

**Before the  
NATIONAL TELECOMMUNICATIONS AND  
INFORMATION ADMINISTRATION  
Washington, D.C. 20230**

In the Matter of )  
 )  
Broadband Equity, Access, and Deployment )  
(BEAD) Program: Alternative Broadband )  
Technology Policy Notice )  
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**COMMENTS OF CORNING INCORPORATED ON NTIA’S “BROADBAND EQUITY,  
ACCESS, AND DEPLOYMENT (BEAD) PROGRAM: ALTERNATIVE BROADBAND  
TECHNOLOGY POLICY NOTICE”**

**I. INTRODUCTION AND SUMMARY**

Corning Incorporated (“Corning”) respectfully submits the following comments in response to the National Telecommunication and Information Administration’s (“NTIA’s”) proposed “Broadband Equity, Access, and Deployment (“BEAD”) Program: Alternative Broadband Technology Policy Notice” (the “Notice”).<sup>1</sup> Corning appreciates NTIA’s continued stewardship of the BEAD Program, and its constructive focus on achieving its “principal goal” of “deploy[ing] broadband service to all unserved and underserved locations.”<sup>2</sup>

The Notice seeks to provide Eligible Entities with additional guidance regarding the use of Alternative Technologies, specifically low-earth orbit (“LEO”) satellite broadband service and unlicensed fixed wireless (“ULFW”) service, to serve unserved and underserved locations within their jurisdiction. As explained in the Notice, the BEAD NOFO establishes a clear hierarchy for awarding funding for unserved and underserved areas: (1) Priority Broadband Projects (*i.e.*, end-to-end fiber); (2) other Reliable Broadband Service projects; and then (3) Alternative Technology<sup>3</sup> projects (where the cost to deploy Reliable Broadband Service exceeds the

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<sup>1</sup> NTIA, “Broadband Equity, Access, and Deployment (BEAD) Program: Alternative Broadband Technology Policy Notice” *available at* <https://www.ntia.gov/sites/default/files/publications/bead-alternative-broadband-technology-policy-notice-for-public-comment-final.pdf> (“Notice”).

<sup>2</sup> *Notice*, p. 4.

<sup>3</sup> Defined as “any broadband access technology that terminates at the end user’s location or premises and does not qualify as Reliable Broadband Service, including ULFW and LEO, but meets the BEAD Program’s minimum technical requirements of speeds of not less than 100 Mbps for downloads and 20 Mbps for uploads and latency less than or equal to 100 milliseconds.” *Notice*, p. 4, note 5.

Extremely High Cost Per Location Threshold (“EHCPLT”) and where the use of an Alternative Technology would be less expensive).<sup>4</sup>

Corning encourages NTIA to adhere to the BEAD NOFO’s established preference hierarchy as it seeks to implement the EHCPLT requirements. Adherence to this hierarchy will best ensure that NTIA satisfies the BEAD Program’s principal focus of deploying appropriate levels of broadband service to all unserved and underserved locations (*i.e.*, speeds of not less than 100 megabits per second (“Mbps”) for downloads and 20 Mbps for uploads and latency less than or equal to 100 milliseconds).

Because of the service limitations that led to the omission of Alternative Technologies from the definition of Reliable Broadband Service, the Proposed Notice would direct Eligible Entities to “consider carefully”<sup>5</sup> the capabilities of existing Alternative Technology network services and existing enforceable commitments to deploy such technologies under three scenarios.<sup>6</sup> The Notice explains that subject to meeting the requirements outlined in the BEAD NOFO and related guidance, Eligible Entities may fulfill their obligation to serve all unserved and underserved locations within their jurisdiction through the use, in part, of such Alternative Technologies, such as LEO satellite broadband service and ULFW service.

With respect to the Notice, Corning submits these comments to emphasize three key elements to NTIA’s consideration of how best to ensure it satisfies its EHCPLT obligations under the BEAD Program.

*First*, fiber is a future-proof broadband technology that remains critical to NTIA’s broader broadband deployment goals under the BEAD Program. The unequaled characteristics of FTTH technologies—high speed, low latency, near limitless capacity, security, sustainability, and high durability/reliability—make it the best suited platform to meet the growing demand of future use cases. In instances where Eligible Entities must satisfy their broader BEAD deployment obligations, and their narrower EHCPLT requirements, they should view fiber as the principal technology to support the deployment of Alternative Technologies.

