Cabling Installation & Maintenance

EXECUTIVE SUMMARY

Fiber: The Integral Enabler of Smart Water Infrastructure

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KEY TAKEAWAYS

- Implementing smart technologies modernizes water and wastewater treatment plants.
- Fiber is the best-suited medium to build a reliable, scalable, and future-ready network.
- Key considerations for deploying the fiber optic network in a water treatment facility.

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Fiber: The Integral Enabler of Smart Water Infrastructure

OVERVIEW

Smart water infrastructure improves security, scalability, and longevity of wastewater infrastructure to meet the demands of today and into the future. Fiber optic networks provide optimal support for smart water infrastructure, create value, and position communities for long-term success by enabling the delivery of new and better services.

Corning Optical Communications offers products and services to implement all-fiber networks. In business for over 45 years, Corning leverages its expertise and strong ecosystem partnerships to provide guiding principles and best practice considerations of fiber-optic network design in addition to its extensive product catalog.

CONTEXT

Gayla Arrindell discussed the importance of smart water technologies and key considerations when installing fiber solutions. Mike Gryn shared how Concentric Integration and Corning worked together to implement fiber in the City of Elmhurst, Illinois.

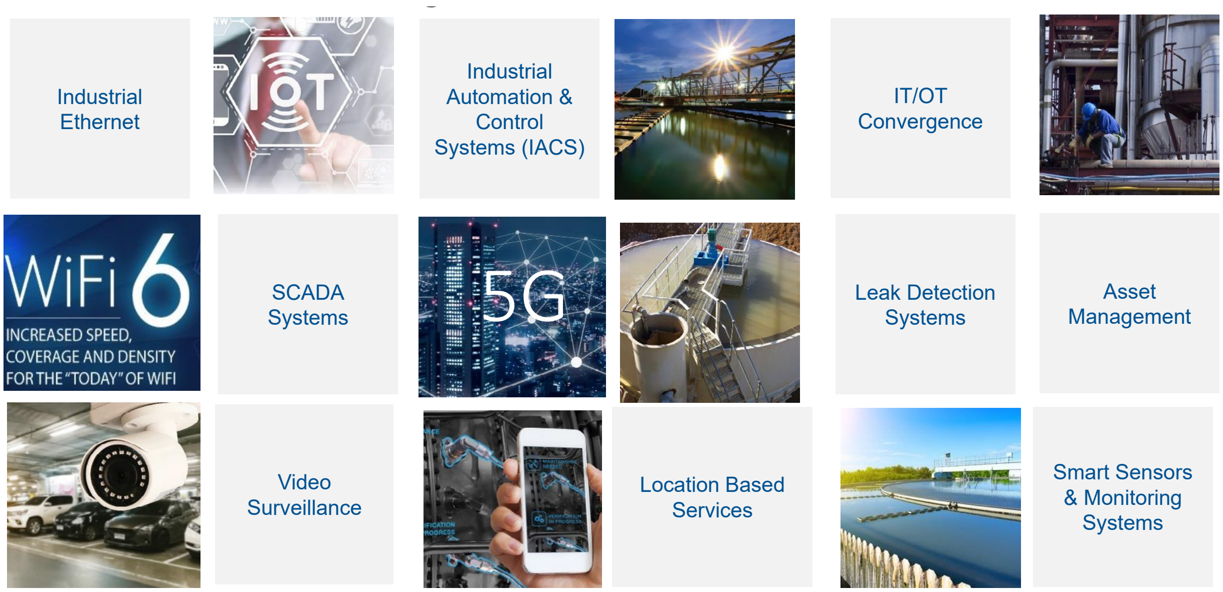
KEY TAKEAWAYS

Implementing smart technologies modernizes water and wastewater treatment plants.

Availability of clean drinking water and effective treatment of wastewater are top priorities for many communities. To keep up with increased demand, water treatment plants must effectively and efficiently operate while continuing to upgrade and expand. As the networks supporting many water treatment plants approach the end of their lifespans, operation and maintenance are becoming more costly. Of the over 16,000 publicly owned wastewater systems in the U.S., 81% percent are at designed capacity and 15% are exceeding capacity. Also, six billion gallons of drinking water are lost every day due to leaks.

