Broadband and Smart City Ad-Hoc Committee and City Commission Joint Work Session

Agenda

August 24, 2023 @ 1:00 pm

City Hall - Commission Chambers
401 S. Park Avenue

welcome

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assistance & appeals

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"If a person decides to appeal any decision made by the Board with respect to any matter considered at this hearing, a record of the proceedings is needed to ensure that a verbatim record of the proceedings is made, which record includes the testimony and evidence upon which the appeal is to be based." (F.S. 286.0105).

please note

Times are projected and subject to change.

agenda	time
1. Call to Order	
2. Discussion Item(s)	
a. Presentation by Magellan Advisors on broadband and smart city initiatives.	2 hours
3. Adjourn	

City Commission agenda item

item type Discussion Item(s)	meeting date August 24, 2023
prepared by Parsram Rajaram	approved by Michelle del Valle, Randy Knight
board approval In Progress	
strategic objective	

subject
Presentation by Magellan Advisors on broadband and smart city initiatives.

motion / recommendation

background
Magellan Advisors will present its report and recommendations. Attached are the following:

- Consultant presentation
- Consultant response to RFP
- Deliverables required in RFP

As a reminder, the Ad-Hoc Committee was tasked with:

- Serving as a forum for the discussion of Smart City and Broadband standard of service, technologies, including, but not limited to, fiber optic technology, and related concepts among stakeholders.
- Evaluating methods of ensuring adequate broadband choice, availability, and capacity.
- Developing an outline for a Smart City strategic plan.
- Exploring Smart City implementation strategies for the City.
- Aligning Smart City initiatives with other City objectives and priorities.
- Evaluating the costs of implementing, administering, and maintaining any such broadband technologies.
- Exploring innovative and creative ways to utilize such broadband technologies.

alternatives / other considerations

fiscal impact

ATTACHMENTS:
Consultant Presentation.pdf

ATTACHMENTS:
RFP Response Magellan Broadband.pdf

ATTACHMENTS:
Deliverable 1 Market Analysis.pdf

ATTACHMENTS:
Deliverable 2 Connectivity Plan.pdf

ATTACHMENTS:
Deliverable 3 Smart City Plan.pdf

Connectivity & Smart City Strategic Plan

City Council

August 24, 2023

Magellan
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Agenda

- Project Overview
- Deliverable 1 - Market Analysis Key Points
- Deliverable 2 - Connectivity Plan - Suggested Projects and Recommendations
- Deliverable 3 - Smart City Strategic Plan - Suggested Priorities and Recommendations
- Questions and Open Discussion

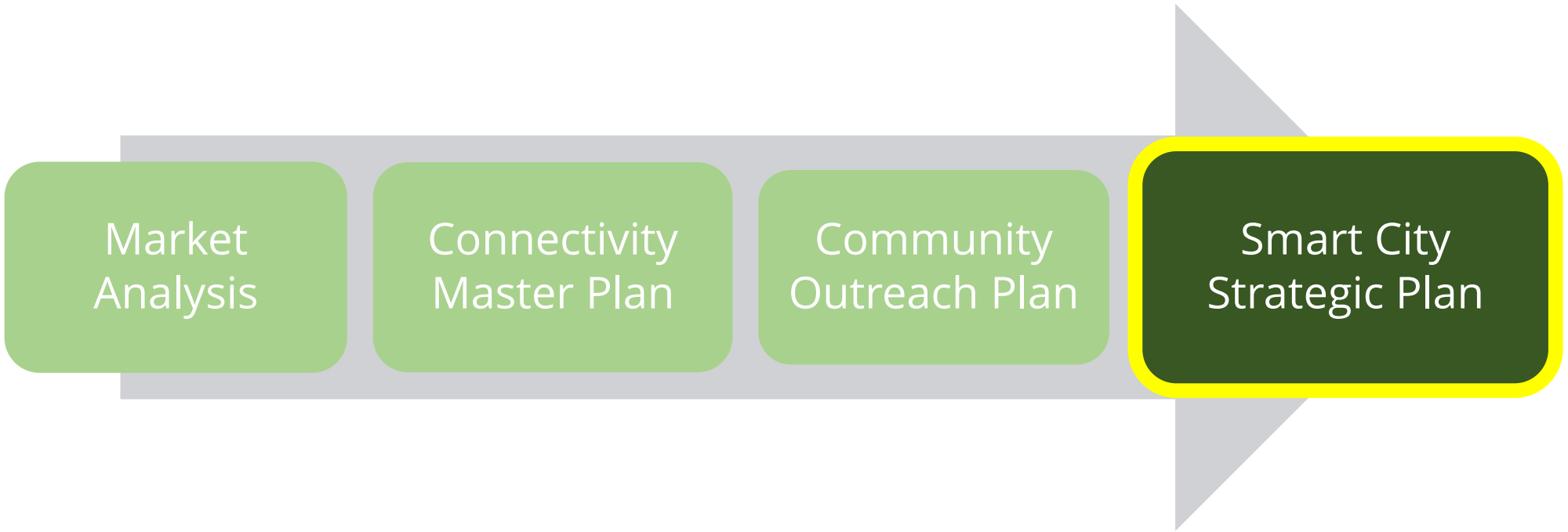
Project Overview

Goals of City Ordinance 3210-21:

- Serving as ***a forum for the discussion*** of Smart City and Broadband standard of service, technologies, including, but not limited to, fiber optic technology, and related concepts among stakeholders.
- Evaluating methods of ensuring ***adequate broadband choice, availability, and capacity***.
- Developing an outline for a ***Smart City strategic plan.***
- Exploring ***Smart City implementation strategies*** for the City.
- Aligning ***Smart City initiatives*** with other ***City objectives and priorities.***
- Evaluating the ***costs of implementing, administering, and maintaining any such broadband technologies***.
- Exploring innovative and creative ways to ***utilize such broadband technologies***.

Project Overview

In November 2022, Magellan was selected to support the City of Winter Park's IT Department and the Broadband and Smart City Ad Hoc Committee by providing services and deliverables satisfying the requirements of City Ordinance 3210-21. Their Scope included:



Market Analysis Key Points

- The FCC National Broadband Map considers Winter Park to be ***nearly 100% served in receiving 100/20 Mbps services***, however, ***not by fiber***.

- ***Spectrum*** has a gigabit monopoly in most of the city, though their upstream bandwidth is limited to 35 Mbps today, and they ***are expected to deploy 10 Gbps "DOCSIS 4.0", as an equipment upgrade, by 2026.***

- ***Lumen*** and ***Frog*** have announced ***plans to deploy 10 Gbps fiber-based services***. Lumen has started deployments (see Connectivity Plan Report, p.33 for more information)

- Cellular providers ***T-Mobile*** and ***Verizon*** offer ***Fixed Wireless Access over their 5G infrastructure in limited locations*** within the city.

- The ***construction phase of the City's backbone*** as part of *The Private Fiber Network Construction and Maintenance Agreement* with Frog is ***expected to be completed in August/September 2023; connecting 18 facilities to a fiber backbone***

- The ***IT conduit***, deployed as part of the electric undergrounding program, ***has been poorly documented and is of reduced value to the City*** until such time it can be fielded, audited, and fully documented.

Connectivity Plan

Project 1: **Backbone Extension**	Project 2: **Wireless Overlays**	Project 3: **Fiber-to-the Premise**

Connectivity Plan Projects

Project 3: Fiber-to-the Premise

KEY FINDINGS

- Winter Park is **served with high-speed broadband**, although **not by fiber, nor by competitive wireline providers**
- **Lumen** and **Frog** have announced **new fiber-based broadband services** and are **beginning to deploy in Winter Park**
- A **city FTTP project** is:
  - a **high-cost project** (over $65M), would include significant construction activities across the community
  - would have **high risk** due to high project costs, and the requirements for high take rates to support a break-even business model

PROJECT RECOMMENDATIONS

- The City ***should not*** consider a ***City-owned and City-operated Full Retail ISP*** and ***Joint-venture*** model due to the competitive landscape, high capital costs, and high risks
- The City should ***continue to communicate and work closely with private ISPs*** to ensure an expedient deployment of upgraded services to all areas of Winter Park

Connectivity Plan Projects

Project 1: Backbone Extension

KEY FINDINGS

- City's **current backbone** will **connect its sites and facilities**
  - ✓ more secure network
  - ✓ faster and less expensive than the alternatives
- **Existing wireless and leased systems** **could be replaced by connecting them to the expanded fiber backbone**

  These include utility *VHF/UHF radio services for city lift stations*, *other leased lines*, *wireless PTP/PTMP systems*, etc.
- **Expanded Fiber Network (30+miles) Build Out**

To be connected sites and facilities

- Expanded Backbone: **$2.3M**
- Traffic Cabinets (64): **$445K**
- Parks & Recreation (14): **$470K**
- Lift Stations (74): **$2.9M**

Total Cost: $6.1M

PROJECT RECOMMENDATIONS

- ***Evaluate funding opportunities***
- ***Design and engineer an expanded fiber backbone*** to support key City priorities
- ***Determine if additional fiber is needed*** within the existing backbone conduit to supplement the City's existing 48-strands

USE CASES AND INITIATIVES ENABLED

- ✓ Connect City Sites, Facilities & Important Public Spaces
- ✓ Smart Traffic/Smart Parking
- ✓ Smart Grid/Smart Utilities
- ✓ Utility Lift Station Remote Monitoring and Operations
- ✓ Wireless/Tower Interconnections
- ✓ Smart Parks
- ✓ Smart City Poles

Connectivity Plan Projects

Project 2: Wireless Overlays

KEY FINDINGS

- The City **operates several legacy wireless networks**:
  - Sensus® 900mhz AMI
  - Utility VHF/UHF
  - Point-to-point/Point-to-multi-point
  - Wi-Fi networks
  - Cellular/Mobile Services

  Several of these **can be aggregated into a single high-speed wireless private CBRS system**, **providing much greater capacity and functionality**

- City's **Sensus®** AMI platform which supports water/electric meters, is **being expanded to support Lake Monitoring sensors, and possibly other sensors**

- The City may have a **meter replacement program** decision to make and should further analyze an open-standards-based LPWAN platform like LoRaWAN®

- **Wireless Overlay (CBRS & LoRaWAN®) deployment Total Cost: $315,000**

PROJECT RECOMMENDATIONS

- **Design and engineer a private LTE, CBRS high-speed wireless broadband system** to **support remote devices** and **city users**, and **act as a backup network for business continuity/disaster recovery purposes**

- **Leverage the existing Sensus® AMI platform** to support connectivity where possible

- **Design and engineer a new open architecture LPWAN** platform based on **LoRaWAN®® standard to replace the legacy system**

USE CASES AND INITIATIVES ENABLED

- ✓ Smart Traffic
- ✓ Utility Lift Station Remote Monitoring and Operations
- ✓ Security Cameras and other High-Bandwidth Devices
- ✓ Mobile Workforce/ Fleet Management*
- ✓ Network Backup for Redundancy and Resiliency
- ✓ Utility AMI
- ✓ Sensor Networks for Water and Environmental Management Structural Monitoring, Panic Alarms, and other uses

* with Mobility Solution at added cost

Connectivity Recommendations

#1 GENERAL RECOMMENDATIONS AND STRATEGY

- Designate a **Connectivity and Smart City Infrastructure Coordinator**
  - to oversee *design, engineering, contracting, installation, operations,* and *overall management and strategy* of all investments and systems
- Continue **engaging a consultant**
  - to oversee and support the implementation of connectivity and smart city strategies
- City **should not** entertain or enter into any **new conduit or fiber usage agreements** until such time as all **existing assets have been documented, and clear strategic direction has been determined** as it relates to the City's participation in such agreements.

#2 EXISTING ASSETS - UTILITIES UNDERGROUNDING CONDUIT PROJECT

- Suspend the **installation of telecommunications conduit in conjunction with the electrical undergrounding project**
- Begin **fielding assessment of existing conduit, fiber, and all assets installed** along with the completed portions of the electrical undergrounding project to date
- Begin **fielding assessment of all assets available** to support the City's smart city vision and future initiatives (towers, buildings, existing connections)
- The City should ensure that all as-builts, construction drawings, and fielding notes are **aggregated and digitized into GIS and into a future Fiber Management System (FMS)**

#3 FROG AGREEMENT

- Immediately **obtain as-built specifications and location of backbone infrastructure** installed by Frog to include in the City's records

Smart City Strategic Plan

Transportation | Public Safety | Utilities | Quality of Life

Smart City Global Trends

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GENERAL

- **Digital Twins** helps with cost savings, increased efficiencies, and resiliency
- **Data-driven Community-Government Collaboration** allows cities to prioritize their core issues
- **Assistive AI** will help city agencies and departments collaborate much faster and effectively, enhancing public safety and city services in general

TRANSPORTATION

- **Intelligent Curb Management Systems** combat traffic issues tied to the growing number of ride-sharing mobile applications and package delivery companies
- **Ridesharing Market** will remain constant.
- **Charger Infrastructure Deployments** will determine the future of EV adoption.
- **Fleet EV Adoption**
- **E-Bikes and E-Scooters Deployments**
- **AI-enabled Autonomous Transportation** such as shuttles

PUBLIC SAFETY

- **Surveillance Systems**
- **Smart Streetlighting**
- **Real-time Crime Mapping**
- **Predictive Policing**

UTILITIES

- **Smart Grids/Grid Modernization** enables real-time usage tracking and forecast usage, peak demand, and potential breakdowns of an electrical distribution system, as well as enables faster recovery in times of outages
- **Virtual Power Plants and Distributed Energy Resources (DER)** provide efficient power distribution, configuration flexibility, power reliability, and overall lower energy costs
- **Leak Detection** is useful for drinking and wastewater systems.
- **Enhanced Control and Operation of Critical Utility Infrastructure Systems**

QUALITY OF LIFE

- **Digital Citizen Initiatives** enable citizens not only to receive alerts and provide feedback/incident reports to the City, but to collaborate easily with their local government in planning projects and addressing issues such as access to health, education, and job resources.
- **Advanced Waste Management** reduces the overall environmental impact by utilizing IoT sensors to efficiently manage city trash bins which regulate the amount of trash and keep the environment clean
- **Smart Buildings** encourage the rethinking of how infrastructures are being built or rebuilt, ensuring low or zero carbon emissions, cost savings, and increased efficiency

Smart City – Case Studies

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City of Orlando, FL

- **Advanced Air Mobility -** Lake Nona Vertiport planning, NASA partnership, and Advanced and Urban Aerial Mobility Cities and Regions Coalition launch
- **Smart Parking and Digital Wayfinding**
- **Urban Autonomous Vehicle –** on a Pilot Program
- **Digital Twin –** drafting an RFP for system procurement
- **Expanded Public W-Fi**

City of Coral Gables, FL

- **AI-powered Integrated/Modular Smart City Poles** – incorporates Wi-Fi, 5G, cameras, traffic, and environmental sensors
- **Unmanned Drones** – used for Public Safety
- **Digital Twin**

City of West Hollywood, CA

- **Innovative Division –** two full-time staff
- **Smart City Hall/Smart Municipal Building**
- **Privacy Policy for Smart Cities and Data Sharing Policy**
- **Smart Streetlighting** – attached sensors used for mobility data analysis

City of New York, NY

- **Data Collection and Usage** – deployed numerous and various sensors and holds a city data usage contest
- **Smart Mobility** – promotes car-sharing services

City of Naperville, IL

- **Energy Efficiency Buildings and Infrastructures**
- **Smart Grid** – providing low-cost and sustainable services
- **Remote Water Reading – *a dashboard for the City customers***
- **Smart 911** – "Safety Profiles" allow efficient and effective response of first responders

City Santa Monica, CA

- **Robust Wireless Networks**
- **Smart Parking** - in partnership with *Waze*
- **Smart Traffic System** – public safety preemption
- **Cameras** – 600 devices used for Public Safety and Traffic Management

City of Seoul, South Korea

- **Environmental and Public Safety Sensors**
- **Cameras and Sensors – used to analyze urban patterns**

City of Zurich, Switzerland

- **Smart Streetlighting –** resulted in 70% energy saving
- **Smart Municipal Buildings**
- **Environmental and Traffic Sensors**
- **Smart City Lab** - a space for inspiration and innovation open to smart city or innovation collaborators

Smart City Pillars and Infrastructures

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Transportation

- Smart Traffic System
- Sensor on Traffic Lights
- Smart Parking
- Smart Curb Management System
- Smart Multi-modal Coordination
- Micro-mobility Integration
- Autonomous Shuttles
- EV Charging Infrastructure
- Smart Parking Garage
- Smart Streetlighting
- Air Taxi Integration

Public Safety

- Dash and Body Cameras *
- Drone Integration *
- First Responders' Preemption
- Smart First Responders' Vehicles
- Automated License Plate Readers *
- People Counters*

Utilities

- Remote Meter Reading (Metering) *
- Remote Meter Reading (User Portal)*
- Remote Asset Monitoring System*
- Remote Asset Operations
- Water and Wastewater Monitoring
- Smart Grid

Quality of Life

- Smart Parks
- Lake Level Monitoring *
- Environmental Monitoring – Water and Air
- Environmental Monitoring - Soil
- Smart City Poles
- Smart Municipal Buildings
- Smart Trashcans
- QR Code (Visitor Engagement) *

Common Data Infrastructure
AI/ML, Analytics, Security, Encryption, Openness, Transparency, Governance

Smart City Infrastructure
Digital Twin(+GIS), 2-way Citizen Communications, Environmental Sensors, Cameras, Digital Signage, Drones

Digital Infrastructure
Fiber/Conduit, Towers/Small Cells, Data Centers/Interconnects, Wireless Spectrum, 5G, CBRS, LoRaWAN®, Wi-Fi, NB-IOT

* Existing Use Case

Smart City Use Cases Plan

Top 10 Suggested Smart City Use Cases						
	Year 1	Year 2	Year 3	Year 4	Year 5	Total per Use Case
Smart Traffic System						
CapEx	$ 115,000	$ 635,000	$ 635,000			**$ 1,385,000**
OpEx			$ 100,000	$ 195,000	$ 195,000	**$ 490,000**
Smart Parking						
CapEx	$ 20,000	$ 205,000				**$ 225,000**
OpEx			$ 35,000	$ 35,000	$ 35,000	**$ 105,000**
Environmental Monitoring - Air & Water						
CapEx		$ 35,000	$ 335,000			**$ 370,000**
OpEx				$ 35,000	$ 35,000	**$ 70,000**
Smart Parks						
CapEx		$ 25,000	$ 235,000			**$ 260,000**
OpEx				$ 30,000	$ 30,000	**$ 60,000**
Smart Grid						
CapEx	$ 40,000	$ 40,000				**$ 80,000**
OpEx						**$** -
Water (Drinking) Monitoring						
CapEx		$ 45,000	$ 415,000			**$ 460,000**
OpEx				$ 45,000	$ 45,000	**$ 90,000**
Smart First Responder Vehicles						
CapEx		$ 25,000	$ 250,000			**$ 275,000**
OpEx				$ 30,000	$ 30,000	**$ 60,000**
Smart Municipal Buildings						
CapEx	$ 30,000	$ 30,000				**$ 60,000**
OpEx						**$** -
Smart City Poles						
CapEx		$ 70,000	$ 670,000			**$ 740,000**
OpEx				$ 70,000	$ 70,000	**$ 140,000**
Electric Vehicle Charging Infrastructure						
CapEx	$ 20,000	$ 190,000				**$ 210,000**
OpEx			$ 15,000	$ 15,000	$ 15,000	**$ 45,000**
Total CapEx Per Year	$ 225,000	$ 1,300,000	$ 2,540,000	$ -	$ -	**$ 4,065,000**
Total OpEx Per Year	$ -	$ -	$ 150,000	$ 455,000	$ 455,000	**$ 1,060,000**
Total Cost Per Year	**$ 225,000**	**$ 1,300,000**	**$ 2,690,000**	**$ 455,000**	**$ 455,000**	**$ 5,125,000**

Suggested Top 10 Use Cases are based on:

- City Departments Outreach
- Implementation Timeframe
- Implementation Complexity
- Global Smart City Trends

Smart City Use Cases 5-Year Plan

Other Smart City Use Cases						
	Year 1	Year 2	Year 3	Year 4	Year 5	Total per Use Case
Autonomous Shuttles						
CapEx		$ 100,000	$ 960,000			$ 1,060,000
OpEx				$ 180,000	$ 180,000	$ 360,000
Soil Sensors						
CapEx		$ 200,000				$ 200,000
OpEx			$ 20,000	$ 20,000	$ 20,000	$ 60,000
Remote Asset Operations (Control and Operate)						
CapEx						$ -
OpEx						$ -
Smart Multi-modal Coordination						
CapEx						$ -
OpEx						$ -
Smart Trashcan						
CapEx		$ 60,000	$ 580,000			$ 640,000
OpEx				$ 60,000	$ 60,000	$ 120,000
Speed Sensors on Traffic Lights						
CapEx		$ 570,000				$ 570,000
OpEx			$ 260,000	$ 260,000	$ 260,000	$ 780,000
Smart Curb Management						
CapEx		$ 5,000				$ 5,000
OpEx			$ 20,000	$ 20,000	$ 20,000	$ 60,000
Smart Streetlights - Transportation						
CapEx		$ 20,000	$ 145,000			$ 165,000
OpEx				$ 15,000	$ 15,000	$ 30,000
Micro-mobility Integration						
CapEx						$ -
OpEx						$ -
Air Taxi Integration						
CapEx				$ 1,000,000		$ 1,000,000
OpEx					$ 4,000,000	$ 4,000,000

Digital Infrastructure 5-Year Plan

Digital Infrastructure						
	Year 1	Year 2	Year 3	Year 4	Year 5	Total per Use Case
Design & Construct Expanded Fiber Backbone						
CapEx	$ 100,000	$ 2,175,000				$ 2,275,000
OpEx			$ 15,000	$ 15,000	$ 15,000	$ 45,000
Design & Construct Fiber Network to Parks, Traffic Cabinets						
CapEx	$ 30,000	$ 885,000				$ 915,000
OpEx			$ 5,000	$ 5,000	$ 5,000	$ 15,000
Design & Construct Fiber Network to Utility Lift Stations						
CapEx	$ 125,000	$ -	$ 2,785,000			$ 2,910,000
OpEx				$ 15,000	$ 15,000	$ 30,000
Design and Deploy LoraWAN Infrastructure						
CapEx	$ 35,000					$ 35,000
OpEx		$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 40,000
Design and Deploy 5G/CBRS Infrastructure						
CapEx	$ 280,000					$ 280,000
OpEx		$ 60,000	$ 60,000	$ 60,000	$ 60,000	$ 240,000
Total CapEx Per Year	$ 570,000	$ 3,060,000	$ 2,785,000	$ -	$ -	$ 6,415,000
Total OpEx Per Year		$ 70,000	$ 90,000	$ 105,000	$ 105,000	$ 370,000
Total Cost Per Year	**$ 570,000**	**$ 3,130,000**	**$ 2,875,000**	**$ 105,000**	**$ 105,000**	**$ 6,785,000**

Smart City Infrastructure 5-Year Plan

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Digital Infrastructure						
	Year 1	Year 2	Year 3	Year 4	Year 5	Total per Use Case
Design & Construct Expanded Fiber Backbone						
CapEx	$ 100,000	$ 2,175,000				$ 2,275,000
OpEx			$ 15,000	$ 15,000	$ 15,000	$ 45,000
Design & Construct Fiber Network to Parks, Traffic Cabinets						
CapEx	$ 30,000	$ 885,000				$ 915,000
OpEx			$ 5,000	$ 5,000	$ 5,000	$ 15,000
Design & Construct Fiber Network to Utility Lift Stations						
CapEx	$ 125,000	$ -	$ 2,785,000			$ 2,910,000
OpEx				$ 15,000	$ 15,000	$ 30,000
Design and Deploy LoraWAN Infrastructure						
CapEx	$ 35,000					$ 35,000
OpEx		$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 40,000
Design and Deploy 5G/CBRS Infrastructure						
CapEx	$ 280,000					$ 280,000
OpEx		$ 60,000	$ 60,000	$ 60,000	$ 60,000	$ 240,000
Total CapEx Per Year	$ 570,000	$ 3,060,000	$ 2,785,000	$ -	$ -	$ 6,415,000
Total OpEx Per Year		$ 70,000	$ 90,000	$ 105,000	$ 105,000	$ 370,000
Total Cost Per Year	**$ 570,000**	**$ 3,130,000**	**$ 2,875,000**	**$ 105,000**	**$ 105,000**	**$ 6,785,000**

Top 10 Use Cases

#1 Smart Traffic System

GOAL to ensure the smooth flow of traffic through the city and region. It measures, monitors, and controls the flow of traffic to reduce congestion, optimize routes, detect accidents, and avoid idling pollution

CASE STUDY Developed an intelligent traffic system and **reduced travel times by 10-20%**

Status: Researching

Connectivity Requirements:
Fiber | CBRS

Dependencies:
- **Backbone connectivity**
- **Requires regional coordination agreements with FDOT, County and neighboring cities**

Complexity Level: **High**

Timeframe:
Mid-term 1-3 yrs.

COST ESTIMATES

Estimated Smart Traffic Cost-5YR Plan	YR 1	YR 2	YR 3	YR 4	YR 5
Total CapEx w/ 20% Contingency	$ 115,000	$ 635,000	$ 635,000		
Total OpEx			$ 100,000	$ 195,000	$ 195,000
Total Cost/YR	$ 115,000	$ 635,000	$ 735,000	$ 195,000	$ 195,000

CapEx - Number of Intersections (64), Number of Cameras (4 per Intersection)
OpEx - Software Fees for the Image and Data Processing Solutions

CONCLUSION

- The City should commission a Smart Transportation Task Force to create a city-wide ***Intelligent Transportation Strategy and Deployment Plan***
- The City should ensure system requirements are based on open APIs, international standards, and municipal best practices
- Appoint a "Smart City Coordinator" who would work with Public Works and be tasked with coordinating with State and County traffic programs and efforts to coordinate infrastructure development and establish real-time traffic data interexchange

Top 10 Use Cases

#2 Smart Parking

GOAL to shorten the time it takes to find a parking space, thereby reducing traffic congestion and car emissions, and providing a better overall user experience

CASE STUDY Deployed parking sensors and parking guidance signages in partnership with a smart city mobility solutions provider. This has **reduced parking search by 45%,** which also led to reduced traffic congestion and emissions in the City

Status: Researching

Connectivity Requirements:
Fiber | CBRS | LoRaWAN®

Dependencies:
- **Deployment of common cameras**
- **Aesthetics of digital signage**
- **Policies/Federal and State Regulation**

Complexity Level: **High**

Timeframe:
Mid-term (1-3yrs)

COST ESTIMATES

Estimated Parking Cost-5YR Plan	YR 1	YR 2	YR 3	YR 4	YR 5
Total CapEx w/ 20% Contingency	$ 20,000	$ 205,000			
Total OpEx			$ 35,000	$ 35,000	$ 35,000
Total Cost/YR	$ 20,000	$ 205,000	$ 35,000	$ 35,000	$ 35,000

CapEx – Planning/Procurement, Cameras (48), Digital Signages (20)
OpEx – Cameras and Digital Signages Maintenance Fees, Software Fees for Smart Parking Image Processing and CMS/Data Processing

CONCLUSION

- This use case should be included in an overall ***Intelligent Transportation Strategy and Deployment Plan***
- Apply an open architecture approach, so the City can leverage common smart city infrastructure including cameras and digital signage

Top 10 Use Cases

#3 Environmental Monitoring - Air & Water

GOAL to evaluate the health and safety of water sources and air quality ensuring the protection of human health and aquatic ecosystems

CASE STUDY

Deployed water quality monitoring sensors in all lakes which **protect the health of its community and establish an effective water system**

Piloted low-cost air quality monitoring sensors in parks, schools, and low-income homes which ensured **cleaner air for the more susceptible citizens**

Status: **Researching**	Dependencies:	Complexity Level: **Low**
Connectivity Requirements: **LPWAN - SENSUS/LoRa**	• **Environmental Monitoring Strategy**	Timeframe: **Immediate**

COST ESTIMATES

Estimated Environmental Monitoring - Air & Water Cost-5YR Plan	YR 1	YR 2	YR 3	YR 4	YR 5
Total CapEx w/ 20% Contingency		$ 35,000	$ 335,000		
Total OpEx				$ 35,000	$ 35,000
Total Cost/YR		$ 35,000	$ 335,000	$ 35,000	$ 35,000

CapEx - Number of Water Sensor Devices (57), Number of Air Sensor Devices (50), Devices Installation Fee
OpEx – Yearly Maintenance Fee

CONCLUSION

- Water and air quality monitoring should be a primary component of the city's ***Environmental Monitoring Strategy***.

Top 10 Use Cases

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#4 Smart Parks

GOAL to enhance the complete outdoor park experience and gain maintenance efficiencies while creating a sustainable, safe environment for the citizens

CASE STUDY CITY of BOSTON

Deployed several park use cases such as Smart Lighting which **increased citizen safety and engagement in public spaces**,. They also Green Infrastructure where they use plants, soils, and other natural materials to address pollution and for stormwater management, which resulted in **lower pump operational costs, urban heat reduction**, and **added greenspace for the community's well-being and the city's aesthetics**

COST ESTIMATES

Estimated Smart Parks Cost-5YR Plan					
	YR 1	YR 2	YR 3	YR 4	YR 5
Total CapEx w/ 20% Contingency		$ 25,000	$ 235,000		
Total OpEx				$ 30,000	$ 30,000
Total Cost/YR		$ 25,000	$ 235,000	$ 30,000	$ 30,000

CapEx – Wi-Fi Access Points (2), Cameras (2), and a Digital Signage deployed across 14 City Parks
OpEx – Devices Maintenance Yearly Fees, Software Yearly Fees

CONCLUSION

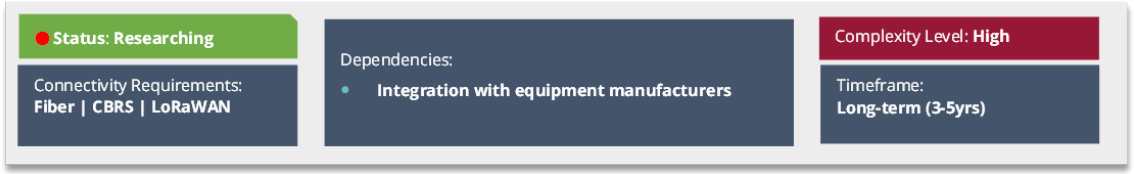
- The City should extend its fiber network to connect the 14 parks and create a ***Common Smart Park Architecture*** that can be deployed at each location as required
- New capabilities and enhancements can be deployed over time, and the data collected could be valuable to numerous smart city applications and will also be valuable through an open data repository

Top 10 Use Cases

#5 Smart Grid

GOAL to gain new levels of efficiency and reliability, better balance the demand and supply of electricity, and advance renewable energy integration

CASE STUDY Established a smart grid system that **reduced environmental impact** and **increased operational savings** by acquiring data every 15 minutes instead of sending out trucks to read meters. It also **cut the City's number and duration of outages by 40-55%**



COST ESTIMATES

Estimated Smart Grid Roadmap Cost-5YR Plan					
	YR 1	YR 2	YR 3	YR 4	YR 5
Total CapEx w/ 20% Contingency	$ 40,000	$ 40,000			
Total OpEx					
Total Cost/YR	$ 40,000	$ 40,000			

CapEx – Consulting Fee to develop the City's Smart Grid Strategy and Implementation Roadmap

CONCLUSION

- The City's electric utility should work to develop a ***Smart Utility Strategy and Deployment Plan***

Top 10 Use Cases

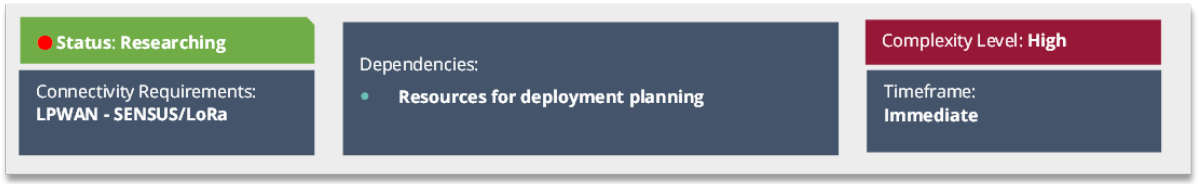
#6 Water and Wastewater Monitoring

GOAL

Monitor purity, chemical composition, and the presence of specific chemicals or detect any harmful substances in drinking water, and monitor composition and flow rates of sewer and stormwater

CASE STUDY

Deployed an IoT solution for wastewater management to mitigate regulatory issues, which **prevents sewer overflows, improves water quality, and ensures safety for the public**



COST ESTIMATES

Estimated Water and Wastewater Monitoring Cost-5YR Plan					
	YR 1	YR 2	YR 3	YR 4	YR 5
Total CapEx w/ 20% Contingency		$ 38,760	$ 414,000		
Total OpEx				$ 45,000	$ 45,000
Total Cost/YR		$ 38,760	$ 414,000	$ 45,000	$ 45,000

CapEx – Drinking Water Monitoring Sensors (200 devices), Stormwater Monitoring Sensors (200 devices), Devices Installation Fees, Planning and Procurement
OpEx – Devices Yearly Maintenance Cost

CONCLUSION

- The City's Water Utility team should determine the proper placement and type of sensors that are required to provide leak detection and monitoring solutions

Top 10 Use Cases

#7 Smart First Responder Vehicles

GOAL

be able to aggregate and process data from local smart devices such as body cams and dash cams for real-time remote viewing both on site and at police headquarters to increase first responders' situational awareness in the field, saving many citizens' lives in critical situations

CASE STUDY

City of Montgomery
CAPITAL OF DREAMS.

Purchased 30 new police vehicles equipped with computers and 360° cameras **increasing police's situational awareness and public safety**

COST ESTIMATES

Estimated Cost for Equipping Smart Vehicle (25 Units) Cost-5YR Plan	YR 1	YR 2	YR 3	YR 4	YR 5
Total CapEx w/ 20% Contingency		$ 25,000	$ 250,000		
Total OpEx				$ 30,000	$ 30,000
Total Cost/YR		$ 25,000	$ 250,000	$ 30,000	$ 30,000

CapEx - Number of environmentally hardened laptops, mobile routers with 5G/CBRS cellular backhaul and servers – 1 of in each of the police (20) and fire (5) vehicles
OpEx – Devices Yearly Maintenance Costs

CONCLUSION

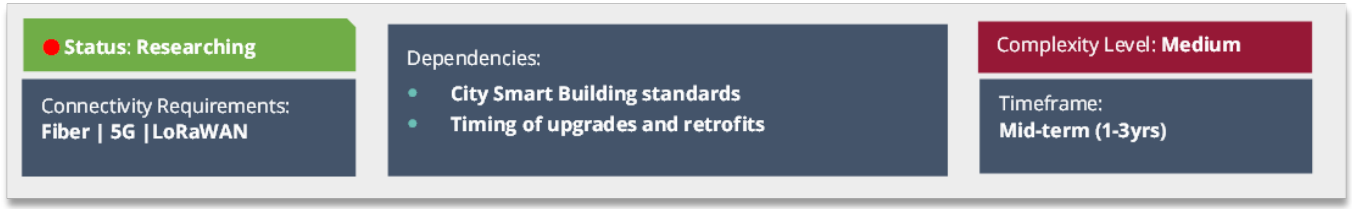
- The City should establish a ***standard architecture*** and advocate for Smart Police and Fire vehicles. This can be accomplished during scheduled upgrades and retrofits or can be incorporated into future budget planning.

Top 10 Use Cases

#8 Smart Municipal Buildings

GOAL to integrate a range of sensors, networks, and automated systems to create and maintain the desired internal and external environments efficiently and securely

CASE STUDY The state's federal buildings have been converted into smart buildings which **reduced total energy use by 45%** and a **$412,000 savings in the first year**



COST ESTIMATES *The cost of a smart building is dependent on the size and type of each building and the technology the City chooses to deploy.

CONCLUSION

- The city should establish ***smart building standards*** and upgrade current municipal buildings during scheduled retrofits and system upgrades.
- All new buildings should be architected from the onset to be 'smart'.

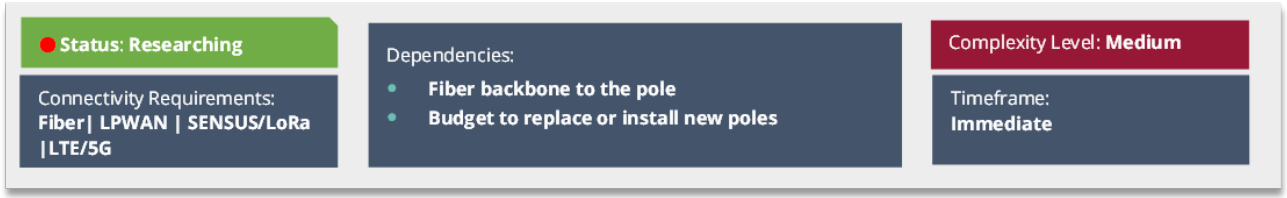
Top 10 Use Cases

#9 Smart City Poles

GOAL to provide an aesthetically appealing lighting system that is a platform to support a range of smart city use cases

CASE STUDY Coral Gables – The City Beautiful

Rolled out smart poles that incorporated sensors and cameras which are now **providing live video and real-time analytics to the City's Urban Analytics IoT AI platform, and the City's Community Intelligence Center and Emergency Operations Center**



COST ESTIMATES

Smart City Pole Cost Estimate (33 Units)-5YR Plan					
	YR 1	YR 2	YR 3	YR 4	YR 5
Total CapEx w/ 20% Contingency		$ 70,000	$ 670,000		
Total OpEx				$ 70,000	$ 70,000
Total Cost/YR		$ 70,000	$ 670,000	$ 70,000	$ 70,000

CapEx – Light Poles (33) with Various Sensors across the city
OpEx – Yearly Maintenance Fee for the Lights, and sensors and electricity costs to operate the lights are not included

CONCLUSION

- The City should consider replacing some of the pole structures for 'Smart City Poles' with additional functionality to support a range of smart city use cases

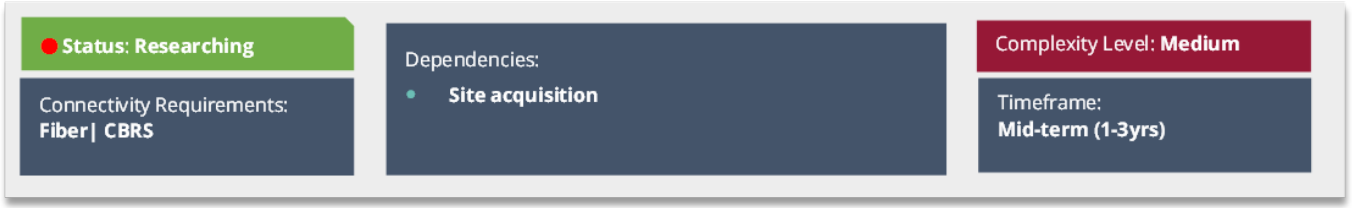
Top 10 Use Cases

#10 EV Charging Infrastructure

GOAL to increase the adoption of sustainable mobility options by building charging infrastructures for electric vehicles including as cars, trucks, and buses

CASE STUDY City of Seattle

Deployed over 700 public charging stations which **increased 63%** and **micro-mobility options (using zero-emission technologies)** and teamed up with BNSF Railway to replace their diesel-powered trucks to electric, which **decreased by 2,498 tons of C02, 6.2 tons of PM2.5, and 25.2 tons of No2 emissions, equivalent to driving 538 gasoline-powered cars for a whole year**



COST ESTIMATES

Estimated EV Charging Stations Cost-5YR Plan	YR 1	YR 2	YR 3	YR 4	YR 5
Total CapEx w/ 20% Contingency	$ 20,000	$ 190,000			
Total OpEx			$ 15,000	$ 15,000	$ 15,000
Total Cost/YR	$ 20,000	$ 190,000	$ 15,000	$ 15,000	$ 15,000

CapEx – Charging Stations (6) in 4 Charging Sites
OpEx – Charging Stations Maintenance Fees

CONCLUSION

- This use case should be included in an overall ***Intelligent Transportation Strategy and Deployment Plan***
- Apply an open architecture approach, so the City can leverage common smart city infrastructure including cameras and digital signage

Smart City - Recommendations

- The City should establish a **city-wide technical layered architecture and open data governance policies** based on international standards and best practices.
- The City should establish an ***Intelligent Transportation Strategy and Deployment Plan.***
- Each City utility should adopt a **5-to-10-year** ***Smart Utility Strategy and Deployment Plan.***
- The City should establish an ***Environmental Monitoring Strategy.***
- Public Safety should continue to deploy and expand **devices, technologies, and systems** as force multipliers and to improve and gain situational awareness across the community.
- The City should immediately begin to deploy '**Pilot Projects'** on those Smart City initiatives and use cases prioritized through this Plan.
- The City should make all datasets generated through its Smart City program available through an **open data site and online platform**.
- The City should closely monitor and participate in **State, County, and Regional Organizations, consortiums, and initiatives**.

THANK YOU

Magellan
An ENTRUST Solutions Group Company

CITY OF WINTER PARK, FLORIDA

Connectivity Master Plan & Smart City Initiative Consultant Services

Prepared for:
Winter Park, FL
City Clerk
cityclerk@cityofwinterpark.org

Prepared by:
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TABLE OF CONTENTS

Cover Letter

August 31, 2022
Dear City of Winter Park:

Magellan is pleased to submit our response to the City of Winter Park's RFP for its Connectivity Master Plan & Smart City Initiative. Our mission is to provide a single source solution to innovative cities that believe in broadband's ability to transform communities. Our staff comes from other cities that have implemented broadband. They carry the most experience industry-wide in planning, community needs assessments, engineering, construction management, inspections, sales, marketing and operations. Magellan provides a full spectrum of services to our municipal clients, because we know that they need guidance on all stages of broadband planning and development, as well as guidance on how to fund, deploy, launch, operate and provide the best levels of services to their citizens and businesses.

We're excited at the opportunity to work with the City of Winter Park again on this very important initiative. Over our 18 years in business, we've worked with over 400 municipalities and commnities across North America. This experience has shaped the way we serve our clients' needs. It's led us to develop a consultative and collaborative approach, ensuring that your community is engaged, and their needs are well-defined. We work hard to develop innovative solutions to deploy broadband networks because we know the political, financial, regulatory and operational challenges that cities face in implementing these projects. Our real-world experience designing, building and operating these networks allows us to customize them specifically for your needs to ensure the best chance of success. We believe that broadband consultants are only as good as the results they produce in their clients' communities. Through our work, we've helped municipalities enhance their communities with leading edge broadband servicesnationwide. Magellan is prepared to guide the City through this complex process to evaluate the feasible options to support your decision-making process around broadband strategies.

If you have any questions or we can be of assistance in any way, please feel free to contact me with any questions or comments. You can reach me directly at 786-208-8952 or Jhonker@magellanbroadband.com.

Sincerely,

John Honker
President & CEO, Magellan

Magellan's Experience

Magellan serves local governments nationally with offices in Texas, Colorado, Florida, California and Missouri. Our Colorado headquarters are located at 999 18th Street, Suite 3000 Denver, CO 80202. Magellan's web address is www.magellanbroadband.com. Magellan Advisors, LLC was founded in January of 2004 and has been in operation as a Limited Liability Company since inception. Magellan's office number is 888-960-5299. The contact for this contract is President & CEO John Honker 786-208-8952, Jhonker@magellanbroadband.com. Magellan has maintained a level workload over the past three years for our staff with flexible timelines giving our staff ample room to manage all projects and availability to take on new projects that best fit their roles and disciplines. We have more than adequate resourcing and availability to complete this Connectivity Master Plan & Smart City Initiative Project as outlined by the City's RFP. Magellan is prepared to hit the ground running to meet these deadlines, with work beginning immediately upon contract approval. Our past history working with Winter Park on its early fiber strategy will allow us to execute this engagement efficently, having such good working knowledge of the City, and its leadership.

Our staff understands the goals of local governments that recognize broadband as a policy issue. In our feasibility studies, we help educate, inform and direct municipalities to the most feasible options for solving local broadband issues. We work with internal and external stakeholders to build a profile of your community to determine the current state of broadband and identify key issues. Based on real-world solutions, we help you determine the best opportunities to close gaps and position your community for the future. We believe that every community is unique and customized broadband strategies are essential in every project we undertake. In every case, we have helped municipalities find and implement the right solutions to enhance local broadband.

We are the only firm that creates custom tailored broadband networks to achieve municipal objectives. Our networks deliver the fastest internet services at the lowest cost, while giving municipalities a platform to deploy smart city innovations that help them manage their communities. We've led the planning, funding, construction and management of over 50 fiber broadband networks passing over 1 million households and connecting more than 1,000 schools, hospitals, government offices and community organizations totaling over $1 billion in investments. Magellan has helped more communities successfully plan, implement and manage broadband networks than any other firm in the market.

MAGELLAN'S COMPLETED AND ONGOING FLORIDA PROJECTS

Magellan Broadband has helped hundreds of local governments throughout North America and we have extensive experience in the State of Florida. References are provided in the appropriate section and if further references are needed, we will be happy to provide them.

Magellan			FEASIBILITY STUDY	FIBER MASTER PLAN	BROADBAND BUSINESS PLAN	GRANT DEVELOPMENT	BROADBAND POLICY	ENGINEERING DESIGN	PERMITTING	PROCUREMENT	CONSTRUCTION MANAGEMENT	CONSTRTUCTION INSPECTIONS	STARTUP & LAUNCH	OPERATIONS & MANAGEMENT	SALES & MARKETING	BROADBAND EXPANSION
City of Cape Coral	FL	City			•											
City of Clermont	FL	City	•			•		•	•	•	•		•		•	
City of Fort Lauderdale	FL	Smart City	•	•		•		•								
City of Gainesville	FL	City			•											
City of Lakeland	FL	City	•			•		•								
City of Jupiter	FL	City	•			•		•		•	•		•		•	
City of Winter Park	FL	City	•	•		•		•								
City of Bartow	FL	City	•			•		•								
Orlando Utilities Commission	FL	City	•													
City of Winter Garden	FL	City	•			•		•								
City of Palm Beach Gardens	FL	City						•								
City of Palm Coast	FL	City	•			•		•		•	•		•		•	
City of Winter Haven	FL	City	•			•		•								
City of Sunrise	FL	City						•								
Charlotte County	FL	County	•			•		•								
City of Oakland Park	FL	County	•													
Escambia County	FL	County	•		•	•		•								
Glades County	FL	County														
Seminole County	FL	County	•			•		•								
Lakeland Utilities	FL	Electric Utility			•	•										
Hendry County	FL	Regional	•		•	•										
Babcock Ranch	FL	Smart City			•											

FIBER ENGINEERING DESIGN

Design it right the first time and it will last a lifetime. Our engineers work extensively with utilities to design broadband networks for the latest technologies, fastest speeds and lowest costs.

For municipalities, we connect your facilities, schools, hospitals and corridors with high-capacity fiber backbones to ensure connectivity for community needs, broadband and smart city applications. Our design work encompasses aerial and underground engineering to build the most advanced fiber networks to meet the needs of communities for years to come.

Aerial Fiber Engineering

- Strand and lash, ADSS engineering for overhead placement on utility poles
- Pole survey using GPS with sub-meter accuracy
- Make-ready engineering
- Pole loading analysis
- Pole attachment applications
- Pole permitting
- Low-level engineering, construction prints, bills of materials and cost estimates

Underground Fiber Engineering

- Underground fiber placement in rights of way, specific to each community's construction standards
- Directional boring, trenching, saw-cut and other construction methods
- Constructability surveys and fielding
- Low-level engineering, construction prints, bills of materials and cost estimates
- Right of way and third-party permitting
- Field changes, markups and final as-builts

Sample Projects

- City of Chesapeake, VA – 170-mile fiber design to connect all City facilities, business districts and redevelopment areas.
- City of Portsmouth, VA – 65-mile fiber backbone design to connect all City facilities, enable Wi-Fi at key locations and support expansion of local broadband services.
- City of Boulder, CO – 65-mile fiber backbone design to support City facilities, public housing, economic development and lay a foundation for fiber to the home broadband.

FIBER CONSTRUCTION PACKAGES

We manage the entire procurement process for fiber and wireless projects to give you the most competitive bids from vendors across the broadband marketplace.

Magellan provides city and county organizations with detailed construction package development for their fiber and wireless broadband projects. We work with you to craft construction bids using your construction standards to ensure contractors follow your policies and minimize community impacts. Our construction plans are designed to seek the best and lowest competitive bids from leading contractors.

Construction Bills of Materials

- Detailed BOMs for aerial, underground, facility and equipment installations
- Design specifications for fiber, conduit, structures, splice enclosures, splitter cabinets, equipment shelters, points of presence and data center construction
- Unit-based BOMs for labor, materials, facilities, equipment, hourly labor and specialized services

Construction Procurements

- Review and integration of the latest broadband standards into your existing construction code
- RFP/IFB development, scopes of work and bid forms
- Construction contract review and recommendations
- RFP/IFB oversight, pre-bid meetings, Q&A, addenda, short-listing and selection of contractors

Sample Projects

- City of Portsmouth, VA – Construction bid packages, procurement, evaluation and selection for 65-miles of fiber construction.
- City of Boulder, CO – Construction bid development, release and selection for an $11 million fiber backbone construction project.
- City of Dayton, TX – Invitation to bid advertisement, review and selection of contractors for a $13 million fiber to the home broadband network.
- City of Ann Arbor, MI – Invitation to bid for a $5 million fiber backbone expansion to support the City's local economic development and business retention programs.

FIBER CONSTRUCTION MANAGEMENT

We are your turnkey partner to manage all fiber and wireless construction to ensure broadband networks meet your community's needs.

As a turnkey construction management provider, we are in the field daily, overseeing construction, coordinating field changes, inspecting workmanship and ensuring adherence to local, state and federal standards. We have managed fiber and wireless construction in 25 different markets across the US for cities, counties and utilities. Our construction managers are on the ground in your community every day for the entire construction lifecycle. We coordinate all construction activities between contractors, public works, permitting, utilities and public relations to ensure timely completion.

Construction Management

- Overall program management and reporting to your departments
- Interface with permitting, public works, utilities, community engagement and the contractors
- Construction production tracking, accounting, invoice review and approvals and close outs
- Field changes and constructability analysis

Construction Inspections

- Daily onsite inspection of underground and aerial construction projects
- Site visits and coordination for fiber installation
- Fiber splicing, termination, testing and inspections
- Experienced inspections for federal broadband grant and loan compliance
- Punch-list and close outs

Sample Projects

- City of Boulder, CO – Turnkey construction management and inspections for 65 miles of fiber backbone throughout the City.
- City of Dayton, TX – Turnkey construction management and inspections for a Citywide fiber to the home network covering 5,000 homes.
- City of Portsmouth, VA – Construction oversight and inspections for the City's 65-mile fiber backbone connecting City sites, schools and utility locations throughout the city.

Project Staff Qualifications

Courtney Violette will be the City of Winter Park's Connectivity Master Plan & Smart City Initiative Project Executive and has experience in leading Broadband Master Plans, Feasibility Studies, Smart City Application, and Fiber Design projects all over the United States with a specialty in the state of Florida. All broadband expansion projects come with unknown variables and our proven methods are ready to tackle any technical or regulatory hurdles involved in the project. Our team is comprised of financial experts in the field of broadband funding and implementation costs. We will use their expertise to guide all phases of the project.

Courtney Violette - Chief Operating Officer
Project Executive

Courtney has led over one hundred municipal broadband planning and implementation projects across the country. He is a Certified Fiber-To-The-Home Professional and holds several technical certifications in broadband, information technology and information security. Prior to joining Magellan, he spent six years as the CIO for the City of Palm Coast. During this time, he planned and built the first true City-owned open-access network in the Southeast. Through his leadership, the network grew to serve government, business, education and healthcare needs across the City, saving these organizations millions of dollars and providing gigabit connectivity to meet the community's needs. Courtney holds an MA in Information Technology Management and a BS in Computer Science from Webster University.

Mike Johnson - Senior Consultant
Project Manager

Mike has over 30 years of extensive experience in wireless communications and broadband data network design. He uses his extensive history and knowledge to assist clients in accomplishing project planning and deliverable essential to deploying successful communications and data systems. His strengths include program management, requirements gathering, field test engineering, equipment evaluation, engineering management, and analyzing complex design conceptions. He has also designed wireless broadband equipment for Point to Point, Point to Multipoint and Mesh Radio Networks. Mike holds four patents on spectrum sensing, channel coordination, and dynamic location information. He also has current certifications in FTTx architecture, Fiber Plug and Play modules, and FTTx link budgets. Mike holds a Bachelor of Science in Electrical Engineering from the University of Florida.

Matthew Southwell - Associate Project Manager – Design

Matthew Southwell has over 13 years in the telecommunications field. Matthew's career began as a U.S. Army Sergeant where he worked on tactical communication systems, Sat-Com radio systems, and deploying weekly COMSEC key changes OTAR (Over the Air Rekeying) with newly deployed radio systems during two Operation Enduring Freedom deployments. Matthew's private sector work includes work with a Motorola radio distributor and contractor where he supported many Federal, State, and local County entities to include: Department of Homeland Security, Immigration and Customs Enforcement, Drug Enforcement Administration, Florida Highway Patrol, Greater Orlando Airport Authority, Orange County Sheriff's Office, and the Lake County Sheriff's Office. Matthew joined Magellan Broadband in 2016 as a telecommunication analyst where he has contributed his knowledge and technical expertise to over 65 broadband projects. Matthew's current role within Magellan includes analysis of client GIS data and mapping, creating conceptual network designs and costing estimates for future fiber builds. Matthew is a Certified Fiber to the Home Professional (CFHP) and holds a Business Management Degree with High Honors from Keiser University in Orlando, FL.

Al Kamuda - Design Team Lead

Al Kamuda is a seasoned telecommunications and GIS professional with over 20 years' experience in telecommunications engineering, mapping, design and outside plant construction. Prior to joining Magellan, Al was the Senior Design Manager for the Central Florida region at Spectrum (Charter Communications), where he led the planning, project management and implementation of outside plant design for various company growth projects including residential, commercial, cellular backhaul and metro WIFI. His extensive experience with the telecommunications industry, CAD platforms and geospatial expertise along with his strategic forward thinking provides an extremely diverse skill set that allows him the valuable insight needed to understand the client's objectives in all aspects of telecommunications construction and design processes.

Kelly Dela Cruz – Project Management Analyst

Kelly is an experienced Analyst with a proven track record of success in various fields such as hospitality, fintech, retail and manufacturing. Her expertise lies in the intersection of User Experience Design and Analytics where she is able to transform project related data and insights into narratives that connect various stakeholders both technical and non technical and act as a catalyst for value creation. Driven by growth opportunities in every community, she believes in maximizing the resources available to them by forming and maintaining coherent, up to date and accurate informative documentations. Kelly as an avid learner has recently earned her master's degree in International Business with a specialization in Business Analytics.

Work Plan

CONNECTIVITY MASTER PLAN

We will prepare a Connectivity Master Plan that will clearly outline how the City can satisfy its connectivity goals while capitalizing on its existing efforts and projects. The Connectivity Master Plan will include:

Analysis of Current Broadband Conditions and Future Trends

We will conduct a comprehensive asset inventory of the current City-owned broadband assets in Winter Park including conduit, fiber, antennas, poles, towers, abandoned facilities, active facilities, and other infrastructure to determine their usefulness for expanding broadband within the City. This effort will provide a realistic assessment of assets available for support Smart City applications and expanding broadband connectivity.

We believe that the following components should be analyzed:

- Underground conduit, innerduct, empty and available conduit
- Fiber cables, strand counts, splice points, terminations and utilized strands
- Vault and handhole locations
- Available and reserved capacity throughout the network
- Construction and placement method policies
- Current as-builts and documentation
- Terminating locations and public facilities
- GIS maps including publicly-owned property, right of way, easements
- Location of capital improvement projects and economic development zones
- Current and planned locations of public safety cameras and traffic signal interconnect

Magellan will request GIS files, capital projects, planning and development data from the City to develop a broadband asset map. Using this data, we propose to first build a geo-correct layer of conduit and fiber, identifying placed conduit, type, size, status (occupied/vacant) and related information. A second layer will incorporate poles, traffic signal cabinets and other assets to be used for expanding broadband.

Assessment of NON-CITY-Owned Broadband Infrastructure

We will document and assess all publicly– and privately-owned networks in the City including:

- Conduit and fiber routes
- Aerial assets including access to and condition of poles,
- Existing wireless telecommunications sites, including publicly available Wi-Fi access points, cellular towers and other antenna placement locations, fixed wireless installations and technologies under development, including but not limited to narrow band systems
- Privately and publicly (non-city) owned data centers, Internet exchange facilities and intercity fiber route access points.

This information will come from a variety of sources, including our comprehensive broadband database, third-party research, and information obtained from the providers and infrastructure owners themselves.

Gap Analysis

Based on the findings of our previous tasks, our team will conduct a gap analysis indicating the need for additional resources and policies in order to meet the City's Smart City and broadband goals. We will illustrate where the digital divide may be most apparent and identify key regions of the City where economic development could be bolstered by broadband. The gap analysis will be based upon Magellan's deep experience with municipal Smart City and broadband initiatives and will include:

- Comparison of the City's existing broadband resources and policies with what will be required to mee the broadband infrastructure goals of the plan including:
  - Identification of existing resources and policies that are sufficient for meeting current and long-term goals
  - Identification of resource and policy gaps that constrain or inhibit attainment of those goals
  - Identification of existing resources and policies that are currently sufficient for the purpose of attaining those goals but could be better configured, managed or otherwise optimized or improved.
  - Recommendations on routes and locations of fiber and/or wireless infrastructure, equipment and points of connection and identification of infrastructure and technical requirements for any recommended network build.

Business Plan

The information from Magellan's business case will help the City evaluate various business models for deploying broadband services, as each has different funding requirements, rates of return and risk profiles.

Magellan will work with Winter Park to define the most optimal business models to evaluate for broadband deployment, which may include the following:

- Retail services to a range of customer segments, including residential and/or commercial;
- Retail services that leverage other utilities for outsourced content and services;
- Fiber leasing arrangements;
- Public-private partnerships with existing providers;
- Retail services to government, education, healthcare and anchor organizations.
- Dark fiber investment only, using private partners for operations and management;
- Others to be determined.

We will work with the City to identify the optimal business models by analyzing the financial outcomes of each. This process will assess the funding requirements (upfront and ongoing), revenues, operating costs, debt service costs, renewal and replacement and related costs borne by each business model.

Financial Plan

Using market derived data Magellan's team will develop a business case and cost estimate for the network for the City. Magellan utilizes a detailed financial model that has been purpose-built for municipal broadband. The financial model accounts for all revenues, costs, funding, debt service, reserves and expansion costs, including engineer's estimates and documentation of all costs and assumptions.

The methodology for the financial analysis will include:

1. Capital costs for the broadband network, including one-time and ongoing capital expenditures;
2. Operating costs for maintenance, field services, staffing, billing and customer service and others;
3. Renewal and replacement costs based on the economic lifetime of each asset class;
4. Customer markets and numbers for residents, businesses and institutional customers;
5. Determine initial and ongoing take rates on the network for each type of customer;
6. Assess financing requirements, costs and terms, calculate annual principal and interest payments;
7. Develop profit & loss statements to determine overall financial feasibility, over a 20-year term;
8. Conduct sensitivity analysis on the project to determine overall financial sustainability using key metrics such as free cash flow, debt service coverage, operating margin, and net income;
9. Define break-even, internal rate of return and similar financial performance metrics;
10. Workshop the financial plan with City leadership.

The financial analysis will also identify feasible grant and loan programs for Winter Park, if eligible. Our analysis will look at the federal FCC, USAC and NTIA programs. The information from Magellan's business case will help the City evaluate various business models for deploying broadband services, as each has different funding requirements, rates of return and risk profiles.

Magellan has a long experience in the development of comprehensive business plans and financial modeling for start-up and expansion of last mile and/or middle mile telecommunications ventures – including in areas with mixed urban and rural and remote "hard to serve" areas that may be isolated from advanced telecommunications networks by terrain barriers, low household density, low population count, and lower than average numbers of businesses and family income. We will work with the City to identify feasible strategies for funding a telecommunications enterprise that can serve stakeholders' needs, generate new revenues and support the economic livelihood of its communities.

Magellan assists communities in developing partnerships that achieve the communities' goals. We will help the City identify what sectors, groups and individuals may help the City achieve their broadband goals including ISP's, NGO's, education partners, cooperatives and others. We help local governments use their public-sector capabilities and assets to attract broadband operators to deploy Gigabit Internet and other leading services to citizens and businesses. Through our deep industry contacts and experience, we help communities find the right providers to deliver the services they need. Magellan will assist the City

in investigating the opportunities for public-private and public-public partnerships including the possibility of a mutually profitable partnership with other local municipalities. We will investigate all opportunities that the City could align with projects that have already been funded by public dollars as well as how these partnerships could be leveraged to attract more funding.

SMART CITY INITIATIVES PLAN

Magellan will provide a final City of Winter Park Smart City Strategic Plan at the conclusion of this engagement. The City of Winter Park's Smart City Strategic Plan will contain the blueprint for deployment of Internet of Things (IoT) devices, Smart City initiatives, enhancements to current City of Winter Park infrastructure and a standard data governance plan to serve municipal and community needs, support economic development, provide policy and connectivity for leveraging assets for new revenue opportunities and prepare the City for the gigabit generation. The Plan will include how the City can use its assets and infrastructure to prepare itself for emerging technologies, including drones, driverless cars, advanced robotics, and mobile hotspots. We will work with you to refine this plan, so it is 100% representative of your stakeholders needs and has a high degree of relevance to your community.

The Strategic Plan will function as the guidebook for Smart City development across the City and will include all information necessary for City to begin expanding its wired and wireless networks, implementing Smart City applications, connecting more businesses for economic development, implementing best practice governance and policy for Smart City operations and leveraging traffic signal and street light poles for generating new revenue from dark fiber and pole attachment leases from 5G wireless microcell sites. It will also provide estimates for Smart City devices. All supporting information such as individual task analysis, raw data, mapping (ESRI) shapefiles and the technical memoranda from each previous task will be included with the Strategic Plan. All documents generated to support delivery of the plan will also be provided to the City. As a part of the Plan, to accelerate the stakeholder and the budget buy-in, not only will we prioritize the initiatives but also, we will provide valuable recommendations for public-private sector partnerships and pilot programs that can be executed to demonstrate the value add and ROI.