*Second*, NTIA should also provide clear direction to Eligible Entities that fiber to the home (“FTTH”) technologies remain the preferred approach under the Priority Broadband Project standard. FTTH technologies have gained a well-earned reputation for far superior performance and reliability versus copper-based and wireless communications networks.

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<sup>4</sup> See NTIA, Notice of Funding Opportunity, Broadband Equity, Access, and Deployment Program, at 36-39 and 41 (2022) (“*BEAD NOFO*”). Capitalized terms not defined herein will be ascribed the definitions in the BEAD NOFO. The EHCPLT “is a BEAD subsidy cost per location to be utilized during the subgrantee selection process described in Section IV.B.7 of the BEAD NOFO above which an Eligible Entity may decline to select a proposal if use of an Alternative Technology meeting the BEAD Program’s technical requirements would be less expensive.” See also *BEAD NOFO* at 13.

<sup>5</sup> *Notice*, p. 7.

<sup>6</sup> *Id.*, pp. 7 – 9.

*Third*, in its implementation of the EHCPLT, NTIA should adopt a forward-looking strategy by prioritizing ULFW over LEO. This prioritization would advance the future deployment of 5G and successor wireless technologies as well as other advanced services. Because ULFW extensively relies on middle mile fiber infrastructure, NTIA can foster concurrent middle mile investment in the implementation of the EHCPLT. By doing so, NTIA will facilitate future deployment of more advanced technologies in unserved and underserved locations.

*Fourth*, the capabilities of nascent LEO technologies remain unclear and may undermine the ability of NTIA to protect the integrity of BEAD funding. As such, there are inherent risks associated with any decision by NTIA to direct BEAD funding to nascent LEO technologies, particularly as they relate to the ability of such technologies to satisfy the speed and latency requirements under the BEAD Program.

## II. DISCUSSION

### A. Fiber is a Future-Proof Broadband Technology That Remains a Cornerstone Component of NTIA’s Implementation of the BEAD Program.

With the billions for broadband appropriated by Congress in the BEAD Program, the United States is poised to achieve its goal of 100% broadband connectivity and thereby close the digital divide once and for all. Like with the Rural Electrification Act of 1936, BEAD affords the United States the opportunity to make a massive, lasting impact for generations to come. Since enactment of the Infrastructure Investment and Jobs Act (“IIJA”), NTIA has faithfully implemented the BEAD Program consistent with Congress’s preference for fiber. Congress’s preference for fiber is logical, given its numerous benefits and immunity from technological obsolescence. As NTIA acknowledged in a blog post accompanying release of the Notice, fiber is the “gold standard” for broadband since it is a “future-proof technology that will grow with families’ data needs over time.”<sup>7</sup>

Fiber is the most capable, sustainable, scalable, multi-use broadband infrastructure available. With its symmetrical speeds, near infinite bandwidth, and unmatched reliability, fiber will ensure that broadband infrastructure constructed with BEAD funds are “future-proof.” Optical fiber is also the only technology that does not impose an intrinsic bottleneck on the transmission medium.

The prioritization and deployment of optical fiber cable will further NTIA’s goals by allowing Americans to access robust, symmetrical, and equitable broadband rather than being relegated to less capable service simply because they happen to live in rural parts of the country, economically challenged areas, or dense urban cores.

Optical fiber networks have revolutionized data transmission, and in the process, created millions of jobs directly and indirectly in the United States and added tens of billions of dollars

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<sup>7</sup> See NTIA website, *Choosing the right mix of technologies to achieve Internet for All*, available at <https://www.ntia.gov/blog/2024/choosing-right-mix-technologies-achieve-internet-all>.

to U.S. GDP annually. Today, there are approximately eight billion kilometers of fiber deployed around the globe, enough to travel to the sun 54 times.<sup>8</sup>

**B. Consistent with the BEAD NOFO, NTIA Should Issue Guidance Clarifying the Primary Role of FTTH in its Technology Hierarchy.**

FTTH technologies have gained a well-earned reputation for far superior performance and reliability versus other broadband technologies. Consistent with Congress’s directive under the IIJA, NTIA should therefore provide clear direction to Eligible Entities that FTTH technologies remain the preferred approach under the NTIA’s established technology hierarchy.<sup>9</sup> To maximize this historic funding opportunity and ensure the public achieves the greatest benefit from this investment, NTIA should continue to prioritize solutions that offer the best combination of capability and scalability. The unequaled characteristics of FTTH technologies—high speed, low latency, near limitless capacity, security, sustainability, and high durability/reliability—make it the best suited platform to meet the growing demand of future use cases. And, it can be deployed in many challenging terrains and at lower cost than some may realize.