The Bipartisan Infrastructure Law (2021) allocates more than $50 billion over the next five years to water. This historic investment includes $35 billion toward safe drinking water and $12 billion toward clean water, via state revolving funds.

Figure 1: Smart water technologies



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It is important to invest this money wisely to utilize technologies that will upgrade infrastructure to serve existing communities and scale to support ever-growing future needs. Technologies such as sensors and monitoring innovations that improve real-time data, video surveillance, and location-based services ensure the safety of critical water infrastructure; secure communication technologies are also a key foundation for improved system operations and maintenance. All of these smart water technologies generate significant data and increased bandwidth demands.

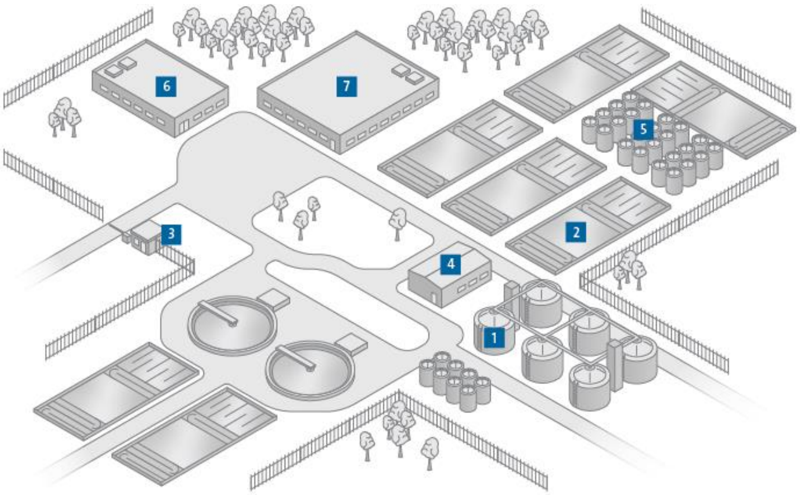
Fiber is the best-suited medium to build a reliable, scalable, and future-ready network.

The harsh environments around water treatment plants can pose a real challenge to the infrastructure, including the communications network. Because these networks monitor and control critical plant processes, degradation or loss of the network can result in catastrophic failures.

Fiber is an integral enabler of smart water infrastructure. Wastewater treatment plants can optimize operations and reduce expenses while ensuring the critical water infrastructure remains safe and secure by basing their communication network on ultra-reliable, high-speed fiber optic cabling.

Corning optical fiber innovations have revolutionized how the world communicates and connects. Made of pure optical glass the diameter of a human hair, Corning single mode fiber is resistant to electromagnetic interference, moisture, and temperatures. The properties of the glass used in fiber have been changed at the molecular level, making fiber as strong as steel and secure over longer distances. This results in a highly reliable network offering virtually unlimited bandwidth and requiring much lower maintenance.

Figure 2: How fiber optics provides an end-to-end solution in water treatment communications



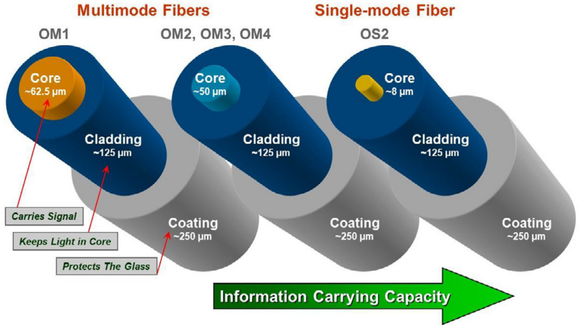
1. Water Storage Tanks
2. Detention Ponds
3. Security Fencing/Gates
4. Pumping/Motor Control Station
5. Chemical Storage Tanks
6. Master Control Station
7. Administration Offices

Key considerations for deploying the fiber optic network in a water treatment facility.

