Town of Addison

ADDISON®

Townwide Asset Management Plan

2018

Acknowledgements

The Town of Addison's (Town) asset management plan was completed with the efforts of the Town's departmental staff, including members of the infrastructure operations, engineering, IT, general services, parks and recreation, utilities, and airport departments. Contributions were made through project management, transfer of knowledge, development and review of asset management methodology, processes, data, condition assessment, analytical results, and the asset management plan.

The asset management plan was prepared, reviewed, and finalized under the guidance of the Town's project team. The efforts of the Town staff should be acknowledged.

Town of Addison Asset Management Project Team

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Background

The Town of Addison (Town) is developing and will implement a comprehensive asset management program to gain better understanding of the current and future asset needs, asset risk profile, appropriate levels of service, cost to provide that level of service, and financial and resource requirements to sustain the delivery of those services. The Town's comprehensive asset management program will provide an integrated, citywide vision for all assets and will provide the data foundation, business processes, and IT infrastructure to effectively manage the Town's current and future infrastructure needs.

The development of the Town's Asset Management Plan began in June 2017 and was divided into two phases: Phase I (June 2017 to May 2018) and Phase II (May 2018 to October 2018). The following assets systems were covered under the asset management plan.

Phase I		Phase II
• Parks and Trails • Landscape Areas • Buildings • Water/Wastewater • Curb & Gutter • Fleet • Vehicular Bridges	• Curb Ramps • Pavement and Pavement Markings • Sidewalks • Street Lights • Traffic Signals • Traffic Signs	• Airport • Storm Water

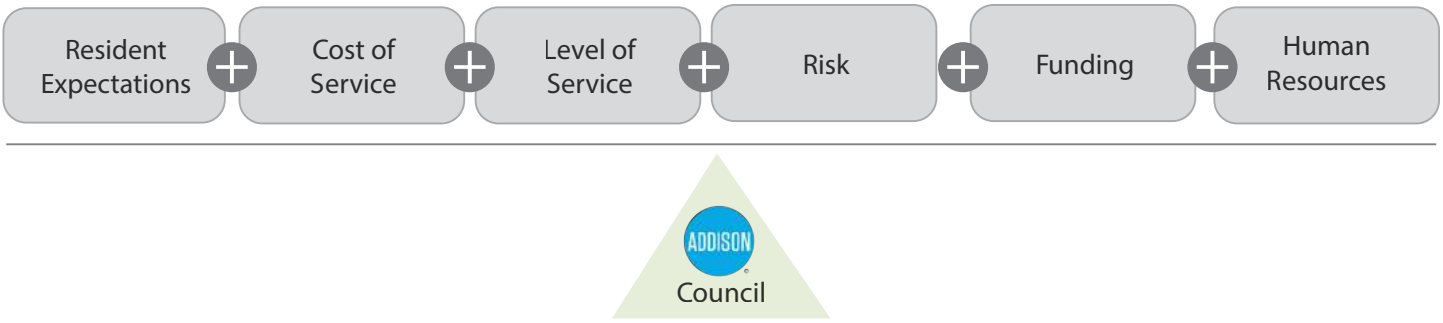
The Asset Management Plan documents the current state of the assets in each management system and their future needs.

Asset Management Definition

The Town defined asset management as:

"Managing assets to minimize the total cost of owning, operating, and maintaining those assets while delivering the desired service level at an acceptable level of risk."

Effective asset management is to balance the expectations of the community with the cost of providing that level of service, with the risk associated with that asset, with available funding, and with available people to do the work.



Background

Asset Management Plan

An asset management plan is a long-range planning document that provides a framework for understanding the assets an organization owns and manages, services it provides, risks it assumes, and financial investments required to sustain the services. An asset management plan can help an organization move from reactive to proactive management of its physical and financial resources. The development of an asset management plan requires answers to the following questions:

- What is an asset? What is not an asset?
- Which assets need to be managed?
- What is the current state of the assets?
- What maintenance and capital work are required? When and how much?
- How long until the assets need to be renewed?
- Which assets are critical?
- What levels of service must be provided?
- What is the long-range investment needed to sustain the delivery of services?

The answers to these questions help in the development of an asset management plan.

The key elements of the asset management plan development are:

1. Asset inventory – What does the Town own and manage?
2. Condition assessment – What are the current conditions and needs of the assets?
3. Risk assessment – Which assets are critical? Which are not?
4. Work management – What work needs to be done? Where, when, and for how much?
5. Life cycle cost assessment – What are the long term financial needs?
6. Funding analyses – Are there enough funds allocated to the management of the asset to sustain the delivery of that asset?

Asset Management Program

An asset management program encompasses the framework, goals, data, methodologies, processes, practices, and information systems used to support asset management decisions.

Background

Goal of the Asset Management Program

The main goal of the Town's asset management program is to transition from reactive to proactive planning and management of its infrastructure assets. More specifically, the Town's overarching goal is to achieve the following objectives:

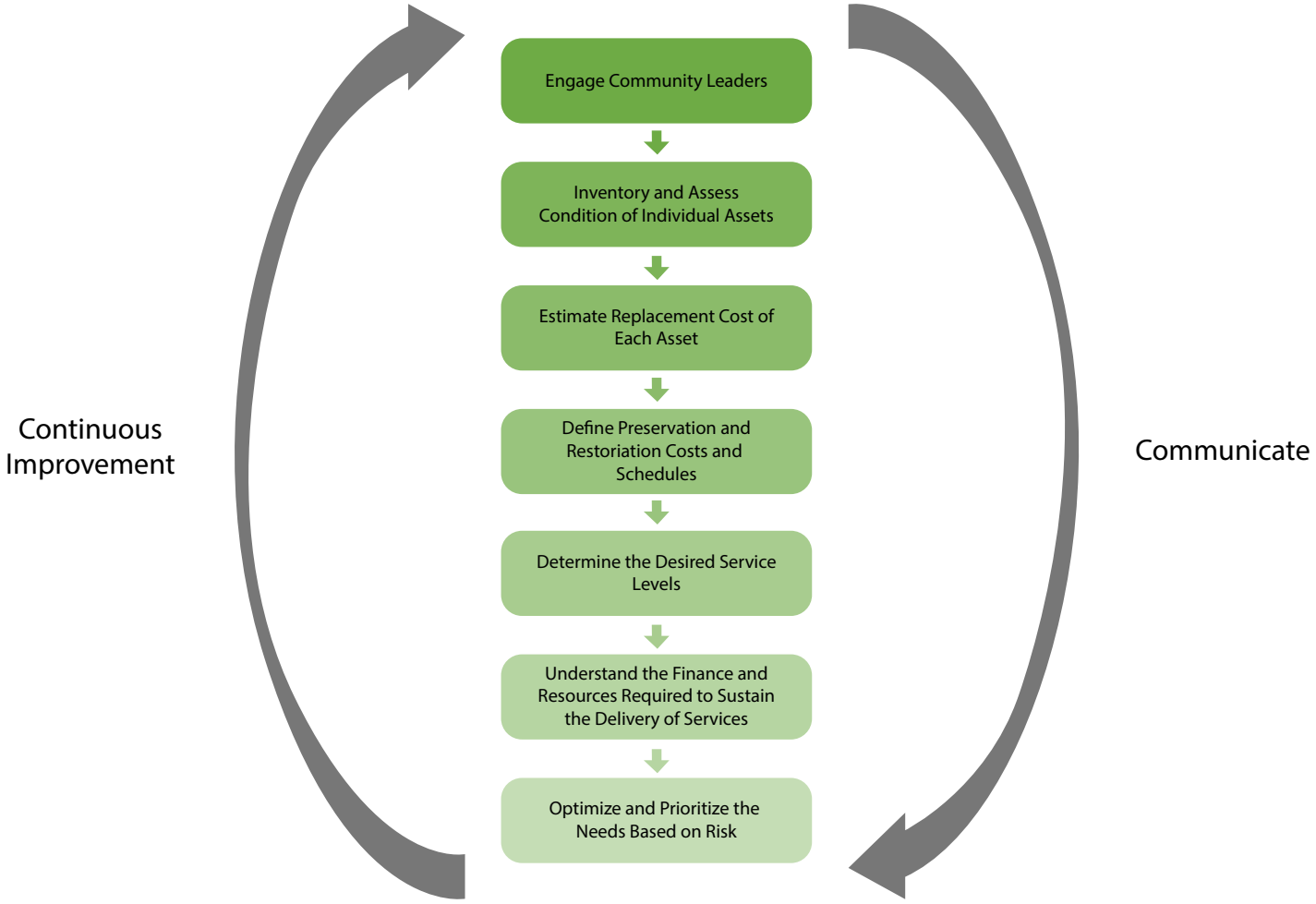
- To understand the magnitude and timing of infrastructure reinvestment needs
- To understand the risk associated with assets
- To develop a data-backed justification to plan and prioritize infrastructure needs
- To understand the cost to provide service
- To develop a consistent and transparent decision-making process
- To develop a sound foundation for continuous improvement
- To communicate and be able to tell the infrastructure story

Some of the major challenges to meeting that goal include the following:

- Old assets in need of maintenance, rehabilitation, or replacement
- High level of service standards
- Limited budget and limited work force
- Loss of institutional history as long-term employees retire

Methodology

The following diagram illustrates the methodology to develop the asset management program.



These processes were applied to each asset management system to develop the asset management plan.

In order to establish the data foundation for the asset management analyses, a comprehensive inventory of assets was developed for each asset management system (e.g., roadway, parks, buildings). Where accessible, assets were viewed, their attributes (e.g., location, size, type, material) recorded, and their conditions assessed. Based on the condition of the assets, the actions required to restore the assets were identified, and the cost and timing of the repair, replacement, or refurbishment were estimated. Through assessment of risk (probability and consequence of failures), activities were prioritized according to the criticality, level of service, and the financial and resource requirements.

Key Components

The following section lists the key components and methodology used to build the asset management program.

Asset Register

The asset register establishes the data foundation of the asset management program by consolidating and documenting all assets owned and managed. The development of the asset register required establishing the following key elements:

- *Asset Definition* – Helps to define what is an asset versus what is not an asset. An asset is defined as something with value that is owned and managed by the Town. More importantly, an asset is defined at the level at which the work order will be generated and tagged. With the asset definition established, the Town is able to separate assets from components and filter assets depending on how they should be managed.
- *Asset Hierarchy* – Organizes the thousands of assets in the asset register. With the asset hierarchy, the Town is able to easily find assets and support asset management decisions at any level within the asset hierarchy.
- *Asset Classes* – Groups the assets to allow the Town to characterize the life-cycle behavior of the assets in the register. An asset class is developed by grouping assets with similar characteristics, such as type, function, useful life, material, and size. Asset classes are used to help model the life-cycle costs of the assets.
- *Asset Data Standards* – Identifies the data attributes required to support asset management decisions.

Replacement Cost

Each asset in the asset register was assigned a replacement cost. This replacement cost estimates the budget required to replace the asset with a like, in-kind asset. The replacement cost incorporates material, labor, removal, and other costs associated with replacing the asset. It should be noted that the replacement cost does not include any changes to capacity or level of service. In addition, the replacement cost does not represent the full CIP project cost, which typically includes the following costs associated with delivering a project:

- Engineering/Design/Project Management
- Demolition and removal
- Permit
- Contractor overhead/profit
- Contingency
- Traffic control
- General conditions

Typically, an additional 15% to 30% is added to the replacement cost to represent the full CIP project costs. In the asset management plan, all costs are represented as replacement costs. The individual replacement costs for the assets are then summed to create a total estimated replacement cost for the management system.

The estimated replacement cost was then increased to estimate the fully burdened project cost.

Condition

Condition is one of the best indicators for estimation of immediate and/or future maintenance, repair, and replacement work. During the asset inventory field visits, each accessible asset was assessed for condition based on the following condition scale. Assets with replacement, rehabilitation, and maintenance needs were highlighted.

Table B-1 Condition Assessment Scale

Condition Score	Description
1	**Excellent:** New or nearly new
2	**Very Good:** Very good
3	**Good/Fair:** Good or as expected based on age
4	**Poor:** Poor or recommended replacement within near-term
5	**Failed/Critical:** Failed or nearing failure, needs immediate attention

Risk

Risk is used for effective prioritization of limited resources (e.g., budget, availability of staff). The two main components of risk are Probability of Failure (PoF) and Consequence of Failure (CoF). PoF indicates the projected time until the asset fails to function at the established levels of service. CoF provides an indication of the impact of a failure in consideration of the triple bottom line factors of sustainability: economic, social, and environmental. Every asset in the asset register is assigned a risk score. Under limited resources, the Town should address the assets with the highest risk scores before addressing the lower-risk assets. Risk allows the Town to transparently prioritize the highest risk assets.

The following formula is used to calculate the risk score:

With each asset's risk score calculated, the Town was able to plot the assets in the risk matrix shown below. This profile incorporates both the PoF and CoF scores to prioritize the assets. The assets in the red zone of the risk matrix are the highest risk assets that have both a high probability and high consequence of failure. Assets with a risk score (PoF x CoF) of 4 or higher were considered high-risk assets. The assets in the green, low-risk zone are not necessarily all in good condition, but rather they have a low probability or consequence of failure.

In moving towards a risk-based decision-making strategy, decisions about investments in the assets will be made to ensure maximum risk reduction. The risk-based strategy is to manage the high-risk zone (red zone) before moving down to medium (yellow zone) and low risk zones (green zone).

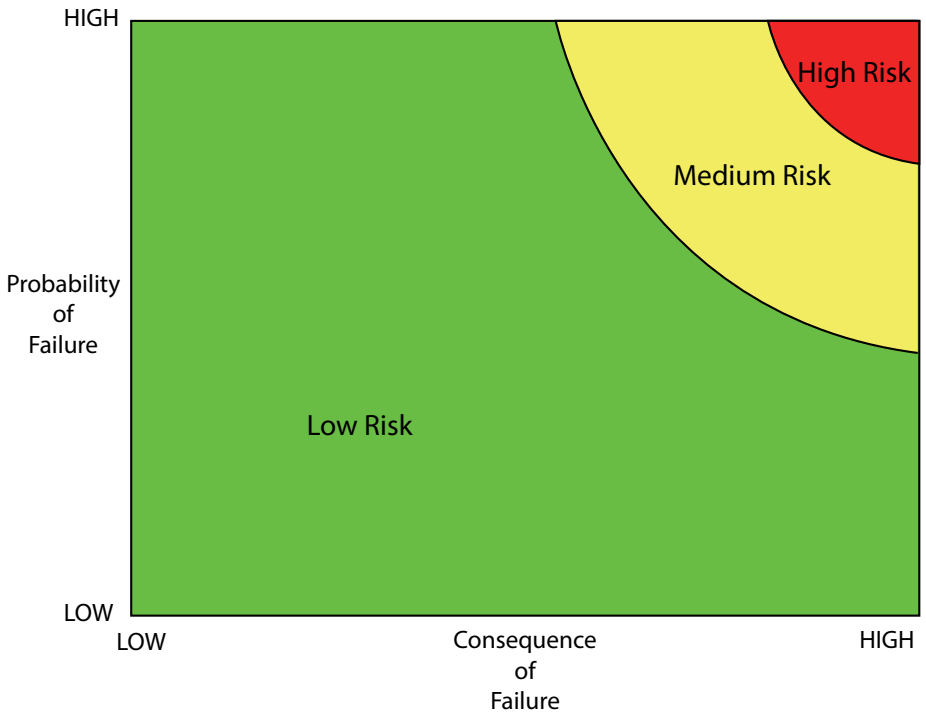


Figure B-1 Risk Matrix

Life-Cycle Cost Analysis

In order to predict the future replacement and rehabilitation need of all assets, a life-cycle cost analysis is performed. The life-cycle cost analysis is a calculation of costs required to support the set of activities (e.g., rehabilitation, replacement) that are needed to sustain the delivery of an asset's services during the life of an asset or for the planning horizon (e.g., 20, 30, or 50 years).

Life-cycle cost analysis is performed for each asset in the asset register. For every year of the planning horizon, the life-cycle analysis will calculate which asset needs a refurbishment or replacement activity and how much it will cost to perform the needed activity. When all the activity costs are summed for each year, the overall replacement and rehabilitation budget for the year will be established. The life-cycle cost analysis drives the estimation of the future financial needs to sustain the delivery of the assets. By comparing and contrasting the life-cycle cost results against the current budget for the replacement and rehabilitation of the asset, the sustainability of the future financial plan can be assessed.

Management Strategy

Life-cycle cost calculation takes place in the context of a management strategy. A management strategy characterizes the life-cycle behavior of an asset (e.g., how it will decay, how long it will last, necessary refurbishment during the life of the asset, when refurbishment is needed, how much refurbishment will cost). Every asset is assigned a management strategy.

The figure below illustrates the relationship between asset condition, management activities, and life-cycle cost. After the installation, asset condition will decrease with time. In order to raise the condition to an acceptable level, an investment in the form of maintenance or rehabilitation will be required. Eventually, at the end of its useful life, the asset will need to be replaced, and the cycle will repeat.

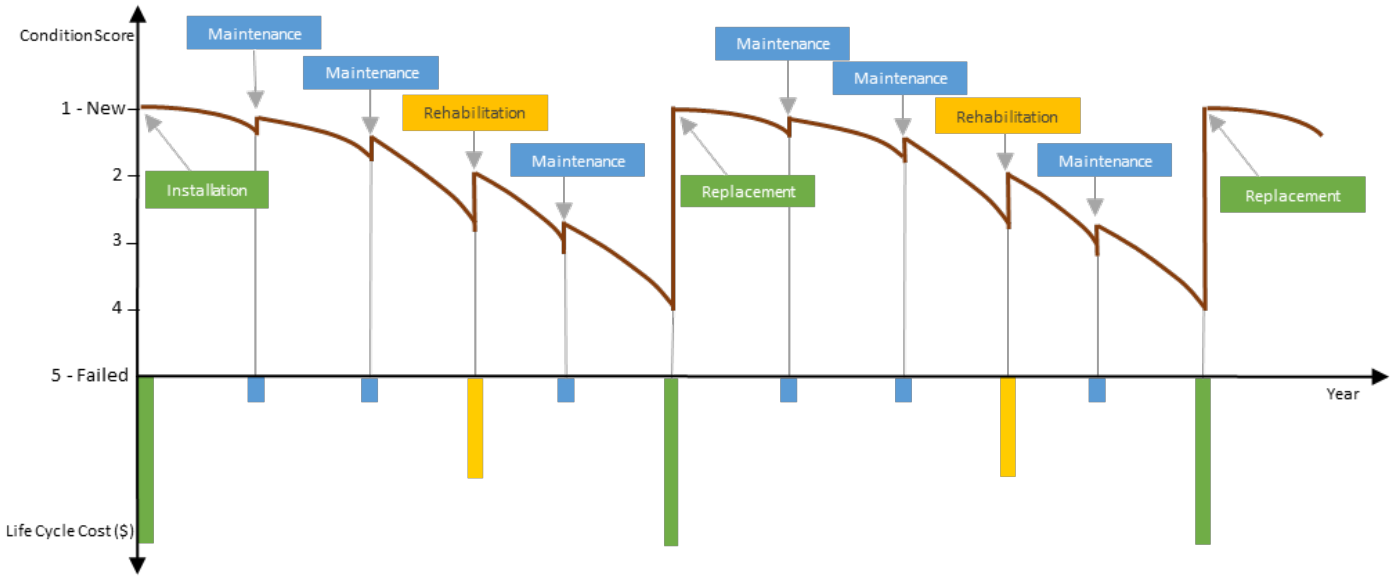


Figure B-2 Life Cycle Cost Logic Illustration

Using life-cycle cost assessment will allow the Town to proactively manage its assets, and be able to predict which assets are nearing the end of their useful life. This leads to a more proactive plan for replacement of high-risk assets to prevent failure. Reacting to a high-risk asset failure typically results in the highest expense. With life-cycle cost analysis, the Town will also have an understanding of the work and investment required for future years and proactively plan ahead to minimize risk and costs. These estimations will be used to prepare the budget and resources required to sustain the delivery of services. When budget and resource limitations exist, the Town will be able to prioritize the needs by risk to ensure the budget is first spent on high-risk assets. In essence, the Town will be able to ensure that minimum funds are spent to maximize risk reduction.

IRIS (Infrastructure Reinvestment Intelligence System)

Life-cycle cost calculation can be very tedious and time consuming. It is especially difficult when the calculations need to be performed for thousands of assets, year-by-year, asset-by-asset. For this reason, the Town utilized Kayuga Solution's asset management planning tool, IRIS (Infrastructure Reinvestment Intelligence System), which incorporates the developed asset register and performs the life cycle cost and risk assessment work.

IRIS is an asset management dashboard that utilizes the Town's asset data and performs asset management calculations and analyses presented in the Town's asset management plan. It is a planning tool the Town can use to project the future maintenance, rehabilitation, and replacement needs, understand its high-risk assets, understand the cost of ownership, calculate the appropriate budget required to mitigate the high-risk assets, and identify assets estimated to require rehabilitation or replacement year-by-year, asset-by-asset.

IRIS will not replace the Town's existing management systems (i.e., Computerized Maintenance Management System [CMMS], GIS). In fact, IRIS is designed to supplement these systems by performing asset management calculations that CMMS and GIS cannot perform (i.e., future long-range capital funding need forecasts, risk analyses, funding scenarios, cost of ownership).

The figure below illustrates a sample view of IRIS dashboard.

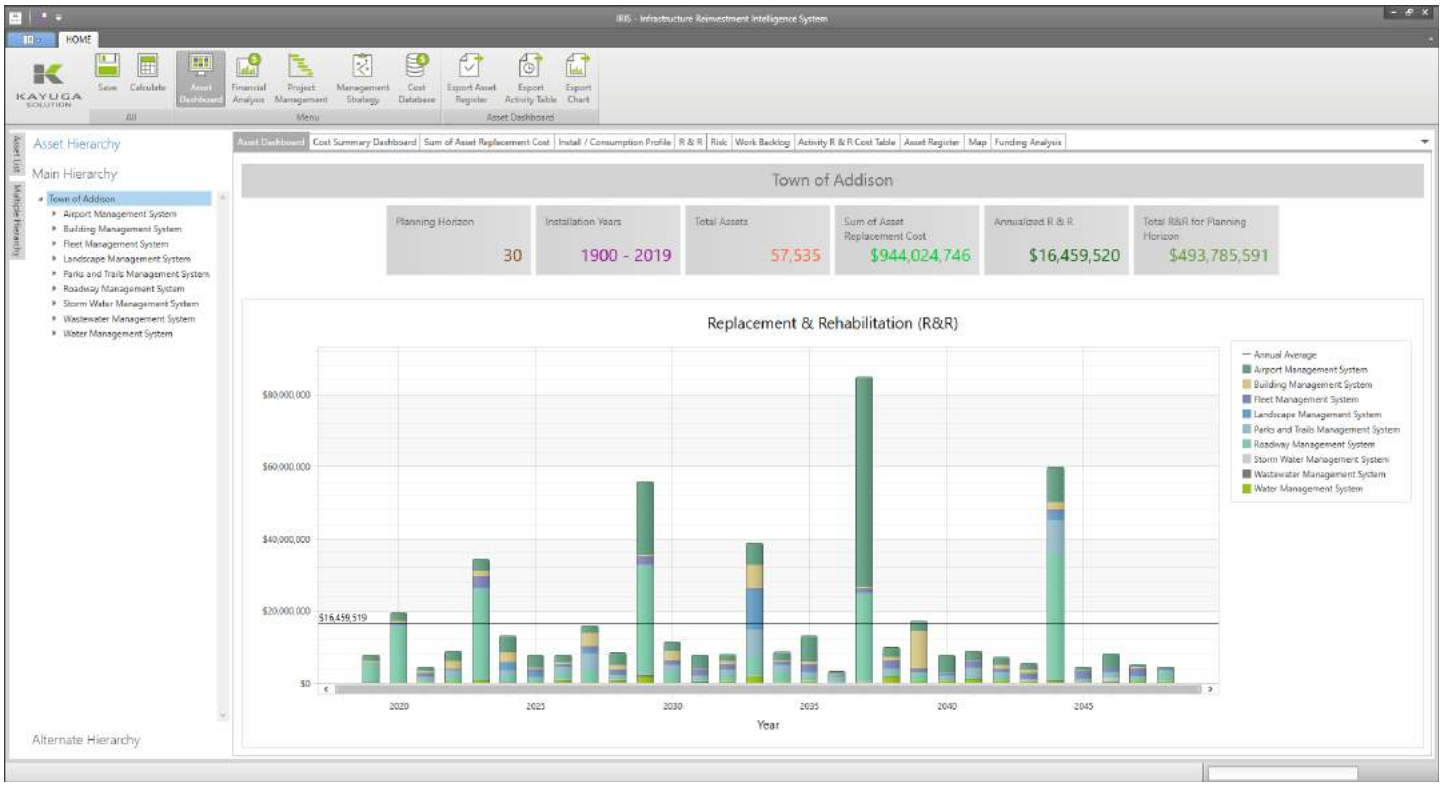


Figure B-3 IRIS (Infrastructure Reinvestment Intelligence System)

The following diagram illustrates how IRIS integrates with the Town's overall asset management system. As shown in the figure, asset information will be stored in the Town's CMMS and GIS. IRIS imports the necessary asset information to help plan for future asset replacement and rehabilitation and financial needs.

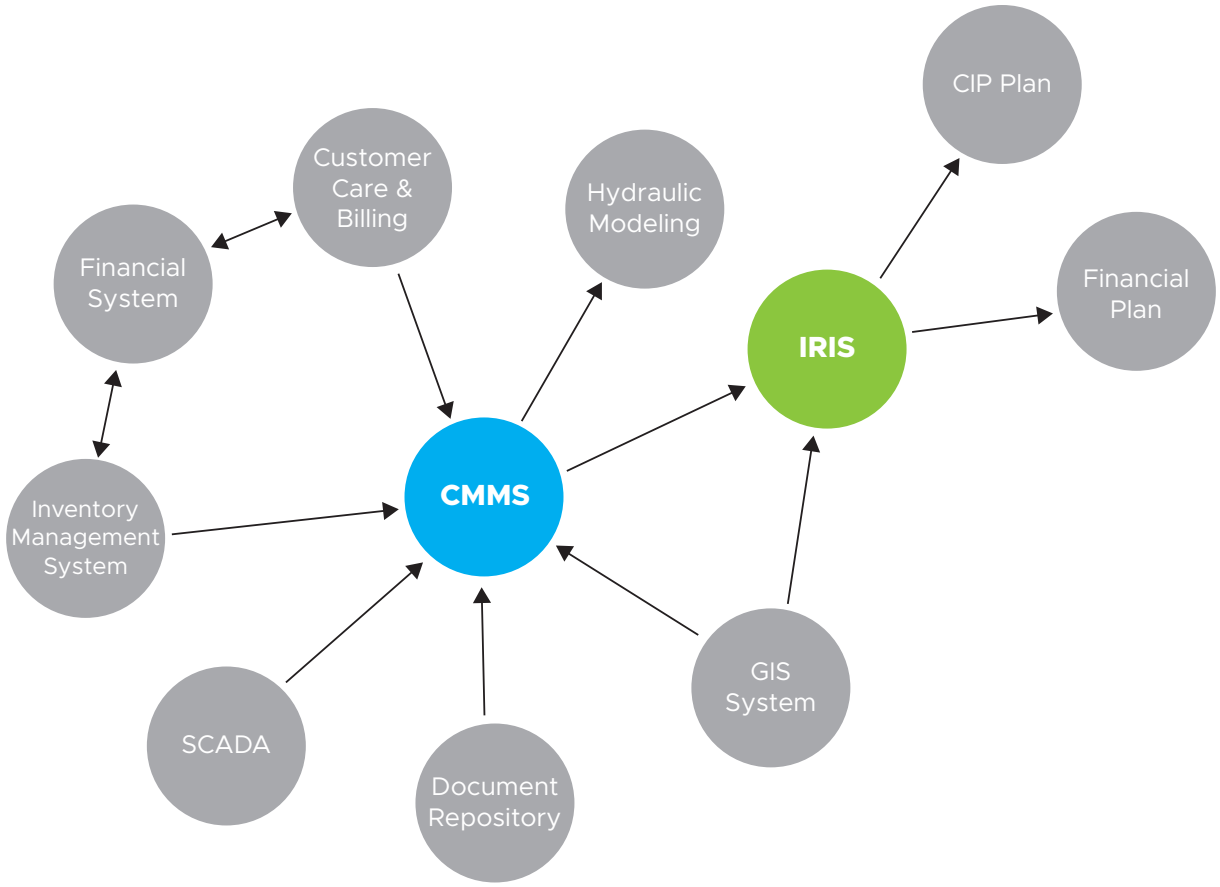


Figure B-4 Town of Addison Asset Management Information System

Long Range Replacement and Rehabilitation Planning Horizon

Based on the life cycle cost analysis, the long-range replacement profile for estimated future replacement and rehabilitation financial needs is generated. Every year, those assets requiring investment are identified and summed to generate the replacement profile. A 30-year horizon life-cycle cost analysis was performed over two types of models: the deterministic model and the probabilistic model. In the deterministic model, assets are rehabilitated and replaced exactly as outlined in the model. In the probabilistic model, asset failures are smoothed to represent a more realistic expectation.

Catch Up and Keep Up

"Catch Up" can be described as all current, upcoming, and past due replacement and rehabilitation needs of the Town. In alignment with the Town's risk-based policy, the Catch Up is associated with the high risk "red zone" (high probability of failure and consequence of failure) in the risk matrix. At minimum, these are assets that the Town should plan to address as quickly as possible.

Once the Town catches up, the "Keep Up" refers to the year-to-year replacement and rehabilitation budget needed to sustain or keep up the level of service. While the Catch Up encompasses all incurred costs for the first year of the planning horizon, the Keep Up is presented as an average of all replacement and rehabilitation costs in the 30-year horizon.

Asset Management System Report Card

Each asset management system (e.g., parks, buildings, water, wastewater, roadway) was given a letter grade to assess its physical health. The physical health of each management system is based on the current condition of the infrastructure (i.e., state of the infrastructure). The following equation presents the analysis for the physical health of each system.

$$Physical\ Health\ = \frac{Sum\ of\ Poor\ Condition\ Asset\ Replacement\ Cost}{Sum\ of\ Total\ Replacement\ Cost}$$

A grade is assigned for each category based on the rating table below. The physical health grading scale reflects the logic and performance measures of several best practices for infrastructure management, such as the Facility Condition Index (FCI) and the Pavement Condition Index (PCI).

Table B-2 Asset Management System Scoring

Category	A	B	C	D	F
Physical Health	≤5%	≤10%	≤20%	≤30%	>30%

Level of Service

The key concept of asset management is to balance level of service, cost to provide the service, and risk. Level of service sets the commitments the Town intends to provide. During the asset management plan development process, the Town considered two potential levels of service: the Preferred and the Minimum.

The Preferred Level of Service is to fully fund the replacement and rehabilitation activities at the ideal level for the upkeep of the assets. In this scenario, the Town would follow the maintenance, rehabilitation, and replacement cycles as outlined in the life-cycle cost logic. The Preferred Level of Service presents an ideal scenario to provide full level of service. However, it is important to remember that the Town may not be able to complete all required maintenance, rehabilitation, and replacement due to limited budget.

The Minimum Level of Service will typically fund rehabilitation and replacement work at the maximum level of risk the Town is willing to accept. In this scenario, only high-risk assets (with a CoF of 4 or higher) would be maintained, rehabilitated, and replaced. None of the low consequence of failure assets would be maintained or rehabilitated, nor would they be replaced after failure.

Financial Management Strategies

By implementing an asset management program, the Town is gaining a better understanding of its future infrastructure asset replacement and rehabilitation needs. The projection of future infrastructure asset replacement and rehabilitation needs reveals that the current Operations and Maintenance (O&M) budgets that are allocated will not be sufficient to catch up or keep up with asset replacement or rehabilitation needs. There are numerous methodologies that can be deployed to fund replacement and rehabilitation of infrastructure assets. The Town should develop financial strategies that will put in place reliable funding sources to address asset needs, so that the assets do not continue to deteriorate.

Applying all of the concepts above, the Town developed a Town-wide asset management plan that documented the state of its infrastructure assets and the financial investments required to sustain the services they provide.

E1 | AMP Executive Summary - Building Management System

Physical Health Score C

Inventory	17 buildings
	7,335 assets
Total Asset Replacement Cost	$ 35 million

Building Facility Condition Index (FCI) Scores

The most commonly used rating tool in the building industry is the Facility Condition Index (FCI). The higher the FCI percentage, the poorer the relative facility condition.

Common immediate maintenance needs found at the Town buildings included leaking condensate lines, concrete spalling on exterior walls, water damage on ceilings, paint touchups, etc. The total cost of maintenance needs is $1.7 million for all Town buildings. The following table presents the FCI score for each building.

Building Name	FCI Score	FCI Rating
Kellway Lift Station Building (Building Only)	0.0%	Good
Surveyor Pump Station Building (Building Only)	0.0%	Good
Celestial Pump Station Generator Building (Building Only)	0.0%	Good
Celestial Pump Station Sampling Building (Building Only)	0.0%	Good
Water Tower Learning Center (Building Only)	0.0%	Good
Celestial Pump Station Building (Building Only)	0.9%	Good
Athletic Club	1.7%	Good
Service Center	10.7%	Fair
Fire Station 1	11.2%	Fair

Building Name	FCI Score	FCI Rating
Fire Station 2	11.3%	Fair
Conference Centre	17.2%	Fair
Theatre Centre	20.7%	Fair
Police Station	23.6%	Fair
Stone Cottage	26.7%	Fair
Special Events Pavilion	30.8%	Poor
Financial & Strategic Services Department	38.6%	Poor
Town Hall	43.4%	Poor

Future Needs

In order to estimate the long-term investment needs for the Building Management System, a 30-year life-cycle cost analysis was performed over two types of models: the deterministic model and the probabilistic model. These models calculate the replacement and rehabilitation needs of the building assets over the 30-year planning horizon.

- **Deterministic Model:** Assets are rehabilitated and replaced exactly as outlined in the model
- **Probabilistic Model:** Asset failures are smoothed to represent a more realistic expectation

30-Year	Annual Average
Deterministic	$ 1.4 M/yr
Probabilistic	$ 1.2 M/yr
Deterministic with 3% Inflation	$ 2.2 M/yr
Probabilistic with 3% Inflation	$ 1.9 M/yr

Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from $1.4 million per year to $2.2 million per year. Similarly, for the probabilistic model, the annual investment need increased from $1.2 million per year to $1.9 million per year.

Prioritizing Risk

In order to ensure that the limited available funds address the ongoing replacement and rehabilitation needs of the building assets in the most efficient and effective manner, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was used.

The building assets were categorized into three risk levels: high risk, medium risk, and low risk. The red zone represents the assets that have both a high probability and high consequence of failure. In total, 83 assets were identified as high-risk assets with a total replacement cost of approximately $1.9 million. These high-risk assets mainly include roofing, HVAC, and wall finishes (paint) at several high-criticality buildings. The assets in the green, low-risk zone, however, are not necessarily all in good condition, but rather they have a low probability or consequence of failure. The following figure shows the number of assets in each category, as well as the total replacement and rehabilitation cost for the assets in each category.

Defining and Sustaining the Desired Level of Service

A defined agreed-upon level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Due to the nature of the asset, the level of service may either be Preferred or Minimum.

- **Preferred Level of Service:** Incorporates full replacement and rehabilitation of all assets in order to sustain the delivery of services; represents the highest budget required
- **Minimum Level of Service:** Involves replacement and rehabilitation of only critical assets; represents the lowest budget required to sustain the delivery of basic services

Projected Long-Range Needs	Level of Service	Average Annual Cost of Replacement & Rehabilitation
$ 1,400,000	Preferred	$ 1,400,000
	Minimum	$ 859,000

Physical Health Score A

Inventory	19 parks and trails
	4,129 assets
	93 acres
Total Asset Replacement Cost	$ 36 million

Condition Assessment

During the inventory verification and development process, each asset in the parks/trails was assessed for condition based on the following condition scale. The condition assessment results are shown below.

Condition Score	Description	Percent of Assets
1	Excellent	2%
2	Very Good	21%
3	Good/Fair	73%
4	Poor	2%
5	Failed/Critical	1%

Future Needs

In order to estimate the long-term investment needs for the Parks and Trails Management System, a 30-year life-cycle cost analysis was performed over two types of models: the deterministic model and the probabilistic model. These models calculate the replacement and rehabilitation needs of the park and trail assets over the 30-year planning horizon.

- **Deterministic Model:** Assets are rehabilitated and replaced exactly as outlined in the model
- **Probabilistic Model:** Asset failures are smoothed to represent a more realistic expectation

30-Year	Annual Average
Deterministic	$ 1.6 M/yr
Probabilistic	$ 1.2 M/yr
Deterministic with 3% Inflation	$ 2.5 M/yr
Probabilistic with 3% Inflation	$ 2.2 M/yr

Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from $1.6 million per year to $2.5 million per year. Similarly, for the probabilistic model, the annual investment need increased from $1.2 million per year to $2.2 million per year.

Prioritizing Risk

In order to ensure that the limited available funds address the ongoing replacement and rehabilitation needs of the park and trail assets in the most efficient and effective manner, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was used.

The park and trail assets were categorized into three risk levels: high risk, medium risk, and low risk. The red zone represents the assets that have both a high probability and high consequence of failure. Currently, there are only two assets identified as high-risk in the Parks and Trails Management System; two light fixtures along Vitruvian Way are in poor or failing condition. The assets in the green, low-risk zone, however, are not necessarily all in good condition, but rather they have a low probability or consequence of failure. The following figure shows the number of assets in each category, as well as the total replacement and rehabilitation cost for the assets in each category.

Defining and Sustaining the Desired Level of Service

A defined agreed-upon level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Due to the nature of the asset, the level of service may either be Preferred or Minimum.

- **Preferred Level of Service:** Incorporates full replacement and rehabilitation of all assets in order to sustain the delivery of services; represents the highest budget required
- **Minimum Level of Service:** Involves replacement and rehabilitation of only critical assets; represents the lowest budget required to sustain the delivery of basic services

Projected Long-Range Needs	Level of Service	Average Annual Cost of Replacement & Rehabilitation
$ 1,600,000	Preferred	$ 1,600,000
	Minimum	$ 674,000

Physical Health Score B

Inventory	164 acres
	3,061 assets
Total Asset Replacement Cost	$ 16.5 million

Condition Assessment

During the inventory verification and development process, each asset in the landscape areas was assessed for condition based on the following condition scale.

Condition Score	Description	Number of Assets	Percent of Total
1	Excellent	18	1%
2	Very Good	33	1%
3	Good/Fair	2,931	96%
4	Poor	56	2%
5	Failed/Critical	23	1%

Future Needs

In order to estimate the long-term investment needs for the Landscape Management System, a 30-year life-cycle cost analysis was performed over two types of models: the deterministic model and the probabilistic model. These models calculate the replacement and rehabilitation needs of the landscape assets over the 30-year planning horizon.

- **Deterministic Model:** Assets are rehabilitated and replaced exactly as outlined in the model
- **Probabilistic Model:** Asset failures are smoothed to represent a more realistic expectation

30-Year	Annual Average
Deterministic	$ 690,000/yr
Probabilistic	$ 600,000/yr
Deterministic with 3% Inflation	$ 1.0 M/yr
Probabilistic with 3% Inflation	$ 941,000/yr

Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from approximately $690,000 per year to $1 million per year. Similarly, for the probabilistic model, the annual investment need increased from approximately $600,000 per year to $941,000 per year.

Prioritizing Risk

In order to ensure that the limited available funds address the ongoing replacement and rehabilitation needs of the landscape assets in the most efficient and effective manner, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was used.

The landscape assets were categorized into three risk levels: high risk, medium risk, and low risk. The red zone represents the assets that have both a high probability and high consequence of failure. In total, 11 assets were identified as high-risk assets with a total replacement cost of $10,600. These high-risk assets include 8 irrigation control valves and 1 backflow preventer located in arterial areas and 2 street lights in the Addison Circle Area. The assets in the green, low-risk zone, however, are not necessarily all in good condition, but rather they have a low probability or consequence of failure. The following figure shows the number of assets in each category, as well as the total replacement and rehabilitation cost for the assets in each category.

Defining and Sustaining the Desired Level of Service

A defined agreed-upon level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Due to the nature of the asset, the level of service may either be Preferred or Minimum.

- **Preferred Level of Service:** Incorporates full replacement and rehabilitation of all assets in order to sustain the delivery of services; represents the highest budget required
- **Minimum Level of Service:** Involves replacement and rehabilitation of only critical assets; represents the lowest budget required to sustain the delivery of basic services

Projected Long-Range Needs	Level of Service	Average Annual Cost of Replacement & Rehabilitation
$ 690,000	Preferred	$ 690,000
	Minimum	$94,000

Physical Health Score A

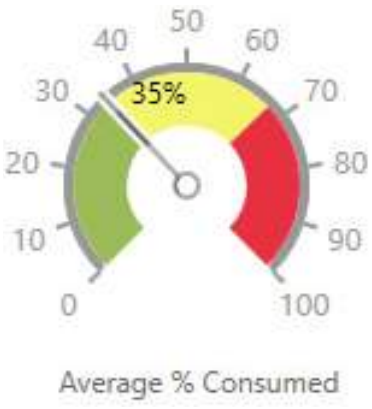
Inventory	96 miles of pipe
	2 pump stations
	4 reservoirs
	12,601 assets
Total Asset Replacement Cost	$ 121 million

*Does not include building assets

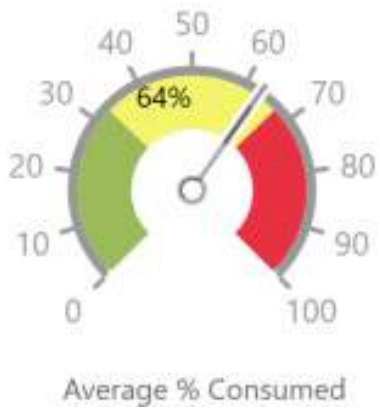
Condition Assessment

Where an asset was visible, a general condition assessment took place through visual inspection. In some cases, however, assets are not visible or visual assessment is not a good representation of the asset's condition. In such cases, the anticipated condition score was estimated based on the age of the asset. Age-based calculation required evaluation of the asset age, expected useful life, and anticipated decay curve. The following figures show the water mains and water facilities by average consumption based on replacement cost. Consumption is a measure of an asset's estimated age or condition relative to its expected useful life. The lower the average percent consumed, the longer the remaining useful life of the asset.

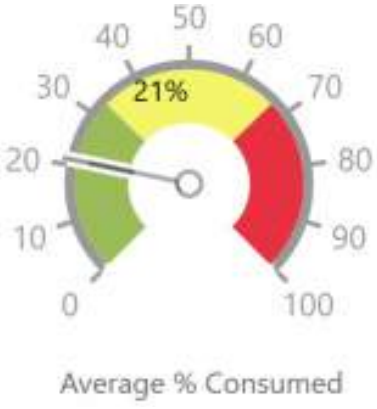
Water Mains



Pump Stations



Reservoirs



Future Needs

In order to estimate the long-term investment needs for the Water Management System, a 30-year life-cycle cost analysis was performed over two types of models: the deterministic model and the probabilistic model. These models calculate the replacement and rehabilitation needs of the water assets over the 30-year planning horizon.

- **Deterministic Model:** Assets are rehabilitated and replaced exactly as outlined in the model
- **Probabilistic Model:** Asset failures are smoothed to represent a more realistic expectation

30-Year	Annual Average
Deterministic	$ 478,000/yr
Probabilistic	$ 423,000/yr
Deterministic with 3% Inflation	$ 796,000/yr
Probabilistic with 3% Inflation	$ 696,000/yr

Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from approximately $478,000 per year to $796,000 per year. Similarly, for the probabilistic model, the annual investment need increased from approximately $423,000 per year to $696,000 per year.

Prioritizing Risk

In order to ensure that the limited available funds address the ongoing replacement and rehabilitation needs of the water assets in the most efficient and effective manner, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was used.

The water assets were categorized into three risk levels: high risk, medium risk, and low risk. The red zone represents the assets that have both a high probability and high consequence of failure. In total, 26 assets were identified as high-risk assets with a total replacement cost of approximately $617,000. Some of these high-risk assets include the generator at Celestial Pump Station, the analyzer and Solarbee mixer at Surveyor EST, and various pumps and motors at Surveyor Pump Station. The assets in the green, low-risk zone, however, are not necessarily all in good condition, but rather they have a low probability or consequence of failure. The following figure shows the number of assets in each category, as well as the total replacement and rehabilitation cost for the assets in each category.

Defining and Sustaining the Desired Level of Service

A defined agreed-upon level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Due to the nature of the asset, the level of service may either be Preferred or Minimum.