As a threshold matter, operational expenses for FTTH networks are far lower than for other broadband network technologies. According to one study, operational expenses for a typical FTTH network amount to \$53 per year per home passed, compared with \$107 per year per home passed for a Hybrid fiber-coaxial (“HFC”) network and \$144 per year per home passed for DSL.<sup>10</sup> By switching from HFC to FTTH, an operator can save \$54 per year per home passed, and by switching from DSL to FTTH, it can save \$91 per year per home passed. This translates to 50 percent savings for FTTH relative to HFC and 63 percent relative to DSL.<sup>11</sup>

FTTH technologies also benefit from significant scalability and longevity characteristics. Wireless, DOCSIS, and DSL technologies have required continuous outdoor infrastructure upgrades to increase speeds and capacity, and carriers have recognized the value of fiber as these incremental approaches typically include more optical fiber deeper into the network toward the subscriber. FTTH to each subscriber, by contrast, is the only communications technology that

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<sup>8</sup> See Corning website, *The Evolution of Optical Fiber*, available at: <https://www.corning.com/media/worldwide/coc/documents/Fiber/evolution-of-optical-fiber.pdf>.

<sup>9</sup> See *BEAD NOFO*, p. 42 (stating that “NTIA has determined that ‘Priority Broadband Projects’ are those that use end-to-end fiber-optic architecture,” and that “[o]nly end-to-end fiber will ‘ensure that the network built by the project can easily scale speeds over time to ... meet the evolving connectivity needs of households and businesses’ and ‘support the deployment of 5G, successor wireless technologies, and other advanced services.’” Citing IIJA, § 60102(a)(1)(I).

<sup>10</sup> See Fiber Broadband Association Study, *Operational Expenses for All-Fiber Networks are Far Lower Than for Other Access Networks*, p. 12 (June 2020); available at: <https://url.us.mimecastprotect.com/s/5jFeCn5Gg8SKLXNjtJhYCJ14LM?domain=fiberbroadband.org>.

<sup>11</sup> *Id.*

can support decades of speed and capacity increases with no upgrades to the outdoor infrastructure.<sup>12</sup> The scalability of today’s optical fiber to support higher speeds is virtually unlimited, to speeds 60,000 times higher than today’s 10 Gigabit per second (“Gbps”) systems to individual homes or businesses.<sup>13</sup>

In terms of longevity, when fiber is properly designed, manufactured, cabled, and installed per standards and manufacturer recommendations, there are no inherent mechanisms that cause high-quality fiber to spontaneously break or darken. Where a quality fiber optic cable manufacturing process is in place, there is no defined lifetime or expiration date for such a fiber optic cable.<sup>14</sup> Although 25 and 40-year lifetimes have been sometimes attributed to fiber, those lifetimes are driven by accounting depreciation schedules versus inherent degradation mechanisms. Other long-lived assets often have shorter depreciation schedules than operating lives.<sup>15</sup> The decades-long lifespan for fiber stands in contrast to LEO satellites, which are typically designed to last approximately 5 years or less.<sup>16</sup>

To ensure that Eligible Entities are meeting Congress’s directive under the IIJA, and satisfying NTIA’s accompanying guidance through the BEAD NOFO, NTIA should provide clear direction to Eligible Entities that FTTH technologies remain the preferred approach under NTIA’s established technology hierarchy. Such guidance will best ensure that Eligible Entities adhere to appropriate stewardship of once in a lifetime BEAD funding.