There are two major types of fiber used in communication networks: single-mode and multimode.

- **Single-mode** fiber carries the highest bandwidth.
- On the **multimode** side, there are four versions: 62.5 µm (OM 1), 50 µm (OM 2, OM 3, OM 4). The main variation between these fibers is in the size of the core, where information (in the form of light pulses) travels. As the OM number increases, so does the bandwidth. Fiber type should remain consistent throughout the facility, as different types of fiber are not optimally compatible.

Figure 3: Single-mode fiber has greatest bandwidth over the longest distances

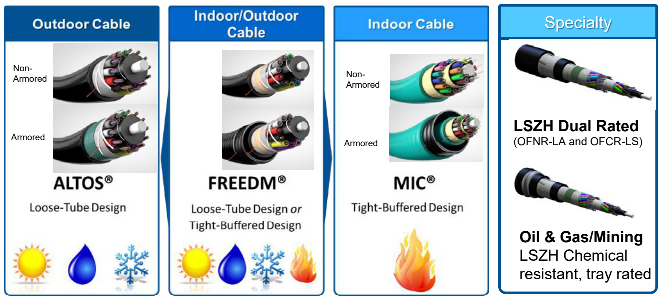


When deploying a fiber optic network, fiber type is just one consideration. Additional areas include: **fiber optic cable** that transports the data, **fiber optic connectors** that terminate the cables, and **hardware and closures** that provide management and protection to the network.

Fiber optic cable.

The cable that protects the fiber comes in various forms. The application where the cables will be used is a key consideration for cable type selection to ensure long-term performance of the communications network, including cable tensile strength, jacket thickness, chemical resistance, weather resistance, fire rating, and more. The other primary consideration is the cable deployment location. Both the inner construction and the cable jacket can provide essential protection from the environment.

Figure 4: Corning offers a wide range of cable types



Fiber optic connectors.

The most common types of fiber connectors are the SC ("Sam Charlie"), which are heavily used in the transportation, electrical, and utilities verticals. The LC ("Laurie Charlie" or "little connector") is becoming more popular as transceivers in electronics are becoming smaller. The ST ("Sam Tom") is a twist-locking connector, making it ideal for low-density harsh environment applications. Choosing the proper termination method depends on the quality and performance required, speed of deployment, cost and budget, and skill level of the technician implementing the fiber connectors.

There are three main types of termination methods:

- **Epoxy & Polish connectors** are the most labor-intensive and lowest-performing method, but the most cost-effective. This method requires skilled labor, installation toolkits, and a dedicated space to work.
- **No Epoxy, No Polish** connectors do not require field epoxy or polishing. These connectors are easy to install and relatively high-performing. A wide variety of skill sets can be utilized with little variability.

- Fusion Splicing involves high-precision fiber cleaving, alignment, and permanent fusion with a special fusion splicing machine.

Figure 5: Corning has a solution for each termination method

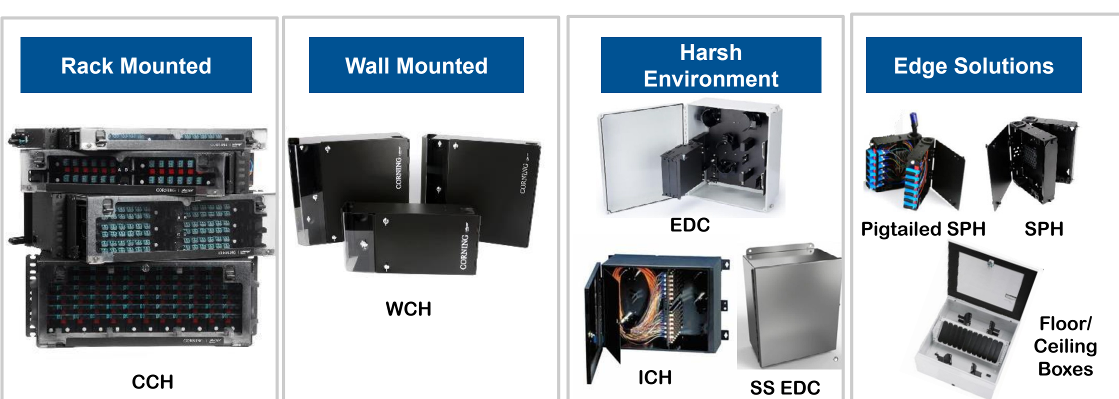
Hardware and closures.