The City's Smart City Strategic Plan must address the potential options in which Smart City technologies and devices or IoT, can provide positive impacts on the community as it relates to operational efficiencies, decreasing the digital divide, along with improving citizen health, safety and quality of life. The Plan must include input from the City's internal stakeholders as well as external community-based organizations. The Smart City Strategy will include initiatives to be identified efforts by staff or community stakeholders. Collectively, they will contribute to making the City a tech savvy community that will have the tools for advancements in public health, education, safety, economic sustainability and wellbeing.

The Business Plan will be a part of our final deliverables and will cover at least five years for funding prioritization. This will be based on:

- City assets and initiatives
- Departmental Needs Assessment Analysis
- Current Smart City technologies / Future trends

- Security measures and features

Magellan will provide the City with a Roadmap to Smart City initiatives in the form of our SMART matrix. It lays out actions, contingencies, dependencies, drivers and impediments, and metrics for each application or initiative. The tech stack and value chain will provide clear before and after pictures for the initiatives. Risk assessment, SWOT analysis, and strategic prioritization tools will be built into the Roadmap as a means to monitor and steer implementation. Magellan's project team will be available for meetings with City leadership to support the adoption of the Strategic Plan and we are happy to present the final report and findings to your leadership, City officials or other stakeholders you believe should be included in the final presentation.

COMMUNITY OUTREACH PLAN

Magellan will develop and conduct an engagement plan to solicit feedback from stakeholders and community members about preliminary findings.

Magellan proposes to also hold interviews and workshops with key stakeholders with internal City departments and anchor organizations to gather input about the plan. We find the most effective format for these interviews to be in group settings where participants are encouraged to share open, honest feedback with our team. Community partners to be included in this process may include:

- City departments including IT, Planning, Public Works, Economic Development, and the City Manager's Office
- Orange County
- Local businesses
- Chambers of Commerce and Economic Development Groups
- Anchor Institutions such as healthcare facilities, schools, and libraries
- Public safety agencies
- Transportation & Utilities
- Water agencies
- Non-profit organizations
- Broadband providers and infrastructure owners
- Commercial property developers

We will also work with the City to develop additional community engagement tools including the use of social media, online surveys, and/or other media that will be used to inform and collect information about the needs of the stakeholders.

BROADBAND TASK FORCE MEETINGS AND TIMELINE

Magellan's project team will meet on a bi-weekly basis with your project team to discuss the status of the project, major milestones and deliverables, and ensure alignment on project goals. We will attend all meetings to set by the Broadband Ad Hoc Task Force to discuss the status of ongoing project tasks.

PROJECT TIMELINE

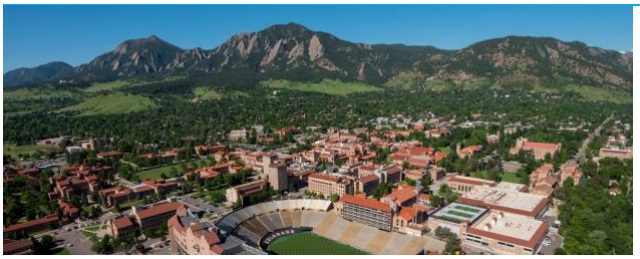
Based on projects of a similar nature, we estimate that Winter Park's Connectivity Master Plan & Smart City Initiative Project would take approximately nine (9) months to complete.

◆ Ongoing Task
☐ Final Deliverable

	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9
Connectivity Master Plan	◆	◆	◆						☐
Assessments of Broadband Infrastructure and Gap Analysis	◆	◆	◆						☐
Business Plan		◆	◆	◆	◆				☐
Financial Plan		◆	◆	◆	◆				☐
Smart City Initiatives Plan			◆	◆	◆	◆			☐
Community Outreach Plan				◆	◆	◆			☐
Funding Strategy				◆	◆	◆	◆		☐
Connectivity Master Plan and Smart City Initiatives Approval						◆	◆	◆	☐
Project Management & Meetings	◆	◆	◆	◆	◆	◆	◆	◆	◆

Professional Contacts / References

SMART CITY FIBER DESIGN REFERENCE: CITY OF BOULDER, CO



CONTACT

Steve Catanach
Director of Utilities
P: 303.441.3274
E: catanachs@bouldercolorado.gov

"The city's vision is to provide a world-class community telecommunications infrastructure to Boulder for the 21st Century and beyond. Broadband connectivity is a critical infrastructure service for quality of modern life, as is the case with roads, water, sewer and electricity."

CHALLENGE

The City of Boulder, CO is an innovative city with many diverse needs for connectivity, from traffic signalization to public housing, to smart utilities to next-generation broadband. The City needed a comprehensive engineering design for a citywide fiber backbone to expand on the City's original fiber network that was installed nearly 15 years ago. The City's objectives were to build this new network to meet the needs of the City and community over the next 10-15 years, with special focus on how building the fiber backbone could create a foundation for residential fiber to the home broadband services. The City needed an engineering partner with specific experience in municipal fiber and broadband services and in 2019, Magellan was retained to develop the design.

MAGELLAN'S SOLUTION

In 2019, Magellan first conducted a comprehensive review of departmental needs within the City, including transportation, public works, public housing, police and fire, utilities, information technology and open space mountain parks. Through this assessment, over 200 new City-owned sites were identified to be connected to fiber. Magellan developed the full engineering design package and optimized the fiber backbone to support fiber to the home distribution, to support broadband programs that the City would consider in the future. Our unique design lowered the bar for deployment of new fiber to the home by reducing the cost to build this infrastructure. We also found miles of unused City conduit during the design process, which we integrated into the final engineering design, saving the City approximately $1 million in new construction. We provided detailed fielding, utility assessment, permitting, make-ready, prints, costing and as-builts for each phase of construction. To enable seamless deployment of the network, the City also selected Magellan to manage construction, given our deep experience constructing municipal fiber and our collaborative approach with the City's internal departments.

OUR CLIENT'S SUCCESS

Today, the first two phases of construction are complete. Over the next 24 months, Magellan will manage the construction of the remaining 50 miles of fiber, connect 114 traffic signals, 23 public housing sites, 2 data centers, 7 towers and 25 other city facilities. Over this time, it will lead to significantly improved capabilities for the City's departments and a new fiber resource to support future broadband applications for residents and businesses.

FIBER DESIGN & CONSTRUCTION REFERENCE: CITY OF RANCHO CUCAMONGA, CA

CONTACT

Fred Lyn
Utility Division Manager
P: 909.477.2740 ext. 4035
E: fred.lyn@cityofrc.us

"Today this infrastructure plays a crucial role in Rancho Cucamonga, not only in economic development, but will be pivotal in the long-term sustainability and future planning of the City. Rancho Fiber has arrived." -Fred Lyn, Utilities Division Manager

CHALLENGE

City leadership recognizes that fiber-optic infrastructure is an important part of the Rancho Cucamonga community. They understand that in today's world, connectivity affects every aspect of the community - whether in municipal operations, public safety, education, healthcare, quality of life, entertainment and commerce. To realize leadership's vision, the City needed a partner that could develop and manage the expansion of fiber-based broadband across the City in a measured approach that achieved the City's financial constraints while expanding access in year-by-year deployments across the City.

MAGELLAN'S SOLUTION

In 2016, Magellan worked with the City to develop a fiber master plan and engineering assessment that laid out a multi-year plan for new aerial and underground fiber deployment throughout the City, totaling $12 million over 6 years. Since adopting the master plan in 2017, Magellan has designed and built the first three phases of the fiber to the premises network. In this work, we have provided full engineering, fielding, utility assessments, pole and make ready planning, construction prints and bid packages. We also manage construction as an owner's representative for the City in the fiber build, ensuring that the construction contractor meets our engineering specifications developed for the City, with tight quality control and within the budget.

OUR CLIENT'S SUCCESS

Today, the City has connected neighborhoods and business corridors, enabling gigabit broadband services to residents and businesses across the City. Residential customers receive gigabit service for $69.99 per month, giving them nearly 5 times the bandwidth for a lower cost than is available in the market today. Businesses have competitively priced internet on City fiber that has replaced slow and unreliable DSL, and cable internet services.

FIBER & WIRELESS NETWORK DESIGN REFERENCE: CITY OF CHESAPEAKE

CONTACT

Jay Krail
Project Manager
P: 504.920.3181
E: jkrail@cityofchesapeake.net

"The deployment of fiber throughout the City will open doors and offer benefits that we have only begun to fathom. It is critical that we approach this project with a strategic mindset, and that's why we're so pleased to have Magellan Advisors on our team. They, along with our regional partners in Hampton Roads, will help us all take a giant leap into the future." - Rick West, Mayor of Chesapeake

CHALLENGE

The City of Chesapeake, located in the Hampton Roads region of Virginia, is currently experiencing a technology ecosystem boom. As the region flourishes, Chesapeake's leadership noticed a lack of resilient and accessible fiber infrastructure to support the City's technology initiatives and broadband services. In late 2019, the City engaged Magellan Advisors to lead the development of Chesapeake's Next Generation Network (C-NGN) in an effort to provide world-class fiber connectivity to the City's enterprises, partners, and the greater Hampton Roads region. The objectives included enhancing municipal services, promoting economic development, supporting education and creating a catalyst for future private investment in broadband.

MAGELLAN'S SOLUTION

Magellan worked with the City to engineer the 170-mile C-NGN fiber-optic network and complementary smart city wireless overlay, branded Chesapeake Connects. Magellan conducted detailed assessment of each stakeholders' needs and developed the network design to maximize community use of the fiber. The network connects over 200 community facilities including city, school, library, hospital, public utility, public safety and traffic locations. The design also incorporates Chesapeake's economic development goals by ensuring that key business corridors are equipped with high-capacity fiber. Magellan Advisors engineered over 170-mile route miles of fiber, including fielding, low-level design, construction prints, permitting, master budgets and construction bids. In late 2020, Magellan's scope was expanded to determine how Chesapeake Connects will support organizations during and after the COVID-19 pandemic focusing on telehealth and remote education.

OUR CLIENT'S SUCCESS

Magellan's process of design, then bid, then build is giving the City best approach to minimize the cost of construction, select the most capable construction contractor and ensure rapid deployment of the network. The City of Chesapeake began construction by July 2021 and is working with Magellan to accelerate the timeline, targeting 18-24 months for completion of major construction related activities.

FIBER FEASIBILITY STUDY & IMPLEMENTATION MANAGEMENT REFERENCE: CITY OF PORTSMOUTH, VA

CONTACT

Daniel Jones
Chief Information Officer
P: 757.393.8398 x2117
E: jonesd@portsmouthva.gov

"Our municipal fiber backbone fits right in with Council's vision of becoming a smart city and being prepared for the next generation of technology"
-Mayor John Rowe, City of Portsmouth

CHALLENGE

With significant growth, the City of Portsmouth's existing budget for telecommunications services was expected to double from $1 million to over $2 million per year. To reduce its costs and create new capabilities, the City envisioned investing in its own fiber backbone. To do so, the City needed a partner that had planned, designed, and built these networks in the municipal environment.

MAGELLAN'S SOLUTION

In 2017, Magellan conducted a needs assessment and fiber master plan for the City. The master plan included a high-level design for a citywide fiber backbone, with accompanying cost estimates and a strategic business case. The business case showed by investing in the fiber, the City would eliminate 95% of its recurring telecommunications costs and own the fiber to support growing needs among city departments, external stakeholders and the community. In 2018, City Council approved the master plan and authorized the construction of the fiber network to 85 city, school, library, public safety, tower and other sites. Magellan developed the engineering design for the fiber network using 100% underground construction, with high capacity fiber and multiple levels of redundancy. Magellan's design process gave the City the most effective solution to build the network at the lowest cost. Upon completion of the design, Magellan was retained to procure the construction contractor and manage construction and inspections for the City.

OUR CLIENT'S SUCCESS

Today, the majority of the network has been built and the City is already realizing benefits of its investment. The City will connect each and every site at 1 Gbps and 10 Gbps, increasing site bandwidth to every facility. The network is connecting major community anchors like Tidewater Community College and other key stakeholders throughout the City. It will enable a new platform for innovation in traffic management, public safety, utilities management, and most importantly, it will Portsmouth as a Smart City for tomorrow.

Pricing

The total cost to the City of Winter Park's Connectivity Master Plan, Smart City Initiative Plan and a Community Outreach Plan is $150,100 and includes all work to be completed by Magellan as stated in this proposal.

Magellan will bill on the first day of the month for the current month's services Travel and incidental expenses will be billed as incurred at a not to exceed rate of $10,000. Invoices are payable on net 30 terms from the date of invoice and include a 10% administration fee.

Task/Description	Hours	Cost
Connectivity Master Plan	350	$66,500
Smart City Initiatives Plan	300	$57,000
Community Outreach Plan	140	$26,600
Total for Magellan's Services		$150,100
Travel		$10,000
Total Not-to-Exceed		$160,100

Miscellaneous

ADDITIONAL SERVICES AND RATES

Labor Classification	Hourly Rate
Project Executive	$190
Licensed Professional Engineer	$180
Broadband Consultant	$190
Project Manager	$190
GIS Engineer	$140
Broadband Designer	$130
Design Lead	$170
Field Engineer	$100
Project Coordinator	$120
Permitting Coordinator	$120
Make Ready Engineer	$120
Lead Construction Manager / Inspector	$140
Additional Inspector	$105
Electronics Engineer	$185
Broadband Integration Specialist	$185
Broadband Operations Lead	$185
Broadband Sales & Marketing Lead	$185
Description	**Cost**
Underground Engineering Design	$1.50 / foot
Aerial Engineering Design	$1.10 / foot
P.E. Stamps	Pages 1-10 - $190 Pages 11 – 20 - $165 Pages 21+ - $150

Public Records Act/Chapter 119 Requirements

Successful Respondent agrees to comply with the Florida Public Records Acts to the fullest extent applicable, and shall, if this engagement is one for which services are provided by doing the following:

1. Successful Respondent shall keep and maintain public records that ordinarily and necessarily would be required by the public agency in order to perform the service;
2. Successful Respondent shall provide the public with access to such public records on the same terms and conditions that the public agency would provide the records and at a cost that does not exceed that provided in Chapter 119, Florida Statutes or as otherwise provided by law;
3. Successful Respondent shall insure that public records that are exempt or that are confidential and exempt from the public record requirements are not disclosed except as authorized by law; and
4. Successful Respondent shall meet all requirements for retaining public records and transfer to the public agency, at no cost, all public records in possession of the Successful Respondent upon termination of the contract and shall destroy any duplicate public records that are exempt or confidential and exempt. All records stored electronically must be provided to the public agency in a format that is compatible with the information technology systems of the City.

The parties agree that if the Successful Respondent fails to comply with a public records request, then the City must enforce the contract provisions in accordance with the contract and as required by Section 119.0701, Florida Statutes. Notwithstanding any other requirement herein stated, the Successful Respondent shall comply fully with the requirements of Florida Statutes 119.0701.

Authorized Signature: John Honker Print: John Honker

Title: President and CEO Date: 8/31/22

Solicitation #: RFP 26-22

State of Texas County of Harris

Sworn to and subscribed before me

on 08/26/2022 by John Honker.

NOTARY PUBLIC STATE OF TEXAS
John Louis Williams JR
ID NUMBER
13267006-4
COMMISSION EXPIRES
September 10, 2024

John Louis Williams JR.
Notary Public, State of Texas

Notarized online using audio-video communication

Sworn Statement Under Section 287.133(3)(a), Florida Statutes, on Public Entity Crimes

This sworn statement is submitted to the City of Winter Park by John Honker for Magellan Broadband whose business address is 999 18th Street, Suite 3000, Denver, CO 80202 and (if applicable) its Federal Employer Identification Number (FEIN) is 65-1218484 (If the entity has no FEIN, include the Social Security Number of the individual signing this sworn statement): _____

I understand that a "public entity crime" as defined in Paragraph 287.133(1)(g), **Florida Statutes,** means a violation of any state or federal law by a person with respect to and directly related to the transaction of business with any business with any public entity or with an agency or political subdivision of any other state or of the United States, including, but not limited to, any bid or contract for goods or services to be provided to any public entity or an agency or political subdivision of any other state or of the United States and involving antitrust, fraud, theft, bribery, collusion, racketeering, conspiracy, or material misrepresentation.

I understand that "convicted" or "conviction" as defined in Paragraph 287.133(1)(b), **Florida Statutes,** means a finding of guilt or a conviction of a public entity crime, with or without an adjudication of guilt, in any federal or state trial court of record relating to charges brought by indictment or information after July 1, 1989, as a result of a jury verdict, nonjury trial, or entry of a plea of guilty or nolo contendere.

I understand that an "affiliate" as defined in Paragraph 287.133 (1)(a), **Florida Statutes,** means:

A predecessor or successor of a person convicted of a public entity crime; or

An entity under the control of any natural person who is active in the management of the entity and who has been convicted of a public entity crime. The term "affiliate" includes those officers, directors, executives, partners, shareholders, employees, members, and agents who are active in the management of an affiliate. The ownership by one person of shares constituting a controlling interest in another person, or a pooling of equipment or income among persons when not for fair market value under an arm's length agreement, shall be a prima facie case that one person controls another person. A person who knowingly enters into a joint venture with a person who has been convicted of a public entity crime in Florida during the preceding 36 months shall be considered an affiliate.

I understand that a "person" as defined in Paragraph 287.133(1)(e), Florida Statutes means any natural person or entity organized under the laws of any state or of the United States with the legal power to enter into a binding contract and which bids or applies to bid on contracts for the provision of goods or services let by a public entity, or which otherwise transacts or applies to transact business with a public entity.

The term "person" includes those officers, directors, executives, partners, shareholders, employees, members, and agents who are active in management of an entity.

Based on information and belief, the statement which I have marked below is true in relation to the entity submitting this sworn statement. **[indicate which statement applies.]**

X Neither the entity submitting this sworn statement, nor any officers, directors, executives, partners, shareholders, employees, members, or agents who are active in the management of the entity, nor any affiliate of the entity has been charged with and convicted of a public entity crime subsequent to July 1, 1989.

__ The entity submitting this sworn statement, or one or more of its officers, directors, executives, partners, shareholders, employees, members or agents who are active in management of the entity, or an affiliate of the entity has been charged with and convicted of a public entity crime subsequent to July 1, 1989.

__ The entity submitting this sworn statement, or one or more of its officers, directors, executives, partners, shareholders, employees, members, or agents who are active in the management of the entity, or an affiliate of the entity has been charged with and convicted of a public entity crime subsequent to July 1, 1989. However, there has been a subsequent proceeding before a Hearing Officer of the State of Florida, Division of Administrative Hearings and the Final Order entered by the hearing Officer determined that it was not in the public interest to place the entity submitting this sworn statement on the convicted vendor list. [attach a copy of the final order]

I UNDERSTAND THAT THE SUBMISSION OF THIS FORM TO THE CONTRACTING OFFICER FOR THE PUBLIC ENTITY IDENTIFIED IN PARAGRAPH 1 (ONE) ABOVE IS FOR THAT PUBLIC ENTITY ONLY AND, THAT THIS FORM IS VALID THROUGH DECEMBER 31 OF THE CALENDAR YEAR IN WHICH IT IS FILED. I ALSO UNDERSTAND THAT I AM REQUIRED TO INFORM THE PUBLIC ENTITY PRIOR TO ENTERING INTO A CONTRACT IN EXCESS OF THE THRESHOLD AMOUNT PROVIDED IN SECTION 287.017, FLORIDA STATUTES FOR CATEGORY TWO OF ANY CHANGE IN THE INFORMATION CONTAINED IN THIS FORM.

John Honker
Authorized Signature

Sworn to and subscribed before me by means of __ physical presence or ✓ online notarization, this 26th day of August 20 22. Personally known N/A OR Produced identification DRIVER LICENSE

Notary Public - State of Texas My commission expires 09/10/2024

(Printed typed or stamped Commissioned name of Notary Public)

John Louis Williams JR
Notary Public, State of Texas County of Harris

Solicitation #: RFP 26-22

Notarized online using audio-video communication

NOTARY PUBLIC STATE OF TEXAS

John Louis Williams JR

ID NUMBER
13267006-4
COMMISSION EXPIRES
September 10, 2024

Non-Collusion Affidavit of Prime Respondent

STATE OF Florida

COUNTY OF Dade

John Honker, being duly sworn, deposes and says that:

1. They are President and CEO of Magellan Broadband, the respondent that has submitted the attached response.
2. They are fully informed respecting the preparation and contents of the attached solicitation and of all pertinent circumstances respecting such solicitation.
3. Such solicitation is genuine and is not a collusive or sham solicitation.
4. Neither the said respondent nor any of its officers, partners, owners, agent representatives, employees or parties in interest including this affiant, has in any way, colluded, conspired, or agreed, directly or indirectly, with any other respondent, firm or person, to submit a collusive or sham response in connection with the Agreement for which the attached response has been submitted or to refrain from bidding in connection with such Agreement, or has in any manner, directly or indirectly, sought by Agreement or collusion or communication or conference with any other responder, firm or person to fix the price or prices in the attached solicitation or of any other respondent, or to fix any overhead, profit or cost element of the proposed price or the proposed price of any other responder, or to secure through any collusion, conspiracy, connivance or unlawful Agreement any advantage against the City of Winter Park, Florida, or any person interested in the proposed Agreement.
5. The price or prices quoted in the attached response are fair and proper and are not tainted by any collusion, conspiracy, or unlawful Agreement on the part of the proposer or any of its agents, representatives, owners, employees, or parties of interest, including affiant.

John Honker

Authorized Signature

President and CEO

Title

Sworn to and subscribed before me by means of N/A physical presence or ✓ online notarization, this 26th day of August 2022. Personally known N/A OR Produced identification DRIVER LICENSE

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John Louis Williams JR

Notary Public, State of Texas

County of Harris

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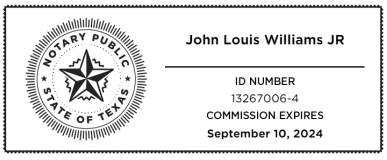


Background Check Verification

SECTION 1: REQUIREMENTS

The Respondent/Vendor shall Agree to the following:

1.1 Respondent/Vendor shall perform a Level I (Past 5 years) FDLE Computerized Criminal History (CCH) (FDLE CCH Website) background check in accordance with all applicable state and local laws, on any assignee being assigned and prior to assignment with the City. All background checks shall be accomplished prior to any assignment or work taking place on City property. The cost of the background checks shall be borne by the Respondent/Vendor. The contractor

1.2 If the Respondent/Vendor has employed officials that have a current Level 2 Background Screening which was completed by a local government, school board, the Florida High School Activities Association, the Contractor agrees to provide a list of those officials to the City.

1.3 Respondent/Vendor agrees to make its officials sign a sworn statement affirming that they have not pled guilty to or convicted of any of the crimes listed in Section 2: Prohibited Offenses, prior to any assignment. This information shall always be kept current. The Respondent/Vendor shall be in complete compliance within 30 days after award.

1.4 Respondent/Vendor shall require its officials to report to the Contractor immediately if they have been convicted of any of the crimes listed in Section 2: Prohibited Offenses. Respondent/Vendor shall not use that official, unless they have been cleared of the crime.

SECTION 2: PROHIBITED OFFENSES

Respondent/Vendor certifies that its officials/employees have not been arrested with disposition pending or found guilty of, regardless of adjudication, or entered a plea of nolo contender or guilty to or have been adjudicated delinquent and the record has not been sealed or expunged for, any offense prohibited under any of the following provisions of the Florida Statutes or under any similar statute of another jurisdiction for any of the offenses listed below:

- Section 393.135 - sexual misconduct with certain developmentally disabled clients and reporting of such sexual misconduct
- Section 394.4593 - sexual misconduct with certain mental health patients and reporting of such sexual misconduct
- Section 415.111- adult abuse, neglect, or exploitation of aged persons or disabled adults or failure to report of such abuse
- Section 741.28 - criminal offenses that constitute domestic violence, whether committed in Florida or another jurisdiction
- Section 782.04 - murder
- Section 782.07 - manslaughter, aggravated manslaughter or an elderly person or disabled adult, or aggravated manslaughter of a child
- Section 782.071 - vehicular homicide
- Section 782.09 -killing an unborn quick child by injury to the mother
- Chapter 784 - assault, battery, and culpable negligence, if the offense was a felony

- Section 784.011 - assault, if the victim of offense was a minor
- Section 784.03 - battery, if the victim of offense was a minor
- Section 787.01 - kidnapping
- Section 787.02 - false imprisonment
- Section 787.025 - luring or enticing a child
- Section 787.04(2) - taking, enticing, or removing a child beyond the state limits with criminal intent pending custody proceeding
- Section 787.04(3) - carrying a child beyond the state lines with criminal intent to avoid producing a child at a custody hearing or delivering the child to the designated person
- Section 790.115(1) - exhibiting firearms or weapons within 1,000 feet of a school
- Section 790.115(2) (b) - possessing an electric weapon or device, destructive device, or other weapon on school property
- Section 794.011 - sexual battery
- Former Section 794.041 - prohibited acts of persons in familial or custodial authority
- Section 794.05 - unlawful sexual activity with certain minors
- Chapter 796 - prostitution
- Section 798.02 - lewd and lascivious behavior
- Chapter 800 - lewdness and indecent exposure
- Section 806.01 - arson
- Section 810.02 - burglary
- Section 810.14 - voyeurism, if the offense is a felony
- Section 810.145 - video voyeurism, if the offense is a felony
- Chapter 812 - theft and/or robbery and related crimes, if a felony offense
- Section 817.563 - fraudulent sale of controlled substances, if the offense was a felony
- Section 825.102 - abuse, aggravated abuse, or neglect of an elderly person or disabled adult
- Section 825.1025 - lewd or lascivious offenses committed upon or in the presence of an elderly person or disabled adult
- Section 825.103 - exploitation of disabled adults or elderly persons, if the offense was a felony
- Section 826.04 - incest
- Section 827.03 - child abuse, aggravated child abuse, or neglect of a child
- Section 827.04 - contributing to the delinquency or dependency of a child
- Former Section 827.05 - negligent treatment of children
- Section 827.071 - sexual performance by a child
- Section 843.01 - resisting arrest with violence
- Section 843.025 - depriving a law enforcement, correctional, or correctional probation officer means of protection or communication
- Section 843.12 - aiding in an escape
- Section 843.13 - aiding in the escape of juvenile inmates in correctional institution
- Chapter 847 - obscene literature
- Section 874.05 (1) - encouraging or recruiting another to join a criminal gang
- Chapter 893 - drug abuse prevention and control only if the offense was a felony of if any other person involved in the offense was a minor
- Section 916.1075 - sexual misconduct with certain forensic clients and reporting of such sexual conduct

- Section 944.35 (3) - inflicting cruel or inhuman treatment on an inmate resulting in great bodily harm
- Section 944.40 - escape
- Section 944.46 - harboring, concealing, or aiding an escaped prisoner
- Section 944.47 - introduction of contraband into a correctional facility
- Section 985.701 - sexual misconduct in juvenile justice programs
- Section 985.711 - contraband introduced into detention facilities

SECTION 3: CERTIFICATION

I hereby certify that I will utilize FDLE Computerized Criminal History (CCH) system in accordance with the terms governing the use of the system to confirm eligibility of the individuals being assigned and prior to assignment with the City. In accordance with s. 837.06, Florida Statutes, I understand and acknowledge that whoever knowingly makes a false statement in writing with the intent to mislead a public servant in the performance of his or her official duties shall be guilty of a misdemeanor in the second degree, punishable as provided in s. 775.082 or s. 775.083, Florida Statutes.

Company: Magellan Broadband

Solicitation #: RFP 26-22

John Honker

Authorized Signature

President and CEO

Title

Sworn to and subscribed before me by means of __ physical presence or ✔ online notarization, this 26th day of August 2022. Personally known N/A OR Produced identification DRIVER LICENSE

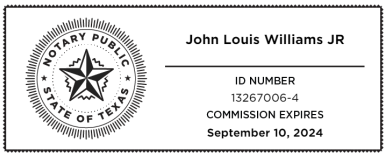
Notary Public - State of Texas My commission expires 09/10/2024

(Printed typed or stamped Commissioned name of Notary Public

John Louis Williams JR

Notary Public, State of Texas County of Harris

Notarized online using audio-video communication



Master Plan

Deliverable 1 – Telecommunications Environment and Market Analysis

Magellan
An ENTRUST Solutions Group Company

TABLE OF CONTENTS

TABLE OF FIGURES

TABLES

Executive Summary

An ordinance has been established through Chapter 2, Section 2-48(1) of the City of Winter Park, Code of Ordinance by the City Commission creating a temporary five (5) member Broadband and Smart City Ad-Hoc Committee to evaluate Smart City Technologies to foster continuous improvements of services and advance Broadband standard of service, technology, choice, and availability, to citizens and visitors of the City of Winter Park, making recommendations to the City Commission. The following are the goals of the Committee together with the City's consultant, Magellan to address the ordinance:

- Serving as a forum for the discussion of Smart City and Broadband standard of service, and technologies, including, but not limited to, fiber optic technology, and related concepts among stakeholders.
- Evaluating methods of ensuring adequate broadband choice, availability, and capacity.
- Develop an outline for a Smart City strategic plan.
- Exploring Smart City implementation strategies for the City.
- Aligning Smart City initiatives with other City objectives and priorities.
- Evaluating the costs of implementing, administering, and maintaining any such
- broadband technologies.
- Exploring innovative and creative ways to utilize such broadband technologies.

In November 2022, Magellan has been selected to support the City of Winter Park's Information Technology Department and the current Broadband and Smart City Ad Hoc Committee by providing services and deliverables in satisfaction of the requirements of City Ordinance 3210-21.

In this Marketing Analysis - Interim Report, Magellan's team analyzed the connectivity and smart city landscape of the City of Winter Park. This document summarizes the team's initial research and analysis. From a project aspect, this document covers the City asset analysis, market analysis, stakeholder outreach, and a discussion on both connectivity and smart city perspectives. The fulfillment of the Connectivity and Smart City strategic plan deliverables based on the ordinance, is currently underway.

KEY FINDINGS:

- The FCC National Broadband Map considers Winter Park to be nearly 100% served in receiving 100/20 Mbps services, however, not by fiber.
- Spectrum has a gigabit monopoly in most of the city, though their upstream bandwidth is limited to 35 Mbps today, and they are expected to deploy 10 Gbps "DOCSIS 4.0", as an equipment upgrade, by 2026. Competition from 10 Gbps fiber-based broadband service providers is expected in the near term.
- Lumen has begun replacing CenturyLink DSL with FTTP (Fiber-to-the-Premises) distribution networks passing 900 locations. However, given what the City team knows today, it cannot assume that Lumen will cover 100% of the city with their FTTP services in their planned build-out.
- FrogNow "Frog", has limited fiber in the city and they have publicly announced plans to serve the residential market with FTTP. However, the committee has not seen new deployments.

- T-Mobile and Verizon are marketing fixed wireless broadband service availability with Verizon offering a gigabit service in limited locations.
- The construction phase of the City's backbone as part of *The Private Fiber Network Construction and Maintenance Agreement* with Frog is expected to be completed in August/September 2023. This connects 18 key City facilities to a fiber backbone. This backbone forms the foundation of future fiber and wireless infrastructure expansions to support smart city technologies and use cases.
- The IT conduit, deployed as part of the electric undergrounding program has been poorly documented and is of reduced value to a city until such time it can be fielded, audited, and fully documented.
- Smart City use cases apply across every department, though four key pillars of focus emerged. They are: Transportation, Public Safety, Utilities, and Enhanced Quality of Life. Each will impact future connectivity needs.
- There are numerous foundational technologies and systems that apply across many use cases and should be centralized to reduce the City's Capital Expenditures (CAPEX) and Operational Expenditures (OPEX). This will eliminate redundant technology siloes and improve communication and data transparency.

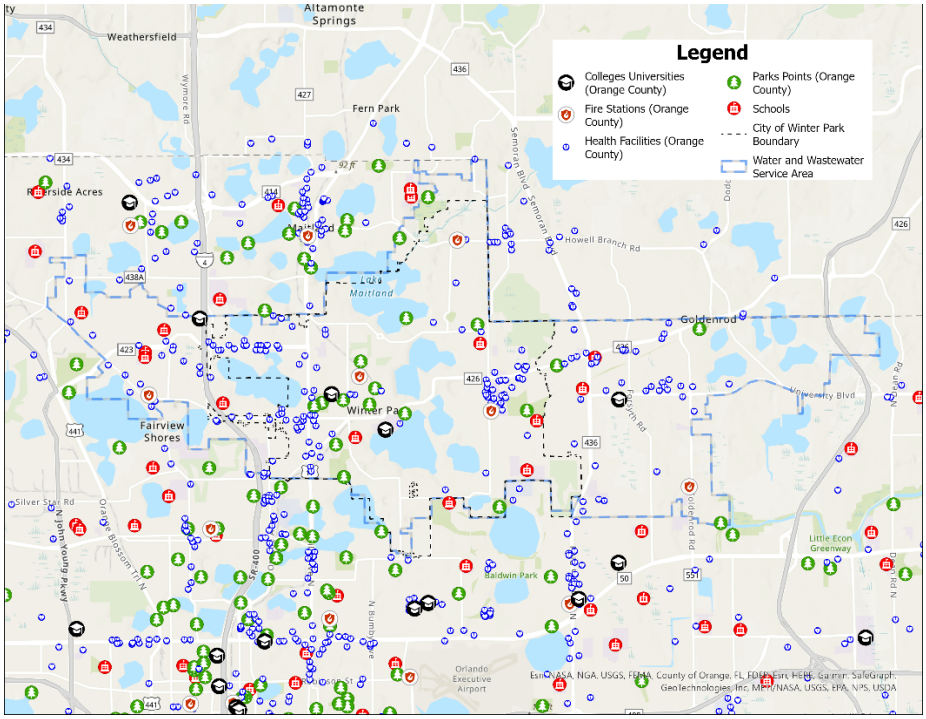
Winter Park's Base Maps and Telecommunications Environment

Magellan studied the broadband environment in the city by reviewing public and private data sources and verifying most of this information through outreach with City Departments and one-on-one interviews with the local providers (meetings are further elaborated in the Market Analysis section below). Generally, the City of Winter Park is well covered by broadband, although, today, most of the city has a single provider of gigabit services. Competition is coming to the city as Lumen has begun replacing the CenturyLink copper network with FTTP and will soon offer multiple gigabit symmetric services. Spectrum will counter Lumen fiber by upgrading to the emerging industry standard called DOCSIS 4.0. In addition, Frog is already in the city offering FTTP services to businesses and they have announced plans to serve the residential market. In 3-5 years, Winter Park will likely have three facilities-based multi-gigabit providers, one using copper/fiber hybrid technologies, and two using end-to-end fiber.

(a) City Points of Interest Map

As indicated below, there is a significant number of public facilities and locations throughout the city. The City has a project underway to connect 18 City facilities with a 48-count fiber backbone via Frog's Agreement with it. Items shown below are schools (Orange County), fire stations, city parks (Orange County), and health facilities. This map of facilities depicted below provides a frame of reference for public sites located throughout both the city's limits (municipal boundaries) and the water service territory.

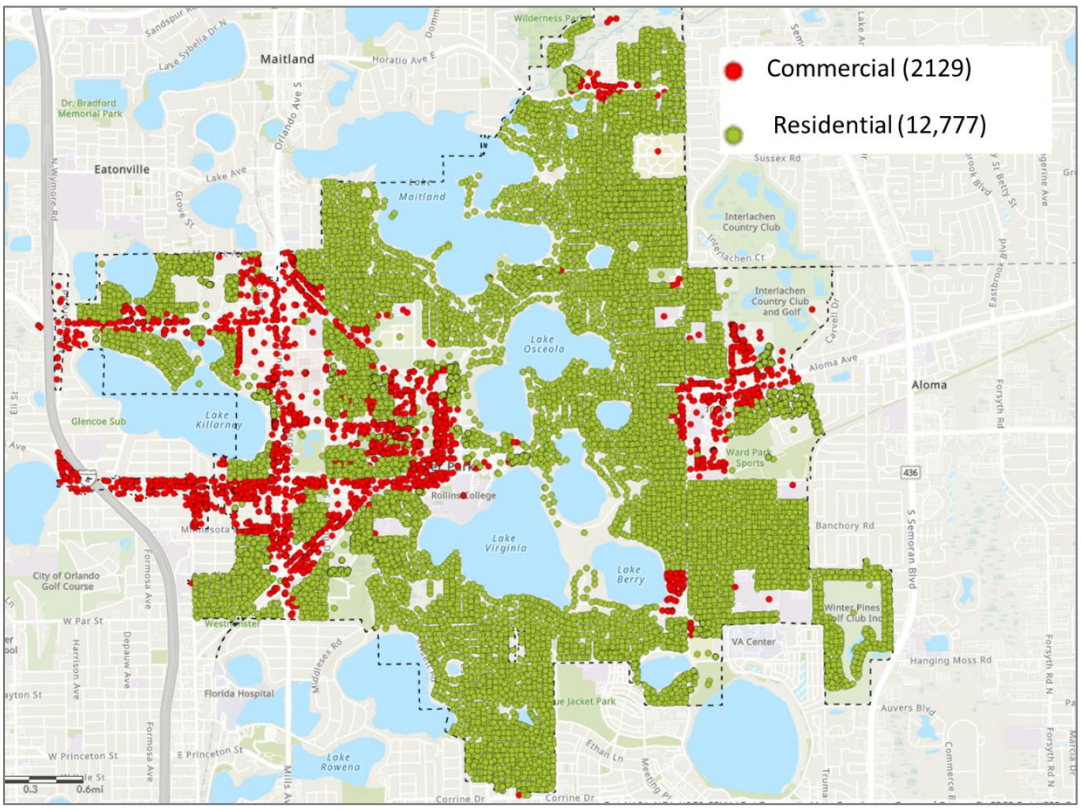
Figure 1 - Winter Park Points of Interest Map



(b) Population Density

Winter Park is a densely populated city with 12,777 residential and 2,129 commercial addresses (as shown in the figure below) within the city limits, as well as utility areas beyond the city limits. Density is a critical parameter for broadband providers as construction costs are linear (e.g., $/ft or $/mile). The city's dense environment enables the Internet Service Provider (ISP) to amortize its costs over more locations, thus reducing the cost to serve each location. This also applies to other costs such as customer acquisition (e.g., Marketing).

Figure 2 - City Address Points



(c) Smart City Components

Winter Park has been innovative for many years and has begun its smart city journey. Smart city technologies and solutions have been deployed by the City to serve specific departments' unique needs. This experience with smart city hardware and software components can be used to achieve the goals desired in the vision for a Smarter Winter Park as we look to the future.

An example of this is the use of Advanced Metering Infrastructure (AMI) by the city's electric and water utilities. Today, the City can remotely read its 22,500 water meters and 15,344 electric meters. The water service territory is much larger than the electric service territory and extends well beyond city limits.

Figure 3 - City's Electric Service Territory Map

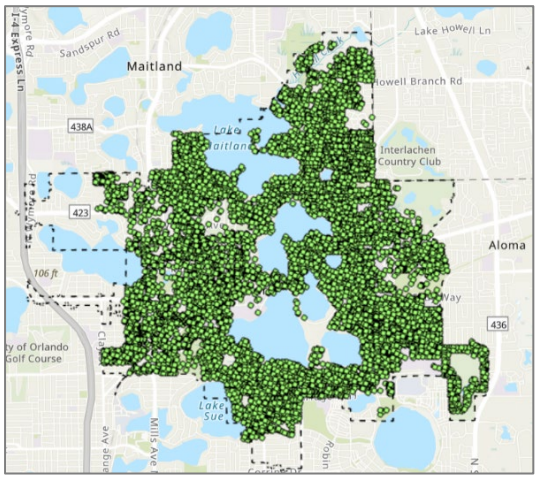
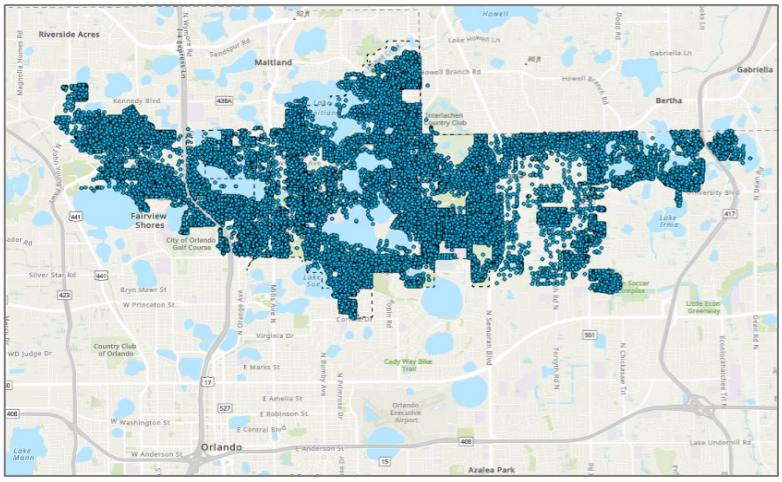


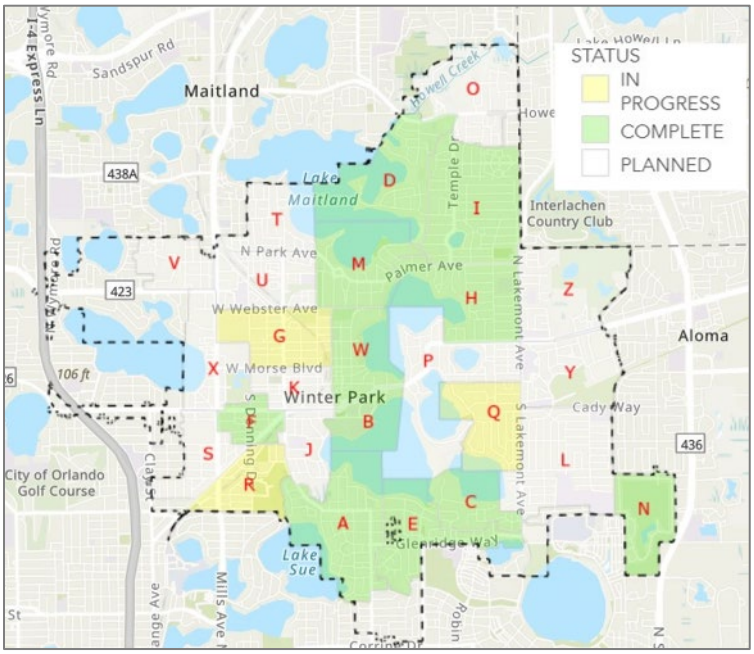
Figure 4 - City's Water Service Territory Map



(d) Utilities Undergrounding/Internet Conduit Project

Winter Park is in the middle of an Electric Project where the City is funding the move of all electric utilities from above ground on poles, to underground conduit banks. This will make the utilities' infrastructure less vulnerable to weather events like tornadoes or hurricanes, thus improving reliability. In conjunction with this project, they are also deploying a 2" conduit for future telecommunications use for the City. The City could also lease or sell this conduit to a private ISP. Further, the City is installing another 2" conduit, paid for by Spectrum, where needed to aid their transition from overhead/aerial infrastructure to underground. The map below in Figure 5 shows the undergrounding areas and the status of each area.

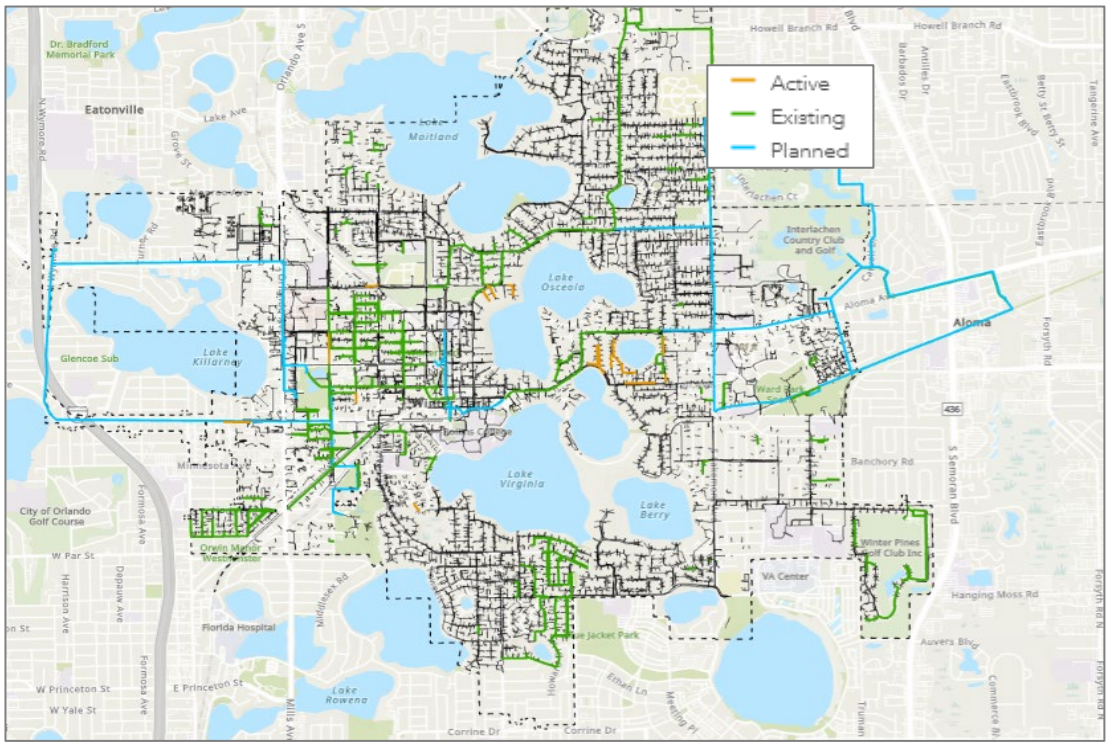
Figure 5 - Winter Park Utilities Undergrounding Initiative



The City has estimated that 60% of the project has been completed, and the remaining 40% will be completed over the next 7 years from this year, 2023. The vast scope of the City communication conduit could enable the City, or a private ISP, to deploy fiber in the city quicker and cheaper. The exact status and location of this conduit is not known at this time.

The map in the figure below shows the conduit installed with the undergrounding utilities initiative.

Figure 6 - Active, Planned and Existing Conduit



(e) Light Poles/Streetlights

Winter Park has decorative streetlights and several types of light poles deployed across the community. The City is actively using them for small cell, Wi-Fi, and smart city deployment. Winter Park has over 4,220 streetlights dispersed throughout the city, of which at least 338 are upgraded Light-Emitting Diodes (LED). Streetlights are potential locations to deploy cameras, environmental sensors, and other smart city technologies.

Figure 7 - Utility Poles

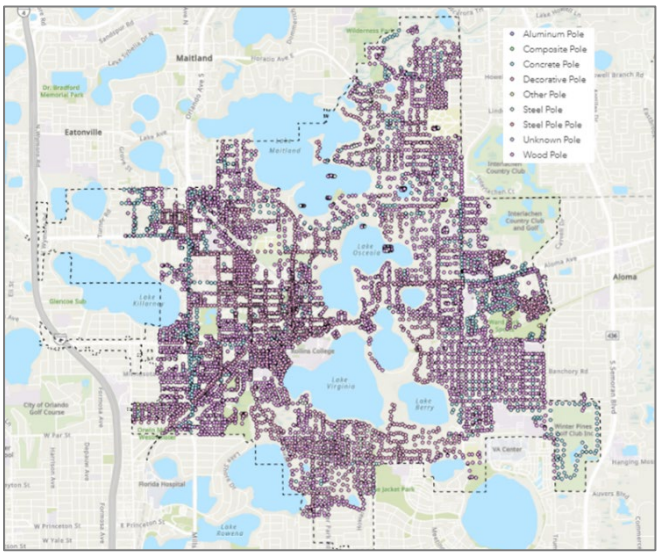
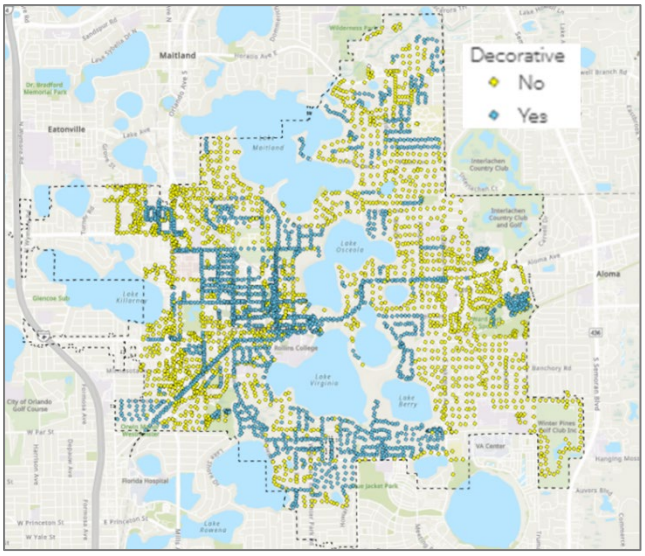


Figure 8 - Streetlights



(f) Capital Improvement Program (CIP)

Capital Improvement Projects (CIP) in cities can help advance the broadband/smart city agenda of a municipality. For example, if a road is being widened or a new sewer line is being installed, a conduit can be installed at the same time to support the deployment of fiber optics in that area. Fiber itself is relatively inexpensive, however, the cost of underground deployment (construction/restoration) is the costliest portion of these projects. The City's large electric undergrounding project is a great example of leveraging a project for communication purposes. The same applies to installing sensors, cameras, and other devices. It is often less expensive and quicker to install smart city devices during other engagements.

Magellan reviewed the City's current CIP to identify opportunities to leverage projects to facilitate smart city device deployments or connectivity infrastructure such as underground conduit. Examples of opportunities and synergies are illustrated in Table 1 below and in Appendix 5.

Table 1 - City of Winter Park Capital Improvement Program Opportunities

Department	Project	Description	5-Year Cost	Connectivity Plan Opportunities	Smart City Plan Opportunities
Public Works	Pavement resurfacing and brick road repairs	The City's pavement resurfacing program calls for the resurfacing of eight to nine miles of streets in the upcoming fiscal year. A pavement condition assessment identifies those streets in most need of resurfacing to prevent degradation of the road base	$5,560,805 $1.1 Million/yr.	Conduit	Sensors
Public Works	Sidewalk, bike path and curb repairs	Replacement of sidewalks, bike paths, and curbing where necessary for public safety	$2,750,000	Conduit opportunity, Microtrench,	Sensors
Facilities	Replacement account	This account will accumulate funds for the replacement of	$2,055,000	In-building wiring upgrades,	Sensors, Smart Buildings

		roofs, air conditioning, paint and flooring and other major capital expenditures for City's facilities		Rooftop, small cell	
IT	IT Upgrades	Upgrades to computers, networks, servers and phone systems. Also contains funding to continue the city facilities underground fiber network	$1,200,000		
Parks	Park Maintenance	This funding is set aside for needed Parks Department capital equipment and facility maintenance and repairs	$90,000	Public Wi-Fi, Conduit, In-building wiring upgrades	Sensors, Cameras, smart parking, equipment telemetry,
Parks	Restorations and Improvements	Replacement and updating of playground structures. General upgrades and refurbishments.	$250,000	Public Wi-Fi, Conduit	Security cameras Parking avail Smart Trash, smart irrigation
Parks	Ward Park Improvements	Update sports complex irrigation to wireless controls for remote access and monitoring	$190,000		Smart Irrigation
Parks	Mini Parks	General upgrades and refurbishment of mini parks throughout the city. Replacement of site amenities, furnishings, and landscape.		Public Wi-Fi, Small Cell	Security cameras Parking avail Smart Trash
Parks	Athletic Field & Tennis Court Lighting	Multi-year lighting enhancement project at the city's athletic venues. Includes replacement of worn poles and fixtures		Public Wi-Fi, Small Cell	Smart LED Lighting, sensors, cameras.
Parks	Pavilion Replacement	Provides funding to replace two pavilions.		Public Wi-Fi, Small Cell	Smart Lighting and sensors
Parks	Cemetery Improvements	Funding for this project will be used to create columbarium's at Pinneywood and to start work at Palm Cemetery. Future funding will centralize maintenance services.			Smart Irrigation, Autonomous Maintenance,
Parks	Tennis Center	Funding for ongoing resurfacing of WPTC hard courts			
Parks	Mead Garden Master Plan Renovation	This fund provides the implementation of the Master Plan Renovations to Mead Garden.		Conduit, Public Wi-Fi, Small Cell	
Planning & Transportation	Bicycle/Pedestrian Plan Improvements	Funding for this project will be used to create and promote a viable and safe pedestrian and bicycle-friendly infrastructure and promote these modes of transportation throughout the city.		Conduit	Digital signage/wayfinding
	Signalization Upgrades	This project is part of a multi-year plan to upgrade antiquated traffic signals and improve the safety of pedestrians crossing intersections			Smart Traffic System, ITS, Wayfinding

Fire	Fire Safety Equipment Replacement Fund - Station Alerting	Contributions to the funding pool for the capital replacement of crucial life-saving equipment will go towards the cost of replacing the station alerting system to improve response times			Emergency Management System, 2-Way community engagement.
General	Renovation of City Hall			In-building wiring	Smart Building
Police	Police Safety & Equipment Fund	This fund will allow the Police Department to create a funding pool for the replacement of crucial life-saving equipment. In FY21 -24, funds will be saved to replace the aging 124 Motorola Radios.		Private 5G/CBRS	

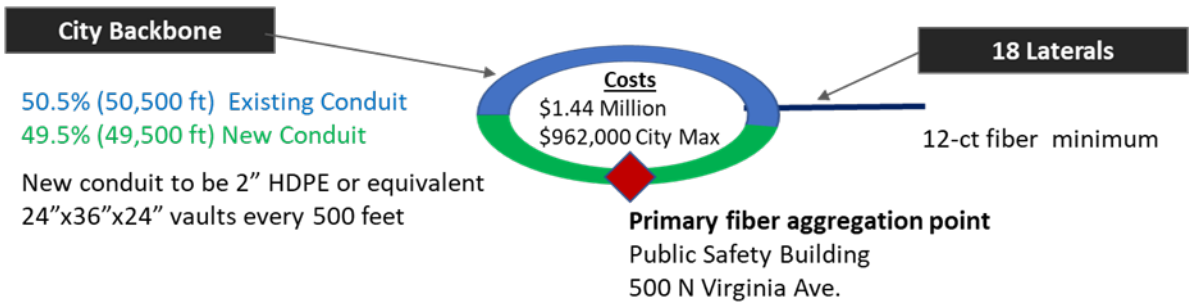
(g) Fiber in Winter Park

The City of Winter Park has many fiber-optic networks and routes within its boundaries. There are metro fiber, long-haul fiber, and City-owned networks located within the city.

CONNECTED CITY FACILITIES

In 2022, the City entered into a Private Fiber Network Construction and Maintenance Agreement with Frog[1] to construct a fiber backbone in the city (see figure below for the Agreement's illustration). This nearly finished project will connect 18 City buildings and other assets over an expanded City-owned fiber network.

Figure 9 - Private Fiber Network Construction and Maintenance Agreement Summary



The table in the figure below shows the current connectivity statuses for the buildings identified.

1 Frog is a fiber-based internet service provider based in Orlando, FL and Fort Worth, TX. They service business and residents in select areas. They work in close partnership with the city to deliver some of the City's services such as its free public W-Fi.

Figure 10 - Connected City Facilities (existing and planned)

Existing	Building Farmers Market Farmers Market	200 W NEW ENGLAND AVENUE
Existing	Building Public Safety Building WP Police Communications	500 N VIRGINIA AVENUE
Existing	Building Community Center	721 W NEW ENGLAND AVENUE 721 W NEW ENGLAND AVENUE 721 W NEW ENGLAND AVENUE
Existing	Building Winter Park Civic Center	1050 W MORSE BOULEVARD
Planned	Building Wymore Water Facility	926 WYMORE ROAD
Planned	Building Azalea Lane Recreation Center	1045 AZALEA LANE
Existing	Building City Hall	401 S PARK AVENUE
Planned	Building Fire Station 62	300 SOUTH LAKEMONT AVENUE
Existing	Building Fire Station 64	1439 HOWELL BRANCH ROAD
Planned	Building WP Estates Wastewater Plant	2655 BONGARD ROAD
Planned	Building Interlachen Electric Substation	2533 BALFOUR COURT
Planned	Building Aloma Water Plant	3400 ALOMA AVENUE
Existing	Building Public Works Compound Test	1409 HOWELL BRANCH ROAD
Planned	Building Magnolia Water Plant	1960 MAGNOLIA AVENUE
Existing	Building WP Police Communications WP Police Communications	500 N VIRGINIA AVENUE
Planned	Building Lake Island Recreation Center	450 HARPER STREET
Planned	Building Canton Electric Substation	298 NORTH ORLANDO AVENUE
Existing	Building Farmers Market Farmers Market	200 W NEW ENGLAND AVENUE

Per the agreement, the City paid $962,000 as a direct capital contribution to the project, and will also provide Right-of-Way (ROW) access, space & power in the City's Public Safety building, and rack space in all lateral locations. In return, the City owns all the conduit, and 48 fiber-optic strands throughout the backbone. The City has the right of first refusal to purchase the network from Frog should they want to sell it.

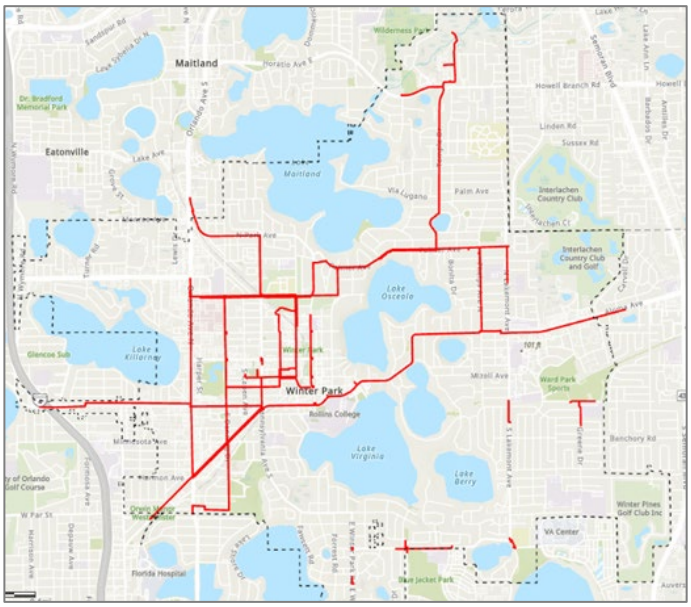
Frog will cover the construction cost above the City's $962K contribution. They have the right to place up to a 1" diameter fiber cable in all conduits and will own all fiber beyond the City's 48 strands. They also have the right to offer active communication services and dark fiber services to local businesses and other communication service providers.

On-going maintenance and repairs on the conduit will be shared 50-50%, and the fiber maintenance costs will be shared pro-rated based on the percentage ownership of the fiber strands in the conduit. For example, if there are 144 fiber stands in the conduit (48 City and 96 Frog) and they all get damaged, the costs to repair will be split 33% City/67% Frog.

(h) City Owned Conduit

The City has a conduit (see figure below) connecting the existing street signal cabinets. In some cases, this conduit can be repurposed for additional communication applications.

Figure 11 - Existing Street Signal Conduit

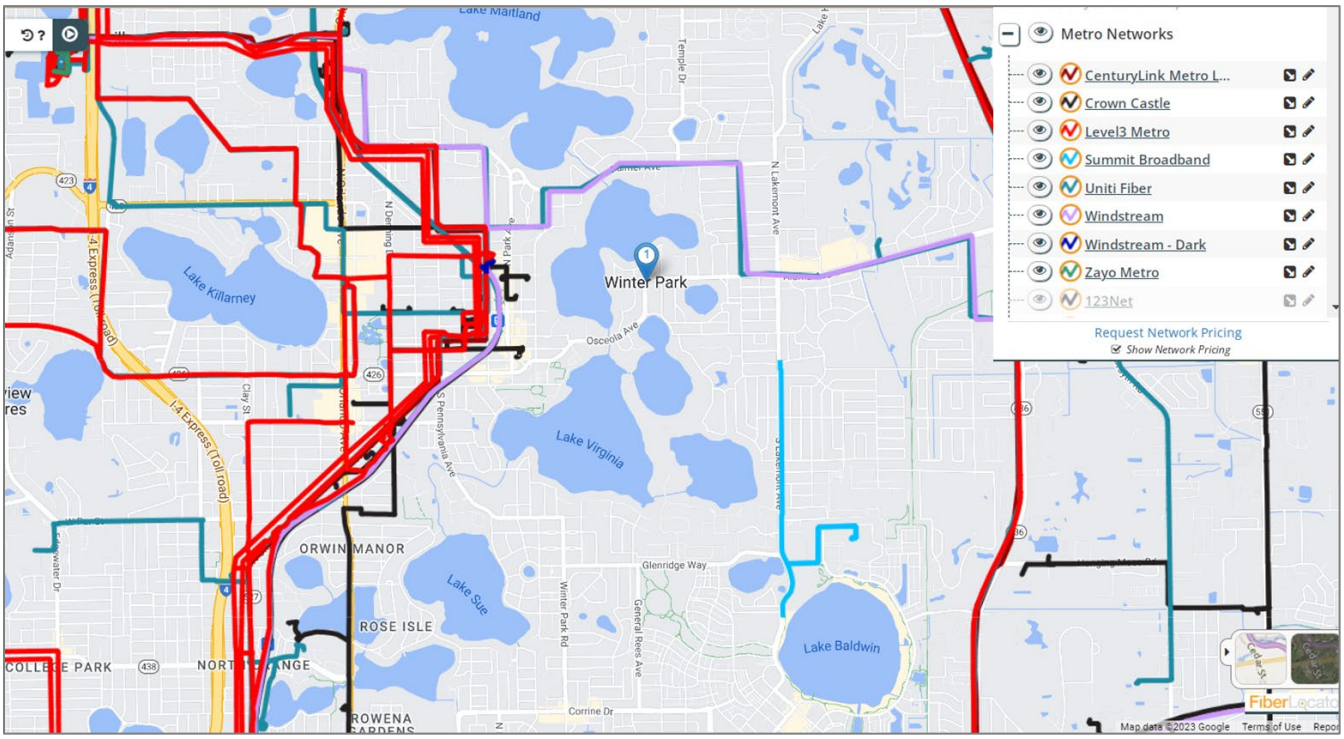


The City is also accumulating conduit from the Electric Undergrounding Project. This is detailed in the City's Connectivity Plan developed by Magellan.

(i) Metro Fiber

In Winter Park several companies own fiber that traverses the city streets and train tracks. Smart city applications can leverage existing metro fiber networks to augment City fiber to connect remote locations and devices. Applications with the need for high bandwidth, such as high-resolution traffic and public safety cameras, can be served on metro fiber networks provided by the area's providers. Services are priced on an individual case basis, based on the service level, number of sites, distance, and bandwidth required. Some carriers will lease dark fiber strands, but these are generally lit, or active services. Many companies prefer to sell connectivity as part of a suite of managed services.