- **Preferred Level of Service:** Incorporates full replacement and rehabilitation of all assets in order to sustain the delivery of services; represents the highest budget required
- **Minimum Level of Service:** Involves replacement and rehabilitation of only critical assets; represents the lowest budget required to sustain the delivery of basic services

Projected Long-Range Needs	Level of Service	Average Annual Cost of Replacement & Rehabilitation
$ 478,000	Preferred	$ 478,000
	Minimum	$ 316,000

Physical Health Score A

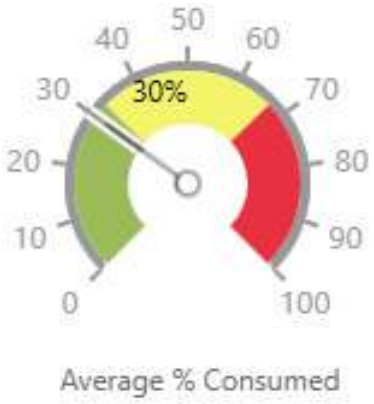
Inventory	68 miles of pipe
	1 lift station
	3,518 assets
Total Asset Replacement Cost	$ 65 million

*Does not include building assets

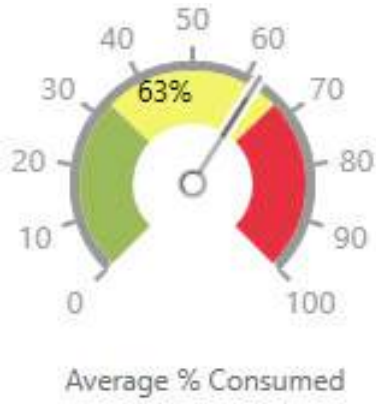
Condition Assessment

Where the asset was visible, a general condition assessment took place through visual inspection. In some cases, however, assets are not visible or visual assessment is not a good representation of the asset's condition. In such cases, the anticipated condition score was estimated based on the age of the asset. Age-based calculation required evaluation of the asset age, expected useful life, and anticipated decay curve. The following figures show the sewer lines and lift station by average consumption based on replacement cost. Consumption is a measure of an asset's estimated age or condition relative to its expected useful life. The lower the average percent consumed, the longer the remaining useful life of the asset.

Sewer Lines



Kellway Lift Station



Future Needs

In order to estimate the long-term investment needs for the Wastewater Management System, a 30-year life-cycle cost analysis was performed over two types of models: the deterministic model and the probabilistic model. These models calculate the replacement and rehabilitation needs of the wastewater assets over the 30-year planning horizon.

- **Deterministic Model:** Assets are rehabilitated and replaced exactly as outlined in the model
- **Probabilistic Model:** Asset failures are smoothed to represent a more realistic expectation

30-Year	Annual Average
Deterministic	$ 97,000/yr
Probabilistic	$ 77,000/yr
Deterministic with 3% Inflation	$ 152,000/yr
Probabilistic with 3% Inflation	$ 117,000/yr

Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from approximately $97,000 per year to $152,000 per year. Similarly, for the probabilistic model, the annual investment need increased from approximately $77,000 per year to $117,000 per year.

Prioritizing Risk

In order to ensure that the limited available funds address the ongoing replacement and rehabilitation needs of the wastewater assets in the most efficient and effective manner, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was used.

The wastewater assets were categorized into three risk levels: high risk, medium risk, and low risk. The red zone represents the assets that have both a high probability and high consequence of failure. In total, 4 assets were identified as high-risk assets with a total replacement cost of $180,000. All of these high-risk assets are lift station assets, including the two pumps, generator, and generator fuel tank. The assets in the green, low-risk zone, however, are not necessarily all in good condition, but rather they have a low probability or consequence of failure. The following figure shows the number of assets in each category, as well as the total replacement and rehabilitation cost for the assets in each category.

High Risk	Medium Risk	Low Risk
$ 180,000	$ 278,500	$ 64,312,424
4	24	3,490

Defining and Sustaining the Desired Level of Service

A defined agreed-upon level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Due to the nature of the asset, the level of service may either be Preferred or Minimum.

- **Preferred Level of Service:** Incorporates full replacement and rehabilitation of all assets in order to sustain the delivery of services; represents the highest budget required
- **Minimum Level of Service:** Involves replacement and rehabilitation of only critical assets; represents the lowest budget required to sustain the delivery of basic services

Projected Long-Range Needs	Level of Service	Average Annual Cost of Replacement & Rehabilitation
$ 97,000	Preferred	$ 97,000
	Minimum	$ 32,000

E6 | AMP Executive Summary - Pavement Management System

Physical Health Score C

Inventory	10.5 million sq ft
Total Asset Replacement Cost	$ 137 million

Condition Assessment

The condition of the roadway surface is represented as a Pavement Condition Index (PCI) score. PCI scores range between 0 (completely failed) and 100 (new). Factors that influence a PCI score include cracking, distortion, patching, cuts, rutting, and weathering.

In order to make the pavement condition rating align with the condition rating of other asset management systems (e.g., buildings, parks, water, wastewater), the PCI scores were translated into the standard asset management condition scores. The following table summarizes the conversion scale and presents the results of the pavement condition assessment.

Condition Score	PCI Score	Description	Percent of Total
1	90-100	Excellent	36%
2	80-89	Very Good	20%
3	65-79	Good	16%
4	50-64	Fair	18%
5	Below 50	Failed/Critical	10%

Future Needs

In order to estimate the long-term investment needs for the Pavement Management System, a 30-year life-cycle cost analysis was performed over the deterministic model, which calculates the replacement and rehabilitation needs of the Town's pavement over the 30-year planning horizon.

- **Deterministic Model:** Assets are rehabilitated and replaced exactly as outlined in the model

30-Year	Annual Average
Deterministic	$ 4.2 M/yr
Deterministic with 3% Inflation	$ 6.7 M/yr

Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from approximately $4.2 million per year to $6.7 million per year.

Prioritizing Risk

In order to ensure that the limited available funds address the ongoing replacement and rehabilitation needs of the pavement in the most efficient and effective manner, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was used.

The pavement assets were categorized into three risk levels: high risk, medium risk, and low risk. The red zone represents the assets that have both a high probability and high consequence of failure. In total, over $28 million worth of pavement was identified as high-risk. The Town is planning to reconstruct some of the high-risk pavement at Midway Road, Keller Springs Road, Airport Parkway, Quorum Drive, parts of Proton Drive, and parts of Marsh Lane. The pavement in the green, low-risk zone, however, are not necessarily all in good condition, but rather they have a low probability or consequence of failure. The following figure shows the amount of pavement in each category, as well as the total replacement and rehabilitation cost for the assets in each category.

High Risk	Medium Risk	Low Risk
$ 28,381,286	$ 19,824,498	$ 88,359,431
77	84	442

Defining and Sustaining the Desired Level of Service

A defined agreed-upon level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Due to the nature of the asset, the level of service may either be Preferred or Minimum.

- **Preferred Level of Service:** Incorporates full replacement and rehabilitation of all assets in order to sustain the delivery of services; represents the highest budget required
- **Minimum Level of Service:** Involves replacement and rehabilitation of only critical assets; represents the lowest budget required to sustain the delivery of basic services

Projected Long-Range Needs	Level of Service	Average Annual Cost of Replacement & Rehabilitation
$ 4,200,000	Preferred	$ 4,200,000
	Minimum	$ 3,000,000

E7 | AMP Executive Summary - Vehicular Bridge Management System

Physical Health Score A

Inventory	4 vehicular bridges
	387 assets
Total Asset Replacement Cost	$ 10.9 million

Condition Assessment

During the inventory verification and development process, each asset on the vehicular bridges was assessed for condition based on the following condition scale. The condition assessment results are shown below.

Condition Score	Description	Percent of Assets
1	Excellent	0.3%
2	Very Good	88.9%
3	Good/Fair	10.3%
4	Poor	0.3%
5	Failed/Critical	0.3%

Future Needs

In order to estimate the long-term investment needs for the Vehicular Bridge Management System, a 30-year life-cycle cost analysis was performed over two types of models: the deterministic model and the probabilistic model. These models calculate the replacement and rehabilitation needs of the vehicular bridge assets over the 30-year planning horizon.

- **Deterministic Model:** Assets are rehabilitated and replaced exactly as outlined in the model
- **Probabilistic Model:** Asset failures are smoothed to represent a more realistic expectation

30-Year	Annual Average
Deterministic	$ 118,000/yr
Probabilistic	$ 113,000/yr
Deterministic with 3% Inflation	$ 202,000/yr
Probabilistic with 3% Inflation	$ 170,000/yr

Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from $119,000 per year to $202,000 per year. Similarly, for the probabilistic model, the annual investment need increased from $113,000 per year to $170,000 per year.

Prioritizing Risk

In order to ensure that the limited available funds address the ongoing replacement and rehabilitation needs of the vehicular bridges in the most efficient and effective manner, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was used.

The bridge assets were categorized into three risk levels: high risk, medium risk, and low risk. The red zone represents the assets that have both a high probability and high consequence of failure. Currently, there is only 1 asset identified as a high-risk asset with a replacement cost of $12,000. The assets in the green, low-risk zone, however, are not necessarily all in good condition, but rather they have a low probability or consequence of failure. The following figure shows the number of assets in each category, as well as the total replacement and rehabilitation cost for the assets in each category.

High Risk	Medium Risk	Low Risk
$ 12,000	$ 454,775	$ 10,384,940
1	36	350

Defining and Sustaining the Desired Level of Service

A defined agreed-upon level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Due to the nature of the asset, the level of service may either be Preferred or Minimum. Because vehicular bridges provide a critical public service, the Minimum Level of Service is not a viable option.

- **Preferred Level of Service:** Incorporates full replacement and rehabilitation of all assets in order to sustain the delivery of services; represents the highest budget required
- **Minimum Level of Service:** Involves replacement and rehabilitation of only critical assets; represents the lowest budget required to sustain the delivery of basic services

Projected Long-Range Needs	Level of Service	Average Annual Cost of Replacement & Rehabilitation
$ 118,000	Preferred	$ 118,000

E8 | AMP Executive Summary - Curb Ramp Management System

Physical Health Score C

Inventory	1,957 curb ramps
Total Asset Replacement Cost	$ 6 million

Condition Assessment

During the inventory verification and development process, each curb ramp was assessed for condition based on the following condition scale. For curb ramps, it is important to understand that these assets last a very long time. The amount of force exerted by pedestrians will not harm the curb ramp nor accelerate the deterioration rate. Curb ramps typically fail from level of service (e.g., Americans with Disabilities Act (ADA) requirements) and not from mortality (i.e., structural condition). The condition assessment results are shown below.

Condition Score	Description	Percent of Assets
1	Excellent	4%
2	Very Good	22%
3	Good/Fair	55%
4	Poor	2%
5	Failed/Critical	17%

It was found during the inventory and condition assessment that there were locations where there should be a curb ramp but the location did not have one and where existing curb ramps needed to be replaced. Any non-existent curb ramp was automatically given a failing condition score 5, as the Town should immediately address these areas and install curb ramps where required.

Future Needs

In order to estimate the long-term investment needs for the Curb Ramp Management System, a 30-year life-cycle cost analysis was performed over the deterministic model, which calculates the replacement and rehabilitation needs of the Town's curb ramps over the 30-year planning horizon.

- **Deterministic Model:** Assets are rehabilitated and replaced exactly as outlined in the model

30-Year	Annual Average
Deterministic	$ 253,000/yr
Deterministic with 3% Inflation	$ 350,000/yr

Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from approximately $253,000 per year to $350,000 per year.

Prioritizing Risk

In order to ensure that the limited available funds address the ongoing replacement and rehabilitation needs of the curb ramps in the most efficient and effective manner, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was used.

The curb ramp assets were categorized into three risk levels: high risk, medium risk, and low risk. The red zone represents the assets that have both a high probability and high consequence of failure. In total, 270 curb ramps were identified as high-risk assets with a total replacement cost of approximately $860,000. These are the non-compliant ramps identified in the Town's ADA Transition Plan and poor condition ramps in residential areas that should be addressed in the near future. The curb ramps in the green, low-risk zone, however, are not necessarily all in good condition, but rather they have a low probability or consequence of failure. The following figure shows the number of curb ramps in each category, as well as the total replacement and rehabilitation cost for the assets in each category.

Defining and Sustaining the Desired Level of Service

A defined agreed-upon level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Due to the nature of the asset, the level of service may either be Preferred or Minimum.

- **Preferred Level of Service:** Incorporates full replacement and rehabilitation of all assets in order to sustain the delivery of services; represents the highest budget required
- **Minimum Level of Service:** Involves replacement and rehabilitation of only critical assets; represents the lowest budget required to sustain the delivery of basic services

Projected Long-Range Needs	Level of Service	Average Annual Cost of Replacement & Rehabilitation
$ 253,000	Preferred	$ 253,000
	Minimum	$ 156,000

E9 | AMP Executive Summary - Sidewalk Management System

Physical Health Score A

Inventory	119.8 miles
Total Asset Replacement Cost	$ 17 million

Condition Assessment

During the inventory verification and development process, each sidewalk was assessed for condition. For sidewalks, it is important to understand that these assets last a very long time. The amount of force exerted by pedestrians will not harm the sidewalk nor accelerate the deterioration rate. Sidewalks typically fail from level of service (e.g., trip hazards, Americans with Disabilities Act (ADA) requirements) and not from mortality (i.e., structural condition). Sidewalks require continuous maintenance (e.g., fix offsets, replace panels, fill separations).

With the level of service failures (e.g., cracks, offset, depression, uplift) driving the Sidewalk Management System costs, the condition assessment process focused on capturing the level of service needs. This process required identifying the location, significance, and cause of the maintenance needs. All sidewalk damage points were directly tied to the sidewalk segment at which the damage was found. The cost to address each maintenance need was then incorporated in the Sidewalk Management System replacement and rehabilitation needs. A total of 2,110 sidewalk damage points was identified with an estimated one-time cost of $835,000 to repair all damage.

Future Needs

In order to estimate the long-term investment needs for the Sidewalk Management System, a 30-year life-cycle cost analysis was performed over the deterministic model, which calculates the replacement and rehabilitation needs of the Town's sidewalks over the 30-year planning horizon.

- **Deterministic Model:** Assets are rehabilitated and replaced exactly as outlined in the model

30-Year	Annual Average
Deterministic	$ 230,985/yr
Deterministic with 3% Inflation	$ 320,616/yr

Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from approximately $231,000 per year to $321,000 per year.

Prioritizing Risk

In order to ensure that the limited available funds address the ongoing replacement and rehabilitation needs of the sidewalks in the most efficient and effective manner, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was used.

The sidewalk assets were categorized into three risk levels: high risk, medium risk, and low risk. The red zone represents the assets that have both a high probability and high consequence of failure. Currently, there are no sidewalk segments in the red zone. However, since sidewalks are usually rehabilitated and not replaced, all sidewalk segments with damage points should be considered high-risk assets. As such, the Town should plan to address the $835,000 worth of sidewalk damage costs in the near future. The sidewalks in the green, low-risk zone, however, are not necessarily all in good condition, but rather they have a low probability or consequence of failure. The following figure shows the number of assets in each category, as well as the total replacement and rehabilitation cost for the assets in each category.

Defining and Sustaining the Desired Level of Service

A defined agreed-upon level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Due to the nature of the asset, the level of service may either be Preferred or Minimum.

- **Preferred Level of Service:** Incorporates full replacement and rehabilitation of all assets in order to sustain the delivery of services; represents the highest budget required
- **Minimum Level of Service:** Involves replacement and rehabilitation of only critical assets; represents the lowest budget required to sustain the delivery of basic services

Projected Long-Range Needs	Level of Service	Average Annual Cost of Replacement & Rehabilitation
$ 231,000	Preferred	$ 231,000
	Minimum	$ 73,000

E10 | AMP Executive Summary - Traffic Signal Management System

Physical Health Score B

Inventory	38 intersections
	1,463 assets
Total Asset Replacement Cost	$ 9.7 million

Condition Assessment

During the inventory verification and development process, each intersection was visited to assess the overall condition of the traffic signal and its included components. Visual assessment, however, is often not a good representation of traffic signal asset condition. For example, a visual assessment of a controller cabinet or a detection system camera is not a sufficient evaluation of the condition of the asset's ability to function. In such cases, the assets were given an assumed condition score of 3 (good) given that the intersection had a functioning traffic signal system. In other cases, for instance for the communication system, the asset components were given a condition score of 5 (failing) with staff input and knowledge that the overarching system is obsolete and failing. The condition assessment results are shown below.

Condition Score	Description	Percent of Assets
1	Excellent	2%
2	Very Good	17%
3	Good/Fair	81%
4	Poor	0%
5	Failed/Critical	1%

As each intersection was visited, any immediate maintenance needs were noted. Some issues that were found for the traffic signal poles included paint needs, sanding needs, and replacement of pole bases. In total, the immediate maintenance needs came out to a total of $55,400.

Future Needs

In order to estimate the long-term investment needs for the Traffic Signal Management System, a 30-year life-cycle cost analysis was performed over two types of models: the deterministic model and the probabilistic model. These models calculate the replacement and rehabilitation needs of the traffic signal assets over the 30-year planning horizon.

- **Deterministic Model:** Assets are rehabilitated and replaced exactly as outlined in the model
- **Probabilistic Model:** Asset failures are smoothed to represent a more realistic expectation

30-Year	Annual Average
Deterministic	$ 513,000/yr
Probabilistic	$ 435,000/yr
Deterministic with 3% Inflation	$ 760,000/yr
Probabilistic with 3% Inflation	$ 677,000/yr

Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from approximately $513,000 per year to $760,000 per year. Similarly, for the probabilistic model, the annual investment need increased from $435,000 per year to $677,000 per year.

Prioritizing Risk

In order to ensure that the limited available funds address the ongoing replacement and rehabilitation needs of the traffic signal assets in the most efficient and effective manner, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was used.

The traffic signal assets were categorized into three risk levels: high risk, medium risk, and low risk. The red zone represents the assets that have both a high probability and high consequence of failure. In total, there are 11 assets identified as high-risk assets with a total replacement cost of $530,000. These high-risk assets include the traffic signal poles at the intersection of Belt Line Rd and Addison Rd/Inwood Rd, the wiring at the intersection of Midway Rd and Boyington Dr/ Dooley Rd, and the overarching traffic signal communication system and all of its components. The assets in the green, low-risk zone, however, are not necessarily all in good condition, but rather they have a low probability or consequence of failure. The following figure shows the number of assets in each category, as well as the total replacement and rehabilitation cost for the assets in each category.

Defining and Sustaining the Desired Level of Service

A defined agreed-upon level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Due to the nature of the asset, the level of service may either be Preferred or Minimum.

- **Preferred Level of Service:** Incorporates full replacement and rehabilitation of all assets in order to sustain the delivery of services; represents the highest budget required
- **Minimum Level of Service:** Involves replacement and rehabilitation of only critical assets; represents the lowest budget required to sustain the delivery of basic services

Projected Long-Range Needs	Level of Service	Average Annual Cost of Replacement & Rehabilitation
$ 517,000	Preferred	$ 513,000
	Minimum	$ 414,000

E11 | AMP Executive Summary - Traffic Sign Management System

Physical Health Score B

Inventory	1,990 traffic signs
	1,288 poles
	Pavement markings
Total Asset Replacement Cost	$ 995,337

Condition Assessment

During the inventory verification and development process, each traffic sign, pole, and pavement marking was assessed for condition based on the following condition scale. The condition assessment results are shown below.

Condition Score	Description	Percent of Assets
1	Excellent	5%
2	Very Good	20%
3	Good/Fair	68%
4	Poor	7%
5	Failed/Critical	<1%

Future Needs

In order to estimate the long-term investment needs for the Traffic Sign Management System, a 30-year life-cycle cost analysis was performed over two types of models: the deterministic model and the probabilistic model. These models calculate the replacement and rehabilitation needs of the traffic sign assets over the 30-year planning horizon.

- **Deterministic Model:** Assets are rehabilitated and replaced exactly as outlined in the model
- **Probabilistic Model:** Asset failures are smoothed to represent a more realistic expectation

30-Year	Annual Average
Deterministic	$ 224,000/yr
Probabilistic	$ 220,000/yr
Deterministic with 3% Inflation	$ 352,000/yr
Probabilistic with 3% Inflation	$ 347,000/yr

Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from approximately $224,000 per year to $352,000 per year. Similarly, for the probabilistic model, the annual investment need to be increased from $220,000 per year to $347,000 per year.

Prioritizing Risk

In order to ensure that the limited available funds address the ongoing replacement and rehabilitation needs of the traffic sign assets in the most efficient and effective manner, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was used.

The traffic sign assets were categorized into three risk levels: high risk, medium risk, and low risk. The red zone represents the assets that have both a high probability and high consequence of failure. In total, 122 assets were identified as high-risk assets with a total replacement cost of approximately $36,000. The assets in the green, low-risk zone, however, are not necessarily all in good condition, but rather they have a low probability or consequence of failure. The following figure shows the number of assets in each category, as well as the total replacement and rehabilitation cost for the assets in each category.

Defining and Sustaining the Desired Level of Service

A defined agreed-upon level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Due to the nature of the asset, the level of service may either be Preferred or Minimum. Due to the signs' direct impact on public safety and level of service, the Minimum Level of Service is not an viable option.

- **Preferred Level of Service:** Incorporates full replacement and rehabilitation of all assets in order to sustain the delivery of services; represents the highest budget required
- **Minimum Level of Service:** Involves replacement and rehabilitation of only critical assets; represents the lowest budget required to sustain the delivery of basic services

Projected Long-Range Needs	Level of Service	Average Annual Cost of Replacement & Rehabilitation
$ 224,000	Preferred	$ 224,000

E12 | AMP Executive Summary - Street Light Management System

Physical Health Score A

Inventory	385 street lights
Total Asset Replacement Cost	$ 2.4 million

Condition Assessment

During the inventory verification and development process, each street light was assessed for condition based on the following condition scale. The condition assessment results are shown below.

Condition Score	Description	Percent of Assets
1	Excellent	13%
2	Very Good	9%
3	Good/Fair	78%
4	Poor	0%
5	Failed/Critical	1%

Future Needs

In order to estimate the long-term investment needs for the Street Light Management System, a 30-year life-cycle cost analysis was performed over two types of models: the deterministic model and the probabilistic model. These models calculate the replacement and rehabilitation needs of the street lights over the 30-year planning horizon.

- **Deterministic Model:** Assets are rehabilitated and replaced exactly as outlined in the model
- **Probabilistic Model:** Asset failures are smoothed to represent a more realistic expectation

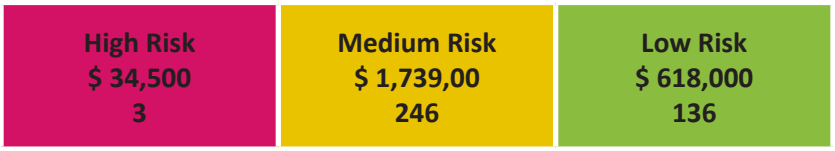
30-Year	Annual Average
Deterministic	$ 74,000/yr
Probabilistic	$ 70,000/yr
Deterministic with 3% Inflation	$ 96,000/yr
Probabilistic with 3% Inflation	$ 93,000/yr

Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from approximately $74,000 per year to $96,000 per year. Similarly, for the probabilistic model, the annual investment need increased from approximately $70,000 per year to $93,000 per year.

Prioritizing Risk

In order to ensure that the limited available funds address the ongoing replacement and rehabilitation needs of the street lights in the most efficient and effective manner, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was used.

The street lights were categorized into three risk levels: high risk, medium risk, and low risk. The red zone represents the assets that have both a high probability and high consequence of failure. Currently, there are no assets identified as high-risk in the Street Light Management System. The assets in the green, low-risk zone, however, are not necessarily all in good condition, but rather they have a low probability or consequence of failure. The following figure shows the number of assets in each category, as well as the total replacement and rehabilitation cost for the assets in each category.



Defining and Sustaining the Desired Level of Service

A defined agreed-upon level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Due to the nature of the asset, the level of service may either be Preferred or Minimum.

- **Preferred Level of Service:** Incorporates full replacement and rehabilitation of all assets in order to sustain the delivery of services; represents the highest budget required
- **Minimum Level of Service:** Involves replacement and rehabilitation of only critical assets; represents the lowest budget required to sustain the delivery of basic services

Projected Long-Range Needs	Level of Service	Average Annual Cost of Replacement & Rehabilitation
$ 74,000	Preferred	$ 74,000
	Minimum	$ 64,000

E13 | AMP Executive Summary - Fleet Management System

Physical Health Score B

Inventory	191 fleet assets
Total Asset Replacement Cost	$ 13.6 million

The Town owns and manages a total of 191 fleet assets, including vehicles and equipment, for 9 Town departments. The replacement cost for each vehicle or piece of equipment was based on the purchase values obtained from the Town's financial records. Where the initial purchase cost was not recent, it was escalated to reflect current year replacement cost in 2018 dollars. A 2% escalation factor (average inflation rate for the last 20 years) was utilized. Where a recent (i.e., 2017, 2018) vehicle or equipment cost is available, the replacement cost of the assets was assumed to be similar.

Condition Assessment

For the Fleet Management System, age was the major factor used to determine the current state of the vehicle or piece of equipment. This reflects the Town's current replacement practice (e.g., police patrol vehicles are replaced every 2 years). Purchase dates from the Town's financial system were compared to the estimated replacement cycles of the fleet assets. The following figure summarizes the overall age-based condition profile for the Fleet Management System. Approximately 77% of the assets are relatively new and are assumed to be in good to excellent condition. It is estimated that approximately 23% of the assets are in nearing the end of their useful lives. These assets mostly include equipment (e.g., air compressor), trucks, passenger vehicles, and police motorcycles.

Future Needs

In order to estimate the long-term investment needs for the Fleet Management System, a 30-year life-cycle cost analysis was performed over two types of models: the deterministic model and the probabilistic model. These models calculate the replacement and rehabilitation needs of the fleet assets over the 30-year planning horizon.

- **Deterministic Model:** Assets are rehabilitated and replaced exactly as outlined in the model
- **Probabilistic Model:** Asset failures are smoothed to represent a more realistic expectation

30-Year	Annual Average
Deterministic	$ 1.2 M/yr
Probabilistic	$ 1.1 M/yr
Deterministic with 3% Inflation	$ 2.0 M/yr
Probabilistic with 3% Inflation	$ 1.8 M/yr

Expecting the cost will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from $1.2 million per year to $2.0 million per year. Similarly, for the probabilistic model, the annual investment need increased from $1.1 million per year to $1.8 million per year.

Prioritizing Risk

In order to ensure that the limited available funds address the ongoing replacement and rehabilitation needs of the fleet assets in the most efficient and effective manner, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was used.

The fleet assets were categorized into three risk levels: high risk, medium risk, and low risk. The red zone represents the assets that have both a high probability and high consequence of failure. In total, 2 assets were identified as high-risk assets with a total replacement cost of approximately $53,000. These high-risk assets are police motorcycles that are existing past their useful lives. The assets in the green, low-risk zone, however, are not necessarily all in good condition, but rather they have a low probability or consequence of failure. The following figure shows the number of assets in each category, as well as the total replacement and rehabilitation cost for the assets in each category.

High Risk	Medium Risk	Low Risk
$ 53,085	$ 218,436	$ 13,365,288
2	7	182

Defining and Sustaining the Desired Level of Service

A defined agreed-upon level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Due to the nature of the asset, the level of service may either be Preferred or Minimum.

- **Preferred Level of Service:** Incorporates full replacement and rehabilitation of all assets in order to sustain the delivery of services; represents the highest budget required
- **Minimum Level of Service:** Involves replacement and rehabilitation of only critical assets; represents the lowest budget required to sustain the delivery of basic services

Projected Long-Range Needs	Level of Service	Average Annual Cost of Replacement & Rehabilitation
$ 1,800,000	Preferred	$ 1,200,000
	Minimum	$ 935,000

Physical Health Score B

Inventory	Facilities	46 facilities
		8,624 assets
	Site/Airfield	1,047 assets
	Pavement	6 million sq ft
Total Asset Replacement Cost	$ 232 million	

Condition Assessment

Airport Facilities

The most commonly used rating tool in the building industry and the tool used for the Airport's facilities is the Facility Condition Index (FCI). The higher the FCI percentage, the poorer the relative facility condition. The following table presents the FCI score for each Airport facility.

Facility	FCI Score	FCI Rating
A-7	9.8%	Good
A-9	0.9%	Good
Automated Weather Observing System (AWOS)	0.0%	Good
Electrical Vault	1.6%	Good
R-1A	0.1%	Good
T-3	6.7%	Good
U-2	1.5%	Good
U-4	0.0%	Good
U-9	1.2%	Good
B-1 - T Hangar	0.0%	Good
B-2 - T Hangar	0.0%	Good
B-3 - T Hangar	0.0%	Good
Fuel Farm	3.9%	Good
North Pilot Lounge	0.8%	Good
R-3	4.5%	Good
S-3	0.4%	Good
S-1	0.0%	Good
T-14 - T Hangar	0.9%	Good
T-15	8.0%	Good
T-5	4.3%	Good
U-11	0.1%	Good
U-13	1.4%	Good
U-15	1.3%	Good

Facility	FCI Score	FCI Rating
U-2B	3.9%	Good
U-3	3.9%	Good
U-5	3.3%	Good
U-7	5.8%	Good
Wiley Post	6.3%	Good
Wiley Post Annex	0.0%	Good
S-2	10.9%	Fair
S-4 - T Hangar	16.0%	Fair
S-5 - T Hangar	15.5%	Fair
A-8	19.1%	Fair
R-3 - T Hangar	28.3%	Fair
R-5 - T Hangar	24.8%	Fair
S-7 - T Hangar	15.6%	Fair
T-18 - T Hangar	15.2%	Fair
T-1	13.3%	Fair
T-7	11.0%	Fair
V-12	13.1%	Fair
S-6 - Patio Hangar	15.7%	Fair
T-16 - Patio Hangar	16.0%	Fair
R-1 - Patio Hangar	47.9%	Poor
T-1	63.0%	Poor
T-13	66.6%	Poor
T-9	58.7%	Poor

Site/Airfield Assets

For the airfield assets, such as the runway lighting, the asset conditions were not visited and assessed due to safety and regulatory issues with being on the airfield. However, given that all airfield assets should always be in working condition, all airfield assets were assigned an assumed condition of 3 (good condition). For the site assets, such as gates and fences, each asset in the register was visited and assessed for overall condition. About 97% of the site assets were in good to very good condition.

Pavement

The condition of the pavement surface is represented as a Pavement Condition Index (PCI) score. PCI scores range between 0 (completely failed) and 100 (new). Factors that influence a PCI score include cracking, distortion, patching, cuts, rutting, and weathering.

In order to make the pavement condition rating align with the condition rating of the other asset management systems (e.g., buildings, parks, water, wastewater), the PCI scores were translated into standard asset management condition scores. The following table summarizes the conversion scale and presents the results of the pavement condition assessment.

Condition Score	PCI Score	Description	Percent of Assets
1	90-100	Excellent	5%
2	80-89	Very Good	55%
3	65-79	Good/Fair	32%
4	50-64	Poor	5%
5	Below 50	Failed/Critical	4%

Future Needs

In order to estimate the long-term investment needs for the Airport Management System, a 30-year life-cycle cost analysis was performed over two types of models: the deterministic model and the probabilistic model. These models calculate the replacement and rehabilitation needs of the Airport assets over the 30-year planning horizon.

- **Deterministic Model:** Assets are rehabilitated and replaced exactly as outlined in the model
- **Probabilistic Model:** Asset failures are smoothed to represent a more realistic expectation

30-Year	Annual Average
Deterministic	$ 5.2 M/yr
Probabilistic	$ 4.7 M/yr
Deterministic with 3% Inflation	$ 8.5 M/yr
Probabilistic with 3% Inflation	$ 7.7 M/yr

Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from approximately $5.2 million per year to $8.5 million per year. Similarly, for the probabilistic model, the annual investment need to be increased from $4.7 million per year to $7.7 million per year.

Prioritizing Risk

In order to ensure that the limited available funds address the ongoing replacement and rehabilitation needs of the Airport assets in the most efficient and effective manner, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was used.

The Airport assets were categorized into three risk levels: high risk, medium risk, and low risk. The red zone represents the assets that have both a high probability and high consequence of failure. In total, 133 assets were identified as high-risk assets with a total replacement cost of approximately $385,000. The assets in the green, low-risk zone, however, are not necessarily all in good condition, but rather they have a low probability or consequence of failure. The following figure shows the number of assets in each category, as well as the total replacement and rehabilitation cost for the assets in each category.

Defining and Sustaining the Desired Level of Service

A defined agreed-upon level of service allows the Airport to evaluate the impact of budget with respect to the projected work backlog. Due to the nature of the asset, the level of service may either be Preferred or Minimum.

- **Preferred Level of Service:** Incorporates full replacement and rehabilitation of all assets in order to sustain the delivery of services; represents the highest budget required
- **Minimum Level of Service:** Involves replacement and rehabilitation of only critical assets; represents the lowest budget required to sustain the delivery of basic services

Projected Long-Range Needs	Level of Service	Average Annual Cost of Replacement & Rehabilitation
$ 5,220,000	Preferred	$ 5,220,000
	Minimum	$ 1,000,000

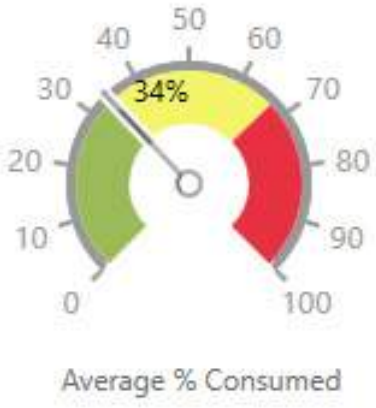
Physical Health Score A

Inventory	78 miles of pipe
	4 miles of open channels
	5,855 assets
Total Asset Replacement Cost	$ 244 million

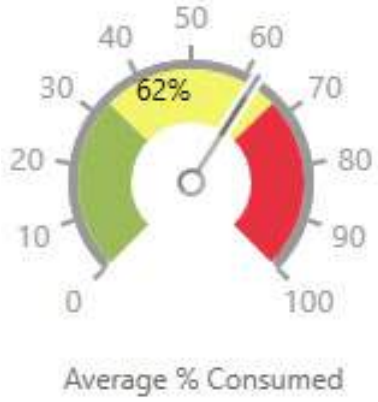
Condition Assessment

Where the asset was visible, a general condition assessment took place through visual inspection. In some cases, however, assets are not visible or visual assessment is not a good representation of the asset's condition. In such cases, the anticipated condition score was estimated based on the age of the asset. Age-based calculation required evaluation of the asset age, expected useful life, and anticipated decay curve. Compared to the water and wastewater pipes, the storm water pipes are, on average, about 20 to 30 years younger, which results in a better overall condition. The following figures show the storm water lines and open channels by average consumption based on replacement cost. Consumption is a measure of an asset's estimated age or condition relative to its expected useful life. The lower the average percent consumed, the longer the remaining useful life of the asset.

Storm Water Lines



Open Channels (Open Drains)



Future Needs

In order to estimate the long-term investment needs for the Storm Water Management System, a 30-year life-cycle cost analysis was performed over two types of models: the deterministic model and the probabilistic model. These models calculate the replacement and rehabilitation needs of the wastewater assets over the 30-year planning horizon.

- **Deterministic Model:** Assets are rehabilitated and replaced exactly as outlined in the model
- **Probabilistic Model:** Asset failures are smoothed to represent a more realistic expectation

30-Year	Annual Average
Deterministic	$ 155,000/yr
Probabilistic	$ 120,000/yr
Deterministic with 3% Inflation	$ 270,000/yr
Probabilistic with 3% Inflation	$ 198,000/yr

Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from approximately $155,000 per year to $270,000 per year. Similarly, for the probabilistic model, the annual investment need increased from approximately $120,000 per year to $198,000 per year.

Prioritizing Risk

In order to ensure that the limited available funds address the ongoing replacement and rehabilitation needs of the storm water assets in the most efficient and effective manner, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was used.

The storm water assets were categorized into three risk levels: high risk, medium risk, and low risk. The red zone represents the assets that have both a high probability and high consequence of failure. In total, 10 assets were identified as high-risk assets with a total replacement cost of about $255,000. These high-risk assets include discharge points (outfalls) that are past their useful lives, inlets that are in poor condition, and open channels that are in poor condition and require maintenance. The assets in the green, low-risk zone, however, are not necessarily all in good condition, but rather they have a low probability or consequence of failure. The following figure shows the number of assets in each category, as well as the total replacement and rehabilitation cost for the assets in each category.

Defining and Sustaining the Desired Level of Service

A defined agreed-upon level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Due to the nature of the asset, the level of service may either be Preferred or Minimum.

- **Preferred Level of Service:** Incorporates full replacement and rehabilitation of all assets in order to sustain the delivery of services; represents the highest budget required
- **Minimum Level of Service:** Involves replacement and rehabilitation of only critical assets; represents the lowest budget required to sustain the delivery of basic services

Projected Long-Range Needs	Level of Service	Average Annual Cost of Replacement & Rehabilitation
$ 155,000	Preferred	$ 155,000
	Minimum	$ 58,000

1 | Building Management System

Physical Health Score C

What Does the Town Own and Manage?

The Town owns and manages 17 buildings in the Building Management System. Some Town buildings provide essential city services (e.g., police station, fire stations, Town Hall), while other buildings provide spaces for community enrichment (e.g., Theatre Centre, Athletic Center). The table below summarizes the Town-owned buildings and their general functions.

Table 1-1 Town-Owned Buildings

Facility	Year Built	Facility Type	Facility Function
Town Hall 	1939	Essential Services	Responsible for management and administrative oversight for the Town of Addison. Houses City Council meetings.
Police Station 	1984	Essential Services	Police headquarters
Fire Station 1 	1984	Essential Services	Provides fire protection services

1 | Building Management System

Facility	Year Built	Facility Type	Facility Function
Fire Station 2 	1982	Essential Services	Provides fire protection services
Service Center 	1980	Essential Services	Responsible for the Town's infrastructure maintenance
Athletic Club 	1987	Community Enrichment	Provides recreational, health, fitness, and athletic programs for residents
Financial & Strategic Services Department 	1983	Essential Services	Responsible for critical operations, including financial reporting, billing, collections, procurement, risk management, purchasing, and budget management for the Town of Addison
Conference Centre 	1991	Community Enrichment	Provides a variety of meeting and event spaces for residents and businesses

Facility	Year Built	Facility Type	Facility Function
Theatre Centre 	1991	Community Enrichment	Provides spaces for a variety of performances and productions
Special Events Pavilion 	2003	Community Enrichment	Provides rental space for special events
Stone Cottage 	1939	Historical Preservation	Preserves historical significance. Provides meeting space
Celestial Pump Station Building 	1987	Essential Services	Water pump station
Celestial Pump Station Generator Building 	1987	Essential Services	Water pump station generator protection

Facility	Year Built	Facility Type	Facility Function
Celestial Pump Station Sampling Building 	1987	Essential Services	Water pump station sampling equipment
Water Tower Learning Center 	2014	Community Enrichment	Provides additional space for meetings
Kellway Lift Station Building 	1997	Essential Services	Sewer water lift station
Surveyor Pump Station Building 	1979	Essential Services	Water pump station

The water facilities (i.e., Celestial Pump Station, Surveyor Pump Station, Kellway Lift Station, Water Tower Learning Center) refer to the building only. The pump/lift station assets (e.g., pumps, motors, generators, motor control center) are included in the Water and Wastewater Management Systems.

The following map shows the locations of the Town-owned buildings.

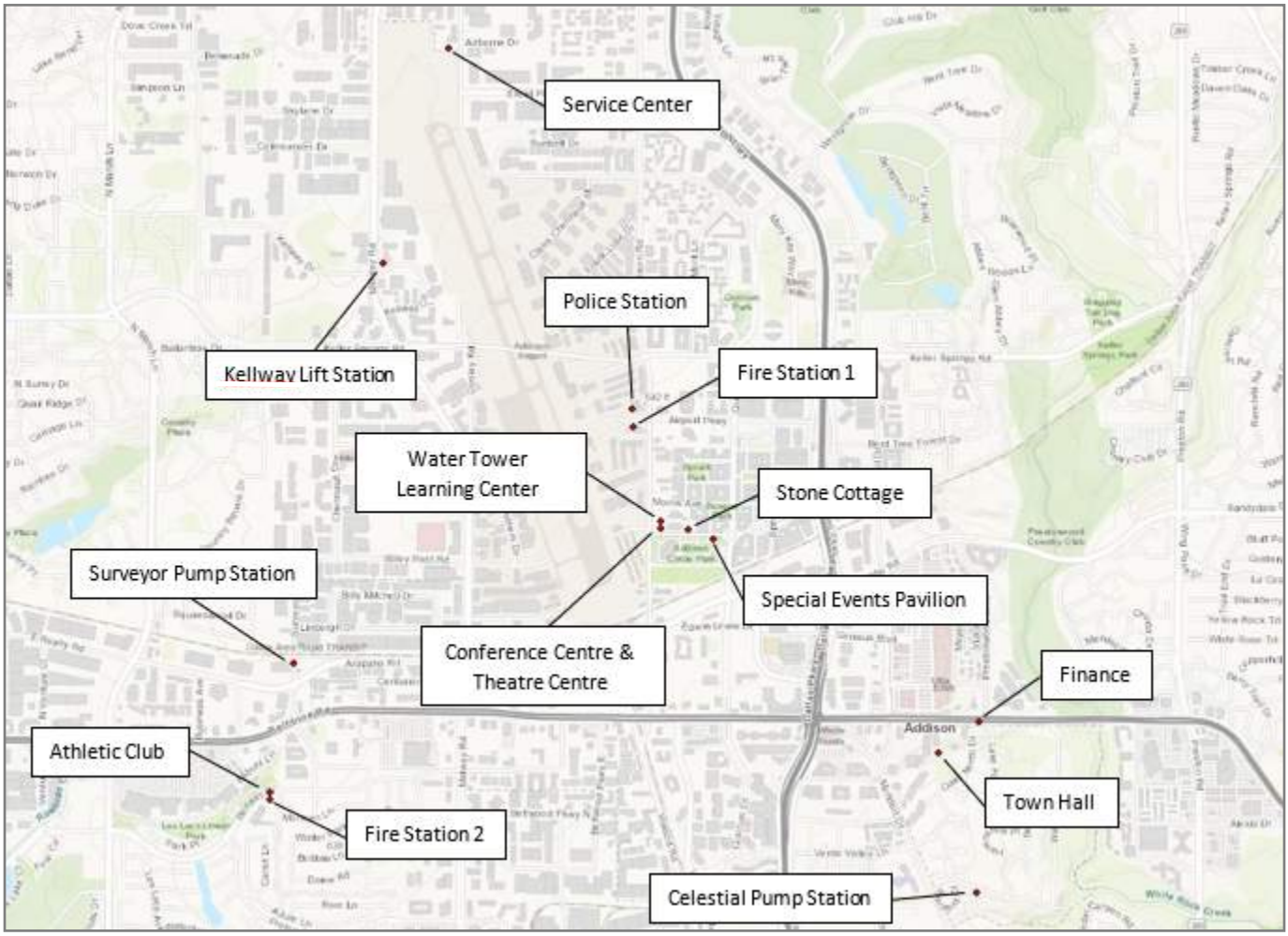


Figure 1-1 Locations of Town-Owned Buildings

What is an Asset?

An asset in the Building Management System is defined as something with value that is owned and managed by the Town. A full list of building asset classes is shown in the table below.

Table 1-2 Building Asset Classes

Asset Classes			
Actuator	Cupola	Irrigation Controller	Retaining Wall
ADA Ramp	Decorative Rock	Jacuzzi	Roof
Add-On Acoustical Wall	Dedication Plaque	Ladder	Roof Covering
Appliances	Door	Landscaping Border	Roof Plate
Art Installation	Drainage	Lighted Concrete Cube	Rotating Wall Panel
Audio System	Drinking Fountain	Lighting	Safety & Security
Awning	Electrical	Monument	Shade Structure
Basketball Hoop	Elevator	Motorized Centerline Curtain	Signage
Bollard	Fencing	Parking Lot	Spa Filter
Ceiling	Fireplace	Patio	Stairways
Check-In Desk	Fixtures	Pavement	Steel Column
Chlorine System	Floor	Pedestrian Bridge	Structure
Concrete Base	Fuel Pump	Perimeter Wall	Wall
Concrete Column	Gate (Motorized)	Plexiglass	Window
Concrete Entry Desk	Gate (Non-Motorized)	Plumbing	Wood Column
Concrete Slab - Decorative	Handrails	Pool	
Concrete Water Feature	HVAC	Pool Filter	
Crown Molding	Interior Partition System	Ramp	

What is the Replacement Value of the Town's Assets?

In total, there are over 7,000 assets in the Building Management System. The sum of all replacement costs for each Building Management System asset is estimated, in 2018 dollars, to be approximately $34 million.

The three locations with the highest replacement costs are the Athletic Club with 1,242 assets totaling to approximately $7.6 million, the Service Center with 1,122 assets at approximately $5.1 million, and the Police Station with 1,181 assets at approximately $4.3 million.

