $1400. While ever case is unique, $1 / foot is a reasonable guess at the cost.
	21	Will it cost more to get hooked up after the initial construction period?	Yes. We expect to charge new subscribers the actual cost of the hookup, which includes bringing a truck out. In Leverett this cost is approximately $2500.	Yes. Matrix expects to charge $1500.	No. There may be periodic promotional offers that decrease the cost.

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Constr.	22	Would every premises be connected or only those of subscribers?	Only subscribers would be connected, although at least 96% of the premises would have a wire on the street and therefore could be connected at a later date.	Only subscribers would be connected, although at least 96% of the premises would have a wire on the street and therefore could be connected at a later date.	Only subscribers would be connected, although at least 96% of the premises would have a wire on the street and therefore could be connected at a later date.
Operation	23	What would the monthly cost be?	Based on current cost estimates we project a maximum subscriber charge of $125 per month for the first five years. This includes internet and does not include phone service. We estimate the cost to be between $75 and $125 a month, depending on a variety of factors including the number of subscribers. There may be different tiers of service, or a single tier.	Matrix proposes a tiered system of $95 / month for up to 50Mbps, and $135 for up to 100Mbps. There would also be a small fee (estimated at $6-$7) to cover the town's costs associated with the right of way on the poles.	Comcast has a wide range of offerings. For comparison, the current pricing for 60Mbps internet only service is $30/m for 12 months, and $75/m after that. 105Mbps internet only service would be $93/m. Internet (75Mbps) and telephone would cost $75/m after an initial discount period. Basic television adds about $10/m for 10 channels. Full pricing details can be found at https://www.xfinity.com/learn/offers although it may not be accurate for our area.
	24	Who would I write the check to?	The contracted Internet Service Provider (ISP) would handle billing for the town.	Matrix	Comcast
	25	What services would be available?	The network would provide high speed internet access and optional voice-over-IP telephone service. There would be no traditional television service as a cable or satellite company might provide. Many services would be available via the internet including content providers such as NetFlix, DirectTV Now, Hulu, and HBO Now. Internet ready devices such as Apple TV and Roku would allow access to such content from a traditional television.	The network would provide high speed internet access and voice-over-IP telephone service. There would be no traditional television service as a cable company might provide. Many services would be available via the internet including content providers such as NetFlix, DirectTV Now, Hulu, and HBO Now. Internet ready devices such as Apple TV and Roku would allow access to such content from a traditional television.	Comcast offers a wide range of services over their network including television, internet access and phone service.
	26	How fast would my connection be?	We expect a 2Gbps backhaul connection to the broader internet via the MBI Middle Mile to Springfield. This connection would be shared by all subscribers. We could elect to limit how much of that connection any one subscriber could consume, or we could leave it open as Leverett has. We could add additional bandwidth at any time, for additional cost.	Matrix also assumes a 2Gbps connection to Springfield, shared by all subscribers. They would limit their 'standard' tier customers to 50Mbps. 100Mbps customers would have priority over 50Mbps customers if there was congestion on the network.	Comcast has a wide range of offerings from 15Mbps to 2Gbps.
	27	Who would handle customer service?	The town would contract with an Internet Service Provider to handle all aspects of customer service - billing, technical support, etc.	Matrix.	Comcast
	28	What if the customer service is awful or if the operator is otherwise unsatisfactory?	The ML Board could decide to not renew the ISP contract, and find a new service provider.	Matrix argues that it is in their best interest to perform well, and they suggest a desire to be very open and transparent with the town about the operation of the network. However, if things went badly, the town would have the option, after 3 years, of buying the network from Matrix. The cost would be known before construction, and is estimated to be $2.2 million, but would decrease by $128k per year until in year 20 it would be $10.	Individuals would be able to raise complaints with Comcast. The town would have limited recourse through a cable franchise agreement. These typically start with a 10 year term, and are renewed every 5 years after that.