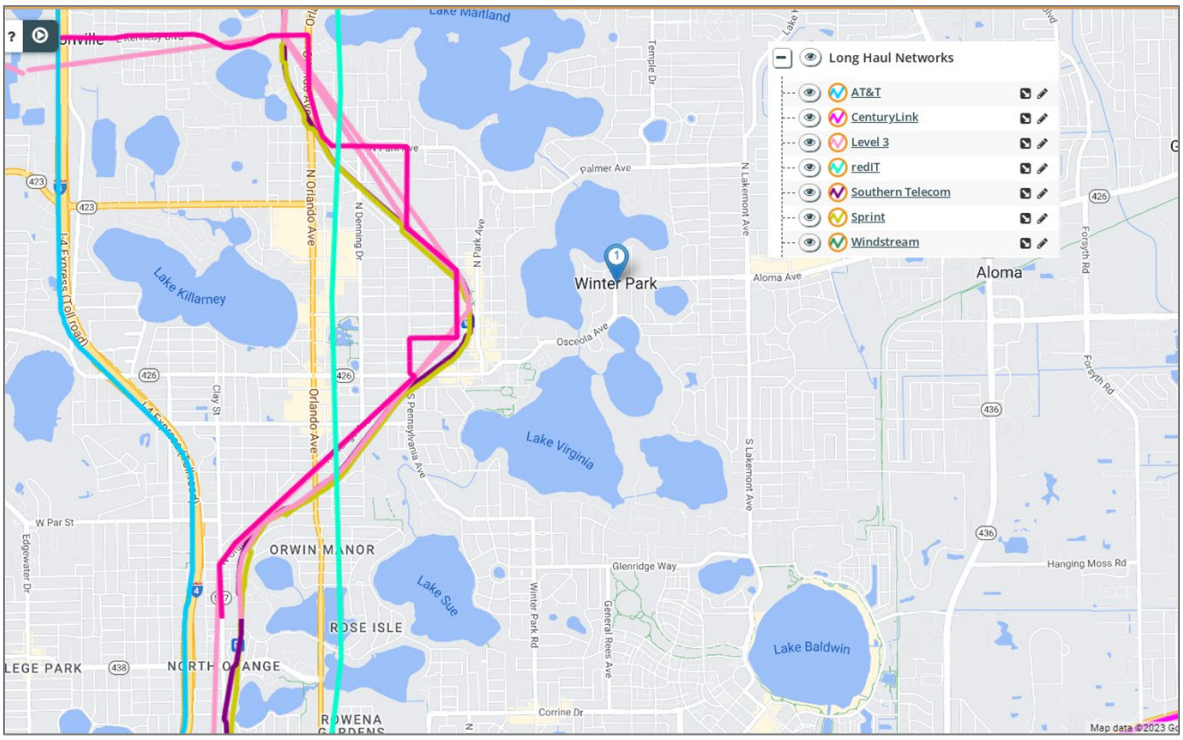
Figure 12 - City of Winter Park's Metro Fiber Routes by Provider



(j) Long-Haul Fiber

Long-haul, or middle-mile, networks typically extend access to interconnection points in major cities and are of limited use for local smart city applications. However, more cities are moving their managed services and IT workloads to public cloud infrastructure, such as Amazon AWS and Microsoft Azure. Certain IT and smart city applications will require high-speed access to remote cloud data centers, and many require low-latency connections to the cloud to function effectively. Many of these public clouds reside in the same interconnect facilities in major U.S. cities, including Miami and Atlanta. Note that many long-haul routes also follow the railroad tracks located in the city.

Figure 13 - City of Winter Park's Long-Haul Fiber Routes by Provider

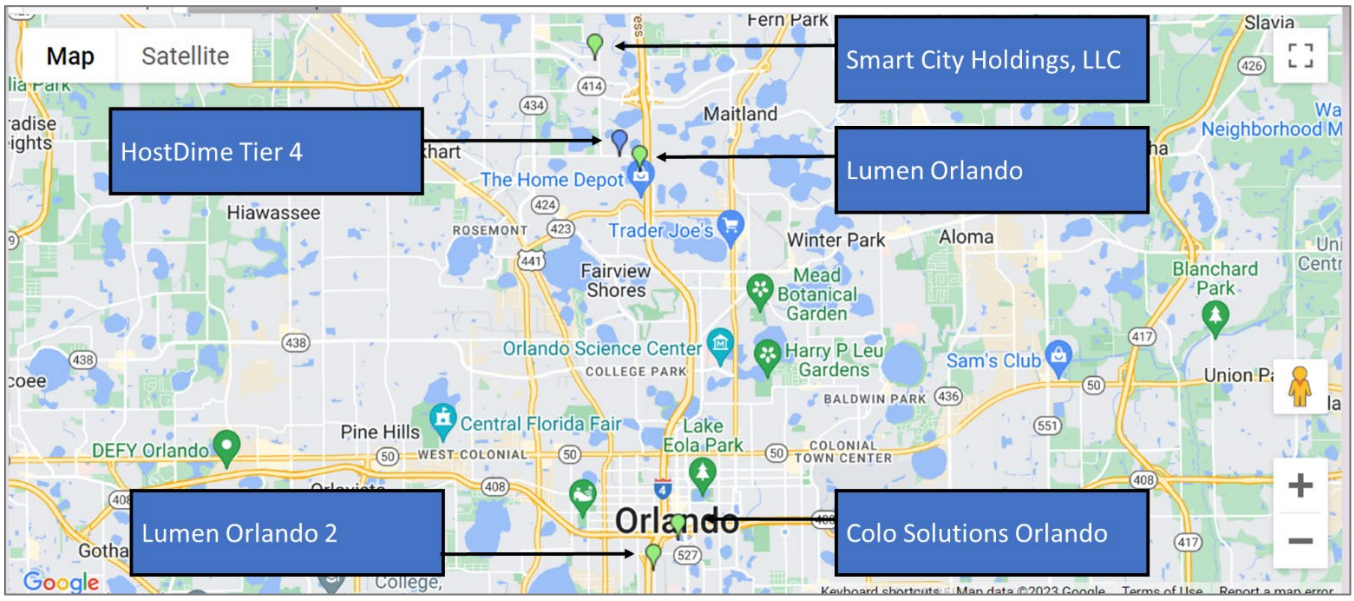


(k) Data Centers

City enterprise software applications and smart city applications of all types ultimately reside on a server. That server can be in an on-site city data center, in a co-location data center, or "in the cloud" in a distant data center, or more likely in all three. A major trend in IT data and software applications is the migration to the cloud in the form as Software-as-a-Service (SaaS). As mission-critical and high-performance applications migrate to the cloud, bandwidth and latency become critical. This trend has driven the move toward the "Edge" and "Edge Computing" where critical applications are hosted in close-by data center and not in distance hyperscale "cloud" data centers. This reduces latency and improves application performance. Thus, data centers and peering points are increasingly being established further from the major internet centers to enable better cloud services in areas further from major U.S. cities.

Miami and Atlanta are Tier 1 Internet Exchange locations and there is significant fiber connecting the Winter Park area to both. The greater Orlando area has a growing number of data centers and inter-exchange locations. HostDime recently opened a large Tier 4 data center and Meet-me Room on W. Kennedy Boulevard in Orlando.

Figure 14 - Data Center Sites[2]



(l) FCC New Broadband Mapping Data[12]

A primary public data source is the new FCC Broadband Map. Their previous 477 data maps were problematic and overstated. If one location in a census block had service, the whole census block showed as covered. The FCC initiated a program to replace this mapping with a location-based system that showed all locations and the type of broadband available at that location. The map's fixed broadband (fiber, cable, copper, satellite, or fixed wireless) and mobile broadband (3G, 4G, and 5G) availability data reflects services available as of June 30, 2022, as submitted by broadband service providers. The map's individual location points (e.g., home, apartment building, or small business) come from a common dataset – the Broadband Serviceable Location Fabric - of all U.S. locations where mass-market fixed broadband internet access service is located or can be installed. The map is part of an ongoing, iterative process that permits providers, third parties, and consumers, to "challenge" the data.

While a step forward, the broadband data is still self-reported by the providers. The speeds shown as available are what might be capable at that location and no actual speed tests are conducted for each location. The consumer at each location has the right to "challenge" a provider's assessment of that location. The challenges are reviewed by the FCC. Consumers can challenge:

- **Fixed Availability** – State, local and Tribal governments, service providers, and other stakeholders can submit "bulk" challenges to the fixed broadband availability data. Individuals can submit fixed availability challenges using the map interface.
- **Locations** – The public can submit challenges to the information associated with mass-market fixed broadband internet access service locations on the map, such as updating an address, changing the building on the property that is the serviceable location, or requesting to add a missing location.

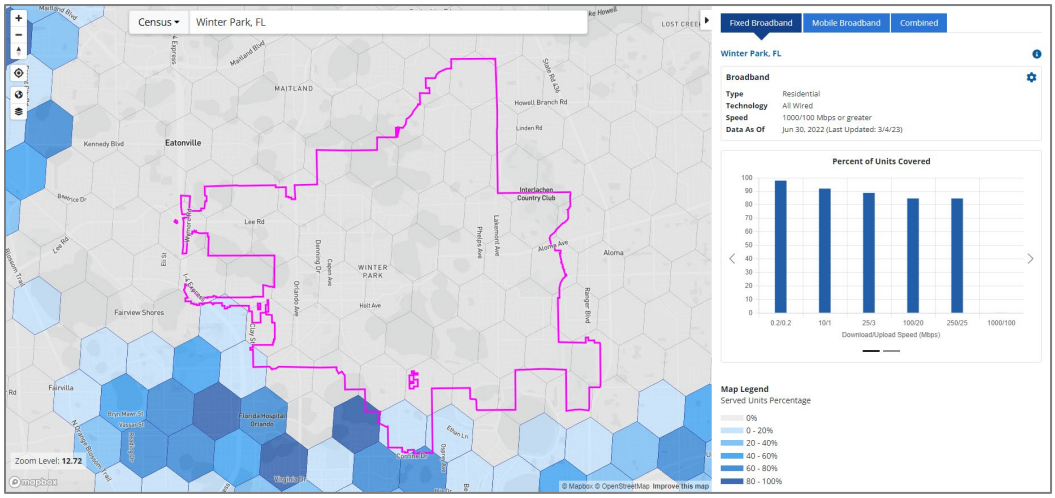
[2] Source: www.datacentermap.com

- **Mobile Coverage** – Governments, broadband service providers, and other third parties can submit bulk mobile availability challenge data collected using their own hardware and software, so long as the data meets the FCC's requirements. Consumers can also submit speed test data collected using the FCC Speed Test App to support mobile challenges.

Residential Wired

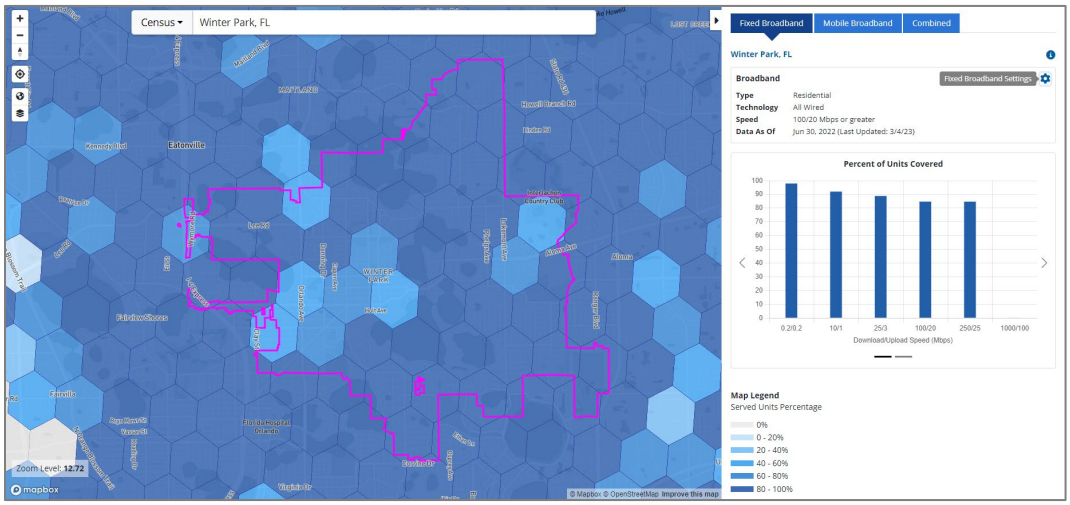
Below are maps specific to the Winter Park market. On the first map shown in the figure below, the map was set to display areas that had 1000 Mbps download and 100 Mbps upload speeds network capability. The grey indicates 0 providers with that capability, indicating that no providers said they could serve 1000/100 in the Winter Park City Limits. Spectrum's offering is a gigabit download, however their upload speed is limited to approximately 35 Mbps due to architectural limitations.

*Figure 15 - FCC's Number of Fixed Residential Broadband Providers Offering **1000/100***



The figure below shows the areas of Winter Park that meet the minimum definition from the FCC of 100 Mbps download and 20 Mbps upload speeds. This is predominantly Spectrum, as Lumen's CenturyLink DSL does not meet the latest FCC minimum data rates.

*Figure 16 - FCC's Number of Fixed Residential Broadband Providers Offering **100/20***



Business Wired

The next two figures illustrate the FCC coverage maps for business internet. The first figure shows that businesses in Winter Park also lack service offerings that provide 1000/100 Mbps download and upload speeds. The grey indicates almost 0% or none of the businesses are able to receive that service. The second figure show that a lower data rate of 100/20 Mbps download, and upload speeds are available to only 25% of the businesses in Winter Park.

*Figure 17 - FCC's Number of Fixed Business Broadband Providers Offering **1000/100***

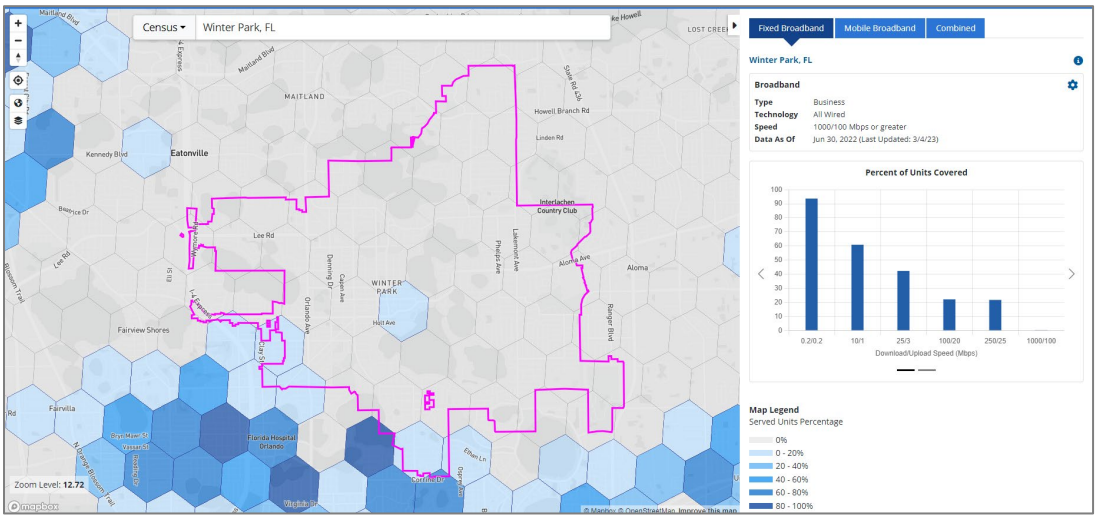
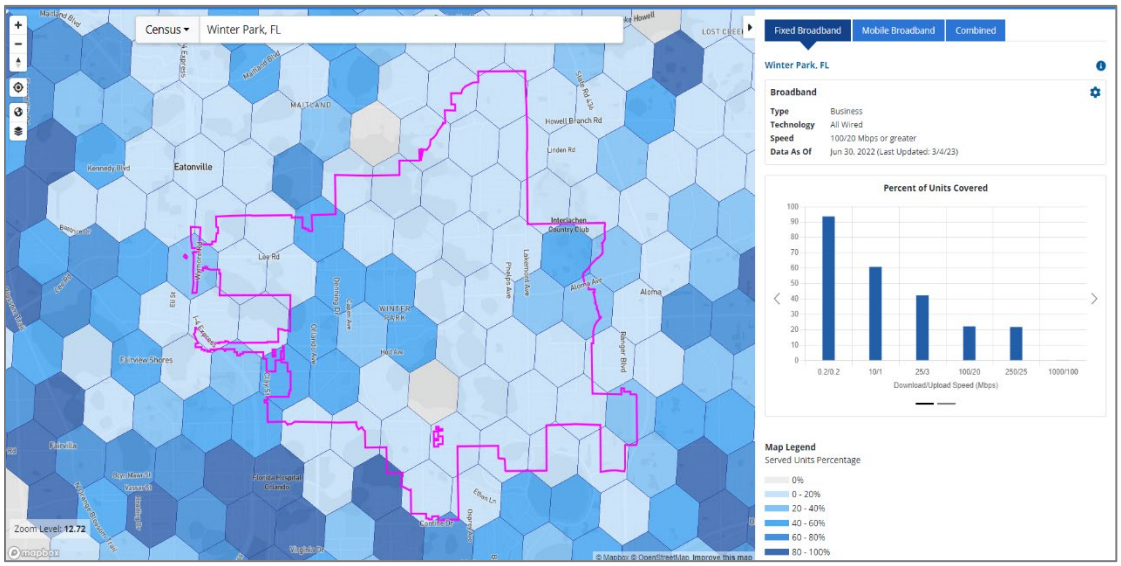


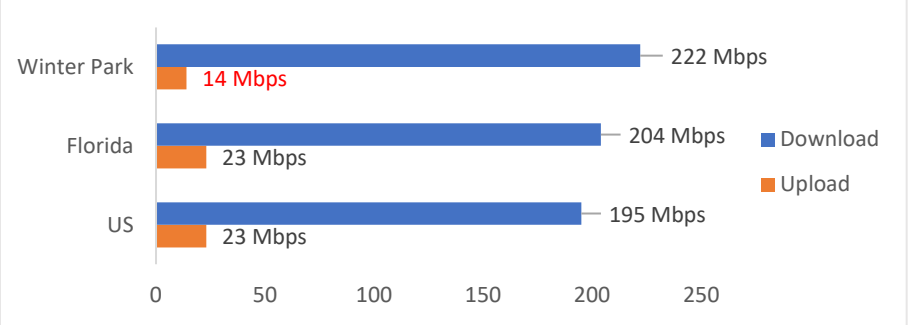
*Figure 18 - FCC's Number of Fixed Business Broadband Providers Offering **100/20***



(m) Ookla Speed Test Data - U.S. Baseline Coverage[3]

OOKLA, a global leader in Internet testing, data, and analysis, reports fixed, and mobile Internet speeds based on user speed tests performed using the Speedtest.net website. As reported by OOKLA, as of January 2023, the nationwide USA median fixed Internet download speed is 195.31 Mbps, and the median upload speed is 22.78 Mbps. At a global level, the U.S. ranked 8th in the world for median fixed Internet speed. Florida ranked 6th in the USA, with a median download speed of 204.26 Mbps and upload speed of 22.58 Mbps. The City of Winter Park's median download speed is 222.13 Mbps and upload speed is 13.8 Mbps. The figure below shows where the City's speeds stand in relation to the rest of the country and of the state of Florida. Although the city's download speed is ahead of the country and its state, the upload speed is still way below those two and the FCC's proposed minimum upload speed of 20 Mbps to catch up with technological advances that are increasing bandwidth demands.

Figure 19 - Speeds Comparison for Fixed Networks

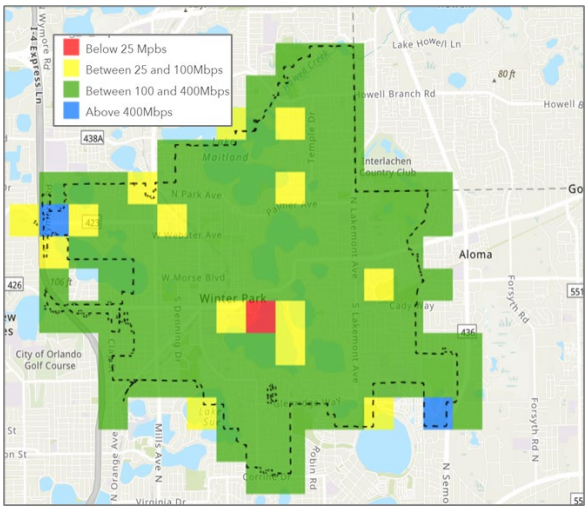


For mobile or cellular connections, the country's median download speed is 79.72 Mbps, and the median upload speed is 9.29 Mbps. At a global level, the U.S. ranked 18th in the world for median mobile Internet speed. The top three providers for mobile Internet in the Country are T-Mobile, Verizon Wireless and AT&T. Florida ranked 25th in the USA, with a median download speed of 68.24 Mbps and upload speed of 7.97 Mbps, having T-Mobile as the fastest provider. Winter Park has median speeds of 199 Mbps download and 17.13 Mbps upload which are well ahead of the country and the state in terms of their median speeds.

The following figure shows the mapped OOKLA data, collected from speedtest.net for the City of Winter Park. It confirms that there are very few areas that can provide above 400 Mbps download speeds. The only areas that have above 400 Mbps are in the western and southeast portion of the city.

3 https://www.speedtest.net/global-index/united-states#fixed

Figure 20 - Ookla Fixed Wireless Speed Test Map



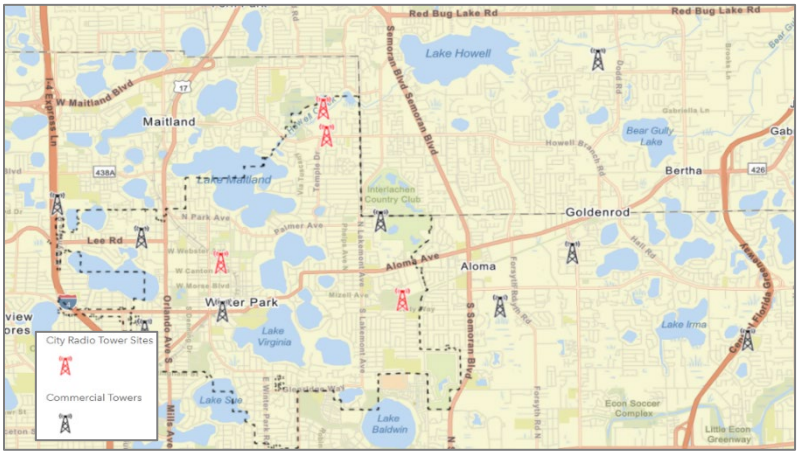
(n) Wireless Network Infrastructure

According to the FCC, the city has full mobile coverage by the big national Mobile Network Operators (MNOs). The City has been working with AT&T and Verizon to accelerate the deployment of 5G infrastructure. Deployment plans will include at least 66 small cells at this time. Most will be deployed in decorative streetlights and will be served by underground fiber.

TOWERS

Magellan was able to identify publicly and privately owned towers throughout the city. The tower data was collected from numerous sources including FCC databases, city data, and other public and commercial data sources. The FCC database usually includes towers that are over 200 feet whereas other sources include stand-alone antennas on rooftops, water towers, etc. The tower ownership database is not always updated in a timely manner. The figure below shows the city's tower locations provided by the City itself and commercial tower locations from the FCC Antenna Structure Registration (ASR) database.

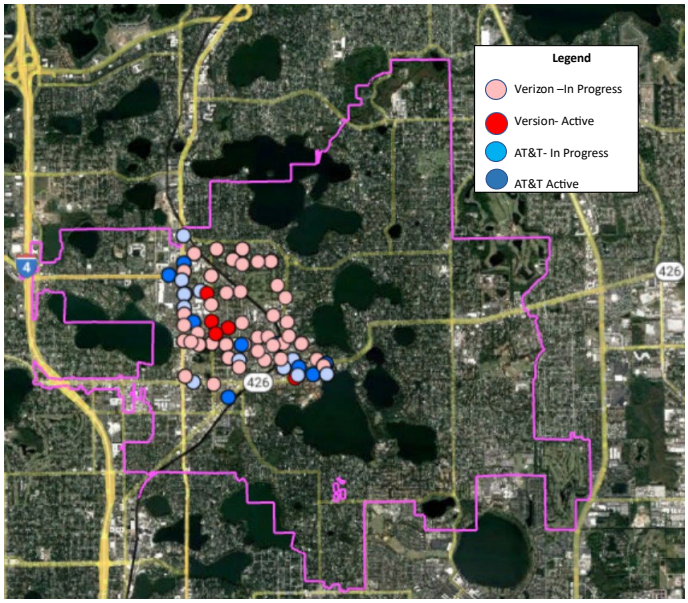
Figure 21 - City and Commercial Towers



The table in Appendix 3 provides details on each commercial tower's owners and locations that are listed as the City of Winter Park. Height, street address, and Lat/Long coordinates are included on this list.

The map below shows the current small-cell deployments in the city. These are mounted on city lighting fixtures. They can be very high-speed but are relatively short-range. Concurrently the City has been working with Verizon and AT&T to bring 5G services to the city. Current plans are already in permitting or planning stages call for 66 microsite nodes to be deployed throughout the city's downtown core. AT&T's nodes are currently being installed in 20 locations. These nodes are fed with underground power and fiber backhaul.

Figure 22 - AT&T and Verizon Small Cells



The City owns 4 macro sites (large cell towers). Currently, two are managed by Crown Castle, and two are managed by the City directly. They represent a potentially underutilized asset and have recently been used to expand connectivity to the city's traffic signals and to provide backup wireless links for some City facilities.

As the importance of these microsites grows due to 5G backhaul being terminated back at tower sites, the City may have functional and financial opportunities available for its use as it pertains to leveraging assets and expanding smart city options in the future.

CELLULAR COVERAGE

To verify the providers' coverage data, Magellan used multiple cellular data sources from the FCC and OOKLA[4], to assess the coverage and speed of the 3 largest mobile networks in the City of Winter Park. As illustrated in the FCC's National Broadband Coverage Maps below, the entire city has "blanket coverage" by the three mobile network operators, AT&T, T-Mobile and Verizon. The figure in the OOKLA section below

[4] Ookla 5G Map - Tracking 5G Network Rollouts Around the World (speedtest.net)

shows the actual tested speed from city speed test takers. Actual data rates are dependent on many parameters such as distance from the tower, foliage density, and number of active users in the sector.

FCC's Broadband Cellular Coverage Map

The maps below illustrate the coverage predicted by the cellular carriers for the FCC broadband data map. These maps are based on Radio Frequency (RF) propagation studies and are not actual measurements. The maps show 100% coverage in Winter Park for a person outside with a cell phone at 35 Mbps DL/ 3Mbps UL speed. If the person is in a vehicle moving, the coverage is predicted to be 98% of the city limits.

Figure 23 - AT&T's FCC Wireless Coverage Map

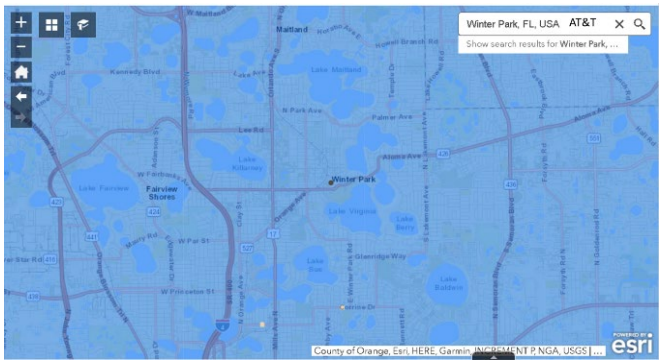


Figure 24 - T-Mobile's FCC Wireless Coverage Map

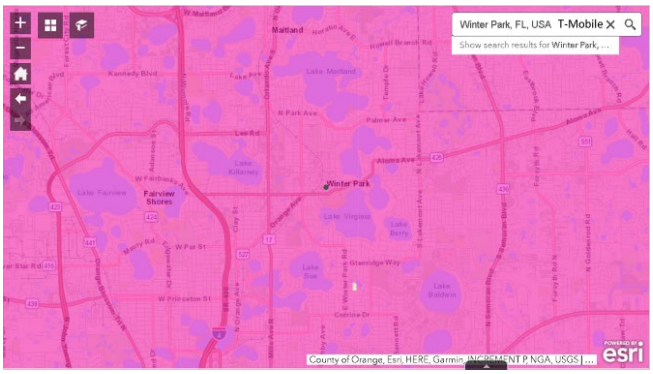
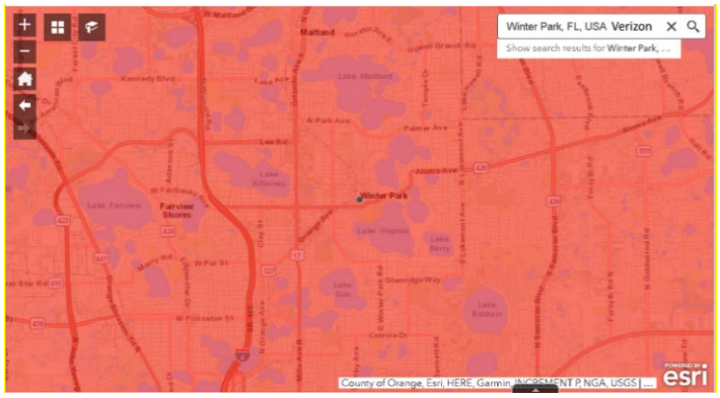


Figure 25 - Verizon's FCC Wireless Coverage Map



The following paragraph is from the FCC Broadband website regarding the cellular coverage maps.

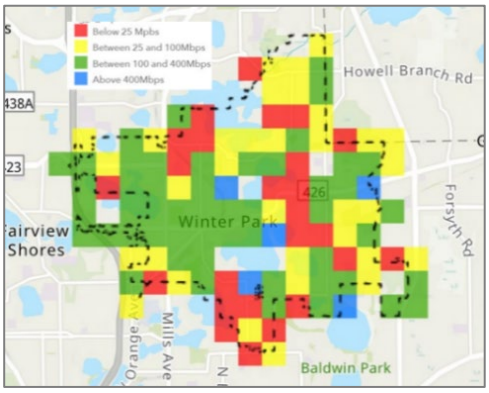
> *"Mobile providers generate the 3G, 4G LTE, and 5G-NR coverage areas shown on the map using propagation modeling, where the models include certain common settings for consistency. The coverage areas are meant to represent the areas where a user should be able to establish a mobile connection, either outdoors or moving in a vehicle, and achieve certain upload and download speeds. Please note that the map does not include information on the availability of mobile wireless broadband service while indoors. Moreover, because the coverage map is based on propagation modeling, a user's actual, on-the-ground experience may vary due to factors such as the end-user device used to connect to the network, cell site capacity, and terrain. The coverage*

maps on mobile wireless service providers' websites may be based on different parameters and assumptions, such as service availability provided through roaming agreements, and therefore may differ from the information shown here."

OOKLA's Actual Cellular Speeds Map

OOKLA's crowd-sourced data (shown in the figure below) shows actual throughput tests run by users. Download speeds of up to 400 Mbps (blue blocks) are recorded minimally in some areas. The tests also show many areas with under 25 Mbps (red blocks) download speeds within the city. OOKLA records these tests every time someone runs a speed test at Speedtest.net.

Figure 26 - OOKLA's Mobile Speed Test Map by Download Speeds in Mbps



FUTURE AMI (ADVANCED METERING INFRASTRUCTURE) AND INTERNET OF THINGS NETWORK (IOT)

Using three of the city's four towers, Magellan created two high-level wireless designs. One was for a private cellular (LTE) network, while the other was a design for a 900 MHz LoRawan network. The Private LTE network, called Citizens Band Radio Service (CBRS), could be used with existing cell phones and routers such as the Cradlepoint or Sierra Wireless in both fixed and mobile configurations. There is fixed wireless MiFi and CPE equipment available for CBRS technology. The 900 MHz propagation study illustrates what coverage might be available using 3 base stations. This network could be used for meter readings, sensors including parking and environmental sensors, as well as many other devices. These were high-level studies. No tower inspections or field visits were completed

Figure 27 - LoRaWan Propagation

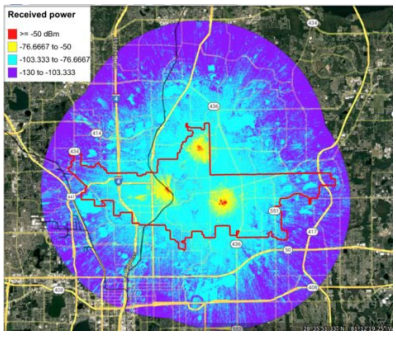
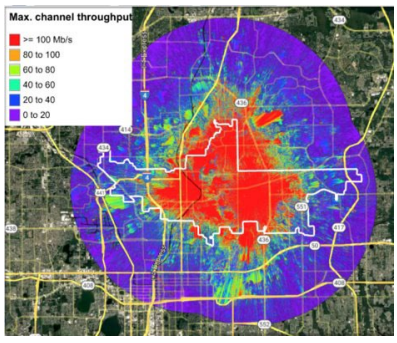


Figure 28 - CBRS Propagation



(o) City Owned Wireless Networks

Private wireless networks along with a fiber backbone can provide many benefits to the City and advance the goal of being a smart city. A private wireless network can be based on 4G/5G/CBRS (Citizens Band Radio Network), LoRaWan (Low Power Wide Area Network), unlicensed spectrum, or Wi-Fi, and often a combination of more than one.

Today, the city has limited private wireless networks. The City has a partnership with Frog to operate public Wi-Fi networks in city parks and other public spaces. To date, these wireless networks are operational in Central Park and Shady Park. There are plans to expand these to all parks using funding earmarked by the City Commission. Public Wi-Fi, particularly at parks, was frequently cited in Magellan's stakeholder outreach as a critical use case for smart cities, and Winter Park's future.

An Advanced Meter Infrastructure (AMI) radio network is used by the city's utilities to read water and electric meters. This is a standard wireless technology to read thousands of meters remotely. The City also has a Motorola radio network for push to talk public safety and City employee use and a point-to-multipoint wireless link connecting the Azalea Lane Rec Center,

Market Analysis

MARKET ANALYSIS OVERVIEW

Magellan analyzed the broadband landscape of the City of Winter Park to determine the options available to residents and small and large (enterprise) businesses. The analysis focused on internet speeds and pricing from commercial ISPs. Emphasis was on "facilities-based" carriers, or those that own their physical infrastructure including miles of fiber, copper and coaxial cables as well as those that own satellites, and wireless radios. This section describes the findings of this research and makes observations regarding the services currently offered in the service area. Magellan's team also considers the state of competition and the effects on costs, speeds, and quality of service. The conclusion of these findings supports enabling increased competition, which would exert downward pressure on the price of service offerings and increase the deployment of next-generation fiber infrastructure into the community. This competition will allow more affordable, reliable high-speed broadband options for the area's residents, businesses, and anchor institutions.

MARKET ANALYSIS KEY FINDINGS

- Winter Park essentially has a gigabit broadband monopoly with Spectrum covering most of the city with their hybrid fiber-coax infrastructure.
- Lumen, the incumbent telephone company, currently offers non-competitive legacy copper-based DSL services using the CenturyLink name.
- Wireless coverage and capacity are improving as T-Mobile, Verizon, and AT&T are upgrading to 5G via new small cells and fiber and radio upgrades.
    - T-Mobile and Verizon offer fixed wireless broadband services over their 5G network.
- Competition is expected to come to Winter Park:
    - Lumen, through their local contractor, BlueWater Telecom, has filed initial permits to pass 900 locations with fiber-to-the-premises. Upwards of 9,000 additional locations are in the planning phase.
    - T-Mobile and Verizon are now offering Fixed Wireless Access (FWA) broadband services leveraging their mobile infrastructure.
    - Spectrum will upgrade its electronics to support 5-10 Gbps symmetrical (equal download and upload speeds) rates starting in late 2025.
- Frog is nearing its completion of the City's fiber backbone, connecting 18 City sites. Expected completion is within the August 2023 timeframe.

RESEARCH METHODOLOGY

This analysis is based on different data sources gathered from the following:

- **FCC's Fixed Broadband Deployment Map**[5]
- **FCC Mobile LTE Coverage Map**

[5] https://go.usa.gov/xuHQ2

- **Ookla's® Speed Test Data**[6]
- **Market Research** – BroadbandNow.com[7], Datacentermap.com, Antennasearch.com, ISP websites, ISP SEC Filings, and quarterly presentations
- **Stakeholder Outreach** – Magellan-Organized interviews with the ISPs

BROADBAND ENVIRONMENT IN THE CITY OF WINTER PARK

As part of this project, Magellan performed an analysis to determine the options available to residents and businesses across the city. This analysis included identifying what service offerings providers are advertising in the area and what their current offers are.

(a) Provider Coverage Availability Summary

An assessment of private-sector telecommunications infrastructure in Winter Park's area provides context for a more targeted and up-to-date assessment. It also informs the City's strategies given the services that are available to the market. These service offerings were then verified by Magellan by comparing multiple data sources such as what the providers report through BroadbandNow and ISP websites. The percentage coverage in the table below is based on BroadbandNow's comprehensive coverage data and verifying it through a random sample set of 17 addresses across different areas of the city. These addresses are also mapped below.

Companies that nominally sell network services in Winter Park are listed in the table below

Table 2 - Major Internet Service Providers in Winter Park

Residential[8]			Business[9]		
Provider	**% City Availability**	**Type of Connection**	**Provider**	**% City Availability**	**Type of Connection**
Spectrum	97.8%	HFC Cable	Spectrum	69.3%	HFC Cable
CenturyLink- Lumen	96.9%	DSL	CentrutyLink Business - Lumen	100%	DSL
T-Mobile Home Internet	97.8%	Fixed Wireless	T-Mobile Home Internet	100%	Fixed Wireless
Verizon	75%	Fixed Wireless	Verizon	30.5%	Fixed Wireless
Summit Broadband	1.4%	Cable	Comcast Business	8%	Cable
Frog	N/A[10]	Fiber	Frog	N/A	Fiber

[6] https://www.speedtest.net/global-index/united-states
[7] BroadbandNow has a comprehensive database of internet service provider information including their coverage, background and up to date service offerings per zip code based on FCC's 477 and Census Bureau data - https://broadbandnow.com/
[8] Top 6 Internet Providers in Winter Park, FL (broadbandnow.com)
[9] Business Internet Service in Winter Park, Florida | Broadbandnow.com
[10] Frog does not have a publicly available information on their coverage thus labeled "N/A".

As part of the research's validation process, the "actual" services available to the 18 randomly selected addresses from different parts of the city, were determined using the ISPs' "check availability" option on their respective websites.

Two facilities-based last-mile providers, Charter/Spectrum, the legacy cable company, and CenturyLink, the legacy telephone company had services available at each location. Spectrum has a 1 Gbps service to all locations and CenturyLink has copper-based DSL services with data rates between 0.50 Mbps and 50 Mbps to all locations.

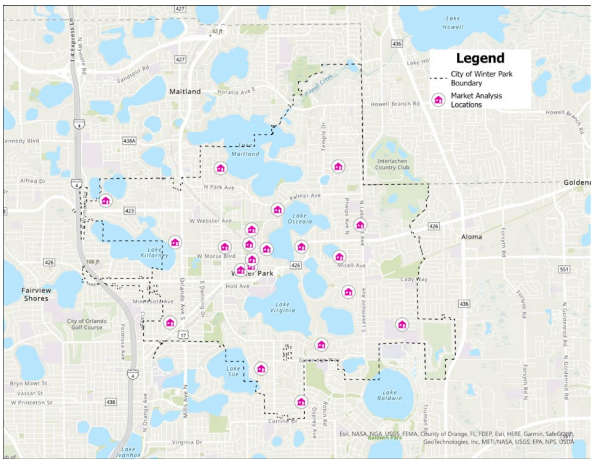
T-Mobile's Fixed Wireless Access (FWA) service was available everywhere and Verizon's higher data service was limited to approximately 25% of the city. T-Mobile's FWA is delivered using infrastructure on towers and Verizon's is more reliant on small-cell deployments.

Table 3 - Provider Service Availability Determination by Sampled City Addresses[11]

Address	Spectrum	CenturyLink (DSL)	T-Mobile Home Internet	Verizon Fixed Wireless	Frog (refused to respond)
140 Chelton Cir, Winter Park, Fl 32789	X	X	X		
2343 Sherbrooke Rd, Winter Park, Fl 32792	X	X	X		
1531 Chestnut Ave, Winter Park, Fl 32789	X	X	X		
1001 Early Ave, Winter Park, Fl 32789	X	X	X		
217 W Lyman Ave, Winter Park, Fl 32789	X	X	X	X	
1576 Harris Cir, Winter Park, Fl 32789	X	X	X		
526 Garfield Ave, Winter Park, Fl 32789	X	X	X	X	
1340 Harmon Ave, Winter Park, Fl 32789	X	X	X	X	
1503 Summerland Ave, Winter Park, Fl 32789	X	X	X		
1760 Lookout Landing Cir, Winter Park, Fl 32789	X	X	X		
1870 Walker Ave, Winter Park, Fl 32789	X	X	X		
2131 Sycamore Dr, Winter Park, Fl 32789	X	X	X		
501 S Phelps Ave, Winter Park, Fl 32789	X	X	X		
909 Seminole Dr, Winter Park, Fl 32789	X	X	X		
261 Detmar Dr, Winter Park, Fl 32789	X	X	X		
410 Killarney Bay Ct, Winter Park, Fl 32789	X	X	X		
208 N Interlachen Ave Winter Park, Fl 32789	X	X	X		
300 South Park Ave Winter Park, Fl 32789	X	X	X	X	
142 South Park Ave Winter Park, Fl 32789	X	X	X	X	
303 North Park Ave Winter Park, Fl 32789	X	X	X	X	
640 North Park Ave Winter Park, Fl 32789	X	X	X	X	

[11] Frog was not added to this table as there is currently no way to validate their availability in the market

Figure 29 - Mapped Addresses Tested for Provider Availability



Below is an overview of the city's ISP residential internet service offerings.

Table 4 - ISP Internet Only Services Price Per Speed

Speeds	Spectrum	CenturyLink (DSL)	Frog[12]	T-Mobile Home Internet	Verizon Fixed Wireless
3 Mbps	-	$65	-	-	-
25 Mbps	-	-	-	-	-
50 Mbps	-	-	-	-	$25
182 Mbps	-	-	-	$50	-
250 Mbps	-	-	$49	-	-
300 Mbps	$50	-	$65	-	$60
500 Mbps	$70	-	$105	-	-
1,000 Mbps	$90	-	$150	-	-
2,000 Mbps			$299		
10,000 Mbps	-	-	-	-	-

[12] Frog has not confirmed that it is currently offering its residential offerings within Winter Park, but prices are available on their website – www.FrogNow.com

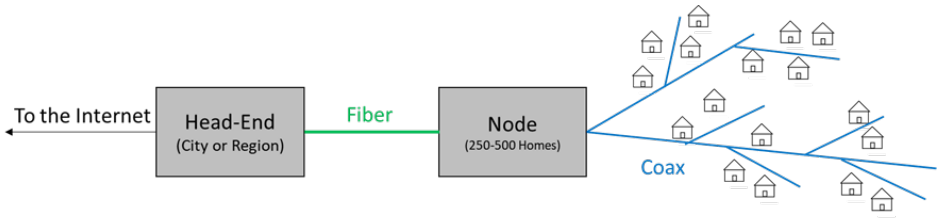
FIXED BROADBAND PROVIDERS

(a) Spectrum

Spectrum is the second largest ISP in the U.S. just slightly smaller than Comcast. Spectrum's 2022 revenues were $54 billion, and they ended the year with 32 million customer relationships. This includes 30 million residential subscribers and 2.2 million small and medium businesses. They also have a total of 5.3 million Mobile 5G customers.

Spectrum's legacy cable TV assets are based on the Hybrid-Fiber-Coax (HFC) architecture. The head-end and hubs connect to nodes with fiber optics. The node translates the download optical signals into radio frequency (RF) signals which are retransmitted on the coax cable. The reverse is true on the upload. The residential cable modem sends RF signals which are translated into optical signals at the node.

Figure 30 - Spectrum HFC Network & Coverage



Hybrid-Fiber-Coax Architecture

Spectrum's offerings in Winter Park are based on the DOCSIS 3.1 standard from CableLabs, the research and development organization of the cable industry. DOCSIS (Data Over Cable Service Interface Specification) specifies how data is transmitted over the HFC network. With DOCSIS 3.1 download data rates of over 1 Gbps can be achieved. Though, due to historic spectrum allocation in the coax, the upload data rate is limited to approximately 35 Mbps. As shown in the figure above, the HFC network is a shared network so the actual real-time performance will vary based on the number of actual users at any given time. Consumer rates are 'best effort', and therefore ISPs add the phrase "up to" when specifying data rates. Their current offerings in the city are summarized below.

Table 5 - Spectrum's Published Residential Internet Service Offerings in Winter Park

Package	*Type of Connection*	*Download Speed*	*MRC*	*MRC per Mbps*	*Notes*
Spectrum Internet	Cable	300 Mbps	$50	$0.16	Price for 1 year, no data caps, nationwide Wi-Fi
Internet Ultra	Cable	500 Mbps	$70	$0.14	Price for 1 year, no data caps, nationwide Wi-Fi
Internet Gig	Cable	1 Gbps	$90	$0.09	Price for 1 year, no data caps, nationwide Wi-Fi

Cable TV was created to broadcast TV channels from a central location to many end users. The traffic was highly asymmetric with little traffic being sent “upstream”. Thus, while the coax may support 750 MHz or 1.2 GHz of RF spectrum, only the band from 5-32 MHz is allocated for upload traffic. This band is also highly susceptible to ingress interference which further limits the usable bandwidth.

Spectrum, Comcast, and the entire cable industry realize the limited upload has become a competitive disadvantage against fiber-based competition which offer symmetrical rates up to multiple gigabits per second. To address this, CableLabs is creating DOCSIS 4.0, which will support up to 10 Gbps download speeds and 6 Gbps upload speeds.

Unlike previous versions, DOCSIS 4.0 will require the cable operator to make upgrades to the coax portion of their outside plant cables. This is primarily due to re-allocation of the RF spectrum within the coax to achieve higher upload rates. Nationally, Spectrum has already begun its outside plant upgrades. In December 2022, they announced a three-phase approach. The first phase is called a “high-split architecture” that increases the total available RF bandwidth and allocates more for the upload direction. This will enable up to 1 Gbps upload rates. Phase 2 will begin in 2024 and will add a new distributed access architecture (DAA) using Remote PHY or Physical Layer. This is a new architecture that distributes low-level modem functionality to optimize system partitioning. This phase will boost download rates to 5 Gbps. Phase 3 will deploy extended spectrum using DOCSIS 4.0 and will enable download speeds of 10 Gbps. Charter expects 85% of their national footprint to be able to offer 5 Gbps/1 Gbps data rates by the end of 2025. The major benefit of DOCSIS 4.0 is it will enable the cable industry to leverage its installed base of network assets and remain competitive for another decade.

To further compete with both telco-fiber and new-entrant fiber providers, Spectrum and Comcast have created a new connectivity bundle. Spectrum recently announced, “Spectrum One”. This offering includes Internet, whole-home Wi-Fi, and 5G Mobile. This makes it more challenging for fiber competitors to compete. Providing whole-home Wi-Fi, for example, requires a fleet of trucks and a staff of skilled technicians. This changes the dynamics and economics of fiber competitors. To offer a national 5G service to local customers would require the fiber providers to engage in a reseller agreement with one or more mobile network operators as Spectrum has done.

In Winter Park, Spectrum is expecting to begin DOCSIS 4.0 rollouts in late 2025. They are participating in the electric undergrounding initiative by paying the City for the installation of a conduit for their use.

(b) Lumen Technologies/CenturyLink

The Incumbent Local Exchange Carrier (ILEC) is Lumen Technologies, which markets DSL services under the legacy CenturyLink brand. Lumen is a large global telecommunications company servicing major international corporations with network, cloud, managed IT, and edge computing services. CenturyLink can trace its origin back to 1930 and since then has gone through many iterations and has bought, sold, merged, and divested

many territories across the U.S. throughout the years. In October of 2016, they bought Level 3 Communications for $25 billion giving them a national long-haul fiber network. Total Lumen revenues for 2022 were $17.5 Billion.

In August 2021, they sold their assets in Alabama, Arkansas, Georgia, Illinois, Indiana, Kansas, Louisiana, Michigan, Mississippi, Missouri, New Jersey, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, and Wisconsin to Apollo Global Management (A private equity firm) for $7.5 billion. They retained assets in 16 states, including Florida, Nevada, and the states formerly served by Qwest (USWest) in Arizona, Colorado, Idaho, Iowa, Minnesota, Montana, Nebraska, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming. In November 2022, Lumen announced 32 metropolitan areas where they are committed to upgrading to FTTP, branded Quantum Fiber. The Orlando, Florida metro area was included in these plans.

Lumen has publicly stated that they are targeting to pass an additional 8-10 million locations with fiber. This is down from previous projections of 10-12 million due to inflation and other cost issues. While 2022 revenues were $17.5 billion, they have a finite amount of capital for last-mile fiber investments. This investment will spread across their 16-state footprint. It will be directed at those locations that have the highest financial return potential. This naturally favors dense areas and areas with lower construction costs. This in turn favors aerial deployments and areas with less rock.

Given this financial scrutiny Lumen executives have put on fiber investments, the Orlando area, and Winter Park specifically, should be high priorities to overbuild with fiber. In Winter Park they have started to deploy FTTP. In the city, they use BlueWater Telecom as their design and construction contractor. In February 2023, BlueWater filed two permits with the City to construct fiber. Their permits will deploy underground fiber throughout two neighborhoods. The first is near the Tuscarora Trail near W. Comstock Ave. and the second is near Lakemont Ave. These permits cover 900 homes over three subdivisions.

BlueWater is also in the design and engineering phase for an additional 8,000 to 9,000 locations in Winter Park. Once complete, they will present the plans to Lumen. Lumen will then determine which addresses or areas meet their financial models. Even if all these locations are funded, that does not cover all the city's locations. When asked, Lumen will not commit to universal fiber coverage of the city. They will commit to deploying fiber to all reasonable locations. Given the density of households and commercial locations and the geography of Winter Park, we expect Lumen to cover most of the city with fiber. Those 'unreasonable' locations could be limited to private multi-dwelling units with previous agreements with competitor ISPs.

In Winter Park

Lumen continues to use the CenturyLink brand for their residential DSL offerings. The rate supported at each location is dependent on the length of copper wire connecting the residence to the CenturyLink central office. Their actual rates can only be estimated. In Winter Park, and nationally, Lumen/CenturyLink has a flat price for their DSL offering of $50/month. There is also a mandatory $15/month equipment leasing fee resulting in $65/month service. This is not competitive with Spectrum's offering. For business users, they offer the same $65/month DSL service with a $150 charge for professional installation.

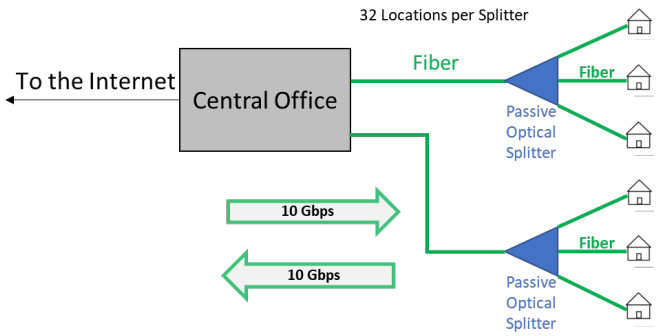
Table 6 - Lumen's Published Residential Internet Service Offerings in Winter Park

Package	Type of Connection	Download Speed	MRC	MRC per Mbps[i]	Notes
	DSL	3 Mbps	$65.00	$21.67	Leased Equipment, Rate Changes, Add'l Install Charges, Fees, Construction Charges, Affordable Connectivity Funds and Lifeline Programs and Taxes

Lumen Fiber

The fiber-to-the-premises network that Lumen will be deploying in Winter Park is branded "Quantum Fiber". Their fiber architecture is based on 10 Gbps XGS-PON shown in the figure below and they offer a 1 Gbps symmetrical service at a very competitive rate of $65/month plus taxes and fees.

Figure 31 - XGS-PON Architecture



(c) Frog

FrogNow (Frog), is a fiber-based internet service provider based in Orlando, FL and Fort Worth, TX. They service businesses and residents in select areas. In addition to the fiber construction and maintenance agreement they have with the City of Winter Park, they claim to offer Internet access to the city's businesses and residents. In addition, they also provide the city Library with a free 2 Gbps service. Their business and residential service and price offerings[13] are shown in the tables below.

Table 7 - Frog's Published Non-residential Business Internet Service Offerings in Winter Park

Package	Type of Connection	Download Speed	MRC	MRC per Mbps	Notes
250 Mbps Internet	Fiber	250 Mbps	$60	$0.24	-
300 Mbps Internet	Fiber	300 Mbps	$75	$0.25	-
500 Mbps Internet	Fiber	500 Mbps	$100	$0.20	-
1000 Mbps Internet	Fiber	1,000 Mbps	$200	$0.20	-

[13] Internet – Frog (frognow.com)

In 2021, Frog publicly stated they intended to serve the residential market of Winter Park. Their pricing in the areas they serve is shown in Table 7. Specific locations where they are available are currently unavailable to the public. Their pricing in the areas they serve is shown in Table 7.

Table 8 - Frog's Published Residential Internet Service Offerings in Winter Park

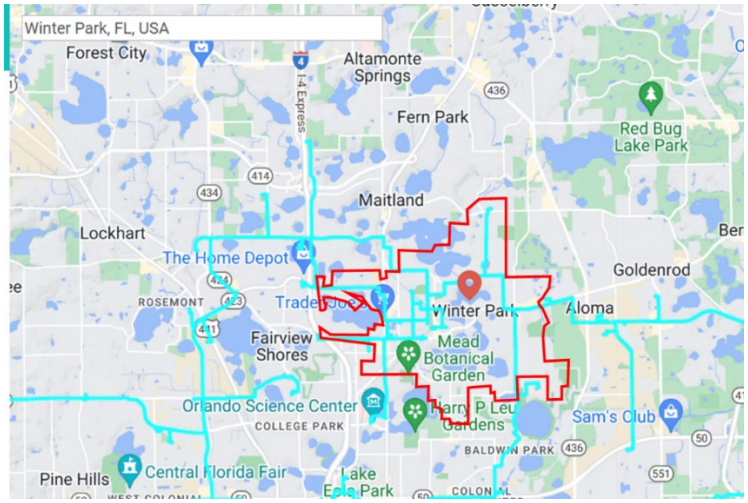
Package	Type of Connection	Download Speed	MRC	MRC per Mbps	Notes
250 Mbps Internet	Fiber	250 Mbps	$49	$0.20	-
500 Mbps Internet	Fiber	500 Mbps	$65	$0.13	-
1000 Mbps Internet	Fiber	1,000 Mbps	$105	$0.10	-
2,000 Mbps Internet	Fiber	2,000 Mbps	$150	$0.07	-
10,000 Mbps Internet	Fiber	10,000 Mbps	$299	$0.03	-

(d) Summit Broadband

Summit Broadband provides fiber and broadband services in Florida, with their network including 3,500 fiber route miles. They serve bulk residential customers (e.g., MDUs, HOAs) with an FTTP-based triple-play bundle of Internet, TV/Video and voice services. They serve commercial and wholesale customers with ethernet managed and dark fiber services. In 2020, Summit Broadband was bought by a private equity firm, Grain Management.

Currently, in Winter Park they do not serve residential customers in either MDUs or Single-Family Units (SFUs). They are active in Winter Park serving commercial, education, and government customers. They provide active services from 10 Mbps to 400 Gbps as well as dark fiber services. They will deploy new fiber to serve customers in the city on a case-by-case basis, though they do not have any current permits.

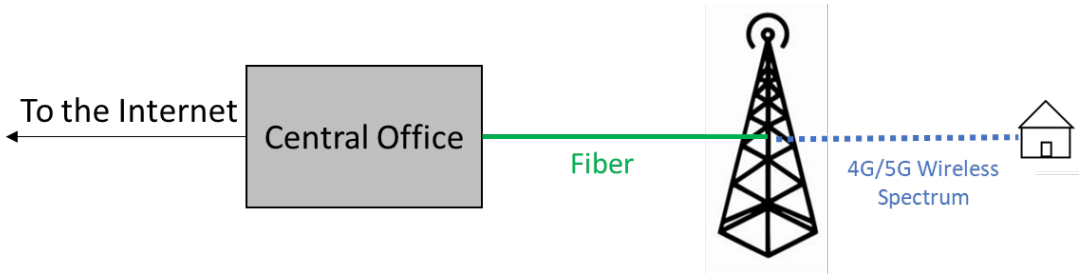
Figure 32 - Summit Fiber in Winter Park



FIXED WIRELESS ACCESS (FWA)

In recent years, the mobile network operators (MNO), T-Mobile and Verizon have started offering internet access to homes and businesses using their 4G and 5G networks. Data rates will depend on several parameters including distance from the tower and foliage density. T-Mobile and Verizon are offering services as high as 150-300 Mbps download.

Figure 33 - Fixed Wireless Network Illustration



The concept of wireless internet access is not new, and it is widely used in rural environments. What has changed is the impact the MNOs are having in denser urban and suburban markets they serve. T-Mobile is the most aggressive in marketing their FWA services and nationally, have added 2 million FWA customers in their first year after product launch. Some residences and businesses will use FWA as a backup to their primary wireline connections. In Winter Park, they offer a high-speed alternative to Spectrum. According to the FCC maps, T-Mobile FWA service is available at all locations. Verizon's FWA service was only available to less than 25% of addresses tested.

The wireless infrastructure in Winter Park will be discussed in the section below.

(a) T-Mobile

T-Mobile provides 4G and 5G LTE fixed wireless services to households across all 50 states in the US. Its residential plans main features include contract-free services and unlimited data access. The typical download speeds it offers are between 33-182 Mbps and may vary according to location, time of the day, weather, and other factors.

Table 9 - T-Mobile's Published Residential Internet Service Offerings in Winter Park

Package	*Type of Connection*	*Download Speed*	*MRC*	*MRC per Mbps*[ii]	*Notes*
5G Home Internet	Fixed Wireless	182 Mbps	$50.00	$0.27	Unlimited Data, No Annual Contract

(b) Verizon Wireless

Verizon's 5G Home internet services are an affordable solution with faster speeds than satellite and DSL types of connections. Verizon offers unlimited data and contract-free plans, but speeds may vary based on a location's distance to its network towers and real-time network traffic.

Table 10 - Verizon's Published Residential Internet Service Offerings in Winter Park

Package	*Type of Connection*	*Download Speed*[16]	*MRC*[17]	*MRC per Mbps*[18]	*Notes*
LTE Home Internet	Fixed Wireless	50 Mbps	$25	$0.50	Unlimited Data, No Annual Contract
5G Home	Fixed Wireless	300 Mbps	$60	$0.20	Unlimited Data, 10-year price guarantee
5G Home Plus	Fixed Wireless	300 Mbps	$80	$0.27	Unlimited Data, No Annual Contract, 10-year price guarantee. Gift cards, Cloud unlimited

In Winter Park, Verizon will continuously expand its wireless infrastructure to improve coverage and capacity. They have a pole attachment agreement with the City and plan to deploy an additional 50 small cells in Winter Park. They prefer to own the fiber connecting towers and small cells. Though, they will consider leasing both conduit and fiber in challenging locations such as under railroads or rivers.

In addition to citywide 4G/5G coverage, Verizon offers a fixed wireless access (FWA) broadband service in the city. This uses the same infrastructure as their mobile services to connect homes and businesses to the internet providing download speeds above Lumen DSL and below Spectrum Cable capabilities.

From a smart city perspective, Verizon has a range of IoT connectivity options based on both 5G and FWA. A sensor that sends less than 1 Mbyte of data per month can be connected for $5/month. They also offer

private 5G network options for cities. Here, they design, build, and operate a 5G network on an outsourced basis.

(c) AT&T

AT&T has full wireless 4G/5G coverage in Winter Park. They began working with the city in 2017 to deploy small cells and have a master agreement for light pole attachments. They currently have no additional expansion plans in the city as their current infrastructure supports their coverage and capacity plans for the city. As data traffic demands change, they will deploy additional infrastructure.

Table 11 - AT&T's Published Residential Internet Service Offerings in Winter Park

Package	*Type of Connection*	*Download Speed*	*MRC*	*MRC per Mbps*[iii]	*Notes*
AT&T Fixed Wireless	Fixed Wireless	25 Mbps	$59.99	$2.40	350 GB data cap

SATELLITE INTERNET

Historically, there are two satellite internet companies servicing the entire continental USA; HughesNet and ViaSat. These are based on geosynchronous satellites (GEO) that orbit ~23,000 miles above the Earth. Even though the signals travel at the speed of light, the 23,000 miles up and 23,000 miles down adds substantial latencies (600-700 milliseconds) and signal degradations that minimize the effective bitrates.

There are at least two Low Earth Orbit Satellites (LEOS) constellations being deployed today. One is Starlink from SpaceX Corporation and the other is a UK-based consortia called OneWeb. These satellites orbit the earth at altitudes of about 350-500 miles. Thus, latencies have been reduced to 30-50 milliseconds from 600-700 milliseconds latencies of the GEO offerings. Data rates of 50-100 Mbps download are expected once the full constellation of satellites is launched over the next few years.

Starlink is currently in beta testing and has limited availability in most locations. It costs $99/month and has a $500 upfront charge for hardware.

GEO or LEO satellite is not considered a broadband service or as a viable primary option for urban and suburban users. However, they could be considered as a redundant backup link for the city government, businesses, and residences.

STAKEHOLDER OUTREACH SUMMARY

The smart city use cases of the highest importance are focused on Transportation, Public Safety, Utilities, and Better Community Living.

The top priority use cases are:

- Transportation
  - Intelligent Transportation Systems for traffic management
  - Smart Parking Solutions
- Public Safety
  - Enhanced Emergency Management and Incident Response
  - More devices (e.g., cameras, license plate readers) and smarter vehicles
- Utilities
  - Enhanced Remote Meter Reading
  - Remote Asset Monitoring (e.g., Lift stations, substations, underground assets).
  - Remote Asset Operations
  - Smart Grid/Grid Modernization
- Better Community Living
  - Environmental Monitoring / Air Quality Monitoring
  - Automated and Remote Monitoring and Sampling
  - Lakes: Water Quality, Algae, Water Levels

(a) City Leadership

City Management (City Manager, HR, Finance) noted that the City has a lot of technology and solutions but lacks a comprehensive strategy and understanding of the current asset base. There is receptiveness to trying new technologies as long as they have long-term positive impacts and support the greater vision for a Smarter Winter Park. Traffic and parking were cited as two key city problems that should be addressed in this planning effort.