The table below summarizes the total asset replacement cost of each building.

Table 1-3 Summary of Building Asset Replacement Costs

Building Name	Number of Assets	Replacement Cost
Town Hall	484	$ 1,545,368
Police Station	1,181	$ 4,433,273
Fire Station 1	541	$ 3,116,430
Fire Station 2	271	$ 1,267,589
Service Center	1,122	$ 5,195,552
Athletic Club	1,242	$ 7,571,843
Financial & Strategic Services Department	383	$ 1,137,339
Conference Centre	525	$ 2,471,763
Theatre Centre	818	$ 3,688,456
Special Events Pavilion	243	$ 1,098,936
Stone Cottage	96	$ 267,666
Celestial Pump Station Building*	154	$ 1,114,631
Celestial Pump Station Generator Building*	32	$ 112,110
Celestial Pump Station Sampling Building*	9	$ 24,252
Water Tower Learning Center*	110	$ 691,051
Kellway Lift Station Building*	65	$ 367,074
Surveyor Pump Station Building*	61	$ 440,722
Total	**7,335**	**$ 34,544,055**

*The water facilities (i.e., Celestial Pump Station, Surveyor Pump Station, Kellway Lift Station, Water Tower Learning Center) refer to the building only. The pump/lift station assets (e.g., pumps, motors, generators, motor control center) are included in the Water and Wastewater Management Systems.

What is the Condition of the Town's Assets?

During the inventory verification and development process, each building in the register was visited and assessed. The asset condition was assessed during these visits, and assets requiring immediate replacement, rehabilitation, and maintenance needs were noted and highlighted.

Some issues found during the condition assessment process are illustrated below. These images depict failed or failing (condition 5) assets.

Figure 1-2 Failed/Failing (Condition 5) Building Assets

The table below summarizes the total maintenance need costs found during the inspection process at each building.

Table 1-4 Building Management System Additional Maintenance Needs

Site	Maintenance Cost
Conference Centre	$ 7,000
Financial & Strategic Services Department	$ 64,600
Fire Station 1	$ 55,500
Fire Station 2	$ 11,500
Police Station	$ 439,000
Service Center	$ 172,950
Town Hall	$ 102,500
Athletic Club	$ 59,500
Special Events Pavilion	$ 2,500
Stone Cottage	$ 4,000
Theatre Centre	$ 751,000
Total	**$ 1,670,050**

The most commonly used rating tool in the building industry and the tool used for the Town's buildings is the Facility Condition Index (FCI). This index score is typically denoted as a percentage representing the physical condition of a facility in terms of value. FCI is calculated using the following formula:

$$FCI = \frac{Unweighted\ Repair\ Costs}{Replacement\ Value}$$

The unweighted repair costs include any costs for needed repairs and deferred maintenance. The replacement value is the estimated cost to replace the assets in the entire facility. The higher the FCI percentage, the poorer the relative facility condition. In the asset management plan, the sum of replacement costs was used as the building's replacement value. It should be noted that the methodology may present a more conservative representation of the FCI as the sum of asset replacement costs are typically less than the overall market value of the building.

Table 1-5 displays the facility condition description corresponding to each FCI range. The table shows the industry standard Facility Condition levels. However, past experience has shown that the industry standard levels can be unrealistic representations of the buildings. An adjusted FCI rating was used instead to more accurately capture the condition of the buildings in the Town. The adjusted value provides a more reasonable view of the building's overall conditional health.

Table 1-5 FCI Rating Scores

Facility Condition	Standard FCI	Adjusted FCI
Good	0 - 4.9%	0 – 9.9%
Fair	5 - 9.9%	10 – 29.9%
Poor	10% and Above	30% and Above

The Town recently completed an Americans with Disabilities Act (ADA) Self-Evaluation and Transition Plan (2018). The ADA deficiencies that were noted in the assessment were incorporated in the analysis for each of the buildings and the costs associated thereof are incorporated into the FCI calculation. The following table presents the FCI score for each building.

Table 1-6 FCI by Building

Building Name	FCI Score	FCI Rating
Kellway Lift Station Building (Building Only)	0.0%	Good
Surveyor Pump Station Building (Building Only)	0.0%	Good
Celestial Pump Station Generator Building (Building Only)	0.0%	Good
Celestial Pump Station Sampling Building (Building Only)	0.0%	Good
Water Tower Learning Center (Building Only)	0.0%	Good
Celestial Pump Station Building (Building Only)	0.9%	Good
Athletic Club	1.7%	Good
Service Center	10.7%	Fair
Fire Station 1	11.2%	Fair
Fire Station 2	11.3%	Fair
Conference Centre	17.2%	Fair
Theatre Centre	20.7%	Fair
Police Station	23.6%	Fair
Stone Cottage	26.7%	Fair
Special Events Pavilion	30.8%	Poor
Financial & Strategic Services Department	38.6%	Poor
Town Hall	43.4%	Poor

What Does the Town Need to Sustain the Delivery of Services?

In order to estimate the long-term investment needs for the Building Management System, a life cycle cost analysis was performed. Each asset class was assigned a management strategy that includes the rehabilitation and replacement activities to best characterize the life cycle investment needs for the asset. Below is a sample list of management strategies used to calculate the life cycle costs of the building assets.

Table 1-7 Examples of Building Management Strategies

Management Strategy ID	Useful Life	Rehabilitation	Frequency	Rehabilitation	Frequency
ADA Ramp*	50	Minor Repairs	5		
Ceiling-Acoustical/T-Bar	30	Repair (2% of Ceiling)	10		
Drinking Fountain	50	Minor Repair	5		
Flooring-Ceramic Tile	75	Repair (2% of Floors)	15		
Interior Walls-Drywall-Painted	50	Paint	10		
Roofing-Metal Standing Seam	40	Minor Replacement (2% of Roof)	20	Repair	5

*May reach regulatory obsolescence before physical obsolescence

The following figure presents the 30-year replacement and rehabilitation needs for the Building Management System. Utilizing a deterministic model, the average annual replacement and rehabilitation investment needs for the building assets is approximately $1.4 million.

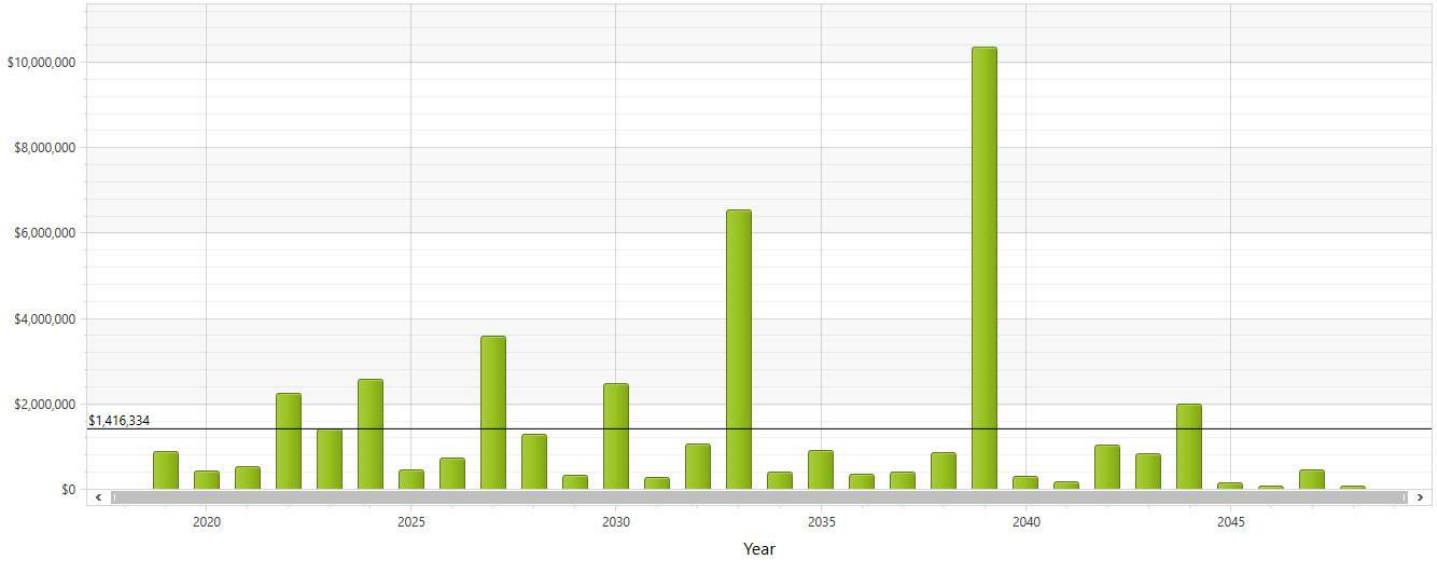


Figure 1-3 30-Year Building Replacement and Rehabilitation Profile (Deterministic Model)

The 30-year life cycle cost analysis was repeated utilizing a probabilistic model, in which asset failures were smoothed to represent a more realistic expectation. The probabilistic model predicts the annual replacement and rehabilitation needs to be approximately $1.2 million.

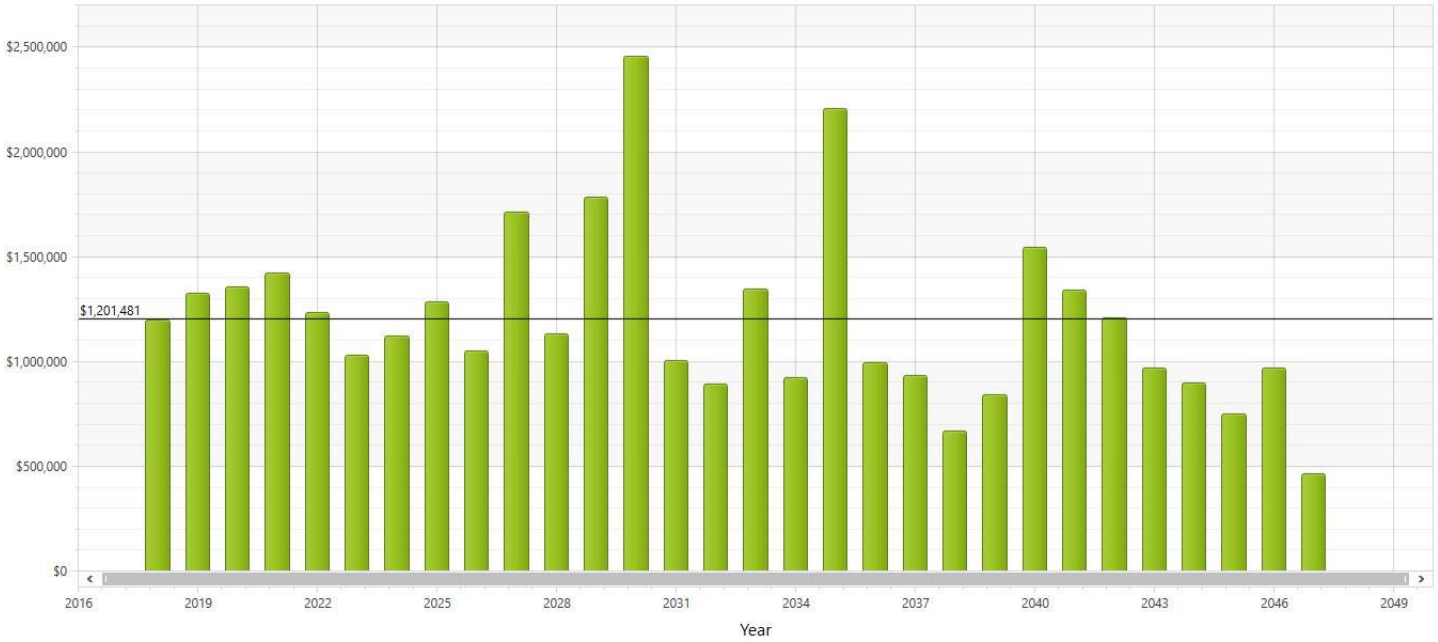


Figure 1-4 30-Year Building Asset Replacement and Rehabilitation Profile (Probabilistic Model)

The costs in both the deterministic and probabilistic analyses are in 2018 dollars. Because the cost of construction is expected to increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from $1.4 million per year to $2.2 million per year. Similarly, for the probabilistic model, the annual investment need increased from $1.2 million per year to $1.9 million per year. The results of these analyses are presented in the table below.

Table 1-8 Building Management System 30-Year Summary

30-Year	Annual Average
Deterministic	$ 1.4 M/yr
Probabilistic	$ 1.2 M/yr
Deterministic with 3% Inflation	$ 2.2 M/yr
Probabilistic with 3% Inflation	$ 1.9 M/yr

How Should the Town Prioritize?

In order to prioritize the limited budget available to address the ongoing replacement and rehabilitation needs of the building assets, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was utilized. As illustrated in the figure below, a multi-tier methodology was deployed.

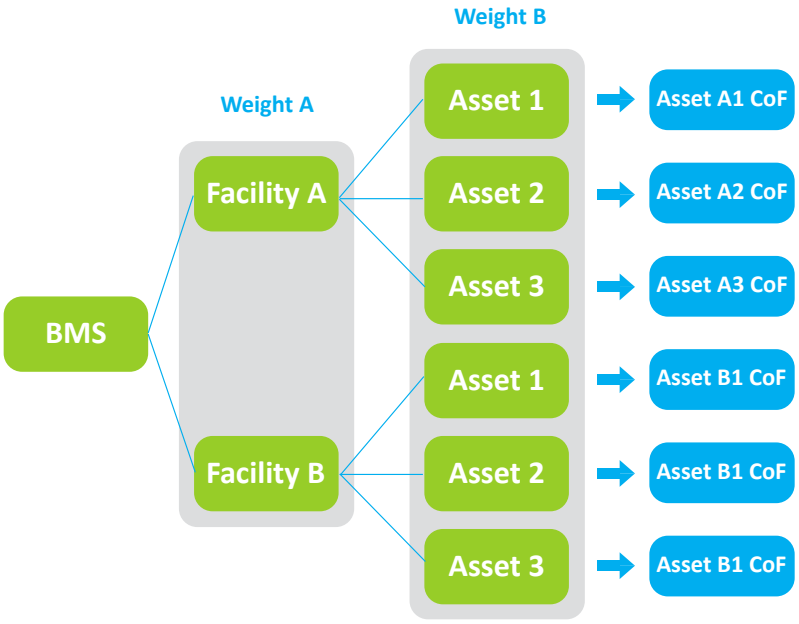


Figure 1-5 Multi-Tier Logic CoF Rating Methodology

In the first tier, criticality was assessed at the facility level based on the importance of the facility to the Town. The assessment considered the type of services provided (e.g., essential services vs. community enrichment), utilization of the facility, and impact to the citizens in case of facility shut down. In the second tier, asset level criticality was evaluated. How critical is the asset with respect to disrupting the overall service? Will the asset failure prevent the facility operations? The larger the impact of the asset failure, the higher the criticality.

The first-tier criticality rating for the Town facilities is summarized in the following table. As expected, emergency response facilities (i.e., fire stations, Police Station) are high criticality facilities. In addition, facilities that benefit the citizens (e.g., Athletic Club) and facilities that are essential to the management of the Town's everyday functionality and efficiency (e.g. Town Hall, Service Center) were identified as highly critical.

Table 1-9 Facility Criticality Categories

Criticality Category	Facility
High	Town Hall Police Station Fire Station 1 Fire Station 2 Service Center Athletic Club
Medium	Financial & Strategic Services Department Conference Centre Theatre Centre Celestial Pump Station Building*
Low	Special Events Pavilion Stone Cottage Celestial Pump Station Generator Building* Celestial Pump Station Sampling Building* Water Tower Learning Center* Kellway Lift Station Building* Surveyor Pump Station Building*

*Building only. Assets that can lead to disruption of water distribution and wastewater collection services are incorporated in their respective asset management systems.

The second-tier criticality at the asset level is presented in the following table. These criticality scores were based on the importance of the asset class to the overall function of the building. For example, an HVAC system was considered critical, while bike racks and trash bins at building sites were considered non-essential.

Table 1-10 Examples of Building Asset-Level Criticality

Criticality - 5	Criticality - 4	Criticality - 3	Criticality - 2	Criticality - 1
Critical				Non-Essential
• ADA Ramp • Breaker Panel • Elevator • Roofing • Stairways	• Door - Exterior • Water Heater • Lighting • Signage - Informational	• Gate • Flooring • Toilet • Interior Wall Finish	• Drinking Fountain • Patio • Ceiling Fan • Dedication Plaque • Pavement - Gravel	• Artwork • Hand Dryer • Fireplace • Bike Rack • Trash Bin

1 | Building Management System

The following figure shows the resulting risk profile for the Building Management System. In total, 83 assets were identified as high-risk assets. Summing up the replacement of all high-risk assets (red zone) equated to approximately $1.9 million. These high-risk assets mainly include roofing, HVAC, and wall finishes (paint) at several high-criticality buildings.

Figure 1-6 Buildings Risk Matrix

The table below summarizes the high-risk asset replacement and rehabilitation costs by building.

Table 1-11 Building Management System Immediate Needs (High Risk)

Building	Immediate Cost
Athletic Club	$ 18,000
Conference Centre	$ 26,200
Financial & Strategic Services Department	$ 2,871
Fire Station 1	$ 329,145
Fire Station 2	$ 59,953
Police Station	$ 610,745
Service Center	$ 482,024
Stone Cottage	$ 15,000
Town Hall	$ 346,746
Total	**$ 1,890,684**

The following table displays the total Catch Up and the Keep Up for a 30-year planning horizon. These dollars are represented in current year (2018) dollars.

Table 1-12 Catch Up and Keep Up Values

Category	Cost
Catch Up	$ 1.9 M
Keep Up	$ 1.4 M/yr

What Level of Service Should the Town Provide?

Level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Two scenarios were developed: Preferred Level of Service and Minimum Level of Service.

As shown in Figure 1-3, the estimated annual needs over a 30-year horizon for the Preferred Level of Service was approximately $1.4 million.

The figure below shows the rehabilitation and replacement profile over a 30-year horizon for the Minimum Level of Service, where only the high-risk assets (with CoF 4 or higher) are addressed. The annual average needs for the Minimum Level of Service is approximately $859,000 per year.

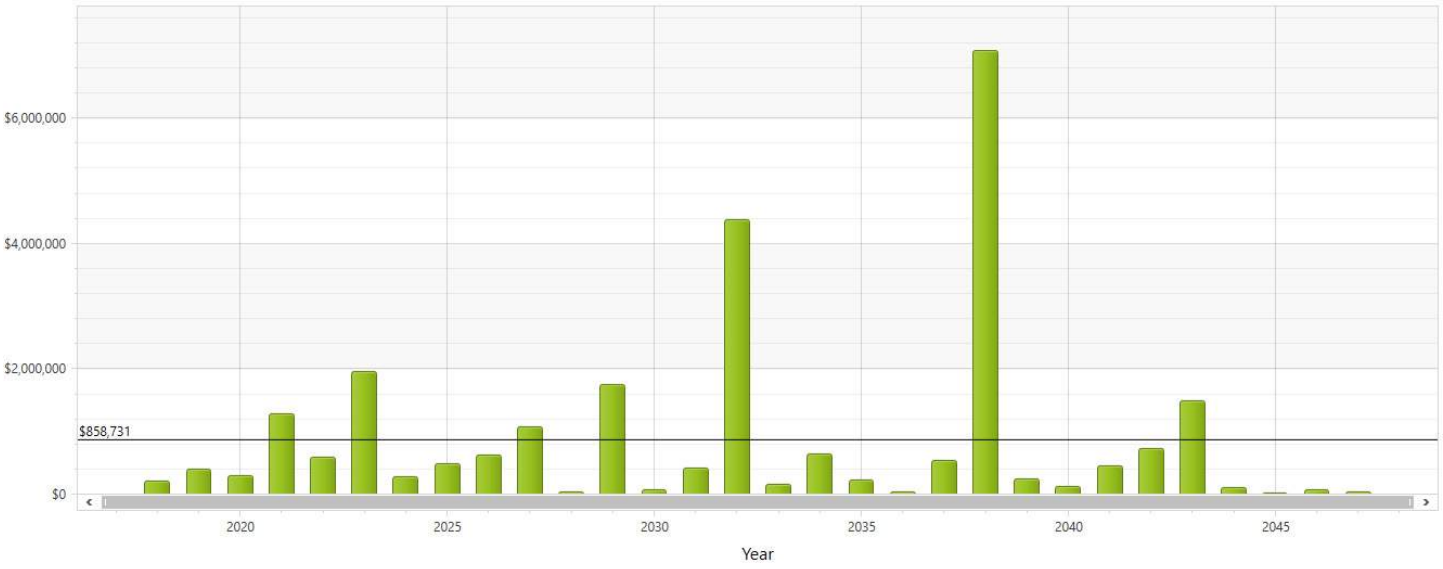


Figure 1-7 Minimum Level of Service Replacement and Rehabilitation Profile

While funding only the high-risk assets would allow the Town to prioritize the high-use buildings, this Minimum Level of Service would not fund several of the Town's buildings. Under this Minimum Level of Service, Kellway Lift Station, Special Events Pavilion, Stone Cottage, Surveyor Pump Station, and Water Tower Learning Center would not receive funding. As such, this Minimum Level of Service is not recommended. The Minimum Level of Service scenario is only performed to present the lower spectrum of the funding requirements.

2 | Parks & Trails Management System

Physical Health Score A

What Does the Town Own and Manage?

The Town owns and manages a total of 19 parks and trails that cover approximately 95 acres. The table below summarizes the items included in the Parks and Trails Management System.

Table 2-1 Town-Owned Parks and Trails

Park/Trail Name	Size	Year Built
Addison Circle Park	10 acres	2005
Addison Town Park	2.5 acres	1980
Arapaho Park	4.0 acres	1996
Beckert Park	9.0 acres	2000
Beltway Sam's Park	1.5 acres	2004
Blueprints at Addison Circle	0.3 acres	2000
Bosque Park	1.0 acres	1995
Celestial Park	4.0 acres	1987
Community Garden	0.8 acres	2010
Les Lacs Linear Park	19.5 acres	1987
North Addison Park	3.2 acres	1991
Parkview Park	0.5 acres	2001
Quorum Park	3.5 acres	1997
Redding Trail	2.5 miles	2010
Redding Trail Dog Park	0.5 acres	2010
Spruill Park	1.5 acres	2002
Vitruvian Park	19 acres	2011
White Rock Creek Trail	5.3 acres/0.75 miles	1986
Winnwood Park	4.2 acres	1985

What is an Asset?

In the case of parks and trails, each piece of equipment (e.g., bench, drinking fountain, walkway) is considered an asset. A full list of park and trail asset classes is shown in the table below.

Table 2-2 Park and Trail Asset Classes

Asset Classes – Parks and Trails				
Abutment	Bridge Beam	Fountain	Park Monument	Shed
ADA Ramp	Bridge Substructure	Gate	Parking Lot	Shelter
Aerator	Canopy	Gazebo	Pedestrian Bridge	Signage
Amphitheater	Chair	Gravel Walkway	Pergola	Stage
Announcement Board	Concrete Edge	Handrails	Pet Waste Station	Stairway
Artwork	Concrete Pad	Interactive Fountain	Pet Waste Station Sign	Stone Pilaster
Backflow Preventer	Culvert	Irrigation Control Valve	Photo Eyes	Tennis Court
Barbecue Grill	Curb	Irrigation Controller	Picnic Table	Trash Can
Basketball Court	Dam/Weir	Irrigation Head	Pile	Trellis
Basketball Hoop	Decorative Boulders	Island	Play Structure	Turf
Beach Volleyball Court	Decorative Light	Landscape Lighting	Playground Surfacing	Vent
Beach Volleyball Poles	Decorative Rocks	Lighting	Misc Playground Equip	Walkway
Bench	Decorative Wall	Meter	Pond	Stone Paver Walkway
Bike Rack	Dedication Plaque	Monument	Pump System	Waterfall System
Bird Feeder	Door	Mulch	Pump Vault	WiFi Point
Bleachers	Drinking Fountain	Net	Retaining Wall	Windbreakers
Bollard	Electrical Panel	Observation Deck	Roof Covering	
Brick Pavers	Fencing	Overflow Structure	Security Camera	

What is the Replacement Value of the Town's Assets?

In total, there are over 4,000 assets in the Parks and Trails Management System. The sum of all replacement costs for each Parks and Trails Management System asset is estimated, in 2018 dollars, to be approximately $36 million.

The table below summarizes the estimated total asset replacement cost of each park/trail.

Table 2-3 Summary of Park and Trail Asset Replacement Costs

Park/Trail Name	Number of Assets	Replacement Cost
Addison Circle Park	688	$ 5,475,122
Addison Town Park	108	$ 773,150
Arapaho Park	136	$ 848,581
Beckert Park	133	$ 345,784
Beltway Sam's Park	42	$ 157,140
Blueprints at Addison Circle	77	$ 151,051
Bosque Park	126	$ 613,885
Celestial Park	161	$ 707,255
Community Garden	85	$ 232,038
Les Lacs Linear Park	397	$ 3,155,869
North Addison Park	144	$ 1,129,119
Parkview Park	95	$ 504,553
Quorum Park	197	$ 1,354,345
Redding Trail	562	$ 4,823,556
Redding Trail Dog Park	99	$ 237,646
Spruill Park	168	$ 798,333
Vitruvian Park	713	$ 12,437,984
White Rock Creek Trail	99	$ 455,326
Winnwood Park	99	$ 1,829,568
Total	**4,129**	**$ 36,030,303**

What is the Condition of the Town's Assets?

Each asset in the park and trail was visited for asset inventory and condition assessment. Location, type, material, size, condition, age, and other information required to support asset management decisions were captured and recorded for each asset.

The following images show the different examples of condition 2 versus condition 4 assets. As is shown in the images, the condition 2 assets are in very good condition. On the other end of the spectrum, the condition 4 assets have deteriorated and in the near future will no longer serve their functions or will present serious safety hazards.

Table 2-4 Examples of Condition 2 and 4 Park and Trail Assets

Condition 2 Image Examples	Condition 4 Image Examples
	
	

Throughout the condition assessment, the majority of the park assets (73%) have a condition score of 3 (good or as expected with age). A little under 25% of the assets have a condition score of 1 or 2 (new or very good condition). Overall, it can be concluded that the park assets are in good to excellent condition. Of the total park assets, less than 3% were observed to be condition 4 or 5. Some examples of these poor condition assets included the barbecue grill and the tennis court windbreakers at Les Lacs Linear Park, and various pet waste stations and signs throughout several of the parks. These assets will need attention in the near future.

What Does the Town Need to Sustain the Delivery of Services?

In order to estimate the long-term asset replacement and rehabilitation needs for the Parks and Trails Management System, a life-cycle cost analysis was performed each asset. Each asset class was assigned a life cycle cost logic or management strategy that includes the rehabilitation and replacement activities to best characterize the life cycle investment needs for the asset. Below is a sample list of management strategies used to calculate the life-cycle costs of the park and trail assets.

Table 2-5 Examples of Park and Trail Management Strategies

Management Strategy ID	Useful Life	Rehabilitation	Frequency
Bench – Coated Steel	15	Recoat	8
Bench – Concrete	50		
Fencing – Chainlink	15		
Irrigation Controller	10		
Playground Surfacing – Rubber	15	Rehab	5
Retaining Wall – Concrete	50		
Trash Can – Coated Steel	15	Recoat	5

The figure below displays the 30-year replacement and rehabilitation needs for the Parks and Trails Management System. Utilizing a deterministic model, the average replacement and rehabilitation needs are approximately $1.6 million per year.

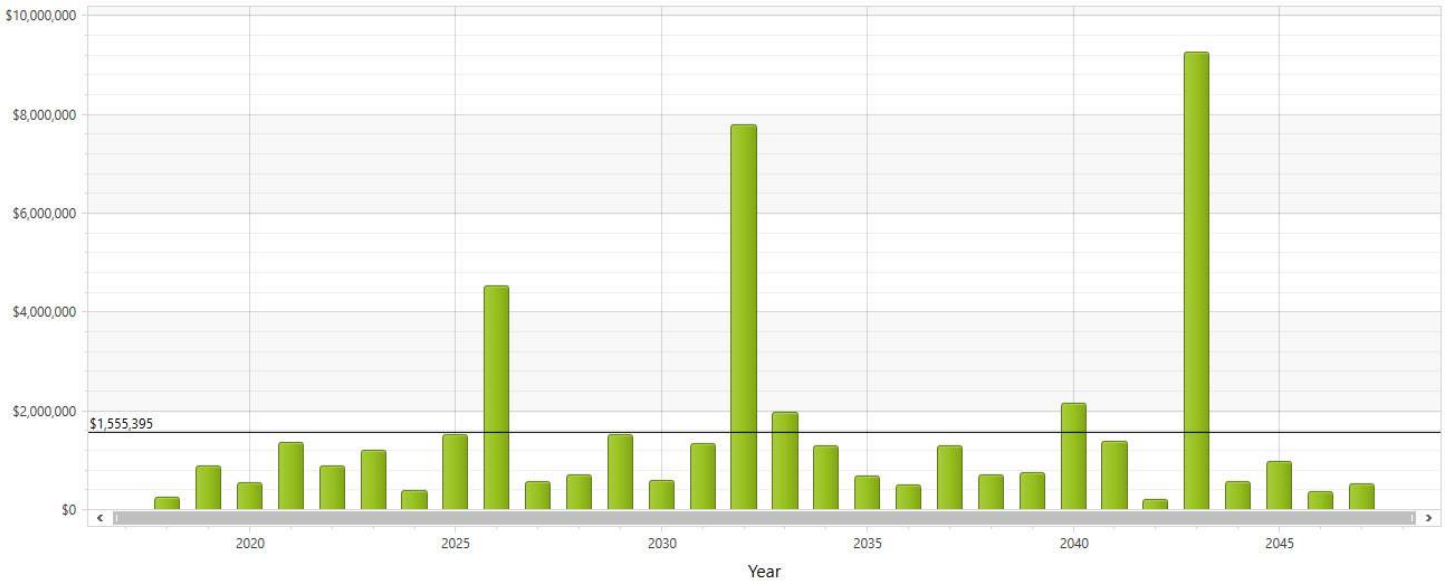


Figure 2-1 30-Year Park/Trail Replacement and Rehabilitation Profile (Deterministic Model)

The 30-year life cycle cost analysis was repeated utilizing a probabilistic model, in which asset failures were smoothed to represent a more realistic expectation. The probabilistic model predicts the annual replacement and rehabilitation needs to be approximately $1.2 million per year.

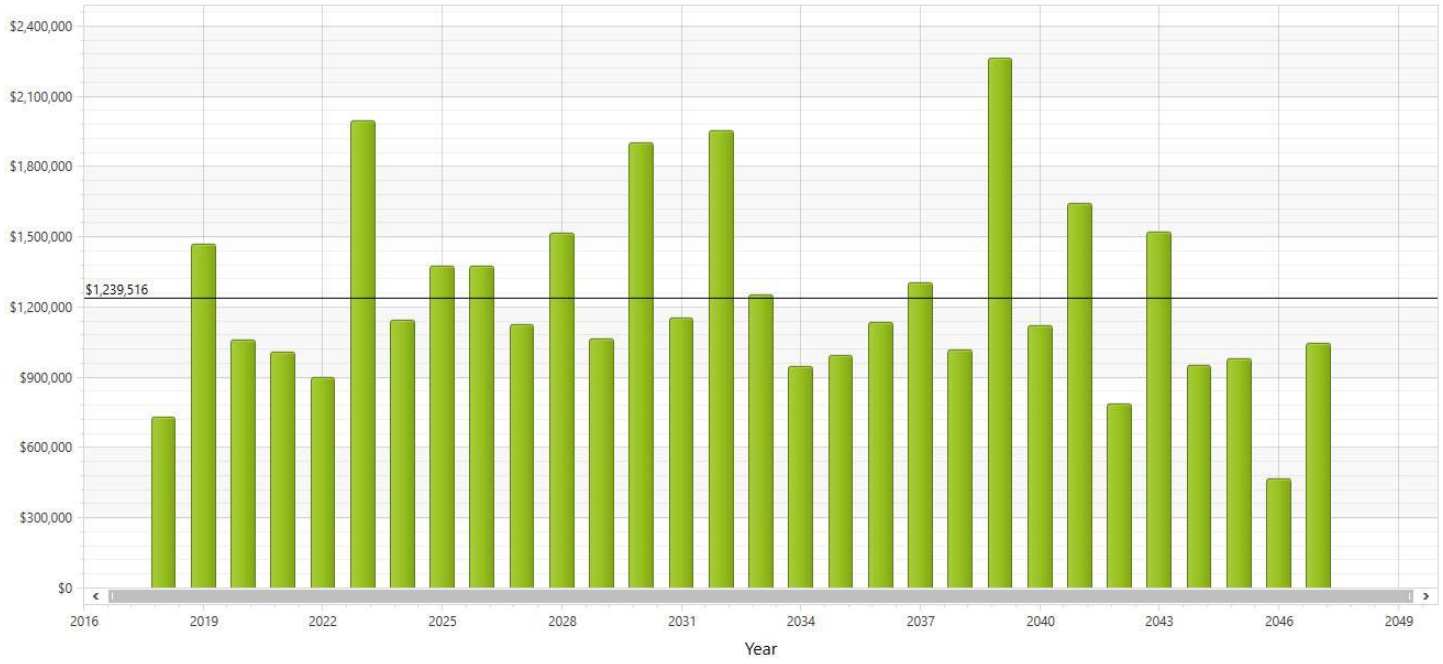


Figure 2-2 30-Year Park/Trail Replacement and Rehabilitation Profile (Probabilistic Model)

Both analyses above represented results in today's dollars (2018). Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from $1.6 million per year to $2.5 million per year. Similarly, for the probabilistic model, the annual investment need increased from $1.2 million per year to $2.2 million per year.

The results of these analyses are summarized in the table below.

Table 2-6 Parks and Trails Management System 30-Year Summary

30-Year	Annual Average
Deterministic	$ 1.6 M/yr
Probabilistic	$ 1.2 M/yr
Deterministic with 3% Inflation	$ 2.5 M/yr
Probabilistic with 3% Inflation	$ 2.2 M/yr

How Should the Town Prioritize?

In order to prioritize the limited budget available to address the ongoing replacement and rehabilitation needs of the park and trail assets, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was utilized. As illustrated in the figure below, a multi-tier methodology was deployed.

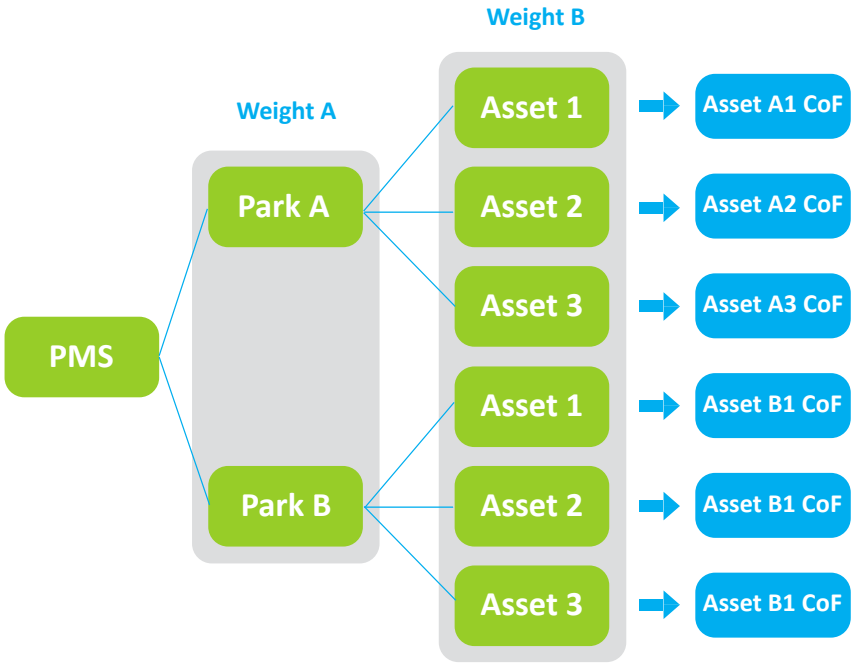


Figure 2-3 Multi-Tier Logic CoF Rating Methodology

In the first tier, a criticality level was assessed at the park level based on the importance or significance of the park to the Town. A park's significance is based on multiple factors, such as usage volume, amenities offered, and contribution to the Town's image. In the second tier, asset level criticality was evaluated. How critical is the asset? Will park services be disrupted due to the asset failure? Will the asset failure pose safety hazards? The larger the impact of the asset failure, the higher the criticality.

First-tier criticality ratings for the Town parks/trails are summarized in the table below. As expected, parks/trails with high social impact received a higher criticality score compared to parks/trails with low usage.

The table below shows the priority assigned to each park/trail.

Table 2-7 Park/Trail Criticality by Usage

Criticality Category	Park/Trail
High	Addison Circle Park
	Spruill Park
	Vitruvian Park
	Beckert Park
	Blueprints at Addison Circle
Medium	Bosque Park
	Celestial Park
	Les Lacs Linear Park
	Parkview Park
	Quorum Park
	Winnwood Park
	Redding Trail
Low	Addison Town Park
	Arapaho Park
	North Addison Park
	Beltway Sam's Park
	Community Garden
	Redding Trail Dog Park
	White Rock Creek Trail

Second-tier criticality at the asset level is presented in the following table. One of the main considerations in assessing the criticality at an asset level was safety. Any asset with direct impact on public safety received the highest criticality score of 5. In addition, level of service was considered to be very important. The table below highlights a sample of the asset class criticality.

Table 2-8 Examples of Park/Trail Asset-Level Criticality

Criticality – 5	Criticality – 4	Criticality – 3	Criticality – 2	Criticality – 1
Critical				Non-Essential
• Play Structure • Playground Surfacing • Walkway • Handrail	• Irrigation Controller • Bollards • Gate • Signage • Stairs	• Bench • Drinking Fountain • Gazebo • Lighting • Picnic Table	• Bike Rack • Trash Bin • Fountain	• Park Sign • Information Board

The following figure shows the resulting overall risk profile for the Parks and Trails Management System. Currently, there are only two assets in the high-risk zone, so the Parks and Trails Management System is in overall good physical condition. The two high-risk assets are two light fixtures along Vitruvian Way.

Figure 2-4 Parks and Trails Risk Matrix

Although there are very few assets in the high-risk zone, approximately $2.6 million worth of assets (7%) are in the medium-risk zone. Many of these medium-risk assets will begin to fall in the high-risk zone in the near future.

Additionally, approximately $11 million worth of overall assets are expected to need replacement or rehabilitation in the next 10 years. It will be critical for the Town to proactively manage the assets to mitigate the deterioration process. If maintenance work is missed, the condition of the assets will decrease exponentially, making the need for replacement approach sooner. The following figure presents the assets needing replacement or rehabilitation in the next 10 years with respect to replacement cost for each park.

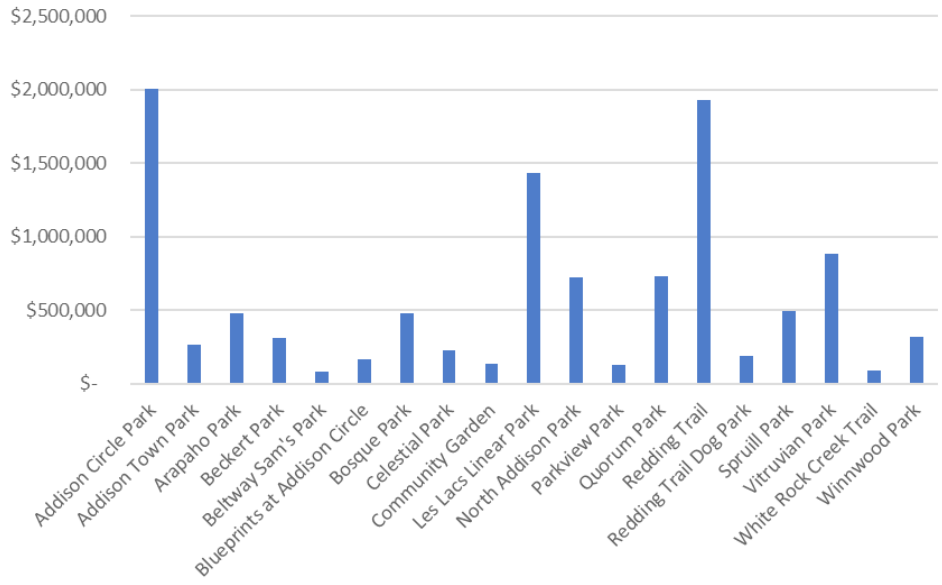


Figure 2-5 Costs of Assets Requiring Replacement or Rehabilitation in the Next 10 Years by Park/Trail

The following table displays the total Catch Up and Keep Up for a 30-year planning horizon. These amounts are represented in current year (2018) dollars.

Table 2-9 Catch Up and Keep Up Values

Category	Cost
Catch Up	$ 18,000
Keep Up	$ 1.6 M/yr

What Level of Service Should the Town Provide?

Level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Two scenarios were developed: Preferred Level of Service and Minimum Level of Service.

As shown in Figure 2-2, the estimated annual needs over a 30-year horizon for the Preferred Level of Service was approximately $1.6 million.

The figure below shows the rehabilitation and replacement profile over a 30-year horizon for the Minimum Level of Service, where only high-risk assets (with CoF 4 or higher) are addressed. The annual average needs for the Minimum Level of Service is approximately $674,000 per year.

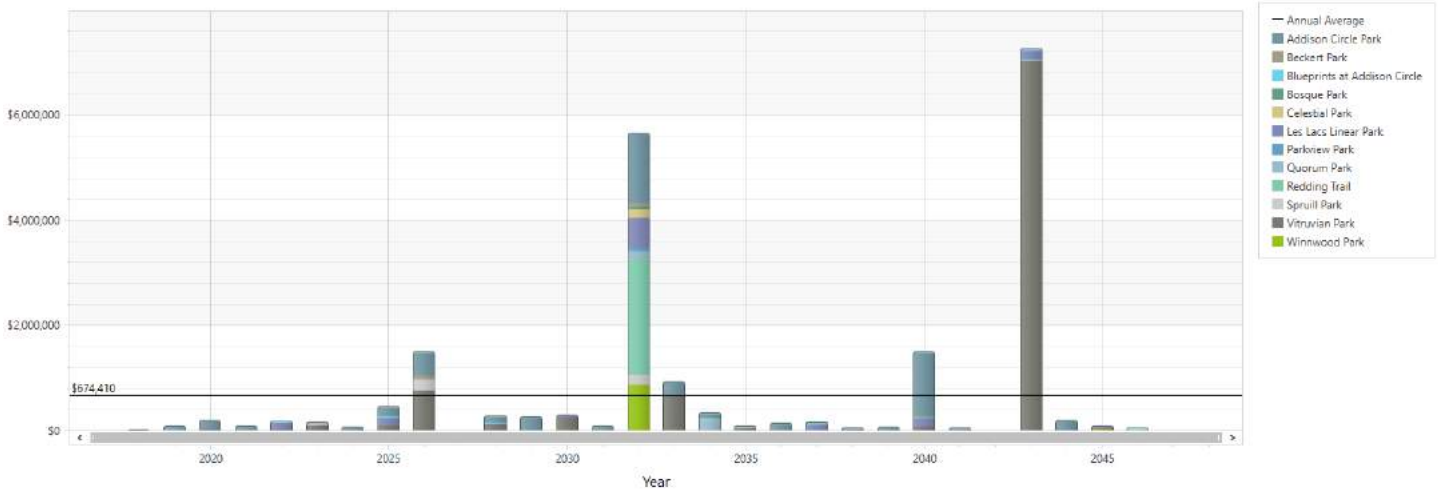


Figure 2-6 Minimum Level of Service Replacement and Rehabilitation Profile

While funding only the high-risk assets would allow the Town to prioritize the high-use parks, this Minimum Level of Service would not fund several of the Town's park assets. As such, the Minimum Level of Service is not recommended. The Minimum Level of Service scenario is only performed to present the lower spectrum of the funding requirements.

3 | Landscape Management System

Physical Health Score B

What Does the Town Own and Manage?

The Town owns and manages 164 acres of landscaping, including areas on road medians, areas within residential neighborhoods, and areas along the streets. Landscape areas provide green spaces throughout the Town. Many of the landscape areas and the included assets are the Town's responsibility. Some assets in these areas, however, are owned by other entities, such as single-headed pole lights that are utility-owned and managed. Only the Town-owned assets are included in this management system. The figure below shows a map of all the Town's landscape areas.