**C. In Its Implementation of the EHCPLT, NTIA Should Adopt a Forward-Looking Strategy by Prioritizing ULFW Over LEO to Advance the Future Deployment of 5G, Successor Wireless Technologies, and Other Advanced Services.**

In considering how best to specifically address locations subject to the EHCPLT, NTIA should avoid quick fixes or ‘check the box’ solutions that, while superficially appealing, are incapable of meeting the agency’s and Congress’s ultimate objective of ubiquitous deployment of robust broadband networks. Instead, NTIA’s decisions made as part of its EHCPLT implementation should seek to leverage to the greatest extent possible the ability to increase the level of broadband service to these areas over time and at minimal cost. By doing so, NTIA can

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<sup>12</sup> See Fiber Broadband Association Study, *Fiber Broadband Scalability and Longevity*, p. 3 (February 2024); available at: <https://url.us.m.mimecastprotect.com/s/vspHCo2Aj7uBGD3ZhVigCplPB-?domain=fiberbroadband.org>.

<sup>13</sup> *Id.*

<sup>14</sup> *Id.*, p. 7.

<sup>15</sup> *Id.*

<sup>16</sup> See Congressional Budget Office Report, *Large Constellations of Low-Altitude Satellites: A Primer*, p. 19 (May, 2023); available at: <https://www.cbo.gov/system/files/2023-05/58794-satellite-primer.pdf>. See also Notice of Proposed Rulemaking, *Streamlining Licensing Procedures for Small Satellites*, FCC 18-44, ¶ 4 (discussing the orbital lifetime of small satellites as “five years or less.”).

best leverage this once in a lifetime investment opportunity to lay the groundwork for greater deployment of advanced technologies in the years and decades ahead.

NTIA can best achieve this goal by prioritizing ULFW technologies over LEO technologies to satisfy the BEAD Program’s EHCPLT framework. Every technology in the broadband ecosystem needs access to fiber—including fixed broadband, cable, and cellular, particularly 5G. Deploying more fiber helps everyone, and fiber densification throughout the U.S. is particularly critical for winning the race to 5G. By fostering concurrent investment in middle mile fiber networks during implementation of the EHCPLT component of the BEAD Program, NTIA can best lay the groundwork for future deployment of more advanced technologies.

Unlike LEO technologies, deployment of ULFW technologies to locations subject to the EHCPLT will require increased densification of middle mile fiber backbone infrastructure, particularly in unserved and underserved areas. Given that middle mile fiber infrastructure is the foundation upon which networks are built, its deployment in support of ULFW technologies can be leveraged in the future to support future broadband deployments of 5G, successor wireless technologies, and other advanced services. This virtuous dynamic (*i.e.*, supporting ULFW in EHCPLT deployments and encouraging deployment of middle mile fiber infrastructure) will lay the groundwork for future technologies – including advances in ULFW – to equally benefit from the deployment of middle mile infrastructure.

Moreover, by some estimates the expected typical lifetime of fiber networks is up to 40 years.<sup>17</sup> Given the longevity of middle mile fiber networks, by directing EHCPLT funding towards ULFW technologies, NTIA can best advance deployment of future – and more robust – broadband technologies to American consumers living in rural parts of the country for decades to come.

#### **D. NTIA Should Remain Cautious About Funding of Nascent LEO Technologies for BEAD Support Given the Lack of Clarity Regarding Their Capabilities.**

The capabilities of nascent LEO technologies remain unclear and may undermine the ability of NTIA to protect the integrity of BEAD funding. As such, there are inherent risks associated with any decision by NTIA to direct BEAD funding to nascent LEO technologies, particularly as they relate to the ability of such technologies to satisfy the speed and latency requirements under the BEAD Program.

For example, in August 2022, the Federal Communications Commission’s (“FCC” or “Commission”) Wireline Competition Bureau (“Bureau”) determined that a proposed LEO offering was “not reasonably capable of complying” with the FCC’s [Rural Digital Opportunity

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<sup>17</sup> Washington State Department of Commerce Report, *Low Earth Orbit (LEO) Satellite Feasibility Report*, p. 18 (“*Washington State LEO Report*”).

Fund (“RDOF”)] requirements.<sup>18</sup> Among other things, the Bureau noted that the offering relied upon a “nascent LEO satellite technology,” and questioned the LEO provider’s ability to timely deploy future satellites to address capacity constraints while maintaining broadband speeds to both RDOF and non-RDOF customers, by providing 100/20 Mbps low latency service.<sup>19</sup> Notably, the FCC’s 100/20 Mbps standard<sup>20</sup> – which reflects the “Above Baseline” tier in the RDOF – reflects the *minimum* speed tier under the BEAD.<sup>21</sup> The Bureau further noted that – at the time of its decision – the LEO provider’s speeds were declining from the last quarter of 2021 to the second quarter of 2022, including upload speeds that were “falling well below 20 Mbps.”<sup>22</sup>