The discussion addressed many smart city technologies that are foundational and support many use cases and departments. The ability to communicate with residents impacts all City departments. This includes outbound communication including distribution of emergency alerts and inbound functions such as payments and applications.

(b) Police

Today, the Winter Park Police feel their connectivity needs are met with current solutions. Chief Volkerson noted the department takes advantage of remote devices such as cameras, license plate readers and people counters. License plate readers are used to identify stolen cars and people of interest. The department has three today and has requested 11 more.

The department is in the process of implementing a “real-time” crime center system called Fusus, a cloud-based Software-as-a-Service application. A primary feature of Fusus is the integration of private surveillance cameras into police operations. Each entity, such as a store on Park Avenue, would opt-in to the program. The police would install a small electronic device in each location that would connect the

camera to the Fusus dashboard. The device would only be activated when there is an incident, and the police would have access to the video stream.

The Police also noted the need for improved 2-way communication with the community. This involves the ability for citizens to report issues to the department. This could involve citizens uploading videos and images, as well as live video interviews. This could be the evolution of the current City portal. The impact on the digital infrastructure would be the increase in video transmission and data storage demands.

Communicating to the community is a challenge noted by the Police and other departments. This involves both non-emergency notices (E.g., New York Ave will be closed for maintenance next Tuesday) and real-time emergency/incident responses. The days of relying on the 'home phone' and paper-bill inserts are long gone. Email and texting work for those that have opted-in to receive them. Even with the proliferation of communication options it cannot be assured that everyone who needs the information will receive it. Social media outlets (Twitter, Facebook, NextDoor, Instagram, etc.) are the 'go-to' media for community outreach. Yet, this medium only reaches those who participate in those media outlets.

They also requested an enhanced, or next-generation Emergency Management System (EMS). This includes identifying the closest resources to the incident and identifying the optimal route to the incident. The latter would be integrated with an Intelligent Traffic System for pre-emption purposes. The EMS would also need to communicate the status of the incident in real-time to department personnel and the public.

The future of policing will also involve more cameras including "BodyCams" and "DashCams" and more two-way data flows. This will put added demands on the connectivity infrastructure of the City as each camera will send a high-resolution real-time video stream from the remote camera to the police command center and other displays such as laptops and mobile devices for viewing. The increase in demand for data processing and data transmission will result in each vehicle becoming mini-data centers and communication hubs.

(c) Fire

Chief Hagedorn noted that the Fire Department can and will benefit from enhanced connectivity, and smart city technologies. The connectivity aspect also includes transparent access to data from other City departments and County, and State resources.

Today, each first responder vehicle has a Mobile Data Terminal. These are ruggedized computers connected to headquarters via a cellular (4G or 5G) connection. Vehicles also have transponders that track location and speed.

A primary need cited is the ability of first responders to access the medical history of the injured person both at the site of the incident and while transporting them to a hospital. They also envision sending high-resolution images from the vehicle to the hospital. Technology can solve part of this problem, however, there are legal and regulatory issues (e.g., HIPPA) that also need to be addressed.

The Fire Department is working on a traffic signal pre-emption system where an in-vehicle device communicates with the intelligent traffic system to ensure green lights on the way to an incident. The

system is being deployed in collaboration with the Florida Department of Transportation (FDOT), and when the current phase is complete, 12 main intersections will be enabled. At the end of the final phase, all city intersections will be enabled.

The department would also benefit from the next-generation Emergency Management System and 2-way citizen communication system.

(d) Electric

The electric utility is in the process of undergrounding the overhead electric wires throughout the city. They are about 60% complete with the remaining 40% scheduled over the next 7 years. As part of this process, the City is also paying for an additional 2" underground conduit for future communications purposes.

The electric utility connectivity and smart city needs are driven by the two electric substations, Canton and Interlachen. These will be connected to the City backbone being built with Frog. They prefer fully redundant fiber connections and require a physically separate network from the City's IT network.

From a smart city perspective, the electric utility would like to monitor these assets remotely and envisions connecting them to fiber and ultimately deploying grid modernization components such as reclosers to automate the routing of electricity in the case of issues or outages on the grid. This includes deploying remote security with cameras, motion detectors, and other sensors. It also would include transmitting real-time operational data from the systems to "the cloud" for monitoring and maintenance purposes. The next step from remote asset monitoring is remote asset operations. This would enable the utility to monitor and operate the remote substations from a centralized location in real-time. These are evolutionary steps to the concept of a "Smart Grid" with full renewable and distributed energy integration.

Today, they use an AMI remote meter reading application, Sensus®[14]. This reduces operation expenses and enables real-time usage monitoring.

They also would like an improved incident/outage management system. They want to have systems that are comparable to a private utility or Investor-Owned Utility (IOU), which includes communicating the real-time status of an outage to the affected subscribers and the community.

They also operate over 3,000 streetlights which are potential locations for smart city sensors and other devices to monitor the environment and other assets.

(e) Water and Wastewater

Water and Wastewater have similar smart city use cases as Electric does. They also use Sensus® for remote meter readings. From a connectivity perspective, the department would like a fully connected and redundant network of all key components of the system with centralized monitoring via remote digital devices and sensors. This would include over 100 lift stations. Connecting the lift stations would enable system telemetry and the deployment of smart city sensors and cameras. Sensors will measure water quality, system pressure, and additional system and environmental parameters, and can include leak

[14] https://sensus.com/solutions/advanced-metering-infrastructure-ami/

detection sensors. This will enable remote monitoring and then remote operations of the assets. Continuous data collection and telemetry will enable proactive and predictive maintenance of systems and equipment.

The department would also benefit from an enhanced incident management system and 2-way citizen communication system.

(f) Public Works

Charles Ramdatt of Public Works suggested that the City focuses on 5 areas regarding smart city deployments and application focus. The first is "Smart Transportation". This is a broad use case that includes an Intelligent Traffic System (ITS) that controls the city's traffic lights. it was also suggested that the City connect all traffic controllers including those owned by the State DOT, and by the county with fiber optics. This would enable the City to better control the flow of traffic and would support public safety pre-emption initiatives. Smart Parking is also included in smart transportation. The importance of addressing the parking challenges in Winter Park was noted. This would include a system that would be able to monitor parking spaces, communicate the availability, and guide drivers to the open spaces.

The second priority use case suggested was "Smart Stormwater". This would entail monitoring the water levels in area lakes, ponds, inflow structures, lake gauges, drain wells, etc. All of these locations should be equipped with a smart instrument to monitor the level of rainfall, archive and correlate this with different rainfall events and do predictive analysis to allow the City to take proactive steps.

The third use case is "Smart Facilities". Smart facilities include a range of technologies and systems designed to reduce costs and improve the internal environment. It includes smart HVAC systems, smart lighting systems and an array of sensors to monitor all aspects of the facility. Asset tracking by putting GPS-enabled devices on expensive equipment and other assets to monitor their location and usage.

The fourth use case is "Event Management". Events, such as the Central Park Art Show, attract a large number of visitors and that puts pressure on many City departments. Smart parking, wayfinding, cameras, people counters are all technologies and systems that are needed to best support City events, enabling the City to better scale their resources for major events.

The fifth area of focus suggested was a Smart Emergency Management System for all aspects of public safety. This would include a single operations center for the City departments. This centralized approach would enable data sharing amongst all those departments involved in public safety, including external 3rd parties when necessary.

(g) Parks and Recreation

Parks and Recreation have a broad range of responsibilities that include the boat ramps and golf courses. They have connectivity and sensors today but can benefit from enhance connectivity and smart city technologies and applications.

Some parks are in the process of being connected to fiber via an agreement with Frog and those that have fiber also have Public Wi-Fi operated by Frog. Once connected to fiber, each park will be able to support a range of smart city devices. These include cameras, people counters and the range of sensors.

The department is responsible for several buildings that require connectivity and their own smart building strategy or upgrade plan. These locations and facilities are also potential locations for cameras and sensors.

The two golf courses can gain efficiencies and lower operational costs by deploying a smart irrigation system and a smart grass management system. Sensors would measure and communicate soil and grass conditions. Watering would be automated, and mowing would be accomplished with autonomous vehicles.

The parks, golf courses, boat ramps, tennis courts, and other facilities could also benefit from the 2-way citizen communication system for bookings and payments.

(h) Natural Resources & Sustainability

Natural Resources and Sustainability handles solid waste, recycling, energy, energy and water conservation; anything biological as far as assessments, permitting, clean-up events, and hazardous events. Their immediate smart city use case would be automatic monitoring stations. These would contain a range of environmental sensors and would be able to take samples of lake water and transmit the results to the centralized database. They noted the importance of departments sharing data and the need for better 2-way communication with the community.

(i) Schools

Winter Park High School in undergoing a $65 million renovation that includes fiber connectivity on the main campus. They also have campus-wide Wi-Fi and all students have laptops. They are piloting electric buses that will include cameras but not Wi-Fi.

(j) Library

The Winter Park Public Library plays an important role in the Winter Park digital ecosystem. They are a digital literacy training center, and they lend digital technologies including mobile Wi-Fi hot spots and laptops. They would like to expand both programs. They also have a professional recording studio and a maker space.

The Winter Park Public Library has 2 Gbps symmetrical connection to the internet from Frog free for public use, thus making connectivity not an issue. They are migrating towards having a smart building, and they are interested in extending their Wi-Fi to the outside areas adjacent to their facility.

(k) Health Industry

Orlando Health is a major provider of health services to the City of Winter Park and Orange County. Their main campus in Orlando is connected with diverse and redundant fiber from several providers including AT&T and Lumen Technologies.

From an IT perspective, their focus internally is on smart buildings with sensors and asset trackers throughout their facilities. The surge of telemedicine during Covid is here to stay and is expected to increase. The hospitals and remote facilities are well connected. The key issue for telemedicine is the unreliable connections from the home locations of the patient and perhaps the home-based medical provider. To be effective, telemedicine requires high-definition (e.g., 1K or more) video resolution as well as excellent audio quality. This puts demand on the upload data rates well beyond legacy DSL. This impacts lower-income residents who may lack broadband or the requisite devices and those that signup for the lower cost and lower speed options that may not support the required video bandwidth demands.

(l) Local Businesses

Brasfield & Gorrie

Brasfield & Gorrie is one of the country's largest privately held construction firms with a local office in Winter Park. Connectivity is critical at their job site and the cost and time of deploying fiber requires a wireless solution initially. Many devices (iPad, Drones) are 5G enabled and can be impacted by dead zones. Larger sites can create a local area Wi-Fi network with a 5G hotspot connection.

They are very supportive of Winter Park's smart city initiatives, and they see great value in a city digital twin[15]. They could use the digital twin to show the impact of a new building on the neighboring areas and the entire city. This could streamline permitting and facilitate community buy-in for developers' projects.

The participant for this meeting as a resident of the city, any smart city application that addresses traffic and parking would be of interest.

(m) Chamber of Commerce

The Chamber of Commerce (CoC) made it very clear that there is not any ISP competition in Winter Park. Businesses have the same choice of Spectrum and Lumen DSL. Both have "business-grade" offerings with service-level agreements for higher monthly fees. Spectrum's business offerings are limited to 35 Mbps upload speeds, and it is over the same infrastructure with noted reliability issues. This applies to the central business district as well. The lack of high-speed alternatives is impacting existing businesses and deterring technology-based businesses from locating in the city.

The demand for a smart traffic solution is expected, and so is the demand for reliable broadband connectivity throughout the city. Traffic was cited as the biggest issue impacting the quality of life in Winter Park. They reported that 6,000 more people commute into the city than leave it, while 2,000 city residents are moving around, and in and out of the city. The lack of parking also impacts the city's businesses.

[15] Digital Twin – a digital counterpart of a physical structure or systems used for simulations, integrations, testing, monitoring and maintenance.

Summary

Today, Winter Park's connectivity environment is limited to a single high-speed or gigabit service provider, Spectrum. This is slowly changing since Lumen has begun the process to deploy fiber to the premises. As Lumen enters the market with competitively priced symmetrical gigabit services, Spectrum will be upgrading to the next-generation cable technology giving the City of Winter Park at least two facilities-based gigabit providers.

The City's internal network is also evolving. A construction and maintenance agreement with the private company Frog will give the City a backbone connecting 18 critical municipal locations with fiber. This gives the City a great foundation to start, however, as it pursues its smart city journey, additional fiber, and wireless infrastructure will be required.

The City is very receptive to smart city investments to be a leader in smart city innovation, in the region. Four key pillars of focus have been established by the City, based on the meetings with the City departments' key stakeholders. These four pillars are: Transportation, Public Safety, Utilities, and Better Quality of Life. Smart City use cases and specific applications were also identified under these pillars.

In addition to these pillars, there are many common technologies (e.g., cameras) that create an additional smart city infrastructure layer for the City. These should be centralized for the City's use, to reduce the City's CapEx and OpEx by eliminating redundant technology siloes and improving communication and data transparency.

Appendix 1 - Service Provider Outreach Overview

As part of this analysis, we reached out to facility-based service providers and had 1-on-1 interviews. The internet service providers we spoke with are shown in the table below.

Date	Organization /Department	Name	Role
3/2/23	AT&T	Dan Pollock	Regional Director Of External Affairs For Central Florida
3/6/23	Charter Communications - Spectrum	Marva Johnson	Group Vice President, State Government Affairs for Charter Communications' Southern Region
3/6/23	Lumen Technologies/CenturyLink	Dana Bailey	Director of State & Local Government Affairs
3/28/23	BlueWater Telecommunication	Paul Wheeler	President
		Ashely Wheeler	Vice President of Operations
		Alex Ferguson	Director of Business Solutions
3/29/23	Verizon	Rachel Wright	Product Strategy Manager - Network Solutions
		Jay Bidlack	Senior Manager Real Estate in Florida - Network Solutions
		Christopher Milnes	Real Estate in Winter Park - Network Solutions
4/4/23	Summit Broadband	Marvin Bouquette	Account Director - Government & Education
		James Lam	Vice President, Enterprise Sales
		Bill Lean	Product Vice President, Solutions Architecture
		Melissa Santiago	Director, Enterprise Sales

Our goal in the interviews was to gain an understanding of their local assets and their future plans to serve the City of Winter Park. The questions we used for discussion purposes were:

- What are your current assets and services in the city?
- What are your future plans to upgrade, overbuild, or expand in the city (e.g., types of services, etc.)?
- Would you lease assets from the City such as:
  - Conduit?
  - Dark Fiber?
  - "Rooftops" and "light poles"?
- How do you address low-income and digital literacy/equality in the city?
- How has the experience of working with the City been? How can the City further support you in serving its citizens?

Magellan analyzed the broadband landscape of the City of Winter Park to determine private broadband assets within the City. Emphasis was placed on “facilities-based” carriers, or those that own their physical infrastructure including fiber, copper, and coaxial cables, as well as wireless infrastructure.

Appendix 2 - Stakeholder Outreach Participants List

Category	Date	Organization /Department	Name	Role
City Leadership	2/14/23	Administration	Randy Knight	City Manager
	2/14/23	Finance	Wes Hamil	Finance Director
	2/14/23	Administration	Pamela Russell	Human Resources Division Director
	2/14/23		Leif Bouffard	Program Manager
	2/14/23	Communications	Clarissa Howard	Communications Director
	2/14/23	Information Technology	Parsram Rajaram	IT Director
	2/14/23	Management and Budget	Peter Moore	Office of Management & Budget Division Director
	2/14/23	Information Technology	Parsram Rajaram	IT Director
	2/14/23	Police	Tim Volkerson	Police Chief
	2/14/23	Fire-Rescue	Dan Hagedorn	Fire Chief
	2/15/23	Electric Utility	Mourad Belfakih	Electrical Engineer
	2/21/23	Risk, Safety & Fleet Division	Keri Martin	Director
	2/28/23	Public Works	Charles Ramdatt	Public Works & Transporation Director
	2/15/23	Planning and Zoning	Allison McGillis	Planning and Zoning
	2/15/23	Parks and Recreation	Jason Seeley	Director
	2/15/23	Parks and Recreation	Kathlyn	Assistant Director
	2/22/23	Natural Resources and Sustainability	Gloria Eby	Director
Schools	2/22/23	Winter Park High School	Matthew Arnold	Principal
		Rollins College – Public Safety	Ken Miller	Assistant Vice President for Public Safety
	2/24/23	Rollins College - IT	Troy Thomason	CIO
	2/22/23	Winter Park High School	Paul Wilher	Assistant Principal
Library	2/15/23	Winter Park Public Library	Melissa Schneider	Interim Director
Health	2/15/23	Orland Health	Marc Simmons	Network Engineer
	2/15/23	Orland Health	Greg Hardings	Wiring Analyst
Local Businesses	2/15/23	Brasfield & Gorrie	Jacob Stern	Preconstruction Manager at Brasfield Gorrie

	2/24/23	Winter Park Chamber of Commerce	Betsy Gardner Eckbert	President/CEO
Non-profit organizations, Community Partners	2/15//23	Edyth Bush Charitable Foundation	Davidalliso Odahowski	President & CEO
	2/23/23	Rollins Museum of Art & The Alfond Inn	Laney Velazquez	Digital Programming Director
ISPs	3/2/23	AT&T	Dan Pollock	Regional Director of External Affairs For Central Florida
	3/6/23	Charter Communications - Spectrum	Marva Johnson	Group Vice President, State Government Affairs for Charter Communications' Southern Region
	3/6/23	Lumen Technologies/CenturyLink	Dana Bailey	Director of State & Local Government Affairs
	3/28/23	BlueWater Telecommunication	Paul Wheeler	President
			Ashely Wheeler	Vice President of Operations
			Alex Ferguson	Director of Business Solutions
	3/29/23	Verizon	Rachel Wright	Product Strategy Manager - Network Solutions
			Jay Bidlack	Senior Manager Real Estate in Florida - Network Solutions
			Christopher Milnes	Real Estate in Winter Park - Network Solutions
	4/4/23	Summit Broadband	Marvin Bouquette	Account Director - Government & Education
			James Lam	Vice President, Enterprise Sales
			Bill Lean	Product Vice President, Solutions Architecture
			Melissa Santiago	Director, Enterprise Sales

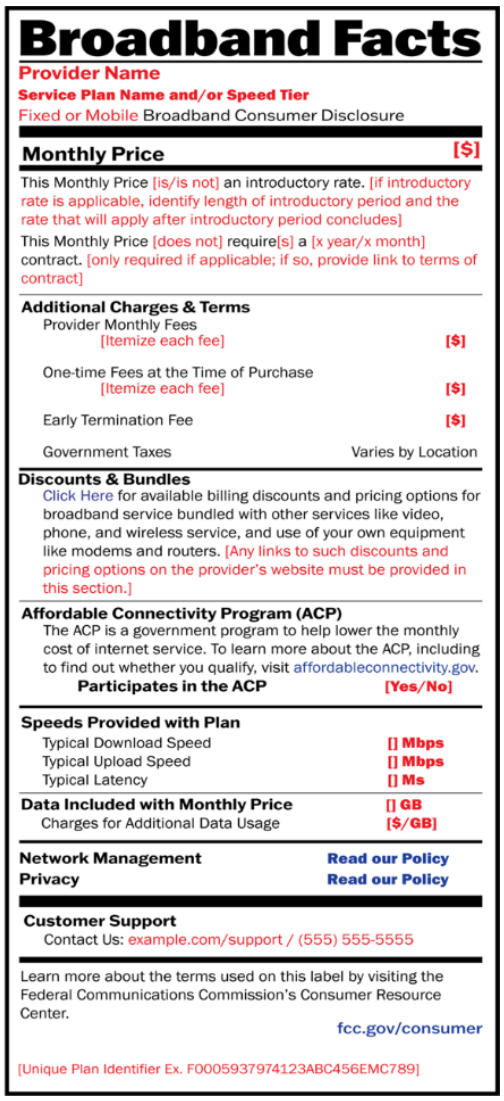
Appendix 3 - Tower Site List

Registration Number	Status	Owner Name	Latitude/Longitude	Addresses	Structure City/State	Overall Height Above Ground (AGL)
1037874	Constructed	Hearst Properties Inc. c/o Brooks, Pierce et al.	28-36-46.0N	1021 N Wymore Rd	Winter Park, Fl	77.1
			081-23-09.0W			
1039785	Constructed	Spectrum Sunshine State, LLC	28-36-35.0N	E End of Palmer Ave	Winter Park, Fl	100.3
			081-19-27.0W			
1053237	Constructed	Orange County Govt	28-35-39.0N	6600 Amory Ct	Winter Park, Fl	95.0
			081-18-05.0W			
1229249	Constructed	T-Mobile USA Tower LLC	28-35-36.7N	401 W. Fairbanks Ave	Winter Park, Fl	40.5
			081-21-15.6W			
1231095	Constructed	Seminole County Telecommunications	28-38-20.0N	3250 Dike Rd	Winter Park, Fl	76.0
			081-16-58.2W			
1234917	Constructed	Pinnacle Towers LLC	28-35-23.5N	1501 Minnesota Ave	Winter Park, Fl	60.7
			081-22-09.0W			
1269196	Constructed	SBA 2012 TC Assets, LLC	28-36-24.2N	933 Bennet Ave	Winter Park, Fl	41.1
			081-22-11.2W			
1273908	Granted	Secure Communications	28-35-17.2N	2900 Logandale Dr	Winter Park, Fl	45.7
			081-15-15.0W			
1280751	Constructed	Crown Castle South LLC	28-36-14.1N	4490 North Goldenrod Rd	Winter Park, Fl	59.1
			081-17-15.4W			
1285321	Constructed	Seminole County Telecommunications	28-38-20.6N	3540 Dike Rd	Winter Park, Fl	83.8
			081-16-57.8W			

Appendix 4 - Assumptions and Definitions

Technically, broadband refers to a communications circuit that is split into multiple, separate channels. Broadband has come to be defined as always on, high-speed internet access. As of January 2015, the Federal Communications Commission (FCC) defines "broadband" as a minimum of 25 megabits per second (Mbps) download speed and 3 Mbps upload speed, or "25/3." In January 2018, the FCC reaffirmed that definition, which they deemed adequate for a single user engaged in telecommuting or student activity. Most broadband services are asymmetrical, with faster download than upload, and providers commonly only advertise download speeds.

The figure on the right is the FCC's proposed broadband label[16] for providers' use to ensure that customers have access to accurate and simple to understand information about their broadband service options.



Broadband Facts

Provider Name
Service Plan Name and/or Speed Tier
Fixed or Mobile Broadband Consumer Disclosure

Monthly Price [$]

This Monthly Price [is/is not] an introductory rate. [if introductory rate is applicable, identify length of introductory period and the rate that will apply after introductory period concludes]

This Monthly Price [does not] require[s] a [x year/x month] contract. [only required if applicable; if so, provide link to terms of contract]

Additional Charges & Terms

Provider Monthly Fees
[Itemize each fee] [$]

One-time Fees at the Time of Purchase
[Itemize each fee] [$]

Early Termination Fee [$]

Government Taxes Varies by Location

Discounts & Bundles

Click Here for available billing discounts and pricing options for broadband service bundled with other services like video, phone, and wireless service, and use of your own equipment like modems and routers. [Any links to such discounts and pricing options on the provider's website must be provided in this section.]

Affordable Connectivity Program (ACP)

The ACP is a government program to help lower the monthly cost of internet service. To learn more about the ACP, including to find out whether you qualify, visit affordableconnectivity.gov.

Participates in the ACP [Yes/No]

Speeds Provided with Plan

Typical Download Speed [] Mbps
Typical Upload Speed [] Mbps
Typical Latency [] Ms

Data Included with Monthly Price [] GB
Charges for Additional Data Usage [$/GB]

Network Management Read our Policy
Privacy Read our Policy

Customer Support
Contact Us: example.com/support / (555) 555-5555

Learn more about the terms used on this label by visiting the Federal Communications Commission's Consumer Resource Center.
fcc.gov/consumer

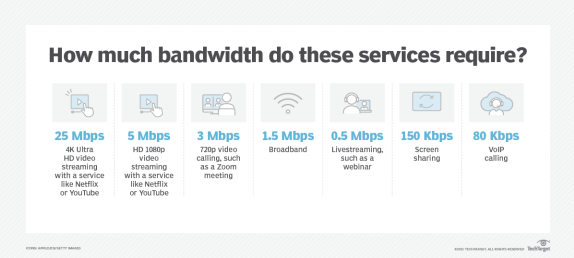
[Unique Plan Identifier Ex. F0005937974123ABC456EMC789]

The FCC's 2015 definition of broadband and its current classifications are summarized below[17]:

Unserved areas in which households and businesses lack access to broadband service speeds that meet the FCC threshold of 25/3 Mbps

Underserved areas in which households and businesses lack access to broadband service speeds that meet the FCC threshold of 100/10 Mbps

Served areas in which households and businesses have access to broadband service speeds that meet the FCC threshold of 100/10 Mbps and above



[16] https://www.fcc.gov/broadbandlabels
[17] https://broadbandnow.com/report/fcc-broadband-definition/

Appendix 5 - Summary of Capital Projects Fund

Water and Wastewater Fund

Department	Description	Funding Source	Estimated 5 Yr. Cost	Connectivity Plan	Smart City Plan
Water and Sewer	Upgrade sewer mains - Rehabilitation of defective sewer mains with heavy groundwater infiltration.	Water and Sewer Fees	$3,400,000	Conduit	**Leak detection, remote sensors**
		Water and Sewer Fees	$450,000	Conduit	**Leak detection, remote sensors**
Water and Sewer	Rehabilitation of sanitary manholes to restore their structural integrity	Water and Sewer Fees	$1,250,000	Conduit	**Leak detection, remote sensors.**
Water and Sewer	Short Liner Installation - for rehabilitation of sanitary sewer mains and laterals from the main to the property line.	Water Impact Fees/ Water and Sewer Fees	$5,500,000	Conduit	**Leak detection, remote sensors**
Water and Sewer	Upgrade water mains - Replacement of sub-standard water mains throughout the water distribution system.	Water and Sewer Fees	$1,500,000	Fiber connectivity, Local Network	**Remote Asset Monitoring/Operations**
		Water and Sewer Reserves	$6,829,467	Fiber connectivity, Local Network	**Remote Asset Monitoring/Operations**
Water and Sewer	Lift Station Upgrades	Water and Sewer Reserves	$915,000	Conduit	**Leak detection, remote sensors**
Water and Sewer	Upgrading/rerating of Iron Bridge Regional Wastewater Treatment Facility (City of Orlando).	Sewer Impact Fees	$200,000	Conduit	
Water and Sewer	Richard Crotty Parkway Utility Upgrade	Water and Sewer Fees	$580,000	Fiber connectivity, Local Network	**Remote Asset Monitoring/Operations**
Water and Sewer	Kennedy Blvd Road Widening Force Main Upgrade	Water and Sewer Fees	$330,000	Fiber connectivity, Local Network	**Remote Asset Monitoring/Operations**
Water and Sewer	Water Treatment Plant Renewal and Replacement	Water and Sewer Fees	$600,000	Enhanced connectivity	**Access to smart city common technologies and infrastructure**
Water and Sewer	Winter Park Estates Water and Wastewater plant				
ITS	Information Technology Infrastructure Upgrades (50% General Fund, 25% Water and Sewer Fund and 25% Electric Services Fund).				

Community Redevelopment Agency Fund

			Capital Funding Amount	Connectivity Plan	Smart City Plan
CRA	MLK Park Improvements	First phase of the improvements to Martin Luther King park, to include renovation of the fields and viewshed improvements, park amenities, playground, restroom, stormwater, and hardscape and lighting.	$2,900,000	**Public Wi-Fi**	**Sensors, cameras, smart lighting, smart trashcans,**
CRA	North Denning Dr. Streetscape Extension	This funding will extend the improvements along the portion of Denning from Webster to Solana and complete the continuity of the previous phase completed south of Webster Ave	$500,000	**Public Wi-Fi**	**Sensors, cameras, smart lighting, smart trashcans,**
CRA	Denning/Fairbanks Intersection Improvements	This will expand on the intersection improvements planned for the intersection by allowing for a southbound right turn lane from Denning onto Fairbanks Ave. This will be accommodated by the property purchases made in the previous year at the northwest corner	$321,765	**Public Wi-Fi**	**Smart Traffic, Intelligent Traffic System, Automatic Traffic Enforcement.**

Stormwater Fund

Department	Description	Funding Source	Estimated 5 Yr. Cost	Connectivity Plan	Smart City Plan
Public Works	Drainage Improvements - Most of the City's stormwater sewer infrastructure is over fifty years old. Some of these older systems do not meet the City's current drainage standards and in many cases are experiencing pipe material failures. Groundwater seepage into the stormwater sewer system is considered an illicit discharge carrying sediments to the City's lakes compromising water quality.	Stormwater Fees	$950,000	**Conduit**	**Remote Asset Monitoring, Leak sensors, Lake Monitoring**
Public Works	N Lakemont Seminole Ditch Piping	Stormwater Fees	$300,000	**Conduit**	**Leak sensors**
Public Works	Canton at Knowles Drainage Improvements	Stormwater Fees	$250,000	**Conduit**	**Leak sensors**
Public Works	Temple Dr Stormwater Replacement	Stormwater Fees	$500,000	**Conduit**	**Leak sensors**
Public Works	Curb Implementation	Stormwater Fees	$250,000	**Conduit, Micro trenching**	
Public Works	Nicolet Ave Stormwater Pond	Stormwater Fees	$200,000	**Conduit**	
Public Works	Stirling Bridge Replacement	Stormwater Fees	$250,000	**Conduit**	**Sensors/Cameras**

Electric System Fund

Department	Description	Funding Source	Estimated 5 Yr. Cost	Connectivity Plan	Smart City
Electric Services	Routine Capital improvements including: renewals, replacements, and other improvements required to provide service and improve the reliability of the electric system	Electric System Revenues	$7,516,024	**Isolated Operational Network**	**Smart Grid, Remote Monitoring**
Electric Services	Undergrounding of Electric Lines	Electric System Revenues	$40,845,466	**Conduit**	
Electric Services	EL Meter Upgrade	Electric System Revenues	$500,000	**CBRS/LoRaWan**	**Remote meter reading**
ITS	Information Technology Infrastructure Upgrades (50% General Fund, 25% Water and Sewer Fund and 25% Electric Services Fund)	Electric System Revenues	$600,000	**Enhanced Communications**	**Smart City Common Technologies.**
Public Works	Facility replacement account funding (replacement of flooring, roofing, air conditioning, painting, & other capital needs) (65% General Fund, 25% Water and Sewer Fund, and 10% Electric Fund)	Electric System Revenues	$316,154	**In-building wiring upgrades**	**Smart Building**

Connectivity Plan

Deliverable 2

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TABLE OF CONTENTS

TABLE OF FIGURES

TABLES

1. Executive Summary

The City of Winter Park is considering further investments in extending fiber and wireless infrastructure to support municipal operations, utility operations, and for an overall better quality of life across the community. The City provides a full range of local government services for a population of 31,000, covering 10.2 square miles within the Central Florida/Orlando metro area. The area is densely populated and includes an extensive collection of freshwater lakes. Winter Park's daytime and event population swells to a larger population during workdays, and especially during events in the city which creates challenges for transportation, public safety, parking, and other municipal operations.

Connectivity is necessary across the Winter Park community for libraries, EMS/Fire, police, utilities, and other essential government services. City leaders want to use technology to work smarter while minimizing costs as the city continues to evolve.

Winter Park has several options for getting the connectivity it requires. Winter Park will soon have a conduit and fiber backbone connecting eighteen primary city and utility sites. However, a more complex and extensive network is required to support full City operations and the vision of a highly connected "Smarter Winter Park."

Magellan conducted interviews with officials from various City departments, as well as external entities like schools and libraries, to determine their connectivity needs. The team also studied comparable communities and industry trends and gathered information from Winter Park's telecommunications companies operating within the city – and regionally.

Winter Park has also been deploying underground telecommunications conduit along with its electric undergrounding efforts over the last several years – using a joint trench concept to deploy this additional conduit at an overall reduced cost. These efforts have been undertaken in order to deploy fiber conduit infrastructure deeper into the community to provide ubiquitous high-speed fiber broadband services. While this undergrounding effort was commendable, it should be noted that Magellan has not been able to validate where it is located, nor how much of it has been deployed – as-builts have not been provided to assess its overall useability.

The City is at a crossroads as it relates to its desire to ensure ubiquitous, competitive fiber access to its citizens, having to decide if it should continue its conduit undergrounding project, or if it should take a different approach. These approaches could include providing funding for a more rapid fiber conduit expansion or continuing to engage the private sector to expand access but in a more passive approach.

Connectivity and Smart City infrastructures affect each department within the City's operations. The challenges are magnified by the numerous technologies that are applicable across different smart city pillars and use cases. A centralized approach led by the IT department would reduce and eliminate technology and solution silos, which in turn would reduce overall capital and operating expenditures. However, given the current staffing levels, the wide range of technologies, and the integration complexities, the City should consider creating a new position to lead and coordinate its connectivity and smart city initiatives and the general program.

This Connectivity Plan provides a roadmap for Winter Park to extend its fiber-optic backbone to connect more City assets, implement other wireless overlay technologies to support smart city use cases, and to ensure access to competitive high-speed fiber-based broadband services for all residents. The Connectivity Plan also makes recommendations in six areas. These include:

GENERAL RECOMMENDATIONS & STRATEGY

I. The City must identify and designate a Connectivity and Smart City Infrastructure Coordinator.
II. This position would oversee the design, engineering, contracting, installation, operations, and overall management and strategy of all investments and systems. This includes coordination with internal City departments, and 3rd party community stakeholders and partners.
III. The City should continue to engage a consultant to assist with oversight and implementation of the City's connectivity and smart city strategies and to supplement staff as needed.
IV. The City should not entertain or enter into any new conduit or fiber usage agreements until such time as all existing assets have been documented, and clear strategic direction has been determined as it relates to the City's participation in such agreements.

EXISTING ASSETS - UTILITIES UNDERGROUNDING CONDUIT PROJECT

I. Suspend the installation of telecommunications conduit in conjunction with the electrical undergrounding project, unless areas are specifically called out, and designed appropriately.
II. Immediately begin fielding assessment of existing conduit, fiber, and all assets installed along with the completed portions of the electrical undergrounding project to date.
III. Immediately begin fielding assessment of all conduits, fiber, and other assets available to support the City's smart city vision and future initiatives. These include conduits connecting existing traffic and street lighting infrastructure.
IV. The City should ensure that all as-builts, construction drawings, and fielding notes are aggregated into a single record, and digitized into GIS, and easily into a future Fiber Management System (FMS).

FROG AGREEMENT

I. Immediately obtain as-built specifications and location of backbone infrastructure installed by Frog, in its capacity of general contractor, contracted on behalf of the City.
    i. Identify all assets owned by City and Frog.
    ii. The City should inspect to confirm that all backbone infrastructure was installed per specifications in the agreement.
    iii. The City should determine if Frog has utilized conduit installed as part of the electric undergrounding project, beyond the backbone agreement.

PROJECT 1: FIBER BACKBONE EXTENSION RECOMMENDATIONS

I. The City of Winter Park should evaluate funding opportunities to expand the backbone as outlined then design and engineer an expanded fiber backbone to support key City priorities.
    i. Value engineer and utilize existing assets where possible.
    ii. Determine estimated costs, priorities, and timelines of phases.

iii. Determine if additional fiber is needed within the existing backbone conduit to supplement the City's existing 48-strands.
- Determine an efficient fiber allocation strategy for the use of existing 48-strands.
- Incorporate Wave Division Multiplexing "WDM" technologies to allow increased capacity across the existing 48-strands, if and where required.

PROJECT 2: WIRELESS OVERLAYS

I. Leverage the existing Sensus® AMI platform to support connectivity where possible, incorporating "low-hanging" opportunities that are supported by the system today.
II. Design and engineer new open architecture LPWAN platform based on LoRaWAN®.
   i. Determine cost, priority, and timeline.
III. Design and engineer a private LTE, CBRS high-speed wireless broadband system.
   i. Determine cost, priority, and timeline.

PROJECT 3: FIBER-TO-THE-PREMISES ACROSS WINTER PARK

I. The City should not consider a City-owned and City-operated full retail ISP model.
   i. Current financial projections do not support a sustainable business.
   ii. Emerging fiber providers create headwinds to creating a viable financial business.
II. A joint-venture model may provide a viable solution to deliver 100% fiber access in Winter Park.
   i. While this option might be viable, the City should focus on key smart city initiatives identified in this planning process.
   ii. Optionally, the fiber backbone extension should be designed to accommodate a potential FTTP system in target areas, based on need.

2. Market Analysis Summary

Magellan conducted an analysis of the connectivity and smart city landscape in the City of Winter Park from February to March 2023. These Key Findings of the Market Analysis provide a summary of our initial research and analysis, which are further detailed in Deliverable 1 - Telecommunication Environment and Market Analysis.

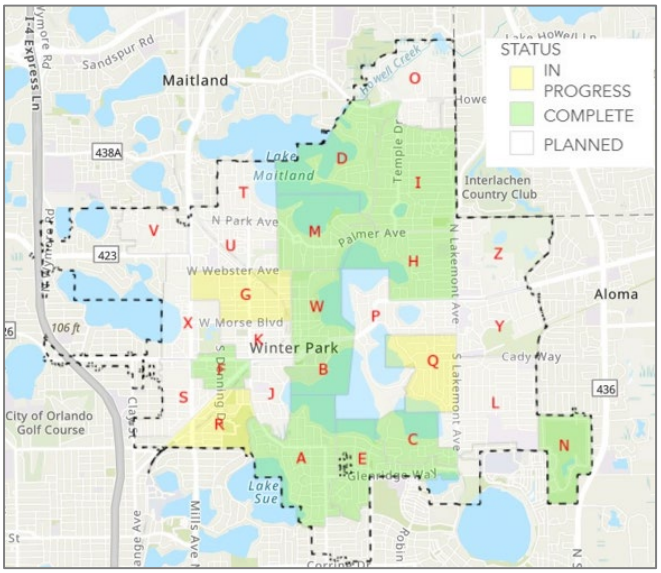
KEY FINDINGS:

I. Winter Park is served by Spectrum, which offers internet access over its hybrid fiber-coax network and holds a gigabit broadband monopoly in most parts of the city. Spectrum is preparing for a 10 Gbps electronics upgrade expected in late 2025 or early 2026.
II. Competition from 10 Gbps fiber-based broadband service providers is expected in the near term.
    i. Lumen has begun replacing *CenturyLink DSL* with FTTP (Fiber-to-the-Premises) distribution networks passing 900 locations. However, given what the City knows today, it cannot be assumed that Lumen will cover 100% of the city with FTTP services in their planned build-out.
    ii. Frog has limited fiber in the city, although they have publicly announced plans to serve the residential market with FTTP. At this time additional details for these plans have not been made available to the city's committee.
III. T-Mobile and Verizon are marketing fixed wireless broadband service availability with Verizon offering a gigabit service in limited locations.
IV. The construction phase of the city's backbone as part of The Private Fiber Network Construction and Maintenance Agreement with Frog is expected to be completed in August/September,2023. This connects eighteen key city facilities to a fiber backbone. This backbone forms the foundation of future fiber and wireless infrastructure expansions to support smart city technologies and use cases.
V. The IT conduit, deployed as part of the electric undergrounding program, has been poorly documented and has limited value to the city.
VI. Smart city use cases apply to every department, with four key pillars of focus emerging: Transportation, Public Safety, Utilities, and Enhanced Quality of Life. Each pillar will impact future connectivity needs.
VII. There are several foundational technologies and systems that are relevant across multiple use cases and centralizing them would reduce the City's Capital Expenditures (CapEx) and Operational Expenditures (OpEx). This approach would eliminate redundant technology silos and improve communication and data transparency.

EXISTING ASSETS - UTILITIES UNDERGROUNDING CONDUIT PROJECT

Winter Park is in the middle of an Electric Project where the City is funding the move of all electric utilities from above-ground poles to underground conduit banks. This will make the utilities' infrastructure less vulnerable to weather events like hurricanes, thus improving reliability. In conjunction with this project, they are also deploying a 2" conduit for future telecommunications use for the City or to be leased or sold to a private Internet Service Provider (ISP). Further, the City is installing another 2" conduit, paid for by Spectrum, where needed to aid their transition from overhead/aerial infrastructure to underground. The map on the right shows the undergrounding areas and the status of each area.

Figure 1 - Undergrounding Initiative Map by Status



The City has estimated that 60% of the project has been completed, and the remaining 40% will be completed over the next 7 years from this year, 2023. The vast scope of the City communication conduit could enable fiber deployment in the city quicker and cheaper.

Unfortunately, there is limited documentation available on the project, therefore the exact locations, amount, and quality of the conduit is unknown at this time, nor is the value of the conduit placed. The City should immediately begin a fielding assessment of the existing conduit, fiber, and all assets deployed with the Frog backbone project, as well as all other conduits owned by the City, to fully document and determine the value and usefulness for both public and private ISP purposes.

a) Recommendations

I. Suspend the installation of telecommunications conduit in conjunction with the electrical undergrounding project, unless areas are specifically called out, and designed appropriately.
II. Immediately begin fielding assessment of existing conduit, fiber and all assets installed along with the completed portions of the electrical undergrounding project to date.
III. Extend fielding to include the assessment of all conduits, fiber, and other assets available to support the City's smart city vision and future initiatives. These include conduits connecting existing traffic and street lighting infrastructure.
IV. The City should ensure that all as-builts, construction drawings, and fielding notes are aggregated into a single record, and digitized into GIS, and easily into a future Fiber Management System (FMS).

FROG PRIVATE FIBER NETWORK CONSTRUCTION AND MAINTENANCE AGREEMENT

In 2022, the City entered into a *Private Fiber Network Construction and Maintenance Agreement* with Frog[1] to construct a fiber backbone for the city. This project is connecting 18 City buildings and other assets over an expanded City-owned conduit and fiber network. The construction phase is expected to be completed in August/September of 2023. The result of this phase is the City owning all the conduit and 48 strands of fiber in the backbone segments. Frog has a license to deploy up to 1" of fiber in all conduits as part of this agreement and owns all fibers beyond the City's 48 strands. Once the project is complete, in order to properly close out the construction project, the City must ensure the final network is inspected, as-builts are properly documented.

The second phase of this initial agreement is a 10-year maintenance contract. On-going maintenance and repairs on the conduit will be shared 50-50%, and the fiber maintenance costs will be shared pro-rated based on the percentage ownership of the fiber strands in the conduit. For example, if there are 144 fiber stands in the conduit (48 City and 96 Frog) and they all get damaged, the fiber repair costs will be split 33% City/67% Frog, while conduit repair costs will be split 50% City/50% Frog.

The current agreement does not provide for access to any conduit beyond the backbone routes identified in this initial agreement, as is documented in the exhibits supporting maps.

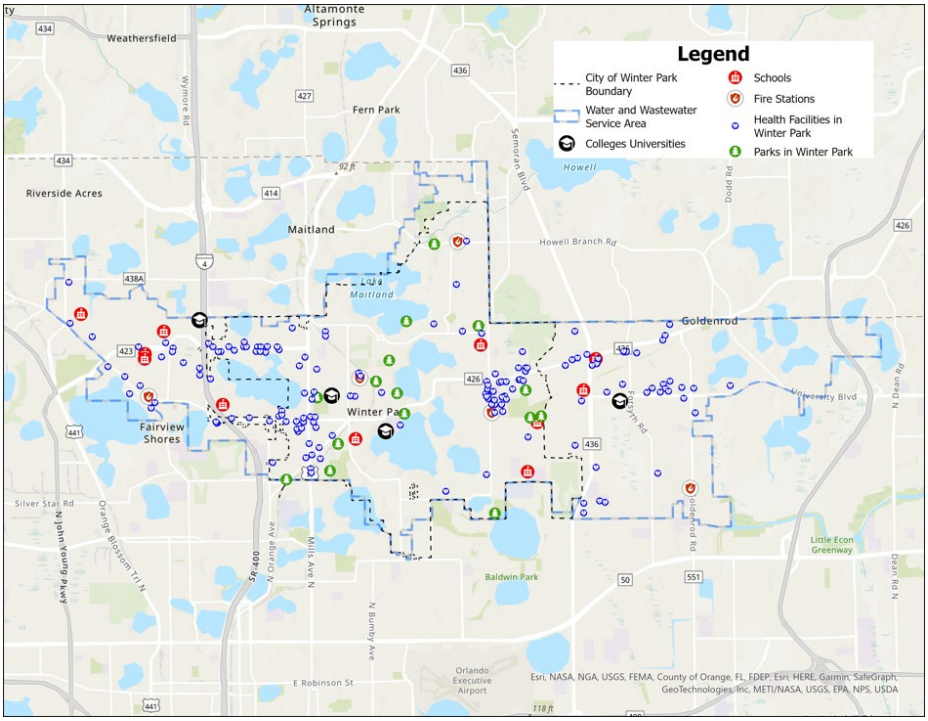
a) Recommendations

I. Immediately obtain as-built specifications and location of backbone infrastructure installed by Frog, in its capacity of general contractor, contracted on behalf of the City.
    i. Identify all assets owned by City and Frog.
    ii. The City should inspect to confirm that all backbone infrastructure was installed per specifications in the agreement.
    iii. The City should determine if Frog has utilized conduit installed as part of the electric undergrounding project, beyond the backbone agreement.

3. Connectivity Analysis & Environmental Scan

Magellan analyzed the current connectivity needs of the City and estimated its future needs. The future needs were established based on interviews with City and community leaders, global technology trends, and emerging applications and use cases. The current goal and objective of the City is to economically connect City sites, facilities, assets, and important public spaces, illustrated in the figure below, and to drive private investment in network infrastructure and services, while ensuring Winter Park is a thriving smart city well into the future.

Figure 2 - Winter Park Points of Interest Map (facilities, sites and assets)



These connections are located within the municipal limits, as well as the City's utility boundaries for water and electric services. City departments also require multiple, independent secure networks for public Wi-Fi, CJIS (Criminal Justice Information Systems), traffic, and, utility SCADA (Supervisory Control and Data Acquisition) requirements. The City also requires various wireless connections for automation, remote metering, telemetry, and related applications for its fleet, traffic management, and utility operations. The fundamental requirement is for an expanded fiber network (beyond the 18 sites being connected today), to traverse the City of Winter Park underground in a conduit bank, physically interconnecting all municipal sites including wireless access points and gateways. The City's primary sites – which are currently connected to the City's backbone, are listed below in Table 1.

Table 1 - City Backbone Connected Sites

City Sites	
City Hall	**Azalea Lane Rec Center**
Public Safety	**Fire Station 62**
Public Works Compound	**Fire Station 64**
Library & Events Center	**Showalter Field**
Lake Island Rec Center	**WP Estates Wastewater**
Canton Electric Substation	**Interlachen Substation**
Wymore Water Facility	**Aloma Water Plant**
Farmers Market	**Magnolia Water Plant**
Community Center	**Train Station**

The City is likely to connect many core sites, traffic, utility, and other key assets via the network that are not currently connected today. To achieve the objective of economical connectivity, the network will have to interconnect City–owned wireless communications towers to create a complimentary high-speed wireless overlay network.

BROADBAND TELECOMMUNICATIONS INDUSTRY TRENDS AND ASSOCIATED EMERGING TECHNOLOGIES

There are multiple global telecommunications industry trends and emerging technologies that have implications for Winter Park and its goals. These apply to both wireline and wireless technologies for smart cities and broadband. The trend of municipalities deploying their networks, as discussed in the section below, and the emergence of smart cities are possibly the most important trends for Winter Park. The general growth of data and increasing use of cloud services, which drive demand for data center capacity, could impact Winter Park on several fronts. Other major industry trends in telecommunications include ongoing network "densification," continued roll-out of "5G" services by cellular telephone companies, and increasing deployment and use of low-power wide area networks (LPWAN). Mergers and acquisitions occur regularly within the industry, along with efforts to expand into lucrative markets for fiber and wireless and to exit high-cost/low-demand markets.

a) Smart Cities

Many cities are deploying technology to automate operations. The purpose is to attract and engage businesses and citizens, as well as operate more efficiently. Smart cities involve multiple technologies, each of which is a trend in its own right. Some of these include:

ADVANCED METERING INFRASTRUCTURE (AMI) AND SMART GRID – A smart grid is a utility distribution network that uses digital technologies to detect and respond to changes in demand and supply. It can also automatically address faults or changes in water pressures and can even redirect resources for special purposes such as emergencies. Pioneered in electricity distribution, these technologies are now common in all utilities in the form of advanced metering infrastructure.

ADVANCED WIRELESS – Wireless technologies are evolving rapidly. Fifth-generation cellular data service, known as "5G," may be the most known of these. Wi-Fi has multiple new versions for a variety of

applications, from super-fast/short-range to low-speed/long-range connections. There are various standards and technologies for LPWAN for the Internet of Things (IoT). Part of the advance in wireless options comes from the federal government opening up additional radio spectrum with relatively light and flexible licensing requirements for data connections.

CYBER-SECURITY – Computer system break-ins, data breaches, and ransomware are all too common. While it is quite practical to secure these systems, it is nearly impossible to stop any potential threats. Hackers have found that lax practices and helpful people can be the easiest way into secured systems. Consequently, cyber-security practices and tools continue to evolve into more comprehensive as well as focused solutions.

E-GOVERNANCE – Technology can improve governance, but it too must be governed. eGovernance means making government more open and accessible and involving more citizens in public services, almost like "crowd-sourcing." It also means ensuring that all technology initiatives (along with other aspects of government) are aligned with public priorities and have clear, meaningful results.

INTELLIGENT TRANSPORTATION – Vehicles already have a great deal of intelligence built into them for regular operation, diagnostics, and emergencies. Intelligent transportation extends this by interconnecting vehicles in all modes of transportation, feeding them data, and enabling them to sense traffic and weather conditions, and aggregating all this data for travelers to make optimal decisions about how and when to travel. The foundation of intelligent transportation are sensors and controls built into transportation infrastructure.

INTERNET OF THINGS (IOT) – Most modern devices, from appliances to vehicles, have digital control and monitoring systems. It is also becoming quite economically and technically practical to deploy sensors for almost anything. All these devices generate data that must be collected and analyzed to be useful. Many of them also control physical systems much faster and more precisely than prior control systems. This can allow for automating activities, avoiding problems and risks, and huge cost savings. Connectivity and security are essential.

SMART BUILDING/SMART HOME – The combination of sensors and servo controls integrated into building access, HVAC and lighting systems, functional spaces, and storage transforms the places in which we live and work. Energy efficiency was a leading application that has been supplemented with security. Similarly, we can expect a prior focus on comfort and convenience to evolve into more practical and productive uses. For example, a smart building could direct persons to safety in an emergency, or order pizza for a team working late.

EHEALTH – Health and wellness have been impacted on all sides by technology. eHealth refers to software tools for maintaining wellness as well as advanced systems for operating health programs. For example, patients can consult caregivers and generalists can consult specialists flexibly and efficiently via secure multi-media conferences. Devices can track vital statistics for first responders and everyday citizens and make it easy for them to analyze and share that data. The data in these systems must be kept private but still accessible and usable.

LEARNING TECHNOLOGIES – Human knowledge is commonly augmented by ready access to information. Googling to get an answer is a simple example. Behind such activities are huge amounts of data, sophisticated algorithms, and artificial intelligence that can discern patterns that would be lost on humans. All of this is being integrated into smartphones and other devices that allow highly tailored, all the-time-anywhere learning by virtual teachers that can assess performance and adjust content accurately and rapidly.

Industries important to Winter Park have parallel "smart" trends, too. Retail is exploring automated checkout, assistive robots, beacons, and other technologies, while educational organizations including Rollins are also focused on similar trends and concepts such as Smart Buildings, and in general a Smart Campus.

b) Big Data, Cloud Services, and Data Centers

The amount of data traveling over the internet has increased exponentially for nearly three decades, and it is just the tip of the iceberg. Enterprises of all sorts and sizes are using more and more data, which must be acquired, processed, stored, and used. This "big data" as it is often called, has driven demand for processing and storage capacity distributed across the network for quick access, called "cloud" services or just "the cloud". The industry's data shows that 94% of all enterprises use cloud services and the global market for cloud services will reach $832.1 billion by 2025, and over 40% of that will be private, non-internet connected clouds. More than just raw growth, there is increasing investment in both huge, "hyper-scale" data centers and smaller "edge" data centers for niche markets, like those being deployed in and around Winter Park.

c) Network Densification

Densification involves deploying as much network capacity into an area as is economical for the dual purposes of acquiring as many customers as possible and meeting network users' increasing bandwidth demands. One aspect of this trend is simply more fiber in the ground and on poles. Directional borers and fiber splicing trailers have become common sights in areas experiencing this trend, including in Winter Park, as providers tend to target affluent communities, including major metros. Investors require relatively short payback on access networks, which is where much of the costs occur. Backbone, distribution, middle mile, and long-haul networks serve larger markets consisting of many access networks as well as higher-value customers such as access providers and major enterprises.

Another aspect of network densification is higher bandwidth services at lower costs. This is because densification tends to be driven by competitive opportunities, particularly insurgent providers, including the trend of local power companies and municipalities entering the broadband market around the country. Rapid population growth, especially among high-income households, can also drive densification to meet customer requirements and/or foreclose competitive entrants. These dynamics are most evident in dense, dynamic, and wealthy urban areas where insurgents can most easily gain market share. Generally, providers seek to squeeze as much utilization and revenue from existing infrastructure and only invest in response to events that erode their margins such as competitive market entrances and/or failure to meet service level agreements.

d) Rollout of 5G cellular

While much of the densification in recent years has involved fiber, that trend is now extending to cellular via "5G." Nominally, 5G cellular telephone service is a set of standards (which are not expected to be consistently applied) and totally new radio systems using different spectrums. In the past, cellular providers have focused on geographic coverage; 5G operates under the same economic forces as fiber densification, driven by the combination of competitive threats and bandwidth-hungry customers. True 5G is hitting the market and is limited to dense, affluent markets. Providers are still deploying 4G in small cells to accommodate more customers using more bandwidth. Like 5G, the 4G small cells require short towers and abundant fiber in high-traffic areas, which essentially paves the way for 5G. Due to economics, 5G is unlikely to be deployed in rural or even suburban areas in the foreseeable future. 5G's physical layer uses a relatively high-frequency radio spectrum, which gives it more inherent capacity but also shorter ranges. It also uses a different antenna and manages power differently than earlier protocols to better capitalize on and minimize issues with this spectrum. Its encoding scheme is more efficient than 4G and has lower latency. The network layer can support various access protocols, including Wi-Fi, and can be used to support low-frequency, long-range, wireless low-power wide-area networks. The 5G core network, which registers devices (called UE or user equipment) and allows them to move from cell to cell, maybe a more radical change than 5G's physical protocols. It enables whole new classes of services and applications, many of which focus on machine-to-machine communications.

e) Evolution and Growth of LPWAN

Low-Power Wide Area Networks (LPWANs) continue to expand, particularly into public space. They are designed to communicate over long distances (10+ km), use very little power, and handle small amounts of data for monitoring and controlling devices. Hampered by proprietary standards in the past, LPWAN now has multiple non-proprietary open standards, including LoRaWAN®, DASH-7, cellular-based NB-IoT, Weightless, and Wi-Fi-based HaLow.

NB-IoT has the largest market base as it is deployed over cellular networks and works in conjunction with 5G and older cellular network technologies. The availability of radio spectrum remains an issue. There are unlicensed Industrial, Scientific, and Medical (ISM) and Unlicensed National Information Infrastructure (U-NII) radio bands, used by Wi-Fi, LPWAN, and many other technologies. "White space" bands within the television spectrum were opened up by the FCC in 2010 for rural internet access, avoiding interference with broadcast signals. The FCC opened up the Citizens Band Radio Service (CBRS) for data connections in 2015 with three tiers of use: unlicensed General Authorized Access (GAA), up to seven Priority Access Licenses (PAL) per county and protected Incumbent Access. These PAL licenses were auctioned off by the FCC in Sept of 2020. Verizon spent the most on PALs bidding at 1.8 billion dollars. Dish and Charter Spectrum purchased the most PALs but spent less than Verizon. Increasing the use of the limited radio spectrum is itself densification and drives fiber densification for backhaul to the internet and offloading of excess traffic.

f) U.S. Market Dynamics

The telecommunication industry is going through a massive wave of public and private investments driven by ensuring every American is connected to fiber. AT&T has stated they have passed 25 million locations

with fiber in their current operating footprint and will pass 5 million more by the end of 2025. They have also entered into a multi-billion-dollar joint venture with BlackRock, called Gigapower, which is targeting to pass an additional 30 million locations with fiber outside of AT&T's traditional wireline territory. Gigapower will operate as an open access network with AT&T being the first customer. Comcast and Spectrum are upgrading their outside plant to be ready for DOCSIS 4.0, the next big cable modem technology upgrade. The first deployments are planned for late 2025. DOCSIS 4.0 will enable multi-gigabit symmetrical[1] service to compete with full fiber networks. Comcast and Spectrum have also introduced new connectivity bundles consisting of internet, whole-home and national Wi-Fi, and 5G mobility. Other incumbent *telcos*[2], such as Lumen, Frontier, and Consolidated, have also announced large fiber deployments in their territories. The incumbents, large and small, are trying to fend off new private equity-funded entrants that are building all fiber networks in their areas. The new entrants are racing to be the first fiber company to compete with the gigabit cable company in each market. Rising interest rates and aggressive posturing by the incumbents have slowed funding for new fiber entrants.

g) Public-Private Partnerships (P3)

Some local governments have sought to drive additional investment in both advanced wireless and wireline broadband access, via P3s. For example, the City of Rancho Cucamonga, California, has developed a partnership with a regional triple-play fiber-based Internet Service Provider (ISP) to utilize existing and newly constructed conduit and fiber assets to support a fiber-to-the-premise deployment, targeting businesses, greenfield residential developments, and community anchors. Generally, such P3s involve the private partner utilizing public assets for distribution and customer premise drops for access. This reduces the provider's cost of entry and upfront capital requirements, allowing them to invest incrementally to meet demand or to roll out services in phases over time. Some municipalities, such as Ammon, Idaho, own the entire network, operate it on a neutral, open basis, and charge providers a per-subscriber fee to serve businesses and residents.

Local power distributors, particularly municipally owned, have been active entrants into broadband markets, as have electric membership coops, although at a slower rate. Large, multi-state or statewide, privately held, vertically integrated power companies are not venturing into the business for the most part but have been known to partner with local governments on the issue. Wireless may be a prime but is also an unexplored area for such partnerships as private utilities have connectivity needs, and often assets as well, and may see local public sector customers as a low-risk opportunity to test the telecom waters.

h) Factors Behind the Trends

It is important to understand what is behind these trends. Technological advancements, as well as digital media growth, are mutually strengthening the demand for better efficiency and organizational effectiveness. For instance, the use of social media has skyrocketed. With it, online material has grown at an exponential rate. New applications (apps) emerge regularly, then expand, capitalizing on niches or types of content, such as 10-second videos or 140-character messages. The enterprise software evolution has

[1] Symmetrical – pertains to the equal download and upload speeds is Mbps or Gbps
[2] Telco - telecommunications company

been even more rapid, particularly with cloud computing and software-as-a-service. Meanwhile, devices are getting smaller, more powerful, and less expensive. Powerful environmental sensors, for example, can now be purchased online for less than $150 retail, and sensors for almost any purpose can be purchased in bulk for a few dollars apiece. Similar trends are apparent in intelligent speakers, smart TVs, and building controls.

New applications, uses, media and forms of content will emerge as the technologies evolve, which will drive further evolution in the technology as people use (or not) the applications. Smart city applications and the general need for data analytics and operational support are such drivers for municipalities. The anticipated results for taxpayers drive technology investment, which then creates new ways for cities to use and benefit from technology. Being revolutionary is not necessarily desirable, especially for the public sector. But investment and returns flow to innovators who adopt these technologies. This means cities should seek to attract and support these innovators. They should consider becoming their partners or customers. Cities should not become too dependent on specific technologies in case they fail to gain significant momentum.

Fiber infrastructure can enable Winter Park and other cities to capitalize on these trends—as they meet internal requirements, control recurring costs, and become more responsive—if it is approached as a platform for innovation and improved operations. All the trends point to increasing demand for bandwidth because that's what businesses and consumers use to interact. Any investment that substantially impacts the local economy is therefore likely to require fast, flexible connectivity. The City's network assets could give the city a rare, distinct asset for such prospects, especially within targeted industries (Professional, Scientific & Technical Services, Health Care, and Finance). Municipal technology use not only meets public expectations based on the trends, but also shows technology-based companies that they are among peers and belong in the area.

CURRENT FEDERAL AND FLORIDA STATE LAWS, POLICIES AND REGULATIONS ON COMMUNICATIONS SERVICES OFFERED BY GOVERNMENTAL ENTITIES – F.S. 350.81

The State of Florida has the same legal barriers (F.S. 350.81) in place as discussed in the City's 2016 Broadband Assessment. Overall, these barriers continue to affect Winter Park's ability to provide retail telecommunications services directly to its residents and businesses.

To date, the City of Winter Park does not hold any certificated status from the State and therefore would be prohibited under F.S. 350.81 from offering retail services as a telecommunications provider without undertaking the required process. Should the City of Winter Park decide that retail service is the optimal business model, it would have to file with the State of Florida Public Services Commission (PSC) and would have to follow the various provisions of F.S. 350.81, as noted below.

F.S. 350.81 of the Florida Statute imposes procedures and certain operating practices for counties, cities, or other specified governmental entities that sell cable or telecommunications services, including wireless services. These terms are specifically defined as follows:

- "Communications Services" includes any 'advanced service,' 'cable service,' or 'telecommunications service' and shall be construed in the broadest sense";

- "Advanced service" means high-speed-Internet-access-service capability over 200 kilobits per second in the upstream or downstream direction, including any service application provided over the high-speed-access-service or any information service as defined in 47 U.S.C. Section 153(20)";
- "Cable service" is defined using the definition in the FCC's governing statutes at 47 U.S.C. Section 522(6);
- "Telecommunications services" means the transmission of signs, signals, writing, images, sounds, messages, data, or other information of the user's choosing, by wire, radio, light waves, or other electromagnetic means, without change in the form or content of the information as sent and received by the user and regardless of the facilities used, including without limitation, wireless facilities."