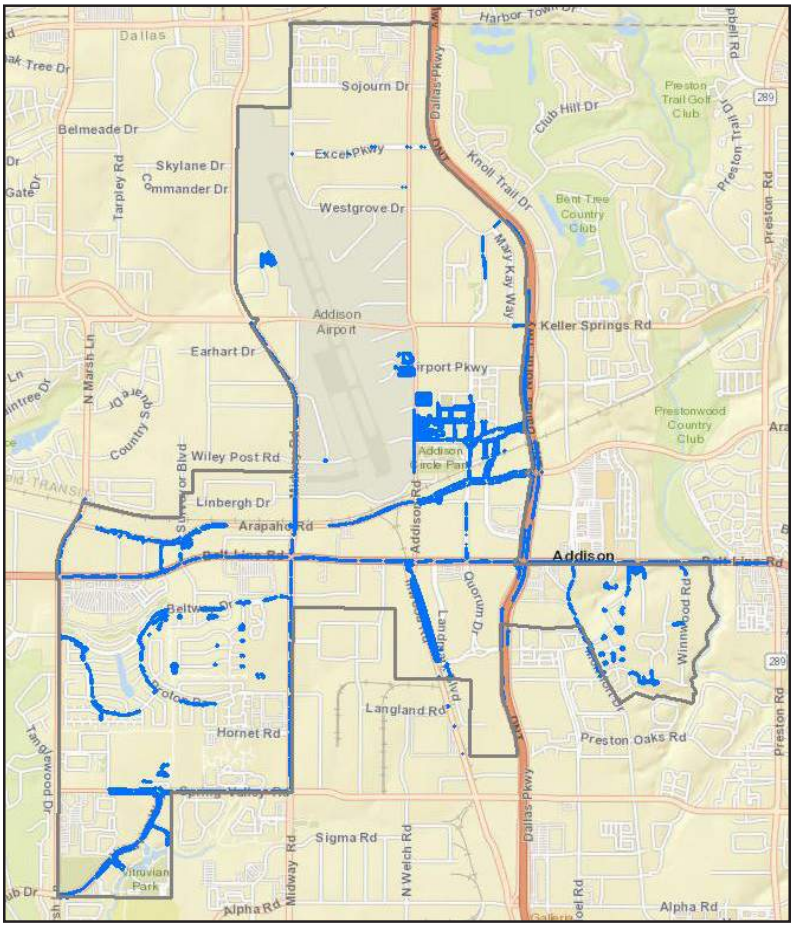


Figure 3-1 Map of Addison Landscape Areas

The following figures show examples of landscape areas found throughout the Town.

Figure 3-2 Landscape Area – Residential Area

Figure 3-3 Landscape Area – Median

What is an Asset?

In the case of landscape areas, each piece of equipment (e.g., bench, bike rack, trash can) as well as each type of ground covering (e.g., mulch, gravel) is considered an asset. Below is a list of asset classes in the Landscape Management System.

Table 3-1 Landscape Asset Classes

Asset Classes – Landscape Areas			
Artwork	Bollard	Irrigation Controller	Seasonal Color Bed
Backflow Preventer	Flagpole	Perennial Bed	Street Light
Bench	Impervious Surfaces (i.e. concrete slab, deck, driveway, parking, road, sidewalk)	Pervious Surfaces (i.e. mulch, grass, gravel, sand)	Trash Can
Bike Rack	Irrigation Control Valve Box	Pet Waste Station	

What is the Replacement Value of the Town's Assets?

In total, there are over 3,000 assets in the Landscape Management System. The sum of all replacement costs for each Landscape Management System asset is estimated, in 2018 dollars, to be approximately $16.5 million.

The table below summarizes the estimated total asset replacement cost by landscape asset class.

Table 3-2 Summary of Landscape Asset Replacement Costs

Asset Class	Number of Assets	Replacement Cost
Artwork	2	$ 10,000
Backflow Preventer	97	$ 194,000
Bench	152	$ 269,500
Bike Rack	56	$ 56,000
Bollard	137	$ 82,200
Flagpole	1	$ 2,500
Impervious Surfaces	382	$ 11,583,435
Irrigation Control Valve Box	832	$ 166,400
Irrigation Controller	108	$ 1,725,000
Perennial Bed	56	$ 70,218
Pervious Surfaces	899	$ 1,570,016
Pet Waste Station	6	$ 1,800
Seasonal Color Bed	14	$ 7,004
Street Light	200	$ 700,000
Trash Can	119	$71,400
Total	**3,061**	**$ 16,512,473**

What is the Condition of the Town's Assets?

Each asset in the landscape areas was visited for asset inventory and condition assessment. Location, type, material, size, condition, age, and other information required to support asset management decisions were captured and recorded for each asset.

The figure below presents a summary of the results of the asset inventory and condition assessment.

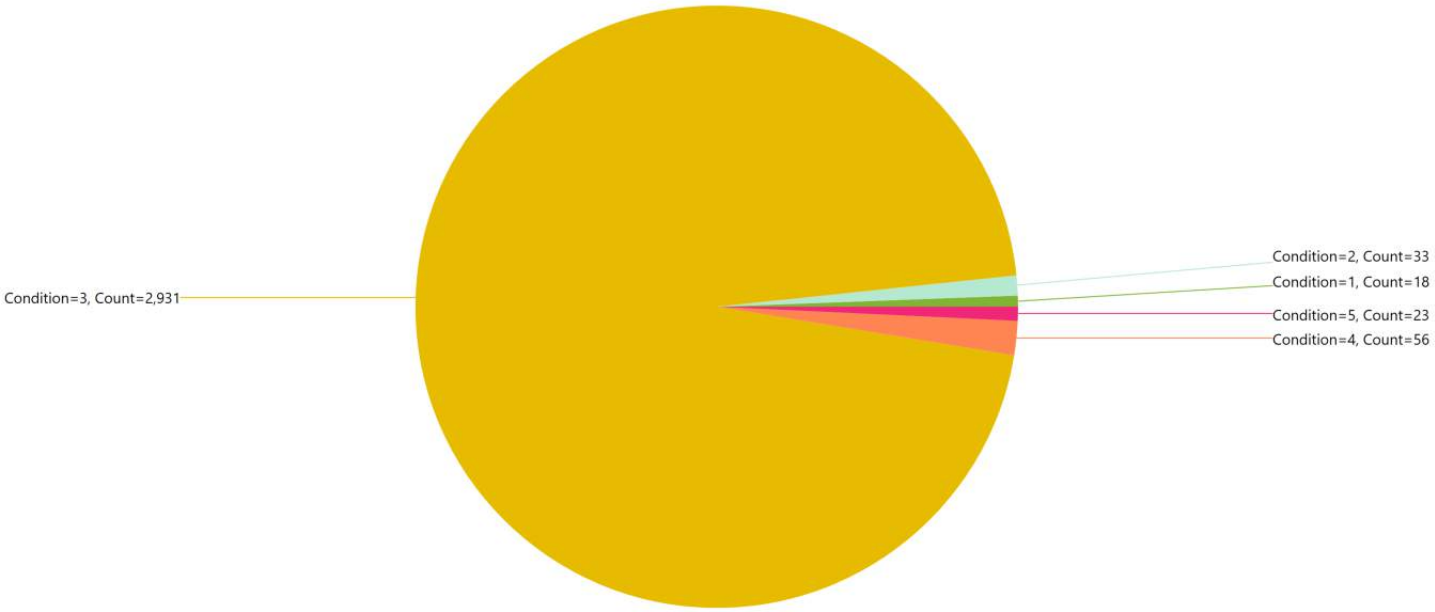


Figure 3-4 Landscape Asset Condition Assessment Results

As is shown in the previous figure, the majority of the landscape assets (96%) are in good condition (condition score of 3). About 2% of the assets were in great to excellent condition (i.e., condition score 2 and 3) and the remaining assets (3%) were in fair to poor condition (i.e., a score of 4 or 5). The assets observed to be condition 4 or 5, which are mostly irrigation control valves, will need attention in the near future.

What Does the Town Need to Sustain the Delivery of Services?

In order to estimate the long-term asset replacement and rehabilitation needs for the Landscape Management System, a life-cycle cost analysis was performed each asset. Each asset class was assigned a life cycle cost logic or management strategy that includes the rehabilitation and replacement activities to best characterize the life cycle investment needs for the asset. Below is a list of management strategies used to calculate the life-cycle costs of the landscape assets.

Table 3-3 Landscape Management Strategies

Asset Class	Useful Life	Rehabilitation Activity	Frequency
Artwork	30	Paint	5
Backflow Preventer	20	Inspect	1
Bench – Coated Steel	15	Paint	4
Bike Rack – Coated Steel	20	Paint	4
Bollard – Coated Steel	30	Paint	4
Brick Pavers	50		
Flagpole	30		
Ground Covering (Pervious Surfaces)	1000	Rehab	2
Irrigation Control Valve	8		
Irrigation Controller	10		
Perennial Bed	4		
Pet Waste Station	5	Paint	4
Seasonal Color Bed	4		
Street Light	30	Paint	10
Trash Can – Coated Steel	10	Paint	5
Walkway - Concrete	50		

The figure below displays the 30-year replacement and rehabilitation needs for the Landscape Management System. Utilizing a deterministic model, the average needs are approximately $690,000 per year.

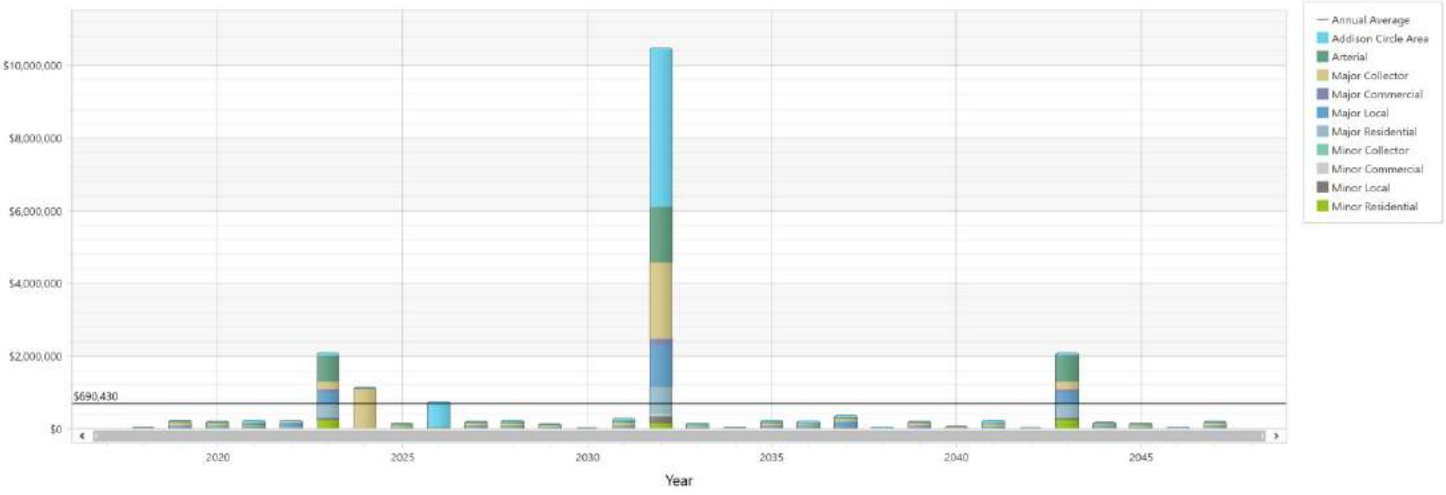


Figure 3-5 30-Year Landscape Asset Replacement and Rehabilitation Profile (Deterministic Model)

The 30-year life cycle cost analysis was repeated utilizing a probabilistic model, in which asset failures were smoothed to represent a more realistic expectation. The probabilistic model predicts the annual replacement and rehabilitation needs to be approximately $600,000 per year.

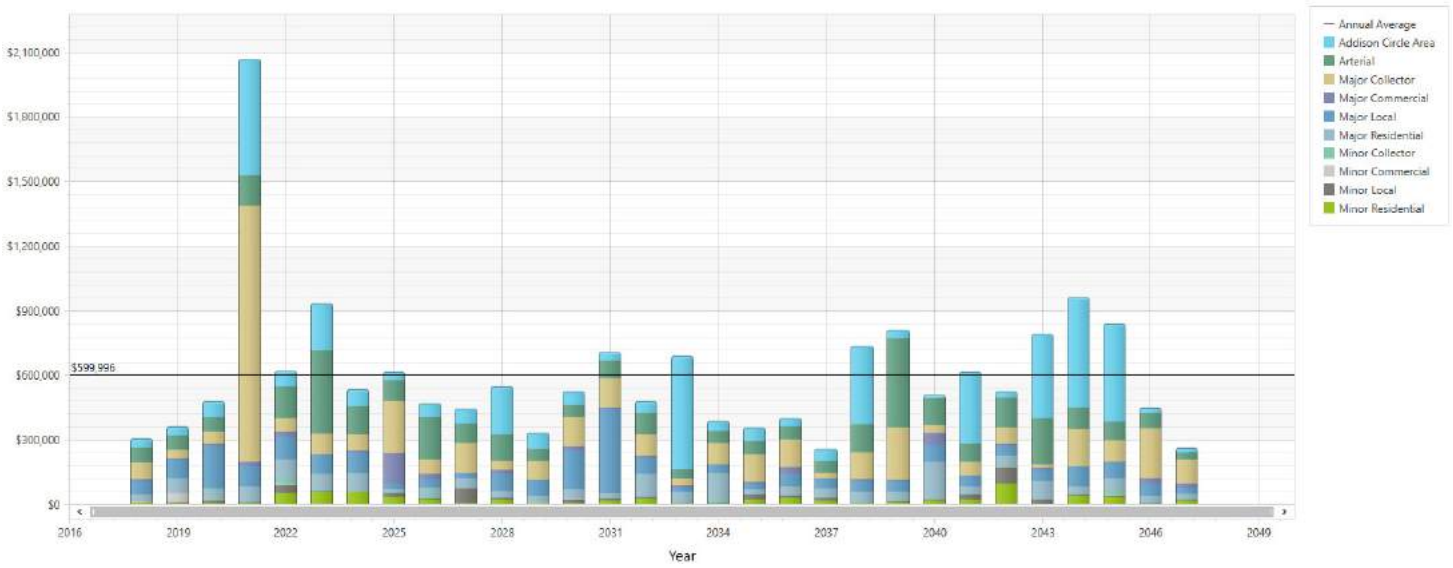


Figure 3-6 30-Year Landscape Asset Replacement and Rehabilitation Profile (Probabilistic Model)

Both analyses above represented results in today's dollars (2018). Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from approximately $690,000 per year to $1 million per year. Similarly, for the probabilistic model, the annual investment need increased from approximately $600,000 per year to $941,000 per year. The results of these analyses are summarized in the table below.

Table 3-4 Landscape Management System 30-Year Summary

30-Year	Annual Average
Deterministic	$ 690,000/yr
Probabilistic	$ 600,000/yr
Deterministic with 3% Inflation	$ 1 M/yr
Probabilistic with 3% Inflation	$ 941,000/yr

How Should the Town Prioritize?

In order to prioritize the ongoing replacement and rehabilitation needs of the landscape assets, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was utilized.

CoF assessment took place through a multi-tier logic. The logic was based on each asset class' importance to the system relative to other asset classes. For example, the most critical assets within the landscape areas include backflow preventers, walkways, and other assets that directly impact safety and level of service. In addition, not all landscape areas have the same level of criticality. Landscape areas in road class locations with high social impact (e.g., high volume of traffic) received a higher criticality score compared to areas with low usage and visibility.

The following table shows the ranking of the road class criticality.

Table 3-5 Road Class Criticality

Road Classes	Criticality
Addison Circle Area	High
Arterial	
Major Collector	
Minor Collector	
Major Commercial	
Minor Commercial	
Major Local	
Minor Local	
Major Residential	
Minor Residential	

Criticality was then assigned by asset class. CoF scores ranged from 1 (least critical) to 5 (most critical). Level of service was considered to be very important. The table below highlights the ranking of asset class criticality.

Table 3-6 Landscape Asset-Level Criticality

Criticality – 5	Criticality – 4	Criticality – 3	Criticality – 2	Criticality – 1
Critical				Non-Essential
• Backflow Preventer	• Irrigation Control Valve • Irrigation Controller • Street Light	• Bench	• Bollard • Trash Can • Bike Rack • Artwork • Pet Waste Station • Impervious Surfaces • Flagpole • Pervious Surfaces	• Perennial Bed • Seasonal Color Bed

The following figure shows the resulting overall risk profile for the Landscape Management System. Currently, there are only 11 assets in the high-risk zone with a total replacement cost of $10,600. As such, the Landscape Management System is in relatively good condition overall. The high-risk assets include 8 irrigation control valves and 1 backflow preventer located in arterial areas and 2 street lights in the Addison Circle Area.

Figure 3-7 Landscape Area Risk Matrix

Although there are currently only 11 high-risk assets in the Landscape Management System, approximately $750,000 worth of assets are in the medium-risk zone. Many of these medium-risk assets will begin to fall in the high-risk zone in the near future. While the replacement cost of assets might be high, the risk can be mitigated by maintenance or rehabilitation, so the cost to lower the risk scores may be significantly less than the total value.

The following table displays the total Catch Up, or the total replacement and rehabilitation costs in 2018 as well as the Keep Up for a 30-year planning horizon. These amounts are represented in current year (2018) dollars.

Table 3-7 Catch Up and Keep Up Values

Category	Cost
Catch Up	$ 10,600
Keep Up	$ 690,078/yr

What Level of Service Should the Town Provide?

Level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Two scenarios were developed: Preferred Level of Service and Minimum Level of Service.

As shown in Figure 3-5, the estimated annual needs over a 30-year horizon for the Preferred Level of Service was approximately $690,000.

The figure below shows the rehabilitation and replacement profile over a 30-year horizon for the Minimum Level of Service, where only high-risk assets (with CoF 4 or higher) are addressed. The annual average needs for the Minimum Level of Service is approximately $94,000 per year.

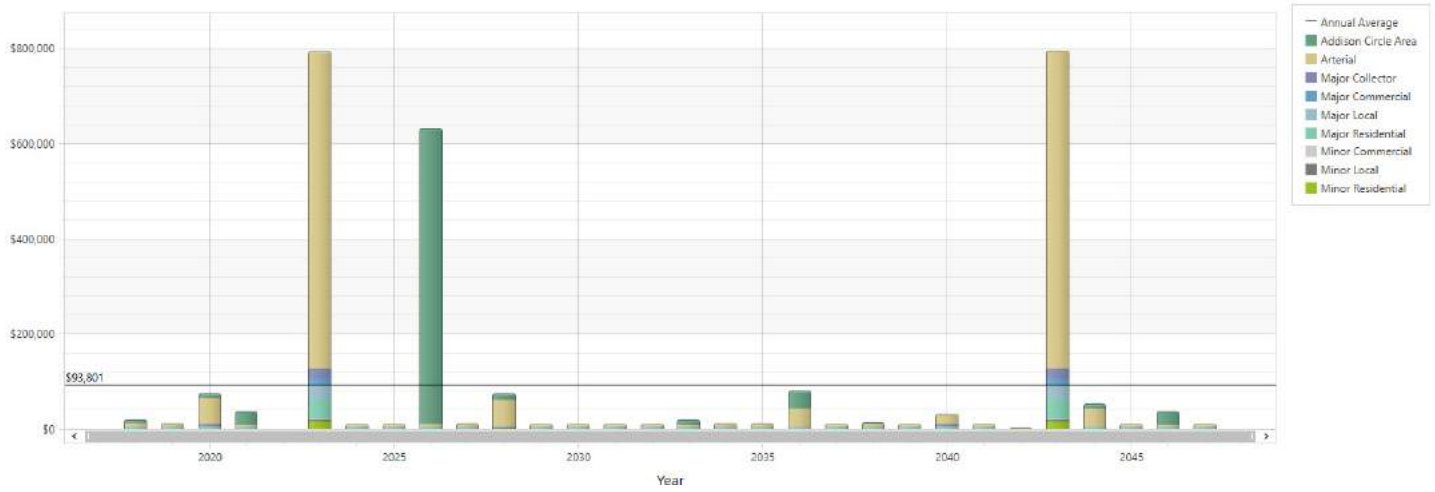
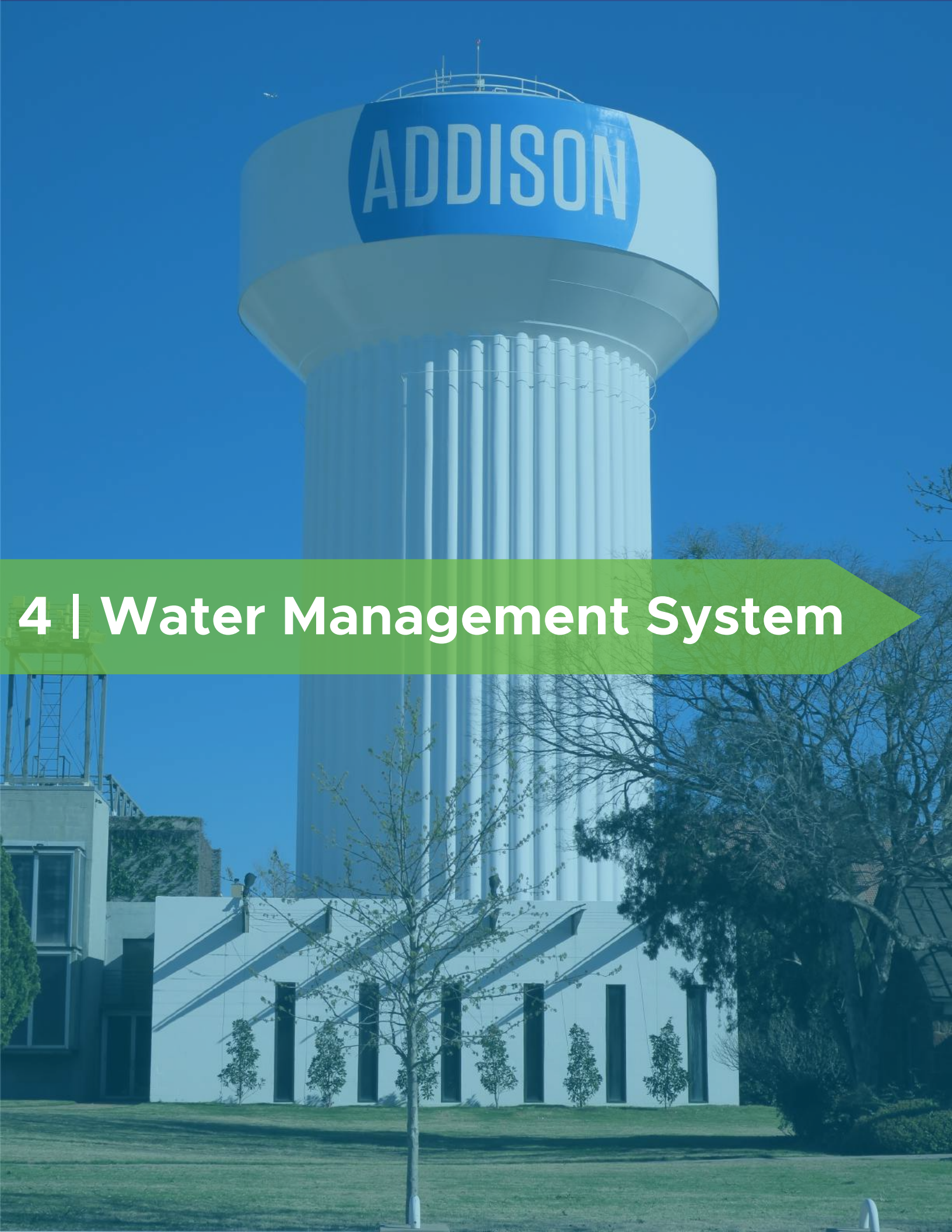


Figure 3-8 Minimum Level of Service Replacement and Rehabilitation Profile

While funding only the high-risk assets would allow the Town to prioritize the higher-risk landscape areas, this Minimum Level of Service would not fund several of the Town's landscape assets. As such, the Minimum Level of Service is not recommended. The Minimum Level of Service scenario is only performed to present the lower spectrum of the funding requirements.



4 | Water Management System

Physical Health Score A

What Does the Town Own and Manage?

The Town owns and manages a total of 12,600 water management system assets, which includes approximately 96 miles of pipes, 2 pump stations, and 4 reservoirs. The Town is responsible for all publicly-owned water distribution and facilities assets. The tables below summarize the items included in the Water Management System.

Table 4-1 Water Management System Asset Inventory

Asset	Quantity	Length
Fire Hydrants	1,077	
Mains		96.2 mi
Meters	3,865	
Valves	3,084	
Facility Assets (e.g. Pumps, Motors, Valves, etc.)	262	

Table 4-2 Water Main Inventory

Material	Length (mi)
CI	7.1
CPP	0.1
CU	4.5
DI	6.3
PCCP	3.6
PVC	72.1
RCCP	2.4
Steel	0.01

What is an Asset?

Water assets include pipes (segment by segment), valves, meters, and hydrants. In addition, the water facility components (e.g., pump, motor, motor control center (MCC), supervisory control and data acquisition (SCADA), valves) are considered an asset. Pump station building assets (e.g., roof, structure, windows, doors) are included in the Building Asset Management system.

A comprehensive list of Water Management System asset classes is shown in the table below.

Table 4-3 Water Asset Classes

Asset Classes – Water				
Access Hatch	Expansion Joint	Heating, Ventilation, Air Conditioning (HVAC)	Motor	Transformer
Actuator	Fencing	Instrumentation	Pavement	Valve
Battery Backup Power	Filter	Ladder	Structure	Vault Structure
Building	Fire Hydrant	Lighting	Pump	Vent
Capacitor	Gate	MCC	SCADA	Water Main
Control Panel	Generator	Mixer	Tank	Water Meter

What is the Replacement Value of the Town's Assets?

In total, there are 12,600 assets in the Water Management System. The replacement cost for each asset was estimated. It should be noted that replacement cost represents an estimated cost to replace the asset either by Town staff or by contractor. It does not represent a project cost that includes engineering, management, insurance, contingency, etc. In many cases, project costs can add an extra 15% to 30% to the replacement cost. The total replacement cost of the Water Management System, in 2018 dollars, is approximately $121 million.

The underground assets (i.e. water mains and valves) make up approximately $96 million (79%) of the total asset replacement cost of the Water Management System. The above ground assets (i.e. fire hydrants, water meters, and water facility assets) make up approximately $25 million. By individual asset classes, water mains make up the most of the value of the Water Management System at approximately $64 million (53%), followed by system valves at approximately $32 million. The remaining valuation is made up of fire hydrants, water meters, and water facility assets (e.g., pump station assets). The following figure shows the total asset replacement cost of the Water Management System by major asset classes.

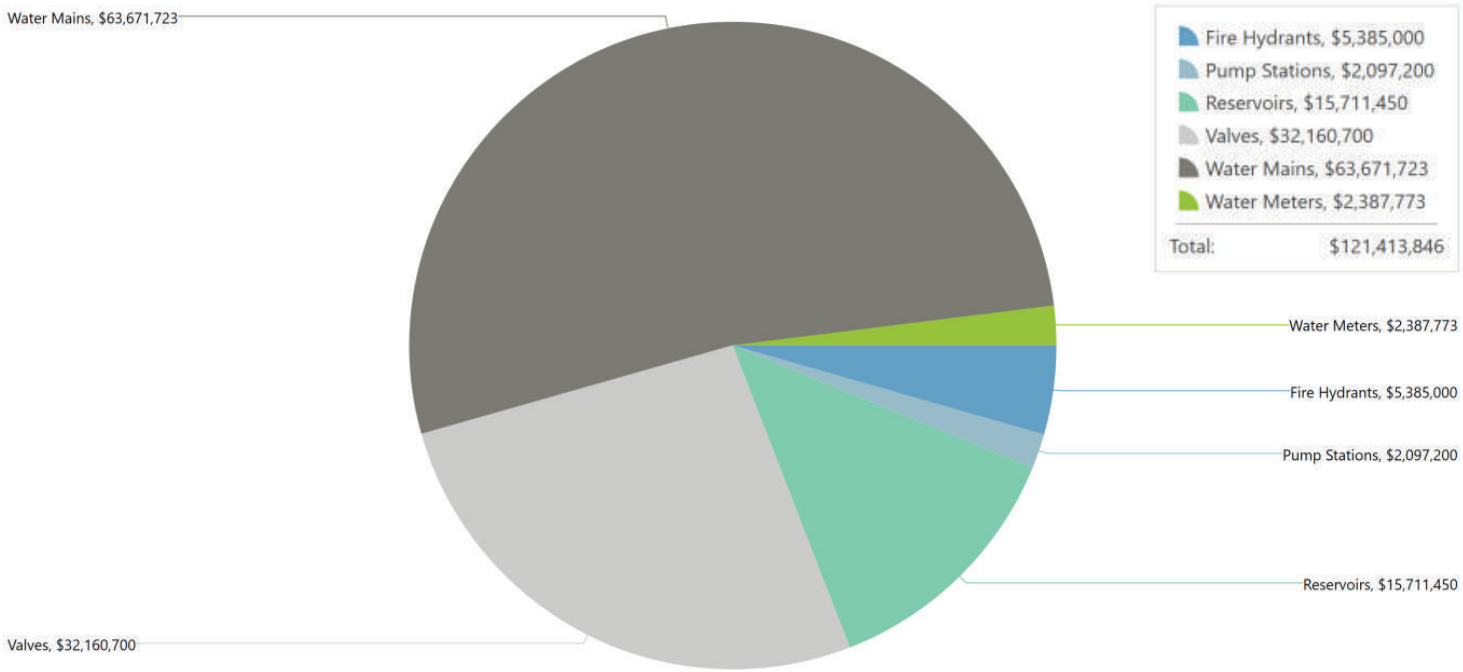


Figure 4-1 Water Management System Valuation

The following figures show the valuation of the water facility assets. The total valuation of the water facility assets is approximately $18 million. Celestial Pump Station has the higher valuation of the two pump stations at approximately $1.5 million without the building and site assets. Amongst the reservoirs, Celestial Ground Storage Tank (GST) Reservoir has the highest valuation at approximately $6.1 million.

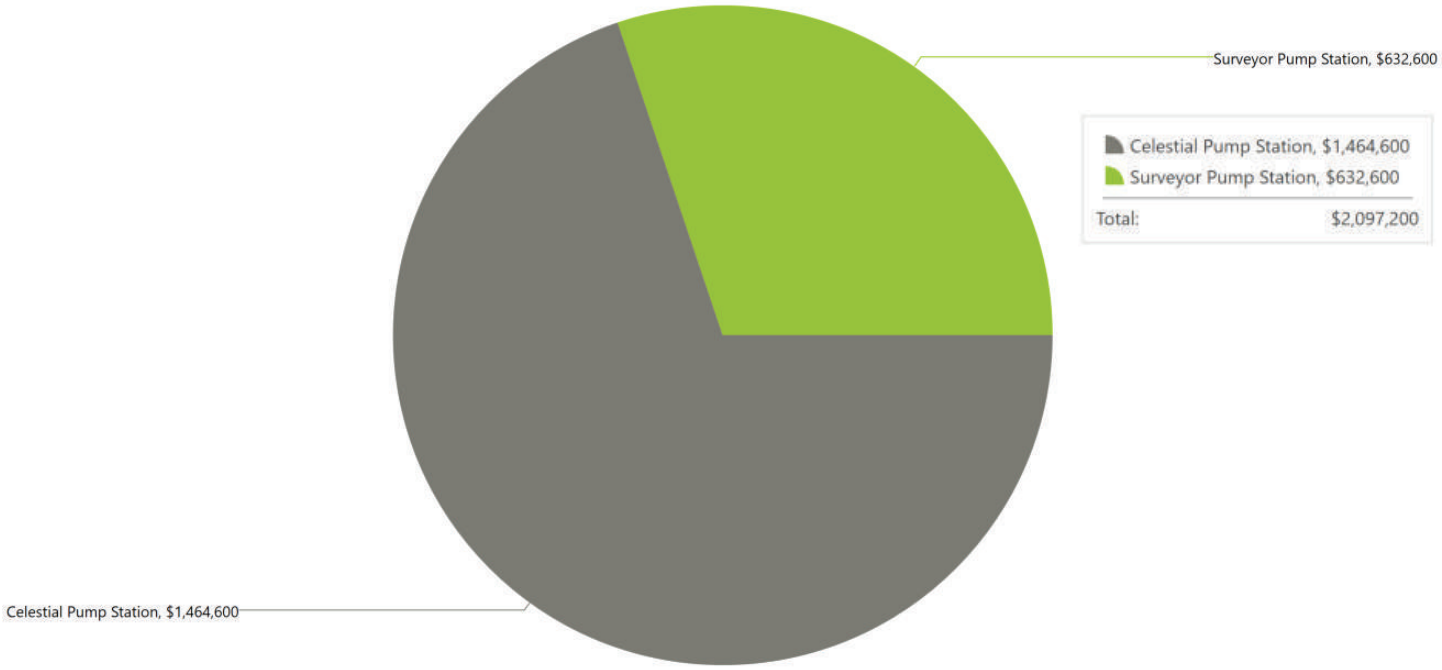


Figure 4-2 Pump Station Replacement Costs

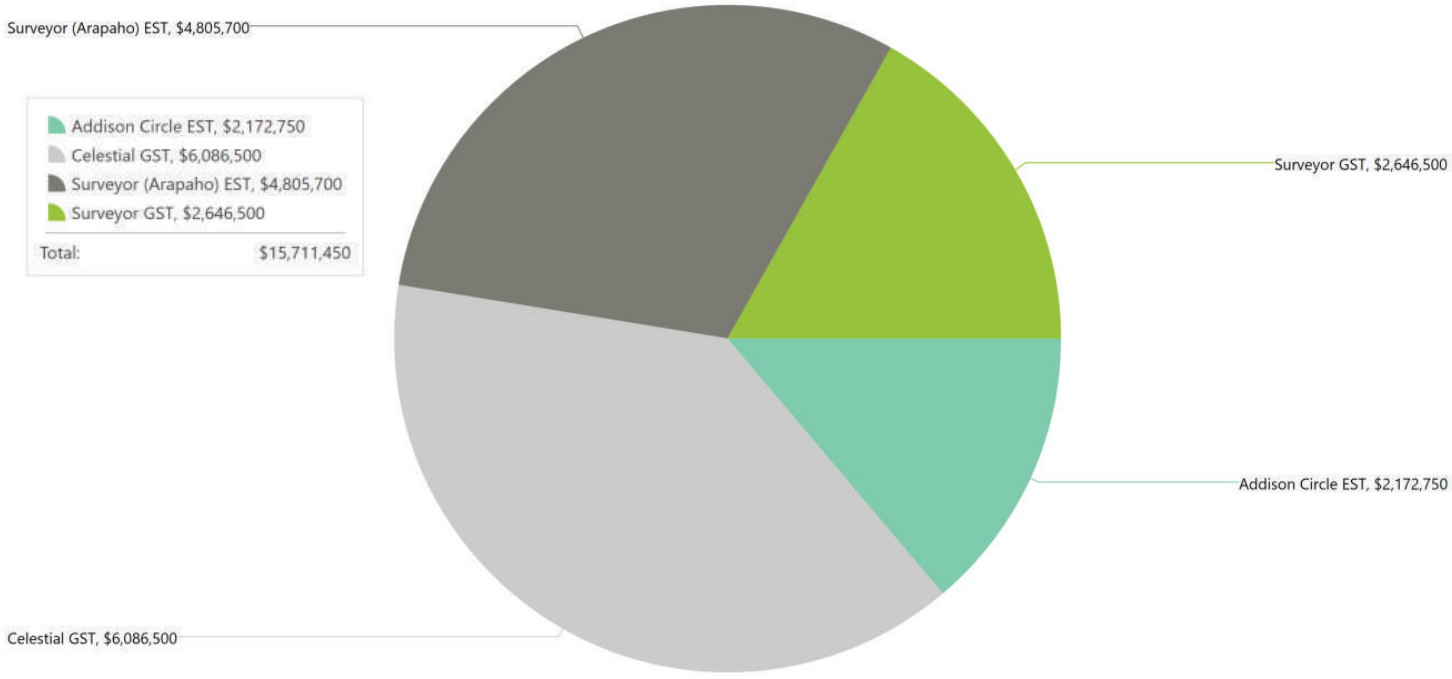


Figure 4-3 Water Reservoir Replacement Costs

The following tables summarize the estimated total asset replacement cost by asset type (Table 4-4) and by facility (Table 4-5).

Table 4-4 Summary of Water Asset Replacement Costs

Asset	Number of Assets	Length	Replacement Cost
Fire Hydrants	1,077		$5,385,000
Mains	4,312	96.2 mi	$63,671,723
Meters	3,865		$2,387,773
Valves	3,084		$32,160,700
Total	**12,338**	**96.2 mi**	**$103,605,196**

Table 4-5 Summary of Water Facility Asset Replacement Costs

Facility	Number of Assets	Replacement Cost
Celestial Pump Station	141	$1,464,600
Surveyor Pump Station	45	$632,600
Addison Circle Elevated Storage Tank (EST) Reservoir	18	$2,172,750
Celestial Ground Storage Tank (GST) Reservoir	8	$6,086,500
Surveyor (Arapaho) Elevated Storage Tank (EST) Reservoir	25	$4,805,700
Surveyor Ground Storage Tank (GST) Reservoir	26	$2,646,500
Total	**263**	**$17,808,650**

What is the Condition of the Town's Assets?

During the asset inventory process, the general condition of the assets were assessed or estimated. Where an asset was visible, a general assessment took place through visual inspection. In some cases, however, assets are not visible or visual assessment is not a good representation of the asset's condition. In such cases, the anticipated condition score was estimated based on the age of the asset. Age-based calculation required evaluation of the asset age, expected useful life, and anticipated decay curve.

The following figure represents the general condition of the Water Management System water mains based on pipe installation years. As shown in the figure, most of the water mains were installed beginning the 1970s. It is very difficult to do a condition assessment on mains due to the possibility of water service disruption during the assessment process. As such, it is very typical to drive the general condition analysis based on age. The relatively young pipe age for most of the mains leads to an overall relatively good condition for the water mains. However, there are some mains that are known to need replacement in the near future. About 2.5% of the water mains are over 50 years old and are nearing the end of their useful lives.

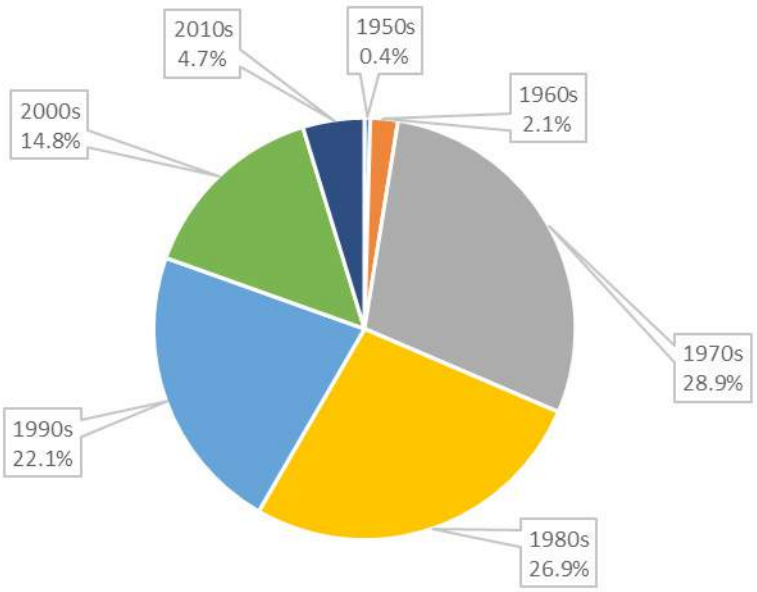


Figure 4-4 Water Main Construction by Decade

The following figures show the water facilities by average consumption. Consumption is a measure of an asset's estimated age or condition relative to its expected useful life. For instance, if a pump has a useful life of 30 years and it is 25 years old, it has used 83% of its useful life. The following figures show the averages of the asset consumption for each facility based on replacement cost.

Figures 4-5 and 4-6 show the average consumption percentages for the pump stations.

Figure 4-5 Celestial PS 69% Consumed

Figure 4-6 Surveyor PS 53% Consumed

As shown in the consumption gauge for Celestial Pump Station (Figure 4-5), the average consumption of the assets at this facility is 69%. This means that the assets at this building are in fair condition and are beginning to age.

Figure 4-6 shows the consumption gauge for Surveyor Pump Station. This facility is in decent condition, considering the recent upgrades that were made to improve the facility.

Figures 4-7 through 4-10 show the average consumption percentages for the reservoirs.

Figure 4-7 Addison Circle EST 49% Consumed

Figure 4-8 Celestial GST 30% Consumed

Figure 4-9 Surveyor EST 7% Consumed

Figure 4-10 Surveyor GST 4% Consumed

The Town's reservoir assets are relatively in good condition, considering that their consumption percentages are low. The Town recently refurbished the water tower structure at Addison Circle EST, which led to a significant improvement in overall facility condition and extension of useful life. In addition, the Town recently did an extensive refurbishment at Surveyor GST, as well. The lower consumption percentages show that the reservoir assets currently have long remaining useful lives.

What Does the Town Need to Sustain the Delivery of Services?

In order to estimate the long-term asset replacement and rehabilitation needs for the Water Management System, a life-cycle cost analysis was performed for each asset. Each asset class was assigned a life cycle cost logic or management strategy that includes the rehabilitation and replacement activities to best characterize the life cycle investment needs for the asset. Below is a sample list of management strategies used to calculate the life-cycle costs of the water assets. The estimated useful life is based on reference documents, similar projects, and staff review.

Table 4-6 Examples of Water Asset Management Strategies

Asset Class	Useful Life	Rehabilitation Activity	Frequency (Years)
Water Main	100	*No rehabilitation activity	N/A
Pump	30	Rehab (e.g. clean, replace bearings, replace impeller)	15
Motor	30	Rehab	10
Reservoir	100	Coat interior and exterior	20
Flow Meter	20	*No rehabilitation activity	N/A

The figure below displays the 30-year replacement and rehabilitation needs for the Water Management System. Utilizing a deterministic model, the average needs are approximately $478,000 per year. The graph predicts smaller replacement needs for approximately the next 10 years. However, after 2027, the needs will start to increase. For example, the peak in 2028 includes re-coating of the interior and exterior walls of the structure at Addison Circle EST, replacement of various MCC components at Celestial Pump Station, and replacement and rehabilitation of some water meters and water valves. In addition, the peak in the 2033 includes a re-coating of the interior and exterior walls of the water tower structure at Surveyor EST that is estimated to cost $1.5 million. Similarly, the peak in 2038 includes re-coating and other general rehabilitation needs for Celestial GST. The majority of pipe replacement needs will start in the early 2040s. Although there are relatively low investment needs in the near future, it is important to note that the investment needs will sharply increase beyond this 30-year planning horizon.

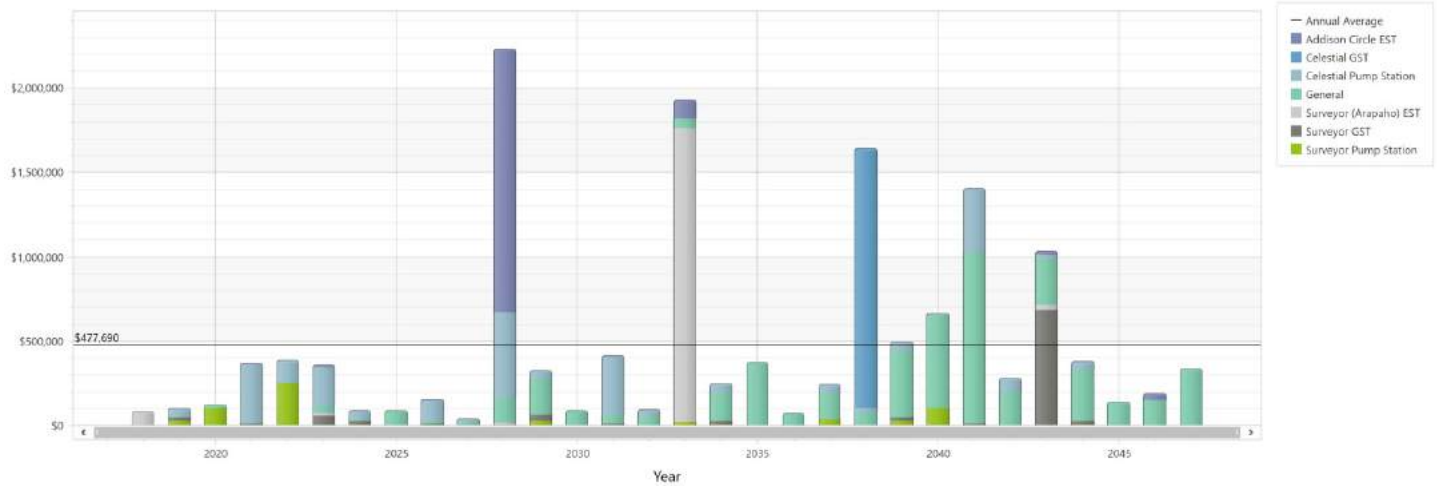


Figure 4-11 30-Year Water Asset Replacement and Rehabilitation Profile (Deterministic Model)

The 30-year life cycle cost analysis was repeated utilizing a probabilistic model, in which asset failures were smoothed to represent a more realistic expectation. The probabilistic model predicts the annual replacement and rehabilitation needs to be approximately $423,000 per year.