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Operation	29	What experience does this company or group of companies have to offer?	We expect to contract with a firm to manage the network. The firm would be responsible for customer service, including billing, repairing issues at subscribers' houses, maintaining the equipment and the fiber plant itself. There are several companies which would be capable of playing this role. One is Crocker Communications who managed Leverett's network for the first three years. Another is OT&T, which has replaced Crocker as the ISP for Leverett. A third is Westfield Gas & Electric. All three have extensive experience with customer service and managing networks. It is likely that all of them would subcontract some portions of the maintenance but the customer service would be handled in house. Both Crocker and Westfield Gas & Electric are local companies for whom the addition of Worthington subscribers would not represent a significant increase in subscribers. On the other hand, if a large number of towns contracted with them, it would be a significant increase in scale. Both seem to have thought about how to manage that growth.	Matrix has limited experience operating residential-scale networks. They do have experience with commercial networks which share the same concerns about equipment maintenance, plant repair, negotiating backhaul rates, etc., but they do not have the same customer service requirements. Matrix is not concerned about scaling up that portion of their business. They are not a local company, but they propose that there would be repair personnel staged locally to ensure prompt execution of repair and maintenance requirements. They are currently building a network in Petersham under a very similar proposal.	Comcast is the largest home Internet service provider, the largest cable TV company, and the third-largest home telephone service provider in the United States. Locally, they have long provided service in Huntington and Chester and recently expanded into Montgomery through the MBI under a similar agreement as being proposed in Worthington.
	30	How soon would this network be operational?	The network would need to be completely built prior to making it operational. We estimate 18 to 24 months before any subscriber would have access, but then all the subscribers would have access within a few weeks at most.	Matrix estimates 18-24 months to complete the design and build. However they can start serving subscribers as the network is built and they expect the first subscribers to have access in as little as 10 months from the end of the subscription period.	Comcast has said that as little as 6 months would be required, after "make-ready". This means a total of 15-21 months.
	31	What about my privacy or "net neutrality"?	The town would have complete control in terms of protecting subscribers privacy and preserving net neutrality within the town owned network. We would be buying access to the larger network over networks such as the MBI's Middle Mile and therefore subject to their policies when accessing the broader internet.	Matrix adheres to Net Neutrality. They have stated in writing that they will not hinder access to content or applications nor favor one web site over another. Matrix has stated that they will not sell subscriber information to any third parties.	Subscribers would be bound by Comcast's privacy policy which is available through their website. Comcast is committed to what some critics describe as a narrow definition of net neutrality in which the internet is not regulated by the FCC but rather by acts of congress.
	32	How does WiredWest fit into this picture?	The town could decide to allow WiredWest to negotiate the ISP contract. Subscribers may get a better per month cost as a result, and the amount of work for the ML Board may decrease. In addition, being part of WiredWest would spread the risk of low subscriber numbers over a larger population.	It has no role, unless the town decides to buy the network and not hire Matrix to operate it.	It has no role.
	33	What is the long term plan?	The expectation with any fiber network is that it would last at least 20 years. The town would own the network and be responsible for replacing it if and when it needed it.	The town would have the option to buy the network after 3 years, but before 20 years. After 20 years, Matrix would own the network and the town would not have any rights to it.	Comcast would have to agree to operate the network for at least 15 years.

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Operation	34	Will the network be reliable?	Network service can be interupted by a variety of events, but we are most concerned with two types: power outages and accidents affecting the town's connection to the internet. To protect against a power outage, all system electronics will be served by a generator, and house mounted electronics will have a battery backup. The basic design calls for a single connection using the MBI's Middle Mile network from the town to the broader internet. This means that any disruption to that connection will cut off internet for the entire town. As we move forward, we expect to work with neighboring towns to develop redundent network paths which will insulate us from such disruptions. It is too early to know what the costs would be or exactly how it would be done, but reliability is a priority for us.	Matrix will address power outages with generators and batteries. It is in Matrix's interest to provide a reliable network, but we will have no direct control over how they achieve that.	Comcast's network design is proprietary and therefore hard to compare to the other options however, there is no reason to suspect it will be any less reliable than those options.
	35	What will happen to any operational surplus?	The ML Board will decide what to do with any operational surplus. It could be used to increase a contingency fund, or saved for equipment renewal, or applied to debt service, or used to reduce subscriber charges.	Any operational surplus will go to Matrix while it owns the network. However, if the town decides that there is a good business case to owning and operating the network, it can buy it at a pre-determined price after 3 years.	Any operational surplus will belong to Comcast.