Below is a summary and comments on the steps and requirements outlined in F.S. 350.81:

- The City must hold at least two public hearings with specifically prescribed notice provisions.
- The City must include specifically prescribed content for the public hearings including factors that can be difficult to demonstrate since the information is held by the broadband providers themselves such as details on where service is or is not available, where service providers plan to provide service, etc.
- The presentation must include the provision of data showing "the private and public costs and benefits of providing the service by a private entity or a governmental entity, including the effect on existing and future jobs, actual economic development prospects, tax-base growth, education, and public health", data which no other provider must create, gather, or defend to provide service.
- The presentation must include the provision of a written business plan in public showing details, which again no other provider must publicly disclose to provide service, which provision provides a road map to existing service providers to stunt the success of the City's planned telecommunications initiative.
- The presentation must include provision of "a plan to ensure that revenues exceed operating expenses and payment of principal and interest on debt within four years" which no other provider must create or publicly disclose.
- Required findings for vote by the Commission or Board.
- Annual review of operations in a formal public meeting.
- Restrictions on bonding for capital costs including referendum requirements.
- Public hearing if revenues do not exceed operating expenses and payment of principal and interest after four years with the mandated decision on four specific options.

4. Current and Future Needs of the City

The demand for broadband infrastructure is projected to rise substantially due to increasing internet traffic, especially from mobile devices and bandwidth-intensive applications. Trends indicate a shift towards wireless connectivity with a focus on localized capacity, necessitating denser radio access networks, robust core networks, and significant demand for fiber-optic infrastructure to manage the expected surge in data transmission.

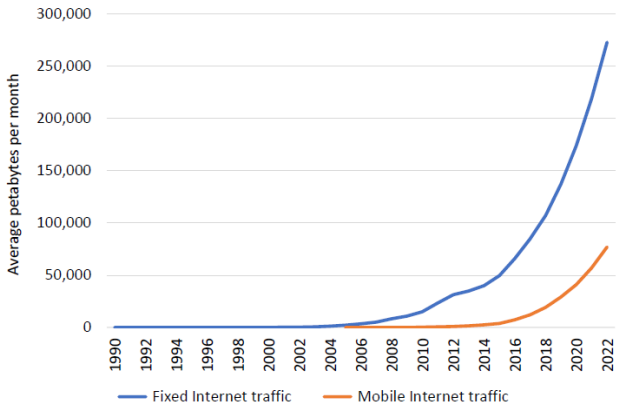
The following sections explore how various cities within the country successfully rolled out their broadband and wireless infrastructures. They also discuss how they adapt to diverse economic and geographical settings and emphasize the significance of broadband for communities and its role in ensuring cities are future-proofed and prepared for any smart city initiatives.

ASSESSMENT OF THE FUTURE DEMAND FOR BROADBAND INFRASTRUCTURE

Demand projections for technology are notoriously difficult. When the worldwide web was created 30 years ago, leading thinkers doubted we would ever read the newspaper, shop for groceries, or watch movies online. Today such activities are common, creating ever-increasing internet traffic along with bandwidth-intensive business applications. There are clear trends. The challenge is to localize them, especially since we have no historical data on local broadband demand. Therefore, we use projections for local demographic change in combination with internet forecasts to estimate future demand.

Internet traffic from fixed locations has increased exponentially since the turn of the century, as shown in the figure on the right, and mobile internet traffic has been on a similar path since 2012. Much of the growth has been related to video, which has been steadily increasing and now accounts for over a quarter of all time spent online. Generally, that use has shifted from desktop devices with fixed connections to mobile devices. Internet use among adults has steadily increased over the last 20 years, as has home broadband use, to the point that 90% of adults are online, 96% have cell phones, and 73% have broadband at home. The Census Bureau estimated that 89.4% of homes in Winter Park had internet as of 2017-2021 reporting, compared to 87.2% for all of Florida, and 87% for the United States as a whole.

Figure 3 - Annual Internet Traffic[1]



Statista[3] forecasts that 96.01% of the United States population will have access to the internet by 2028, thereby driving internet access growth at a base rate of about 4.2% annually, as projected by Cisco Systems[4]. The number of devices per person in the United States increased to 13.4 from 8.2 with an average of 586.7 GB[5] broadband data usage per household in 2023. Statista forecasts that between 2023

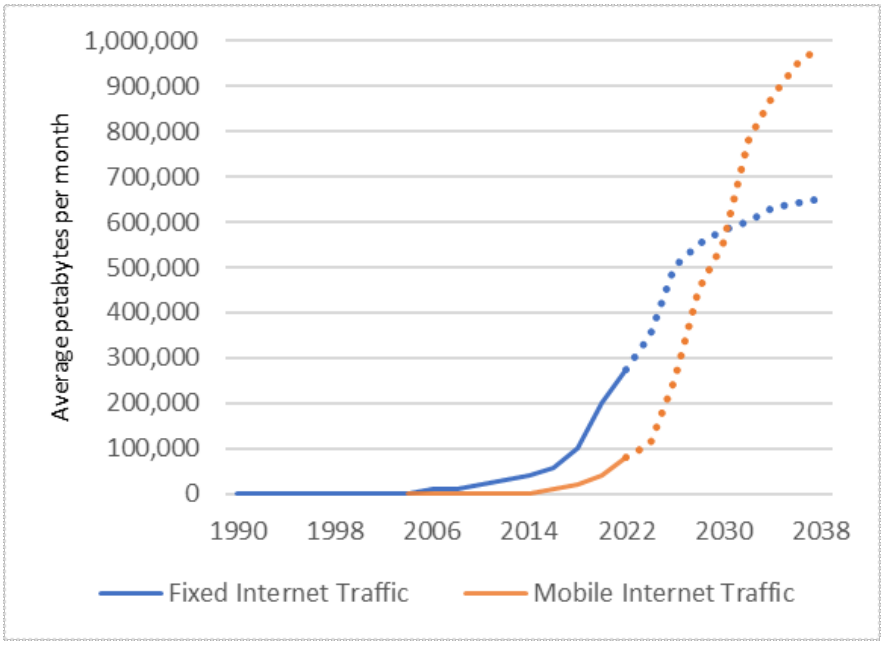
[3] Statista - an online data platform
[4] Cisco Systems – a network equipment producer
[5] GB – Gigabit is a unit measurement for data

to 2028, there will be a 7% total increase in fixed internet traffic and a total of 6% increase in mobile internet. Speeds will increase too, according to Cisco.

For businesses, internet use, including online sales, ad spending, and time online all continue to increase, although the rates of increase have slowed in recent years. However, the telecommunication industry is increasingly focused on capacity in particular areas rather than expanding coverage. More cities are expected to invest in Smart City technologies "due to the rising awareness about smart technology and the concept of smart cities has also been a gathering of all advanced technologies to enhance the living conditions of the residents." Globally, the $748.5 billion market for smart city solutions is expected to increase by about 25.8% between 2023 and 2030, with North America covering 30%, the largest market share globally. Newer technologies such as augmented reality, big data, IoT devices, and massive multiplayer games are likely to feed the demand for connectivity by end-users and the companies that operate them.

All signs point to an especially strong demand for wireless connectivity, as illustrated in the figure below. This means denser and more expansive radio access networks, more robust core networks, and more need for fiber-optic infrastructure, even as the amount of bandwidth squeezed from the electromagnetic spectrum continues to increase. There will be more people sending and receiving more data, most of it wirelessly means, placing more demand on the limited radio spectrum. This means the geographic footprint of wireless access networks will have to get smaller, requiring more fiber for interconnecting radio access points.

Figure 4 – Projected Internet Traffic Growth[6]



[6] Magellan projections are based on Cisco's data and standard technology diffusion patterns.

a) 2025 Projection

Aggregate traffic on the internet will continue to increase in the near future as the number of devices per person increases. Based on increasing bandwidth demands and trends it is expected to reach 175 zettabytes[7] by 2025, a 3-fold increase from 2020 where 59 zettabytes had been created[8]. While bandwidth-hungry applications are bound to increase, many of the devices that will be added to the Internet of Things (IoT) generate and use relatively little data. The implication is that the number of connected "things" will explode by 2025. Norton[9] predicts there will be more than 21 billion IoT devices by 2025.

b) 2030 Projection

Experience and research show that the adoption of technology like broadband tapers off over time. At the same time network equipment will evolve to handle the huge number of devices, in part with edge processing and software-defined networking. We expect computing power to continue diffusing into the internet, making it more adaptive, dynamic, and flexible. Indeed, the internet is likely to become a multitude of special purpose networks that arise ad hoc, as needed by the intelligent systems that will be firmly in place in a decade.

c) 2040 Projection

Quantitative projections for 20 years from now are not substantively meaningful. Futurists and tech visionaries anticipate a network that is transparently integrated into everyday life. Users will have complete and intuitive control over their "infosphere" for which data as much as cables and antennae will be infrastructure. The structure of the internet will be fully decentralized as innovations such as optical and quantum computing will transform it into an infinitely faceted platform. Networks will be spawned within it as needed, along with applications they support, and disappear or morph as needs change. Antenna and other access infrastructure will be integrated into the built environment in much the same way computing power becomes part of the network. Cities will become truly smart as computing power becomes an integral part of their buildings, roads, and other physical assets. Demand by 2040 involves a fundamental transformation in architecture rather than just an increase in the amount of data, number of devices, or size of the user base.

CONNECTIVITY PROJECTIONS RELATIVE TO WINTER PARK NETWORKS

Cisco's Visual Networking Index[10] (VNI) forecast relies upon independent analyst forecasts, real-world network usage data, and Cisco's estimates for global IP traffic and service adoption. Over its nearly 15-year history, their research has become a highly regarded measure of the internet's growth. National governments, network regulators, academic researchers, telecommunications companies, technology experts, and industry/business press and analysts rely on the annual study to help plan for the digital future. Considering the consistent historical trend of IP traffic growth, it is clear all Winter Park City

[7] Zettabyte – a unit of measurement used to represent device's storage or capacity
[8] Data Centers Around the World: A Quick Look (usitc.gov)
[9] Norton, *The future of IoT: 10 predictions about the Internet of Things*, https://us.norton.com/internetsecurity-iot-5-predictions-for-the-future-of-iot.html
[10] Cisco Visual Networking Index, *Forecast and Trends, 2017–2022 White Paper*, https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-indexvni/white-paper-c11-741490.html

departments and their networks will continue to see sustained growth of their enterprise IP network traffic as applications, technologies, and operations continue to evolve.

Enterprise IP traffic growth is typically driven by both near-term IT service/application changes and long-term industry trends in sector-appropriate technologies and operations. For the City of Winter Park, the move of applications and data into the cloud, the increased use of video in education/training, and the future deployment of smart city services will drive both internal and external bandwidth across the City's networks. Given the criticality of remote cloud-based resources, it is common practice to ensure at least two path-diverse routes to two major interexchange points (IXPs). This is often accomplished using two ISPs to ensure redundancy.

CRITICALITY OF FIBER BROADBAND AS A KEY COMPONENT OF MUNICIPAL INFRASTRUCTURE

Assessments of criticality are even more fraught than technology forecasts because importance is highly subjective. For this and the next sub section, we consider deployment and use as indicators of importance. Numerous cities and counties are deploying broadband infrastructure. According to information compiled by the Institute for Local Self-Reliance[11]:

- 196 communities have some fiber-based service available via a publicly owned infrastructure
- 150+ communities in 29 states have publicly owned networks offering at least 1 gigabit services, and 20+ communities in 4 states have municipal networks delivering 10 gigabit services.
- 120+ communities have publicly owned dark fiber available
- 109 communities have citywide fiber-to-the-home via 55 publicly owned networks.

We have selected six cities for comparison, listed in the table below. While there are some differences in socioeconomic characteristics, each has a combination of economy and geography that is similar to Winter Park. This table provides background information for comparison purposes, showing how Winter Park generally relates to the other case studies. It shows that broadband can be critical infrastructure across a variety of locales, Winter Park is in the mid-range of the variety, and that positive impacts were realized in larger, small, more, and less affluent areas.

Table 2 – Comparable Cities with Publicly Owned Fiber-Based Broadband Infrastructure (2022 Data)[12]

Community	Population	Median Age[13]	Median Household Income	Poverty Rate	Number of Employees[14]	Median Property Values
City of Winter Park, FL	29,795	45.3	$80,500	12.7%	600+	$492,100
City of Santa Monica, CA	91,885	40.2	$99,847	5.4%	1000+	$1,484,500
City of Hillsboro, OR	105,909	33.9	$91,540	5.1%	780+	$386,700
City of Rancho Cucamonga, CA	176,482	36.8	$97,046	6.3%	500+	$551,700
City of Chattanooga, TN	184,086	37	$50,437	17.6%	2,500+	$189,500
City of Huntsville, AL	215,006	35.8	$60,959	14.6%	2,400+	$194,500
City of Lakeland, FL	358,000	40.9	$52,972	11.9%	2,500+	$171,700

[11] https://muninetworks.org/communitymap
[12] https://www.census.gov/quickfacts
[13] https://data.census.gov/table
[14] These numbers include both full time and part time employees

a) City of Santa Monica, CA

Before 2000, the City of Santa Monica began laying underground fiber-optic infrastructure as a WAN replacement for City sites and facilities, then by 2006, they began leasing dark fiber to businesses. Their network has been expanded and upgraded throughout the years through an on-demand strategy to ensure efficient use of funds. In 2010, they trademarked Santa Monica Net, which served more businesses and institutions across the city. It is important to note, by 2012, the tech-community in the city has grown significantly, and Santa Monica had become known regionally, as the "Silicon Beach". Because of their continued success, and growth in revenues, they launched their gigabit broadband service to city residents in 2015.

The City's municipal networks are also effective in providing affordable means for sustaining current and implementing new smart city initiatives. On the City's wireless networks, they are currently offering free public internet through their extensive Wi-Fi system. Today, they have more than 600 wireless access points mounted on streetlights and traffic signal poles that also support their smart public safety, smart traffic, and smart parking initiatives. In summary, Santa Monica's health, education, public safety, mobility, and economic vitality thrive because of the fiber network investments that have been made over the last 2 decades.

b) City of Hillsboro, OR

In 2018, the City of Hillsboro embarked on a fiber backbone project in collaboration with Hillsboro City Schools, to interconnect key city sites and facilities across Hillsboro. The backbone was also planned with sufficient capacity to support a Fiber-to-the-Home project, to provide next-generation high-speed broadband across the community.

By 2020, Hillsboro had completed the backbone project, then proceeded to bring fiber to the home in the same year. The City's ISP was launched as Hillsboro HiLight, providing residential and commercial internet and voice services, with a 1 Gigabit offering at $55.00 per month.

The City of Hillsboro is cash flowing the project through a General Fund appropriation of approximately $5M-$6M per year – and because the City had expedited the project, the originally 10-year roll out is expected to be completed only within 7 years. The City has also secured and utilized funds from several grant programs such as the Gain Share program and American Rescue Plan Act (ARPA) to support its investments.

c) City of Rancho Cucamonga, CA

In 2016, the City of Rancho Cucamonga embarked on the development of a broadband and smart city program which included significant amounts of fiber expansion that would make use of existing broadband assets (fiber/conduit/poles), while providing a roadmap for further expansion of the existing network. Rancho Cucamonga was in an advantageous position as they have its own electric and underground utilities department, Rancho Cucamonga Municipal Utilities (RCMU), comprising of extensive underground telecommunications assets, including traffic conduit, telecommunications conduit, and fiber-optic cable. In

addition, RCMU owns over 18,000 streetlight poles within the city's right-of-way, which is becoming more common amongst local governments today.

The expanded network continues to serve the City's municipal departments and public facilities, and it has provided long-term cost savings for its connectivity throughout the city's footprint. The network has introduced new high-speed fiber-based broadband services in areas it has been deployed and is supporting innovations as they are commercialized through the Internet of Things (IoT).

The city's fiber footprint has increased from about 23 miles to nearly 75 miles after the 7-year Plan timeframe. Through this program, the City has funded all Capital Expansion costs, including in facilities and equipment, and contracts with a P3 ISP partner who is responsible for all aspects of ISP services. The City of Rancho Cucamonga collects up to 60% of all revenues generated from Internet or network transport services, while the P3 ISP keeps 40% of revenue from these services, and 100% of all value-added services it offers like voice and video services.

d) City of Chattanooga, TN

In 2010, the City of Chattanooga, through its Electric and Telecommunications Utilities, EBP of Chattanooga started offering 1 Gbps symmetrical speeds of fiber to its citizens, thus being called the first "Gig City". In 2015, the City started offering 10 Gbps symmetrical speeds and 25 Gbps in 2022 city-wide. The City is spearheading community-wide high-speed internet services. The City not only continues to draw national but global recognition and attention.

Looking back, in 2008 the City approved the construction of its Smart Grid which required high bandwidth and reliable broadband networks. By 2010 the City has completed a 9,000-mile community-wide fiber backbone that connected all the City sites, more than 175,000 homes and businesses within the city limits.

e) City of Huntsville, AL

In 2016, the City of Huntsville's Utilities, in collaboration with Google Fiber, started working on its fiber network to become a Gig City. In 2021 they received the "Gig City Award" by the broadband community at Fiber Connect, for its accomplishments in world-class broadband delivery. The city being home to defense and aerospace innovations that first set a man on the moon gave its name the "Rocket City". Huntsville even today, is outliving its reputation of being a leading innovation hub for the country's top technological workforce by providing a reliable and sustainable connectivity infrastructure.

Huntsville Utilities leases fiber within its distribution network or on its fiber rings and also leases colocation space within its fiber huts deployed across the city. Huntsville utilizes a lease-back model, whereby the City builds, owns, and operates the fiber network to connect its sites and facilities, and those of its partners, like the City government, while also leasing capacity to ISPs. Huntsville's model charges a per port cost per passing and has a Low Density/Low Volume cost, as well as a High Density/High Volume cost which is associated with how much of the city a provider plans to serve.

f) City of Lakeland, FL

In 2015, the City of Lakeland (population 120,000) which owns a municipal electric utility, Lakeland Electric with over 100,000 meters and a 300+ mile fiberoptic network, explored a range of options to provide broadband services within its community. It reviewed business models which included dark fiber, open access, as well as direct retail services.

By 2018 the City has received an unsolicited bid from Summit Broadband, a competitive Florida-based fiber ISP, to partner with the City, utilizing its existing assets, including its fiber backbone and its extensive electric pole line assets which span the city, and its electric service territory. The City of Lakeland proceeded with this partnership, and Summit began construction in 2020. The City has a $100,000 base lease fee associated with the use of excess fiber capacity from its existing fiber backbone, from which Summit will construct fiber distribution. Summit will attach to Lakeland Electric poles, paying pole attachment fees, and will provide a small revenue share to the City once it exceeds its project targets – which are unknown at this time.

THE IMPORTANCE OF BROADBAND INFRASTRUCTURE FOR MUNICIPALITIES

The evidence presented above suggests that broadband infrastructure is essential to cities. They depend on the infrastructure to operate the government. Loss of broadband would effectively shut down the cities. Fiber-based site interconnection and shared internet access enable municipalities to communicate and share information internally and externally. Similarly, broadband is vital for business and necessary for attracting and retaining industry. Indeed, these cases suggest that broadband can provide a competitive advantage for cities of all sizes. The importance of broadband is evident in the extent to which many cities, exemplified by the cases described above, have invested directly in this infrastructure.

CRITICALITY OF A WIRELESS OVERLAY AS A KEY COMPONENT OF A MUNICIPAL SMART CITY STRATEGY

Wireless networks are commonly used by municipalities for cellular telephone and land mobile "push to talk" radio, as well as to support legacy utility monitoring applications but there are many other uses. Private low-power wide area networks and mobile networks are used by a variety of cities but are less common than wired broadband networks. Therefore, most of the case studies here are from areas that are either larger or more populous than Winter Park (see table below). These examples show the practical importance of municipal networks for a range of essential services.

Table 3 - Demographics of Wireless City/County Examples Compared to Winter Park

City	Area	Population (2018)	Income (2017)	Employees (2021)
City of Winter Park, FL	**10 sq mi**	**30,000**	**$88,688**	**500+**
City of Albuquerque, NM	189.5 sq mi	560,218	$49,878	6,000+
City of Glendale, CA	30.56 sq mi	201,361	$58,657	1,400+
City of Las Vegas, NV	141 sq mi	646,790	$61,356	2,000+
Gwinnett County, GA	437 sq mi	927,781	$64,496	5,600+
City of Calgary, Alberta Canada	318.6 sq mi	1,560,600	$75,437	13,000+

a) City of Albuquerque, NM

The City of Albuquerque, for example, has been exploring private wireless. This wireless network has been used for streaming video from police body cameras, real-time access to crime scene analytics, and forward observation by field units of incidents such as the recent floods to assist with emergency management. Albuquerque is a much larger geographic area than Winter Park so it may have greater need and lower costs. Regardless, the basic applications are similar. Another example is the State of New Mexico Traffic Management Center in Albuquerque which uses a mixture of cameras, dynamic message signs, road telemetry, and traffic signals connected via a combination of publicly owned fiber in the city's urban areas and unlicensed microwave in areas not served by fiber.

b) City of Glendale, CA

The City of Glendale developed a city-wide Advanced Metering Infrastructure (AMI) that included a meter data management system as well as intelligent electric meters connected via a wireless network. The system enables customers to track their electricity use via the web, their smartphones, and in-home displays. It also enabled the City to manage, measure, and verify demand and grid performance. With the AMI and upgraded distribution automation equipment the City was able to improve operational efficiency as well as system reliability.

c) Las Vegas, NV

The City of Las Vegas is deploying a private wireless network. Once complete, this will be the most extensive private wireless network in the US. The City intends for the network to serve as an open platform available to local businesses, government, and educational institutions. While the network is not a direct-to-consumer service, it is being tested with various organizations for different use cases such as remote learning, as well as smart city applications such as traffic-monitoring cameras.

For Las Vegas, the CBRS network will expand its reach from its existing fiber networks, allowing it to connect remote and mobile devices across the community. More importantly, it will support its smart city ambitions, including initiatives within the City's Six Pillars of a Smarter Vegas, Public Safety, Economic Growth, Mobility, Education, Social Benefit, and Healthcare.

d) Gwinnett County, GA

Gwinnett County created a Situational Awareness and Crime Response Center (SARC) that brings together data from a variety of sources, video, and analytical capabilities to provide real-time information to first responders. The system connects cameras in parks and other public spaces, public buildings, on aerial units (drones), and at 724 traffic signals to technologies such as automatic license plate readers. The County's network, which consists of both wired and wireless connections, supports access to the SARC from mobile command vehicles, precinct offices, schools, and other remote sites.

e) City of Calgary, Alberta, Canada

The City of Calgary launched the first city-owned LPWAN network in Canada in 2016 to track city vehicles, noise pollution, and water usage across the city. The network is also used to monitor light, humidity, temperature, and water of one of the largest indoor gardens in the world, Devonian Gardens. Calgary Transit (CT) relies on a hybrid of public and private wireless, via licensed and unlicensed spectrum, for automatic vehicle location, telematics, status messaging, and passenger fare collection. Calgary also has 300+ miles of fiber-optic network that supports the LPWAN, as well as interconnecting municipal sites.

THE IMPORTANCE OF WIRELESS FOR SMART CITY STRATEGIES

Wireless is essential to smart cities because it enables automation as sensors and other devices communicate with control systems. To date, these systems have not deployed as universally as internet access and wide-area networks, so wireless is generally not as critical as wireline broadband infrastructure. The case studies reviewed above suggest that wireless is being applied to utilities, traffic, public safety, and environmental applications – all of which are core concerns for municipalities. As smart city technologies become more prevalent not only with the importance of wireless increase (especially where relied upon more for monitoring and response) the importance of broadband will also increase because it interconnects the variety of wireless access points and gateways

5. Connectivity Project Options

The future municipal connectivity infrastructure of Winter Park will encompass both fiber and wireless technologies. The connectivity at each site will depend on many parameters including what is currently available, the total bandwidth requirements of the location, and the cost to connect with either public or private infrastructure.

The total bandwidth of the location must also be considered. For example, we recommend parks be connected with fiber to support the aggregate bandwidth of public Wi-Fi, multiple high-definition cameras, smart parking systems, digital signage, local sensor aggregation and many other current and future smart park applications.

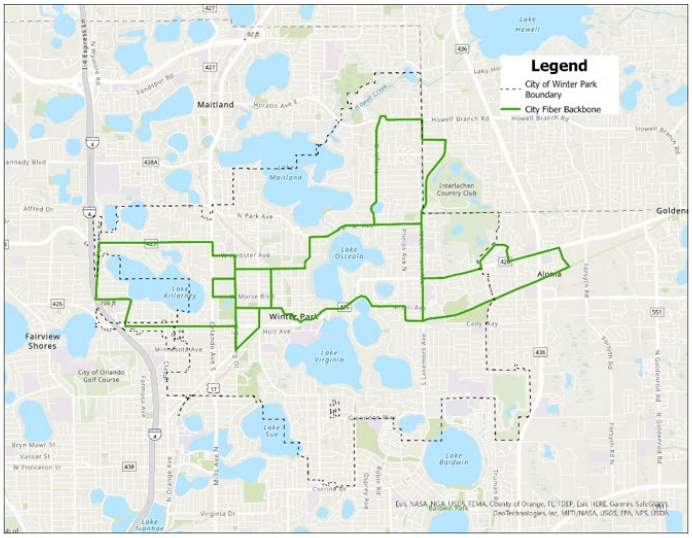
While the City's current fiber backbone project nears completion, and will connect 18 City sites initially identified, Winter Park's bandwidth demands, and usage trends will ultimately lead to connecting many more sites and facilities in the future. Priorities should be placed on connecting critical locations in support of transportation, utilities, public safety, and any key sites where smart city technologies may be abundantly deployed. These sites would include traffic cabinets, utility lift stations and pump stations, stormwater structures and pumps, and key assets within the electric utility infrastructure.

The City could extend its fiber-optic backbone to interconnect more city sites and facilities, while also focusing on the implementation of a new wireless overlay to support remote connectivity and future smart city initiatives.

PROJECT 1: FIBER BACKBONE EXTENSION – CONNECTING MORE CITY SITES AND FACILITIES

The current City of Winter Park backbone will connect 18 City locations and is depicted in the figure below.

Figure 5 - City's Fiber Backbone Map with Site List



Fiber Backbone Locations
City Hall
Public Safety
Public Works Compound
Library & Events Center
Lake Island Rec Center
Canton Electric Substation
Wymore Water Facility
Farmers Market
Community Center
Azalea Lane Rec Center
Fire Station 62
Fire Station 64
Showalter Field
WP Estates Wastewater
Interlachen Substation
Aloma Water Plant
Magnolia Water Plant
Train Station

This backbone is estimated to be 100,000 feet (38.76 miles) of conduit. This includes 50,500 feet of existing City-owned conduit. The City's backbone is comprised of 48 fiber strands with 24 fiber strands for each lateral. Based on the expectation of future growth, the 48 strands should be used efficiently such as focusing on ring architectures instead of point-to-point connections for example. If there is fiber exhaustion there are electronic solutions that increase the total available bandwidth on each segment of fiber. Wave Division Multiplexing Systems (WDM) can simultaneously send upwards of 100 individual wavelengths of light through each strand of fiber optic cable. Other solutions include adding more fiber to the 2" conduit. To understand the potential space in the conduit for additional fiber, the City would need the construction details, including as-builts from Frog and perform a detailed fielding analysis of each segment.

a) Additional Sites Connected by Extended Fiber Backbone

Based on the analysis of current and future needs, Magellan proposes that the City's backbone be extended as shown in the map below, depicted by the routes in Red. These extensions are suggested as potential routes to interconnect additional sites for transportation, utilities, and parks.

This backbone extension is designed to connect 152 new sites and is comprised of 20 fiber segments that total 62,570 feet (11.85 miles). The average length of each segment is 3,128.5 feet.

Figure 6 - Backbone Network Expansion (Red Routes)

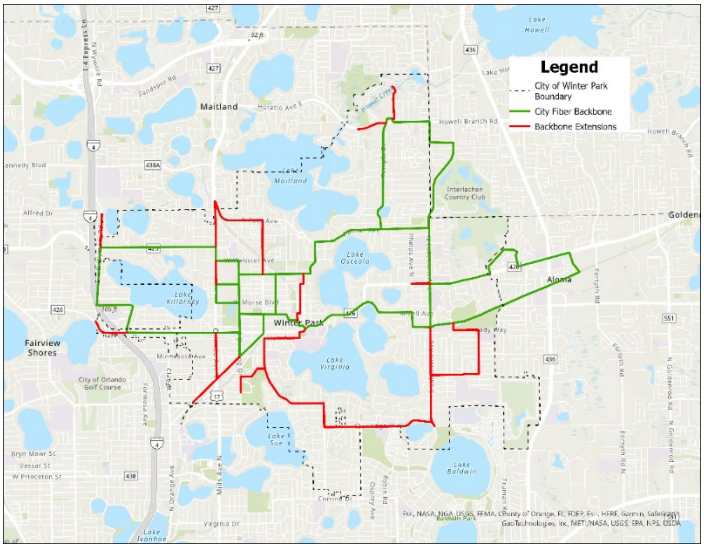
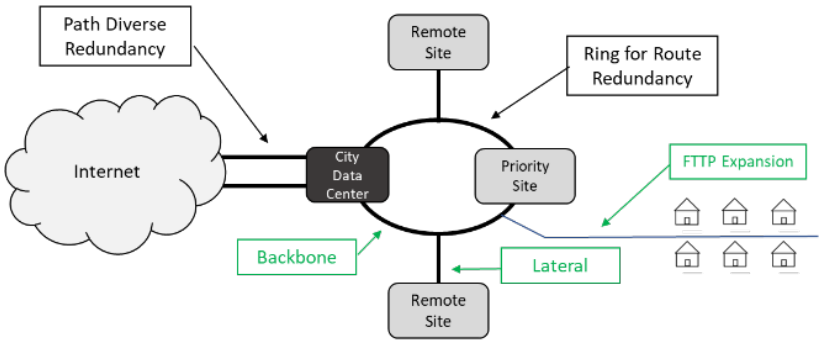


Table 4 - Backbone Cost Estimates for Backbone Expansion Segments

Backbone Expansion		
Footage		62,570
Mileage		11.85
Design, Engineering and Permit		$95,541
Fiber OSP Construction	Labor Total	$1,381,633
	Material Total	$417,567
	Fiber OSP Construction Total	$1,894,741
	20% Project Contingency	$378,948
	Grand Total	**$2,273,689**

From the total backbone, we have designed "laterals" for the proposed locations. Laterals, as illustrated in the figure below, are point-to-point fiber connections of the fiber backbone. The suggested laterals will connect 64 traffic signals, 14 parks and 74 lift stations. The costs for the Extended Backbone are shown in the table above.

Figure 7 - Lateral and Backbone Connecting Sites Illustration



TRAFFIC SIGNALS

Traffic management is a critical function for the city and there are many emerging "smart traffic" and "smart parking" solutions to address this. All require sensors and cameras at each intersection with high-speed connections to and from the cloud-based image and video processing, data analysis, and management systems. To accomplish this securely, Magellan suggests major intersections and traffic signals be connected with fiber, and to support future smart traffic systems.

The traffic signal network could be a ringed backbone interconnecting 10-12 cabinet sites per pair of fiber in the backbone. This architecture would allow the City to conserve as many fiber strands in the backbone as possible.

Figure 8 - Fiber Backbone Expansion to Traffic Signals Sites

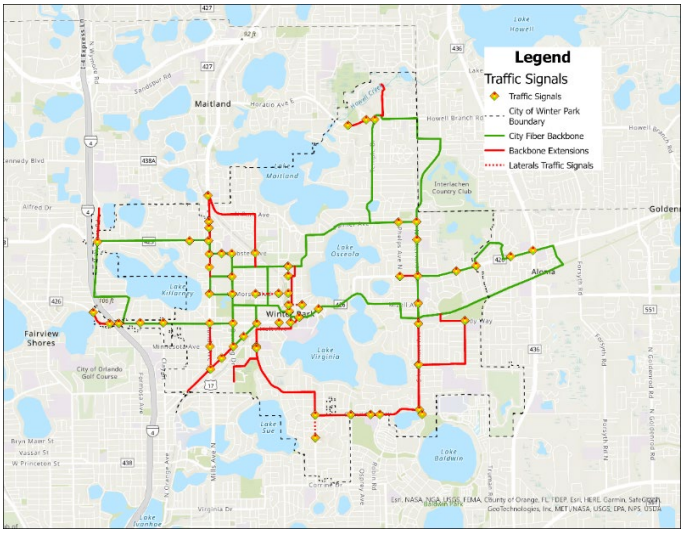


Table 5 - Backbone Cost Estimates to Connect Traffic Signal Sites

Traffic Signals		
# of Sites		64
Footage		6,046
Mileage		1.15
Design, Engineering and Permit		$9,480
Fiber OSP Construction	Labor Total	$220,567
	Material Total	$139,810
	Fiber OSP Construction Total	$370,217
	20% Project Contingency	$74,043
	Grand Total	**$444,260**

PARKS

Future smart parks will have a wide range of use cases and applications that, in total, will justify the need for higher capacity bandwidth that can be achieved with fiber. Thus, we recommend the City's backbone be extended to all parks. The first application will likely be Public Wi-Fi, but a smart park will have additional connectivity needs. These uses include multi-use high-definition cameras, smart parking systems, digital signage, smart trashcans, smart municipal buildings, and local environmental sensor aggregation. The costs highlighted in this report suggest bringing fiber to the location. As the City deploys smart city devices at each location, additional local area networking costs may be incurred.

Figure 9 - Fiber Backbone Expansion to City Park Sites

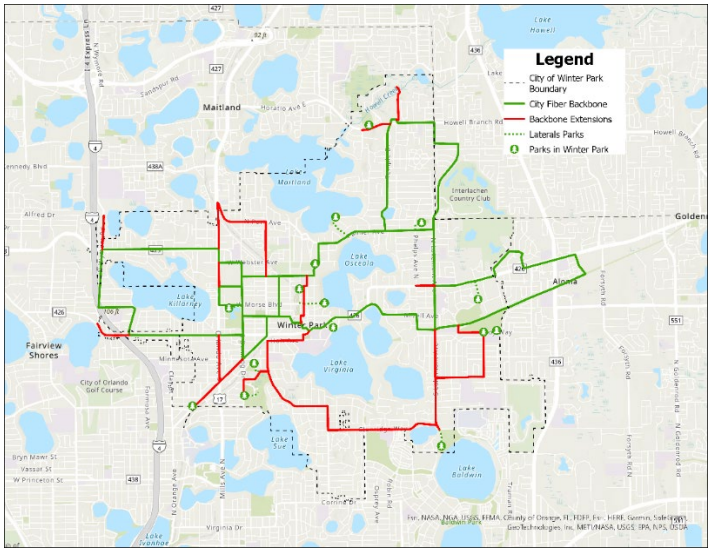


Table 6 - Backbone Cost Estimates to Connect City Park sites

Parks		
# of Sites		14
Footage		11,779
Mileage		2.23
Design, Engineering and Permit		$18,393
Fiber OSP Construction	Labor Total	$290,418
	Material Total	$82,321
	Fiber OSP Construction Total	$391,132
	20% Project Contingency	$78,226
	Grand Total	**$469,358**

LIFT STATIONS

The next major asset class where a fiber connection is recommended are the wastewater lift stations, and other key utility assets. The Winter Park utility has 106 lift stations of which approximately 1/3 are outside the city limits. Magellan suggests that lift stations be connected to fiber as they are passed, wherever possible. Many lift stations within the city are located outside the central district where City fiber is not available. This would entail substantial new fiber construction. Serving these could be coordinated with private companies' FTTP build out, or by wireless connections through CBRS.

The lift stations outside the city limits should also be connected wirelessly through CBRS unless a fiber connection can be obtained. Over the long term, we recommend that all critical City locations are connected directly to fiber when prudent. Wireless can be both a long-term and an interim solution until fiber is available. Wireless also acts as a second circuit at critical sites, where redundant fiber may not be possible.

Magellan suggests that 74 lift stations be connected via fiber laterals. These include all lift stations in the city limits and those that are outside city limits but are close to the City's existing and expanded City backbone.

The utility network could be a ringed backbone interconnecting 10-12 lift station sites per pair of fiber in the backbone. This architecture would allow the City to conserve as many fiber strands in the backbone as possible.

Figure 10 - Fiber Backbone Expansion to Utility Lift Stations

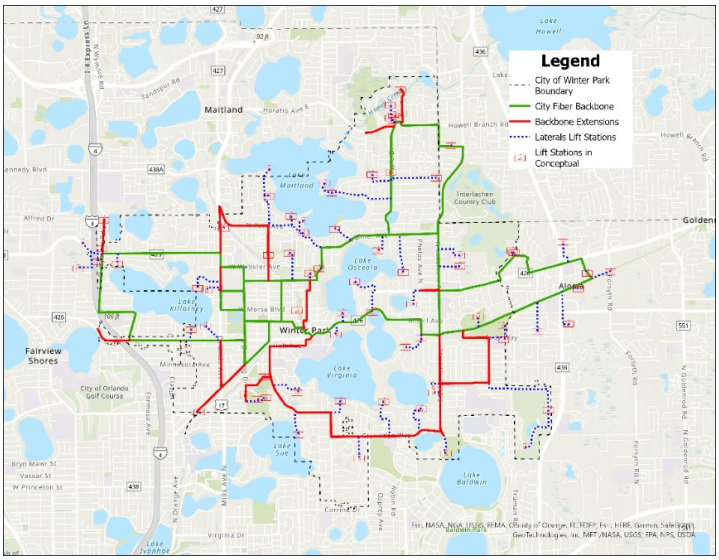


Table 7 - Backbone Cost Estimates to Connect Utility Lift Station Sites

Utility Lift Stations		
# of Sites		74
Footage		79,373
Mileage		15.03
Design, Engineering, and Permit		$121,135
Fiber OSP Construction	Labor Total	$1,787,016
	Material Total	$515,466
	Fiber OSP Construction Total	$2,423,617
	20% Project Contingency	$484,723
	Grand Total	**$2,908,340**

b) Fiber Backbone Expansion Capital Expenditures (CapEx)

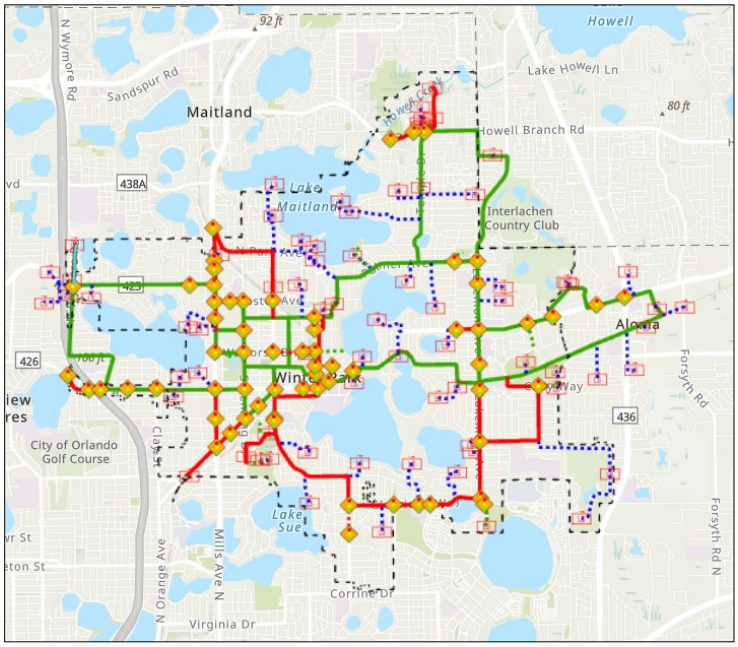
The total estimated cost to construct the expanded backbone is $6,095,647 (see detailed costs in the table below). While the City could look to ISP providers in and around Winter Park to connect the key City sites mentioned earlier, the monthly recurring charges associated with these "leased services" would likely be cost-prohibitive when you look at the scope of over a hundred new connections. Further, the City is already managing its current backbone, with its partner sharing in maintenance costs and funding the capital expansion of the backbone. As proposed, it would make the most sense unless the costs for certain sites were just high due to construction distances, and requirements.

The many sites outside the city limits have long distances associated with them. The City would be better served using a fixed wireless CBRS solution to connect these locations, or it may use a leased circuit approach, but should conduct site assessments on a case-by-case basis. LoRaWAN® could support remote sensors but would not be efficient in supporting high bandwidth cameras.

Table 8 - Fiber Backbone Expansion Capital Expenditures (CapEx)

	Length (Feet)	Costs w/20% Contingency
Existing	20.95 miles (110,062)	
Backbone Extension	11.85 miles (62,570)	$2,273,689
Traffic Signal Laterals	1.14 miles (6,046)	$444,260
Park Laterals	2.23 miles (11,779)	$469,358
Lift Station Laterals	15.03 miles (79,373)	$2,908,340
Totals	**30.26 miles (159,768)**	**$6,095,647**

Figure 11 - Combined Backbone, Traffic Signal, Park and Lift Station Laterals Map



c) Fiber Backbone Expansion 5-Year Plan

The following 5-Year Capital Improvement Plan (CIP) has been outlined to support a fiber backbone expansion project.

Table 9 - Fiber Backbone 5-Year CIP

	Year 1	Year 2	Year 3	Year 4	Year 5
Design, Engineering and Permit	$293,458				
Construct Phase 1	$1,802,189				
Construct Phase 2		$1M	$1M		
Construct Phase 3				$1M	$1M

d) Project 1: Fiber Backbone Extension Recommendations

I. Design and engineer an expanded fiber backbone to support key City priorities.
   i. Value engineer and utilize existing assets where possible.
   ii. Determine estimated costs, priorities, and timelines of phases.
   iii. Determine if additional fiber is needed within the existing backbone conduit to supplement the City's existing 48-strands.
      - Determine efficient fiber allocation strategy for use of existing 48-strands.
      - Incorporate Wave Division Multiplexing "WDM" technologies to allow increased capacity across the existing 48-strands, if and where required.

PROJECT 2: WIRELESS OVERLAYS – CBRS AND LORAWAN®

Wireless overlays are equally important to provide a comprehensive connectivity solution for a city like Winter Park. A very small percentage of its assets, namely large sites and facilities, or critical utility components will get a fiber connection. As we look over the next 5–10-year period, the City will likely connect hundreds, if not thousands of remote components and lightweight sensor-based devices which will require an alternative connection.

While Winter Park has wireless assets in place to support the utility AMI (Sensus® FlexNet), there will be other use cases not supported by its existing connectivity platforms, and others requiring more significant capacity than this network can provide. The utility's existing VHF/UHF system for SCADA alarming and alerting is also not scalable to support any future connectivity needs. The City also operates some wireless Point-to-Point and Point-to-Multipoint links in unlicensed bands. These networks are useful in some cases but can suffer from interference, building penetration and scalability issues. Therefore, a City-owned private 5G/CBRS overlay network and an open architecture lightweight protocol wireless network based on LoRaWAN® could be required to support the breadth of connectivity the City is considering.

a) Connecting Remote City Devices – CBRS Wireless Overlay and Coverages

Citizens Band Radio Service (CBRS) is a band of radio-frequency spectrum that the Federal Communications Commission has designated for sharing among users. It is capable of high throughput low-latency data communications. Using this CBRS band, cities can build private wireless (LTE and 5G) networks that can be used for many smart city functions. More information on CBRS is available in Appendix 4 - CBRS.

Today the City has 111 Mi-Fi[15] devices , in vehicles used for fleet management and to provide mobile connectivity for public safety vehicles. These use commercial cellular/mobile services. Public Safety agencies within Winter Park also require mobile coverage outside of the city's limits, into the water service territory, and even regionally during times of mutual aid. The City is likely to grow these numbers of connected devices significantly as it looks to expand its network.

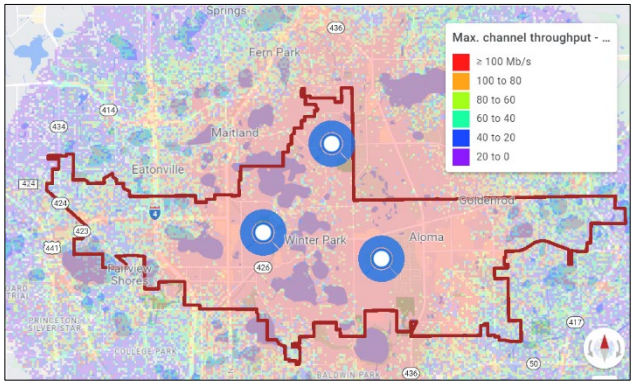
To support this, Magellan developed a high-level CBRS design to provide coverage across the Winter Park community. Three of the City towers (Fire Station 64, Showalter Field, and Public Safety Complex) were used, as they are owned by the City and would not require any commercial lease payments, and they are connected by City fiber. The design parameters used were for fixed wireless service to support applications that are stationary like wireless access points, security cameras, utility lift and pump stations, and to provide internet in hard-to-reach buildings and places across the city. This design can produce over 100 Mbps throughput to most locations in the city limits. If needed, other base stations may be added to cover the extended water service areas in the east and northwest. These private CBRS networks can also be configured to support fully mobile users. This would allow users to handoff from base station to base station and if the user device has dual service on a commercial network the device can roam onto the commercial cellular networks outside of the private coverage area. This would require coordination/configuration/interconnection of the commercial cellular and private network cores.

[15]Mi-Fi Device – a mobile router with cellular backhaul, ethernet connections and Wi-Fi access point built in

Table 10 - CBRS Wireless Overlay Deployment Capital Expenditure Projections (CapEx)

Cost Estimate for Total CBRS Infrastructure	Quantity	Cost/Piece	Total Cost
City-owned Towers	3	0	-
Proposed New Towers	0	$150,000	$0
Base Stations (4 per tower) + $500 install	12	$13,000	$156,000
90° Antennas (4 per tower)	12	$900	$10,800
Equipment Cabinets (1 per Tower if needed)	3	$500	$1,500
Outdoor Switches	3	$500	$1,500
Electric (if needed)	3	$1,000	$3,000
Generator (if needed)	3	$5,000	$15,000
UPS (if needed)	3	$1,500	$4,500
CPE cost ($350 equipment, $350 labor)		$700	
Stand Alone EPC option		$100,000	
Cloud-Based EPC Option One Time Fee/CPE or UE		$35	
		Subtotal	$192,300
Engineering, Project & Construction Mgmt.		**20%**	$38,460
Total for CBRS Infrastructure			**$230,760**

Figure 12 - CBRS Coverage Area for Winter Park



b) Connecting Meters and Sensors – LPWAN Overlay and Coverages

LoRaWAN® is a Low-Powered Wide-Area Network (LPWAN) type of wireless telecommunication network that allows connected devices to have long-range communications capabilities at a low bit rate. LPWANs are typically used in asset monitoring and management in smart cities and industrial Internet of Things deployments.

Long battery life is a critical requirement for remote sensors, and many are designed to have a 10–15-year lifespan. The LoRaWAN® network is based on open international standards and is supported by the LoRa Alliance[16], an international trade association. LoRa Alliance has thousands of participating members from hundreds of companies producing a multitude of different types of certified sensors. Function examples are metering, air quality, water level monitoring, pressure sensing, temperature sensing and many others.

More information on LoRaWAN® can be found in Appendix 5 – LoRaWAN® Networks.

Sensus® FlexNet (Sensus®) is the network that the City currently operates and is also an LPWAN technology. It is based on a proprietary protocol operating over a licensed 900Mhz radio spectrum allowing 2 watt transmit power. Sensus® products deployed in the market today concentrate mainly on providing a reliable, high-quality, meter reading network supporting both electric and water meter reading operations. The products are low total power usage and battery powered water metering will last 10-15 years. To interface with other sensor types, Sensus® uses an external gateway box with a defined interface. Each new sensor type must be investigated to determine if it can utilize the Sensus®-defined interface. Today Sensus®-compatible products are available to measure lake-water levels, water quality, and other

[16] Homepage - LoRa Alliance® (lora-alliance.org)

use cases, such as to detect doors being opened, but the supported product set is more limited than LoRaWAN®.

Table 11 - Sensus® and LoRaWAN® Pros and Cons

Sensus®		LoRaWAN®	
Pros	**Cons**	**Pros**	**Cons**
Currently Available to the City, Existing Investment	Proprietary Protocol supported by 1 vendor	**Industry standard protocol supported by many vendors**	Can be affected by interference in the unlicensed band
Licensed Spectrum	Limited portfolio of sensors available	**High resistance to interference**	
High Transmit Power	2 box solution to support additional sensors	**Runs in the unlicensed spectrum; Can be deployed anywhere**	
Widely Used for Meter Reading		**Large portfolio of sensors of all types available. See sample devices in Appendix 6 or www.MyDevices.com/store for a complete list**	
		Opportunities to monetize investments	

LORAWAN® COVERAGE

Because the City currently owns and operates a (Sensus®) FlexNet network, this section presents coverage of a conceptually designed LoRaWAN® network within Winter Park. The same three City owned towers that were used for CBRS RF analysis, were also used to model LoRa coverage across the community. Three LoRaWAN® base stations/gateways were positioned on the towers. The map image below indicates the coverage model from the City's three towers. The City's water territory is mostly covered by this design. A micro-gateway can be added in the east and west if more coverage is required.

Figure 13 - LoRaWAN® Coverage for Winter Park

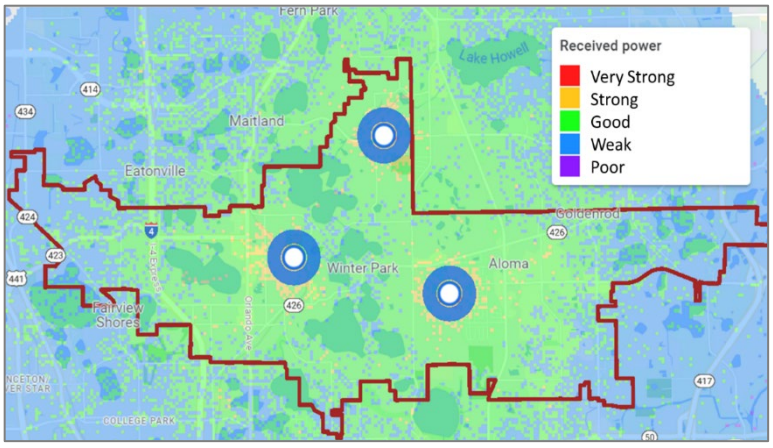


Table 12 - LoRaWAN® Wireless Overlay Deployment Capital Expenditure Projections (CapEx)

Cost Estimate for LoRaWAN®	Quantity	Cost/Piece	Total Cost
City-owned Towers	3	-	-
LoRa Gateways	3	$5,000	$15,000
Omni Antennas (2 per Gateway)	6	$300	$1,800
Electrical (if needed)	3	$1,000	$3,000
Installation on Tower	3	$1,000	$3,000
		Subtotal	$22,800
Engineering, Project & Construction Mgmt.		**20%**	$4,560
Total for LoRaWAN® Infrastructure			**$27,360**

c) Wireless Overlay Deployment 5-Year Plan

Table 13 - Estimated Wireless Overlay Cost-5 Year Plan

Estimated Wireless Overlay Cost-5 Year Plan								
Item	**Cost**	**Units**	**/Month**	**Year 1**	**Year2**	**Year3**	**Year 4**	**Year 5**
Utilities	$100	3	$300	$3,600	$3,600	$3,600	$3,600	$3,600
SAS fee per CBRS CPE	$2	0	$0					
Maintenance/Warranty					$51,624	$51,624	$51,624	$51,624
Subtotal				$3,600	$55,224	$55,224	$55,224	$55,224
Contingency	20%			$720	$11,045	$11,045	$11,045	$11,045
Total Opex Cost				**$4,320**	**$66,269**	**$66,269**	**$66,269**	**$66,269**
CBRS Capex				$230,760				
LoRaWAN® Capex				$27,360				
Total Cost/YEAR				**$262,440**	**$66,269**	**$66,269**	**$66,269**	**$66,269**

The 5-Year plan above makes the following assumptions:

- CapEx for all the equipment is expended in the first year when the system is deployed.
- 20% annual maintenance/warranty cost included in years 2-5.
- Utilities are $100 per month per tower for the new base stations.
- Fiber backhauls exist at all 3 tower locations.

d) Wireless Overlay Business Case Analysis

The table below shows the 5-year total cost of ownership for the CBRS and LoRaWAN® networks. The LoRaWAN® table uses the initial number of currently deployed water and electric meters as the anchor use case/application. Sensus® is currently serving these meters. The use of existing City towers connected by fiber is assumed. The $.04 per month is the network operating costs to serve LoRaWAN® device (like a water meter or air quality sensor) spread over 5 years. This cost includes the initial capital expense (but not the cost of the actual LoRaWAN® device being served), operating costs, and renewal and replacement costs for the network.

Table 14 - LoRaWAN® 5-year TCO and Monthly Cost per Device

Cost Description	Cost	Other Details
LoRaWAN® Initial CapEx	$27,360	One Time Deployment Cost **LoRaWAN®**
5-Year Maintenance/Warranty	$21,888	20% CapEx (Years 2-5)
5-Year Utilities	$9,000	$50/month 5 years 3 locations
Infrastructure Renewal and Replacement (7 Year schedule)	$23,451	(Initial CapEx + 20%/7*5)
Total 5-Year TCO	**$81,699**	
Total Gateways	3	
Total Endpoints/Devices	37,994	Assumes City departments pay for endpoints
Monthly Device Access Fee	$0.04	Total TCO/Total Endpoints/60 months

Below is the cost per month for LoRaWAN® versus the cost of low-power cellular technology from the commercial providers. The subscription prices from the commercial vendors were obtained by getting retail listed costs for service from the provider's website. The cost savings per year figure assumes the 37,994 number of meters x (times) the cost difference in the high and low range.

Table 15 - Cost Savings Per Year on LoRaWAN® vs. Commercial Provider

Technology	Devices	WP-MRC[17]	Cellular Commercial MRC	Cost Savings Per Year
LoRaWAN®	37,994	$0.04	**$1.00 - $2.50 (LTE-M)**	$438k - $1,122k
	37,994	$0.04	**$1.00 - $2.00 (NB-IoT)**	$438k - $894k

The table below shows the breakeven point for buying and running a private CBRS network. CBRS provides secure low latency, high-bandwidth services capable of supporting critical switching systems, high-definition surveillance cameras, backhaul for Wi-Fi access points, and to be able to push firmware and configuration updates to devices over the network.

These tasks could also be performed with fixed wireless/mobile services from commercial providers like T-Mobile or Verizon. Verizon sells the least expensive monthly service that will provide the required throughput and amount of data to be transferred. According to Verizon's website, the cost will be $29.00 per month. Assuming that price for commercial service, the breakeven scenario for a private CBRS system is 5 years and will require at least 360 devices to be connected to the network. Device costs are not included in the cost estimate below, as that is a per-cost device, and is not related to the core infrastructure-related

[17] MRC – Monthly Recurring Cost

costs. Today Winter Park has 290 cameras that are fixed in their locations. There is also 111 Mi-Fi[18] devices on cellular. These counts exceed the 360 number of devices to break even. Further analysis needs to be done to determine the case for mobile network deployment and how many users would travel outside the city private coverage area. This would require a second Subscriber Identity Module (SIM) and commercial account to hand off to a commercial carrier when leaving the private network coverage area.

Table 16 - CBRS Private Network Costs

Cost Description	Cost	Other Details
Initial CapEx	$230,760	One-Time Deployment Cost CBRS
5-Year Maintenance/Warranty	$184,608	20% CapEx (Years 2-5)
5-Year Utilities	$9,000	$50/month 5 years 3 locations
Infrastructure Renewal and Replacement	$197,794	(Initial CapEx + 20%/7*5)
Total 5-Year TCO	**$622,162**	
Total CBRS sites/base stations	3/12	
Total Endpoints/Devices	360	Assumes City departments pay for endpoints
Monthly Device Access Fee	$28.80	TCO/Total Endpoints/60 Months

e) Project 2: Wireless Overlay Recommendations

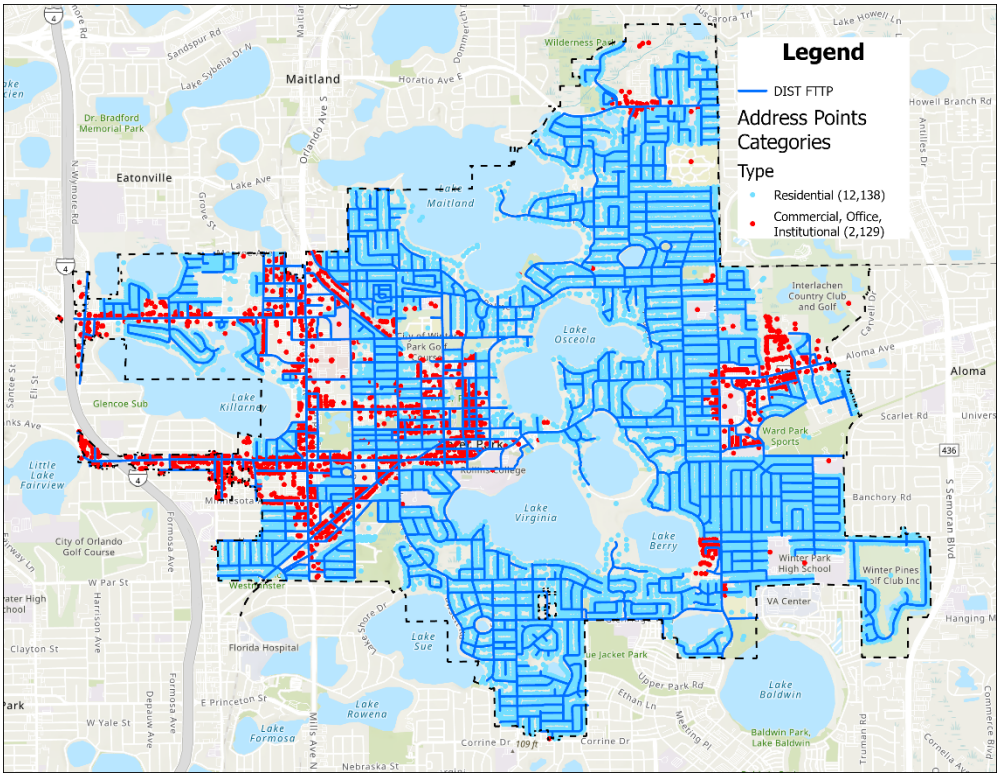
I. Leverage existing Sensus® AMI platform to support connectivity where possible, incorporating "low-hanging" opportunities that are supported by the system today.
II. Design and engineer new open architecture LPWAN platform based on LoRaWAN® .
    i. Determine cost, priority, and timeline.
III. Design and engineer a private LTE, CBRS high-speed wireless broadband system.
    i. Determine cost, priority, and timeline.

[18]Mi-Fi Device – a mobile router with cellular backhaul, ethernet connections and Wi-Fi access point built in

PROJECT 3: FIBER-TO-THE-PREMISES ACROSS WINTER PARK

This section analyzes the City funding, constructing, and operating a retail internet service provider (ISP) in the City of Winter Park. The network would be a Fiber-to-the-Premise (FTTP) network deployed across all of Winter Park and would require an estimated 275 miles of underground construction (shown in the figure below), to enable each business and residential customer with fiber-based services.

Figure 14 - City of Winter Park FTTP Conceptual Design - 275 Miles



While the City's electrical undergrounding project did include an extra telecommunications conduit, it only did so sporadically with the primary electric segments of their project. As further outlined below, this conduit was not deployed through an actual design and requires substantial retrofit and upgrades to make it functional for FTTP.

a) Conceptual Design and Cost Estimates

The conceptual design outlined above includes all underground conduit routes, using various size conduits and fiber cables in the distribution segments of the network. Fiber would route through each city street passing every parcel within Winter Park. The FTTP network estimated at 275 miles of construction would take an estimated 3 years to complete if it was undertaken at one time – in a single effort. Total Outside Plant (OSP) construction costs, including all labor and materials, are estimated at $53,369,298, with a 10% contingency totaling $58,706,228, more fully summarized in the table below. The cost per mile for the network is estimated at $212,703.

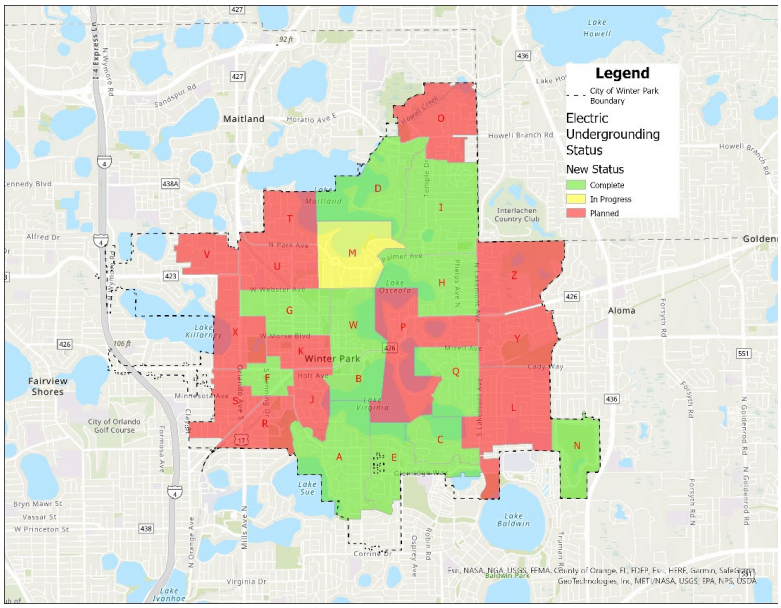
Table 17 - OSP Construction Estimates – 275 miles

Cost Component	Cost Estimate
Design, Engineering, and Permitting	$2,503,343
OSP Construction	$53,369,298
10% Construction Contingency	$5,336,930
Total OSP Construction Costs	$61,209,571

b) Existing Conduit from Undergrounding Project

The City is implementing a joint trench concept to deploy the underground construction of its electric and telecommunications infrastructure for cost and resource efficiency. The figure below shows the undergrounding effort by the City, by phase, in alphabetical zones, and the status of the telecommunications conduit in each project area.

Figure 15 - Undergrounding Phase Map by Zone with Zone List



ZONE (A)	COMPLETE/NO CONDUIT	J	PLANNED (2024)	S	PLANNED/30% CONDUIT
B	COMPLETE/NO CONDUIT	K	PLANNED/NO CONDUIT	T	PLANNED/20% CONDUIT
C	COMPLETE/20% CONDUIT	L	PLANNED/60% CONDUIT	U	PLANNED/60% CONDUIT
D	COMPLETE/NO CONDUIT	M	IN PROGRESS/60% CONDUIT	V	PLANNED/30% CONDUIT
E	COMPLETE/50% CONDUIT	N	COMPLETE/30% CONDUIT	W	COMPLETE/80% CONDUIT
F	COMPLETE/100% CONDUIT	O	PLANNED/? CONDUIT	X	PLANNED/10% CONDUIT
G	COMPLETE/100% CONDUIT	P	PLANNED/50% CONDUIT	Y	PLANNED/20% CONDUIT
H	COMPLETE/100% CONDUIT	Q	COMPLETE/100% CONDUIT	Z	PLANNED/20% CONDUIT
I	COMPLETE/100% CONDUIT	R	PLANNED/70% CONDUIT		

c) Retail FTTP Broadband Financial Plan

The question presented to Magellan was whether the available conduit gave the City a competitive advantage should it decide to construct and operate a city-wide FTTP network. While this is a valid question, the deployment of conduits as part of the electric undergrounding has been sporadic and poorly documented. The City estimates that FTTP deployment will cost up to $2.5 million, but due to the lack of information, Magellan has reduced this sunk cost as a $1.25 million cash contribution in year one.