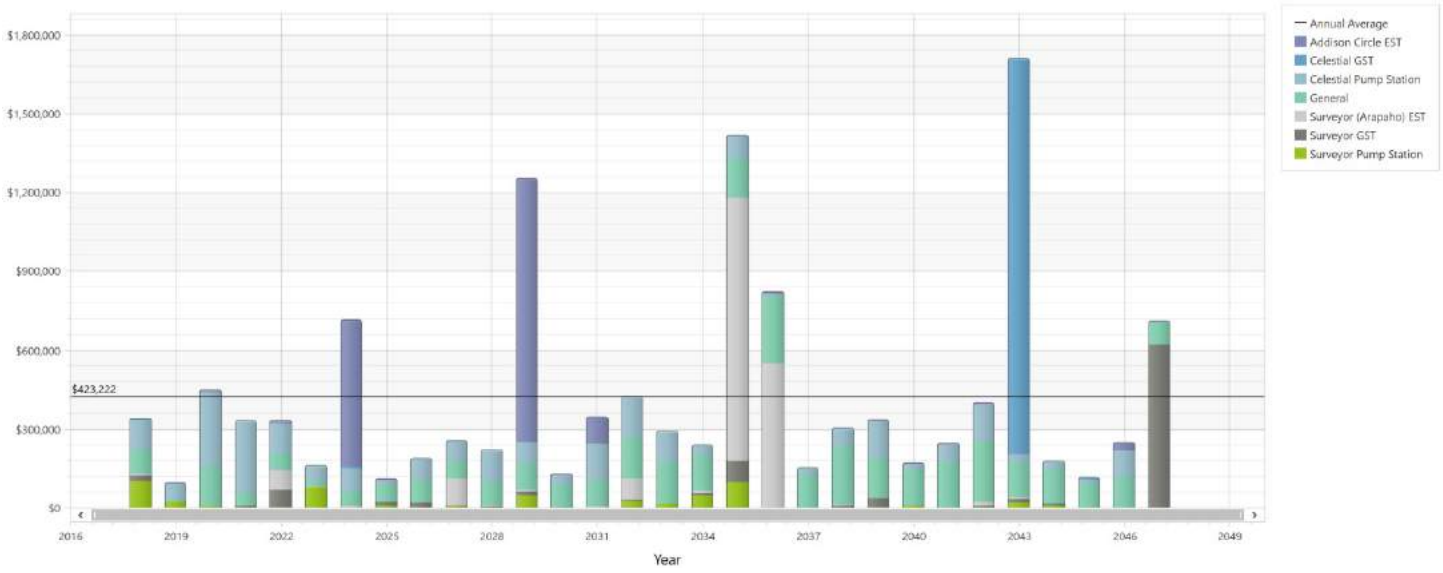


Figure 4-12 30-Year Water Asset Replacement and Rehabilitation Profile (Probabilistic Model)

Both analyses above represented results in today's dollars (2018). Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from approximately $478,000 per year to $796,000 per year. Similarly, for the probabilistic model, the annual investment need increased from approximately $423,000 per year to $696,000 per year. The results of these analyses are summarized in the table below.

Table 4-7 Water Management System 30-Year Summary

30-Year	Annual Average
Deterministic	$478,000/yr
Probabilistic	$423,000/yr
Deterministic with 3% Inflation	$796,000/yr
Probabilistic with 3% Inflation	$696,000/yr

In referencing the Town's 2018 Water and Sewer Rate Study, the capital budget allocated in the rate study exceeds projected amounts generated in the above analysis. With the adoption of the new water rate, the Town will be able to generate enough capital to address the projected needs of the Water Management System.

How Should the Town Prioritize?

In order to prioritize the limited budget available to address the ongoing replacement and rehabilitation needs of the water assets, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was utilized.

The CoF scores of the Water Management System mains were assessed based on the social, economic, and environmental consequences of a main failure. Each main was assessed based on its location and service area. Pipe failures that would cause disruptions to businesses and traffic were given higher CoF scores. For instance, a large main that serves a large number of customers was given a higher CoF. In particular, mains that would cause disruptions to businesses and traffic flow were given higher CoF scores.

Pipe size, zoning classification of the pipe location, pipe proximity to major roads, and pipe proximity to body of water were used as factors in the CoF score. These factors were weighted, and the factors were assigned for each pipe segment. The following table summarizes the weight each factor was given to determine the overall CoF score.

Table 4-8 Mains CoF Weighting Factors

CoF Factors	Weighting
Pipe Size	50%
Zoning	15%
Creek	10%
Street	25%

The zoning or the use of the land at the location of the main was considered when assigning CoF. This factor is used to highlight pipes near businesses where the impact of a failure can be greater. The following table shows the zoning scores assigned to each pipe.

Table 4-9 Zoning CoF Factor

Zoning Classification	CoF Score
Industrial/Airport	5
Commercial	5
Local Retail	4
Urban Center	4
Mixed Use	4
Apartment	3
Planned Development	3
Residential	3
Park	3

The proximity of the main to major roads was also a major factor in the CoF. A main failure that disrupts traffic flow and necessitates the replacement of the pavement has high social and economic consequences. As such, the CoF of pipes within 100 feet of larger roads with higher traffic levels were given higher CoF scores.

Table 4-10 Street CoF Factor

Street Classification	CoF Score
Tollway	5
Arterial	5
Major Collector	4
Minor Collector	3
Major Local	2
Major Commercial	2
Major Residential	2
Minor Local	1
Minor Commercial	1
Minor Residential	1
Private	1

The proximity of the main to a body of water was also considered. A spill entering a water body (e.g., ponds, streams, creeks) can have an environmental consequence. Any pipe close to a creek was given a higher CoF score.

Table 4-11 Creek CoF Factor

Creek Classification	CoF Score
Creek/Channel	4

The greater the size of the pipe, the greater the impact of failure as a larger diameter carries a greater water volume and would affect a larger number of customers. In addition, the larger pipes can be costlier to replace and are likely to be located under major roads. As such, the larger the pipe size, the higher the CoF.

Table 4-12 Pipe Size CoF Factor

Pipe Diameter (in)	CoF Score
1	1
2	1
3	2
4	2
6	3
8	3
10	4
12	4
16	5
18	5
20	5
24	5
30	5
36	5
42	5

Other Assets

The following table shows some of the CoF scores assigned to other asset classes. Hydrants and fire services have a major impact on public safety and were given a CoF score of 5. Larger meters tend to serve businesses and serve more customers, and as such were given higher CoF scores.

Table 4-13 Other Asset CoF Scores

Type	CoF
Fire Hydrant	5
Fire Service	5
Meter (≤ 1 in)	1
Meter (2 - 4 in)	3
Meter (6 - 8 in)	4

In addition, valves were assigned a CoF score based on the CoF of the pipe to which they were connected.

Water Facilities

CoF assessment took place through a logic based on each asset class' importance to the system relative to the function of the entire facility and to other asset classes. The CoF scores for each asset class in the water facilities is presented in the table below. Assets with a CoF score of 5 indicates that the facility will not be able to perform its function in the case of asset failure. A lower CoF score indicates that the facility will still be able to function even if the asset fails.

Table 4-14 Facility Asset Class CoF Scores

Asset Class	CoF
Generator	5
Generator Fuel Tank	5
MCC	5
Motor	5
Process Structure	5
Pump	5
Emergency Shower	5
SCADA	5
Transformer	5
Vault Structure	5
Wet Well Structure	5
Level Transducer	5
Level Transmitter	5
Battery Backup Power	4
Capacitor	4

Asset Class	CoF
Control Panel	4
Load Bank	4
Mixer	4
Sump Pump	4
Analyzer	4
Flow Meter	4
Flow Transmitter	4
Level Switch	4
Pressure Transmitter	4
Vibration Switch	4
Gate	4
Filter	3
Lifting Equipment	3
Building	3
Expansion Joint	2

Asset Class	CoF
Air Dryer	2
Exhaust Fan	2
Heater	2
Louver	2
Supply Fan	2
Ladder	2
Driveway	2
Stairways	2
Valve	2
Vent	2
Access Hatch	2
Fencing	2
Actuator	2
Lighting	1
Tank	1

The following figures give a detailed look at the CoF levels of the water mains. The CoF scores were based on multiple factors, including proximity to roads, pipe diameter, and zoning. Most of the water mains have low CoF; a few mains on arterials, marked in red, have high CoF.

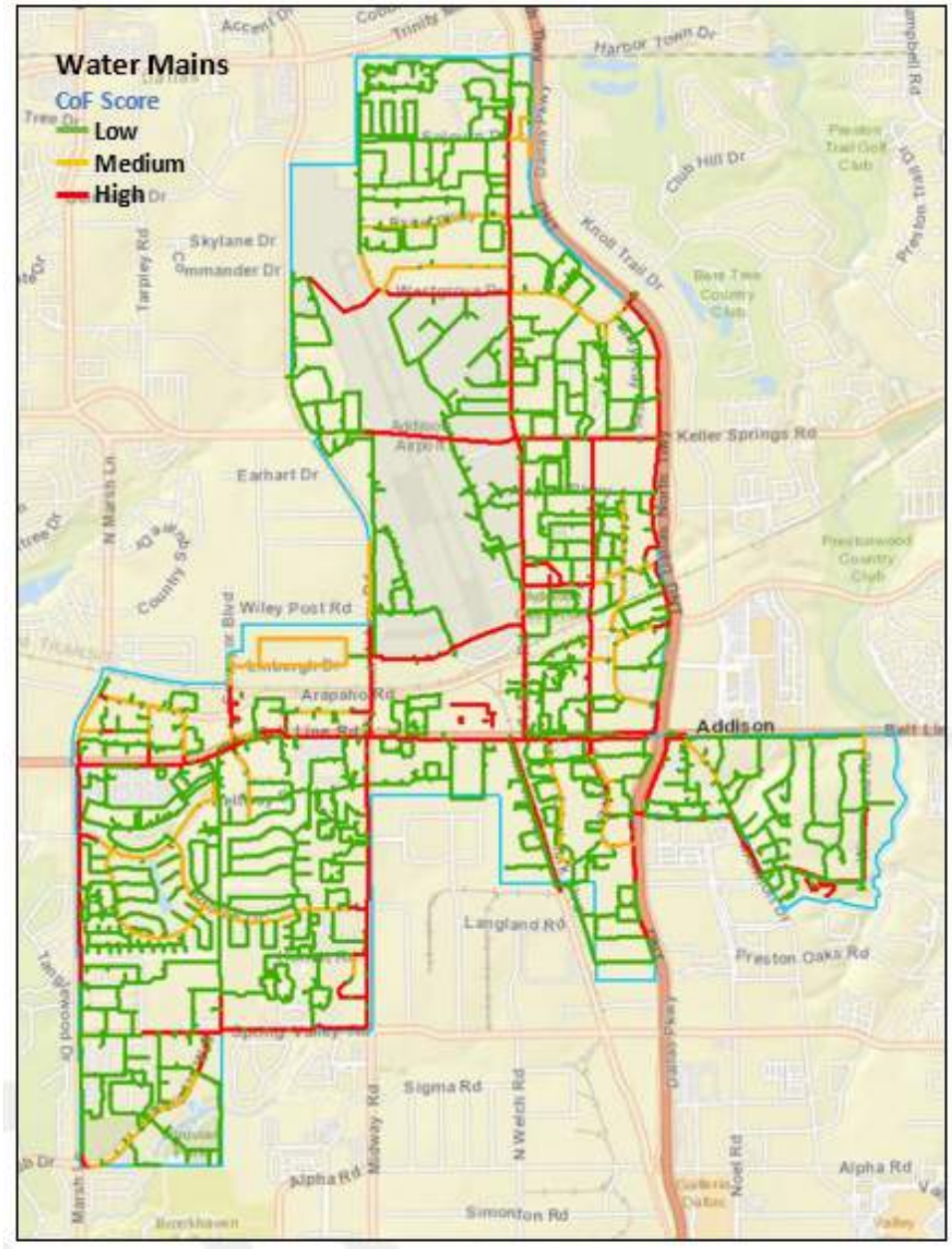


Figure 4-13 Water Mains CoF Map

The following figure shows the resulting overall risk profile for the Water Management System. Currently, there are only 24 assets in the high-risk zone with a total replacement cost of approximately $617,000. The majority of these high-risk assets are found at Surveyor Pump Station, such as the pumps, motors, and MCC Cabinet components. These assets are old and are nearing the end of their useful lives. The remaining high-risk assets include the generator at Celestial Pump Station, the analyzer, Solarbee mixer, and uninterruptible power supplies (UPS) at Surveyor EST and Addison Circle EST.

Figure 4-14 Water Risk Matrix

Although there are currently only 24 high-risk assets in the Water Management System, the value of assets that will require replacement or rehabilitation in the next 10 years is approximately $1.8 million. While the replacement cost of assets might be high, the risk can be mitigated by maintenance or rehabilitation, so the cost to lower the risk scores may be significantly less than the total value.

The following figures present the risk results for the Water Management System mains. Although there are both high PoF and CoF mains, the combined scores resulted in mostly low to medium risk water mains, as shown in the map.

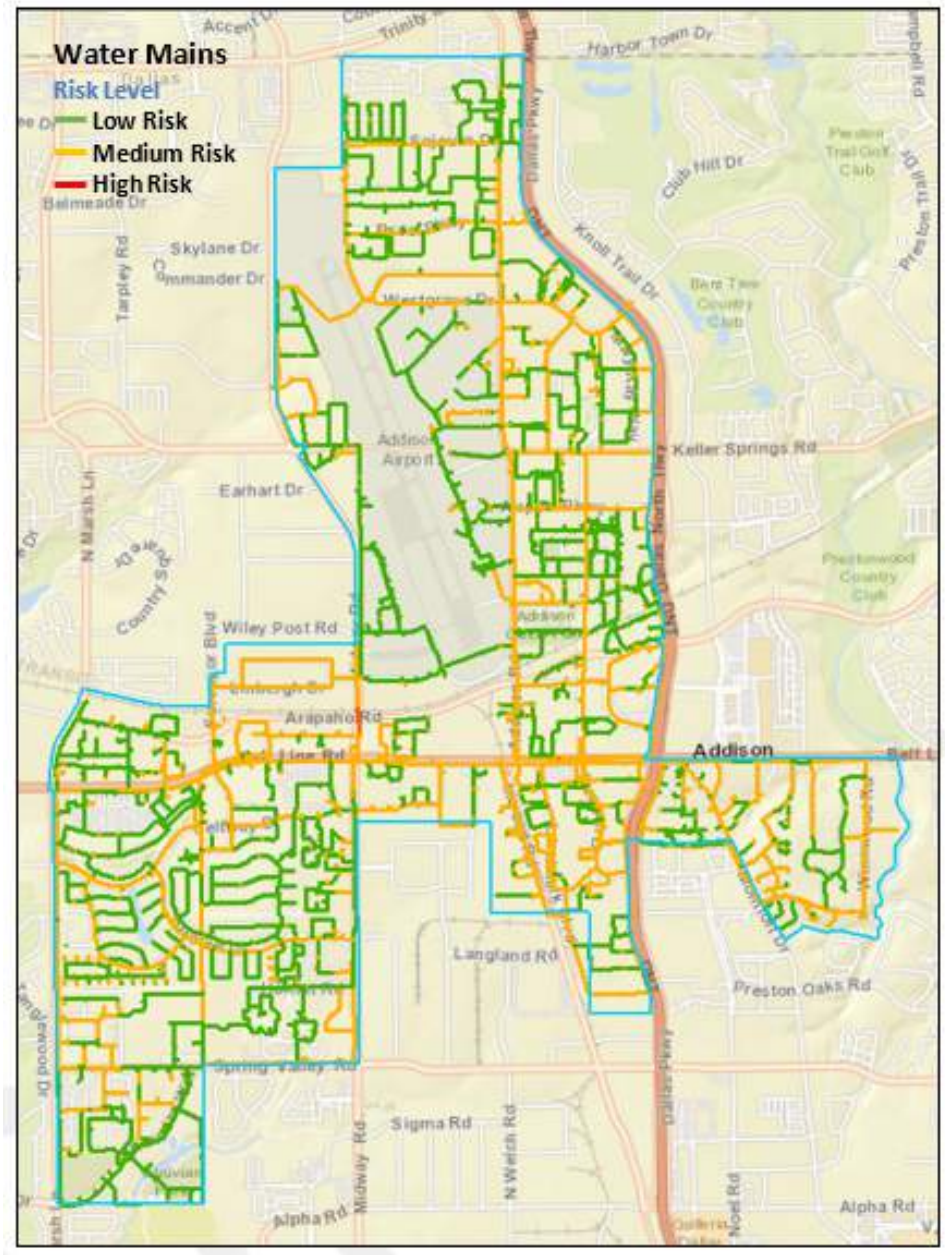


Figure 4-15 Water Mains Risk Map

The figures below show the risk profiles for the water facility assets. Of the facilities, only Celestial Pump Station, Surveyor Pump Station, and Surveyor (Arapaho) EST Reservoir have high risk assets. As mentioned previously, these high-risk assets include pumps, motors, MCC components, UPS, and analyzers.

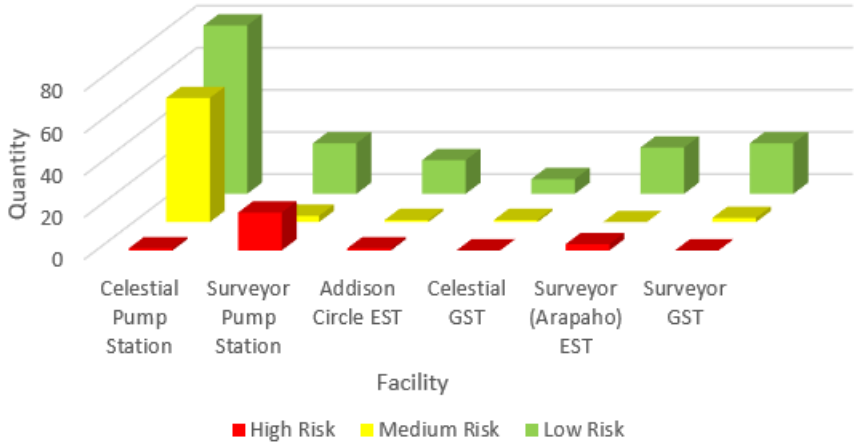


Figure 4-16 Facility Risk Level by Quantity

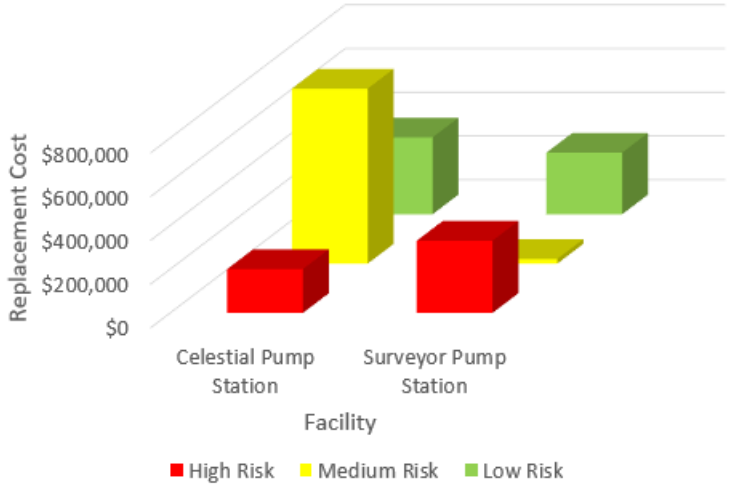


Figure 4-17 Pump Station Risk Level by Replacement Cost

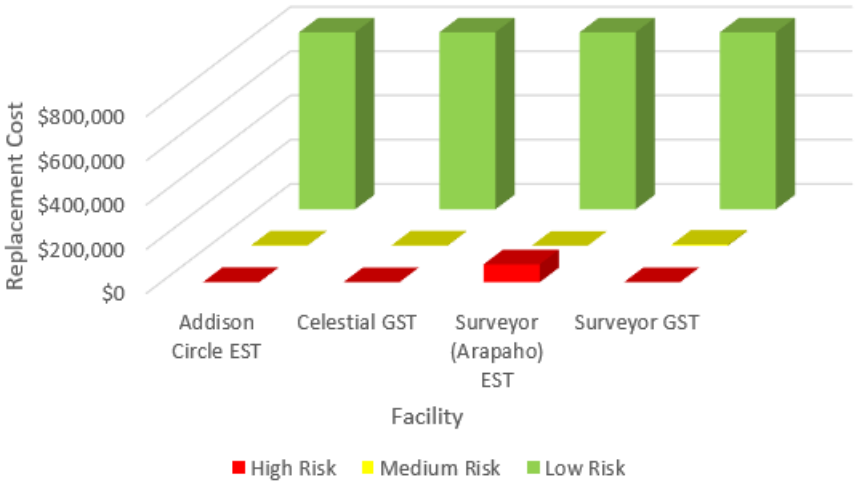


Figure 4-18 Reservoir Risk Level by Replacement Cost

The following table displays the total Catch Up, or the total replacement and rehabilitation costs in 2018 as well as the Keep Up for a 30-year planning horizon. These amounts are represented in current year (2018) dollars.

Table 4-15 Catch Up and Keep Up Values

Category	Cost
Catch Up	$ 612,531
Keep Up	$ 463,957/yr

What Level of Service Should the Town Provide?

Level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Two scenarios were developed: Preferred Level of Service and Minimum Level of Service.

As shown in Figure 4-11, the estimated annual needs over a 30-year horizon for the Preferred Level of Service was approximately $478,000.

The figure below shows the rehabilitation and replacement profile over a 30-year horizon for the Minimum Level of Service, where only high-risk assets (with CoF 4 or higher) are addressed. The annual average needs for the Minimum Level of Service is approximately $316,000 per year.

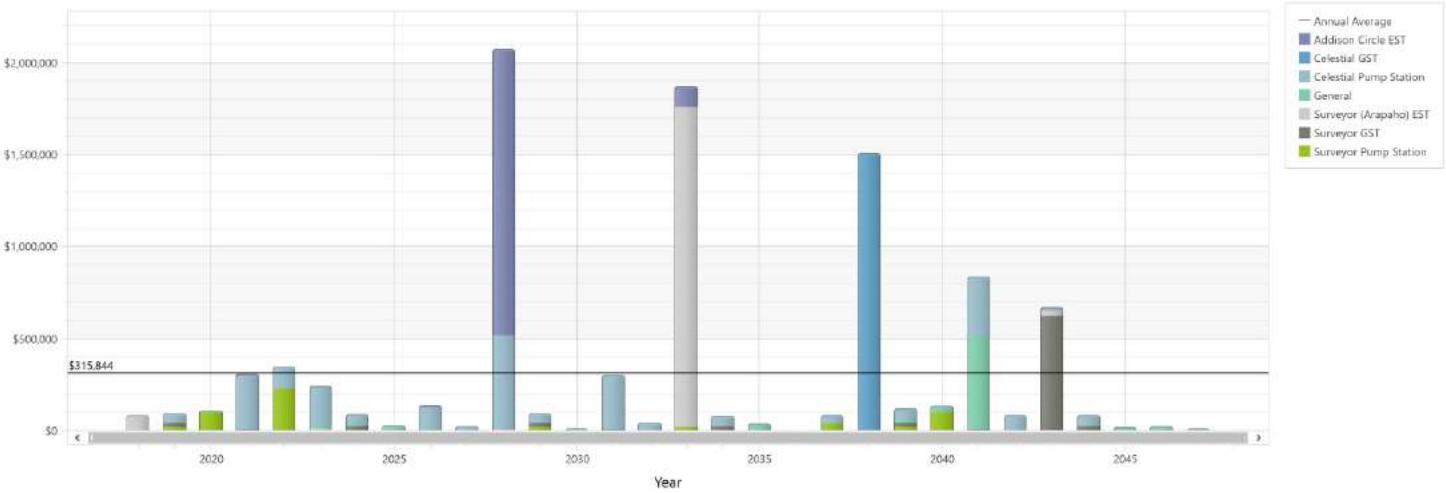


Figure 4-19 Minimum Level of Service Replacement and Rehabilitation Profile

While funding only the high-risk assets would allow the Town to prioritize the more critical needs, this Minimum Level of Service would not address several of the Town's water assets. As such, the Minimum Level of Service is not recommended. The Minimum Level of Service scenario is only performed to present the lower spectrum of the funding requirements.

5 | Wastewater Management System

Physical Health Score A

What Does the Town Own and Manage?

The Town owns and manages a total of 3,518 Wastewater Management System assets. The system is composed of approximately 68 miles of sewer lines (i.e. force mains, gravity mains, laterals) and a lift station. The table below summarizes the items included in the Wastewater Management System.

Table 5-1 Wastewater Management System Asset Inventory

Asset	Quantity	Length
Cleanouts	587	
Force Mains		2.3 mi
Gravity Mains		60.6 mi
Laterals		4.9 mi
Manholes	1,059	
Facility Assets (e.g. Pump, Motor, Dry Well Structure, etc.)	68	

Table 5-2 Sewer Line Inventory

Material	Length (mi)
CI	0.1
PVC	60.5
VCP	7.1
VCT	0.1

What is an Asset?

In the case of wastewater, every main, manhole, cleanout, and lift station asset (e.g., motor control center (MCC), pumps, motors) is considered an asset. Lift station building assets (e.g., roof, structure, doors) are included in the Building Asset Management system.

Assets are grouped into classes to more efficiently model and manage the assets. Below is a complete list of asset classes in the Wastewater Management System.

Table 5-3 Wastewater Asset Classes

Asset Classes - Wastewater			
Access Hatch	Gravity Main	Load Bank	Supervisory Control and Data Acquisition (SCADA)
Cleanout	Heating, Ventilation, and Air Conditioning (HVAC)	Manhole	Stairways
Control Panel	Instrumentation	MCC	Transformer
Force Main	Lateral	Motor	Valve
Generator	Lifting Equipment	Pump	Vault Structure
Generator Fuel Tank	Lighting	Emergency Shower	Wet Well Structure

What is the Replacement Value of the Town's Assets?

In total, there are 3,518 assets in the Wastewater Management System. The replacement cost for each asset was estimated. It should be noted that replacement cost represents an estimated cost to replace the asset either by Town staff or by contractor. It does not represent a project cost that include engineering, management, insurance, contingency, etc., costs. In many cases, project costs can add an extra 15% to 30% to the replacement cost. The sum of all replacement costs in the Wastewater Management System, in 2018 dollars, is approximately $65 million.

The following figure shows the total asset replacement cost of the Wastewater Management System by major asset categories. Gravity mains make up most of the value of the Wastewater Management System at approximately $52 million (80%), followed by manholes at approximately $6 million. The remaining valuation is made up of laterals, cleanouts, force mains, and lift station assets.

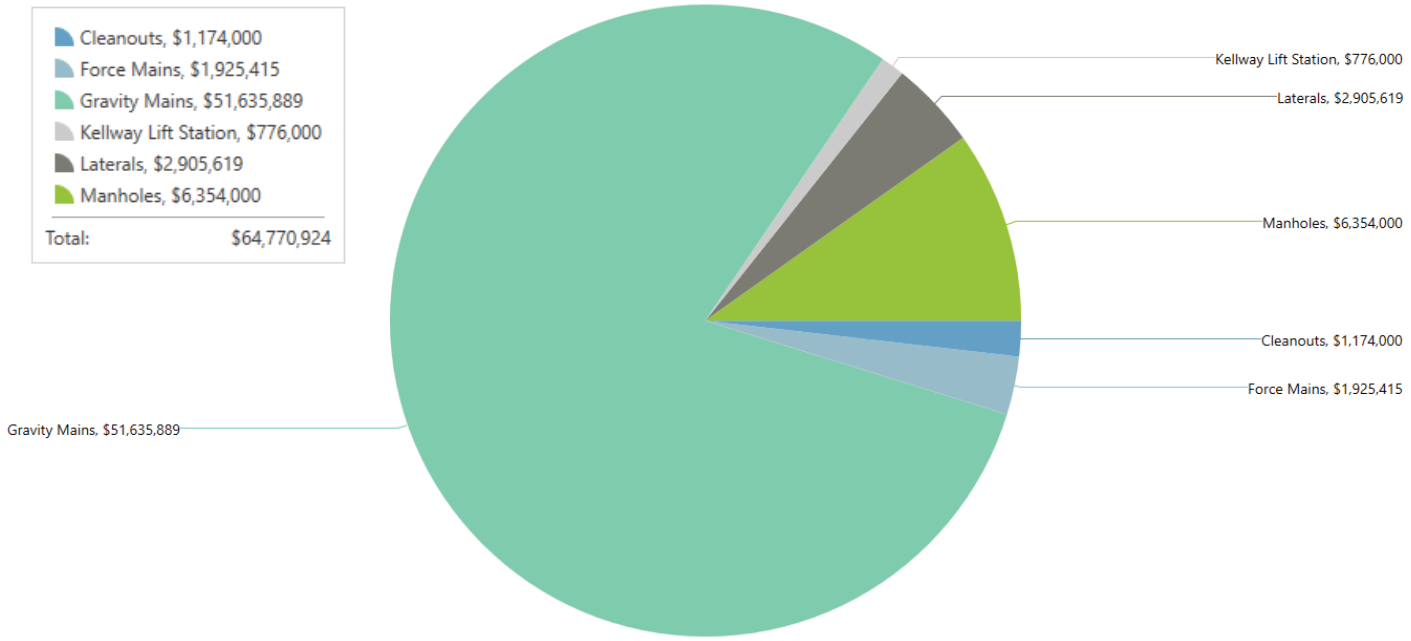


Figure 5-1 Wastewater Management System Valuation

The following tables summarize the estimated total asset replacement cost by asset type (Table 5-4) and by facility (Table 5-5).

Table 5-4 Summary of Wastewater Asset Replacement Costs

Asset	Number of Assets	Length	Replacement Cost
Cleanouts	587		$1,174,000
Force Mains		2.3 mi	$1,925,415
Gravity Mains		60.6 mi	$51,635,889
Laterals		4.9 mi	$2,905,619
Manholes	1,059		$6,354,000
Total	**1,646**	**67.8 mi**	**$63,994,923**

Table 5-5 Summary of Wastewater Facility Asset Replacement Costs

Facility	Number of Assets	Replacement Cost
Kellway Lift Station	68	$776,000*

*Does not include building assets

What is the Condition of the Town's Assets?

During the asset inventory process, the general condition of the asset was assessed or estimated. Where the asset was visible, a general assessment took place through visual inspection. In some cases, however, assets are not visible or visual assessment is not a good representation of the asset's condition. In such cases, the anticipated condition score was estimated based on the age of the asset. Age-based calculation required evaluation of the asset age, expected useful life, and anticipated decay curve.

The following figure represents the general condition of the Wastewater Management System sewer lines based on pipe construction years. As is shown in the figure, most of the sewer lines were installed beginning the 1970s. It is very difficult to do a condition assessment on mains due to the possibility of sewer line disruption during the assessment process. As such, it is very typical to drive the general condition analysis process based on age. The relatively young pipe age for most of the sewer lines leads to an overall relatively good condition for the pipes. However, there are some sewer lines that are known to need replacement in the near future. About 4.5% of the sewer lines are over 50 years old and are nearing the end of their useful lives.

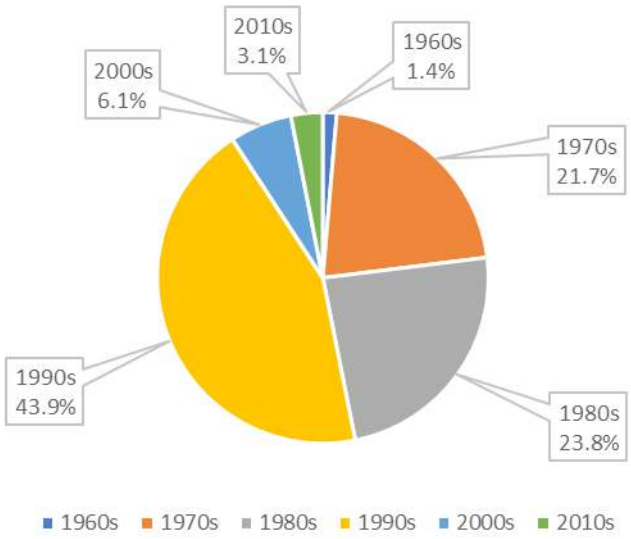


Figure 5-2 Sewer Line Construction by Decade

The following figure shows Kellway Lift Station by average consumption. Consumption is a measure of an asset's estimated age or condition relative to its expected useful life. For instance, if a pump has a useful life of 30 years and it is 25 years old, it has used 83% of its useful life. Figure 5-3 shows the average consumption percentage for the lift station assets.

Figure 5-3 Kellway LS 63% Consumed

As shown in the consumption gauge for Kellway Lift Station (Figure 5-3), the average consumption of the assets at this facility is 63%. This means that the assets at this building are in fair condition. Overall, the 63% consumption percentage shows that the facility and its included components still retain much of their useful lives.

What Does the Town Need to Sustain the Delivery of Services?

In order to estimate the long-term asset replacement and rehabilitation needs for the Wastewater Management System, a life-cycle cost analysis was performed for each asset. Each asset class was assigned a life cycle cost logic or management strategy that includes the rehabilitation and replacement activities to best characterize the life cycle investment needs for the asset. Below is a sample list of management strategies used to calculate the life-cycle costs of the wastewater assets.

Table 5-6 Examples of Wastewater Asset Management Strategies

Asset Class	Useful Life	Rehabilitation Activity	Frequency
Wastewater Pipe – Clay	90		
Wastewater Pipe – PVC	100		
Lateral	50		
Generator	30		
Pump	25	Rehab (e.g. clean, replace bearings, replace impeller)	10

The figure below displays the 30-year replacement and rehabilitation needs for the Wastewater Management System. Utilizing a deterministic model, the average needs are approximately $97,000 per year. The graph predicts smaller replacement needs for the next 10 years. Beginning 2029, however, the needs will start to increase. For example, the peak in 2029 includes a large number of lateral replacements and replacement of the automatic transfer switch at the lift station. Similarly, the peak in 2031 includes many updates to the lift station, including replacement of various instrumentation and controls, valves and pumps, as well as lateral replacements. Although there currently aren't significant investment needs, it is important to note that the investment needs will sharply increase in the near future. In other words, the majority of investment needs will be required during the late 2020s to the early 2030s.

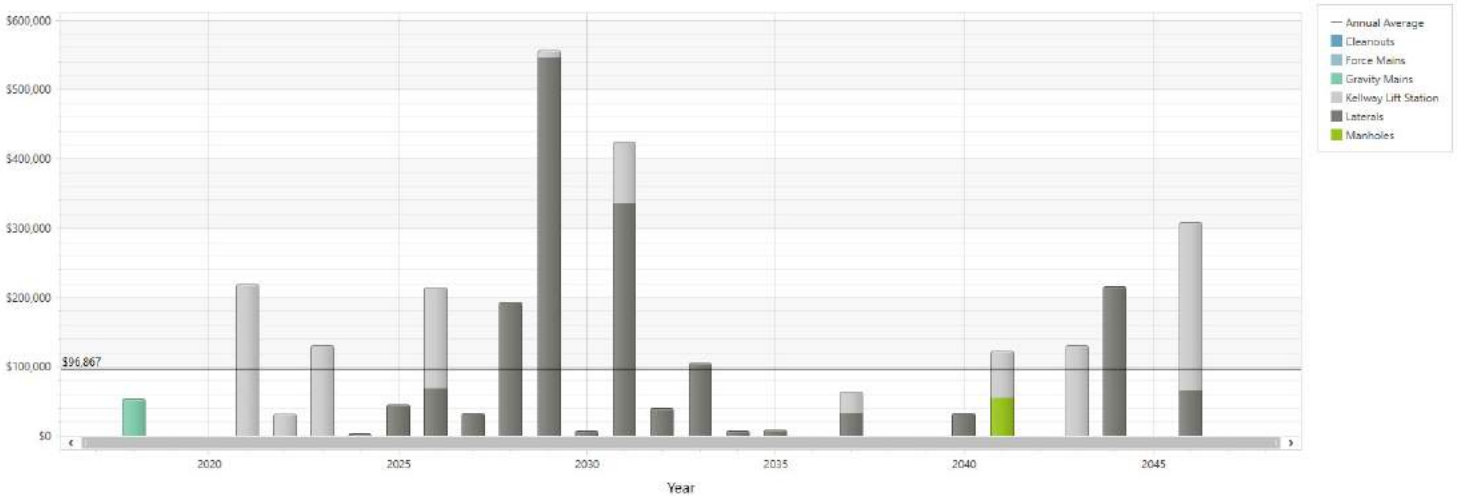


Figure 5-4 30-Year Wastewater Asset Replacement and Rehabilitation Profile (Deterministic Model)

As demonstrated in the figure above, the majority of pipes are relatively young and will not require replacement within the next 30 years.

The 30-year life cycle cost analysis was repeated utilizing a probabilistic model, in which asset failures were smoothed to represent a more realistic expectation. The probabilistic model predicts the annual replacement and rehabilitation needs to be approximately $77,000 per year.

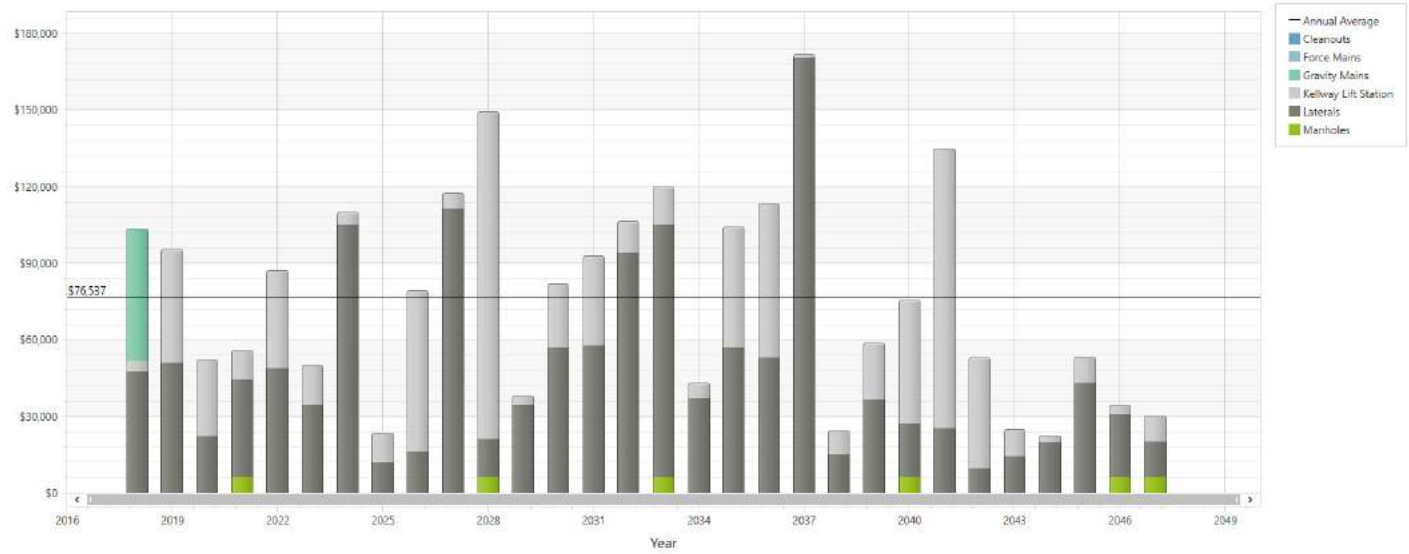


Figure 5-5 30-Year Wastewater Asset Replacement and Rehabilitation Profile (Probabilistic Model)

Both analyses above represented results in today's dollars (2018). Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from approximately $97,000 per year to $152,000 per year. Similarly, for the probabilistic model, the annual investment need increased from approximately $77,000 per year to $117,000 per year. The results of these analyses are summarized in the table below.

Table 5-7 Wastewater Management System 30-Year Summary

30-Year	Annual Average
Deterministic	$97,000/yr
Probabilistic	$77,000/yr
Deterministic with 3% Inflation	$152,000/yr
Probabilistic with 3% Inflation	$117,000/yr

In referencing the Town's 2018 Water and Sewer Rate Study, the capital budget allocated in the rate study exceeds projected amounts generated in the above analysis. As such, the capital that will be generated from the new water rate will increase the funding for the Wastewater Management System.

How Should the Town Prioritize?

In case of budgetary limitations, the Town will need to prioritize the ongoing replacement and rehabilitation needs of the wastewater assets. A risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was utilized.

The CoF scores of the Wastewater Management System pipes were assessed based on the social, economic, and environmental consequences of a failure. Pipes were assessed based on their location. Pipe failures that would cause disruptions to businesses and traffic were given higher CoF scores. The higher the cost (e.g., large pipe sizes, pipes under roads), the more social disruption (e.g., road closures), and the higher the environmental consequences (e.g., pipe breaks near a body of water), the higher the overall CoF of the pipes.

Pipe size, zoning classification of the pipe location, pipe proximity to major roads, and pipe proximity to body of water were used as factors in the CoF score. These factors were weighted, and the factors were assigned for each pipe segment. The following table summarizes the weight each factor was given to determine the overall CoF score.

Table 5-8 Mains CoF Weighting Factors

CoF Factors	Weighting
Pipe Size	40%
Zoning	15%
Creek	15%
Street	30%

The zoning or the use of the land at the location of the pipe was considered when assigning CoF. This factor is used to highlight pipes near businesses, where the impact of failure can be greater. The following table shows the zoning scores assigned to each pipe.

Table 5-9 Zoning CoF Factor

Zoning Classification	CoF Score
Industrial/Airport	5
Commercial	5
Local Retail	5
Urban Center	5
Mixed Use	4
Apartment	3
Planned Development	3
Residential	3
Park	3

The proximity of the pipe to major roads was also a major factor in the CoF. A pipe failure that disrupts traffic flow has high social and economic consequences. As such, the CoF of pipes within 100 feet of larger roads with higher traffic levels were given higher CoF scores.

Table 5-10 Street CoF Factor

Street Classification	CoF Score
Tollway	5
Arterial	5
Major Collector	4
Minor Collector	3
Major Local	2
Major Commercial	2
Major Residential	2
Minor Local	1
Minor Commercial	1
Minor Residential	1
Private	1

The proximity of the pipe to a body of water was also considered. A wastewater spill entering a water body (e.g., ponds, streams, creeks) can have high environmental consequence. Any pipe close to a creek was given a higher CoF score.

Table 5-11 Creek CoF Factor

Creek Classification	CoF Score
Creek/Channel	5
Pond	5

The greater the size of the pipe, the greater the impact of failure as a larger diameter carries a greater water volume and would affect a larger number of customers. In addition, the larger pipes are costlier to replace and are likely to be located under major roads. As such, the larger the pipe size, the higher the CoF.

Table 5-12 Pipe Size CoF Factor

Pipe Diameter (in)	CoF Score
1	1
2	1
4	2
6	3
8	3
10	4
12	4
14	4
15	4
16	5
18	5
21	5
24	5
30	5

Other Assets

Manholes and cleanouts were assigned a CoF score based on the CoF of the sewer line to which they were connected.

Wastewater Facility

CoF assessment took place through a logic based on each asset class' importance to the system relative to the entire facility and to other asset classes. The CoF scores for each asset class in the lift station is presented in the table below. Assets with a CoF score of 5 indicates that the facility will not be able to perform its function in the case of asset failure. A lower CoF score indicates that the facility will still be able to function even if the asset fails.

Table 5-13 Facility Asset Class CoF Scores

Asset Class	CoF
Generator	5
Generator Fuel Tank	5
Instrumentation	5
MCC	5
Motor	5
Pump	5

Asset Class	CoF
Emergency Shower	5
SCADA	5
Vault Structure	5
Wet Well Structure	5
Control Panel	5
Load Bank	4

Asset Class	CoF
Stairways	4
Overhead Crane	3
HVAC	2
Valve	2
Access Hatch	1
Lighting	1

The following figure give a detailed look at the CoF levels of sewer lines. The CoF scores were based on multiple factors, including proximity to roads, pipe diameter, and zoning. Most of the sewer lines have low to medium CoF; a few lines marked in red, including pipes near the airport and on arterials such as Marsh Lane, have high CoF.