Analysis	36	What factors will affect subscriber cost?	If the town owns the network then the relatively significant fixed annual cost to operate the network is shared by all subscribers. This has the advantage that as the number of subscribers goes up, the cost for each subscriber may go down. If the town owns the network, that can result in a reduction of the monthly bill for each subscriber, an increase in the share of the debt service that the subscribers bear, or both. On the other hand, if the number of subscribers is low, then the cost per subscriber will be high, potentially higher than the market rate for such a service, which will further impact how many residents subscribe. It is possible that if the town were part of a regional group such as WiredWest, that in itself would reduce the operational cost for Worthington enough that the subscribers and taxpayers would benefit even if a smaller percentage of the residents in Worthington subscribed to the service. In that case, all decisions would be handled at the regional group level.	Matrix has stated that the monthly cost per subscriber will be $95 (for 50Mbps), and that cost will be fixed for the first 2 years. After that, the cost can be increased, but the Worthington ML Board will have to approve any increase over the Consumer Price Index. Decreases are possible, if unlikely. It should be noted that Matrix would allow the town to buy the network after 3 years. The price is expected to start at $2.2 million, and decrease by approximately $130k per year, until at year 20, it would cost $10. This is the same affect that we would see in the town owned option if the subscribers covered the entirety of the debt service. In that case the debt service is estimated at $137k per year.	In order to receive funding from the State, Comcast must agree to offer the same services to residents of Worthington as are available to other customers in a 100 mile radius, at the same monthly cost. In practice, Comcast offers the same services at the same price to all their customers, nationwide. The effect is that the price of service in Worthington would be subject to the same competetive pressures as pricing in Boston or Albany.

			Town Owned with Contracted Operator	Matrix Owned & Operated	Comcast Owned & Operated
Analysis	37	How transparent would the operation be?	The operation would be managed at a high level by the town's elected ML board, which is bound by the same transparency and public access laws as all other town boards. That board would be responsible for contracting with vendors to provide the services needed. The primary contract would be with a company like Westfield Gas & Electric or Crocker to operate the network, but there are other costs such as insurance, pole rentals and debt service. The board would develop a budget each year and set the subscriber cost based on that budget. This process would be public, with opportunities for public input into the subscriber rate. If the town were to join WiredWest there would still be openness to the process, but significantly less control within the town. The subscriber rate would be set by the cooperative with input from all member towns.	Matrix has proposed that all assets associated with the network within Worthington would be held by an LLC, and that the town would have access to the accounting records of that LLC. Having the assets held by an LLC facilitates an easy sale, if the town decided to buy the network. Having access to the accounting records allows the town to understand exactly what they would be buying, both in terms of costs and revenues. This is a high level of transparency. However the town would have very little input into any decision making processes, as long as Matrix owned the network.	There would be no transparency.
	38	What happens if it fails to attract enough subscribers?	We expect to pre-subscribe as many as we can so that we know whether the network will be sustainable prior to building it. We consider the network sustainable when the subscriber fees cover all operational expenses and debt service. We will build the network with 280 subscribers. With 280 subscribers paying $125 / month, our estimates show that all of the operational expenses and a bit over half of the debt service will be paid for by the subscribers. In order to be fully sustainable (cover 100% of the debt service) with a $125 / month subscriber charge, we estimate we need approximately 320 subscribers, or 50% of the 650 potential subscribers. We are comfortable building a network with 280 pre-subscribers because we are confident that we can get to 320 within 5 years. However, it is possible that we build the network and after a few years the number of subscribers drops off until we have too few to operate it sustainably. What happens next depends on just how few subscribers we have. If we are close to 50% we may be able to join with WiredWest which may lower our operational costs as well as spreading that cost over subscribers in other towns as well. If the numbers are really low, we may have to stop operating the network which would mean the town owns and the tax payers are paying debt service on an asset which we are not able to use. It seems conceivable that we could sell it, were there a buyer. This is the scenario we are working very hard to be sure will not happen!	Matrix will not start construction until 365 people have put down $125 and promised to pay another $125, plus subscribe for 2 years. We estimate there are 650 premises in Worthington, so this represents 56% of the possible subscribers. If they do not get that many early subscribers, the network will not be built. They will work with the town to do outreach and marketing. If they reach that number and build the network, it is still possible that after a few years people stop subscribing. At some point, Matrix would be at risk of loosing money, and could decide to sell the network or to simply shut it down. The town would have the option of buying the network, if it felt it was worth preserving.	Comcast must agree to run the network for 15 years in order to receive funding from the State. They must do so even if the network operates at a loss.