The numbers and projections presented below in the FTTP Analysis would hold similar to private sector providers, although their cost structures around the cost of money, operations, and other aspects could vary greatly – higher or lower.

The Broadband Financial Model below depicts a financial outlook for the Winter Park Broadband Utility offering retail internet services to all businesses and households in the city. This financial information provides a model that projects the City's financial performance under a particular set of conditions based on the following assumptions:

I. The City backbone exists. No additional backbone buildout is required to support the FTTP network. This **does not** include the **$6.1M** in backbone expansion that has been summarized previously.
II. The $2.5 million investment in conduit as part of the Electric Undergrounding Project was accounted for as a $1.25 million upfront capital contribution to the FTTP project.
    i. ***Usability is questionable due to the lack of details on the conduit, and the additional and substantial labor costs that will be incurred to locate, prepare and retrofit the existing buried conduit.***
III. For the FTTP base case, the City invests an additional $500,000 per year for Years 1 through 5.
    i. The average revenue per user (ARPU) per month for residences is $74.50.
    ii. 1 Gbps service @$70 and 45% of residential subscribers also pay $10/month for a managed service such as home Wi-Fi management.

CAPITAL EXPENDITURES SUMMARY

Capital Expenditures are summarized in the table below. As illustrated, construction costs are the dominant component.

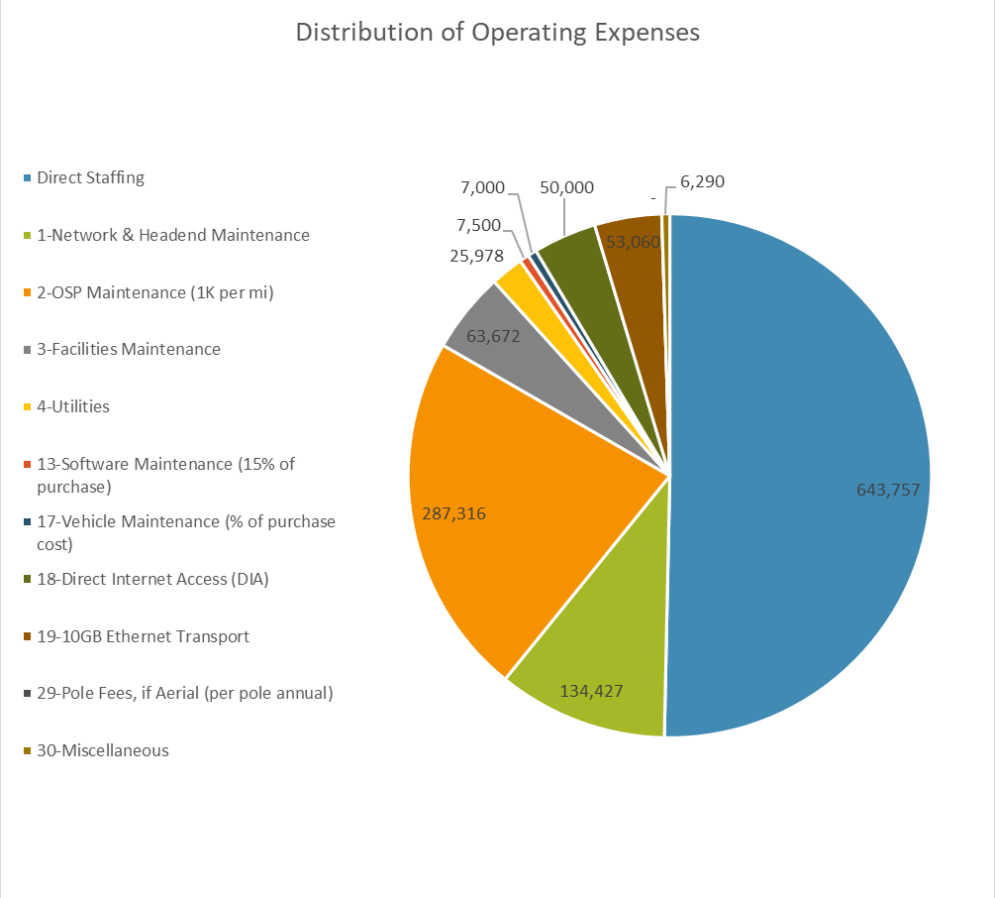
Table 18 - Capital Expenditures

Capital Component	Cost Estimate
OSP Construction Costs (includes drop fiber and labor)	$70,075,574
#1A Premises Connected (Drops) (less fiber drop costs/labor)	$9,340,854
Network Equipment/Refresh/Systems/Project Mgmt	$5,822,233
Building Improvements (Central Office/City Data Center)	$125,000
General Equipment/Other CapEx	$969,830
Total All Categories	$86,333,491

OPERATING EXPENDITURES

Based on a full retail model, expected operating expenditures encompass the day-to-day costs incurred in running the broadband utility. Some of these costs include staffing, cost of goods sold, office expenses, legal fees, travel, etc. Operating expense costs are a mixture of fixed annual fees and variable, per-subscriber costs. The figure below, highlights the operating expenses in Year 7, once the utility is fully built out and at a steady run rate.

Figure 16 - Operational Costs Year 7



STAFFING

This financial model includes the required staff to operate a carrier-class network infrastructure as an ISP in a competitive marketplace. Under this model, Year 1 requires 0.75 Full-time Employees (FTEs), and staffing begins in Year 2 with 8.25 FTEs. A steady state could be expected in Year 3 with 11.25 FTEs. Year 3 and beyond positions and annual personnel costs are shown in the table below.

Table 19 - Staffing Requirements

Position	(H)ourly (S)alary	(F)ull (P)art Time	Hourly rate or Salary
FTE-A-Telecom Director	S	F	$ 130,000.00
FTE-A-Broadband Accounting Supervisor	S	F	$ 100,000.00
FTE-A-OSP/Engineering Supervisor	S	F	$ 100,000.00
FTE-A-Sales & Marketing Manager	S	F	$ 85,000.00
FTE-A-Network Engr	S	F	-
FTE-A-Customer Support Manager	S	F	$ 65,000.00
FTE-A-Technical/NOC Support Manager	S	F	$ 95,000.00
FTE-A-Sales Supporting	S	F	$ 65,000.00
FTE-A-Business/Enterprise Account Manager	S	F	$ 72,900.00
FTE-D-Network/NOC Technician (Data Center/Inside)	H	F	$ 46.00
FTE-D-Technical Service Rep (TSR Level 1)/(CSR)	H	F	$ 20.00
FTE-D-Technical Service Rep (TSR Level 2)/(CSR)	H	F	$ 25.00
FTE-D-Field Services Technician	H	F	$ 25.00
FTE-D-Field Services Technician (in-house)	H	F	$ 20.00
FTE-D-Field Locates Technician (in-house)	H	F	$ 20.00

PRODUCTS AND PRICING

Proposed offerings and rates are illustrated in the table below. Monthly prices are based on the competitive market in Winter Park and national pricing trends.

Table 20 - Proposed Residential and Business Service Offerings

Residential Service	Price	Business Service	Price
		250 Mbps 250 Mbps SMB	$80/Month
1 Gbps x 1 Gbps	$70/Month	**1 Gbps x 1 Gbps SMB**	$150/Month
		10 Gbps x 10 Gbps SMB	$900/Month
Managed Service	$10/Month	**SMB Managed Services**	$29.95

If the City adopts the full retail FTTP model it is suggested that a low-cost and reduced bandwidth offering be included with a direct tie-in to the Federal low-income broadband subsidy American Connectivity Program (ACP). A 100 Mbps symmetrical service for $30/month could be added.

FUNDING

The model calls for the City to fund all capitalized expenses (Capex) based on the specific expected asset life. The capital costs of constructing the fiber network would be financed using a 20-year municipal bond. Network equipment and facilities would be financed over 10 years and CPE (Customer Premises Equipment) such as in-home Wi-Fi routers, would be financed over 7 years. Working capital is financed over 15 years. All interest rates used in the model were 5.5%. The borrowing summary and debt service summary are shown in the table below.

Table 21 - Borrowing and Debt Service Summary

Total To Be Financed	
20 Year - Fiber Plant/Facilities (inc drop fiber costs)	$65,924,974
10 Year - Network Equipment & Buildings	$4,289,900
7 Year - Home Equipment	$5,360,449
Less Contribution (apply to fiber/plant) ***	$3,750,000
15 Year - Working Capital	$15,880,000
Total	$87,705,323

FINANCIAL SCENARIOS

The table below summarizes various scenarios based on differing Residential and Business *Take Rates*. Magellan uses 20-year End-of-Year Cash as a key indicator of financial sustainability. With a 50% residential take rate and 35% business take rate, the City ISP would not be sustainable as illustrated by the negative 20-year End-of-Year Cash. However, increasing both take rates by 5% would create a sustainable financial operation with 55% residential and 40% business take rates.

Table 22 - Summarized Take-Rate Scenarios

Households	12,138	12,138	12,138	12,138	12,138
Projected Uptake	50%	55%	60%	65%	70%
Estimated Subs (Based on 12,138 Passings)	6,009	6,609	7,209	7,809	8,409
Businesses	2,129	2,129	2,129	2,129	2,129
Projected Uptake	35%	40%	45%	50%	55%
Estimated Subs (Based on 2,129 Passings)	744	849	960	1,065	1,170
Anchor	0	0	0	0	0
Projected Uptake	50%	50%	50%	50%	50%
Estimated Subs (Based on 0 Passings)	0	0	0	0	0
20-Year Projected Cap-Ex					
OSP Construction Costs	$ 61,209,571	$ 61,209,571	$ 61,209,571	$ 61,209,571	$ 61,209,571
Premise Drops	$ 16,468,455	$ 18,206,857	$ 19,944,988	$ 21,669,911	$ 23,397,202
Network Equipment/Refresh/Systems/Project Mgmt	$ 5,822,233	$ 5,822,233	$ 5,822,233	$ 5,822,233	$ 5,822,233
Building Improvements	$ 125,000	$ 125,000	$ 125,000	$ 125,000	$ 125,000
General Equipment/Other CapEx	$ 969,830	$ 969,830	$ 969,830	$ 969,830	$ 969,830
	$ 84,595,089	**$ 86,333,491**	**$ 88,071,622**	**$ 89,796,545**	**$ 91,523,836**
20-Year Projected Op-EX					
Operations	$ 25,219,355	$ 25,219,355	$ 25,219,355	$ 25,219,355	$ 25,219,355
SG&A	$ 16,595,521	$ 16,967,500	$ 17,346,903	$ 17,719,108	$ 18,093,284
	$ 41,814,876	**$ 42,186,855**	**$ 42,566,258**	**$ 42,938,462**	**$ 43,312,638**
Funding / Debt Service					
Cap-Ex to be funded	$ 74,643,991	$ 75,575,323	$ 76,550,069	$ 77,511,172	$ 78,476,013
City Contribution	$ 3,750,000	$ 3,750,000	$ 3,750,000	$ 3,750,000	$ 3,750,000
Net To Be Funded	**$ 70,893,991**	**$ 71,825,323**	**$ 72,800,069**	**$ 73,761,172**	**$ 74,726,013**
Projected Interest Rate	5.50%	5.50%	5.50%	5.50%	5.50%
Total Principal	$ 70,893,991	$ 71,825,323	$ 72,800,069	$ 73,761,172	$ 74,726,013
Total Interest	$ 44,120,098	$ 44,523,933	$ 44,952,641	$ 45,375,565	$ 45,800,178
	$ 115,014,089	**$ 116,349,256**	**$ 117,752,710**	**$ 119,136,737**	**$ 120,526,190**
Projected Working Capital Needed	$ 26,000,000	$ 15,880,000	$ 8,710,000	$ 3,530,000	$ 2,150,000
Interest (based on 15-year term @ 5.50%)	$ 12,853,983	$ 7,850,817	$ 4,306,084	$ 1,745,175	$ 1,062,926
	$ 38,853,983	**$ 23,730,817**	**$ 13,016,084**	**$ 5,275,175**	**$ 3,212,926**
20-Year Projected Revenue	137,791,182	152,708,076	167,922,996	182,849,062	197,853,426
20-Year End-of-Year Cash	(9,631,408.20)	4,554,492.13	19,740,937.70	34,832,359.41	49,304,182.36

ADDITIONAL RETAIL ISP SCENARIOS

Magellan analyzed the baseline retail financial model outlined above and created two alternative scenarios. The first was to determine how much capital investment (i.e., cash) the City would need to invest to support a 40% residential take rate with a $60/month rate for a gigabit connection. The business take rate was also reduced to 35%. In this scenario, the City would need to invest $6,100,000 per year for the first 5 years of the project, totaling $30.5M. With this amount of investment, an uptake of 40% residential/35% business would be sustainable while providing service at $60 for a 1 Gigabit residential service.

The second scenario was to determine the residential take rate that would be required to ensure sustainability, assuming the City invested $5 million per year for the first 5 years, totaling $25M. Under this scenario, at $70 for a 1 Gigabit residential service, the take rate would need to be 36-37% of the residential households.

SUMMARY OF RETAIL ISP SERVICES

Scenario 1	Scenario 2	Scenario 3:
• Full City Retail with $1.2M invested to date • **$2.5M** additional investment (Years 1-5) • $70 residential monthly cost for 1 Gbps • 53% residential take rate	• Full City Retail with $1.2M invested to date • **$30.5M** additional investment (Years 1-5) • $60 residential monthly cost for 1 Gbps • 40% residential take rate	• Full City Retail with $1.2M invested to date • **$25M** additional investment (Years 1-5) • $70 residential monthly cost for 1 Gbps • 37% residential take rate

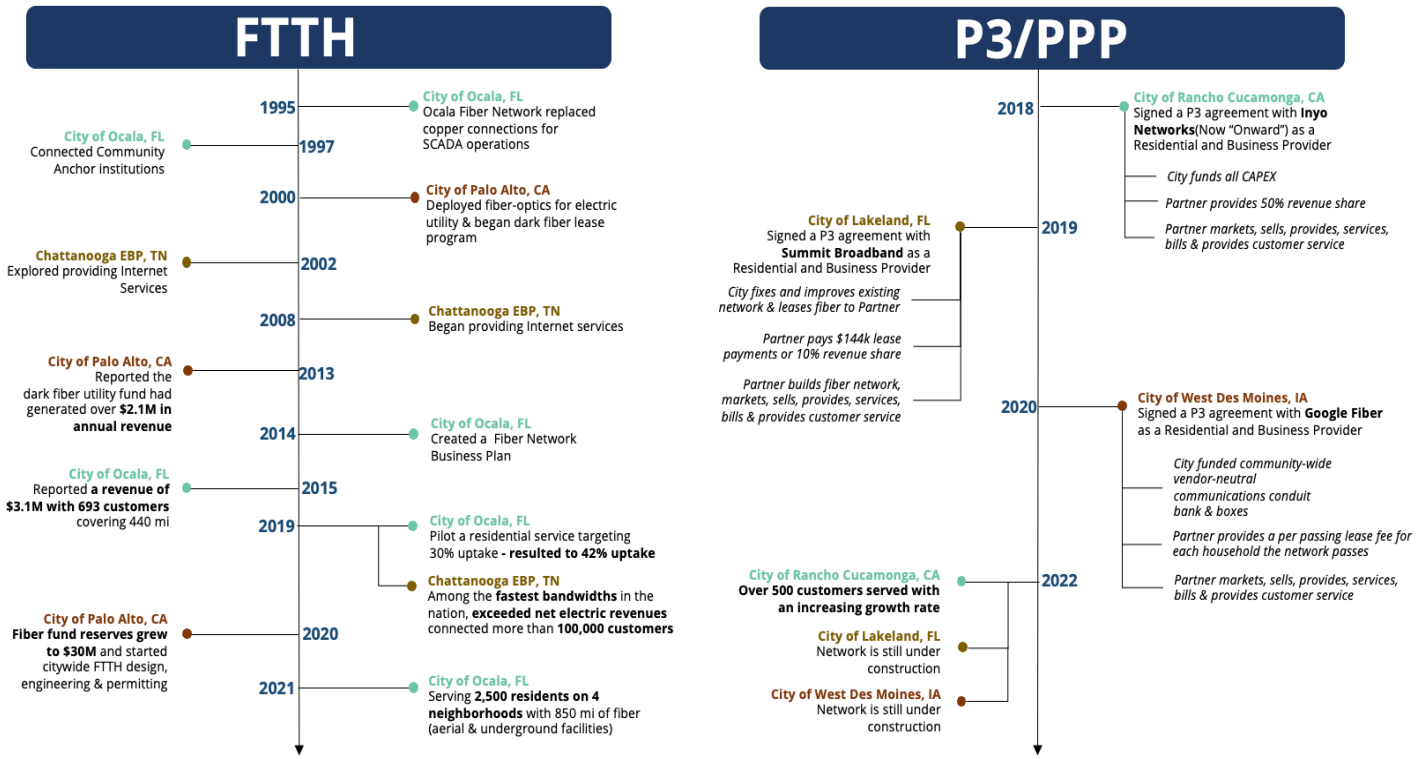
PROJECT 3A: FIBER-TO-THE-HOME ACROSS WINTER PARK CITY - ISP PARTNERSHIP (CITY BUILDS INFRASTRUCTURE & ISP OPERATES)

Alternatively, the City of Winter Park could continue its undergrounding conduit program, accelerating and formalizing it with a detailed design and fielding audit of the existing constructed conduit, to expand FTTP infrastructure to each area of Winter Park more quickly than the current electric undergrounding project allows. The financial model improves substantially as more subscribers are attached to the network as soon as possible. However, instead of standing up and operating as an ISP, the City would leverage its infrastructure buildout, which it would own, and lease the entire conduit network with dark fiber to a partner through a fixed lease or through a revenue-sharing mechanism to generate revenue to achieve sustainability.

In recent years, Public-Private Partnership (P3s) have been increasingly implemented as more municipalities use their public broadband and utility infrastructure in conjunction with private broadband providers. P3s leverage public broadband assets, such as fiber, conduit, poles, facilities with private

broadband provider assets, and expertise, to increase the availability and access to broadband services. A P3 can simultaneously introduce a new provider into the marketplace which provides it with accelerated access to a new market, with reduced capital requirements under the P3 structure. P3s that are implemented well reduce operational risks, and provide a positive impact to the city, while leaving substantial fiber capacity that could be leveraged to support the municipal operations of the City well into the future. This additional capacity could help "future-proof" Winter Park, allowing the City to take advantage of future technologies that require robust connectivity, at little incremental cost. But the tradeoffs include lessening City control to that which can be assured by the P3 agreement and loss of "upside" opportunity. Ultimately, Winter Park residents would benefit through access to a new fiber-based service offering, where local decision-makers can influence how the community is served.

Figure 17 - Case Studies Presented to the City



Under a P3 arrangement, the City of Winter Park would fund the Capex associated with the buildout of the FTTP infrastructure and would maintain it, while shifting all remaining responsibilities to its partner. The partner ISP would own and operate all electronics and operational and business systems required to operate the business. It would also be responsible for marketing and customer management. The latter would include on-site maintenance and support of all systems, equipment, and services.

A key consideration in the business arrangement is the distribution of the risks between the City and the ISP. At one end of the risk-sharing spectrum is the *fixed lease model,* where the City would lease the entire network for a fixed fee for a predetermined amount of time (7-20 years) to a financially stable ISP. The

only risks remaining to the City are related to the execution of the fiber-leasing ISP. The other end is a *revenue-sharing model* where the City only gets paid when the ISP gets paid. In this case, the City should take a more active role in promoting the new ISP in Winter Park and it could incur additional marketing expenses to support these efforts. The table below highlights the Capex and Opex responsibilities in the P3 Model discussed herein.

Table 23 - City-ISP Partnership Responsibilities

	CapEx	OpEx
City	• Design, Engineering, and Permitting • OSP Fiber Construction (Distribution & Drop) • Facilities and Buildings	• Outside Plant Maintenance • General Management functions (Admin, Compliance, Auditing, etc.) • Promotion/Marketing
ISP	• XGS-PON Infrastructure and CPE • Ethernet Infrastructure • IP Edge – BGP4 Routers • Core/Aggregation Network • NOC (Net Ops Center) • OSS Software Licenses • Fielding Equipment (Trucks, Test Equip) • Legal/Regulatory Fees • Customer Support Operations • Branding/Marketing • BSS/Billing Software	• Network Management • OSS Software Licenses • BSS Software Licenses • Middle Mile bandwidth • Last Mile fees to Passive Owner (If separate) • Sales, General & Administrative Expenses • Marketing • Payments to the City per pass or revenue share, lease • Interconnect Fees • Middle Mile Connections and Fees

a) City-ISP Partnership Revenue Analysis

In the 'city-owned and ISP-operated' model, the critical success factor for the City to achieve, at a minimum, is cash flow neutrality. Yearly cash outflows will be for the Opex of the passive assets and the debt service expenses from the City's construction Capex.

We analyzed two models, the *fixed lease model,* and the *revenue share model*, to determine the minimal payments to the City to attain cash flow neutrality. Our analysis was based on Year 10 to eliminate the construction capital costs and ramp-up periods. Costs and expenses are the same for both models.

As noted, operating costs from this passive model are comparatively low. In year 10, Outside Plant (OSP) maintenance is estimated at $1,000 per mile per year or $295,872, and facilities maintenance is estimated at $67,500. We also plan on $100,000 for the City to allocate toward staffing and admin as needed. Marketing and Promotional expenses are estimated at $50K per year to educate the community on the costs and benefits to the city of the P3 agreement and to amplify the ISPs' customer acquisition programs.

The upfront, Capex-related design and construction costs are funded by debt proceeds, which are accounted for annually by the debt service comprised of principal and interest payments. Funding is assumed to be taxable municipal/utility bonds with a 20-year maturity, and a rate of 5.5% bonds issued by the City.

These values are based on the assumptions in the 40% residential take rate and $60/month scenario, with a business take rate of 35%. In this scenario, the City would be required to contribute $6.1 Million per year for the first 5 years of the project ($30.5M Total).

Table 24 - Summary of City-ISP Partnership Revenue

City-ISP Partnership Revenue		
Revenues (Year 10)	**$**	**6,028,312**
Passive OpEx Expenses		
OSP Maintenance (1K per mi)	$	295,872
Facilities Maintenance	$	67,570
Administrative/Staffing	$	100,000
Marketing/Promotion	$	50,000
Total OpEx Expenses	**$**	**513,442**
Capital Borrowing Summary		
Total Fiber OSP Capex (passive infrastructure + drops)	**$**	**65,011,507**
Cash Investment by the City	**$**	**31,750,000**
Total Debt Service (paid through debt proceeds)	**$**	**33,251,507**
Principal	$	1,589,428
Interest	$	1,155,367
Annual Debt Service	**$**	**2,744,795**
Total Passive Costs/Year	**$**	**3,258,237**
Passive Costs per Month	**$**	**271,520**
Total Passings		**14,267**
Cost/passing	**$**	**19.03**
Costs as % of Revenue		**54%**

In the *fixed lease model*, where the City funds the construction of a city-wide network and leases the entire passive infrastructure to a single ISP, the ISP would need to pay the City $19.03 per month per location passed by the City, for the City to achieve cash flow neutrality.

In the *revenue share model*, where the City funds the construction of a city-wide network and shares in the revenue stream, the City would need to receive at least 54% of the monthly revenue received by the ISP.

OPTION 3B: STATUS QUO

Under Option 3, the City of Winter Park does not take an active role in deploying FTTP infrastructure and instead works with, and even incentivizes, the private sector ISPs in and around Winter Park to accelerate their investments and expansions within the city.

Today, the City of Winter Park lacks competitive broadband infrastructure. Charter-Spectrum is the only widespread gigabit provider in the city and there are currently no providers offering symmetrical gigabit speeds or up to 10 Gbps services to households. However, two private companies, Lumen and Frog have

announced their intention to deploy FTTP in Winter Park. Thus, while today there is a lack of broadband and fiber options in the city, market forces should establish at least one competitor to Spectrum and drive the market to offer symmetrical speeds and 10 Gbps.

Currently, Lumen, through their local contractor (BlueWater Telecom), has started deploying FTTP in three sub-divisions near the Tuscarora Trail near W. Comstock Ave. and Lakemont Ave. These permits cover 900 homes over three subdivisions. BlueWater is also in the design and engineering phase for an additional 8,000 to 9,000 locations in Winter Park. At this time, given Lumen's public statements at both the corporate and local levels, their near-term plans call for expanding their FTTP services in the Greater Orlando market, specifically to Winter Park. However, it is not assured they will serve 100% of the city's households.

Frog has a Private Fiber Network Construction and Maintenance Agreement with the city. Under this agreement, Frog built the City's backbone and now has a 10-year joint maintenance agreement with the City of Winter Park for the conduit and fiber constructed under this agreement. Frog has stated publicly that they intend to deploy FTTP to businesses and residences in Winter Park. Currently, however, Frog's network assets are very limited in Winter Park.

Magellan also gathered that Charter-Spectrum will upgrade to 10 gigabit DOCSIS 4.0 starting in late 2025 or early 2026 thus creating a 2- or 3-way competitive market for gigabit services. They are also deploying conduit as part of the electric undergrounding project.

To accelerate new deployments and upgrades, the City should adopt broadband-friendly policies such as:

- Accelerate the permitting process.
- Adopt a "Dig Once Policy".
- Identify opportunities to deploy broadband infrastructure in conjunction with private and public construction projects.
- Incorporate connectivity and smart city concepts into the City's Capital Improvement Plan (CIP) and fund connectivity and smart city infrastructure as part of the CIP's budget.
- Offer access to the City's conduit and dark fiber to ISPs at reduced rates.

PROJECT 3: FTTP RECOMMENDATIONS

I. The City should not consider a City-owned and City-operated full retail ISP model.
    i. Current financial projections do not support a sustainable business.
    ii. Emerging fiber providers create headwinds to creating a viable financial business.
II. A joint-venture model may provide a viable solution to deliver 100% fiber access in Winter Park.
    i. While this option might be viable, the City should focus on key smart city initiatives identified in this planning process.
    ii. Optionally, the fiber backbone extension should be designed to accommodate a potential FTTP system in target areas, based on need.

6. Recommendations

The City of Winter Park has taken actions over these last few years to develop and build out its backbone infrastructure to connect key City sites and facilities, including 18 that are connected to date. This has been a positive movement toward providing the City and its utilities more robust connectivity including faster and more resilient services. However, the City will require additional network infrastructure including additional underground conduit and fiber as well as wireless networks to support further connectivity, deeper into the community as it begins to plan for and implement smart city initiatives across the City's 4 Smart City Pillars.

GENERAL RECOMMENDATIONS & STRATEGY

I. The City must identify and designate a Connectivity and Smart City Infrastructure Coordinator.
II. This position would oversee the design, engineering, contracting, installation, operations, and overall management and strategy of all investments and systems. This includes coordination with internal City departments, and 3rd party community stakeholders and partners.
III. The City should continue to engage a consultant to assist with oversight and implementation of the City's connectivity and smart City strategies and to supplement staff as needed.
IV. The City should not entertain or enter into any new conduit or fiber usage agreements until such time as all existing assets have been documented, and clear strategic direction has been determined as it relates to the City's participation in such agreements.

EXISTING ASSETS - UTILITIES UNDERGROUNDING CONDUIT PROJECT

I. Suspend the installation of telecommunications conduit in conjunction with the electrical undergrounding project, unless areas are specifically called out, and designed appropriately.
II. Immediately begin fielding assessment of existing conduit, fiber and all assets installed along with the completed portions of the electrical undergrounding project to date.
III. Immediately begin fielding assessment of all conduits, fiber, and other assets available to support the City's smart city vision and future initiatives. These include conduits connecting existing traffic and street lighting infrastructure.
IV. The City should ensure that all as-builts, construction drawings, and fielding notes are aggregated into a single record, and digitized into GIS, and easily into a future Fiber Management System (FMS).

FROG AGREEMENT

I. Immediately obtain as-built specifications and location of backbone infrastructure installed by Frog, in its capacity of general contractor, contracted on behalf of the City.
    i. Identify all assets owned by the City and Frog.
    ii. The City should inspect to confirm that all backbone infrastructure was installed per specifications in the agreement.
    iii. The City should determine if Frog has utilized conduit installed as part of the electric undergrounding project, beyond the backbone agreement.

PROJECT 1: FIBER BACKBONE EXTENSION RECOMMENDATIONS

I. The City of Winter Park should evaluate funding opportunities to expand the backbone as outlined. Design and engineer an expanded fiber backbone to support key City priorities.
   i. Value engineer and utilize existing assets where possible.
   ii. Determine estimated costs, priorities, and timelines of phases.
   iii. Determine if additional fiber is needed within the existing backbone conduit to supplement the City's existing 48-strands.
      - Determine efficient fiber allocation strategy for use of existing 48-strands.
      - Incorporate Wave Division Multiplexing "WDM" technologies to allow increased capacity across the existing 48-strands, if and where required.

PROJECT 2: WIRELESS OVERLAYS

I. Leverage existing Sensus® AMI platform to support connectivity where possible, incorporating "low-hanging" opportunities that are supported by the system today.
II. Design and engineer new open architecture LPWAN platform based on LoRaWAN®.
   i. Determine cost, priority, and timeline.
III. Design and engineer a private LTE, CBRS high-speed wireless broadband system.
   i. Determine cost, priority, and timeline.

PROJECT 3: FIBER-TO-THE-PREMISES ACROSS WINTER PARK

I. The City should not consider a City-owned and City-operated full retail ISP model.
   i. Current financial projections do not support a sustainable business.
   ii. Emerging fiber providers create headwinds to creating a viable financial business.
II. A joint-venture model may provide a viable solution to deliver 100% fiber access in Winter Park.
   i. While this option might be viable, the City should focus on key smart city initiatives identified in this planning process.
   ii. Optionally, the fiber backbone extension should be designed to accommodate a potential FTTP system in target areas, based on need.

Appendix 1 – Park Addresses

Park	Address
AZALEA LANE PARK	1045 AZALEA LN
CADY WAY PARK	2525 CADY WAY
CENTRAL PARK	101 N PARK AVE
DINKY DOCK PARK	410 OLLIE AVE
HOWELL BRANCH PRESERVE PARK	1205 HOWELL BRANCH RD
KRAFT AZALEA GARDEN	1429 ALABAMA DR
LAKE BALDWIN PARK	2000 S LAKEMONT AVE
LOCH LOMOND / PERTH MEDIAN WELLNESS PARK	2294 HAWICK LN
MEAD BOTANICAL GARDEN	1300 S DENNING DR
MLK PARK	1050 W MORSE BLVD
PHELPS PARK	1206 N PHELPS AVE
THE PARK AT ORWIN MANOR	1701 N ORANGE AVE
WARD PARK	2339 CADY WAY

Appendix 2 – Traffic Signal Locations

STREET	CROSS STREET	OWNER
HOWELL BRANCH RD	TEMPLE DRIVE	Winter Park
HOWELL BRANCH RD	TEMPLE TRAIL	Winter Park
HOWELL BRANCH RD	VIA TUSCANY	Winter Park
LAKEMONT AVE	PALMER AVE	Winter Park
ALOMA AVE	LAKEMONT AVE	State
ALOMA AVE	PHELPS AVE	State
ALOMA AVE	ST. ANDREWS	State
LAKEMONT AVE	MIZELL AVE	Winter Park
LAKEMONT AVE	WHITEHALL DR.	Winter Park
LAKEMONT AVE	GLENRIDGE WAY W	Winter Park
LAKEMONT AVE	GLENRIDGE WAY E	Winter Park
WINTER PARK RD	GLENRIDGE WAY	Winter Park
PENNSYLVANIA AVE	MINNESOTA AVE	Winter Park
FAIRBANKS AVE	PENNSYLVANIA/ORAN	State
FAIRBANKS AVE	NEW YORK AVE	State
FAIRBANKS AVE	PARK AVE	State
FAIRBANKS AVE	ROLLINS XWALK	State
FAIRBANKS AVE	DENNING DRIVE	State
ORANGE/DENNING	MINNESOTA AVE	State
OSCEOLA AVE	OLLIE AVE/CHASE A	State
PARK AVE	LYMAN AVE	Winter Park
PARK AVE	NEW ENGLAND	Winter Park
PARK AVE	MORSE BLVD	Winter Park
NEW YORK AVE	MORSE BLVD	Winter Park
PENNSYLVANIA AVE	MORSE BLVD	Winter Park
PARK AVE	CANTON AVE	Winter Park
US 17-72	GAY ROAD	State
US 17-72	MORSE BLVD	State
DENNING DRIVE	MORSE BLVD	Winter Park
DENNING DRIVE	CANTON AVE	Winter Park
PENNSYLVANIA AVE	WEBSTER AVE	Winter Park
US 17-72	WEBSTER AVE	State
US 17-72	LEE ROAD	State
DENNING DRIVE	WEBSTER AVE	Winter Park
US 17-72	FAIRBANKS AVE	State
US 17-72	MINNESOTA AVE	State
US 17-72	ORANGE AVE	State
NEW ENGLAND	INTERLACHEN AVE	Winter Park
GLENRIDGE WAY	GENERAL REES	Winter Park
LEE ROAD	WYMORE ROAD	Winter Park
FAIRBANKS AVE	I4 RAMP WEST	Winter Park
FAIRBANKS AVE	I4 RAMP EAST	Winter Park
FAIRBANKS AVE	CLAY STREET	Winter Park

FAIRBANKS AVE	FORMOSA AVE	Winter Park
GLENRIDGE WAY	PRESERVE POINT DR	Winter Park
GLENRIDGE WAY	UPPER PARK ROAD	Winter Park
FAIRBANKS AVE	WYMORE ROAD	State
ALOMA AVE	BALFOUR DRIVE	State
ALOMA AVE	RANGER BLVD	State
ALOMA AVE	SEMORAN BLVD	State
ORANGE AVE	CYPRESS AVE	State
ORANGE AVE	CAPEN AVE	Winter Park
WEBSTER AVE	LEE ROAD EXT	Winter Park
US 17-92	PARK AVE	State

Appendix 3 – Utility Assets Location

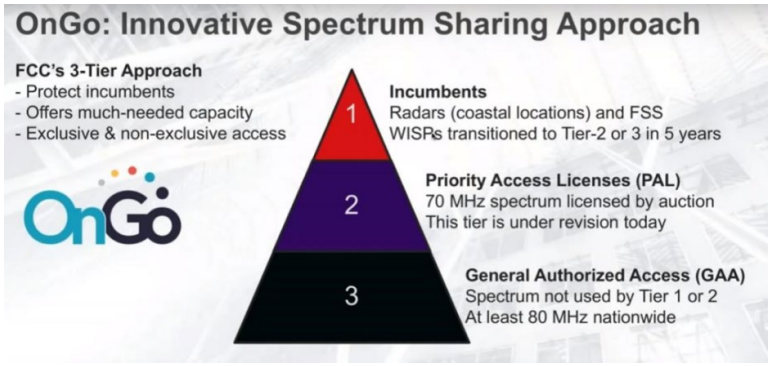
Lift Station Name	Lift Station Address
Greentree	905 Greentree Dr
Bonita	600 Bonita Dr
East Gate	2121 Taylor Ave
Cady Way	0 Cady Way
Fairway	1045 Fairway Dr
Golfside	1414 Golfside Dr
Lake Berry	724 Balmoral Rd
Phelps Ave	401 Balmoral Rd
Roundelay	1629 Roundelay Ln
Brewer Hill	921 Osceola Ave
Lakewood Dr	400 Lakewood Dr
Osceola Ct	201 Osceola Ave
Dinky Dock	410 Ollie Ave
Stirling	290 Stirling Ave
Laurel Rd	1512 Laurel Rd
Howard Dr	650 Randy Ln
Lake Sue	2010 Fawsett Rd
Denning	1300 S Denning Dr
Orwin Manor	1660 N Orange Ave
Lake Killarney	350 Killarney Dr
Gay Rd	1500 Gay Rd
Solana	1221 Solana Ave
Pennsylvania	922 N Pennsylvania Ave
Northwest	1602 Summerland Ave
New York	1400 N New York Ave
Kraft Garden	1429 Alabama Dr
Sicilian Shores	561 Via Lugano
Isle of Sicily	5 Isle of Sicily
Twelve Oaks	1204 N Park Ave
Waterbridge	1801 Lake Berry Dr
Red Lobster	245 Driggs Dr
Ranger	318 S Ranger Blvd
Georgetown	3113 Raiders Run
Lakeside Manor	2500 Lee Rd
Summerland	2080 Summerland Ave
Sharon Place (Storm)	1230 Sharon Pl
Windsong South	1152 Preserve Point Way
Windsong North	409 Genius Dr
Central @ vactor pad	1409 Howell Branch Rd
Gun Range	3100 Temple Trail
Cemetary Office	1005 N New York Ave
Mead Garden	1300 S Denning Dr
Mead Amphitheater	1300 S Denning Dr

Courtland	604 Courtland St
Howard Johnson's	5351 Diplomat Cir
Denny's	611 N Wymore Rd
Summertime	909 N Wymore Rd
W.P. Estates	2655 Bongart Rd
Central	1409 Howell Branch Rd
Central Utilities	1409 Howell Branch Rd
Melrose Ave	1146 Washington Ave
Wymore North	1021 N Wymore Rd
Kilshore Lane	1573 W Fairbanks Ave
Park Manor	2131 Oakhurst Ave
Casa Feliz	656 N Park Ave
WP #4	1960 Magnolia Rd
Cady Way Trail	150 W Morse Blvd
N Forsyth Rd	4025 N Forsyth Rd
4 Rivers BBQ (temp)	1600 W Fairbanks Ave
1190 N Park Ave	1190 N Park Ave
Hibiscus	2032 Arbor Park Dr
Tennis Court Bath	2525 Cady Way Tr
Central Streets	1409 Howell Branch Rd
Fleet Peoples Park	2000 S Lakemont Ave
Ballfield@Showalter	2525 Cady Way Tr
WP Estates Treatment	2655 Bongart Rd
150 W Morse Ave	150 W Morse Ave
Central Utility	1409 Howell Branch Rd
Via Tuscany (Storm)	2111 Via Tuscany
Killarney Bay	TBD
University Park	130 University Park Dr

Appendix 4 – Citizens Broadband Radio Services (CBRS)

In 2015 the U.S. FCC set aside the frequency band of 3550-3700 MHz (3.5 GHz) for Citizens Broadband Radio Services. The FCC used a new, ***shared spectrum approach*** for CBRS with three tiers of users, illustrated in the figure below.

FCC'S CBRS 3-Tier Approach[19]



Incumbent tier 1 spectrum users include the U.S. Navy, fixed satellite stations, and, for a limited time, wireless internet service providers (WISPs). With the CBRS approach these incumbents are protected from interference by other users. Seven Priority Access Licenses (PAL) for 10 MHz channels between 3550 and 3650 MHz in a specific county were auctioned off by the FCC in July 2020. These licensees are protected from interference by other users but may not interfere with incumbent users. A licensee may aggregate up to 4 PALs for higher data rates. Any portion of the spectrum may be used without a license for General Authorized Access (GAA), but this may not interfere with incumbent or PAL users. The CBRS spectrum can be used for 4G and 5G and can be utilized by MNOs and other service providers such as Cable Companies as well as by private industries and governments. CBRS impacts local broadband and fiber in the following ways:

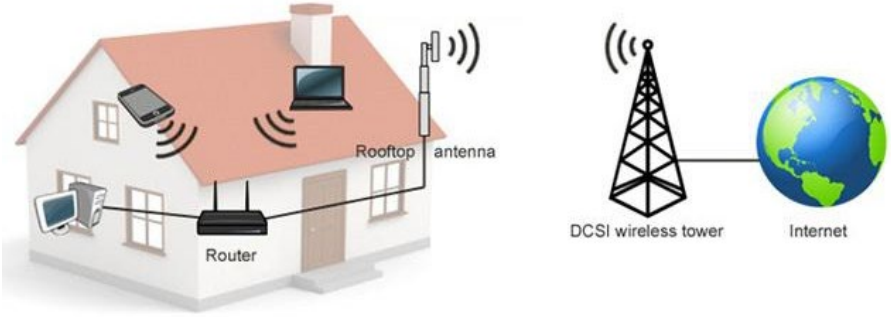
- **The spectrum is available to everyone and is shared.** This has led to cable companies' interest in using the CBRS spectrum to reach consumers that are 'near' their existing coaxial cable footprint in single and multi-family units using a fixed-wireless access approach and to create a potential national mobility service to compete with the MNOs.
- **The emerging use of this spectrum by private companies to create their wireless networks.** This allows them to reduce payments to the MNOs and as an alternative to Wi-Fi in-building benefiting the use of applications requiring longer distances than Wi-Fi can provide.
- **Municipalities can also use the CBRS spectrum for their own internal wide and local area networks.**

Access to 'free spectrum' for the three big MNOs. They can utilize this to increase their coverage and capacity in local areas. They are also looking at CBRS to enhance indoor coverage and capacity in large

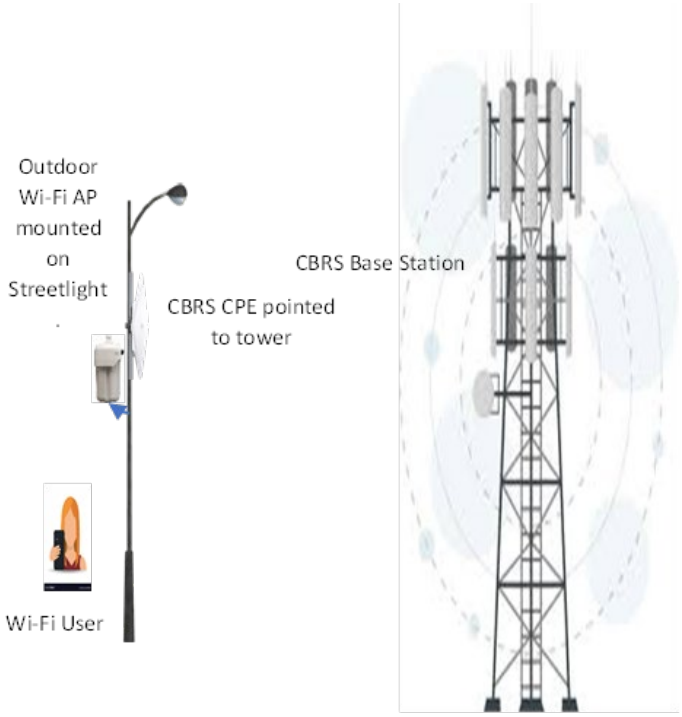
[19] Image from *OnGo*, a CBRS Trade Association

facilities and buildings. In the indoor scenario, MNOs or neutral host companies will deploy CBRS small cells throughout a large building to enhance coverage and capacity in the building and to eliminate the handoff to in-building Wi-Fi.

Fixed Wireless to Building Example

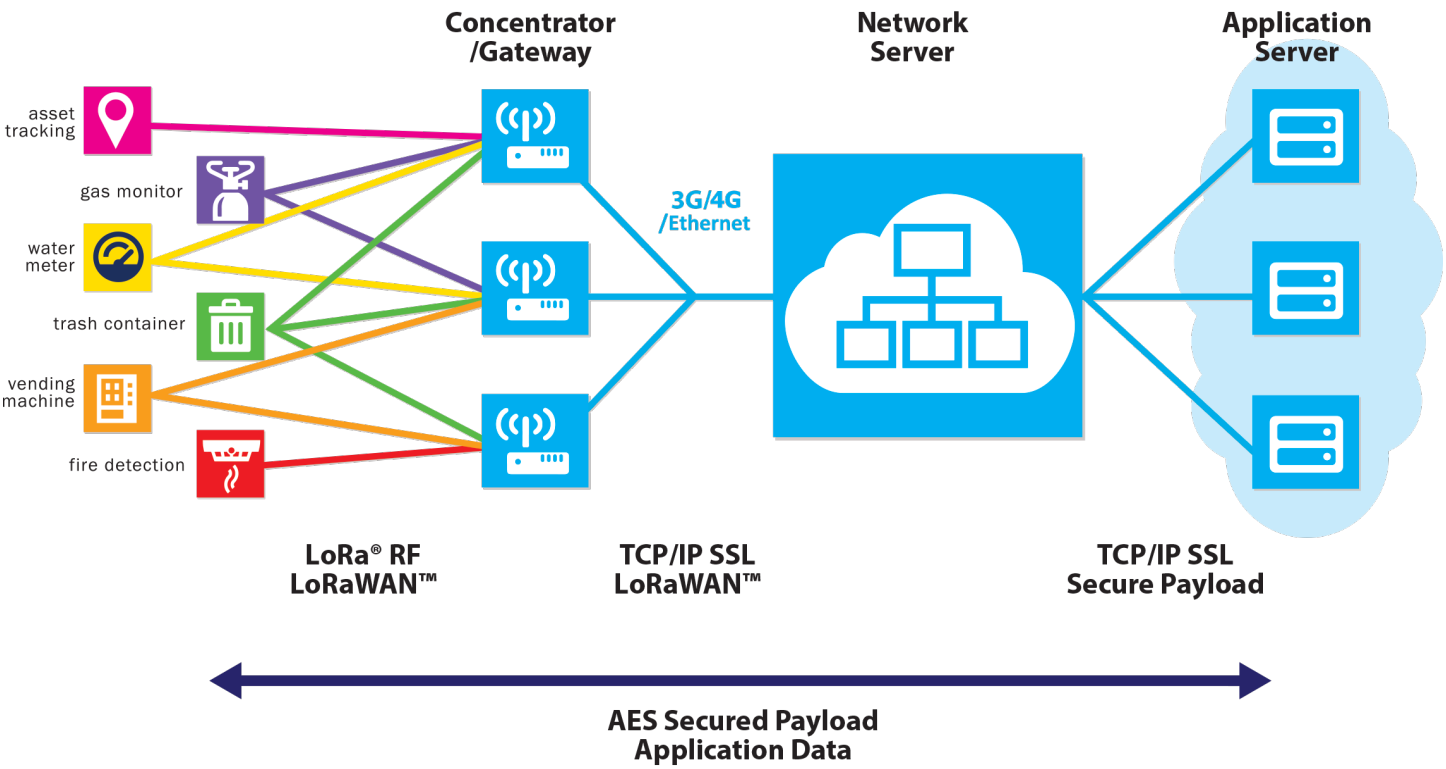


CBRS Public Wi-Fi Example



Appendix 5 – LoRaWAN® Networks

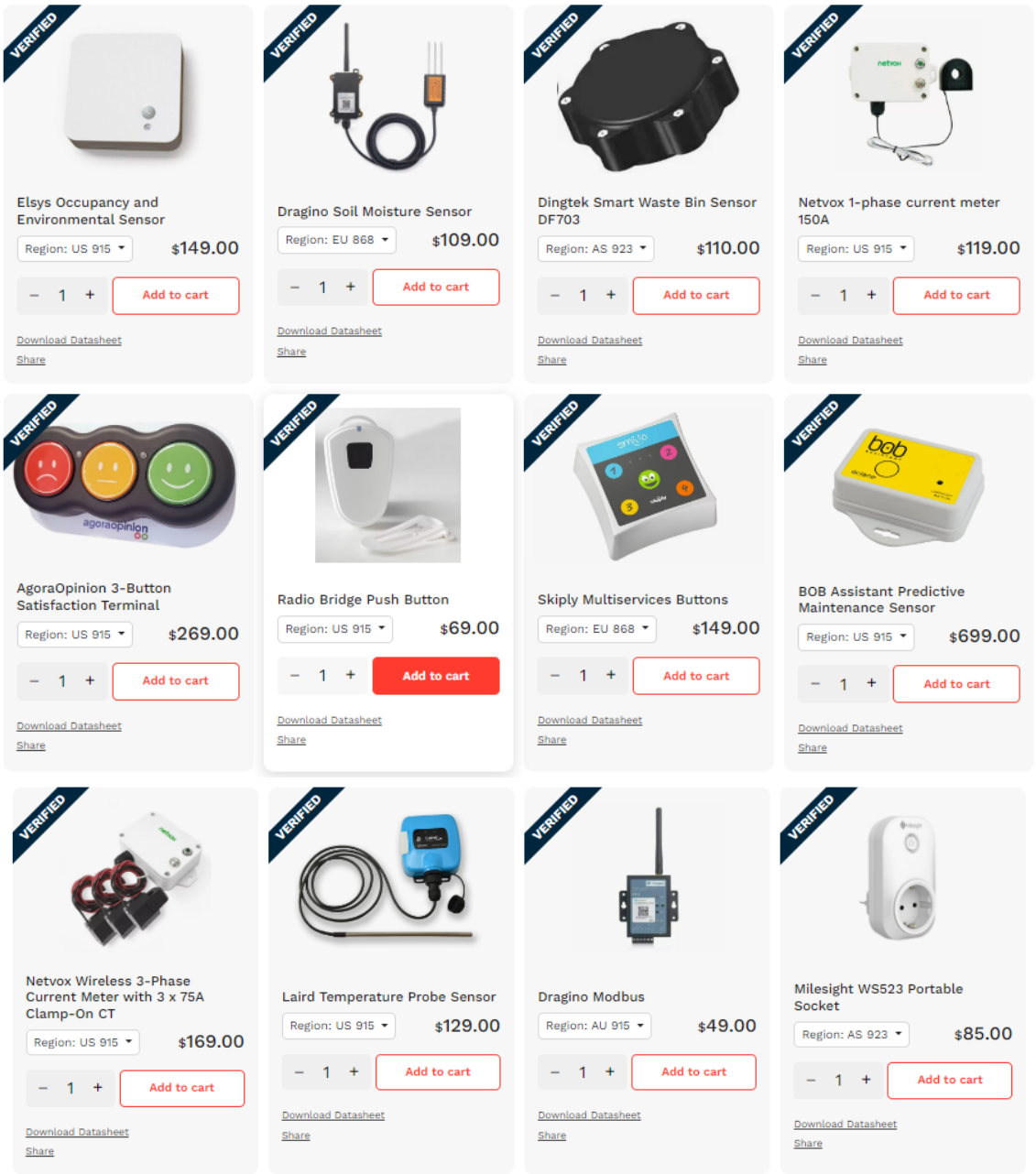
LoRaWAN® networks are a type of LPWAN (Low Power Wide Area Network). It operates in the 902-928 MHz unlicensed ISM band. It is a published standard supported by the LoRa alliance. The advantages of LoRaWAN® are that it has a long range and uses low power so can run long on batteries (>10 years). Since it's standard with support from vendors, many vendors make sensor devices that are ready to operate on a LoRaWAN® network. The LoRaWAN® network uses Spread Spectrum variable chips per bit for data modulation. This is very interference resistant but operates at a low bit rate, typically .3 to 50kbps. It can operate 64 channels in the 902-928 MHz network so is also able to avoid interference by switching channels. The LoRaWAN® standard used 256 AES encryption to secure messages. LoRaWAN® has defined upper layers and message headers in the LoRaWAN® standards documents.



To promote the growth and success of LoRaWAN® , which is addressing a broad range of IoT applications and guarantees interoperability, LoRa Alliance®[20], an open and non-profit organization enables its members within the technology sector to collaborate and gain access to standards and technical flexibilities.

[20] www.LoRa-Alliance.org

Appendix 6 – Sample **LoRaWAN®** Devices



VERIFIED

Dragino LHT65N LoRaWAN Temperature & Humidity Sensor

Region: US 915 $49.00

– 1 + Add to cart

Download Datasheet
Share

VERIFIED

Advantech Condition Monitoring Sensor

Region: US 915 $429.00

– 1 + Add to cart

Download Datasheet
Share

VERIFIED

GlobalSat Panic Button

Region: AU 915 $119.00

– 1 + Add to cart

Download Datasheet
Share

VERIFIED

Milesight Ambience Monitoring Sensor AM107

Region: US 915 $399.00

– 1 + Add to cart

Download Datasheet
Share

VERIFIED

Soter Technologies FlySense Enhanced Vaping & Elevated Sound Detector

Region: US 915 $995.00

– 1 + Add to cart

Download Datasheet
Share

VERIFIED

Elexa Water Leak IP67

Region: US 915 $60.00

– 1 + Add to cart

Download Datasheet
Share

VERIFIED

Milesight IoT Solenoid Valve Controller (UC511)

Region: US 915 $170.00

– 1 + Add to cart

Download Datasheet
Share

VERIFIED

Milesight 3D ToF People Counting Sensor VS132

Region: US 915 $575.00

– 1 + Add to cart

Download Datasheet
Share

VERIFIED

Milesight WS522 Portable Socket (Discontinued – use WS523)

Region: EU 868 $85.00

– 1 + Add to cart

Download Datasheet

Share

VERIFIED

Milesight EM500-PP Pipe Pressure Sensor

Region: US 915 $265.00

– 1 + Add to cart

Download Datasheet

Share

VERIFIED

Dragino LSN50v2-D23 LoRaWAN Temperature Sensor

Region: US 915 $62.00

– 1 + Add to cart

Download Datasheet

Share

VERIFIED

Dragino LSN50v2-S31B – LoRaWAN Temperature & Humidity Sensor

Region: US 915 $56.00

– 1 + Add to cart

Download Datasheet

Share

VERIFIED

Dragino LSN50v2-D22 LoRaWAN Temperature Sensor

Region: US 915 $56.00

– 1 + Add to cart

Download Datasheet

Share

VERIFIED

Dragino Waterproof Temperature Sensor – Weaved Metal PT100 probe (-196 – 150 °C)

Region: US 915 $65.00

– 1 + Add to cart

Download Datasheet

Share

VERIFIED

Dragino LoRaWAN Water Leak Sensor

Region: US 915 $19.00

– 1 + Add to cart

Download Datasheet

Share

VERIFIED

Dragino Waterproof Temperature Sensor – Weaved Metal PT100 probe SI (-50 – 200 °C)

Region: AU 915 $59.00

– 1 + Add to cart

Download Datasheet

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VERIFIED

Dragino LDS02 Door Sensor

Region: US 915 $19.00

– 1 + Add to cart

Download Datasheet

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VERIFIED

Dragino Non Contact Liquid Level Sensor

Region: US 915 $59.00

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VERIFIED

Dragino LDS03A Door Sensor

Region: US 915 $55.00

– 1 + Add to cart

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VERIFIED

Dragino Distance Detection Sensor LDDS75

Region: US 915 $69.00

– 1 + Add to cart

Download Datasheet

Share

VERIFIED

Moko H2 iBeacon

Type: BLE

$50.00

− 1 + Add to cart

Download Datasheet

Share

VERIFIED

Netvox Indoor Window & Door Sensor

Region: US 915

$49.00

− 1 + Add to cart

Download Datasheet

Share

VERIFIED

Milesight Smart Button Red WS101

Region: EU 868

$60.00

− 1 + Add to cart

Download Datasheet

Share

VERIFIED

Netvox Occupancy, Temperature and Light Sensor

Region: US 915

$59.00

− 1 + Add to cart

Download Datasheet

Share

VERIFIED

Milesight Smart Button White WS101

Region: EU 868

$60.00

− 1 + Add to cart

Download Datasheet

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VERIFIED

Netvox Indoor Temperature & Humidity Sensor

Region: US 915

$49.00

− 1 + Add to cart

Download Datasheet

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VERIFIED

Netvox Indoor Water Leak Sensor

Region: US 915

$49.00

− 1 + Add to cart

Download Datasheet

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VERIFIED

Netvox Water Rope Leak Detector

Region: US 915

$149.00

− 1 + Add to cart

Download Datasheet

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VERIFIED

Netvox Temperature and Humidity Sensor for Low Temp

Region: EU 868

$99.00

− 1 + Add to cart

Download Datasheet

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VERIFIED

Netvox Light Sensor (R311G)

Region: US 915

$49.00

− 1 + Add to cart

Download Datasheet

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VERIFIED

Netvox PM2.5 Sensor

Region: EU 868

$179.00

− 1 + Add to cart

Download Datasheet

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VERIFIED

Netvox Emergency Push Button (R312A)

Region: US 915

$49.00

− 1 + Add to cart

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Synetica enLink Air LoRa Wireless Air Quality Monitor

Region: US 915 $1,269.00

Contact for info

Download Datasheet

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Laird Temperature & Humidity Sensor with Datalogger

Region: US 915 $89.00

Contact for info

Download Datasheet

Share

Polysense External UV Sensor

Region: US 915 $149.00

Contact for info

Download Datasheet

Share

Digital Matter Oyster 3 4G

Type: cellular $214.00

Contact for info

Download Datasheet

Share

MCF88 Weather Station

Region: US 915 $3,102.00

Contact for info

Download Datasheet

Share

Netvox RA02C Wireless CO Detector

Region: US 915 $89.00

Contact for info

Download Datasheet

Share

Tracknet Object Locator

Region: EU 868 $59.00

Contact for info

Download Datasheet

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Vutility HotDrop 4000 Amp Max

Region: US 915 $825.00

Contact for info

Download Datasheet

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DecentLab High-Precision Pressure/Liquid Level and Temperature Sensor

Region: US 915 $1,299.00

Contact for info

Download Datasheet

Share

Milesight IoT Controller UC300

Region: US 915 $140.00

Contact for info

Download Datasheet

Share

Elexa Remote Sensor Probe GRSP2-4

$10.00

Contact for info

Share

Abeeway Compact Tracker

Region: US 915 $130.00

Contact for info

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VERIFIED

Tracknet PIR Motion / Desk Occupancy Sensor

Region: EU 868 $49.00

− 1 + Add to cart

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VERIFIED

DecentLab CO2, Temperature, Humidity and Barometric Pressure Sensor

Region: US 915 $644.00

− 1 + Add to cart

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VERIFIED

DecentLab Ultrasonic Distance/Level Sensor (0.3–10m)

Region: EU 868 $700.00

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Share

VERIFIED

Elsys CO2 Sensor

Region: US 915 $199.00

− 1 + Add to cart

Download Datasheet

Share

VERIFIED

DecentLab Ultrasonic Distance/Level Sensor (0.3–10m – Snow Level)

Region: EU 868 $700.00

− 1 + Add to cart

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VERIFIED

Elsys Sound Sensor

Region: US 915 $169.00

− 1 + Add to cart

Download Datasheet

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VERIFIED

Polysense Sound Sensor

Region: US 915 $179.00

− 1 + Add to cart

Download Datasheet

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VERIFIED

RisingHF Temperature & Humidity Sensor

Region: US 915 $80.00

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Download Datasheet

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VERIFIED

Woodstream Smart-Kill Electronic Mouse Trap

Region: US 915 $149.00

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Download Datasheet

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VERIFIED

Woodstream Smart-Kill Electronic Rat Trap

Region: US 915 $169.00

− 1 + Add to cart

Download Datasheet

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VERIFIED

Elsys Desk Presence Sensor

Region: US 915 $99.00

− 1 + Add to cart

Download Datasheet

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VERIFIED

Polysense CO Sensor

Region: AU 915 $139.00

− 1 + Add to cart

Download Datasheet

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Tektelic Cellular Gateway

Region: US 915 $419.00

− 1 + Add to cart

Download Datasheet

Share

Vutility HotDrop 2.0

Region: US 915 $250.00

Contact for info

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Dragino LHT65S Temperature & Humidity Sensor

Region: AS 923 $55.00

Contact for info

Download Datasheet

Share

Vutility HotDrop XL 400 Amp Max

Region: AS 923 $450.00

Contact for info

Download Datasheet

Share

Decentlab Eleven Parameter Weather Station

Region: US 915 $3,749.00

Contact for info

Download Datasheet

Share

Synetica enLink Status-DP LoRa Wireless Differential Pressure Sensor

Region: US 915 $299.00

Contact for info

Download Datasheet

Share

Polysense External UV Intensity Sensor

Region: AS 923 $333.00

Contact for info

Download Datasheet

Share

IMBUILDINGS People Counter

Region: US 915 $299.00

Contact for info

Download Datasheet

Share

Yabby Edge Cellular-NB-IoT

Type: nb-iot $128.00

Contact for info

Download Datasheet

Share

Vutility HotDrop XL 1000 Amp Max

Region: AS 923 $500.00

Contact for info

Download Datasheet

Share

Axioma Water Meter DN20

Region: US 915 $265.00

Contact for info

Download Datasheet

Share

Dragino SW3L: DW-006 Flow Sensor: Diameter: G3/4" / DN20. 360 Pulse = 1 L

Region: US 915 $59.00

Contact for info

Download Datasheet

Share

Smart City Strategic Plan

DELIVERABLE 3

Magellan
An ENTRUST Solutions Group Company

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TABLE OF CONTENTS

TABLE OF FIGURES

TABLES

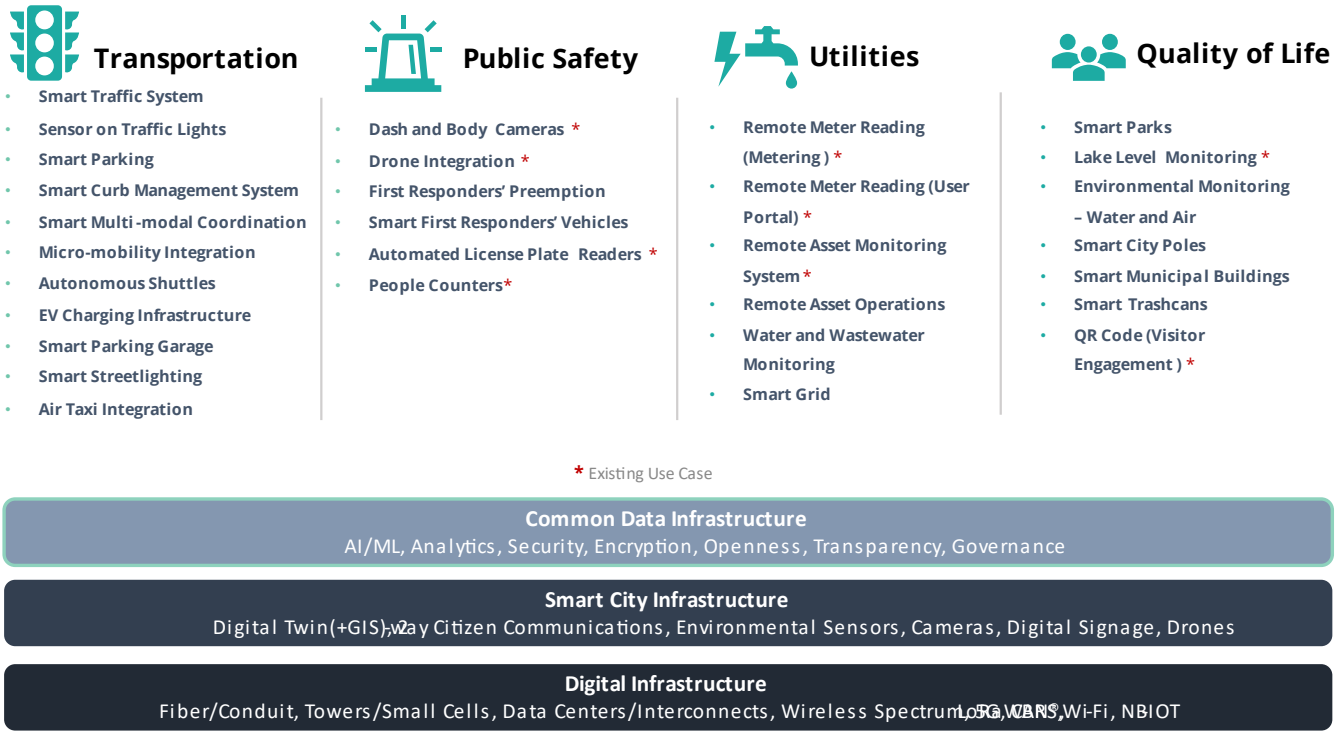
1. Executive Summary

The City of Winter Park has a vision to become a "Smarter" City by leveraging technology to enhance and streamline municipal operations, thereby improving the overall quality of life for all residents, workers, and visitors in the community. The city aims to incorporate innovative solutions and platforms into its municipal systems and processes to support the Winter Park community.