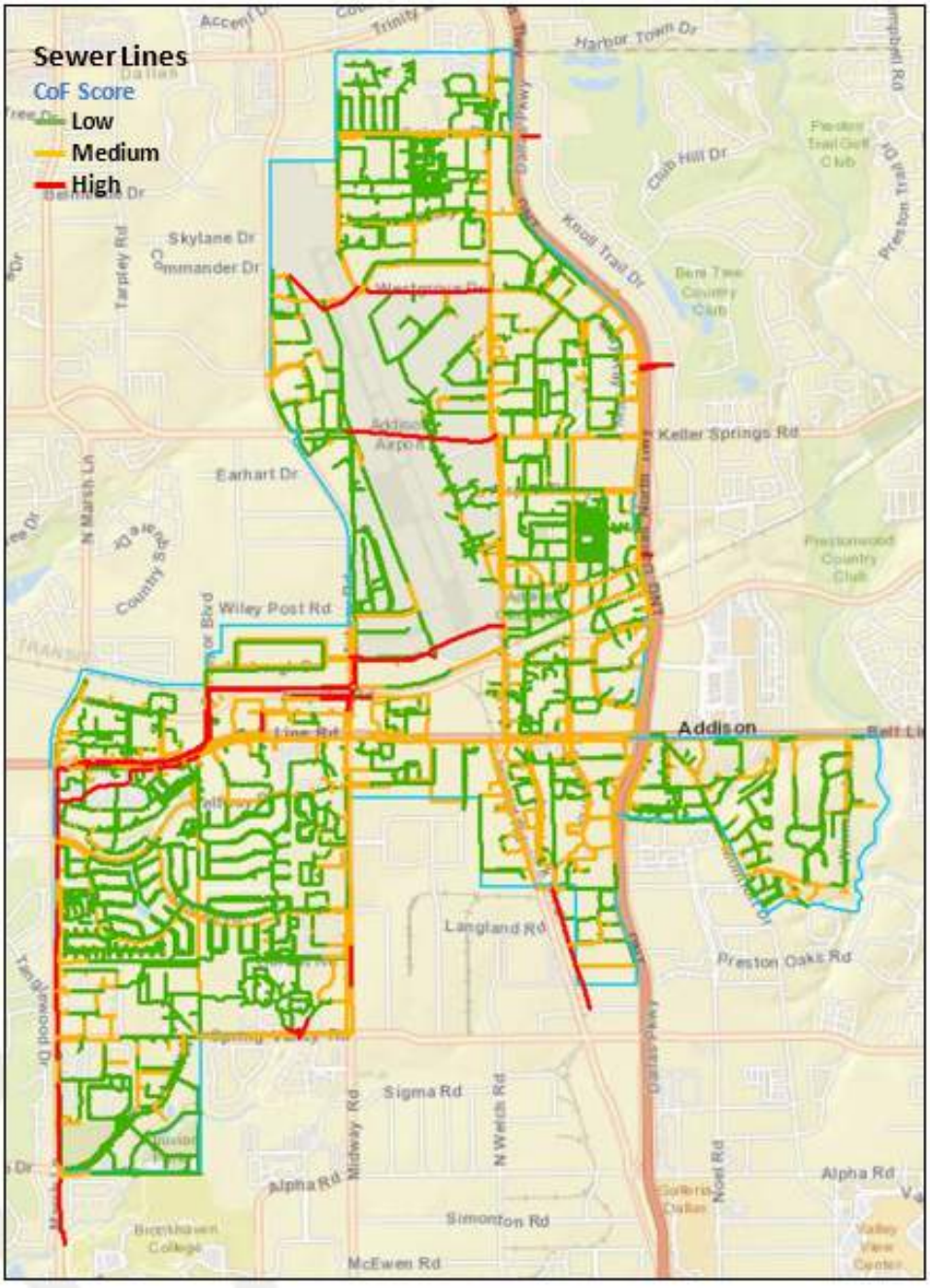


Figure 5-6 Sewer Lines CoF Map

The following figure shows the resulting overall risk profile for the Wastewater Management System. Currently, there are only 4 assets in the high-risk zone with a total replacement cost of approximately $180,000. All of these high-risk assets are lift station assets, including the two pumps, generator, and generator fuel tank. As such, the Wastewater Management System is relatively in good condition overall.

Figure 5-7 Wastewater Risk Matrix

Although there are currently only 4 high-risk assets in the Wastewater Management System, the value of assets that will require replacement or rehabilitation in the next 10 years, is approximately $715,500. While the replacement cost of assets might be high, the risk can be mitigated by maintenance or rehabilitation, so the cost to lower the risk scores may be significantly less than the total value.

The following figures present the risk results for the Wastewater Management System assets. Although there are both high PoF and CoF sewer lines, the combined scores resulted in mostly low to medium risk sewer lines, as shown in the map.

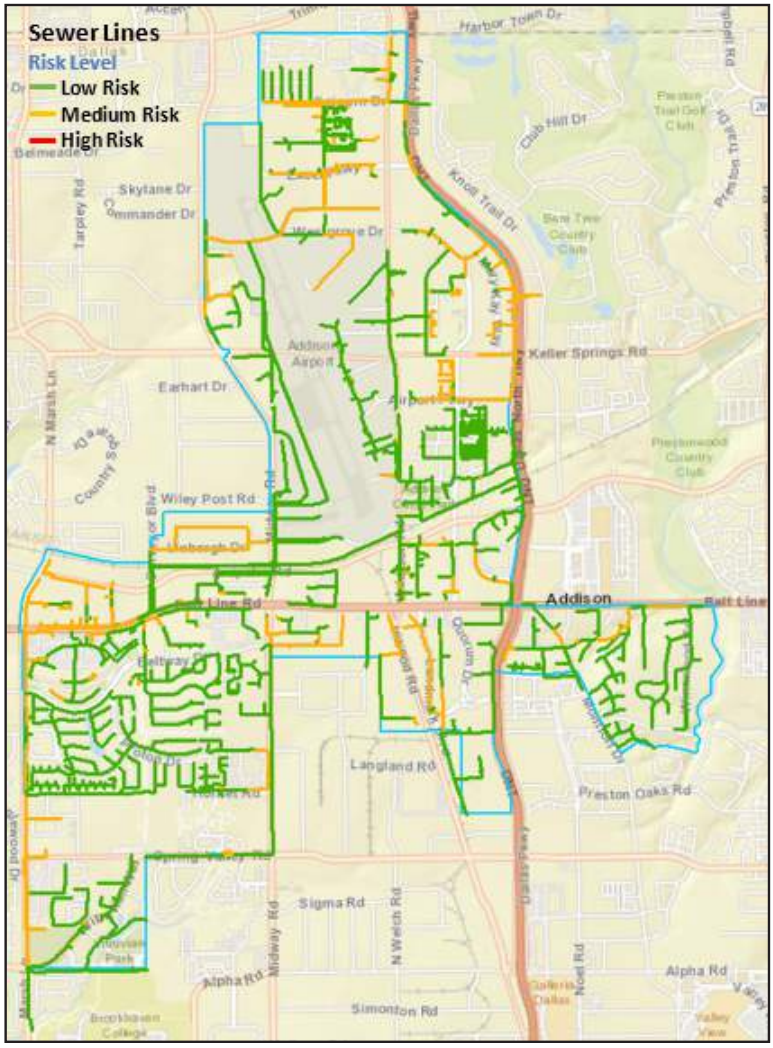


Figure 5-8 Sewer Lines Risk Map

The figures below show the risk profiles for the lift station assets.

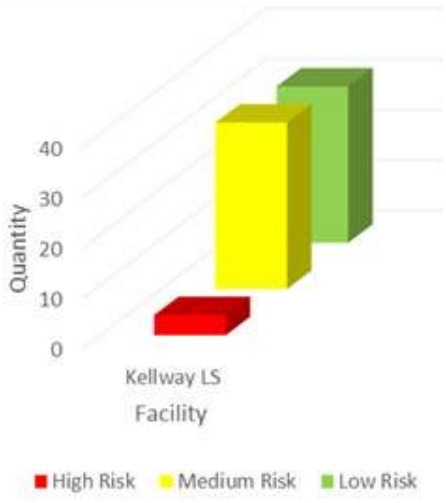


Figure 5-9 Facility Risk Level by Quantity

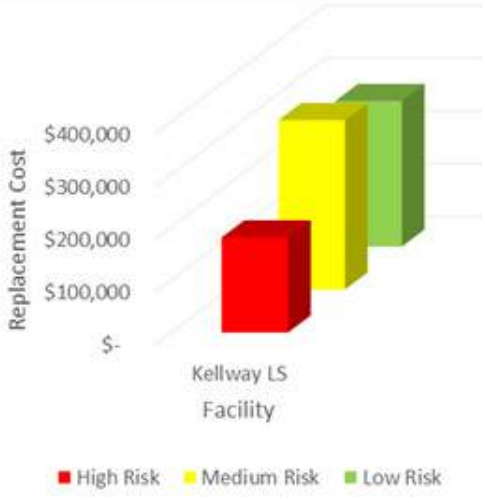


Figure 5-10 Facility Risk Level by Replacement Cost

The following table displays the total Catch Up, or the total replacement and rehabilitation costs in 2018 as well as the Keep Up for a 30-year planning horizon. These amounts are represented in current year (2018) dollars.

Table 5-14 Catch Up and Keep Up Values

Category	Cost
Catch Up	$ 180,000
Keep Up	$ 90,867/yr

What Level of Service Should the Town Provide?

Level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Two scenarios were developed: Preferred Level of Service and Minimum Level of Service.

As shown in Figure 5-4, the estimated annual needs over a 30-year horizon for the Preferred Level of Service was approximately $97,000.

The figure below shows the rehabilitation and replacement profile over a 30-year horizon for the Minimum Level of Service, where only high-risk assets (with CoF 4 or higher) are addressed. The annual average needs for the Minimum Level of Service is approximately $32,000 per year.

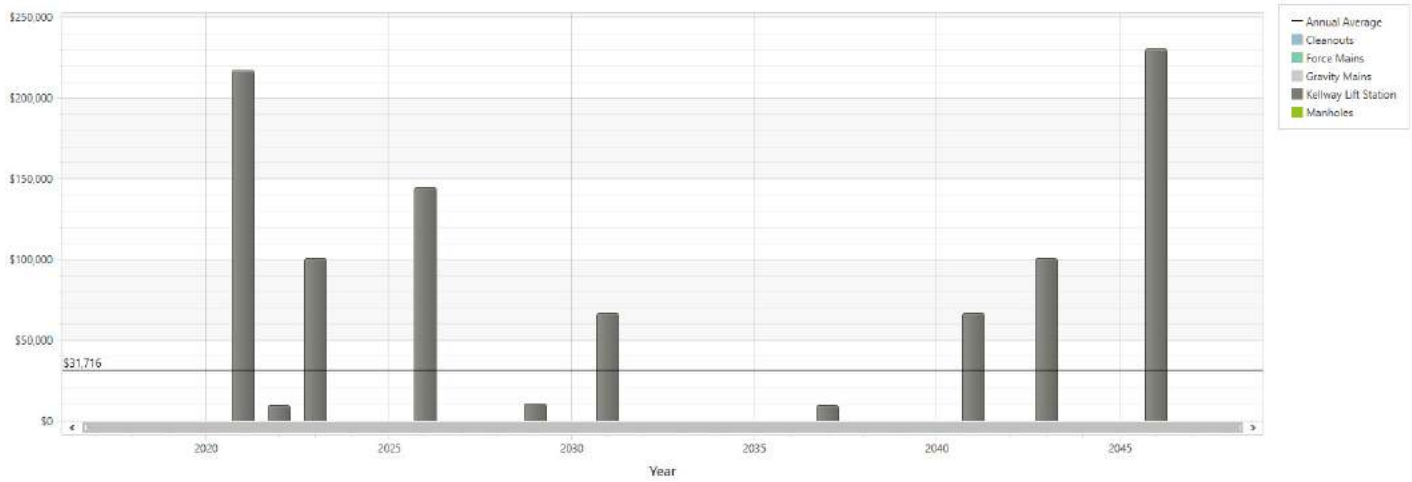


Figure 5-11 Minimum Level of Service Replacement and Rehabilitation Profile

While funding only the high-risk assets would allow the Town to prioritize the more critical needs, this Minimum Level of Service would not address several of the Town's wastewater assets. As such, the Minimum Level of Service is not recommended. The Minimum Level of Service scenario is only performed to present the lower spectrum of the funding requirements.

6 | Pavement Management System

Physical Health Score C

What Does the Town Own and Manage?

The Town owns and manages about 10.5 million square feet of pavement. The Town is responsible for the maintenance, rehabilitation, and replacement of all Town owned pavement. The following map presents the locations of all Town owned pavement.

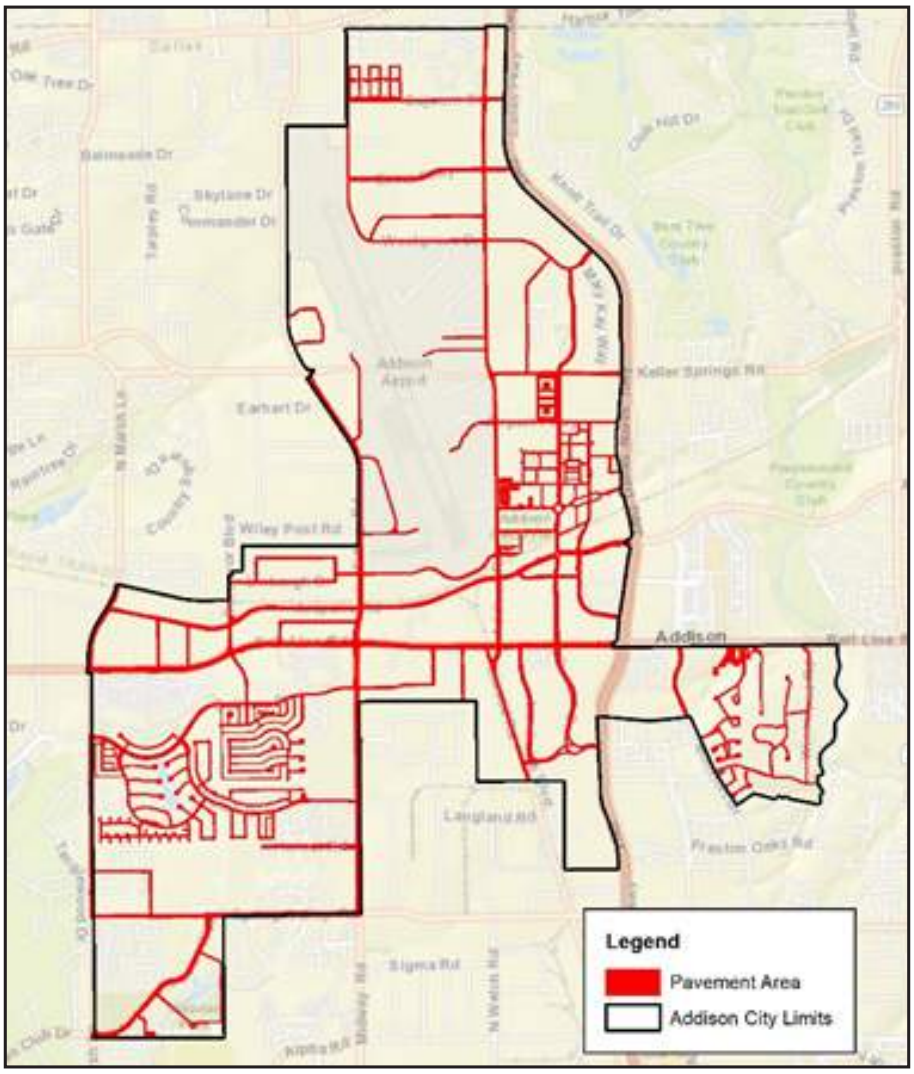


Figure 6-1 Map of Addison Pavement

The Town's 10.5 million square feet of pavement surface can be represented by road classification (e.g., arterial, collector, local, residential, commercial). Arterials are classified as high capacity roads that transport traffic from one end of the town to another. Arterials (e.g., Belt Line Rd., Midway Rd.) connect collector roads to freeways or arterials of other cities. Arterials typically have four or more lanes and are heavily utilized by all vehicle classes. Collectors (e.g., Addison Rd., Arapaho Rd.) are classified as low to moderate capacity roads that serve to deliver traffic from local and residential streets to arterial roads. These roads are typically narrower in width (e.g., four to two lanes) than arterial roads. They are less traveled than arterials but can still carry a significant amount of traffic. Local and residential roads connect residents to collectors and arterials.

The following graph represents the distribution of pavement surface by road class. The Addison Circle Area represents a specific area of the Town that represents a unique residential and tourist environment.

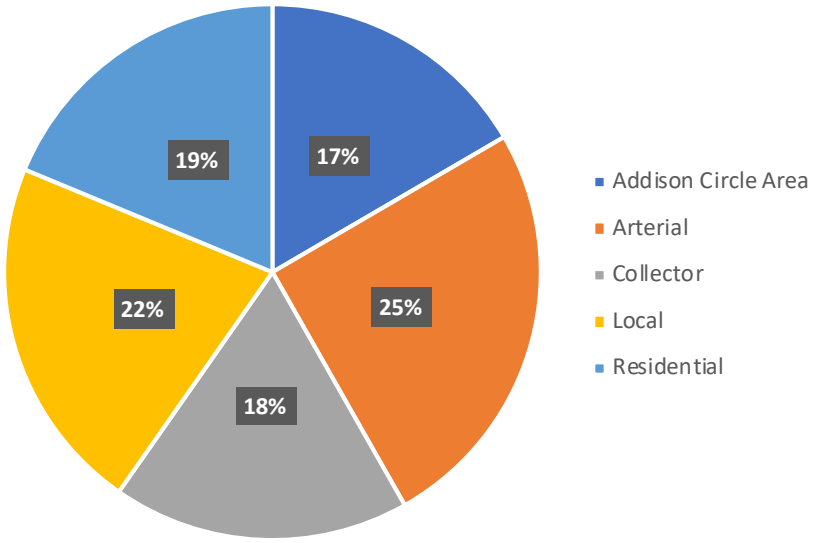


Figure 6-2 Distribution of Pavement by Road Class

What is an Asset?

In the case of the Pavement Management System, an asset is defined as a paved segment of a roadway (intersection to intersection), a parking lot, and an intersection. This definition is illustrated in the figure below where a pavement area from an intersection to intersection is identified. Furthermore, a pavement section of intersection is highlighted.

Figure 6-3 Representation of a Pavement Segment

What is the Replacement Value of the Town's Assets?

In total, there are over 600 pavement assets covering more than 10,500,000 square feet. The Town has two material types of pavement: concrete and asphalt. As represented in the figure below, the Town's pavement material is predominantly concrete (92%) with only 8% of the Town pavement material being asphalt.

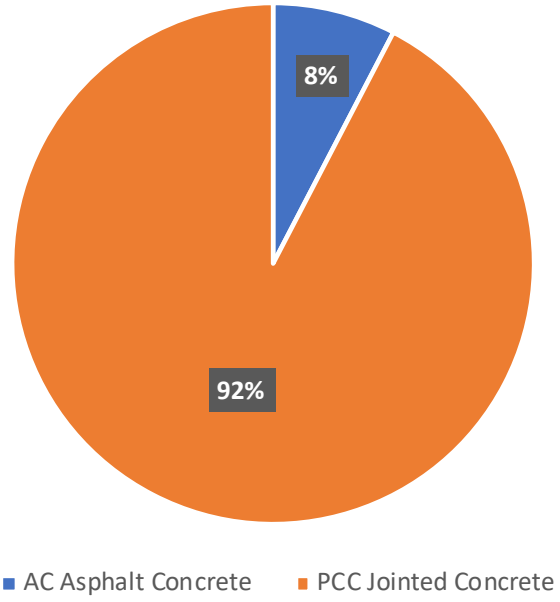


Figure 6-4 Representation of Pavement by Material

Utilizing an estimated rebuild cost of $13 per square foot for pavement, the total replacement cost is estimated to be almost $137 million in 2018 dollars. The figure below summarizes the total asset replacement cost by road class.

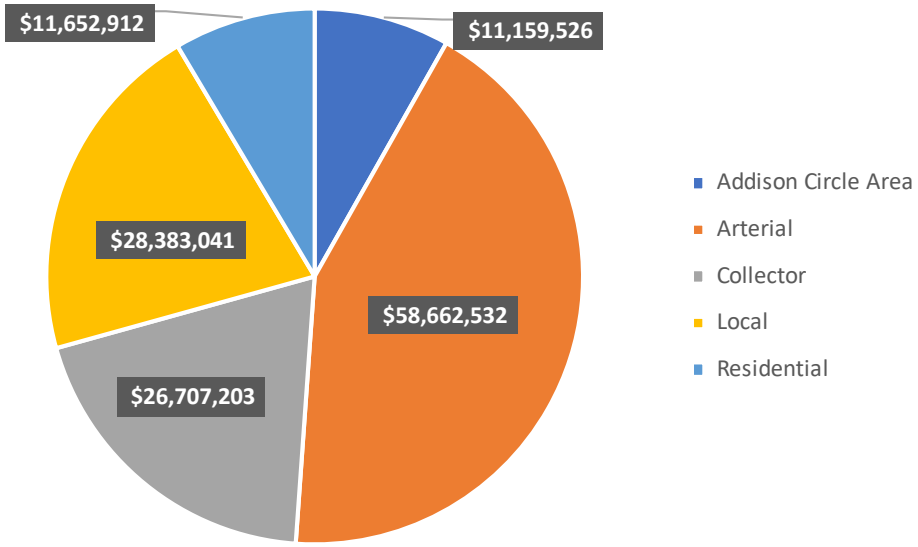


Figure 6-5 Pavement Replacement Cost by Road Type

What is the Condition of the Town's Assets?

The Town inspected the pavement condition in 2010 and 2017. Although the conditions of all arterials and collectors were assessed, not all local and residential roads were assessed. As part of the asset management plan development process, the conditions of roads missing from the previous studies were assessed in 2018. Incorporating the assessment results of 2010, 2017, and 2018, a comprehensive pavement condition database was developed recording a pavement condition index number for every road.

The condition of the roadway surface is represented as a Pavement Condition Index (PCI) score. PCI scores ranges between 0 (completely failed) and 100 (new). Factors that influence a PCI score include cracking, distortion, patching, cuts, rutting, and weathering. The following graph summarizes the spread of PCI scores for the Pavement Management System. As illustrated, over 50% of the Town's pavement condition is a PCI score of 80 or more. Of all the Town's pavement, 10% falls below a PCI score of 50. There are certain areas of the Town where the pavement needs to be replaced in the near future, including Midway Road, Keller Springs Road, etc. These streets were either found to be in poor condition during the condition assessment or have been prioritized by the Town staff for reconstruction and rehabilitation.

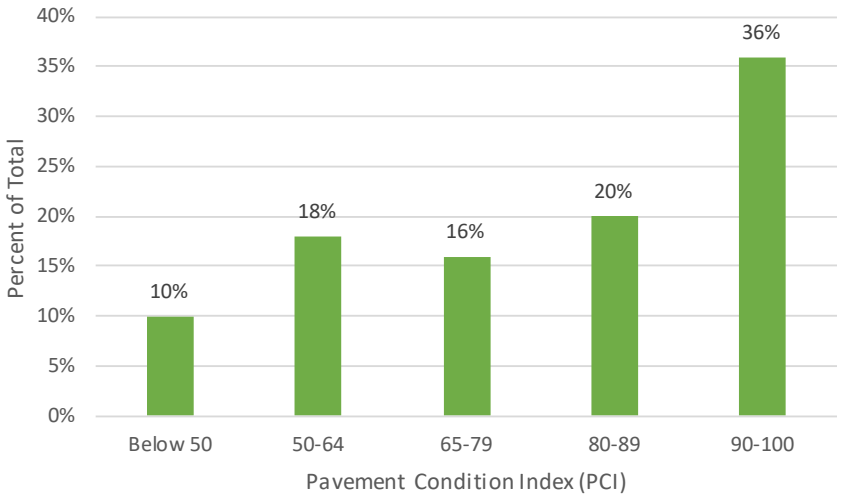


Figure 6-6 Town of Addison Pavement Condition Summary

The health of the Town's pavement was further investigated based on road class. The figure below summarizes the PCI score by road class. The results indicate that of all road types, arterials were in the worst condition. About 12% of arterials were below the PCI range of 65-79, such as Midway Road, which the Town has already planned to reconstruct.

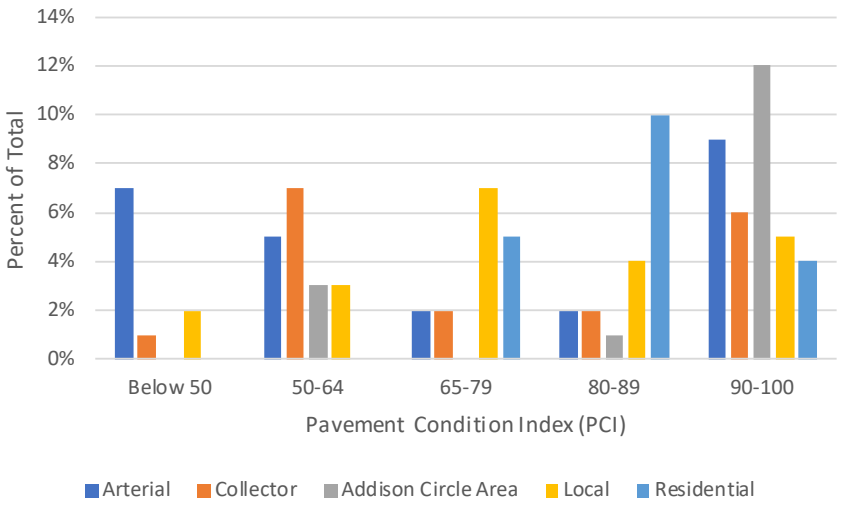


Figure 6-7 Town of Addison Pavement Condition by Road Type

In order to make the pavement condition rating align with the condition rating of other asset management systems (e.g., building, parks, water, wastewater), the PCI scores were translated into the standard asset management condition scores. The following table summarizes the conversion scale.

Table 6-1 Roadway Condition Ratings Scale

Condition	PCI	Road Condition
1	90 - 100	Excellent
2	80 – 89	Very Good
3	65 - 79	Good/Fair
4	50 - 64	Poor
5	Below 50	Failed/Critical

The following graph summarizes the overall condition profile of the Town's pavement. Almost 28% of the pavement is in fair to poor condition, as reflected by the conditions of streets like Midway Road, Keller Springs Road, Airport Parkway, and Quorum Drive. On the other hand, over 50% of the pavement is in very good to excellent condition.

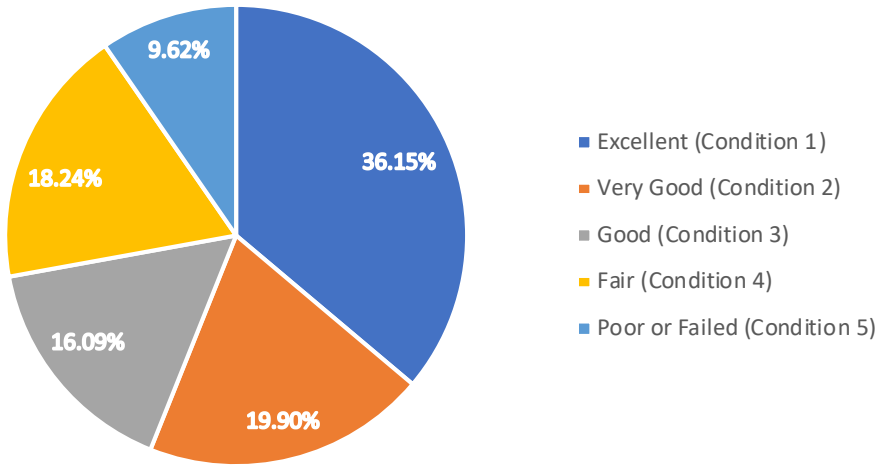


Figure 6-8 Town of Addison Pavement Condition Assessment Results

The following map highlights the condition 4 and 5 assets. The total estimated square footage of the condition 4 and 5 pavement is 3.2 million square feet or approximately $30.4 million worth of pavement.

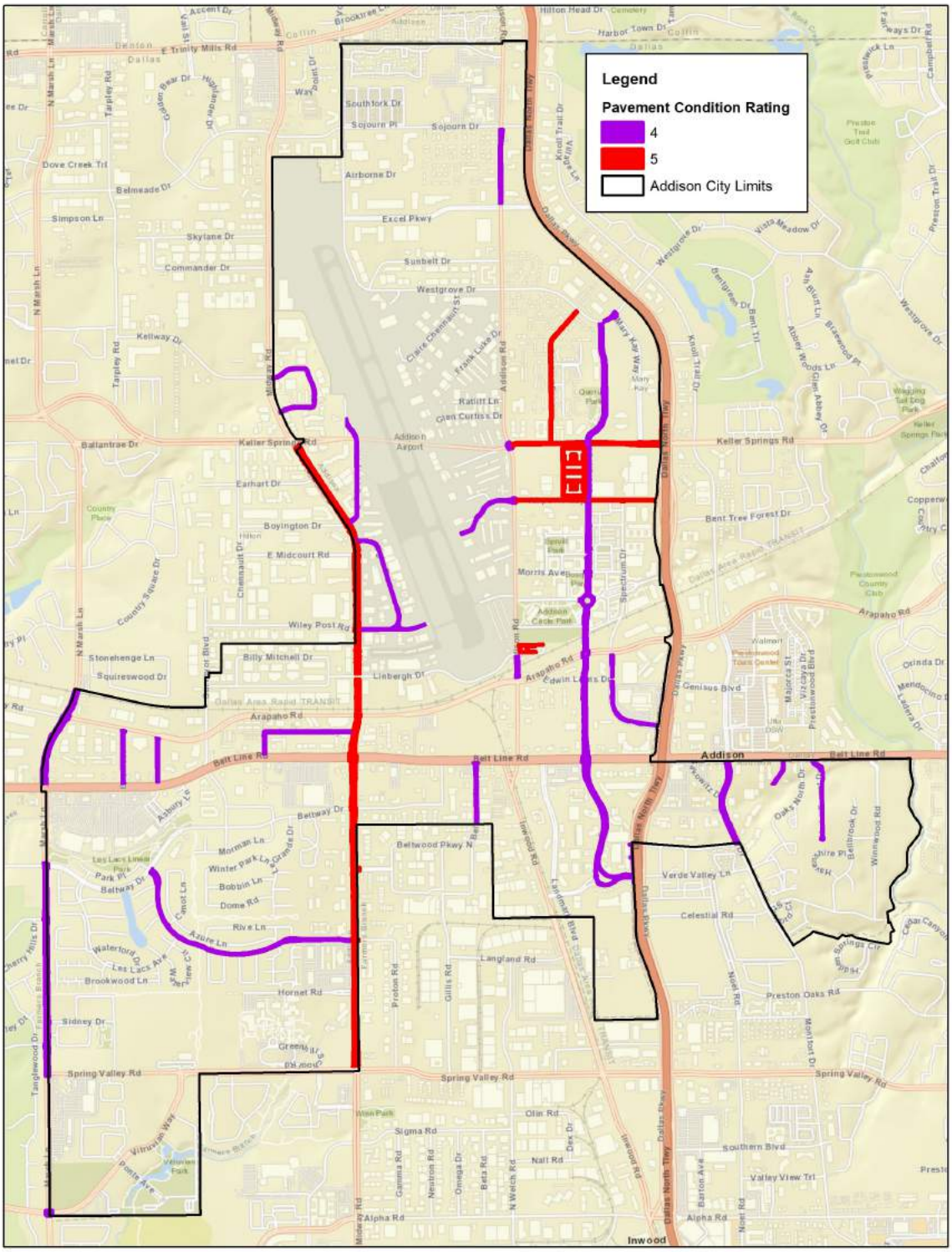


Figure 6-9 Locations of Fair and Poor Condition Pavement (Conditions 4 and 5)

What Does the Town Need to Sustain the Delivery of Services?

In order to understand the long-term investment requirements to sustain the delivery of the pavement system at an acceptable level of service, a life-cycle cost analysis was performed. Pavement requires continuous refurbishment (e.g., replace panels, fill separations, overlay, mill and grind), and when the pavement condition deteriorates, the Town will take a layer off the pavement and repave the top portion. In the most severe cases, the Town will have to full remove and replace the whole roadway. This process recently had to be done to Belt Line Road, one of the Town's main arterials.

Below is a sample list of management strategies developed to calculate the life cycle cost for the asphalt pavement. The listed rehabilitation activities should be done throughout the lifetime of the pavement to keep it in acceptable condition. In general, the management strategy is to constantly rehabilitate the pavement over its lifetime. When the PCI is relatively high (e.g., 80 and above), minor rehabilitation (e.g., slurry seal, mill and fill) is enough for the upkeep of the pavement. When the PCI deteriorates too far, more extensive rehabilitation (e.g., repaving, grind and asphalt overlay) is necessary to raise the PCI. The rehabilitation activities differ based on the pavement type. In addition, the rehabilitation activities were spread based on the current condition.

Table 6-2 Pavement Management Strategies

Type	Condition	Rehabilitation Activity	Rehabilitation Activity	Rehabilitation Activity
Asphalt	PCI 90-100	Slurry seal every 5 years at $0.25/SF (2022)	Mill and fill every 15 years at $2.00/SF (2033)	
	PCI 80-89	Slurry seal every 5 years at $0.25/SF (2021)	Mill and fill every 15 years at $2.00/SF (2031)	
	PCI 65-79	Slurry seal every 5 years at $0.25/SF (2020)	Mill and fill every 15 years at $2.00/SF (2025)	
	PCI 50-64	Slurry seal every 5 years at $0.25/SF (2024)	Mill and fill every 15 years at $2.00/SF (2019)	
	PCI Below 50	Slurry seal every 5 years at $0.25/SF (2023)	Mill and fill every 15 years at $2.00/SF (2018)	
	*AC to PCC	Replace with concrete (2019)	Minor rehab (crack seal and joint fill) at 10% of total PCC every year at $0.02/SF (2020)	Reconstruct every 30 years at $2.50/SF (2048)

*The year specified for a rehabilitation activity refers to the first year that the rehabilitation activity should occur.

The figure below displays the 30-year replacement and rehabilitation needs for the Pavement Management System. Utilizing a deterministic model, in which assets are rehabilitated and replaced exactly as outlined in the model, the average needs are approximately $4.2 million per year, in 2018 dollars.

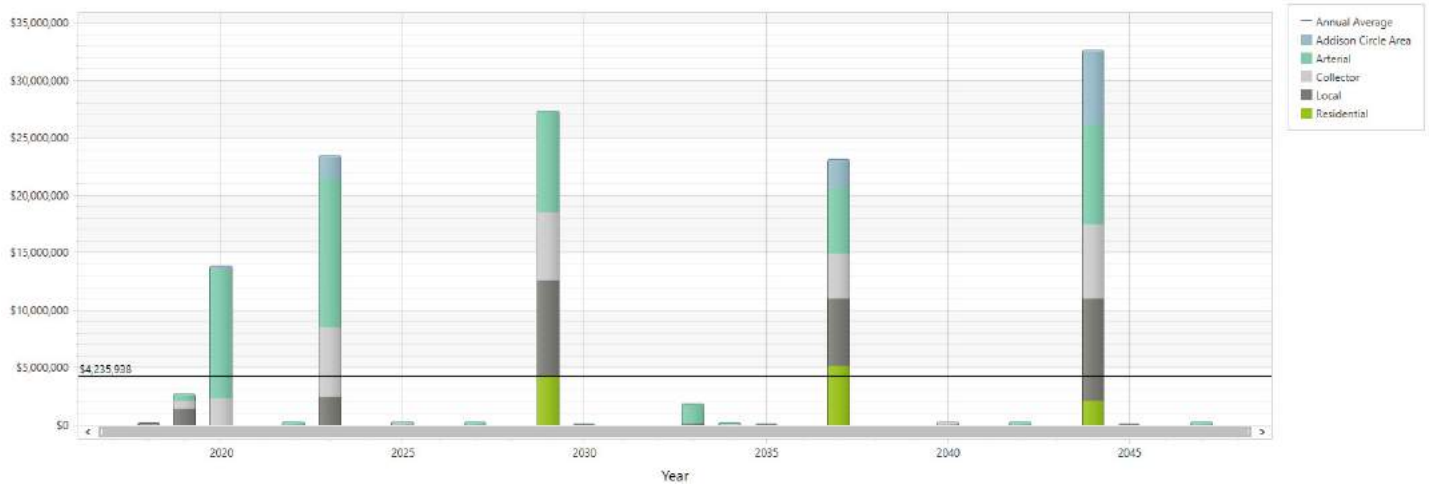


Figure 6-10 30-Year Pavement Replacement and Rehabilitation Profile (Deterministic Model)

Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from approximately $4.2 million per year to $6.7 million per year. The result of the cost escalation model is presented below.

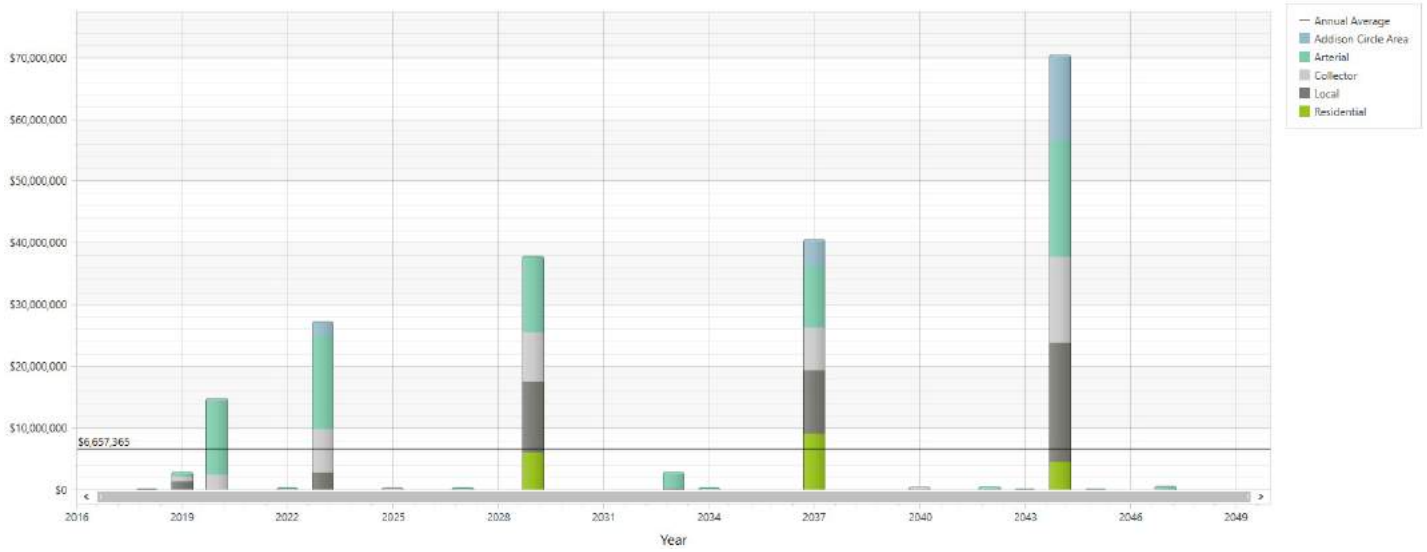


Figure 6-11 30-Year Pavement Replacement and Rehabilitation Profile (With 3% Cost Escalation)

The results of both 2018 cost and escalated cost models are summarized below.

Table 6-3 Pavement Management System 30-Year Summary

30-Year	Annual Average
Deterministic	$ 4.2 M/yr
Deterministic with 3% Inflation	$ 6.7 M/yr

How Should the Town Prioritize?

In order to prioritize the limited budget available to address the ongoing replacement and rehabilitation needs of the pavement, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was utilized.

When assigning criticality to the pavement, road class was taken into account in order to estimate the traffic level. The criticality scale for pavement by road class is shown below. Because pavement plays a major role in public safety, no pavement was assigned a CoF score of 1.

Table 6-4 Pavement Asset-Level Criticality by Road Class

Criticality - 5	Criticality - 4	Criticality - 3	Criticality - 2	Criticality - 1
Critical				Non-Essential
• Arterial	• Collector • Addison Circle Area	• Local	• Residential • Parking Lots	• N/A

The following figure summarizes the distribution of the Town's pavement CoF. CoF 5 pavement, the most critical pavement, makes up 25% of the Town's total pavement. 55% of the Town's pavement is CoFs 4 and 3.

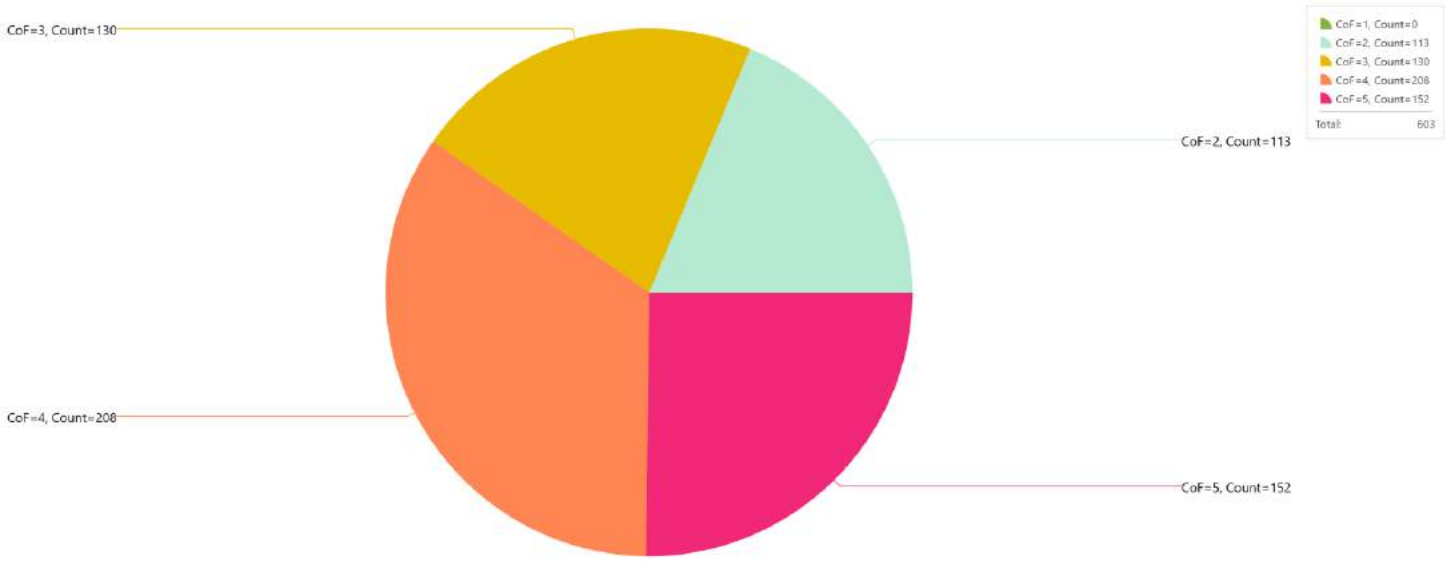


Figure 6-12 Distribution of Pavement Consequence of Failure

The following figure shows the resulting overall risk profile for the Town's pavement. Currently, there is over $28 million worth of pavement in the red zone.

Figure 6-13 Pavement Risk Matrix

The Town is planning to reconstruct some of the high-risk pavement at Midway Road, Keller Springs Road, Airport Parkway, Quorum Drive, parts of Proton Drive, and parts of Marsh Lane. When discussing replacement and rehabilitation, "Catch Up" refers to all high-risk assets in the red zone. These are assets with a high consequence of failure that are soon expected to fail. On the other hand, "Keep Up" describes all asset replacement and rehabilitation needs in the remaining years after the Town has addressed the "Catch Up" or has caught up. The following table displays the total Catch Up, or the total replacement and rehabilitation costs in 2018 as well as the Keep Up for a 30-year planning horizon. These amounts are represented in current year (2018) dollars.

Table 6-5 Catch Up and Keep Up Values

Category	Cost
Catch Up	$1.2 M
Keep Up	$4.2 M/yr

What Level of Service Should the Town Provide?

Level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Two scenarios were developed: Preferred Level of Service and Minimum Level of Service.

As shown in Figure 6-11, the estimated annual needs over a 30-year horizon for the Preferred Level of Service was approximately $4.2 million.

The figure below shows the rehabilitation and replacement profile over a 30-year horizon for the Minimum Level of Service, where only high-risk assets (with CoF 4 or higher) are addressed. The annual average needs for the Minimum Level of Service is almost $3 million per year.