In late December 2023, the FCC released an Order on Review affirming the Bureau’s decision. Among other things, the FCC noted that the LEO provider’s “performance had been declining for download speed, upload speed, and jitter test performance.”<sup>23</sup> The FCC reasoned that the LEO provider was “not only failing to meet the RDOF public interest obligations, but also trending away from them.”<sup>24</sup>

The FCC “has an obligation to protect our limited Universal Service Funds and to avoid extensive delays in providing needed service to rural areas, including by avoiding subsidizing risky proposals that promise faster speeds than they can deliver, and/or propose deployment plans that are not realistic or that are predicated on aggressive assumptions and predictions.”<sup>25</sup> NTIA has a similar obligation with respect to its stewardship of BEAD funding. The Notice emphasizes that where the cost to deploy exceeds the EHCPLT, Eligible Entities are required to seek out “the most *robust, affordable*, and scalable technologies achievable under the circumstances particular to a location.”<sup>26</sup> Just as was the case with the FCC, LEO technologies fail to satisfy the BEAD NOFO’s guidance that technologies be the most robust and affordable.

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<sup>18</sup> Public Notice, *Rural Digital Opportunity Fund Support For 80 Winning Bids Ready to be Authorized; Bid Defaults Announced*, DA 22-848, p. 9 (2022) (“RDOF Public Notice”).

<sup>19</sup> *Id.*

<sup>20</sup> Report and Order, *Rural Digital Opportunity Fund, Connect America Fund*, FCC 20-5, ¶ 31 (2020).

<sup>21</sup> *BEAD NOFO*, p. 37. Further, the FCC expressly prohibited LEO satellite providers from bidding in the RDOF’s Gigabit performance tier. *See* Public Notice, *Rural Digital Opportunity Fund Phase I Auction, Notice and Filing Requirements and Other Procedures for Auction 904*, FCC 20-77, ¶ 99 (2020).

<sup>22</sup> *RDOF Public Notice*, p. 9.

<sup>23</sup> Order on Review, *Application for Review of Starlink Services, LLC, Rural Digital Opportunity Fund*, FCC 23-105, ¶ 30 (2023) (“*LEO Order*”).

<sup>24</sup> *Id.* *See also* Order on Reconsideration, *Rural Digital Opportunity Fund Auction, Rural Digital Opportunity Fund Auction (Auction 904)*, DA 24-883 (2024).

<sup>25</sup> *RDOF Public Notice*, p. 9.

<sup>26</sup> *BEAD NOFO*, at 39 (emphasis added).

In terms of robustness, the FCC ultimately concluded that LEO technologies faced potential limitations on their ability to satisfy either the latency and speed obligations under the RDOF. Further, in its decision less than a year ago, the FCC noted that the LEO provider's deployment plans heavily relied on its ability to launch more LEO satellites through use of an updated version of its launch rocket. In this regard, the FCC noted that the LEO provider had "has not yet had a successful launch; all of its attempted launches have failed."<sup>27</sup> Given these failures, the FCC ultimately concluded that "the uncertain nature" of the LEO provider's future launches could impact its ability to meet its RDOF obligations.

Since that time, uncertainties around the launch vehicle's capabilities have only increased. Subsequent to the FCC's December 2023 Order, the LEO provider conducted two additional launches in 2024, with only one fully successful launch attempt.<sup>28</sup> In light of the above, significant questions remain as to whether LEO technologies satisfy the BEAD's robustness criteria, and NTIA should therefore proceed accordingly.

With respect to affordability, industry analysts have long questioned whether broadband services utilizing LEO technologies can overcome significant cost concerns associated with its deployment.<sup>29</sup> The Notice expressly acknowledges the fact that the acquisition and installation of end-user equipment needed to access ULFW or LEO services can be substantially more expensive than the equipment acquisition and installation costs associated with other last-mile broadband technologies.<sup>30</sup> However, such costs associated with LEO technologies are substantially higher as compared to ULFW technologies.