It is important to note that Winter Park is not just starting to focus on how it can conduct business smarter but has implemented a range of solutions over the last several years, which has given the City insight into the concepts of Smart City and the Internet of Things (IoT). However, this has been implementing solutions as the need arises without a cohesive city-wide strategy. As an example, Winter Park utilities has been remotely reading utility meters using Advanced Metering Infrastructure (AMI) technology for nearly a decade, however the wireless infrastructure can support far more. Just recently the City purchased 57 lake/water body monitoring sensors which will now provide real-time lake water levels - replacing a manual measuring process used today. The city also deployed cameras, people counting sensors, License Plate Readers (LPR), Public Wi-Fi access points, kiosks, and parking sensors over the years, with varied levels of success.

Through this Planning process, Magellan's team, together with the City's leadership, have been able to identify four (4) core smart city pillars on which the City should focus its smart city efforts. The pillars are Intelligent Transportation, Enhanced Public Safety, Next-Generation Utilities, and Enhanced Quality of Life. Each pillar is supported by municipal infrastructure layers that provide common technologies and capabilities, enabling seamless communication across the community. When combined, these systems, platforms, and datasets will ultimately empower Winter Park to manage its municipal infrastructure and the entire city in real-time.

Figure 1 - Winter Park's Smart City Pillars and Supporting Technologies and Infrastructures



The City of Winter Park seeks to learn from other municipal peers who have deployed similar connectivity strategies, and who have leveraged those systems to support their smart city initiative. Each city is unique, yet we can learn from successes and best practices from cities large and small. Winter Park doesn't have to look far to find leaders in Smart City, including its sister city, in Orlando, and Coral Gables located in South Florida.

CONCLUSIONS AND NEXT STEPS

A Smarter Winter Park aims to optimize all aspects of municipal government operations and city life. The scope of technologies and solutions required for this transformation is vast. Each Smart City Pillar and numerous individual use cases represent entire multi-billion-dollar industries, each with its own unique technologies, standards, value chains, innovations, terminology, regulations, and complexities. While certain common technologies, such as IoT, Digital Twins, and AI, can address various use cases, the integration and operational challenges, even for a 10 square mile city like Winter Park, are substantial. To address these complexities, meet the City's needs effectively, and avoid proprietary vendor lock-in, the following next steps are suggested:

I. Spend the time upfront to establish a city-wide technical layered architecture and open data governance policies based on international standards and best practices.
   i. The City should also establish reference architectures for:
      - Smart Parks
      - Smart Buildings
      - Remote Asset Monitoring

II. Initiate the process to establish a city-wide Intelligent Transportation Strategy that addresses all transportation use cases in a single comprehensive and unified long-term strategy.
III. Each city utility should establish a 10-year strategic technology roadmap to ensure they meet the cities needs reliably and cost effectively.
IV. Public Safety should continue to deploy and expand devices, technologies, and systems as force multipliers and to improve and gain situational awareness.
V. Initiate the process to establish a city-wide Environmental Monitoring Strategy to optimize the deployment of sensors and realize the value of data collection.
VI. The city should take a regional approach to its many smart city plans. The city should closely monitor and participate in State, County and Regional Organizations, consortiums, and initiatives.
VII. Initiate the process to define and create a digital twin of the city that supports the widest range of use cases. Learn from early examples in Orlando, Coral Gables and globally.
VIII. Two high priority use cases and foundational technologies, the 2-Way Citizen Communication and the Smart City Management System (Single Pane of Glass), are globally identified as major issues. The markets for these product categories are dynamic and fast moving. They are both nascent with conflicting product requirement and lack of standards. Given the importance and the complexities, the City should initiate the process to gather requirements from all prospective city users and monitor advancements in the industry.

2. Smart City Trends and Case Studies

Cities that embark on deploying smart city initiatives need to understand their communities' needs, how these needs evolve over time, and how they relate to the changing environment and rapid advancements in technology. Beyond being up to date with technological trends, the City must also learn from other cities that have successfully implemented their smart city strategies, including how they are organized, structured, administered, and the stakeholders they engaged with during the process.

This section offers current and future smart city trends and case studies on local and international cities to help the City of Winter Park continue expanding its knowledge as it refines its smart city strategies for both the short- and long terms.

SMART CITY TRENDS

Transportation is the top priority in the smart city trends that various innovation groups anticipate being implemented. Challenges in urban mobility, traffic management, road and pedestrian safety, parking, and Electric Vehicle (EV) adoption are driving the development of a wide array of technologies and solutions and the establishment of new rules and regulations. Other areas of significant development include public safety, utilities, and enhancing the overall quality of life for the community.
Below are the top smart city trends for 2023 that may be relevant for the City of Winter Park, based on several industry experts[1] analysis.

General

- ***Digital Twins*** are gaining traction and uses which leads to cost savings, increased efficiencies, and resiliency. Singapore is now using rapid capture techniques to quickly map the country for its digital twin system. The new lidar and image capture technology helped the nation cut costs from $35 million to $4.5 million, and the time it took to update the map from two years to just eight months[2].
- ***Data-driven Community-Government Collaboration*** allows cities to prioritize its core issues. The city of Memphis, TN uses its real-time dashboards as a basis for the City's monthly meetings, as well as to share outcomes to the community through the weekly newsletter.
- ***Assistive AI*** will help city agencies and departments collaborate much faster and effectively, enhancing public safety and city services in general.

Transportation

- ***Intelligent Curb Management Systems*** combat traffic issues tied to the growing number of ride-sharing mobile applications and package delivery companies.
- ***Ridesharing Market*** will remain constant.
- ***Charger Infrastructure Deployments*** will determine the future of EV adoption.
- ***Fleet EV Adoption***
- ***E-Bikes and E-Scooters Deployments***
- ***AI-enabled Autonomous Transportation*** such as shuttles

[1] www.smartcitydive.com, Top 10 Smart City Trends & Innovations in 2023 | StartUs Insights (startus-insights.com)
[2] How Singapore created the first country-scale digital twin (venturebeat.com)

Public Safety

- *Surveillance Systems*
- *Smart Street Lights*
- *Real-time Crime Mapping*
- *Predictive Policing*

Utilities

- *Smart Grids/Grid Modernization* enable real-time usage tracking and forecast usage, peak demand, and potential breakdowns of an electrical distribution system.
- *Virtual Power Plants and Distributed Energy Resources (DER)* provide efficient power distribution, configuration flexibility, power reliability and overall lower energy costs.
- *Leak Detection* is useful for drinking and wastewater systems.
- *Enhanced Control and Operation of Critical Utility Infrastructure Systems*

Quality of life

- *Digital Citizen Initiatives* enable citizens not only to receive alerts and provide feedback/incident reports to the City, but to collaborate easily with their local government in planning projects and addressing issues such as access to health, education and job resources.
- *Advanced Waste Management* reduces overall environmental impact of increasing citizen and city visitors' activities by utilizing IoT sensors to efficiently manage city trash bins which regulates the amount of trash and keeps the environment clean, implement e-recycling kiosks to reduce overall waste and other initiatives.
- *Smart Buildings* encourages rethinking of how infrastructures are being built or rebuilt, ensuring low or zero carbon emissions, cost savings and increased efficiency.

SMART CITY CASE STUDIES

Table 1 - Demographics of Smart city Case Studies Compared to Winter Park

city	Area	Population (2022)	Income[3] (2023)	Employees (2021)
City of Winter Park, FL	10 sq mi	30,000	$88,688	500+
City of Orlando, FL	110 sq mi	316,081	$58,968	5,000+[4]
City of Coral Gables, FL	12.9 sq mi	49,193	$113,623	1,130+
City of West Hollywood, CA	1.89 sq mi	34,512	$78,719	250
City of Naperville, IL	39.7 sq mi	149,936	$135,772	546
City of Santa Monica, CA	8.41 sq mi	89,947	$99,847	2,000+
City of New York, NY	300.46 sq mi	8,335,897	$70,663	300,000+[5]
City of Seoul, South Korea	234 sq mi	9,968,000	$24,297	10,000+[6]
City of Zurich, Switzerland	34 sq mi	366,445	$48,041	10,000+[7]

[3] https://www.census.gov/quickfacts/fact/table , South Korea: median household income 2021 | Statista, Median Household Income in Switzerland (2015 - 2021, Purchasing Power Parity in Current International Dollars) - GlobalData
[4] City of Orlando Salaries - Florida (govsalaries.com)
[5] About New York City Government | City of New York (nyc.gov)
[6] (4) Seoul Metropolitan Government: Overview | LinkedIn
[7] (3) Stadt Zürich: About | LinkedIn

City of Orlando, FL

The city of Orlando has been one of the cities in the country pioneering the implementation and ongoing innovation within the smart city industry. It established an internal smart city task force to drive the strategy. In 2017, they won the Smart Cities Council Readiness Challenge and currently are a testing ground for autonomous vehicles. It continuously collaborates with local and other third-party partners to secure new funding opportunities for their smart city initiatives. In May 2023, Orlando released its Future-Ready Master Plan with a goal to continue being *"a center for innovation, technological advancement and resilience*[8]*.*

Some of its current initiatives are:

- Deployment of small cells and 5G technology around the city to support citizen's cellular experience and smart city initiatives.
- Advanced Air Mobility through their NASA partnership and planned vertiport at Lake Nona.
- Launched World Economic Forum's Advanced and Urban Aerial Mobility Cities and Regions Coalition, which brings cities together at the forefront of innovation.

Their upcoming projects are the following[9]:

- Digital Twin - they are drafting an RFP to procure this system. This system will enhance their public safety operations and quality of life experiences such as in city parks and other public areas.
- Expanded Public Wi-Fi.
- Digital Wayfinding - along with their plans on Smart Parking.
- Urban Autonomous Vehicle Pilot Program in Altamonte Springs.

City of Coral Gables, FL

The City of Coral Gables has taken a very structured, robust methodology to deploy technologies with the goal of creating data that can be used to manage the city in real-time. Its investments include foundational investments in fiber and wireless technologies, private and commercial cloud networks, as well as systems to deliver real-time data analytics and dashboards for city leadership.

The City of Coral Gables was among the first in the nation to implement AI-powered integrated/modular smart city poles, as well as to deploy unmanned drone technology to monitor large crowds and respond to 911 calls before responders arrived. Coral Gables also uses smart lighting and communication infrastructure that incorporate Wi-Fi, 5G, CCTV, traffic, environmental and safety sensors to improve public safety, mobility and economic opportunities.

See Coral Gables' Smart City Hub - Coral Gables Smart City Hub (arcgis.com)

City of West Hollywood, CA

In 2015, the City of West Hollywood (WeHo) deployed a robust fiber infrastructure that supports their smart city initiatives today. Early on in the process, the City formed its *Innovative Division* comprised of two full time staff to focus on the progress and completion of projects in their 2017 Smart City Strategic Plan. This

[8] final_futurereadycityplan-appendix.pdf (orlando.gov)
[9] Orlando plans for a future-ready city - City of Orlando

division was highly supported by the City's cross-functional teams. *Smart City Hall*, *Smart Streetscape (+ Buildings) Initiatives* and *Smart Mobility* initiatives were the top priority projects of WeHo in their 5-year smart city plan. To date, its citizen services have been made available online, its public safety pilot has been successfully launched, and it is almost finished adopting a privacy policy for smart cities and data sharing policy, upgrading the streetlight infrastructure, adding capacity for data analytics, and developing tools for simple access to mobility data. All of its other initiatives are found here - WeHo Smart City Strategic Plan Progress Update FINAL.pdf | Powered by Box[10].

City of Naperville, IL

In 2019, the City of Naperville, IL prioritized their smart city wish list under several key pillars: *Sustainability, Municipally Owned Utilities*, *Transportation and Public Safety*. Today, its sustainability efforts offers rebates for community's participation to promote energy efficiency through smart thermostat installation, energy efficient windows installation, and more[11]. The City also invested in solar energy installations on city-owned buildings to reduce its energy demand from the grid. The city's - to electric utility initiated the implementation of *Smart Grid* which enables safe, reliable, low-cost and sustainable services. The city's water utility on the other hand, installed devices that enabled remote water meter reading which allows city customers to view their water usage data through a dashboard, and is also tied to the utility's billing software to ensure accurate monthly bills. The City implemented its Centralized Traffic Management System (CTMS) and signed an intergovernmental agreement that connects its traffic light systems with the County of DuPage. Along with the City's implementation of advanced traffic systems and connecting all of its corridors, all traffic signal equipment is being upgraded[12]. Finally, its emergency response is integrated with the Smart911 web service, where citizens can securely create their "Safety Profiles" for free, which then allows public safety officials to respond effectively and swiftly during emergencies[13].

City of Santa Monica, CA

The City of Santa Monica has piloted and implemented several smart city applications throughout the past two decades. Since 2006, they have been working on their municipal fiber networks to ensure its reliability and affordability for when they were ready to deploy potential smart city initiatives. The city has Wi-Fi services provided in 34 'hotzones'[14] such as city facilities, parks, open spaces, entertainment and cultural venues, and business improvement districts. It also has more than 450 wireless access points mounted on streetlight and traffic signal poles with its number increasing by 40 to 50 per year. In addition to the hotzones, Public Wi-Fi is deployed on major transportation corridors and on most commercial streets and has over 3,500 users per day. These wireless networks are also used by the city's transportation and public safety departments. To address the increasing traffic, the City deployed a real-time parking system, where it feeds data to on-street directional signs which leads the public to available parking spots. They have also integrated this parking system with Waze, and other online Application Programming Interface (APIs). Through the city's backbone, they were able to connect all traffic lights, synchronizing and controlling remotely the traffic signals in real-time, especially during emergencies or when there are community

[10] WeHo Smart City Strategic Plan Progress Update FINAL.pdf | Powered by Box
[11] Sustainability Incentives and Rebates | The City of Naperville
[12] Centralized Traffic Management System | The City of Naperville
[13] Smart911 | The City of Naperville
[14] *Hotzones* refer to areas which give users wireless access to the Internet through Wi-Fi. A hotzone can have multiple hotspots.

events. Finally, they have more than 600 cameras around the city used for traffic management and public safety.

City of New York, NY

Hundreds of smart sensors and technologies have been tested and placed through the different districts in New York City as part of its smart city pilot program in 2020. The program amasses data to help manage services like waste management and collection, more efficiently. Car sharing services are also huge in the Big Apple, which helps reduce total emissions and traffic congestions. As an attempt to engage more local perspectives and creativity, New York city holds an annual contest with a generous cash prize for software applications that best utilize the city's open data sets.

City of Seoul, South Korea[15]

Since 2014, Seoul has been implementing different smart city initiatives with the goal of collecting valuable data and analyze urban patterns. They have deployed several sensors for different uses such as for air quality monitoring, motion detection, and surveillance cameras for traffic and public safety. Seoul is also one of the first cities to utilize 5G technology in mobility and transportation. Today, they are prioritizing the deployment of smart technologies based on the city's ageing population. For example, an elderly person can be monitored with motion detectors and other sensors and when an anomaly is detected the relevant city staff will be alerted to respond.

City of Zurich, Switzerland[16]

The City of Zurich developed a smart city strategy in December 2018 under their Urban Development department. They piloted a streetlight project where the light levels (dimmer or brighter) adapted to traffic levels through sensors, ensuring efficient use of energy. This resulted in a 70% energy saving for the City. With the initial success, they have expanded to add a broad range of sensors for other uses such as environmental monitoring and smart traffic. The City's smart building management system, connecting the City's heating, electricity and cooling has been effective as well. Zurich stays on top of the fast-evolving technological trends that benefit their residents and visitors, by creating a space for inspiration and innovation open to smart city or innovation collaborators called, the Smart City Lab. This lab[17] continuously engage city departments, community partners and citizens to contribute their innovative ideas that improve the overall city's quality of life and safety, as its population continuous to grow.

SMART CITY TECHNOLOGY OVERVIEW (INTERNET OF THINGS)

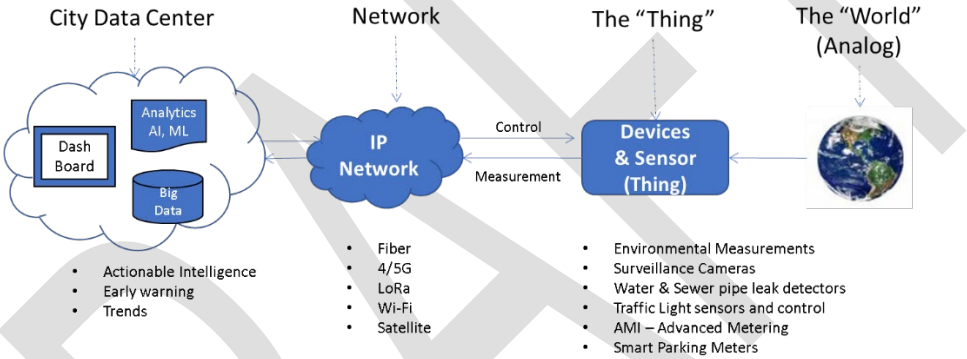
The technologies required to implement a smart city are as far ranging as the smart city applications they support and enable. The requirements of each application need to be well defined and documented. Many smart city applications are associated with a major worldwide trend called the Internet of Things (IoT). The simplified model of smart city IoT applications, shown in the figure below, begins with a device or sensor, '*the thing*', measuring some environmental parameter. This could be an underground sensor detecting

[15] Top 7 Smart Cities in the World in 2023 (earth.org)
[16] Smart City Zurich - City of Zurich (stadt-zuerich.ch)

water pipe leaks, sensors on a streetlight measuring CO2, or a sensor determining whether a parking spot is available.

Once the environmental measurements are digitalized and turned into '1's and '0's, they need to be transmitted to the city's servers over a network. The type of network used will depend on variables like bandwidth, latency, cost, and availability, as described previously in Deliverable 2 - Connectivity Plan. The networking needs are application and location dependent. For instance, sensors measuring air quality send small amounts of data periodically, while a 4K surveillance camera sends large streams of data continuously. Similarly, a sensor located in the city center may have multiple networking options available, such as Wi-Fi, fiber, LoRaWAN®, or 5G/cellular, whereas a sensor on the outskirts may be limited to options like satellites. The "Internet" in IoT comes from the use of internet protocols (e.g., TCP/IP) and global addressing across networks of all types.

Figure 2 - IoT Diagram



Once data is generated, collected, and stored on the city's servers it must be analyzed and processed into useful, or actionable, intelligence. This is accomplished using a range of data science tools including analytics, artificial intelligence, and machine learning. The location of the city's servers could be on-site, at a co-location data center, in the cloud, or likely a combination of them.

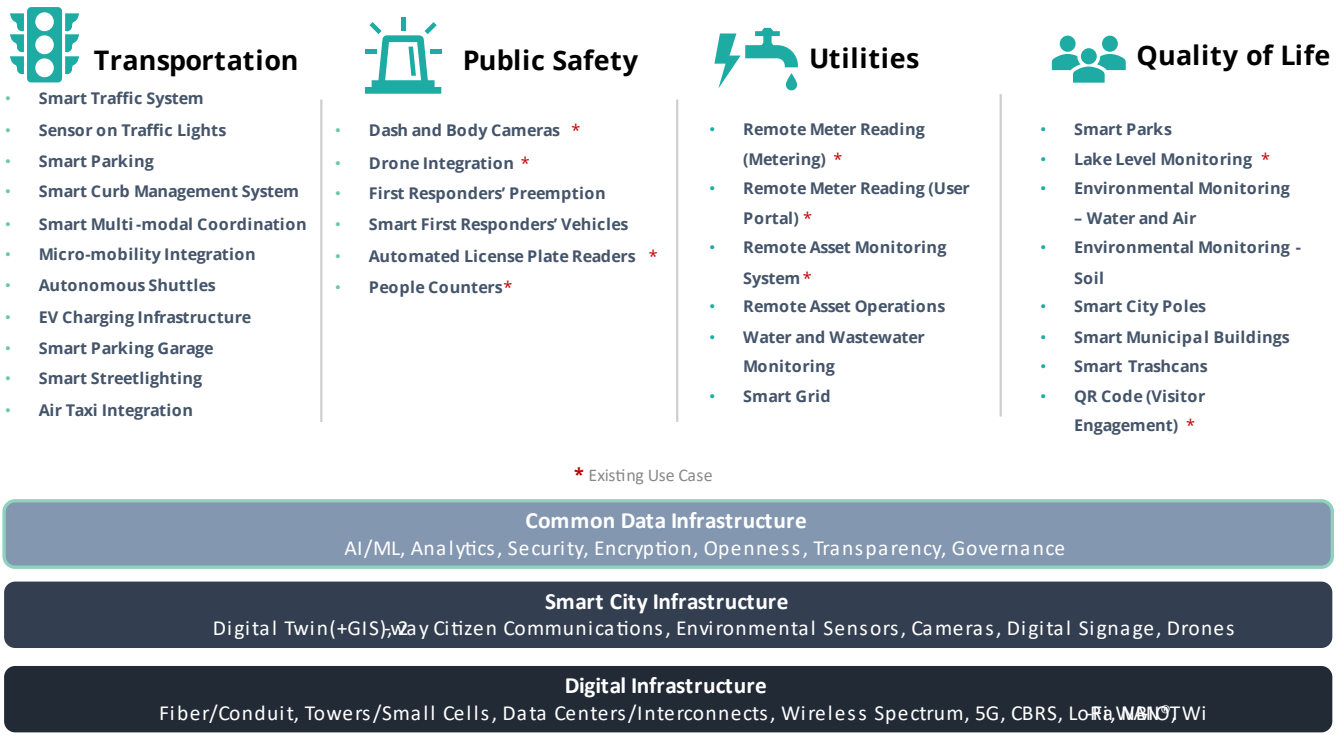
To illustrate, the City could collect data from sensors embedded in the pumps of the water system and use it to compare current data with historical and predicted data. The outcome of the data analysis would be to predict failures before they happen, enabling the City to take pre-emptive action to minimize or eliminate utility service outages. This use case for predictive maintenance can apply to any mechanical systems the City operates.

Many smart city applications are bi-directional. Once the data is received and analyzed, a corresponding action can be initiated. For example, the analysis of data from an array of rainwater sensors could cause the system to alter irrigation schedules or automatically open stormwater flood gates.

3. Smart City Pillars of Winter Park

The results of Magellan's research and analysis, in collaboration with the City and the Smart City Committee, were the identification of the four smart city pillars driven by municipal issues and community drivers. The four key pillars are shown in Figure 3 below, along with the primary use cases for each pillar. Supporting these pillars are three common infrastructure layers that will underpin all aspects of the City's smart city vision.

Figure 3 - Winter Park's Smart city Pillars and Infrastructure



Each pillar and each use case is driven by actual community needs and advancements in an enormous range of technologies. Implementing specific solutions can be the result of advances in semiconductors, artificial intelligence, cloud computing, and image processing—all enabled by the emerging ubiquity of high-speed communications. The identification and standardization of the common infrastructure layers will reduce implementation and operational complexities, thereby decreasing both the CapEx and OpEx for the city.

The following section will highlight the vision, objectives, and primary use cases of each pillar.

WINTER PARK'S SMART CITY PILLARS

Intelligent Transportation

The number of vehicles traveling to and through Winter Park has increased as a result of the city's and regions growth. This impact is clear, given that parking and traffic were the top concerns raised by stakeholders during the project team's extensive stakeholder outreach.

According to the US Department of Transportation, "**Intelligent Transportation Systems** *apply a variety of technologies* to monitor, evaluate, and manage transportation systems to enhance efficiency and safety."

The immediate goal of a city's smart transportation strategy is to ensure the safe and smooth flow of traffic through the city (and region), and to reduce the time to find parking in the central business district. Given the importance and wide range of traffic and parking issues, transportation can best be solved by taking a city-wide (and regional) comprehensive approach and creating a cohesive *Intelligent Transportation Strategy and Deployment Plan*. This single strategy would address all the transportation use cases and issues identified.

Vision

A city with an intelligent transportation system that measures, monitors, and controls the flow of traffic through the city, to reduce congestion, optimize routes, detect accidents, avoid idling pollution, and to detect and communicate available parking.

Key Objectives

- Manage traffic
- Reduce congestion
- Optimize routes
- Maximize city parking spaces
- Reduce pollution

Existing Assets

- 54 Traffic Pole/Span Structures
- 4,218 Streetlights (338 LEDs)
- 40 Bus Stops
- 1 Train Station
- 64 Intersections with Intelligent Traffic Systems

Primary Use Cases

- Smart Traffic System
- Speed Sensors on Traffic Lights
- Smart Parking
- Smart Curb Management
- Smart Multi-modal Coordination
- Micro-mobility Integration
- Autonomous Shuttles
- Electric Vehicle Charging Infrastructure
- Smart Parking Garage
- Smart Streetlighting - Transportation
- Air Taxi Integration

Smart Traffic System

A smart traffic system will ensure the smooth flow of traffic through the city and region. It measures, monitors, and controls the flow of traffic to reduce congestion, optimize routes, detect accidents, and avoid idling pollution. At a high level, a smart traffic system deploys multiple sensors, edge devices, and cameras at key intersections around a city. The camera feeds are then sent to an image-processing system, where videos and images identify vehicles at each intersection. The results are then processed by the Central Management System (CMS), combining them with regional data for real-time and historical analysis. Traffic signal timing can be intelligently modified throughout the day using both manual and automatic processes to enhance traffic flows as required.

In 2020, the city of Greeley, CO, with of a population of 100,000 (with a 30% population growth from year 2000) had to decide whether to expand roads through costly construction, or to develop an intelligent traffic system to handle the increased traffic that came with the city's rapid growth. They have chosen the latter and have successfully reduced travel times by 10-20%[18]. The city utilizes a smart city data analytics platform[19] that provides actionable insights on travel times, traffic patterns and congestion, as well as a traffic management software that helps optimize traffic signal timing, identify safety and operational issues, transit signal priority, adaptive signal control, and network security. With all these systems and technology in place, the City is able to lower its operational costs, cut emissions from idle vehicles in traffic, improve traffic flows, and ultimately offer a reliable and secure traffic system for its citizens.

● **Status: Researching**	Dependencies: · **Backbone connectivity** · **Requires regional coordination agreements with FDOT, County and neighboring cities**	Complexity Level: **High**	
Connectivity Requirements: **Fiber | CBRS**		Timeframe: **Mid-term 1-3 yrs.**	

The capital cost of a smart traffic system is driven by the number of intersections and number of cameras at each intersection monitored. While the yearly operating costs are dominated by software fees for the image and data processing solutions, with a yearly maintenance fee for all devices. The estimated cost summary is shown in the table below and is based on deployments of 4 cameras in each of the 64 intersections that were recommended to be connected with fiber.

Table 2 - Smart Traffic System Cost Estimates

Estimated Smart Traffic Cost-5YR Plan					
	YR 1	YR 2	YR 3	YR 4	YR 5
Total CapEx w/ 20% Contingency	$ 115,000	$ 635,000	$ 635,000		
Total OpEx			$ 100,000	$ 195,000	$ 195,000
Total Cost/YR	$ 115,000	$ 635,000	$ 735,000	$ 195,000	$ 195,000

Conclusion

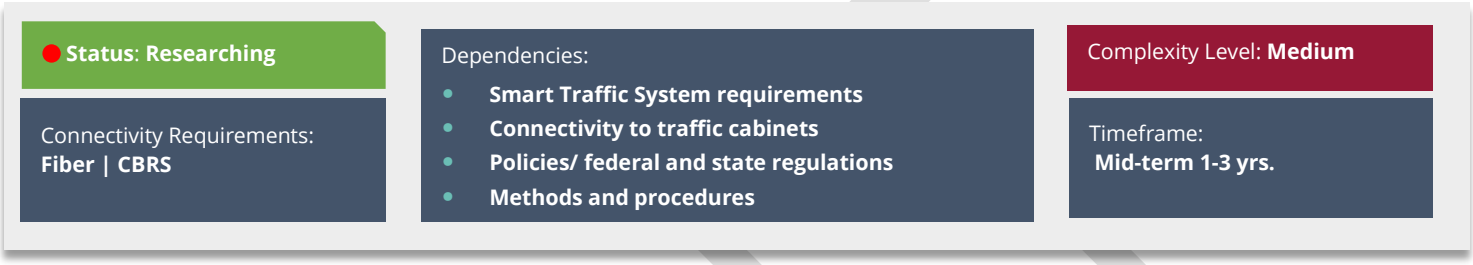
The city should commission a Smart Transportation Task Force to create a city-wide *Intelligent Transportation Strategy and Deployment Plan* with detailed budgets and financial projections. It would address all the use cases included in this pillar in a cohesive long-term strategy. The city should ensure system requirements are based on open APIs[20], international standards, and municipal best practices. An appointed "Smart City Coordinator" would work with Public Works and be tasked with coordinating with State and County traffic programs and efforts to coordinate infrastructure development and establish real-time traffic data interexchange.

[18] https://www.flir.com/products/acyclica/
[19] Q-Free drives citywide traffic operations for Greeley, Colorado into the future - Q-Free
[20] Application Programming Interface

Sensors on Traffic Lights

A vehicle's speed can be determined by specialized devices (e.g., radar or lidar) or cameras mounted on traffic light infrastructures. This system creates a legal proof of the speed and can be used to issue speeding tickets. While dedicated single function systems are available, the trend is to use image processing systems for a range of smart traffic enforcement applications.

In 2022, research done by the city of New York, NY found that the installation of speed sensors, with the use of speed cameras and automated traffic enforcement resulted in a significant drop in traffic-related accidents and speeding by 72%[21].



Costs are based on 4 cameras/devices per intersection deployed at the same number of intersections as the Smart Traffic Systems. Systems such as speed sensing and the broader category of Smart Traffic Enforcement that issue tickets automatically are required by State Law to be calibrated each year. This costs $1500 per camera and is why OpEx is higher per unit than other camera/device-based applications.

Table 3 - Speed Sensors Cost Estimates

Estimated Speed Sensors Cost-5YR Plan					
	YR 1	YR 2	YR 3	YR 4	YR 5
Total CapEx w/ 20% Contingency		$570,000			
Total OpEx			$260,000	$260,000	$260,000
Total Cost/YR		$570,000	$260,000	$260,000	$260,000

Conclusion

The City should not invest in dedicated systems to generate speeding tickets. However, this will likely be an optional feature in future smart transportation and smart traffic systems and could be included in the overall *Intelligent Transportation Strategy and Deployment Plan* along with addition enforcement option such as red lights.

[21] Mayor Adams to Turn On New York City's Speed Cameras 24/7 on August 1 | City of New York (nyc.gov)

Smart Parking

A smart parking system's goal is to shorten the time it takes to find a parking space, hence reducing traffic congestion and car emissions, and to give a better overall user experience. Newer systems are based on advanced image-processing, and they can create a 'fingerprint' of the car based on color, make, decals and dents and track how long it has been parked. Advances in image processing and in algorithms will enable these to record license plates as an optional feature. This information can then be used for parking enforcement and other purposes.

Redwood City, CA, in partnership with a smart city mobility solution partner[22] reduced parking search by 45%, which also led to reduced traffic congestion and emissions in the city[23].

Status: Researching	Dependencies: • **Deployment of common cameras** • **Aesthetics of digital signage** • **Policies/Federal and State Regulation**	Complexity Level: **High**
Connectivity Requirements: **Fiber | CBRS | LoRaWAN®**		Timeframe: **Mid-term (1-3yrs)**

The costs are driven by cameras, digital signages (used to indicate availability), parking management system software and maintenance fees for those technologies. Additionally, the costs presumptively cover 600 parking spaces, 60% of which will be on the street and 40% in lots.

Table 4 - Smart Parking Cost Estimates

Estimated Parking Cost-5YR Plan					
	YR 1	**YR 2**	**YR 3**	**YR 4**	**YR 5**
Total CapEx w/ 20% Contingency	$20,000	$205,000			
Total OpEx			$35.000	$35,000	$35,000
Total Cost/YR	$20,000	$205,000	$35,000	$35,000	$35,000

Conclusion

Smart Parking is a top priority for the city of Winter Park and should be included in an overall *Intelligent Transportation Strategy and Deployment Plan*. With an open architecture approach, the City can leverage common smart city infrastructure including cameras and digital signage.

[22] Cleverciti
[23] Reducing parking search in Redwood City with smart parking — Cleverciti | Smart Parking for Smart Cities

Smart Curb Management System

Curbs are a critical component of the city's limited public Right-of-Way (ROW). Smart Curb Management Systems address the growth in ride sharing, device sharing (cars, bikes and scooters), and package delivery operations. They can be tightly integrated with smart parking systems, but they are stand-alone products due to the ecosystem requirements. Industry solutions on curb management use international standards from the Open Mobility Foundation, including the Mobile Data Specification (MDS) and the Curb Data Specification (CDS) to ensure interoperability amongst the wide array of participates in the curb ecosystem, including the city.

These systems transmit the vehicle's identity and Global Positioning System (GPS) location using public networks such as 5G and LoRaWAN® to the Central Management System (CMS). The flexibility of the systems would give the City the capability to charge a small fee by the minute for delivery trucks and other curb users. The fees may vary by type of user and time-of-day for example.

Early this year, the City of Oakland, CA launched their *Smart Loading Zone* program[24] to address the increasing congestion caused by illegal and unsafe loading-unloading patterns by commercial vehicles. The city partnered with Populus to introduce a digital and frictionless option for delivery operators to pay a curb fee by the minute using GPS technology. Effective Curb Management promotes safety, business vitality and provides access to public and first responders' ROW.

Status: Researching	Dependencies: • **Adherence to International standards**	Complexity Level: **Medium**
Connectivity Requirements: **5G**		Timeframe: **Mid-term (1-3yrs)**

The costs are mainly driven by the curb management software's/SaaS[25] one-time implementation and yearly fee.

Table 5 - Smart Curb Management Cost Estimates

Estimated Smart Traffic Cost-5YR Plan					
	YR 1	**YR 2**	**YR 3**	**YR 4**	**YR 5**
Total CapEx w/ 20% Contingency	$5,000				
Total OpEx		$20,000	$20,000	$20,000	$20,000
Total Cost/YR	$5,000	$20,000	$20,000	$20,000	$20,000

Conclusion

Given the expected growth in ride sharing, device sharing (cars, bikes and scooters), and package delivery operations, Winter Park should include Curb Management in the overall *Intelligent Transportation Strategy and Deployment Plan*.

[24] Oakland boosts kerb management with smart loading zones - Cities Today (cities-today.com)
[25] SaaS – Software as a Service

Smart Multi-modal Coordination

The goal of multi-modal coordination is to optimize the movement of people and goods through the city and region. This involves establishing data sharing agreements and secure connections amongst all public and private participants to coordinate schedules and adapt to demands and delays. Cross-modal payments and discounts would also be possible.

In mid-2021, the City of Pittsburgh, PA launched their program *Move PGH* where they brought emerging low-cost, sustainable, shared multiple transportation services into one app called Transit, meant for use by its citizens. This app also gives the City leaders meaningful data on travel trends which could be helpful in prioritizing its future transportation projects. As a result of this program, at least 25-30% of the trips in and around the city switched over from driven/ridden in car to alternative modes of transportation such as e-bikes, trains, buses etc.[26]

The cost of implementing a Smart Multi-modal Coordination system can be determined through the City's coordination with several government and private transportation agencies.

Conclusion

Multi-modal coordination should be pursued at the state, county and local levels and included in the overall *Intelligent Transportation Strategy and Deployment Plan*. The assigned Smart City Coordinator would be responsible for coordinating and interacting with projects related to regional, state, and national transportation.

[26] Mapping the multimodal future of US mobility - Cities Today (cities-today.com)

Micro-mobility Integration

The growth of urban areas in Central Florida and around the globe is making the one-person-per-car model unsustainable. This is evident by the traffic and parking issues in Winter Park today. Many urban areas encourage the use of bikes by adding bike lanes, even if that means losing a vehicle lane. Although useful, bikes, e-bikes, and e-scooters, add complexity to urban transportation planning.

Micro-mobility, including shared solutions, has both a technical and policy challenges. Technical challenges include storage and charging infrastructure needs. The Curb Management solutions address many of these issues. Challenges on policy revolve around the "where" and the "when" these devices can be used, as well as incurring fines for non-compliance. Today, *Winter Park Ordinance 3195-21* bans the use of "micro-mobility" devices on city roads, bike paths and sidewalks. An additional challenge is presented by Winter Park's many narrow and brick roads.

Today, the City of Orlando, FL is working with a few electric vehicle companies, such as Wheels and Lime that offer several micro-mobility solutions including e-bikes and e-scooters to combat traffic congestion and provide mobility options for citizens.

Status: **Researching**	Dependencies: • **Policies and local ordinances** • **Federal and State Regulation**	Complexity Level: **Medium**
Connectivity Requirements: **5G**		Timeframe: **Short-term (6mo-1yr)**

The cost of implementing a Smart Multi-modal Coordination system can be determined by the City once its ban on micro-mobility devices has been lifted, through quotations from various vendors.

Conclusion

Given the growth in micro-mobility and shared solutions, Winter Park should start to reconsider their implications and effects on the community and include this in the overall *Intelligent Transportation Strategy and Deployment Plan*.

If current trends continue, the city-wide ban for all micro-mobility devices may need to be amended. No one wants to see electric scooters on Park Avenue, however, reasonable accommodations for their use along other commercial thoroughfares and paved residential neighborhoods may help alleviate part of the traffic and parking problems in the city.

Autonomous Shuttles

Electric autonomous shuttles are emerging urban transportation solution. The shuttles being tested typically hold 12-20 people. They generally traverse pre-planned routes through the city connecting downtowns with other key city areas including city parking lots, the train stations and shopping areas. This could reduce downtown traffic and reduce the demand for downtown parking.

The community of Lake Nona in the city of Orlando has deployed and is currently working with Beep to operate 8 shuttles within 5 routes. These connect its citizens to 10 key destinations within the city[27]. On July 24, 2023, Beep began operating its self-driving shuttles in Uptown Altamonte in Altamonte Springs, FL as part of the City's CraneRIDES pilot project. Routes are anticipated to become more extensive over time. The shuttles travel at a rate of 15 mph. This pilot program should ease traffic congestion and offer residents and visitors a more sustainable transit option[28].

Status: **Researching**	Dependencies • **Policies/Federal and state regulation**	Complexity Level: **High**
Connectivity Requirements: **CBRS**		Timeframe: **Long-term (3-5yrs)**

The CapEx assumes that the City would buy two autonomous vehicles. Given the timeframe, fully autonomous operations along a fixed path would be possible. The city could hire or have volunteer 'City Ambassadors" to greet and assist visitors and monitor operations. Salaries are not included in these OpEx cost estimates.

Table 6 - Autonomous Shuttles Cost Estimates

Estimated Smart Traffic Cost-5YR Plan					
	YR 1	**YR 2**	**YR 3**	**YR 4**	**YR 5**
Total CapEx w/ 20% Contingency		$100,000	$960,000		
Total OpEx				$180,000	$180,000
Total Cost/YR		$100,000	$960,000	$180,000	$180,000

Conclusion

Autonomous and/or semi-autonomous shuttles connecting the city's central business district with the train station and primary commercial districts would be a desirable amenity for residents and visitors alike. These types of vehicles are gaining acceptance and are undergoing rapid technical advancements to improve operations and reduces costs to the City. These vehicles can also generate advertising revenues. Over time, the City could add sensors to the vehicles to assist with smart parking, environmental monitoring, while identifying graffiti, potholes, and other issues along their routes.

[27] https://ridebeep.com/location/move-nona/
[28] CraneRIDES: Self-driving shuttle program offers alternative rides around Altamonte Springs (yahoo.com)

Electric Vehicle Charging Infrastructure

Today, many Electric Vehicle (EV) owners charge their vehicles at home. As the country prepares for a more sustainable future, it has been making efforts to increase EV use of all types, including scooters, cars, trucks, and buses. In addition to the incentive programs offered per state[29], the government also invested $5 billion on EV charging infrastructure through the National Electric Vehicle Infrastructure (NEVI) program.

The city of Seattle, WA currently has a total of 724 EV public charging stations supported by Blink, Greenlots, Tesla, EVgo, ChargePoint and SemaConnect. The city's 'Drive Clean Seattle' program, which was launched in 2016, ensures that electrical infrastructure is installed and operable, in preparation for increased EV adoption. As a result, there was a 63% increase in micro-mobility trips between 2021 and 2022 (totaling 3.73 million micro mobility trips), all of which were made, operating on zero-emission technologies[30]. Additionally, the City teamed up with BNSF Railway[31] in 2022 to replace diesel-powered yard trucks and tractors (which serve trains) in order to safeguard individuals impacted by the pollutants those vehicles produce. This initiative decreased 2,498 tons of C02, 6.2 tons of PM2.5, and 25.2 tons of NOx, which is the same as driving 538 gasoline-powered cars for a whole year[32].

Status: **Researching**	Dependencies: • **Site acquisition**	Complexity Level: **Medium**
Connectivity Requirements: **Fiber| CBRS**		Timeframe: **Mid-term (1-3yrs)**

The CapEx is determined by the number of charging stations per location and the cost to prepare the site. It is assumed that in the first two years, the City would deploy 6 charging stations in 4 sites per year. The OpEx is comprised of the yearly maintenance fees for these charging stations.

Table 7 - Electric Vehicle Charging Infrastructure Cost Estimates

Estimated EV Charging Stations Cost-5YR Plan					
	YR 1	**YR 2**	**YR 3**	**YR 4**	**YR 5**
Total CapEx w/ 20% Contingency	$ 20,000	$ 190,000			
Total OpEx			$ 15,000	$ 15,000	$ 15,000
Total Cost/YR	$ 20,000	$ 190,000	$ 15,000	$ 15,000	$ 15,000

Conclusion

This use case should be included in an overall *Intelligent Transportation Strategy and Deployment Plan.* Should the City decide to offer municipal EV Charging, it should adhere to open standards or to Open Charge Point Protocol (OCPP) to implement EV infrastructures faster and more efficiently. This enables EV infrastructure components such as charging stations, vehicles, and grid systems to communicate even if they are provided by different manufacturers. Open-source technologies can also provide the foundation for data exchange via an interoperability platform.

[29] Electric Car Rebates and Incentives: What To Know by State - Kelley Blue Book (kbb.com)
[30] TE_blueprint (seattle.gov)
[31] BNSF Railway - https://www.bnsf.com/ - railway company
[32] Seattle rolls out electric car initiative | CHS Capitol Hill Seattle News

Smart Parking Garage

A smart parking garage is usually a multi-floor structure that has many parking spaces. It is equipped with door gates and devices to detect which parking spaces are available. This information is displayed automatically on digital signage at the entrance. Lights above each parking space guide drivers to an open space. The parking availability information can also be transmitted to a cell phone application so users can see where parking is available and reserve or pay for it automatically. The benefits for this system are more efficient use of the available spaces, reduction in C02 Emissions and fuel costs, and an economic boost because people are comfortable driving and parking in the city.

Organizations that have developed a smart parking garage system[33] are able to maximize available space while easing traffic congestion. Mosman, a small city (population 28,100), adjacent to Sidney, Australia, had parking and traffic ranked as the top problematic issue for 4 years in a row. To address this issue, the City Council adopted a Smart Traffic and Parking Plan. On Smart Parking, they have deployed 158 on-street parking sensors, 215 off-street parking bay sensors, 509 overhead guidance lights in 3 multi-story parking garages, and 49 LED parking availability signs. The results are better utilization of parking spaces and less traffic congestion due to residents and visitors' ability to find parking faster.

Status: Researching

Connectivity Requirements:
Fiber |CBRS|LPWAN

Dependencies:
- **Identification of parking garages**
- **Cooperation of and coordination with private parking garages**

Complexity Level: **Medium**

Timeframe:
Long-term (3-5yrs)

The CapEx consists of equipping an existing garage with parking sensors estimated at $20-$200 per parking space, a smart pay station estimated at $5,000 to $15,000 and License Plate Readers (LPRs) for automatic payment on entry/exit estimated between $10,000 and $25,000. The costs below assumed middle cost of these ranges, equipping a 500-space parking garage including all equipment.

Table 8 - Smart Parking Garage Cost Estimates[34]

Equip Existing Garage with Smart Parking 500 spaces-5YR Plan					
	YR 1	YR 2	YR 3	YR 4	YR 5
Total CapEx w/ 20% Contingency	$15,000	$100,000			
Total OpEx			$15,000	$15,000	$15,000
Total Cost/YR	$15,000	$100,000	$15,000	$15,000	$15,000

Conclusion

Traffic and parking are among the top concerns for the leaders and residents of the city. However, at this time the city does not own parking garages. If one was to be built, the project team recommends that smart equipment and systems are architected into the facility from the onset of the design and construction.

[33] https://www.flashparking.com/ - a company that offers a parking garage solution
[34] Fixr.com | Cost to Build a Parking Garage | Parking Lot Costs per Square Foot

Smart Streetlighting - Transportation

Older legacy streetlights utilize sodium vapor lamps. This older technology is less power efficient and monochromatic so only gives out one color of dull yellow light. Newer lamps such as the Light Emitting Diodes (LED), save energy and have a brighter light source. Modern streetlights are equipped with LED lamps, solar panels and smart controllers. These controllers allow remote control of the lamp allowing dimming, turning off and turning on. Motion detectors have the same functions but adjusts automatically. The smart controllers can also detect malfunctions in the lamp and alert maintenance staff through a cloud-based control dashboard. Modern lamps with solar panels can reduce the streetlight utilities' cost down to zero and typically have a 2-4-year payback period.

The City of West Palm Beach converted 6,800 of its streetlights which resulted in 54% cost savings annually and an 11% decrease in overall greenhouse gas emissions for municipal operations[35].

Status: Researching	Dependencies: • **New controller connection** • **Standardizing on type and technology of the lights**	Complexity Level: **Medium**
Connectivity Requirements: **Fiber | CBRS |LoRaWAN®**		Timeframe: **Mid-term (1-3yrs)**

The purchase, installation, and maintenance for 100 lights (as an example) is considered in the chart below. The CapEx is determined by the type of light and light pole used. The yearly OpEx is driven by the utilities cost and failure rate. The electricity costs to operate the lights are not included in the cost estimates.

Table 9 - Smart Streetlighting Cost Estimates

Cost Estimate to Convert 100 Streetlights -5YR Plan					
	YR 1	**YR 2**	**YR 3**	**YR 4**	**YR 5**
Total CapEx w/ 20% Contingency		$20,000	$145,000		
Total OpEx				$15,000	$15,000
Total Cost/YR		$20,000	$145.000	$15,000	$15,000

Conclusion

The City should covert the remainder of their current streetlights and lamps into Smart LED lights with solar panels where it is technically feasible and meets the decorative requirements of the light fixtures.

[35] West Palm Beach, FL: Street Light Upgrade Project | Better Buildings Initiative (energy.gov)

Air Taxi Integration

The day of taking off in your backyard and flying across town is many decades away. What is envisioned, however, are Electric Vertical Take-off and Landing (eVTOLs)[36] flying in traditional and new helicopter routes such as those connecting city centers and airports. eVTOLs are lower cost, quieter, and 'greener' than the current helicopters in the market. The air taxi industry believes that this will drive down the per trip costs and accelerate the public's adaptation. Cities such as Singapore, Dubai, and Paris view electric air taxis as a critical component of their future transportation strategy. They are also viewed as a status symbol. The US Federal Aviation Administration (FAA) recently released their Air Taxi plans with initial flights expected in 2028 with limited operations starting in 2025[37].

In 2020, of Orlando, FL in partnership with a German aviation company Lilium is building the region's first Vertiport which is expected to be completed by 2025. This infrastructure investment is designed to alleviate rising traffic congestion while also providing citizens with an alternate mode of transportation.

Status: **Researching**	Dependencies: • **FAA and state regulations** • **Site acquisition** • **Regional adoption**	Complexity Level: **High**
Connectivity Requirements: **Fiber**		Timeframe: **Future (>5yrs)**

The cost estimates are based on McKinsey & Company's research[38] which includes planning, designing, procurement, construction, and maintenance of a vertiport. These do not include the expected landing fees which would offset the operating costs.

Table 10 - Air Taxi Vertiport Infrastructure Cost Estimates

Estimated Air Taxi Vertiport Infrastructure Cost-5YR Plan					
	YR 1	YR 2	YR 3	YR 4	YR 5
Total CapEx w/ 20% Contingency				$1,000,000	
Total OpEx					$4,000,000
Total Cost/YR				$1,000,000	$4,000,000

Conclusion

Winter Park should monitor air-taxi integration strategies of the city of Orlando, Orange County and the State of Florida to ensure the city is at, or near, the forefront of urban and regional air transportation. The city's participation would entail identifying a location and establishing one or more eVTOL airports or vertiports in the city.

[36] eVTOLs – Electric Vertical Take-Off and Landing aircraft describes an electric helicopter-like tilt-rotor aircraft
[37] Air Taxis, Hyped for Years, May Finally Take Off - The New York Times (nytimes.com)
[38] https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/to-take-off-flying-vehicles-first-need-places-to-land

Public Safety

City leaders must ensure their first responders have the technology and training to plan for, and respond to emergencies swiftly and effectively, while ensuring citizens' privacy.

To achieve this goal, the Winter Park Police department has deployed various technologies, including cameras, people counters, and license plate readers. These technologies enable the department to increase its presence, enhance data collection, and improve situational awareness more efficiently. Winter Park's Police Chief highlights that the amount and quality of data collected by these technologies cannot be replicated by simply adding more police staff, nor can city budgets afford this.

However, the increasing amount of data from multiple sources and the proliferation of cameras in public areas raise concerns about striking a balance between enhanced public safety and individual privacy. Cameras, both public and private, are found throughout the city and can be enhanced with advanced capabilities, including facial recognition and license plate reading, even before the implementation of artificial intelligence (AI) functionality.

Today, Winter Park Police is deploying FUSUS[39], a system that integrates video feeds from publicly and privately-owned cameras. FUSUS works by deploying a small electronic device at each camera's location such as at a retail store or bank on Park Avenue. When signaled by the Police, the device intercepts the video feed and transmits it to the Police Operations Center. This provides public safety officials with a larger number of camera sources on an on-demand basis. This reduces data storage requirements for retention, which can be costly.

Vision

A city that is safe, with first responders who have the tools, technology, and training to plan for, and respond to, emergencies swiftly and effectively, while balancing the public good with individual privacy.

Key Objectives

- Maintain city-wide safety
- Swift and effective emergency response
- Well-equipped public safety responders

Existing Assets

- 3 License Plate Readers (11 pending)
- 9 People Counters
- 32 Cameras
- FUSUS System
- Body Cameras
- Drones

Primary Use Cases

- Dash Cameras & Body Cameras for First Responders
- Drone Integration
- First Responder Preemption
- Smart First Responder Vehicles
- Automated License Plate Readers
- People Counters

[39] Fusus: Open & Unified Real-Time Intelligence

Dash Cameras & Body Cameras for First Responders

To protect first responders, and to provide real-time data, Body-Worn Cameras (BWCs) and in-vehicle dashboard mounted cameras (Dash Cams or Drive Cams) are in use today. New versions of these devices provide real-time video feeds over 5G mobile connections improving situational awareness to responders on-site and to remote personnel in other vehicles or at police headquarters. Video feeds from these cameras are subject to the retention laws as are other cameras. Winter Park has deployed both Body Cameras and Dash Cameras in its first responder and city worker communities.

Status: **Deployed**	Dependencies: · **Policies/Federal and state regulations**	Complexity Level: **Low**
Connectivity Requirements: **5G |CBRS | Wi-Fi**		Timeframe: **Existing**

Conclusion

The City has already deployed these devices and should continue to invest in body worn and drive cams as needed. The city should ensure devices are compatible with the city's future wireless infrastructure.

Drone Integration

Drones have evolved from being toys and weapons to becoming a tool for a range of industrial and commercial applications. They are finding applications in the public/government sector as well. Drones are considered actual aircraft, requiring certified pilots and adherence to strict FAA regulations. Whether a city needs to own the aircraft and have on-staff pilots, will depend on the number of applications and missions planned. A drone could make periodic (e.g., monthly, weekly) flights across the city to collect images and data for various analysis. Drones can also be available on-demand and fly over public events and during police and fire incidents providing commanders and on-site responders additional situational awareness from a wider perspective.

The city of Coral Gables, FL had begun their drone implementation program for public safety, starting on July 4th, 2022, where they introduced their drones to the public at a city celebration. They considered federal and state regulations while creating a policy of their own. They only fly specific missions and not for random surveillance. Coral Gables also has implemented launching of drones in response to 911 calls.

Status: **Deploying**	Dependencies: • **Smart traffic system deployment** • **FAA regulations** • **Policies/Federal and state regulations**	Complexity Level: **Low**
Connectivity Requirements: **5G/Proprietary Link**		Timeframe: **Existing**

Conclusion

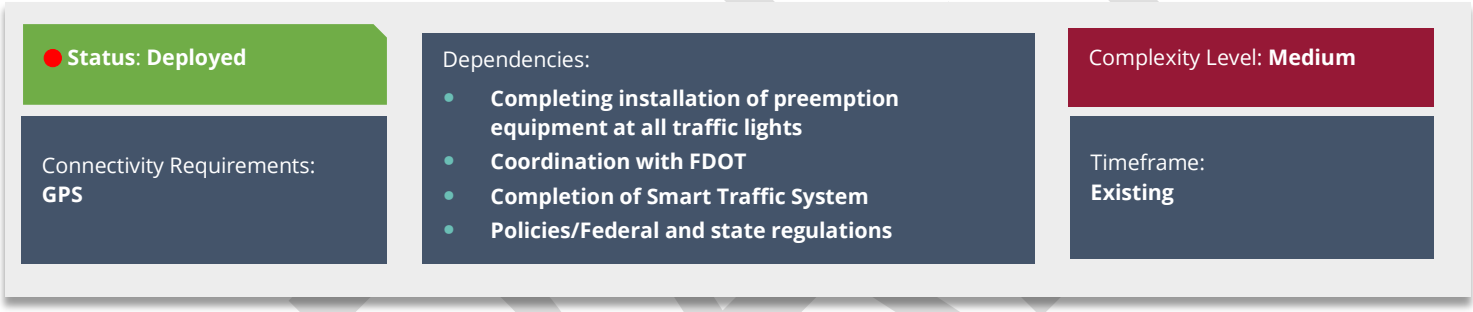
The city's Police Department has begun testing 2 drones and should be encouraged to continue to gain operational experience and eventually build internal capabilities and competencies. The city must review and consider all FAA and state regulations to draft appropriate policies. In general, drones will become a valuable tool which will find many uses throughout the city.

First Responder Preemption

First Responder Preemption is a system that allows emergency vehicles, such as ambulances, fire trucks, and police cars to control traffic signals, ensuring their safe and efficient passage during emergencies. Both the vehicles and traffic lights must be equipped with transponders and receivers. The city has a 3-phase plan, where Phases 1 and 2 are equipping all vehicles with transponders and some of the traffic lights with receivers. Phase 2 is underway, and Phase 3 (equipping all necessary traffic lights) are to be completed.

An additional technology that improves First Responder arrival times is a software application that uses all the information from Smart Traffic systems to send the vehicle on the fastest path to the destination. A complete traffic management system with preemption and cameras would satisfy this use case while providing data potentially for other uses.

Studies have shown that these systems will improve travel time to emergency destinations while reducing cross intersection accidents. The city of Superior, WI is installing vehicle preemption at 21 intersections for an estimated cost of $200,000. They are also considering the installation of cameras for Automated License Plate Readers (ALPRs).



Conclusion

Winter Park should complete deployment of equipment as planned. After which, it should evaluate building an enhanced emergency routing system into its smart traffic system and overall *Intelligent Transportation Strategy and Deployment Plan*.

Smart First Responder Vehicles

First responders' vehicles are evolving to become mobile communication and data processing hubs, connected with secure high-speed connectivity. They will then be able to aggregate and process data from local smart devices such as body cams and dash cams for real-time remote viewing both on site and at police headquarters. They can also become mini-data centers with 'edge'[40] processing capabilities. Video and image processing will be performed locally to reduce latency and deliver actionable intelligence quicker. Cities that have this system in place increase their first responders' situational awareness in the field, allowing them to respond more quickly and effectively, perhaps saving many citizens' lives in critical situations.

In 2023, the City of Montgomery, AL announced that it has purchased 30 new police vehicles that will be equipped with upgraded computers and 360-degree cameras in the car[41]. The city's police chief is looking forward not only to increasing the safety of citizens, but also of its police officers on the ground.

Status: Researching

Connectivity Requirements:
5G |CBRS

Dependencies:
- **A defined communications architecture for vehicles**
- **Policies/Federal and state regulations**

Complexity: Medium

Timeframe:
Mid-term (1-3yrs)

The cost estimates below assume there are 20 police and 5 fire vehicles. The CapEx is determined by the price and number of environmentally hardened laptops, mobile routers with 5G/CBRS cellular backhaul and servers in each vehicle. The OpEx are based on the yearly maintenance costs.

Table 11 - Smart First Responders Vehicle Cost Estimates

Estimated Cost for Equipping Smart Vehicle (25 Units) Cost-5YR Plan					
	YR 1	YR 2	YR 3	YR 4	YR 5
Total CapEx w/ 20% Contingency		$ 25,000	$ 250,000		
Total OpEx				$ 30,000	$ 30,000
Total Cost/YR		$ 25,000	$ 250,000	$ 30,000	$ 30,000

Conclusion

Police Vehicles and Fire Apparatus will become mobile edge data centers with high-speed wireless connectivity. They will process data locally and provide intelligence to both on-scene responders and to remote leadership. To help protect first responders and citizens, the City should establish a *standard architecture* for Smart Police and Fire vehicles. This can be accomplished during scheduled upgrades and retrofits or can be incorporated into future budget planning.

[40] The 'Edge' – a computing architecture that allows IoT devices to process and respond quickly to data received at the edge of the network or closer to the end users of these devices
[41] City buys 30 new patrol vehicles, adds police cameras and computers (montgomeryadvertiser.com)

Automated License Plate Readers

Automated License Plate Readers (ALPRs) are specialized image processing systems that are designed to isolate and identify license plates on vehicles. They are used to improve public safety, enhance traffic enforcement, support amber alerts and for intelligence/investigative purposes.

The Town of Longboat Key, FL has installed LPRs at each entry to its island (north through Manatee County, and south through Sarasota County), which enables its police department to be instantly aware of any vehicle that enters or exits the island.

Today, the City of Winter Park has already installed 3 ALPR systems and has 11 more to install. In addition, the City deployed cameras for red light violations in 5 intersections in the city. These are utilized to enforce traffic violations even when police personnel are not monitoring them, allowing them to focus on more critical duties with greater efficiency and flexibility.

Conclusion

The City should continue the acquisition of the planned 11 ALPRs to augment the 3 existing ones. Beyond this, the City should explore other various solutions that may use camera feeds and specialized image processing. The image processing technologies, as part of the smart parking and smart traffic systems can be adapted to include license plate reading. The city should incorporate the LPR functionality as part of an overall *Intelligent Transportation Strategy and Deployment Plan.*

People Counters

People Counters are specialized devices that count the number of people passing by a given location. Data collected from these devices are typically used by city planners and retail establishments to determine the "foot traffic" in an area. This data can be used in many ways to revise the design of sidewalks, keep track of the number of people visiting a park, or determine the rent for retail locations. Some models just count people while others also recognize and count bikes and scooters. Sophisticated models can be integrated into camera systems and provide details of cars and people passing the locations, how long they visit, and even what they looked at.

Winter Park currently has 9 people counters purchased from Eco-Counter. These are small units that count people passing using infrared, therefore data on people's identity remain anonymous. The data is sent over a cellular NB-IoT connection every six hours. Software is provided to interpret the data in 15-minute intervals. The counters are directional, so they are able to count entering and departing people separately.

In 2023, New York City (NYC) has announced a project to place multi-use counters in 12 locations to perform a long-term study. The counters are installed on light poles and can count cars, pedestrians, bikes, and standing e-scooters. They measure the speed, count turns, detect near misses, and represent paths of travel. NYC wants to analyze effectiveness of street designs, prioritize areas in need of safety improvements and better understand how people use the streets[42].

Status: **Deployed**	Dependencies: • **City policy to determine use of people counter data** • **Strategy for installation of additional counter types**	Complexity Level: **Low**
Connectivity Requirements: **CBRS | LoRaWAN®/Nb-IoT**		Timeframe: **Existing**

Conclusion

The current deployment of the people counters to collect data on how many visitors enter and exit parks provides useful information and insights to the City and should be expanded. Future systems could be image processing-based, utilizing video feeds from city cameras and gathering additional layers of data analysis.

[42] NYC DOT to Test New Technology to Improve Street Safety by Better Measuring and Analyzing Transportation Uses on NYC Streets

Utilities

The city of Winter Park owns and operates the electric, water and wastewater utilities for the city and certain areas beyond the city limits. As all regulated monopolies, public utilities must reliably deliver their service at a fair and reasonable price to rate payers, and they must be capable of responding rapidly and professionally to unplanned incidents and outages.