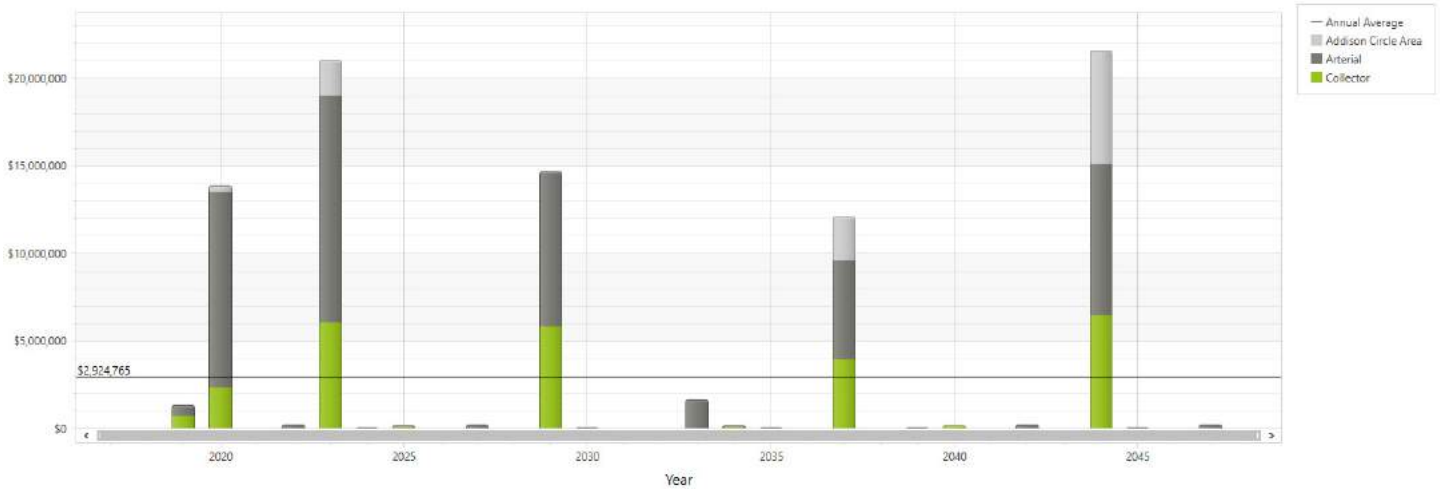


Figure 6-14 Minimum Level of Service Replacement and Rehabilitation Profile

While funding only the high-risk assets would allow the Town to prioritize the high-use roads, this Minimum Level of Service would not fund several of the Town's roads. As such, this Minimum Level of Service is not recommended. The Minimum Level of Service scenario is only performed to present the lower spectrum of the funding requirements.

7 | Vehicular Bridge Management System

Physical Health Score A

What Does the Town Own and Manage?

The Town is responsible for the maintenance, rehabilitation, and replacement of all vehicular and pedestrian bridges. The Vehicular Bridge Management System includes all vehicular bridges. Pedestrian bridges are included in the Parks and Trails Management System as they are managed by the Town's Parks and Recreation Department. The table below presents the four vehicular bridges that the Town owns and manages.

Table 7-1 Town-Owned Vehicular Bridges

Bridge Name	Size (LF)	Year Built
Arapaho Rd Bridge 	1,575	2004
Bella Ln Bridge 	140	2011
Ponte Ave Bridge 	160	2011

Bridge Name	Size (LF)	Year Built
Winnwood Rd Bridge 	175	1988

The following map shows the locations of the Town-owned vehicular bridges.

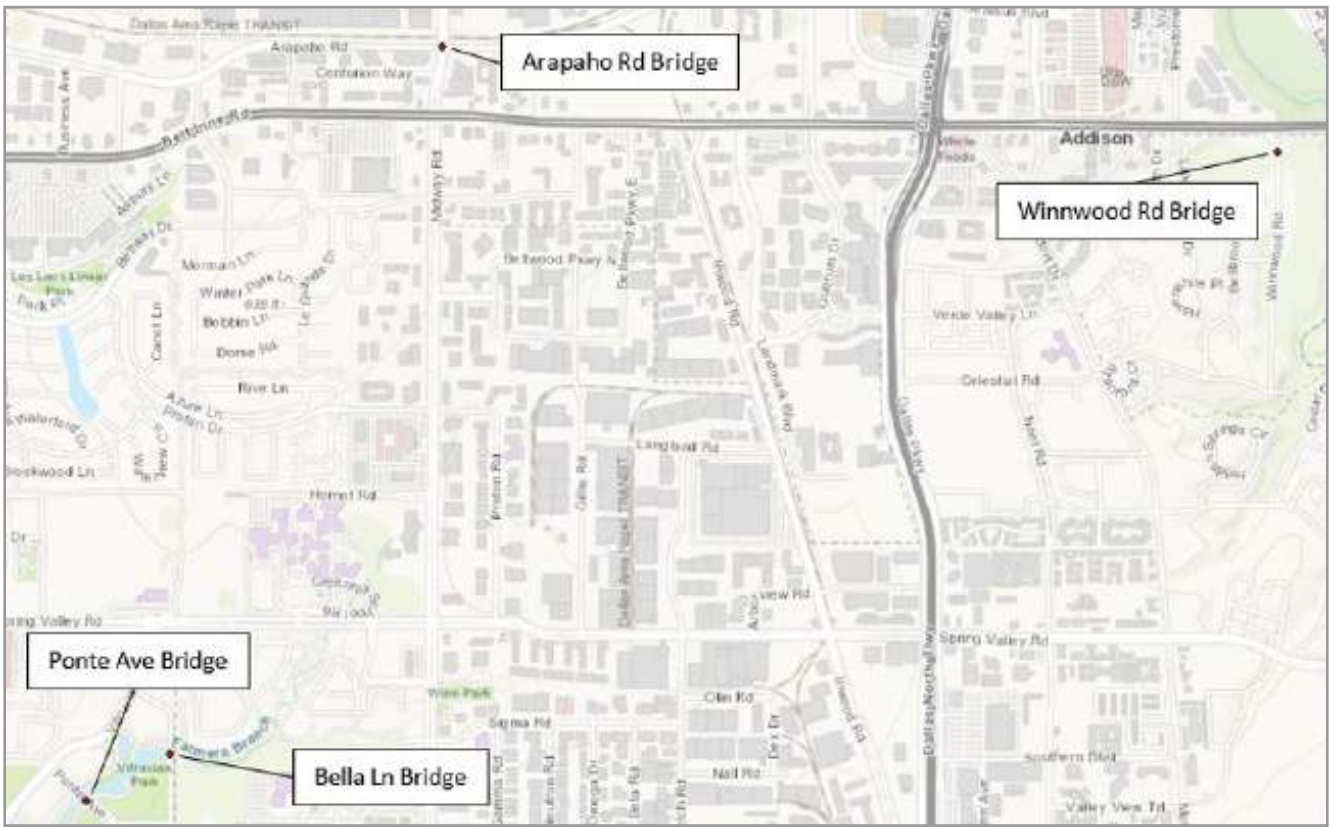


Figure 7-1 Map of Addison Vehicular Bridges

What is an Asset?

In the Vehicular Bridge Management System, each major component of the vehicular bridges is considered an asset. Assets are divided into substructure and superstructure. A full list of vehicular bridge asset classes is shown in the table below.

Table 7-2 Vehicular Bridge Asset Classes

Asset Classes – Bridges				
Substructure				
Abutment	Abutment Footing	Beam	Culvert	Girder
Pile Cap	Piles	Wall		
Superstructure				
Apron	Arch	Deck	End Wall	Facia
Guardrail	Bridge Lighting	Monument Plaque	Railing	Support Cable
Surface Treatment	Thrust Blocks	Wall		

*Street lights located along the Arapaho Rd Bridge are included in the Street Light Management System.

The following images show examples of the bridge assets that were captured during on-site asset inventory and condition assessment.

Figure 7-2 Superstructure – Deck

Figure 7-3 Superstructure – Arch, Support Cable

Figure 7-4 Superstructure – Railing

Figure 7-5 Substructure – Abutment

Figure 7-6 Substructure – Culvert

Figure 7-7 Substructure – Double End Wall

Figure 7-8 Substructure – Box Girder

What is the Replacement Value of the Town's Assets?

In total, there are almost 400 assets in the Vehicular Bridge Management System. The replacement cost for each asset was estimated. The sum of all replacement costs in the Vehicular Bridge Management System, in 2018 dollars, is approximately $11 million. The table below summarizes the total asset replacement cost of each vehicular bridge.

Table 7-3 Summary of Vehicular Bridge Asset Replacement Costs

Bridge Name	Number of Assets	Replacement Cost
Arapaho Rd Bridge	292	$7,688,090
Bella Ln Bridge	19	$1,058,800
Ponte Ave Bridge	33	$1,590,800
Winnwood Rd Bridge	43	$514,025
Total	**387**	**$10,851,715**

What is the Condition of the Town's Assets?

Each vehicular bridge was visited for asset inventory and condition assessment. Type, material, size, condition, age, and other information required to support asset management decisions were captured and recorded for each asset. The condition scores were based on visual inspection. The condition score accounts for the external factors as they relate to safety, service level, functionality, and/or remaining useful life. The score does not reflect the condition of the internal, non-visible components of the asset.

It is important to note that Texas Department of Transportation (TxDOT) performs field inspections of vehicular bridges every 3 years, where the Town is responsible for administering bridge maintenance and repairs. The condition results from the inspection completed by TxDOT were taken into account when assessing the current conditions of the vehicular bridges. Upon visual verification, the conclusions from the TxDOT inspection were still valid and they supplemented the current condition assessment.

A sample of the condition assessment for Winnwood Rd Bridge is presented below. The following table shows examples of bridge components that were individually assessed for condition issues.

Table 7-4 Winnwood Rd Bridge Condition Issues

Bridge Component	Condition Issue
Concrete Apron 	Major deterioration of the concrete apron. Deterioration of the concrete apron may dramatically accelerate the integrity of the end wall, which is supporting the substructure of the bridge.
End Wall 	Gradual deterioration of north end wall; concrete spalling and exposure of re-bar. This bridge asset should be cleaned and reinforced where required.
Concrete Deck 	Cracks on concrete deck. This bridge asset should be re-sealed.

What Does the Town Need to Sustain the Delivery of Services?

In order to estimate the long-term asset replacement and rehabilitation needs for the Vehicular Bridge Management System, a life-cycle cost analysis was performed for each asset. Each asset class was assigned a management strategy that includes the rehabilitation and replacement activities to best characterize the life cycle investment needs for the asset. Below is a sample list of management strategies used to calculate the life-cycle costs of the bridge assets. The following table shows a complete list of bridge management strategies.

Table 7-5 Vehicular Bridge Management Strategies

Asset Class	Useful Life	Rehabilitation	Frequency	Rehab Cost
Substructure				
Abutment	100			
Culvert - Concrete	100			
End Wall - Concrete	100			
Girder - Concrete	100			
Piles	100			
Abutment Footing - Concrete	100			
Beam - Concrete	100			
Pile Reinforcement Beam - Concrete	100			
Sidewalk - Concrete	100			
Superstructure				
Deck - PCC	100	Refurbish deck	10	15%
Guardrail	100	Minor refurbishment	20	20%
Railing - Concrete	100			
Railing - Steel	40	Paint	10	20%
Light Standard	30	Paint	10	$150
Light Decorative	30	Paint	10	$150
Structural Strand	100			
Arch – Steel, Painted	100	Paint	10	$12,000
Wall - Brick w/ Metal Railing	100			
Pile Cap	50			
Surface Treatment	100			
Thrust Blocks	100			
Monument Plaque	20			
Fascia	100			
Apron	100			
Retaining Wall	100			

Figure 7-9 below displays the 30-year replacement and rehabilitation needs for the Vehicular Bridge Management System. Utilizing a deterministic model, the average replacement and rehabilitation needs are approximately $118,000 per year.

The spike in 2033 is due to the need for replacement of the bridge lighting on Arapaho Rd Bridge; by this year, the lighting will have reached the end of its useful life.

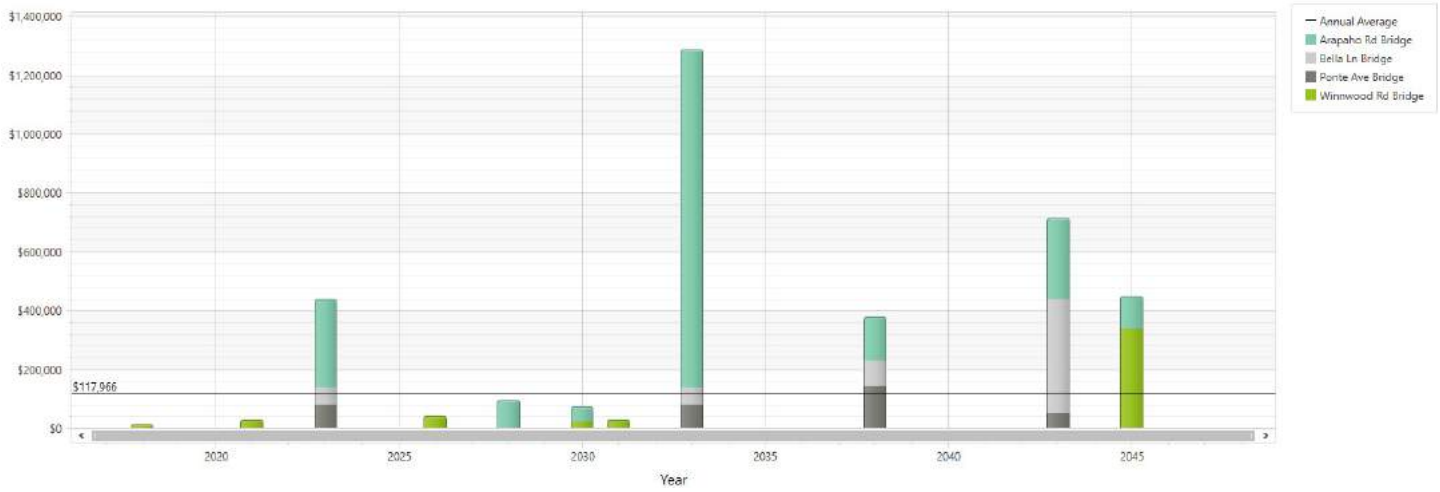


Figure 7-9 30-Year Vehicular Bridge Replacement and Rehabilitation Profile (Deterministic Model)

The 30-year life cycle cost analysis was repeated utilizing a probabilistic model, in which asset failures were smoothed to represent a more realistic expectation. The probabilistic model predicts the annual replacement and rehabilitation needs to be approximately $113,000 per year.

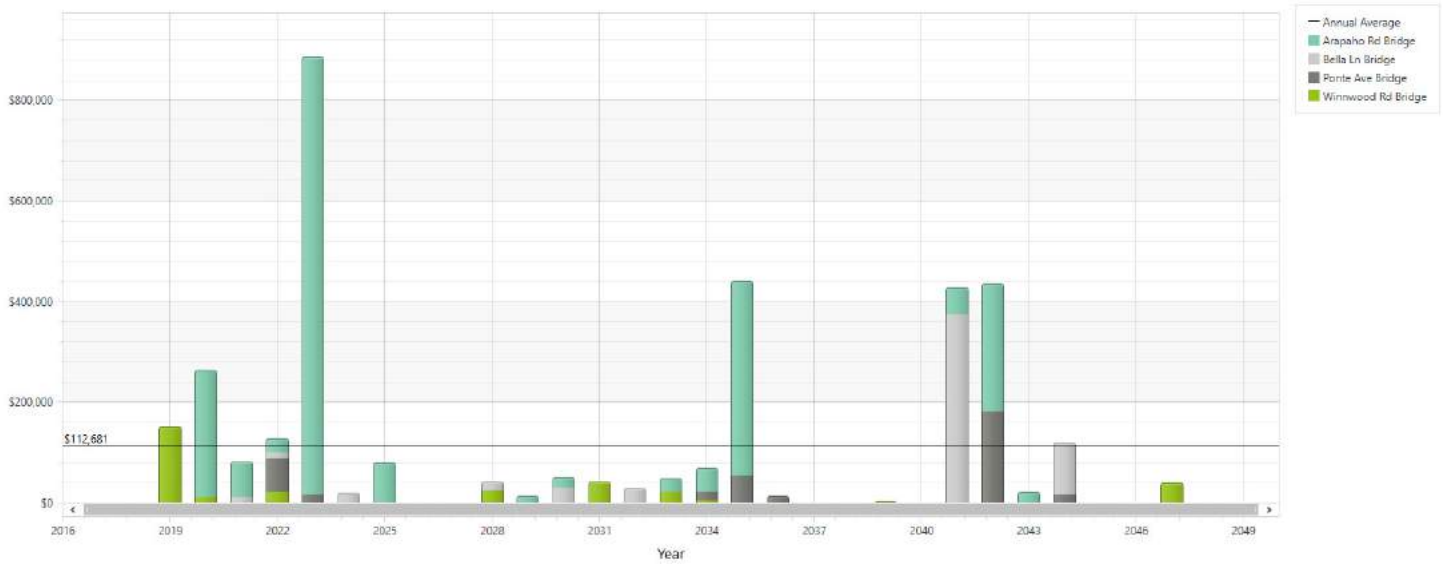


Figure 7-10 30-Year Vehicular Bridge Replacement and Rehabilitation Profile (Probabilistic Model)

Both analyses above represented results in today's dollars (2018). Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from $118,000 per year to $202,000 per year. Similarly, for the probabilistic model, the annual investment need increased from $113,000 per year to $170,000 per year. The results of these analyses are summarized in the table below.

Table 7-6 Vehicular Bridge Management System 30-Year Summary

30-Year	Annual Average
Deterministic	$118,000/yr
Probabilistic	$113,000/yr
Deterministic with 3% Inflation	$202,000/yr
Probabilistic with 3% Inflation	$170,000/yr

How Should the Town Prioritize?

In order to prioritize the limited budget available to address the ongoing replacement and rehabilitation needs of the vehicular bridges, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was utilized. Criticality was evaluated at the asset level.

One of the main considerations in assessing the criticality of an asset was whether or not the asset was a critical structural component of the bridge. An asset with direct contribution to the foundation or structure of the bridge received the highest CoF score of 5. In addition, assets directly contributing to traffic and pedestrian safety and level of service was considered to be very important.

The table below highlights asset class criticality.

Table 7-7 Vehicular Bridge Asset-Level Criticality

Criticality – 5	Criticality – 4	Criticality – 3	Criticality – 2	Criticality – 1
Critical				Non-Essential
• Abutment • Abutment Footing • Arch • Beam • Culvert • Deck • Fascia • Girder • Pile Cap	• Apron • End Wall • Guardrail • Railing • Surface Treatment • Wall	• Bridge Lighting	• Monument Plaque	• N/A

The following figure shows the resulting overall risk profile for the Vehicular Bridge Management System. Currently, there is only 1 asset in the high-risk zone.

Figure 7-11 Vehicular Bridge Risk Matrix

The one high-risk asset in the Vehicular Bridge Management System is the concrete apron at Winnwood Rd Bridge. During the condition assessment, it was found that this asset showed major deterioration. Deterioration of the concrete apron can dramatically accelerate the integrity of the end wall, which directly supports the substructure of the bridge. Therefore, this asset is considered high risk and should be addressed immediately at a cost of $12,000.

As illustrated in the risk matrix, the Vehicular Bridge Management System is relatively in good shape overall. The only other assets that will need to be addressed in the near future are the ones in the yellow zone. Approximately $455,000 worth of assets (4%) are in the medium-risk (yellow) zone, and they will begin to fall into the high-risk zone in the near future.

When discussing replacement and rehabilitation, “Catch Up” refers to all high-risk assets in the red zone. These are assets with a high consequence of failure that are soon expected to fail. On the other hand, “Keep Up” describes all asset replacement and rehabilitation needs in the remaining years after the Town has addressed the “Catch Up” or has caught up. The following table displays the total Catch Up, or the total replacement and rehabilitation costs in 2018 as well as the Keep Up for a 30-year planning horizon. These amounts are represented in current year (2018) dollars.

Table 7-8 Catch Up and Keep Up Values

Category	Cost
Catch Up	$12,000
Keep Up	$117,966/yr

What Level of Service Should the Town Provide?

Level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Two scenarios were developed: Preferred Level of Service and Minimum Level of Service.

As shown in Figure 7-9, the estimated annual needs over a 30-year horizon for the Preferred Level of Service was approximately $118,000.

In the Minimum Level of Service, only high-risk assets would be maintained, rehabilitated, and replaced. Because vehicular bridges provide a critical public service, the Minimum Level of Service is not a viable option. For the Vehicular Bridge Management System, the Minimum Level of Service will match the Preferred Level of Service.

8 | Curb Ramp Management System

Physical Health Score C

What Does the Town Own and Manage?

The Town owns almost 2,000 curb ramps or locations where curb ramps are needed, and it bears full responsibility for the installation and replacement of these curb ramps. Curb ramp standards are regulated by the government under the Americans with Disabilities Act (ADA) standards through the ADA Accessibility Guidelines (ADAAG). The Town has developed an ADA Transition Plan to address non-compliant curb ramps throughout the Town. The repair needs and costs noted in the Transition Plan were incorporated in all of the following analyses.

The following map displays the locations of the Town's curb ramps.

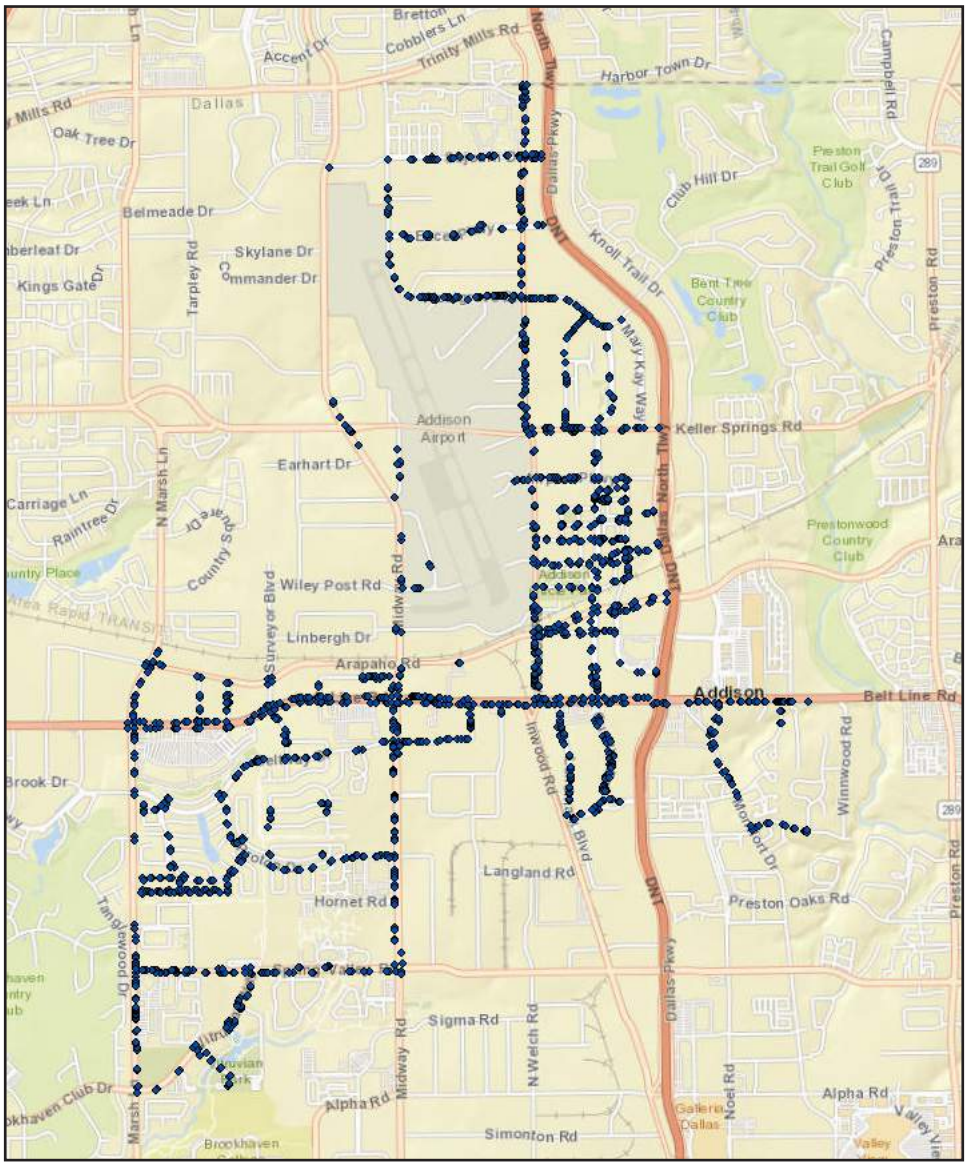


Figure 8-1 Map of Addison Curb Ramps

What is an Asset?

In the case of the Curb Ramp Management System, each curb ramp and each location where there should be a ramp but there currently is not one is considered an asset. The figures below show examples of curb ramps found throughout the Town.

Figure 8-2 Curb Ramp Example #1

Figure 8-3 Curb Ramp Example #2

Figure 8-4 Curb Ramp Example #3

Figure 8-5 Curb Ramp Example #4

What is the Replacement Value of the Town's Assets?

In total, there are almost 2,000 assets (curb ramps and non-existent curb ramps) in the Curb Ramp Management System. The sum of all replacement costs for the Curb Ramp Management System is approximately $6.4 million.

The table below summarizes the total asset replacement cost by location type. It is important to note that these replacement costs incorporate the costs that were outlined in the Town's ADA Transition Plan. Every curb ramp location that was noted for deficiencies in the ADA Transition Plan was identified and matched in the asset register, and the associated ADA deficiency cost was incorporated as a one-time cost for the given curb ramp location.

Table 8-1 Summary of Curb Ramp Replacement Costs by Road Class

Location	Number of Assets	Replacement Cost
Addison Circle Area	126	$381,000
Arterial	489	$1,491,725
Major Collector	403	$1,347,000
Major Commercial	32	$96,000
Major Local	504	$1,697,000
Major Residential	328	$1,143,725
Minor Collector	7	$21,000
Minor Commercial	3	$9,000
Minor Local	41	$126,000
Minor Residential	24	$72,000
Total	**1,957**	**$6,384,450**

What is the Condition of the Town's Assets?

During the inventory verification and asset register development process, each curb ramp was visited and assessed for condition. For curb ramps, it is important to understand that these assets last a very long time. The amount of force exerted by pedestrians will not harm the curb ramp nor accelerate the deterioration rate. Curb ramps typically fail from level of service (e.g., ADA requirements) and not from mortality (i.e., structural condition).

It was found during the inventory and condition assessment that there were locations where there should be a curb ramp but the location did not have one and where existing curb ramps needed to be replaced. Any non-existent curb ramp was automatically given a failing condition score 5, as the Town should immediately address these areas and install curb ramps where required. An example of non-existent curb ramp is pictured in the figure below.

Figure 8-6 Example of a Non-Existent Curb Ramp

Once these curb ramp locations were identified, the assessment was then directly supplemented by the Town's ADA Transition Plan; as mentioned before, the cost that was defined for each curb ramp location was assigned to the asset as a one-time cost.

The figure below presents a summary of the results of the asset inventory and condition assessment.

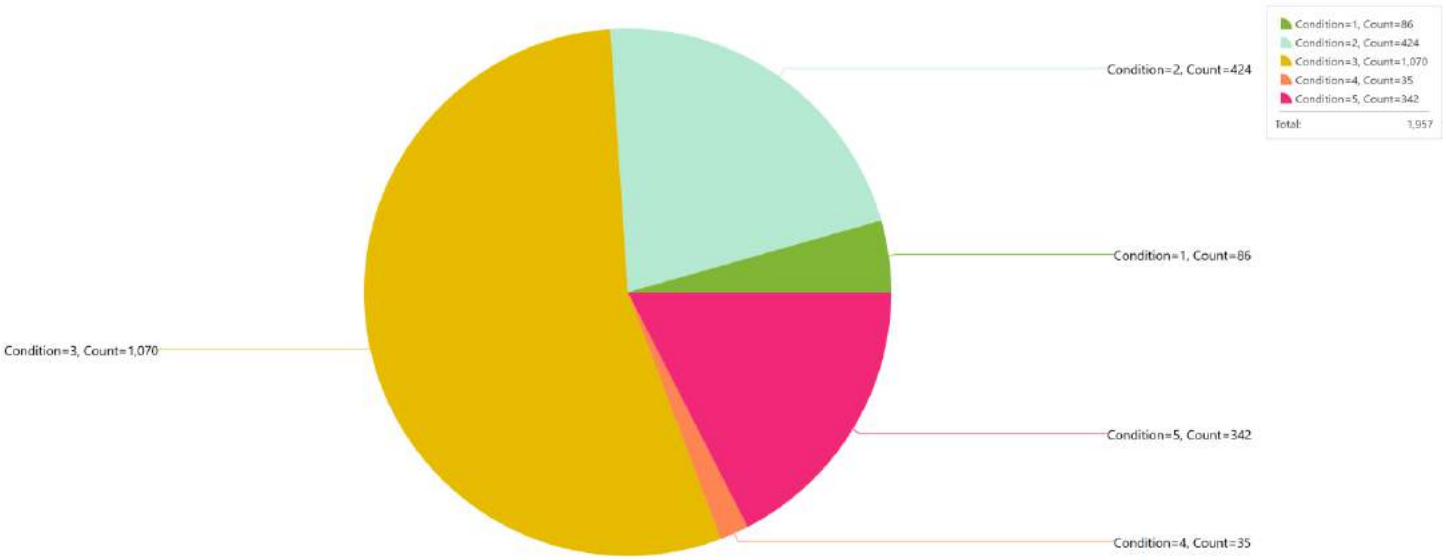


Figure 8-7 Curb Ramp Condition Assessment Results

As shown in the figure above, the majority of the Town's curb ramps (55%) are in good condition (condition score of 3). About 26% of the curb ramps are in great to excellent condition (i.e., condition score 2 or 1, respectively) and the remaining assets (19%) are in fair to poor condition (i.e., condition score 4 or 5, respectively). The curb ramps observed to be in condition 4 or 5, which were also noted in the ADA Transition Plan, will need attention in the near future.

The ADA Transition Plan defined various issues with the Town's curb ramps. Where applicable, the issues and their associated costs were directly tied to specific curb ramps. Other costs noted in the transition plan, such as removing a ramp before installing a compliant one or other remaining project costs associated with correcting the deficiencies, were summed up and incorporated into the overall analysis as one-time costs that occur during the year that the given ramps should be addressed.

What Does the Town Need to Sustain the Delivery of Services?

In order to estimate the long-term asset replacement needs for the Curb Ramp Management System, a life-cycle cost analysis was performed for curb ramps. The life-cycle investment needs for curb ramps are different than other infrastructure assets because curb ramps are rarely replaced due to deterioration. Rather than needing replacement every certain number of years due to structural condition issues, curb ramps require replacement when they fail to maintain a certain level of service (e.g., compliance with ADA standards). In order to account for the cost of replacement of curb ramps, a $48,000 budget was allocated to each year for curb ramp replacement. The $48,000 accounts for the replacement of 16 curb ramps per year, assuming the Town would address an estimated 4 intersections.

The figure below displays the 30-year replacement needs for the Curb Ramp Management System. Utilizing a deterministic model, in which assets are rehabilitated and replaced exactly as outlined in the model, the average needs are approximately $253,000 per year, in 2018 dollars.

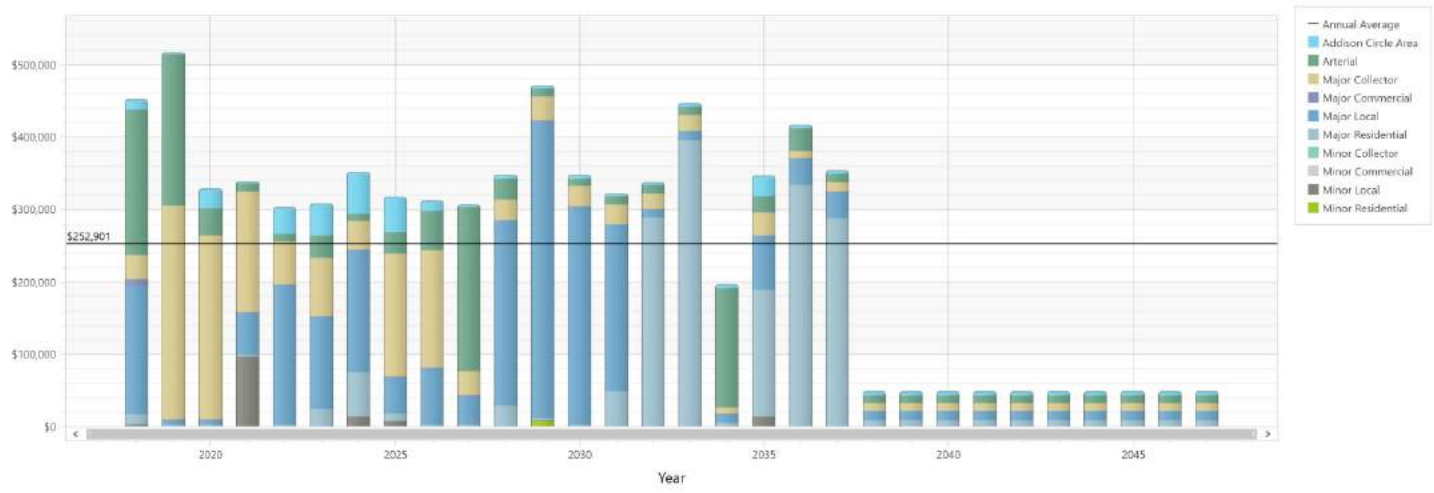


Figure 8-8 30-Year Curb Ramp Replacement and Rehabilitation Profile (Deterministic Model)

The higher spikes throughout the first 20 years are due to the costs outlined in the ADA Transition Plan. All costs from the transition plan are tied to the deficient curb ramp locations and are spread out over the next 20 years. The recurring shorter spikes starting 2038 represent the yearly replacement of $48,000 worth of curb ramps.

Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from approximately $253,000 per year to $350,000 per year. The results of these analyses are summarized in the table below.

Table 8-2 Curb Ramp Management System 30-Year Summary

30-Year	Annual Average
Deterministic	$253,000/yr
Deterministic with 3% Inflation	$350,000/yr

How Should the Town Prioritize?

In order to prioritize the limited budget available to address the ongoing replacement and rehabilitation needs of the curb ramps, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was utilized. When assigning criticality to the curb ramps, road class was taken into account in order to estimate the pedestrian traffic level. The highest criticality was assigned to areas where there is the most foot traffic. Unlike vehicular traffic, it is assumed that most foot traffic occurs near parks, school, and/or homes. The exception is the Addison Circle area. With a combination of parks, homes, and shops, it is considered to be highly used by pedestrians. Industrial and commercial areas were assumed to have low pedestrian traffic. The criticality scale for curb ramps by road class is shown below.

Table 8-3 Curb Ramp Asset-Level Criticality by Road Class

Criticality - 5	Criticality - 4	Criticality - 3	Criticality - 2	Criticality - 1
Critical				Non-Essential
• Residential Areas • Addison Circle Area	• Local Roads • Arterials along offices, restaurants, and shops	• Collectors	• Arterial	• Commercial

Utilizing the criticality scale above, the following figure summarizes the resulting number of ramps in each criticality category.

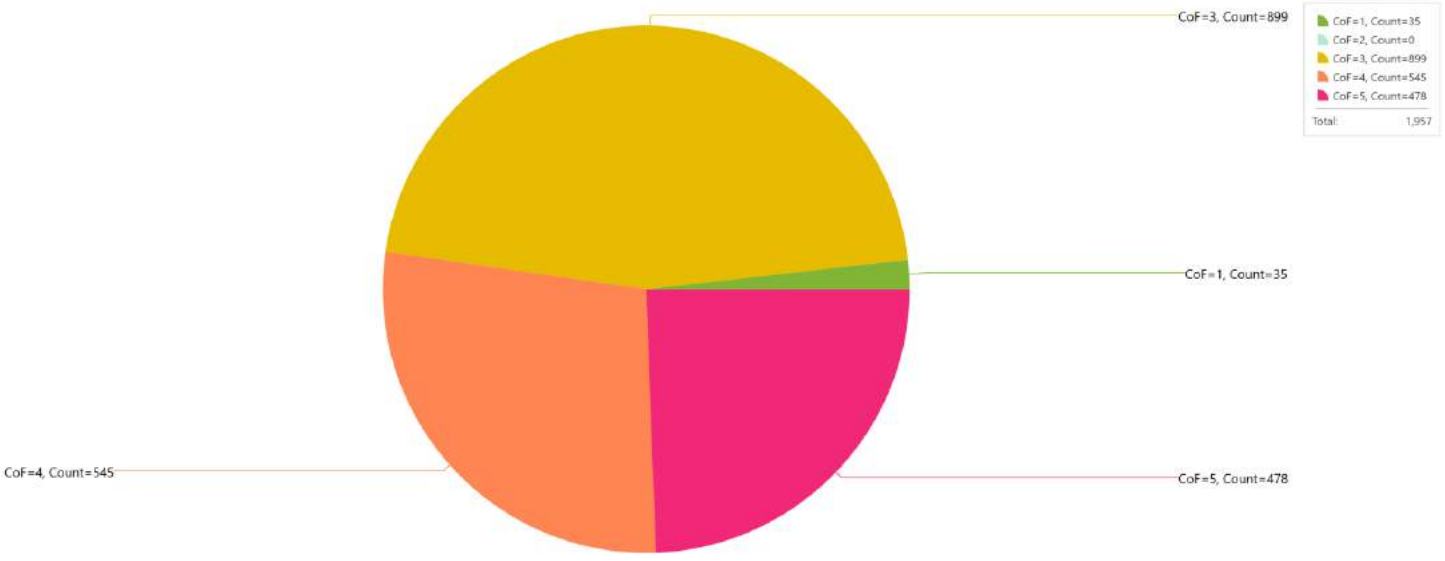


Figure 8-9 Curb Ramp CoF Results

The following figure shows the resulting overall risk profile for Town's curb ramps. Currently, there are 270 ramps in the high-risk (red) zone with a total cost of approximately $860,000.

Figure 8-10 Curb Ramp Risk Matrix

These are the non-compliant ramps identified in the ADA Transition Plan and poor condition ramps in residential areas that should be addressed in the near future.

The following table displays the total Catch Up, or the total replacement and rehabilitation costs in 2018 as well as the Keep Up for a 30-year planning horizon. These amounts are represented in current year (2018) dollars.

Table 8-4 Catch Up and Keep Up Values

Category	Cost
Catch Up	$860,024
Keep Up	$252,399/yr

What Level of Service Should the Town Provide?

Level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Two scenarios were developed: Preferred Level of Service and Minimum Level of Service.

As shown in Figure 8-8, the estimated annual needs over a 30-year horizon for the Preferred Level of Service was approximately $253,000.

The figure below shows the rehabilitation and replacement profile over a 30-year horizon for the Minimum Level of Service, where only high-risk assets (with CoF 4 or higher) are addressed. The annual average needs for the Minimum Level of Service is approximately $156,000 per year.

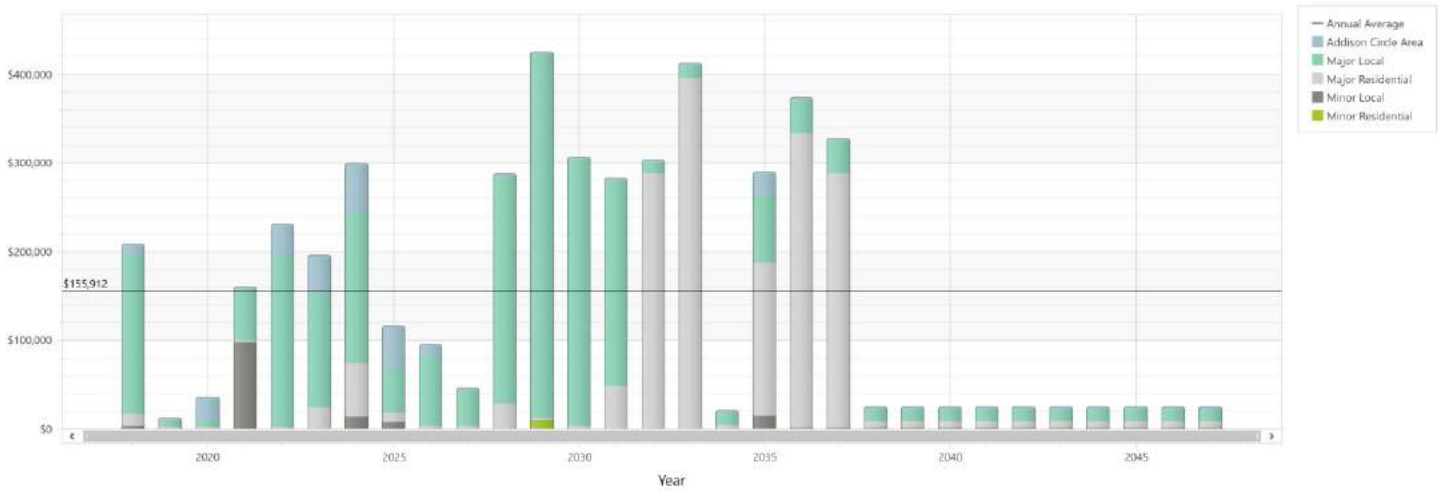


Figure 8-11 Minimum Level of Service Replacement and Rehabilitation Profile

While funding only the high-risk assets would allow the Town to prioritize the more critical needs, this Minimum Level of Service would not address several of the Town's curb ramps. As such, the Minimum Level of Service is not recommended. The Minimum Level of Service scenario is only performed to present the lower spectrum of the funding requirements.

9 | Sidewalk Management System

Physical Health Score A

What Does the Town Own and Manage?

The Town owns and manages about 637,000 linear feet (120 miles) of sidewalk. The Town is responsible for the costs to maintain, replace, and rehabilitate sidewalks around Town property (e.g. Town-owned buildings and parks). Businesses are responsible for the sidewalks in commercial districts, but in residential areas, the Town is ultimately responsible. The following map shows the locations of all Town sidewalk.

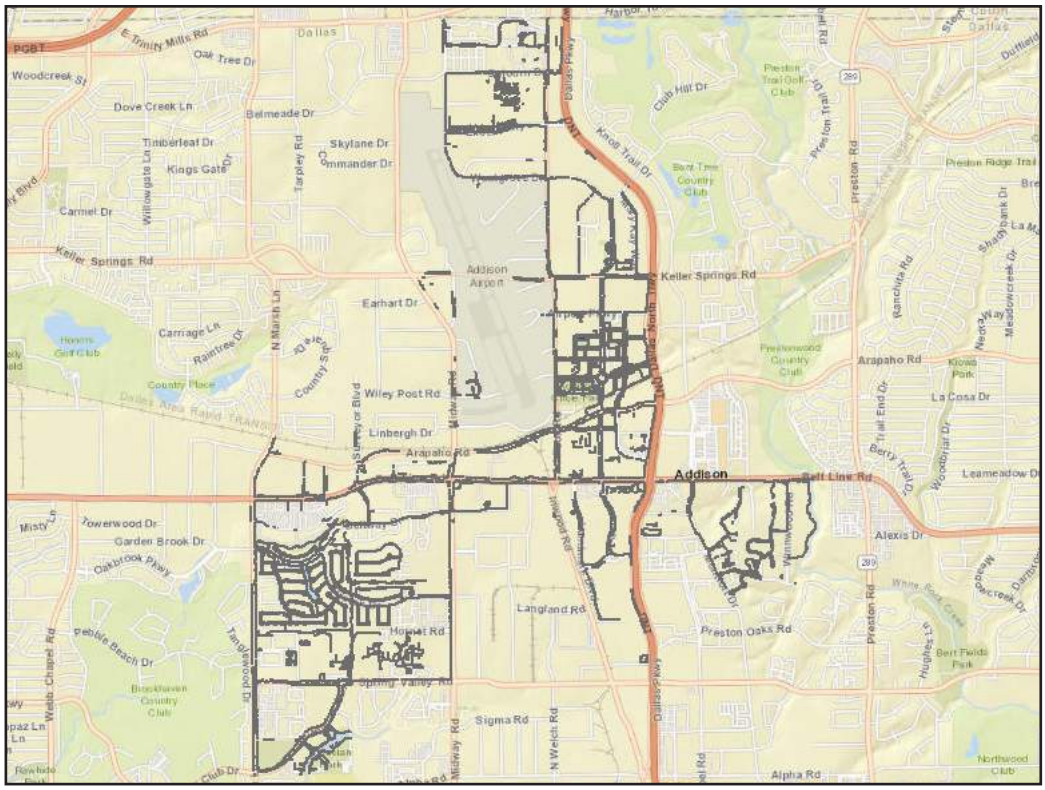


Figure 9-1 Map of Addison Sidewalk

What is an Asset?

In the case of the Sidewalk Management System, each segment of sidewalk from one intersection to the next is defined as an asset. Generally, this corresponds to the sidewalk from block to block. Below is an example of a sidewalk segment.

Figure 9-2 Sidewalk Segment (Block-to-Block)

What is the Replacement Value of the Town's Assets?

In total, there are over 1,300 sidewalk assets, which cover approximately 120 miles. The estimated total replacement cost, based on a cost of $27 per linear foot, is approximately $17 million in 2018 dollars.

The table below summarizes the total asset replacement cost by road class.

Table 9-1 Summary of Sidewalk Replacement Costs by Road Class

Road Class	Length (Miles)	Replacement Cost
Addison Circle Area	15.6	$2,224,998
Arterial	23.7	$3,382,376
Major Collector	17.5	$2,487,898
Major Commercial	1.7	$245,832
Major Local	33.0	$4,706,561
Major Residential	20.3	$2,886,885
Minor Collector	0.3	$47,783
Minor Commercial	0.6	$85,557
Minor Local	2.6	$375,244
Minor Residential	4.5	$644,587
Total	**119.8**	**$17,087,721**

What is the Condition of the Town's Assets?