According to one report focusing on BEAD deployment in the state of Washington, costs of deploying licensed fixed wireless network infrastructure can range from \$465 to \$3,950

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<sup>27</sup> *LEO Order*, ¶ 33. The LEO provider's two test flights preceding issuance of the *LEO Order* "ended in explosions in 2023." CNN, *Starship's Monumental Third Flight Ends Unexpectedly*, available at: <https://www.cnn.com/2024/03/16/world/starship-milestones-science-newsletter-wt-scn/index.html> ("CNN Article").

<sup>28</sup> See SpaceX website, *Starship's Third Flight Test*, March 14, 2024, available at: <https://www.spacex.com/launches/mission/?missionId=starship-flight-3> (noting that the vehicle "experienced a . . . 'rapid unscheduled disassembly' during reentry"). See also CNN Article (noting that the test flight "end[ed] prematurely" with the launch vehicle "likely breaking apart.").

<sup>29</sup> For example, a 2020 report from McKinsey and Associates concluded that their long-term success hinges on substantial cost reductions, and that "companies planning large LEO satellite internet constellations still need to reduce a range of costs significantly to ensure long-term viability." See McKinsey and Associates website, *Large LEO satellite constellations: Will it be different this time?*, <https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/large-leo-satellite-constellations-will-it-be-different-this-time>. These factors include lowering launch costs, along with costs associated with the manufacturing of spacecraft, ground equipment, and user equipment.

<sup>30</sup> *Notice*, para. 14.

depending on rurality. This stands in stark contrast to the per-location infrastructure cost estimates for LEO offerings, which range from \$3,750 to \$5,000.<sup>31</sup>

These cost calculations demonstrate the significant disparity between ULFW and LEO. Specifically, the *highest* anticipated costs for deployment of ULFW technologies, generally align with the *lowest* anticipated costs for LEO. Given the BEAD NOFO's directive that Eligible Entities seek out the most affordable option, ULFW reflects a more prudent choice. LEO affordability considerations are further exacerbated by the Notice's application of funding for LEO Capacity Subgrants, which – as the name implies – are unique to LEO providers alone.<sup>32</sup> The additional costs imposed by LEO Capacity Subgrants will only further strain funding availability under the BEAD Program.

There are also significant limitations on the ability of Eligible Entities to assess the capabilities of LEO technologies fully and accurately for purposes of providing BEAD funding to locations subject to the EHCPLT. The Notice emphasizes that it is “particularly important” that Eligible Entities “carefully consider” the capabilities of existing Alternative Technologies network services and “existing enforceable commitments to deploy such technologies.”<sup>33</sup>

Consistent with the BEAD NOFO, the Notice states that Eligible Entities “must determine” where an existing or completed enforceable commitment to deploy an Alternative Technology is “subject to ongoing network performance monitoring.”<sup>34</sup> This obligation is critical to the integrity of the BEAD Program, since it will prevent unnecessary, wasteful spending on alternative technologies that are unable to meet the requisite speed and latency obligations.

However, while ULFW and other broadband technologies are subject to ongoing network performance monitoring, LEO technologies are not. The single LEO bidder in the FCC's RDOF auction was denied funding, and satellite technologies in general (including LEO technologies) have been expressly excluded from other federal broadband deployment programs.

As such, Eligible Entities will be unable to accurately ascertain the capabilities of LEO technologies through existing federal programs for purposes of providing support to areas subject to the EHCPLT under the BEAD program.

### III. CONCLUSION

Corning appreciates the opportunity to provide input on the important questions posed by NTIA in its Notice. Given its inherent benefits, and the unequaled characteristics of FTTH technologies—high speed, low latency, near limitless capacity, security, sustainability, and high durability/reliability—we believe fiber remains the best suited platform to meet the growing

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<sup>31</sup> *Washington State LEO Report*, p. 6.

<sup>32</sup> *Notice*, pp. 13 – 15.

<sup>33</sup> *Notice*, p. 7.

<sup>34</sup> *Id.*

demand of future use cases. In instances where Eligible Entities must satisfy their broader BEAD deployment obligations, and their narrower EHCPLT requirements, they should continue to view fiber as the principal technology to support the deployment of Alternative Technologies.

Respectfully submitted,

By: /s/ Michelle O'Neill

Michelle O'Neill  
Vice President, Global Government Affairs  
Corning Incorporated  
1001 Pennsylvania Avenue, Suite 420 North  
Washington, DC 20004  
[OneillML@corning.com](mailto:OneillML@corning.com)  
(202) 495-8679

September 10, 2024