As the city and region grows, each utility will continue to adopt specific operational technologies and systems to ensure they can meet their goals. Each utility will have its own technology roadmaps for their core infrastructure. For the electric utility, its key strategy will be implementation of a "smart grid", which is comprised of a wide array of technologies and agreements to add intelligence throughout the system, in order to balance electric supply and demand. Water and wastewater utilities can benefit from remote sensors to determine and locate leakages. Each will also have remote sensor to monitor for specific chemicals and other parameters, as it relates to water safety.

Vision

A city that provides reliable, efficient, secure, and sustainable utility services and exceptional customer service to its residential and business customers.

Key Objectives

- Provide transparent, efficient, and exceptional customer service to its utility customers
- Provide reliable, efficient, secure, and sustainable utility services

Existing Assets

- 2 Electric Substations
- 106 Lift Stations
- 22,650 Water Meters
- 15,345 Electric Meters
- 8 Stormwater Structures and Pumps
- 138 Storm Drain Manholes

Primary Use Cases

- Remote Meter Reading (Metering)
- Remote Meter Reading (User Portal)
- Remote Asset Monitoring System (Alarms and Alerting)
- Remote Asset Operations (Control and Operate)
- Water and Wastewater Monitoring
- Smart Grid

Remote Meter Reading (Metering)

Remote meter reading saves significant operating expenses by eliminating the cost of sending personnel to each location to read the meter and by reducing manual data input errors. Beyond this initial value proposition, remote meters enable more frequent data collection to generate large data sets which can be used to predict and prevent outages and to restore electric power faster. The current systems can also provide the consumers with real-time usage statistics and overconsumption alerts.

Sensus®®/Xylem is the vendor for the existing remote meter reading system used by Winter Park's water and electric utilities today. They use a proprietary radio system in licensed frequency band to automatically read the meters and transmit the data to a central database. Sensus®®' cloud-based portal displays the data for city personnel use.

Status: **Deployed**	Dependencies: • **Proprietary system from Sensus®**	Complexity Level: **Low**
Connectivity Requirements: **LPWAN - SENSUS/LoRa**		Timeframe: **Existing**

Conclusion

The city should continue to leverage its current radio-based remote meter reading system and adopt a long-term migration strategy to support an open standard based LoRaWAN® network.

Remote Meter Reading (User Portal)

A user portal for city utilities allows rate payers to directly access their current usage data. They would be able to pay bills and monitor outages and incidents. Notification messages indicating over-usage or leaks can be sent directly to the user's mobile device or via email.

The Orlando Utilities Commission sends electric alerts directly to users' mobile devices and email if the power is out along with an estimate of when power may be restored. For water utilities, the users are able to receive notifications for unusual usage, which for instance may indicate a burst pipe or sprinkler left running. The user also receives notices of bill amount and payment date if the user has subscribed to autopay. Alerts can be turned off and alert levels can be configured via text messages sent from the user's phone to a designated service number.

Status: Deployed

Connectivity Requirements:
LPWAN - SENSUS/LoRa

Dependencies:
- **City's portal design for user functionality**
- **Proprietary system from Sensus®**

Complexity Level: **Low**

Timeframe:
Existing

Sensus®® has user portal software available where users can read usage, report outages, get alerts for leaks or over usage, and set alert parameters. This feature has not been implemented by the City. The cost listed for this Software as a Service in other cities[43] is about $2.75 per meter per year. The city reports having 37,995 water and electric meters.

Table 12 - Remote Meter User Portal Estimates

	Remote Meter User Portal Cost-5YR Plan				
	YR 1	**YR 2**	**YR 3**	**YR 4**	**YR 5**
Total CapEx w/ 20% Contingency					
Total OpEx	$130,000	$130,000	$130,000	$130,000	$130,000
Total Cost/YR	$130,000	$130,000	$130,000	$130,000	$130,000

Conclusion

The City should explore utilizing the Sensus®®/Xylem User Portal to expand customers' ability to get alerts and usage information.

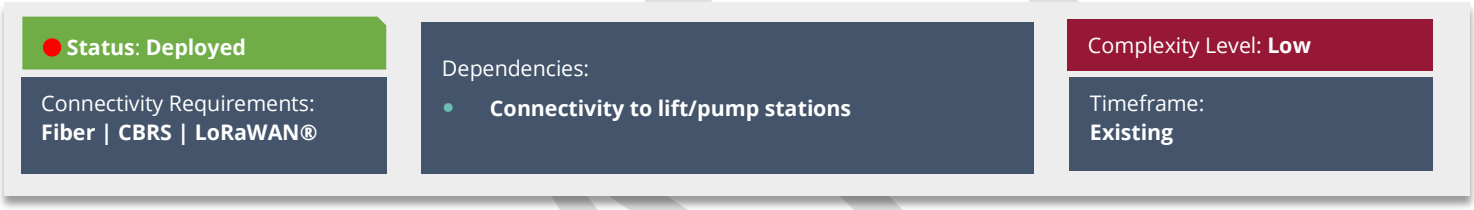
[43] https://new.azwater.gov/sites/default/files/media/2020_TownofPrescottValleyCustomerPortal_Redacted_2.pdf

Remote Asset Monitoring System (Alarms and Alerting)

Water/sewer lift stations are critical civic infrastructure, and they need to be protected and monitored 24/7. The concept of remotely monitoring these assets applies to physical facilities and the on-site equipment and systems.

The city's water utility currently utilizes legacy UHF/VHF radio services to provide alarming and alerting functionality for its lift station/pump station infrastructure, as well as other sites and components. Physical site security may include the installation of surveillance cameras, motion detectors and other sensors. However, these additional monitoring/security solutions would require more bandwidth than can be provided over the existing UHF/VHF system, therefore a secondary high-speed connection would be required to replace or supplement it.

The city of Maumee, OH completed major improvements to its Lift Station Monitoring system in 2022[44]. The new system replaced the pumps and added a new SCADA system to ensure consistent operation and allow for off-site monitoring.



Utility systems are benefiting from the proliferation of the Internet of Things (IoT) and Industry 4.0. System manufactures and integrators are deploying a range of sensors throughout their systems. Desired outcomes include predictive and preventative maintenance to prevent breakdowns and outages. The machine telemetry data will be collected and analyzed by vendor-specific sensors and systems. Each utility will need to address these as part of their normal upgrade cycles and budgets.

Conclusion

The city should continue to leverage its current radio-based status monitoring infrastructure while it establishes a *Common System Architecture* to monitor remote assets. This would include monitoring the physical locations as well as the on-site equipment. Each utility should work with their system providers to understand the current telemetry capabilities and system feature roadmaps that would include the migration to Remote Asset Operations. The city should ensure all system vendors support open standards and city investments in infrastructure such as LoRaWAN® and CBRS.

[44] city to upgrade lift/pump station remote monitoring system 2022 - Google Search

Remote Asset Operations (Control and Operate)

To further gain efficiencies and improve reliability, utilities in the future will be able to remotely operate their systems. For example, when a device detects a leak at an underground location, it notifies the Central Management System. The system operator can then remotely signal the appropriate valves to open or close to immediately mitigate damage and loss from the leak. At some point in the future, the decision to turn the valve off or on could be done autonomously, depending on the criticality of the failure.

The city of Winter Springs, FL (2022) is upgrading its SCADA system to provide additional controls and monitoring above its current level[45]. The benefits of the new system are ensuring the water in the reuse system meets and exceeds quality standards, allow remote control to address any problems identified, and deliver real-time results from the control changes.

Status: **Researching**	Dependencies: • **Integration with equipment manufacturers**	Complexity Level: **High**
Connectivity Requirements: **Fiber |CBRS**		Timeframe: **Long-term**

The City's utilities must work with their system vendors to acquire quotations on enabling remote assets control and operation.

Conclusion

Remote asset operations will become the norm throughout the utilities' operations. Each city utility should work with their system vendors to establish roadmaps and implementation plans to continuously gain operational efficiencies through remote asset operations.

[45] What's New with Water? | Winter Springs Florida

Water and Wastewater Monitoring

Water monitoring applies to drinking water. Drinking water can be constantly monitored for purity, chemical composition, and the presence of specific chemicals or to detect any harmful substances that may be present in the water system. Stormwater and wastewater can be monitored for composition and flow rates.

All monitoring will be accomplished by strategically deploying sensors throughout the system of interest. The remote devices will then communicate with the specific utilities' Central Management System using LoRaWAN®. The sensors will be used to detect anomalies in real-time and generate data for modeling and analytical purposes. In addition, underground pipes can be monitored to determine leaks and to quickly identify their location.

Miami-Dade County in southeastern Florida has deployed an IoT solution for wastewater management to mitigate regulatory issues, prevent sewer overflows, improve water quality, and ensure safety for the public.

Status: **Researching**	Dependencies: • **Resources for deployment planning**	Complexity Level: **High**
Connectivity Requirements: **LPWAN - SENSUS/LoRa**		Timeframe: **Immediate**

A solution from *Ericsson* and *AT&T* monitors water quality for the City of Atlanta, Georgia, where four million citizens get drinking water from the Chattahoochee River. IoT helps authorities check the quality of water, while sensors measure its conductivity, turbidity, temperature, and thermometry.

Smart Water Management with IoT: Key Application Areas (softeq.com)

Table 13 - Water (Potable) Monitoring Cost Estimates *Table 14 - Wastewater Monitoring Cost Estimates*

Estimated Water (Potable) Monitoring Cost-5YR Plan					
	YR 1	**YR 2**	**YR 3**	**YR 4**	**YR 5**
Total CapEx w/ 20% Contingency		$45,000	$415,000		
Total OpEx				$45,000	$45,000
Total Cost/YR				$45,000	$45,000

Estimated Wastewater Monitoring Cost-5YR Plan					
	YR 1	**YR 2**	**YR 3**	**YR 4**	**YR 5**
Total CapEx w/ 20% Contingency	$400,000				
Total OpEx		$45,000	$45,000	$45,000	$45,000
Total Cost/YR	$400,000	$45,000	$45,000	$45,000	$45,000

Conclusion

The City's Water Utility team should determine the proper placement and type of sensors that are required to provide leak detection and monitoring solutions within the city's potable water, wastewater, and stormwater systems.

Smart Grid

A "smart grid' distributes and coordinates intelligence throughout the generation, distribution, and consumption of electric power to gain new levels of efficiency and reliability, and to better balance the demand and supply of electricity. A smart grid is a comprehensive architecture and way of operating the electric utility. It is not a single technology nor a solution but is comprised of a wide array of technologies and solutions deployed throughout the city's electric distribution infrastructure. This ranges from IoT sensors/data analytics (AI, ML, etc.), to advances in renewable energy generation, demand-response, and energy storage.

The City of Chattanooga, TN, was able to establish a smart grid after successfully constructing a comprehensive community-wide fiber network. During the first ten years of implementation, this initiative generated $2.69 billion in community benefit. Today, the City has over 200,000 smart city devices around the city that are made up of sensors, cameras, and other cutting-edge technologies, putting it to the forefront of municipal smart-grid innovations[46].

Status: **Researching**	Dependencies: • **Integration with equipment manufacturers**	Complexity Level: **High**
Connectivity Requirements: **Fiber | CBRS | LoRaWAN®**		Timeframe: **Long-term (3-5yrs)**

The cost is an estimate for a consulting fee to develop, not deploy, a City Smart Grid Strategy and Implementation Roadmap.

Table 15 - Smart Grid Cost Estimates

Estimated Smart Grid Roadmap Cost-5YR Plan					
	YR 1	YR 2	YR 3	YR 4	YR 5
Total CapEx w/ 20% Contingency	$ 40,000	$ 40,000			
Total OpEx					
Total Cost/YR	$ 40,000	$ 40,000			

Conclusion

The City's electric utility should work to develop a *Smart Grid Strategy and Implementation Roadmap*.

[46] The Grid Transformation Forum | Chattanooga: From Smart Grid to Smart City (electricenergyonline.com)

Quality of Life

The Quality of Life (QoL) in a city is a critical factor for citizens to decide whether they would stay or move to one that offers a better living experience. It also applies to prospective newcomers such as residents and businesses. Economically, a city would benefit from attracting businesses and a talented workforce. For instance, during Winter Park's smart city community workshop, the project team met some of the recently relocated citizens who said that they were drawn to the city's pleasant environment and its proactive citizenry. Along with the economic advantages, it promotes the wellbeing, social engagement, safety and prosperity of residents, businesses, and visitors.

Today, Winter Park strives to maintain the city's charm, which attracts more people to live there or visit for business or for leisure purposes. Smart city technologies and systems have been implemented to support, enhance, and preserve the quality of life. For Winter Park, this would mean technologies that would complement the city's infrastructure while also being aesthetically pleasing and optimally functional.

Vision

A city that has an engaging pleasant environment that thrives on technical innovation and modern conveniences.

Key Objectives

- Improve the quality, sustainability, and aesthetics of the city's environment
- Provide a healthier and more beautiful place to live, work and play
- Maintains its natural charm and beauty present around town and on its lakes

Existing Assets

- 2 Public Boat Ramps
- 11 Parks
- 15 Mini-Parks
- 25 Lakes and bodies of surface water

Primary Use Cases

- Smart Parks
- Lake Level Monitoring
- Environmental Monitoring – Water and Air
- Environmental Sensors - Soil
- Smart City Poles
- Smart Municipal Buildings
- Smart Trashcans
- QR-Codes (Visitor Engagement)

Smart Parks

The goal of a smart park is to enhance the complete outdoor park experience, by improving maintenance efficiencies, while creating a sustainable, safe environment. A smart park will require fiber connectivity to provide sufficient bandwidth to support a full range of applications in each park. Public Wi-Fi at parks is becoming a standard city amenity across the globe. This requires strategically deployed Wi-Fi access points to provide adequate coverage throughout the park, or at least a focus area within the park. Additionally, there is an opportunity to deploy a number of smart city use cases which may include and are not limited to the following: Smart Lighting, Environmental Monitoring, Smart Soil Quality Monitoring, Smart Buildings, Visitor Engagement and Smart Trashcans.

Parks engage citizens, contributes to their wellbeing, and fosters economic growth. As a result, many of the city's technology are deployed in parks to collect valuable data and use it to continuously improve the environmental and citizen's wellbeing in a sustainable manner. For instance, the City of Boston, MA as part of their Smart Utilities Program piloted the deployment of their smart technologies to ensure that the city is prepared for the effects of climate change. One of the smart use cases approved and deployed in 2020 were 'Smart Streetlighting', which help optimized maintenance of streetlight infrastructure, increased health and wellness of citizens, reduced carbon and operational costs, increased public safety and awareness, and increased citizen engagement and transparency[47]. Another use case is 'Green Infrastructure' where stormwater is enabled to mimic nature. This resulted to lower pump operational usage, urban heat reduction, added greenspace and improved health and wellness for the community[48].

Status: **Researching**	Dependencies: • **City's fiber network in parks** • **Smart Park architecture development**	Complexity Level: **Low**	
Connectivity Requirements: **Fiber**		Timeframe: **Immediate**	

The capital costs for a Smart Park are determined by the costs and numbers of Wi-Fi access points, cameras, trash bins, digital signage, and installation costs. This cost estimate, assumed that there are 2 Wi-Fi Access Points, 2 cameras, and one digital sign deployed at once, across 14 city parks. The yearly OpEx are driven by the maintenance fee of the devices above and the SaaS annual fees.

Table 16 - Smart Parks Cost (14 Parks) Cost Estimates

Estimated Smart Parks Cost-5YR Plan					
	YR 1	**YR 2**	**YR 3**	**YR 4**	**YR 5**
Total CapEx w/ 20% Contingency		$25,000	$235,000		
Total OpEx				$30,000	$30,000
Total Cost/YR		$25,000	$235,000	$30,000	$30,000

Conclusion

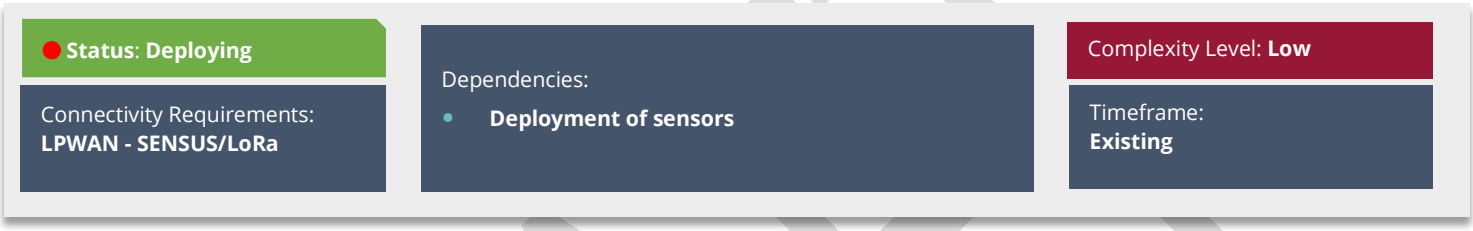
The City should extend its fiber network to connect the 14 parks and create a *Common Smart Park Architecture* which can be deployed at each location as required. New capabilities and enhancements can be deployed over time, and the data collected could be valuable to numerous smart city applications and algorithms and will also be valuable through an open data repository.

[47] Smart Street Lights | Boston Planning & Development Agency (bostonplans.org)
[48] Green Infrastructure | Boston Planning & Development Agency (bostonplans.org)

Lake Level Monitoring

The Winter Park Chain of Lakes consists of six main bodies of water tied together with a system of narrow canals. In a lush urban setting, the lakes are popular destinations for boaters and paddlers. Properties around the chain include large and expensive single-family homes centered on lake life. During hurricanes and other storms, water levels can reach dangerous thresholds. To address this, the City is deploying lake water level monitoring devices that will utilize the same wireless system (Sensus®®) as the electric and water remote meter reading platform.

This allows the City to transition from a very manual process of measuring lakes "by hand", to having levels in real-time at regular intervals. During emergency events, and storms, the City will not have to send staff out to the field any longer to accommodate this any longer.



The City is currently deploying this system in 57 locations.

Conclusion

This use case is deployed using the existing Sensus® radio system. The City should continue to deploy the current proprietary solution.

Environmental Monitoring - Water Quality Monitoring - Bodies of Water

Water Quality Monitoring Sensors

Environmental monitoring is a class of use cases where a city deploys an array of specific sensors at strategic locations around the city to continuously monitor the environment. Water and Air Quality Monitoring are the most common. Given the tight coupling between water and air monitoring and data analysis, the project team expects the City to create a single unified environmental monitoring strategy.

Water quality monitoring involves the systematic assessment and analysis of various physical, chemical, and biological parameters to evaluate the health and safety of water sources. It is conducted to ensure compliance with regulatory standards, protection of human health, and preservation of aquatic ecosystems.

Sensors will be deployed in lakes, ponds, canals, and other water bodies of interest to measure the composition of the water. Numerous parameters will be collected periodically and analyzed including nitrogen, phosphorus, pH, dissolved oxygen, chlorophyll, and others. The data collected will be used for both real-time alerts and long-term trend analysis.

The City of Lakeland, FL is now monitoring 15 of their major lake systems for physical, chemical, bacteriological and biological parameters. Monitoring the health of lakes is critical for preserving ecological balance, protecting the health of the community from harmful pollutants/microorganisms, and establishing an effective water management system[49].

Air Quality Monitoring Sensors

Air Quality Monitoring goes beyond the Environmental Protection Agency's (EPA) Air Quality Index (AQI) standard that measures ground level ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide and airborne particles. Advanced sensors will detect and monitor additional elements, gases, and smaller airborne particles. Additionally, basic weather statistics such as temperature, humidity, air pressure can be captured as well. All collected data is sent to the Central Management System for real-time and historical analysis.

Many cities throughout the world, including Los Angeles, New York, Denver, Portland, Lisbon, and London have installed air quality monitoring sensors. Although their populations vary, one thing is constant: the increasing number of pollutant sources from mobile vehicles, heating of buildings, construction, and power plants. To warn citizens of current conditions, they have piloted low-cost air-quality sensors in susceptible neighborhoods, particularly those near parks, schools, and low-income homes. These cities also educated their residents on how to collaborate to create cleaner, healthier air[50].

Status: **Researching**	Dependencies: • **Environmental Monitoring Strategy**	Complexity Level: **Low**
Connectivity Requirements: **LPWAN - SENSUS/LoRa**		Timeframe: **Immediate**

[49] Florida Utility Deploys Smart Solutions to Monitor Lake Levels | WaterWorld
[50] 4 ways cities are using low-cost sensors to improve air quality - Clean Air Fund

The capital cost below assumes 57 water quality sensors and 50 air sensor devices.

Table 17 - Environmental Monitoring Cost Estimates

Estimated Environmental Monitoring - Air & Water Cost-5YR Plan					
	YR 1	YR 2	YR 3	YR 4	YR 5
Total CapEx w/ 20% Contingency		$ 35,000	$ 335,000		
Total OpEx				$ 35,000	$ 35,000
Total Cost/YR		$ 35,000	$ 335,000	$ 35,000	$ 35,000

Conclusion

Monitoring the water and air quality in Winter Park should be a primary component of the City's *Environmental Monitoring Strategy*.

Environmental Monitoring - Soil

The health of the soil in cities is frequently jeopardized by rising temperatures and pollution brought on by the expansion of urban activities like driving gasoline-powered cars, buildings, and operating structures like stores and restaurants. Soil sensors come in several varieties and perform a variety of tasks. Usually, moisture, light, temperature, and pH sensors are employed in urban soils[51].

Status: **Researching**	Dependencies: • **Communications system to read sensors** • **Smart sprinkler systems that can be controlled remotely**	Complexity Level: **Low**
Connectivity Requirements: **LPWAN - SENSUS/LoRa**		Timeframe: **Immediate**

The cost below is determined by the number and cost of soil sensor devices that measure and monitor moisture levels. This type of sensor works in coordination with Smart Control Systems that assess the requirement for moisture and trigger the automatic operation of sprinklers when the necessary moisture levels are reached.

Table 18 - Environmental Monitoring - Soil Cost Estimates

Estimated Soil Monitoring Cost-5YR Plan					
	YR 1	**YR 2**	**YR 3**	**YR 4**	**YR 5**
Total CapEx w/ 20% Contingency		$200,000			
Total OpEx			$20,000	$20,000	$20,000
Total Cost/YR		$200,000	$20,000	$20,000	$20,000

Conclusion

Soil monitoring should be considered as part of the *Environmental Monitoring Strategy*. Integration with automatic irrigation systems would be determined by the irrigation system vendors.

[51] Soil Health Assessment | Natural Resources Conservation Service (usda.gov)

Smart City Poles

The light poles, fixtures and controllers are all useful resources for both connectivity and smart city use cases. They all represent locations with available electric power to deploy devices such as cameras, Wi-Fi access points, and environmental sensors. The cabinets also provide a weatherproof location to deploy additional electronic controllers and computing resources. Smart Pole uses and applications include LED lighting and applications, solar panels, various devices and sensors, cameras, Wi-Fi, 5G small cells, and even EV and smart device charging ports.

In 2021 the City of Coral Gables, FL has deployed what is titled the first AI-Driven Smart City Pole[52]. This pole is modular, can have lights, cameras, environmental sensors. It can be used for ALPR, speed sensing, traffic violation enforcement, people/bike/car counting, cellular small cells, and public Wi-Fi. It can also provide charging points for smart devices or EVs. Today these smart poles are providing live video and real-time analytics to the city's Urban Analytics IoT AI platform, and the city's Community Intelligence Center and Emergency Operations Center[53].

Status: Researching	Dependencies: • **Fiber backbone to the pole** • **Budget to replace or install new poles**	Complexity Level: **Medium**
Connectivity Requirements: **Fiber| LPWAN | SENSUS/LoRa |LTE/5G**		Timeframe: **Immediate**

The cost estimates are based on 2 poles per 14 parks and 5 poles along Park Avenue (33). The prices are based on data from the Technavio document listed below.

Table 19 - Smart City Poles Cost Estimates

Smart City Pole Cost Estimate (33 Units)-5YR Plan					
	YR 1	YR 2	YR 3	YR 4	YR 5
Total CapEx w/ 20% Contingency		$ 70,000	$ 670,000		
Total OpEx				$ 70,000	$ 70,000
Total Cost/YR		$ 70,000	$ 670,000	$ 70,000	$ 70,000

Conclusion

The City should consider replacing some of the pole structures for 'Smart City Poles' with additional functionality to support a range of smart city use cases.

[52] US City of Coral Gables installs AI-powered smart city pole technology from Ekin | Traffic Technology Today
Smart pole • ELKO EP
Smart Pole Market Size, Share & Trends [2023 Report] (technavio.com)
[53] Coral Gables, Fla., Uses Data Analytics in New Smart City Projects | StateTech Magazine

Smart Municipal Buildings

A smart building integrates a range of sensors, networks, and automated systems to create and maintain the desired internal and external environments efficiently and securely. Systems in a smart municipal building include:

- Indoor Wi-Fi and 5G
- Public Wi-Fi
- Building Automation Systems
- Smart Lighting (Indoor & Outdoor)
- Smart HVAC Systems
- Security and Access Control
- Intrusion Detection
- Solar Panel Integration
- Automated Landscape Management
- Indoor Air Quality Monitoring and Management

All systems collect data for real-time and historical analysis. All new buildings will be designed 'smart' and existing buildings will migrate to smart buildings during upgrades and retrofits. In the longer term, digital twins of the buildings can be added to the future digital twin of the city.

In March 2023, a case study by the U.S. Department of Energy (DOE) Federal Energy Management Program (FEMP) showcased that smart building technologies could save the General Services Administration (GSA) $8.9 million in costs. These energy efficiency improvements were seen in an Oklahoma federal building with a 41% total energy use reduction and $412,000 savings in the first year[54].

Status: **Researching**	Dependencies: • **City Smart Building standards** • **Timing of upgrades and retrofits**	Complexity Level: **Medium**
Connectivity Requirements: **Fiber | 5G |LoRaWAN®**		Timeframe: **Mid-term (1-3yrs)**

The cost of a smart building is dependent on the size and type of each building and the technology the City chooses to deploy.

Conclusion

The city should establish *smart building standards* and upgrade current municipal buildings during scheduled retrofits and system upgrades. All new buildings should be architected from the onset to be smart.

[54] GSA Oklahoma City Federal Building: Smart Buildings Case Study (energy.gov)

Smart Trashcans

A smart trashcan is a garbage disposal bin that may be located all around the city. Built-in technologies are being incorporated to increase hygiene, convenience, and efficiency. Its primary function is to measure the amount of trash and convey the status to the Public Works Department and alert them when it needs to be emptied. Versions of smart trashcans incorporate compactor technology to maximize the storage of waste.

The increased trash volume and pickup frequency resulted in major costs and vehicle traffic for the city of Philadelphia, PA. They have teamed up with Big Belly, a smart trashcan solution company, to address the increasing volume of waste carried by the growing residential and commercial population and visitors. Deploying smart trashcan technology saved them money by lowering trash collection from 17 times per week to three times per week.

Status: Researching	Dependencies: • **Policies/Federal and state regulations**	Complexity Level: **Low**
Connectivity Requirements: **LPWAN - SENSUS/LoRa**		Timeframe: **Immediate**

Costs are based on deploying 100 smart trashcans throughout the city.

Table 20 - Smart Trashcans Cost Estimates

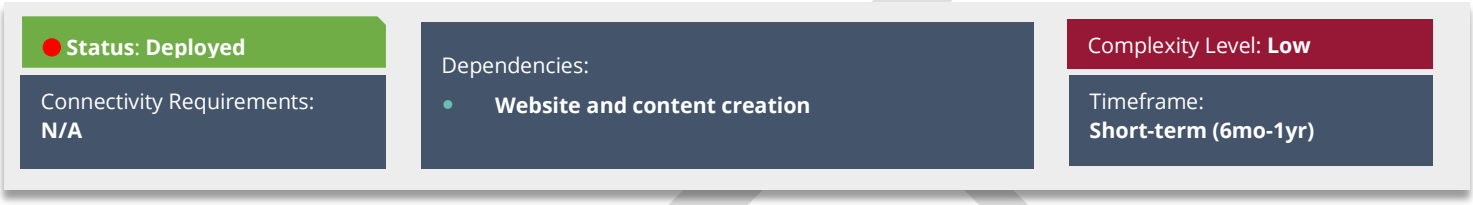
Smart City Pole Cost Estimate (33 Units)-5YR Plan					
	YR 1	YR 2	YR 3	YR 4	YR 5
Total CapEx w/ 20% Contingency	$ 640,000				
Total OpEx		$ 75,000	$ 75,000	$ 75,000	$ 75,000
Total Cost/YR	$ 640,000	$ 75,000	$ 75,000	$ 75,000	$ 75,000

Conclusion

Smart trash cans can improve the quality of life in the city by ensuring trashcans never overflow creating an eyesore. Additionally, they lock the trash in so it cannot be gone through by people passing the location and maintains overall hygiene and cleanliness of the city.

QR-Code (Visitor Engagement)

Visitor Engagement applies to interacting with visitors in new ways to communicate and share information. Winter Park has an interesting history and many historical buildings and artifacts. An emerging method of interacting with citizen in the use of QR-Codes. QR-Codes could be created and securely attached to city buildings and artifacts include Central Park trees. When scanned, the QR-Codes will connect the visitor to specific contents. The city currently has the capability to general QR-Codes which can be leveraged to support this use case.



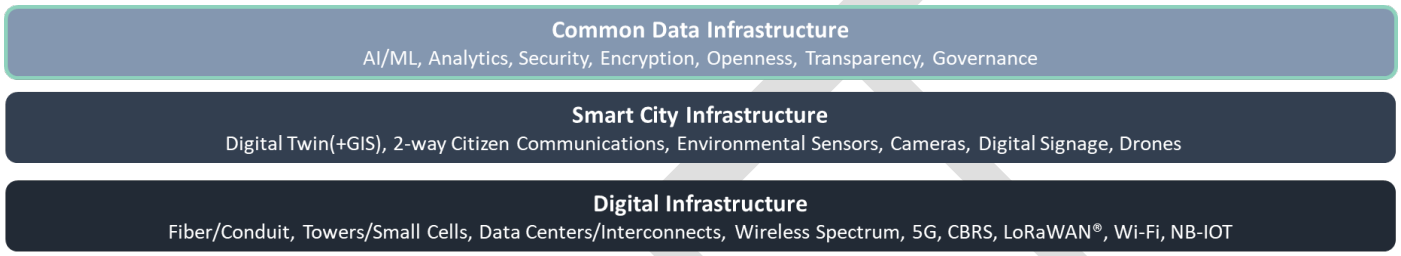
Conclusion

Visitor engagement is critical for a tourist destination like the city of Winter Park. QR-Codes are a low-cost method to enhance the visitor experience in the city. Since the City currently has the capabilities to generate QR-Codes they should establish an overall city-wide strategy to enhance visitor engagement and leverage the QR-Code system when applicable.

COMMON SMART CITY INFRASTRUCTURE

To reduce the complexity caused by integrating so many technologies across all pillars, three infrastructure layers were identified, including Common Data Infrastructure, Smart City Infrastructure, and Digital Infrastructure. These are common infrastructure layers that apply to multiple pillars and multiple use cases where centralizing the deployment of certain technologies and capabilities will reduce CapEx and OpEx over the short term and the long term, ensuring less silos are developed across the City.

Figure 4 - Common Infrastructures



Digital Infrastructure

The common **Digital Infrastructure** layer consists of all the fixed and wireless communication assets available in the city to support implementing the smart city use cases of each pillar. For a detailed discussion on current and proposed digital infrastructure, please see Magellan's *Deliverable 2 - Connectivity Plan*.

Smart City Infrastructure

The common Smart City Infrastructure consists of technologies and systems that can support multiple use cases across the four smart city pillars.

Digital Twin

A Digital Twin for a local government is a digital representation of its municipal boundaries. It starts as a 3D model of the entire city, then adds dynamic data, such as real-time traffic and energy consumption. A common Digital Twin will support all four smart city pillars (see table below) and can be used for a wide range of purposes throughout the city government.

Table 21 - Digital Twin Application per Pillar

Pillar	Use Cases	Comments
Smart Transportation	• Predictive Maintenance • Traffic modeling • Traffic monitoring • city Planning	• Enable the city to model and monitor the flow of vehicles and people in the city. • Model the impact of new buildings on traffic, wind, shadows, cell coverage, etc. • Model and simulate activities that are dangerous and/or expensive. • Enable modeling of smart streetlights
Public Safety	• Situational Awareness • Incidence Response • Training • Public Communication	• Give police and fire improved situational awareness for incidents and planning purposes. • Enable real-time traffic feeds from smart transportation systems will enable the first responders to determine fastest routes to incidents and to view the site before arrival. • Model and simulate activities that are dangerous and/or expensive.
Smart Utility	• Remote asset monitoring with real-time status. • Incident Response/Management • Predictive Maintenance • Public Communication • Training	• Becomes part of their operations center. It provides the real time state/status of utility assets and real-time usage. • Data will be analyzed for preventive maintenance and incident response purposes. • Used for planning purposes such as modeling future additions and changes. • Model and test activities that are dangerous and/or expensive in a virtual domain.
Quality of Life	• Historical record- 3D models of past and future. • Virtual tours • Real-time status • Flood modelling • Permitting • Future city Portal	• Accept data from environmental monitoring stations and add to real-time city model. • Data processing (AI/ML) will generate alarms and alert and communicate them to city officials and the public as prescribed. • Used to model new developments and new buildings for impact on traffic, wind, shadows, cell coverage, etc.

Coral Gables' digital twin is adding real-time data feeds and evolving to be the virtual interface between the city and citizens and visitors. They are adding data from real-time traffic systems and from air and water environmental sensors to gain insights on city dynamics, trends, and behaviors. It will also evolve to be able to monitor and predict urban issues such as flood modeling, 5G coverage, and the effect of a proposed building on local traffic, shadows, and winds. The City sees its digital twin as a 3D interface for all interactions with the city, which they refer to as a "City Operating System". Early outcomes using AI and predictive analytics have reduced road accidents by 30%. This live system can be viewed at [ArcGIS Web Application (coralgables.com).]

Status: Researching

Connectivity Requirements:
Fiber

Dependencies:
- **Future real-time feeds**
- **Open Data**

Complexity Level: **Medium**

Timeframe:
Short-term (6mo-1yr)

The costs for a digital twin include a one-time city-wide aerial scan of the entire city to create the static 3D model and any ongoing maintenance/updates.

Table 22 - Digital Twin Cost Estimates

Digital Twin Cost-5YR Plan					
	YR 1	YR 2	YR 3	YR 4	YR 5
Total CapEx w/ 20% Contingency	$181,500				
Total OpEx		$7,200	$7,200	$7,200	$7,200
Total Cost/YR	$181,500	$7,200	$7,200	$7,200	$7,200

Conclusion

Winter Park should explore Digital Twins to support the wide range of use cases across different city services and functions. Coral Gable and Orlando's digital twins are implementations that Winter Park can learn from.

2-Way Citizen Communication System

During the project team's community stakeholder outreach, the ability to communicate with every citizen was noted to be a challenge by most, if not all the City departments. Citizen communication involves both non-emergency notices (E.g., New York Ave. will be closed for maintenance next Tuesday) and real-time emergency/incident responses. The days of relying on the 'home phone' and paper-bill inserts are long gone. Email and texting, and the current CodeRed Notification System, work for those that have opted-in to receive them. Even with the proliferation of communication options it cannot be assured that everyone who needs the information will receive it. Social media outlets (Twitter, Facebook, NextDoor, Instagram, etc.) are the 'go-to' media for community outreach. Yet, those outlets only reach those who participate in them.

An example of addressing the inbound citizen-to-city communications problem is the Boston, MA 311 app. Through its BOS:311 app, the City of Boston can better engage its residents and deliver city services. Using this platform for non-emergency communication, residents can report issues like potholes and graffiti, which are then turned into repair orders for the designated city team. Access to further city services, like paying real estate taxes, is also made possible through it.

Status: **Researching**	Dependencies: - **Product requirements definition** - **City-wide integration** - **Methods and procedures**	Complexity Level: **High**
Connectivity Requirements: **N/A**		Timeframe: **Mid-term (1-3yrs)**

As the project team aggregated input from different departments the requirements were wide ranging. There are many solutions on the market that address a specific function such as Web-based ePayment systems. A more extensive list of product categories that address unique requirements include:

- Mass notification Systems (E.g., Code Red)
- Critical Event Management Platforms
- Civic Experience Platforms
- Crisis Management Systems
- Incident Reporting Systems
- ePayment Systems
- Websites
- Digital Twins

Conclusion

Given the overall scope and complexity of the problem, the City would benefit from creating a detailed system/product requirements document and deployment roadmap to drive the procurement process. The City should assign resources to generate the City-wide requirements based on each department's common and unique needs.

Cameras

Cameras have many uses and should be part of a common city IT infrastructure to minimize the number of cameras throughout the city for economic, privacy, and aesthetic reasons. Depending on its location a camera's video feed may be useful for the following: Smart Traffic, Smart Parking, Public Safety, Asset Monitoring and Tourism.

Over the years, Washington DC has installed over a thousand cameras dispersed over the area. To give several departments actionable insights in real-time, they are leveraging this technology for video analytics. The mayor of the city claims that the use of cameras has greatly improved their decision-making process and the effective utilization of human resources[55].

Outdoor mounted cameras need to be rugged to endure the Central Florida's environment. Each camera costs about $2,000 and each will need a periodic maintenance which is estimated at $250/camera per year. As noted, cameras that are used to issue fines for traffic violations must be calibrated each year at a cost of $1,500 per camera.

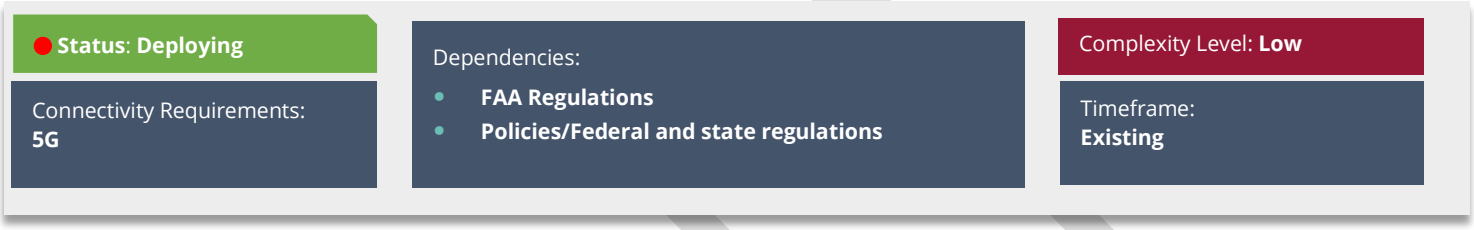
Conclusion

Cameras and image processing are becoming standard municipal equipment and capabilities around the world as they have many uses beyond surveillance. The city should continue deploying cameras to support various smart city use cases, while maintaining strict adherence to the City's Open Data Governance and aesthetic policies.

[55] More speed cameras coming to DC in 2023 | DC News Now

Drones

Industrial and commercial drones are finding their way into many public and private applications. They are aircraft that require certified pilots that must obey strict Federal Aviation Administration (FAA) regulations. Drones are frequently equipped with cameras and can be sent to public safety incident sites on-demand as the need arises. Once on site, they can provide aerial situational awareness to ground personnel in real-time. Drones could assist the Public Works Department by flying around the city during peak traffic hours and provide additional data to the smart traffic and smart parking systems. Drones can also be outfitted with a number of sensors that can assist with environmental monitoring in the city.



Coral Gables, FL is running a pilot program using drones to monitor large crowds and respond to emergency calls in advance of first responders' arrival. The city initially tested the use of drones during its Fourth of July celebration, where a crowd of 40,000 spectators was expected. The drones were used to monitor crowds, traffic, and any incidents that occurred[56].

The acquisition costs for the drone hardware and support infrastructure are comparatively low. The drones envisioned would not be off-the-shelf drones, but custom industrial drones build specifically to support the range of municipal applications. Operations costs are driven by the salary of the drone pilot and the cost per hour to operate the aircraft.

Table 23 - Drones Cost Estimates

Estimated Smart Trashcans Cost-5YR Plan					
	YR 1	YR 2	YR 3	YR 4	YR 5
Total CapEx w/ 20% Contingency	$18,480				
Total OpEx		$184,020	$184,020	$184,020	$184,020
Total Cost/YR	$18,480	$184,020	$184,020	$184,020	$184,020

Conclusion

The city should continue to experiment with drones and established a long-term strategy and mission requirements and operating procedures.

[56] Coral Gables, FL Runs Drone Pilot Program To Monitor Crowds And Respond To Emergency Calls - Smart Cities Connect

Smart city Management System/Single Pane of Glass" (SPOG)

A number of city departments highlighted the need for a "Single Pane of Glass". This concept comes from the siloed[57] nature of many SaaS[58] solutions. Each device/sensor manufacturer and software vendor has their own central management system and dashboard. Decision makers must continuously switch between each vendor's dashboard which are overlapping windows on a crowded screen or separate physical 'glass' displays. Hence the phrase, "Single Pane of Glass" (SPOG). SPOG refers to both the data processing systems and the dashboard. A new product category known as "Smart City Management System" has evolved as a result of the widespread acknowledgment of the necessity for a single platform. Other product categories, such as Unified Operations Centers have overlapping product features and intersecting future product roadmaps. The challenges revolve around data ownership within the city and the software vendors' business models. Each vendor wants their solution to be the primary user interface and to ultimately control their customers' data. Similarly, no vendor wants to be subservient to another vendor and just send their data to be displayed.

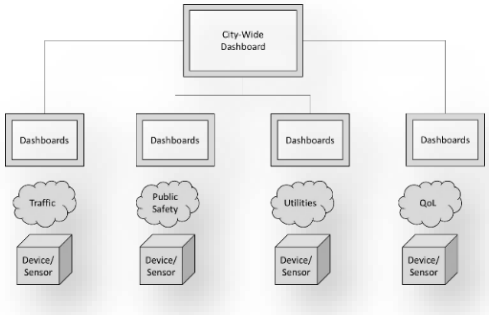
The city of Lisbon, Portugal implemented their Intelligent Management Platform to address challenges with disparate data applications within city operations. The city ensures that they have an 'open architecture[59] platform' to avoid vendor lock-ins, integrate new applications and easily share their data with other organizations and partners. Using this platform improved their citizens mobility, public safety, and quality of life [60].

Status: **Researching**	Dependencies: • **City department coordination and participation** • **Data ownership** • **Available system vendors' solution/models** • **Policies/federal and state regulations**	Complexity Level: **High**
Connectivity Requirements: **Fiber**		Timeframe: **Long-term (3-5yrs)**

The costs of a smart city management system are driven by the number of devices and data sources supported and the number of features utilized. For a city the size and complexity of Winter Park, a smart city management system would cost $100,000 to $300,000 deploy and annual operational annual costs would be of similar magnitude.

Conclusion

The city should work toward establishing a city-wide smart city management system in unison with deploying other smart city solutions and meeting each city departments unique requirements. The city should establish guidelines, standards, and best practices and mandate adherence to them to ensure interoperability, efficiency, and reduce costs, all while taking open data into account. Given the emerging state of this product category and the scope of use cases covered, the City would benefit from creating a detailed system/product requirements document and deployment roadmap to drive the procurement process.



[57] Silo in this context is a state of technologies and or systems being isolated form one another.
[58] Software as a Service
[59] Open Architecture/Open Data – infrastructure specifications shared with the public
[60] Lisbon Council: Case Studies | NEC

Common Smart City Data Infrastructure

Once the City has defined its lists of smart city use cases and common smart city infrastructure, vast amounts of data need to be managed. In the past, data were primarily stored on servers in local data centers but now everything is moving to *the cloud*[61].

The cloud plays an important role in rapidly and securely integrating information from many data sources. It is, in fact, becoming an important component in becoming a smart city. It enables real-time analytics, efficient processing, and data storage, increasing overall productivity, and cost savings. According to Immuta, a US-based data security solutions provider, 81% of the organizations will be in the cloud within the next two years[62]. However, as more data sources are involved, more data become siloed and poorly managed, there could be a lack of ownership or leadership, a violation of federal, state, and local laws and regulations on data usage and privacy, and when private citizen or city information is compromised through cyberattacks. All of these raise the threat to the City's valuable data and result in lost opportunities.

Data Governance

To get the most out of the data that the City has and will have, it must prioritize governance. The following are some methods for governing and making data collection and usage sustainable as it grows with the help of smart city technologies:

- Designate data champions for each city department to prioritize data metrics relevant to them
- Appoint a city data council/owner who will connect data strategies of the City to work towards achieving shared goals with the community, ensures data accuracy, standardization and security, and access and transfers
- Define data scope and purpose
- Prioritize data assets
- Establish an Open Data Policy
- Adopt international standards and best practices.

The preceding processes assure data consistency, accuracy, quality, oversight, and efficacy for data contributors and users.

Open Data

The concept of Open Data has been around for decades even before the internet and has its roots in the science community. Information exchange and public accessibility are the goals, generally for the common good. Three ideas—openness, participation, and collaboration—are the foundation of Open Data.

Any organization or municipal institution that uses open data benefits from transparency, which increases community and third-party confidence. Open data also spurs innovation and other activities that provide economic value. The majority of contributors in cities with open data today are corporations, academic institutions, and health researchers. Despite these benefits, it's vital to remember that open data is subject to legal restrictions and other constantly evolving data regulations.

Local governments frequently spend a lot of money preparing their data and platform for the public, but there are often gaps between the collaborators—the City staff—and the public at large. According to

[61] The "cloud" refers to servers accessed through the internet instead of physical hard drives which is used today for data computing and storage
[62] Avoid the Challenges of Cross-Platform Data Access Governance (immuta.com)

various studies[63], there are a number of reasons why residents are unable to participate in their local government's data platform, from not knowing how it might benefit them to not knowing how to access and collaborate. This still represents a bottleneck, particularly in areas with sizable populations of less tech-savvy citizens.

The following are some strategies for overcoming Open Data challenges:

- Review local data rules and regulations to ensure data security and compliance.
- Present relevant and user-friendly public data
- Collect feedback from collaborators such as city staff and citizens
- Continue promoting digital literacy initiatives

Smart city Privacy Policy and Protocols

The deployment of data-collecting equipment such as sensors, drones, cameras, and other smart city technologies raises concerns about personal privacy, particularly for a city's residents. As a result, it is crucial that Winter Park develop, approve, and enforce its own smart city privacy policy. This policy should specify the City's restrictions on data disclosure and sharing, drawing a line on transparency for the benefit of the general public. Practices in Data Governance will also complement this approach. Examples of cities that adopted smart city privacy protocols and policies are New York , Chicago and Seattle. Below are high-level steps that the City could take to develop one:

- Appoint a *Chief Privacy Officer* (may be the same person who is in charge of Data Governance) who will lead the creation, maintenance, and adoption of the policies
- Review any of the City's existing policy
- If existing policies are available, rewrite in the context of a smart city privacy policy, if none, one must be developed
- Each city department must have a steward in charge of policy compliance
- Policy should be reviewed on a regular basis to ensure its current and relevant

[63] Beyond the supply side: Use and impact of municipal open data in the U.S - ScienceDirect, Best Practices in the Implementation of Open Data at a Municipal Government Level (uoregon.edu)

SMART CITY TECHNICAL CHALLENGES

Given the range of applications, each with its own technologies and complexities, numerous technical challenges need to be addressed. This section will highlight complexity, security, data storage, and the lack of technical standards.

Complexity

Smart cities impact all municipal functions, each requiring applications specific technologies, as well as general-purpose compute and storage technologies. As the City automates more processes, sensors and servos will be embedded in more devices, including buildings and vehicles, which need to connect and communicate. This means managing more devices and infrastructure.

Security

Security should be architected from the start into any smart city project. Every sensor and network connection represents a potential cyber-attack source. The scale of the cyber-environment can be massive, and the risks should not be underestimated.

Data Storage

The amount of data collected and stored can also be massive. Artificial Intelligence and Machine Learning work better when they can analyze vast amounts of data. For example, high-resolution video cameras used for surveillance and other purposes generate large amounts of data that must be transmitted and stored in a central location. A smart city should address future storage and networking requirements from the onset.

Lack of Technical Standards

The lack of standards is a major challenge for a city looking to deploy a future-proof smart city infrastructure today. This lack of standards can lead to a fragmented or siloed smart city infrastructure, which increases both upfront and ongoing operational costs and complexities. This will also lead to limited options and may impact future technology investments. Avoiding smart city fragmentation is crucial.

By addressing these technical challenges proactively, the City can ensure a more efficient, secure, and scalable smart city implementation that meets the needs of its residents and stakeholders effectively.

4. Smart City Workshop and Community Feedback

As a way to validate the City's smart city pillars, the city's leadership team worked closely with Magellan throughout the planning process and in conducting the city stakeholders' meetings, and in person community workshop which was held on June 15, 2023. The goal of the collaborative efforts was to gather feedback on where the City is today, what assets it has and how its short-, mid- and long-term needs can be met through innovative ways, and ultimately with the help of advancing its smart city technologies and systems.

City Stakeholders' Meetings

Figure 5 - Stakeholder Meeting Process

Magellan also met with stakeholders from various city groups listed in the table below.

Table 24 - City Stakeholder Meetings Participants

City Department Representatives	Community Partner
Schools	Chambers Of Commerce
Library	Local Business Owner
Healthcare	Commercial Property Developers
Non-Profit Organization	Broadband Providers and Infrastructure Owners

Community Workshop

The city held a community engagement workshop which was spearheaded by the Communications team. The engagement included initial public announcements on Winter Park's smart city initiative through the City's social media outlets, inviting residents and business to join the in-person workshop which was to be held at the city's Country Club. Winter Park's smart city webpage was also published prior to the workshop - Smart City Initiative - City of Winter Park.

The well-attended workshop had informative posters and a video on Winter Park's smart city pillars and explained potential use cases, which participants were able to walk through in a storyboard type structure. Each pillar included a "booth", which was represented by a city staff expert and a team member from Magellan, who all made sure that questions and/or concerns by the residents were addressed and heard.

On the day of the workshop, feedback forms for each of the pillars was launched on the City's smart city webpage. Below is a process overview on how the feedback forms were created, distributed, and collected for this report's analysis.

Figure 6 - Community Feedback Process

The forms received 324 responses in total. Some of the respondents answered all four or more than 1 of the forms.

Comprehensive Data Analysis

Right after the kickoff of the Connectivity and Smart city Strategic Plan project with Winter Park in early 2023, Magellan collected data from various sources, including data from the City itself, in regard to its existing connectivity and technological assets, and other subscription-based mapping data that the team has access to. Through the City stakeholders' meetings, Magellan's team gained a better understanding on how these assets and technologies are being used today, and what upgrades and additions are needed in the short and long term by department.

Magellan's team collected and refined a list of smart city technologies or use cases that the City departments would like to have and categorized them under four smart city key pillars that the City has identified: Transportation, Public Safety, Utilities and Quality of Life. This list of use cases is translated to a smart city matrix to effectively prioritize them based on existing assets, municipal and community feedback, cost to implement, dependencies, and ideal time of deployment.

5. Roadmap and Action Plan

This section provides the deployment timeline and preliminary budgetary estimates for the top 10 use cases among the smart city infrastructure and the four smart city pillars. It also includes the recommended connectivity infrastructure to support these smart city use cases. For modeling purposes, we assume that the first year involves establishing system requirements and identifying a vendor through the City's standard procurement process. The second year is dedicated to the system deployment, while some of the larger, more complex, and expensive use cases may require a two-year deployment phase. The last phase involves ongoing operating expenses (OpEx). In the financial models, all capital expenses are incurred during the deployment phase.

5-YEAR FINANCIAL PLAN

Top 10 Smart City Use Cases

The use case prioritization was based on municipal priority gathered through stakeholder interviews, implementation timeframe and complexity, and global smart city trends.

Top 10 Suggested Smart City Use Cases						
	Year 1	Year 2	Year 3	Year 4	Year 5	Total per Use Case
Smart Traffic System						
CapEx	$ 115,000	$ 635,000	$ 635,000			**$ 1,385,000**
OpEx			$ 100,000	$ 195,000	$ 195,000	**$ 490,000**
Smart Parking						
CapEx	$ 20,000	$ 205,000				**$ 225,000**
OpEx			$ 35,000	$ 35,000	$ 35,000	**$ 105,000**
Environmental Monitoring - Air & Water						
CapEx		$ 35,000	$ 335,000			**$ 370,000**
OpEx				$ 35,000	$ 35,000	**$ 70,000**
Smart Parks						
CapEx		$ 25,000	$ 235,000			**$ 260,000**
OpEx				$ 30,000	$ 30,000	**$ 60,000**
Smart Grid						
CapEx	$ 40,000	$ 40,000				**$ 80,000**
OpEx						**$ -**
Water (Drinking) Monitoring						
CapEx		$ 45,000	$ 415,000			**$ 460,000**
OpEx				$ 45,000	$ 45,000	**$ 90,000**
Smart First Responder Vehicles						
CapEx		$ 25,000	$ 250,000			**$ 275,000**
OpEx				$ 30,000	$ 30,000	**$ 60,000**
Smart Municipal Buildings						
CapEx	$ 30,000	$ 30,000				**$ 60,000**
OpEx						**$ -**
Smart City Poles						
CapEx		$ 70,000	$ 670,000			**$ 740,000**
OpEx				$ 70,000	$ 70,000	**$ 140,000**
Electric Vehicle Charging Infrastructure						
CapEx	$ 20,000	$ 190,000				**$ 210,000**
OpEx			$ 15,000	$ 15,000	$ 15,000	**$ 45,000**
Total CapEx Per Year	$ 225,000	$ 1,300,000	$ 2,540,000	$ -	$ -	**$ 4,065,000**
Total OpEx Per Year	$ -	$ -	$ 150,000	$ 455,000	$ 455,000	**$ 1,060,000**
Total Cost Per Year	**$ 225,000**	**$ 1,300,000**	**$ 2,690,000**	**$ 455,000**	**$ 455,000**	**$ 5,125,000**

Other Smart City Use Cases

Other Smart City Use Cases						
	Year 1	Year 2	Year 3	Year 4	Year 5	Total per Use Case
Autonomous Shuttles						
CapEx		$ 100,000	$ 960,000			$ 1,060,000
OpEx				$ 180,000	$ 180,000	$ 360,000
Soil Sensors						
CapEx		$ 200,000				$ 200,000
OpEx			$ 20,000	$ 20,000	$ 20,000	$ 60,000
Remote Asset Operations (Control and Operate)						
CapEx						$ -
OpEx						$ -
Smart Multi-modal Coordination						
CapEx						$ -
OpEx						$ -
Smart Trashcan						
CapEx		$ 60,000	$ 580,000			$ 640,000
OpEx				$ 60,000	$ 60,000	$ 120,000
Speed Sensors on Traffic Lights						
CapEx		$ 570,000				$ 570,000
OpEx			$ 260,000	$ 260,000	$ 260,000	$ 780,000
Smart Curb Management						
CapEx		$ 5,000				$ 5,000
OpEx			$ 20,000	$ 20,000	$ 20,000	$ 60,000
Smart Streetlights - Transportation						
CapEx		$ 20,000	$ 145,000			$ 165,000
OpEx				$ 15,000	$ 15,000	$ 30,000
Micro-mobility Integration						
CapEx						$ -
OpEx						$ -
Air Taxi Integration						
CapEx				$ 1,000,000		$ 1,000,000
OpEx					$ 4,000,000	$ 4,000,000

Digital Infrastructure

Digital Infrastructure						
	Year 1	Year 2	Year 3	Year 4	Year 5	Total per Use Case
Design & Construct Expanded Fiber Backbone						
CapEx	$ 100,000	$ 2,175,000				$ 2,275,000
OpEx			$ 15,000	$ 15,000	$ 15,000	$ 45,000
Design & Construct Fiber Network to Parks, Traffic Cabinets						
CapEx	$ 30,000	$ 885,000				$ 915,000
OpEx			$ 5,000	$ 5,000	$ 5,000	$ 15,000
Design & Construct Fiber Network to Utility Lift Stations						
CapEx	$ 125,000	$ -	$ 2,785,000			$ 2,910,000
OpEx				$ 15,000	$ 15,000	$ 30,000
Design and Deploy LoraWAN Infrastructure						
CapEx	$ 35,000					$ 35,000
OpEx		$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 40,000
Design and Deploy 5G/CBRS Infrastructure						
CapEx	$ 280,000					$ 280,000
OpEx		$ 60,000	$ 60,000	$ 60,000	$ 60,000	$ 240,000
Total CapEx Per Year	$ 570,000	$ 3,060,000	$ 2,785,000	$ -	$ -	$ 6,415,000
Total OpEx Per Year		$ 70,000	$ 90,000	$ 105,000	$ 105,000	$ 370,000
Total Cost Per Year	**$ 570,000**	**$ 3,130,000**	**$ 2,875,000**	**$ 105,000**	**$ 105,000**	**$ 6,785,000**

Smart City Common Infrastructure

Smart City Infrastructure						
	Year 1	Year 2	Year 3	Year 4	Year 5	Total per Use Case
Establish Smart City Standards (CapEx)	$ 40,000					
Establish Smart City Mgmt Position in IT (OpEx)	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 500,000
Digital Twin (Static Model)						
CapEx	$ 20,000	$ 165,000			$ 185,000	$ 370,000
OpEx			$ 10,000	$ 10,000	$ 10,000	$ 30,000
2-Way Citizen Communication						
CapEx	$ 40,000	$ 40,000	$ 200,000		$ 280,000	$ 560,000
OpEx				$ 200,000	$ -	$ 200,000
Smart City Management System						
CapEx	$ 40,000	$ 40,000	$ 200,000		$ 280,000	$ 560,000
OpEx				$ 200,000	$ -	$ 200,000
Common Drones						
CapEx	$ 5,000	$ 20,000			$ 25,000	$ 50,000
OpEx			$155,000	$155,000	$155,000	$465,000
Common Cameras	Existing and Currently Operational					
Total CapEx Per Year	$ 145,000	$ 265,000	$ 400,000	$ -	$ 770,000	$ 1,580,000
Total OpEx Per Year	$ 100,000	$ 100,000	$ 265,000	$ 665,000	$ 265,000	$ 1,395,000
Total Cost Per Year	**$ 245,000**	**$ 365,000**	**$ 665,000**	**$ 665,000**	**$ 1,035,000**	$ 2,975,000

Table 25 - SWOT Analysis

Strengths	**Weaknesses**
• Addresses real city needs • Comprehensive approach • Based on extensive local input • Emphasis on upfront strategy creation • Focus on international standards, open APIs, and industry best practices.	• Requirement to integrate a wide range of technologies and vendors
Opportunities	**Threats**
• Create common architectures • Establish Winter Park at the forefront of technical innovation	• Vendor lock-in • Solution silos • Not acting fast enough • Being a regional laggard • Privacy and over-surveillance • Cyber-attacks/Hackers

6. Recommendations

As this report illustrates, a Smart City Strategy encompasses all aspects of the city. This section summarizes the recommendations in this report.

I. The City should establish a **city-wide technical layered architecture and open data governance policies** based on international standards and best practices.
II. The City should establish an *Intelligent Transportation Strategy and Deployment Plan.*
III. Each City utility should adopt a **5-to-10-year** *Smart Utility Strategy and Deployment Plan.*
IV. The City should establish an *Environmental Monitoring Strategy.*
V. Public Safety should continue to deploy and expand **devices, technologies, and systems** as force multipliers and to improve and gain situational awareness across the community.
VI. The City should immediately begin to deploy '**Pilot Projects'** on those Smart City initiatives and use cases prioritized through this Plan.
VII. The City should make all datasets generated through its Smart City program available through an **open data site and online platform**.
VIII. The City should closely monitor and participate in **State, County, and Regional Organizations, consortiums, and initiatives**.

Appendix 1- Stakeholders List

Category	Date	Organization /Department	Name	Role
City Leadership	2/14/23	Administration	Randy Knight	City Manager
	2/14/23	Finance	Wes Hamil	Finance Director
	2/14/23	Administration	Pamela Russell	Human Resources Division Director
	2/14/23		Leif Bouffard	Program Manager
	2/14/23	Communications	Clarissa Howard	Communications Director
	2/14/23	Information Technology	Parsram Rajaram	IT Director
	2/14/23	Management and Budget	Peter Moore	Office of Management & Budget Division Director
	2/14/23	Information Technology	Parsram Rajaram	IT Director
	2/14/23	Police	Tim Volkerson	Police Chief
	2/14/23	Fire-Rescue	Dan Hagedorn	Fire Chief
	2/15/23	Electric Utility	Mourad Belfakih	Electrical Engineer
	2/21/23	Risk, Safety & Fleet Division	Keri Martin	Director
	2/28/23	Public Works	Charles Ramdatt	Public Works & Transportation Director
	2/15/23	Planning and Zoning	Allison McGillis	Planning and Zoning
	2/15/23	Parks and Recreation	Jason Seeley	Director
	2/15/23	Parks and Recreation	Kathlyn	Assistant Director
	2/22/23	Natural Resources and Sustainability	Gloria Eby	Director
Schools	2/22/23	Winter Park High School	Matthew Arnold	Principal
		Rollins College - Public Safety	Ken Miller	Assistant Vice President for Public Safety
	2/24/23	Rollins College - IT	Troy Thomason	CIO
	2/22/23	Winter Park High School	Paul Wilher	Assistant Principal
Library	2/15/23	Winter Park Public Library	Melissa Schneider	Interim Director
Health	2/15/23	Orland Health	Marc Simmons	Network Engineer
	2/15/23	Orland Health	Greg Hardings	Wiring Analyst
Local Businesses	2/15/23	Brasfield & Gorrie	Jacob Stern	Preconstruction Manager at Brasfield Gorrie
	2/24/23	Winter Park Chamber of Commerce	Betsy Gardner Eckbert	President/CEO

Non-profit organizations, Community Partners	2/15//23	Edyth Bush Charitable Foundation	Davidalliso Odahowski	President & CEO
	2/23/23	Rollins Museum of Art & The Alfond Inn	Laney Velazquez	Digital Programming Director
ISPs	3/2/23	AT&T	Dan Pollock	Regional Director of External Affairs For Central Florida
	3/6/23	Charter Communications - Spectrum	Marva Johnson	Group Vice President, State Government Affairs for Charter Communications' Southern Region
	3/6/23	Lumen Technologies/CenturyLink	Dana Bailey	Director State & Local Government Affairs
	3/28/23	BlueWater Telecommunication	Paul Wheeler	President
			Ashely Wheeler	Vice President of Operations
			Alex Ferguson	Director of Business Solutions
	3/29/23	Verizon	Rachel Wright	Product Strategy Manager - Network Solutions
			Jay Bidlack	Senior Manager Real Estate in Florida - Network Solutions
			Christopher Milnes	Real Estate in Winter Park - Network Solutions
	4/4/23	Summit Broadband	Marvin Bouquette	Account Director - Government & Education
			James Lam	Vice President, Enterprise Sales
			Bill Lean	Product Vice President, Solutions Architecture
			Melissa Santiago	Director, Enterprise Sales