When choosing hardware, one of the most important considerations is where it will be located and how it will be mounted. Whether rack or wall mounted, indoor or outdoor, Corning offers a range of options to meet location requirements, including for harsh environments.

Two other key considerations when choosing hardware are the type of connectors needed (as discussed above) and whether an outside plant closure is required. An outside plant closure is a hardened type of hardware available in different configurations, optimized for particular applications.

> Corning has a full team of engineering specialists and online tools that can help to determine which is the best selection and the right type of outside plant closure, depending on the cable and the application that you have.
>
> *Gayla Arrindell, Corning Optical Communications*

Figure 6: Corning's depth and breadth of hardware offerings meet any location and application needs



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Case Study: City of Elmhurst, Illinois

Elmhurst is a Chicago suburb with a population of 46,571. Elmhurst Water & Public Works contracted with Concentric Integration to modernize its water and wastewater operations.

The primary initial challenge centered on reliable communication between all water sites. Elmhurst was dependent on a legacy unlicensed wireless method of communication that was becoming obsolete, and had licensed frequency squatters causing communication issues on some sites. Although Elmhurst had implemented a wireless mesh to gain more bandwidth, the requirements of monitoring multiple cameras across multiple sites was still a challenge due to how much data could practically be transmitted between those different sites.

With so many outside-of-plant communication limitations in comparison with requirements, replacing and expanding the utility's communications network with fiber optic cable made the most sense. Concentric Integration was already connecting the Elmhurst Water & Public Works buildings and facilities with multimode fiber. Working with other public works stakeholders, the team identified additional projects for road and piping improvements would also benefit from an easy add-on of fiber ducts.

The first project was a stormwater site that was having issues with the wireless mesh. Resolving the issues required installation of tall monopoles to get from point to point. Planned roadway improvements in the same area allowed for the add-on of directional boring to get the fibers from site to site. From there, the same approach could be expanded and applied for other wastewater projects, allowing communications solutions for 44 sites to be planned, installing 20 miles of fiber optic cables over a span of several years.

The project started with the goal of connecting water/wastewater infrastructure with the SCADA/OT network, adding in security and an IP network for the public works staff to connect tablets on-site. As the project moved forward, other facilities, such as stormwater sites, fire and police stations, and other public works entities realized the benefits of an improved communication network, adding to the scope of project goals.

With a plan in place, the next step was to create a Fiber Optic Master Plan and Design Guide, which would outline the method for implementing the different sites. Given budget and project constraints, the team identified a need for off-the-shelf equipment that could be purchased on short notice.

> We met with Corning to say, what would you recommend for these sites? And what's available with Corning and the local distributor? What do you have on the shelf? What should we use here?
>
> *Mike Gryn, Engineering Director Concentric Integration*

Based on these requirements, the team chose to work with Corning as its supplier. With proven product availability, diversity, and reliability, plus a strong network of partners, Corning was the best choice for Elmhurst's wide-scope, long-term needs. Using a complete Corning solution including cable, connectivity and hardware, installed by a Corning preferred installer earned the city a 25-year warranty.

In addition to the Certified Installer Program that ensures the 25-year warranty, Corning offers value-added services such as:

- Field sales, solution, and application engineers
- Complimentary design
- Free and paid trainings
- Bill of materials tool
- Core products guide

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Figure 7: Corning works with a range of ecosystem partners on water projects

ADDITIONAL INFORMATION

- **Corning Optical Communications.** To learn more, visit www.corning.com.
- **Concentric Integration.** To learn more, visit www.goconcentric.com.
- **Bipartisan Infrastructure Law.** To learn more, visit www.epa.gov/infrastructure.