During the inventory verification and asset register development process, each sidewalk was visited and assessed for condition and maintenance needs (e.g., offsets, depression, uplift, cracks). For sidewalks, it is important to understand that the life-cycle investment needs are different than other infrastructure assets. Sidewalks last a very long time. The amount of force exerted by pedestrians will not harm the sidewalk nor accelerate the deterioration rate. Sidewalks typically fail due to level of service (e.g., trip hazards, Americans with Disabilities Act (ADA) requirements) and not due to mortality (i.e., structural condition). Sidewalks require continuous maintenance (e.g., fix offsets, replace panels, fill separations). In addition, it is very rare to completely replace a sidewalk along an entire block due to poor condition. Sidewalks will typically get partially replaced as part of a major roadway project.

With the level of service failures (e.g., cracks, offset, depression, uplift) driving the Sidewalk Management System costs, the condition assessment process focused on capturing the level of service needs. This process required identifying the location, significance, and cause of the maintenance needs. All sidewalk damage points were directly tied to the sidewalk segment at which the damage was found. The cost to address each maintenance need was then incorporated in the Sidewalk Management System replacement and rehabilitation needs.

Each block of the Town was examined for overall condition and various sidewalk damage issues. The following figures show the difference between an overall condition 2 (very good) sidewalk and an overall condition 4 (poor or recommended refurbishment within near-term) sidewalk.

Figure 9-3 Vitruvian Way – Condition 2 Example

Figure 9-4 Addison Road – Condition 4 Example

A total of 2,110 sidewalk damage points was identified. The magnitude of each damage point was recorded and categorized into five damage types: offsets, depression, separation, uplift, and tripping hazards. Offsets were further specified by size or cause. The map below presents the damage point locations. Each red dot represents a GPS location of the damage point, and the cause and significance of the issue are recorded as an attribute in the database.

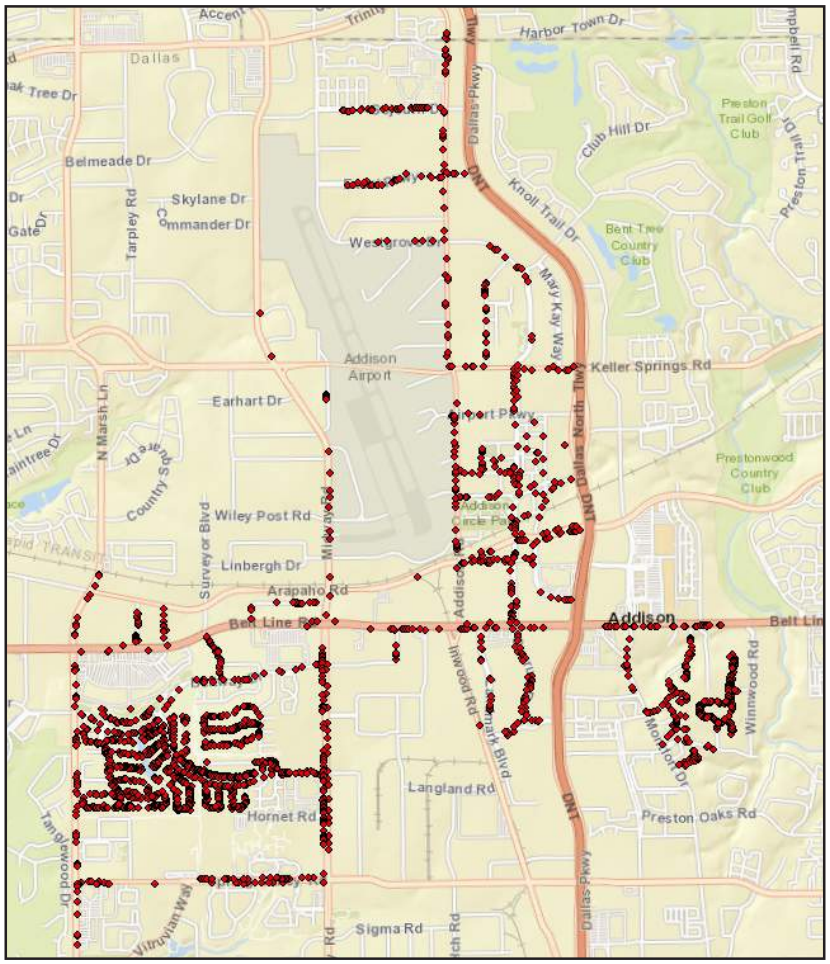


Figure 9-5 Map of Sidewalk Damage Points

The images below show examples of sidewalk damage found during the assessment.

Figure 9-6 Offset – 1 Inch or Greater Example

Figure 9-7 Uplift Example

Figure 9-8 Offset – Storm Drain Inlet Example

Figure 9-9 Depression Example

Figure 9-10 Tripping Hazard Example

Figure 9-11 Separation Example

The table below summarizes the damage types and the number of occurrences found for each type.

Table 9-2 Sidewalk Damage Occurrences by Type

Damage Type	Quantity
Offset	1,125
Depression	428
Uplift	91
Separation	421
Tripping Hazard	45

The following table outlines the cost assumptions used for the sidewalk repair. These costs were applied to each damage point to estimate the overall cost to repair the Town sidewalk. The estimated one-time cost to repair all sidewalk damage is approximately $835,000.

Table 9-3 Estimated Sidewalk Repair Costs by Damage Type

Damage Type	Cost
Offset – Less than 1 inch	$140 EA
Offset – 1 inch or greater	$700 EA
Depression	$70/LF
Uplift	$70/LF
Separation	$10/LF
Tripping Hazard	$350 EA

What Does the Town Need to Sustain the Delivery of Services?

In order to estimate the long-term asset replacement and rehabilitation needs for the Sidewalk Management System, a life-cycle cost analysis was performed. As mentioned earlier, the life-cycle investment needs for sidewalks are different than other infrastructure assets because sidewalks are very rarely completely replaced due to deterioration of its condition. Rather than needing replacement every certain number of years, sidewalks require continuous refurbishment (e.g., fix offsets, replace panels, fill separations). In order to account for partial replacement and refurbishment of sidewalks, a 0.5% refurbishment cost was allocated to each year for sidewalk upkeep. These refurbishment costs equate to approximately $85,000 per year.

The figure below displays the 30-year replacement and rehabilitation needs for the Sidewalk Management System. Utilizing a deterministic model, in which assets are rehabilitated and replaced exactly as outlined in the model, the average needs are approximately $231,000 per year, in 2018 dollars.

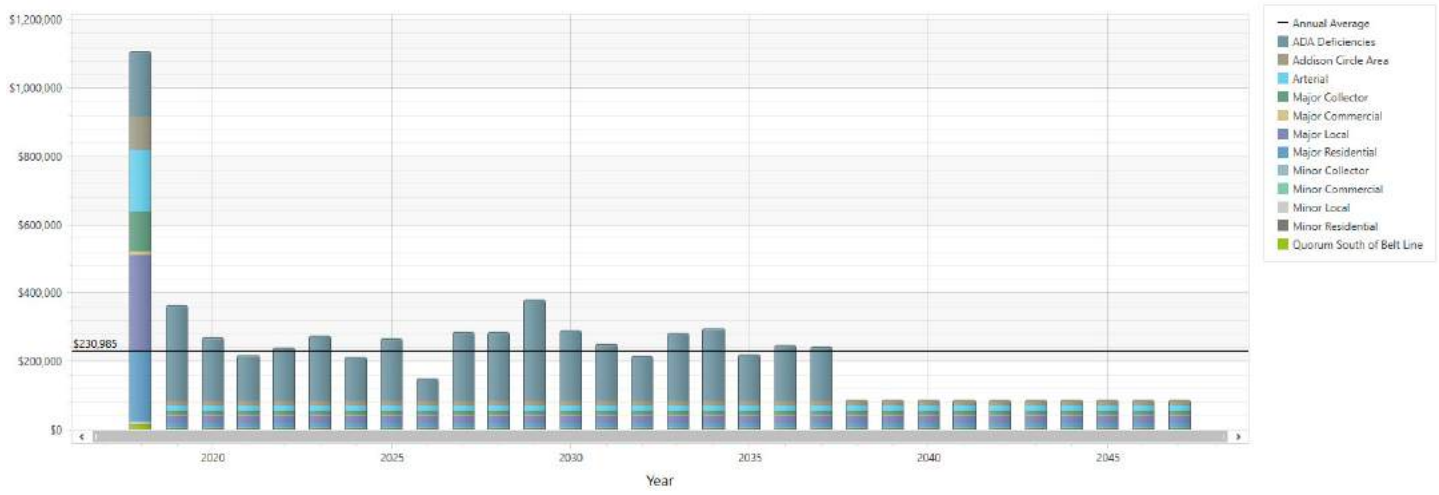


Figure 9-12 30-Year Sidewalk Replacement and Rehabilitation Profile (Deterministic Model)

The spike in the first year is due to the immediate one-time need costs to address the sidewalk damage issues. In addition, the costs outlined in the ADA Transition are spread out over the next 20 years, and they are represented by the top-most portion of each year's spike up until 2038.

Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from approximately $231,000 per year to $321,000 per year. The results of these analyses are presented in the figures below.

Table 9-4 Sidewalk Management System 30-Year Summary

30-Year	Annual Average
Deterministic	$230,985/yr
Deterministic with 3% Inflation	$320,616/yr

How Should the Town Prioritize?

In order to prioritize the limited budget available to address the ongoing replacement and rehabilitation needs of the sidewalks, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was utilized.

When assigning criticality to the sidewalks, road class was taken into account in order to determine pedestrian traffic level. The criticality scale for sidewalks by road class is shown below. Because sidewalks play a major role in public safety, no sidewalks were assigned a CoF score of 1.

Table 9-5 Sidewalk Asset-Level Criticality by Road Class

Criticality - 5	Criticality - 4	Criticality - 3	Criticality - 2	Criticality - 1
Critical				Non-Essential
• Major Residential • Minor Residential • Addison Circle Area	• Major Local • Minor Local • Quorum South of Belt Line	• Arterial • Major Collector • Minor Collector	• Major Commercial • Minor Commercial	• N/A

The following table shows the number of sidewalk segments in each CoF category.

Table 9-6 Sidewalk CoF Results

CoF	Length (mi)
5	40.4
4	35.6
3	41.5
2	2.3
1	0

The following figure shows the resulting overall risk profile for the Town's sidewalks. For the Sidewalk Management System, the sidewalk damage issues should take as high a priority as the red zone assets.

Figure 9-13 Sidewalk Risk Matrix

Currently, there are no sidewalk segments in the red zone. However, since sidewalks are usually rehabilitated and not replaced, all the sidewalk segments with damage points should be considered high-risk assets. As such, the Town should plan to address the $835,000 worth of sidewalk damage costs in the near future.

The following table displays the total Catch Up, or the total replacement and rehabilitation costs in 2018 as well as the Keep Up for a 30-year planning horizon. These amounts are represented in current year (2018) dollars.

Table 9-7 Catch Up and Keep Up Values

Category	Cost
Catch Up	$0
Keep Up	$230,985/yr

What Level of Service Should the Town Provide?

Level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Two scenarios were developed: Preferred Level of Service and Minimum Level of Service.

As shown in Figure 9-12, the estimated annual needs over a 30-year horizon for the Preferred Level of Service was approximately $231,000.

The figure below shows the rehabilitation and replacement profile over a 30-year horizon for the Minimum Level of Service, where only high-risk assets (with CoF 4 or higher) are addressed. The annual average needs for the Minimum Level of Service is approximately $73,000 per year.

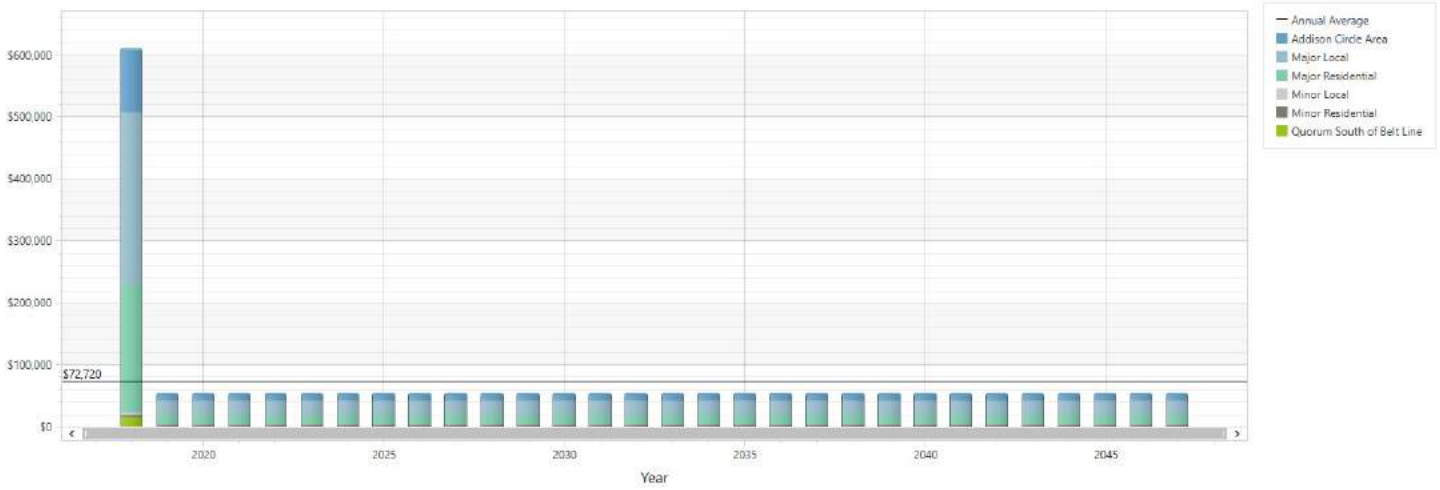


Figure 9-14 Minimum Level of Service Replacement and Rehabilitation Profile

While funding only the high-risk assets would allow the Town to prioritize the more critical needs, this Minimum Level of Service would not address the more important issue of the Town's sidewalks. Although the sidewalks are in decent condition overall, the Minimum Level of Service would not cover the level of service replacement and rehabilitation needs, which is reflected in the current sidewalk level of service failures (e.g., depressions, offsets) throughout the Town. As such, the Minimum Level of Service is not recommended. The Minimum Level of Service scenario is only performed to present the lower spectrum of the funding requirements.

10 | Traffic Signal Management System

10 | Traffic Signal Management System

Physical Health Score B

What Does the Town Own and Manage?

The Town owns and manages a total of 1,463 traffic signal assets at 38 intersections along Town-managed streets. The table below summarizes the assets included in the intersections. In addition to the intersection assets, the Traffic Signal Management System also includes an overarching communication system that is comprised of 8 components, according to Kimley-Horn and Associates' Communication Network Upgrade memorandum.

Table 10-1 Town-Owned Traffic Signal Assets

Intersection	Number of Assets	Intersection	Number of Assets
Addison Rd & Lindbergh Dr	38	Keller Springs Rd & Addison Rd	40
Airport Pkwy & Addison Rd	38	Keller Springs Rd & Quorum Dr	40
Airport Pkwy & Quorum Dr	40	Landmark Blvd & Landmark Pl	34
Arapaho Rd & Addison Rd	41	Marsh Ln & Arapaho Rd	38
Arapaho Rd & Edwin Lewis Dr	42	Marsh Ln & Target	33
Arapaho Rd & Quorum Dr	44	Midway Rd & Beltway Dr	40
Arapaho Rd & Spectrum Dr	41	Midway Rd & Boyington Dr/Dooley Rd	38
Arapaho Rd & Surveyor Blvd	39	Midway Rd & Hornet Rd	30
Belt Line Rd & Addison Rd/Inwood Rd	46	Midway Rd & Lindbergh Dr	41
Belt Line Rd & Beltway Dr	30	Midway Rd & Proton Dr	40
Belt Line Rd & Business Ave	44	Quorum Dr & Edwin Lewis Dr	40
Belt Line Rd & Commercial Dr	24	Sojourn Dr & Addison Rd	38
Belt Line Rd & Marsh Ln	47	Sojourn Dr & Westgrove Dr	39
Belt Line Rd & Midway Rd	48	Spring Valley Rd & Greenhill School Rd	33
Belt Line Rd & Quorum Dr	48	Spring Valley Rd & Midway Rd	49
Belt Line Rd & Runyon Rd	44	Spring Valley Rd & Vitruvian Way	39
Belt Line Rd & Surveyor Blvd	45	Vitruvian Way & Ponte Ave	40
Belt Line Rd Crosswalk	13	Westgrove Dr & Addison Rd	38
Inwood Rd & Landmark Pl	27	Westgrove Dr & Quorum Rd	26
		Total	**1,463***

*Total quantity includes Communication System Components.

Communication System Components
Licensed PTP Backhaul Links (3 Total)
PMP Access Point Radios
PMP Subscriber Unit Radios
Hardened Ethernet Network Switches
PTZ CCTV Cameras
Warranty and Service Agreement
Miscellaneous Conduit and Ground Box Construction
Spare Equipment

What is an Asset?

Assets defined in the Traffic Signal Management System included signal heads, signal poles, pedestrian signal heads, illuminated street name signs, and others. Non-lighted street signs were included in the Traffic Sign Management System. Individual curb ramps were included in the Curb Ramp Management System.

Samples of the traffic signal system components that were designated as assets are shown in the following figures.

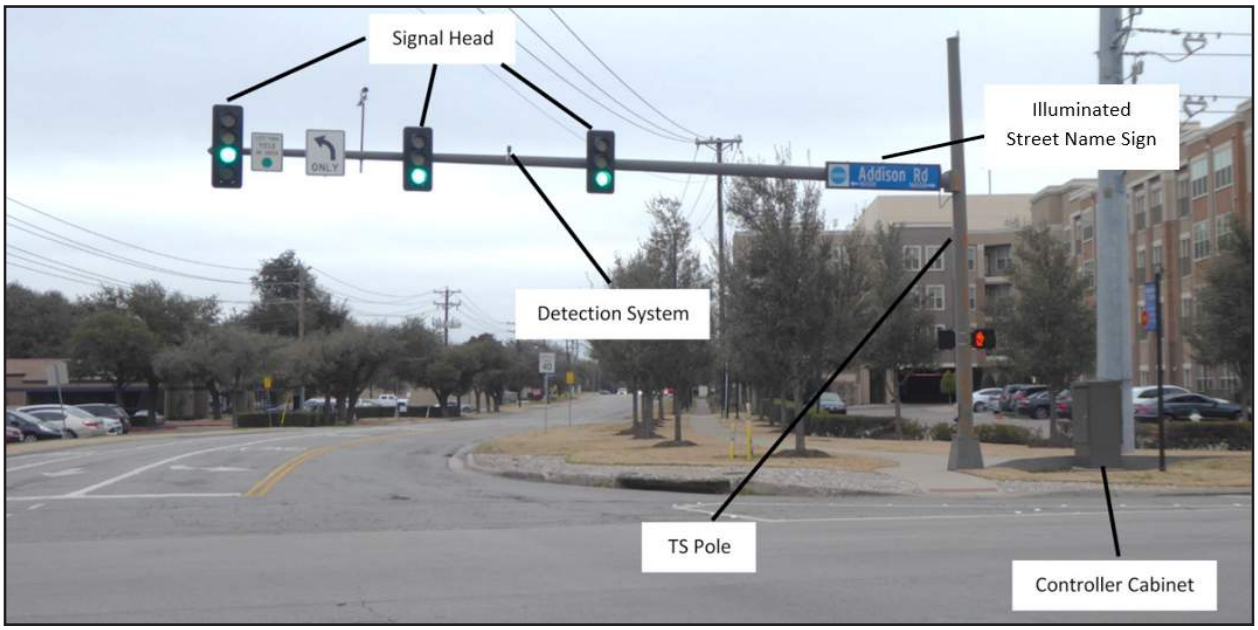


Figure 10-1 Traffic Signal Assets Sample

Figure 10-2 Traffic Signal Pedestrian Assets Sample

A full list of traffic signal asset classes is shown in the table below.

Table 10-2 Traffic Signal Asset Classes

Asset Classes –Traffic Signals	
Traffic Signal Pole + Mast	Illuminated Street (ILS) Sign
Controller Cabinet (Traffic Controller System)	Communication System
Detection System	Pedestrian Signal Head
Signal Heads	Pedestrian Push Buttons
Service Cabinet with Battery Backup System (BBS)	Wiring

What is the Replacement Value of the Town's Assets?

In total, there are almost 1,500 assets in the Traffic Signal Management System. The estimated replacement cost for each asset was based on Town staff estimates and the historical cost database. The sum of all replacement costs for the Traffic Signal Management System, in 2018 dollars, is approximately $9.7 million.

The following table summarizes the total asset replacement cost by intersection.

Table 10-3 Summary of Traffic Signal Asset Replacement Costs

Intersection	Number of Assets	Replacement Cost
Addison Rd & Lindbergh Dr	38	$226,000
Airport Pkwy & Addison Rd	38	$226,000
Airport Pkwy & Quorum Dr	40	$248,210
Arapaho Rd & Addison Rd	41	$241,000
Arapaho Rd & Edwin Lewis Dr	42	$246,000
Arapaho Rd & Quorum Dr	44	$256,000
Arapaho Rd & Spectrum Dr	41	$243,360
Arapaho Rd & Surveyor Blvd	39	$232,985
Belt Line Rd & Addison Rd/Inwood Rd	46	$278,360
Belt Line Rd & Beltway Dr	30	$213,520
Belt Line Rd & Business Ave	44	$269,000
Belt Line Rd & Commercial Dr	24	$220,000
Belt Line Rd & Marsh Ln	47	$271,000
Belt Line Rd & Midway Rd	48	$318,660
Belt Line Rd & Quorum Dr	48	$318,360
Belt Line Rd & Runyon Rd	44	$266,000
Belt Line Rd & Surveyor Blvd	45	$276,000
Belt Line Rd Crosswalk	13	$123,000
Inwood Rd & Landmark Pl	27	$221,360
*Communication System	8	$490,000

Intersection	Number of Assets	Replacement Cost
Keller Springs Rd & Addison Rd	40	$236,000
Keller Springs Rd & Quorum Dr	40	$237,985
Landmark Blvd & Landmark Pl	34	$240,360
Marsh Ln & Arapaho Rd	38	$242,000
Marsh Ln & Target	33	$227,360
Midway Rd & Beltway Dr	40	$248,360
Midway Rd & Boyington Dr/Dooley Rd	38	$228,360
Midway Rd & Hornet Rd	30	$226,360
Midway Rd & Lindbergh Dr	41	$246,000
Midway Rd & Proton Dr	40	$248,360
Quorum Dr & Edwin Lewis Dr	40	$248,600
Sojourn Dr & Addison Rd	38	$226,000
Sojourn Dr & Westgrove Dr	39	$233,585
Spring Valley Rd & Greenhill School Rd	33	$203,500
Spring Valley Rd & Midway Rd	49	$321,000
Spring Valley Rd & Vitruvian Way	39	$233,000
Vitruvian Way & Ponte Ave	40	$236,000
Westgrove Dr & Addison Rd	38	$226,000
Westgrove Dr & Quorum Rd	26	$183,745
Total	**1,445**	**$9,677,390**

*Communication System asset - not an intersection.

What is the Condition of the Town's Assets?

During the inventory verification and development process, each intersection was visited to assess the overall condition of the traffic signal and its included components. Visual assessment, however, is often not a good representation of traffic signal asset condition. For example, a visual assessment of a controller cabinet or a detection system camera is not a sufficient evaluation of the condition or the asset's ability to function. In such cases, the assets were given an assumed condition score of 3 (good) given that the intersection had a functioning traffic signal system. In other cases, for instance for the communication system, the asset components were given a condition score of 5 (failing) with staff input and knowledge that the overarching system is obsolete and failing.

As each intersection was visited, any immediate maintenance needs were noted. Some issues that were found for the traffic signal poles included paint needs, sanding needs, and replacement of pole bases. In total, the immediate maintenance needs came out to a total of $55,400.

What Does the Town Need to Sustain the Delivery of Services?

In order to estimate the long-term investment needs for the Traffic Signal Management System, a life cycle cost analysis was performed. Life cycle cost logic or management strategies were developed for the traffic signal assets. Each asset class was assigned a management strategy that includes the rehabilitation and replacement activities to best characterize the life cycle investment needs for the asset. Below is a complete list of management strategies used to calculate the life cycle costs of the traffic signal assets.

Table 10-4 Traffic Signal Management Strategies

Asset Class	Useful Life	Rehab Activity	Rehab Frequency	Rehab Cost	Rehab Activity	Rehab Frequency	Rehab Cost	Rehab Activity	Rehab Frequency	Rehab Cost
Signal Poles	50									
Controller Cabinet	30	Update internal components	5	$4,000						
Detection System	10									
ILS Sign	20	Replace retroreflective face	5	15%						
Wiring	25									
Pedestrian Push Buttons	15									
Pedestrian Signal Head	25	Replace LEDs	12	$1,000						
Service Cabinet with BBS	30	Paint	5	$500	Replace batteries	3	$2,500	Replace BBS Controller	10	$3,000
Signal Heads	40	Replace LEDs	10	$1,000						

The following figure illustrates the 30-year replacement and rehabilitation needs for the Traffic Signal Management System. The immediate maintenance needs identified during condition assessment, such as painting, were added to the first year cost, as these issues should be addressed immediately. In addition, the Town's Americans with Disabilities Act (ADA) Transition Plan identified some deficiencies in the traffic signal assets. The specified ADA Transition Plan costs were directly tied to each intersection and the total amount was added as a one-time cost. These ADA Transition Plan costs were then spread out throughout the first 20 years as identified in the plan. The total one-time cost to cover immediate maintenance needs and to fix any ADA deficiencies is approximately $870,000.

Utilizing a deterministic model, the average annual replacement and rehabilitation needs over the 30-year planning horizon is approximately $513,000, in 2018 dollars.

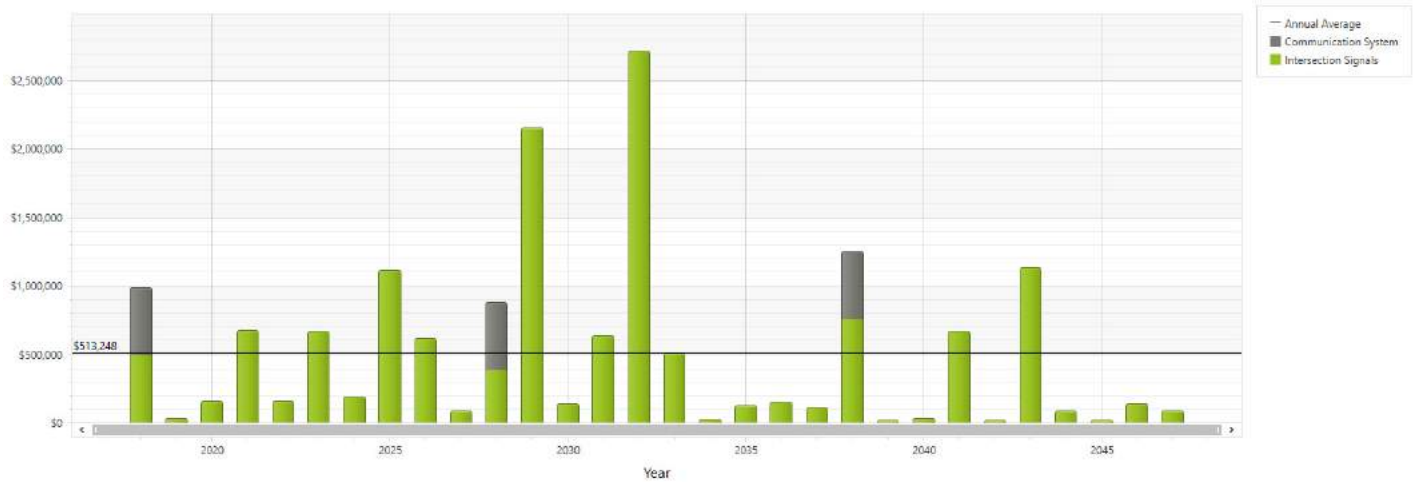


Figure 10-3 30-Year Traffic Signal Replacement and Rehabilitation Profile (Deterministic Model)

The 30-year life cycle cost analysis was repeated utilizing a probabilistic model, in which asset failures were smoothed to represent a more realistic expectation. The probabilistic model predicts the annual replacement and rehabilitation needs to be approximately $435,000.

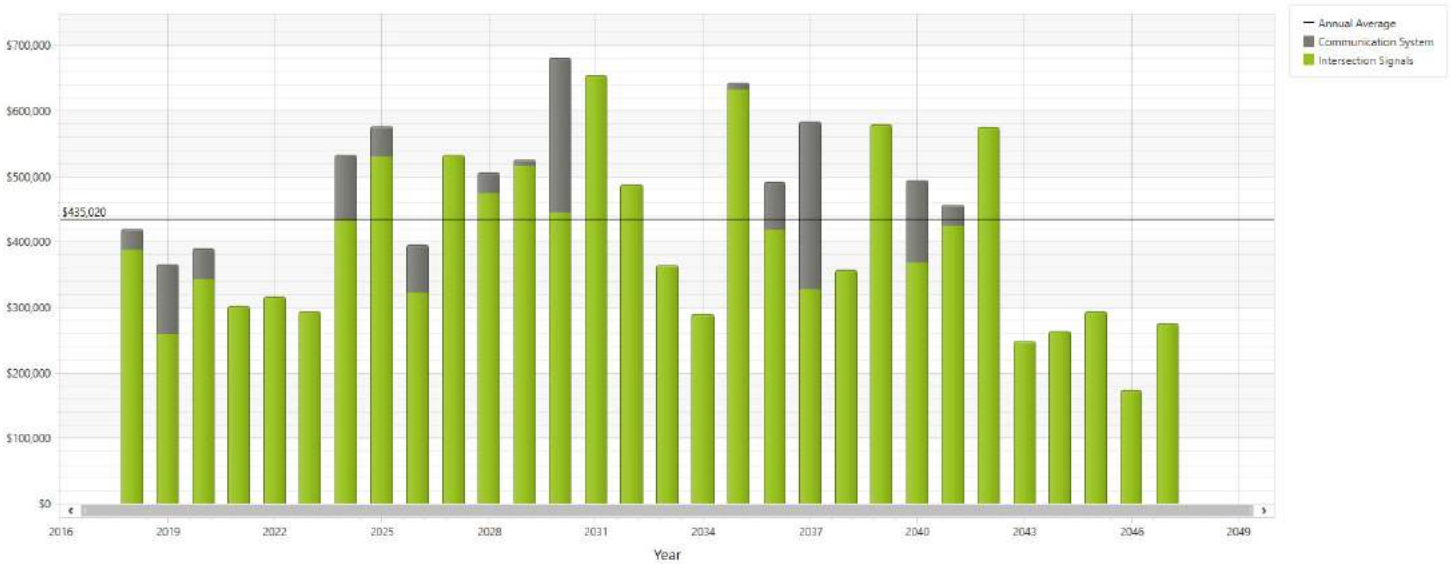


Figure 10-4 30-Year Traffic Signal Replacement and Rehabilitation Profile (Probabilistic Model)

Both analyses above represented results in today's dollars (2018). Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from approximately $517,000 per year to $764,000 per year. Similarly, for the probabilistic model, the annual investment need increased from $435,000 per year to $677,000 per year. The results of these analyses are summarized in the following table.

Table 10-5 Traffic Signal Management System 30-Year Summary

30-Year	Annual Average
Deterministic	$513,000/yr
Probabilistic	$435,000/yr
Deterministic with 3% Inflation	$760,000/yr
Probabilistic with 3% Inflation	$677,000/yr

How Should the Town Prioritize?

In order to prioritize the limited budget available to address the ongoing replacement and rehabilitation needs of the traffic signal assets, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was utilized.

All traffic signals are critical. In order to prioritize the traffic signals, a two-tier system was used. In the first tier, the road class of the intersection was used to estimate the volume and speed of traffic at that intersection. The higher the volume and speed of traffic (e.g., arterial intersection), the higher the criticality of the intersection. The road class of all the intersection legs was considered when assigning criticality. For instance, a traffic signal at the intersection of two arterial roads was given a higher criticality than a traffic signal at the intersection of an arterial road and a collector road. The ranking of the road class criticality is shown in the table below.

Table 10-6 Road Class Criticality

Road Classes	Criticality
Arterial/Arterial	High
Arterial/Major Collector	
Arterial/Major Commercial	
Arterial/Major Local	
Arterial/Minor Local	
Arterial/Major Commercial	
Arterial/Private	
Major Collector/Major Collector	
Major Collector/Major Local	
Major Collector/Minor Local	
Major Local/Major Local	

In addition, each asset class was assigned a CoF score based on their criticality to the system as well as on safety and regulatory concerns. Assets that were critical to the function of the traffic signal (e.g., signal heads, signal poles) and were critical for safety (e.g., pedestrian signal heads) were given high criticality scores.

Table 10-7 Traffic Signal Asset-Level Criticality

Class/Type	Criticality
Signal Poles	5
Signal Heads	5
Pedestrian Signal Head	5
Pedestrian Push Buttons	5
Wiring	5
Service Cabinet with BBS	4
Detection System	4
Controller Cabinet	3
ILS Sign	3

The following figure shows the resulting overall risk profile for Town-owned and managed traffic signal assets. Currently, there are only 11 high-risk assets. These high-risk assets include the traffic signal poles at the intersection of Belt Line Rd and Addison Rd/Inwood Rd, the wiring at the intersection of Midway Rd and Boyington Dr/Dooley Rd, and the overarching traffic signal communication system and all of its components.

Figure 10-5 Traffic Signal Risk Matrix

Although there are only 11 assets in the high-risk zone, all of the immediate maintenance needs and the ADA deficiencies outlined in the transition plan should be considered high risk as well. As such, the aforementioned $870,000 worth of immediate needs and ADA repairs should be treated as high-risk and should be addressed in the near future.

In addition, approximately $5.8 million worth of assets (60%) are in the medium-risk zone, which means many of these assets will begin to fall in the high-risk zone in the near future. It will be critical for the Town to proactively manage the current assets to mitigate the deterioration process. If maintenance work is missed, the condition of the assets will decrease exponentially, making the need for replacement approach sooner.

The following table displays the total Catch Up, or the total replacement and rehabilitation costs in 2018 as well as the Keep Up for a 30-year planning horizon. These amounts are represented in current year (2018) dollars.

Table 10-8 Catch Up and Keep Up Values

Category	Cost
Catch Up	$530,000
Keep Up	$495,582/yr

What Level of Service Should the Town Provide?

Level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Two scenarios were developed: Preferred Level of Service and Minimum Level of Service.

As shown in Figure 10-3, the estimated annual needs over a 30-year horizon for the Preferred Level of Service is approximately $513,000.

The figure below shows the rehabilitation and replacement profile over a 30-year horizon for the Minimum Level of Service, where only high-risk assets (with CoF 4 or higher) are addressed. The annual average needs for the Minimum Level of Service is approximately $414,000 per year.

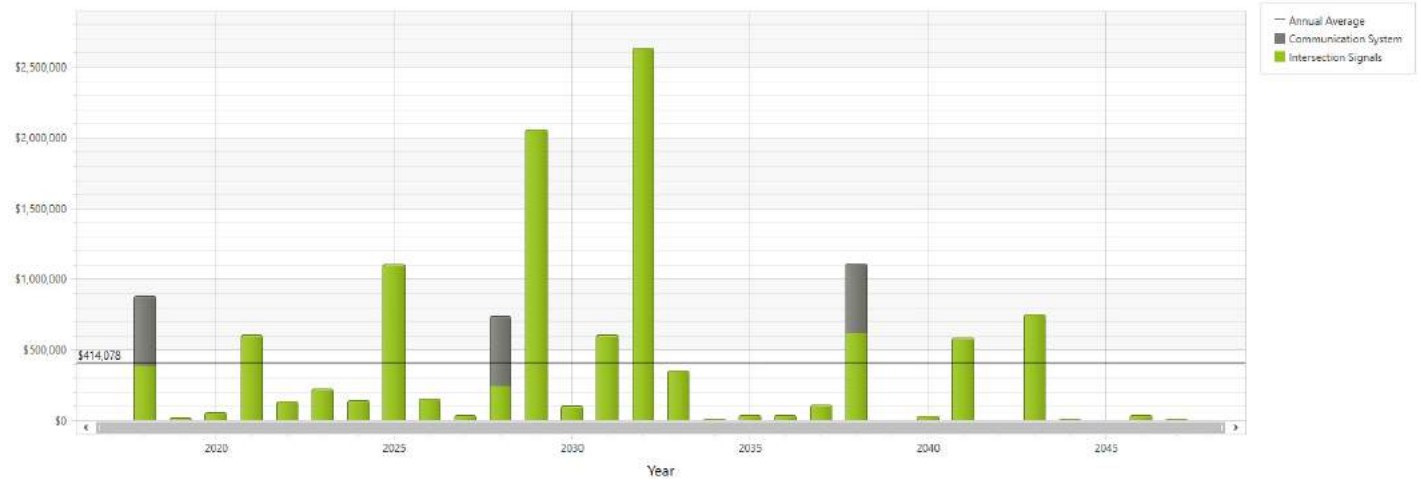


Figure 10-6 Minimum Level of Service Replacement and Rehabilitation Profile

While funding only the high-risk assets would allow the Town to prioritize the more critical needs, this Minimum Level of Service would not address several of the Town's traffic signal assets. As such, the Minimum Level of Service is not recommended. The Minimum Level of Service scenario is only performed to present the lower spectrum of the funding requirements.

11 | Traffic Sign Management System

Physical Health Score B

What Does the Town Own and Manage?

The Town owns and manages a total of 1,990 traffic signs on 1,288 poles and all of the pavement markings throughout the Town. The table below summarizes the Town's sign inventory by sign type and pole type.

Table 11-1 Town-Owned Traffic Sign & Pole Assets by Type

Sign Type	Number of Assets
Directional	397
Guide	112
Regulatory	1,247
School	19
Warning	215
Total	**1,990**

Pole Type	Number of Assets
Decorative Poles	58
Standard Poles	1,230
Total	**1,288**

The figure below illustrates the sign inventory. Each red dot represents a sign location.

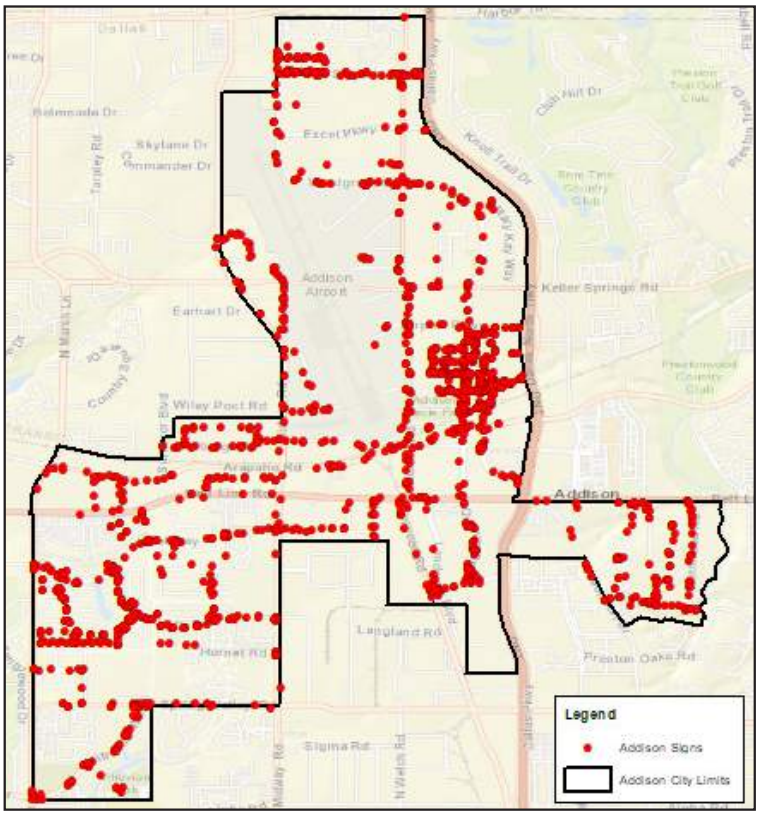


Figure 11-1 Map of Addison Traffic Signs

What is an Asset?

In the case of the traffic signs, each pavement marking, sign, and pole is considered an asset. Signs are typically found on the sides of streets and/or buildings and generally bear symbols, words of warning, or direction to assist people in navigation and safety.

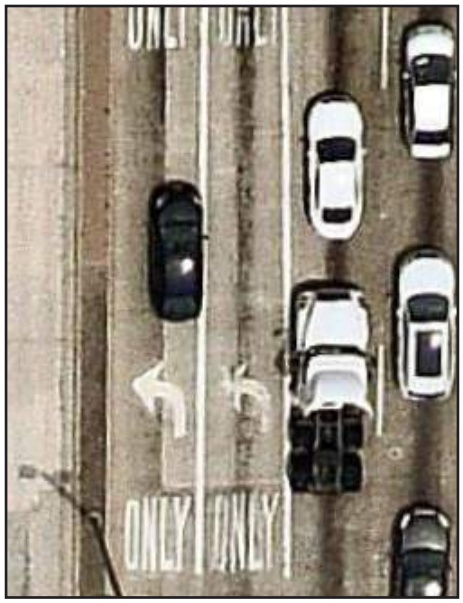
In the Town's sign and pole inventory, each sign asset was captured geographically and categorized into five sign types as defined by the Texas Department of Transportation Standard Highway Sign Design categories. In addition to pavement markings, the five traffic sign types are as follows:

- Directional Signs - provide a directional reference (e.g., Spectrum Dr street sign)
- Guide Signs - give general information, (e.g., Public Parking)
- Regulatory Signs – instruct drivers to perform an action (e.g., Stop)
- Warning Signs – indicate a hazard ahead on the road that a driver may not be prepared for (e.g. Yield).
- School Signs – identify school zones for enhanced safety (e.g. School)

The following images show examples of each sign type.

Table 11-2 Traffic Sign Types

Traffic Sign Examples	
Directional Sign	**Guide Sign**
	
Regulatory Sign	**Warning Sign**
	

Traffic Sign Examples	
School Sign	**Pavement Marking**
	

The sign poles are categorized into two main pole types: standard and decorative. The standard pole is a square non-painted pole and is the most common pole type. Standard poles are located throughout the Town. The decorative poles are round, painted, and typically have a gold "A" post topper. The decorative poles are located in the Addison Circle area and are generally used to support street name and stop signs. Table 11-3 shows samples of the pole types.

Table 11-3 Sign Pole Types

Sign Pole Examples	
Town Sign Pole	**Addison Circle Street Sign Pole**
	

What is the Replacement Value of the Town's Assets?

In total, there are over 4,600 assets in the Traffic Sign Management System. A representative sign cost was applied for each type of sign. Costs were derived from the Standard Highway Sign Designs for Texas, 2012 Edition, Revision 2 – March 2017. For pavement markings, costs were applied based off of recent bid documents for the Town's pavement markings projects. The sum of all replacement costs for all pavement markings, signs, and poles, in 2018 dollars, is approximately $995,000.

The table below summarizes the total asset replacement cost by asset type.

Table 11-4 Summary of Traffic Sign and Pole Asset Replacement Costs

Sign Type	Number of Assets	Replacement Cost
Directional	397	$13,895
Guide	112	$51,240
Regulatory	1,247	$43,645
School	19	$3,985
Warning	215	$9,675
Total	**1,990**	**$122,440**

Pole Type	Number of Assets	Replacement Cost
Decorative Poles	58	$14,500
Standard Poles	1,230	$246,000
Total	**1,288**	**$260,500**

Sign Type	Replacement Cost
Pavement Markings	$597,397
Total	**$597,397**

What is the Condition of the Town's Assets?

During the inventory verification and asset database development process, each sign was visited for inventory and assessment of the sign's general condition. The sign's location was captured using a handheld GPS unit. Each sign was visually evaluated on its overall visibility, clarity, and general structural integrity. Condition issues, such as cracking, peeling or other general failure in the sign's quality, were also noted. Laser reflectivity testing was not performed.

The images below show a representative sample of condition 2 versus condition 4 and 5 assets. As is shown in the images, the condition 2 assets are in very good condition. On the other end of the spectrum, the condition 4 sign is deteriorating and in the near future will no longer serve its function. The condition 5 sign has faded to the point of no longer being able to serve its function.

Table 11-5 Sample Traffic Signs by Condition

Condition 2 Sign Example	Condition 4 Sign Example
	
Condition 2 Sign Example	**Condition 5 Sign Example**
	

In recent years, the Town has diligently replaced numerous traffic signs and poles. The condition assessment results indicated that only about 10% of the signs are in poor to failed condition. The Town's recent replacement program has helped to minimize the poor and failed condition signs.

The figure below summarizes the overall conditions of the Town's traffic signs.

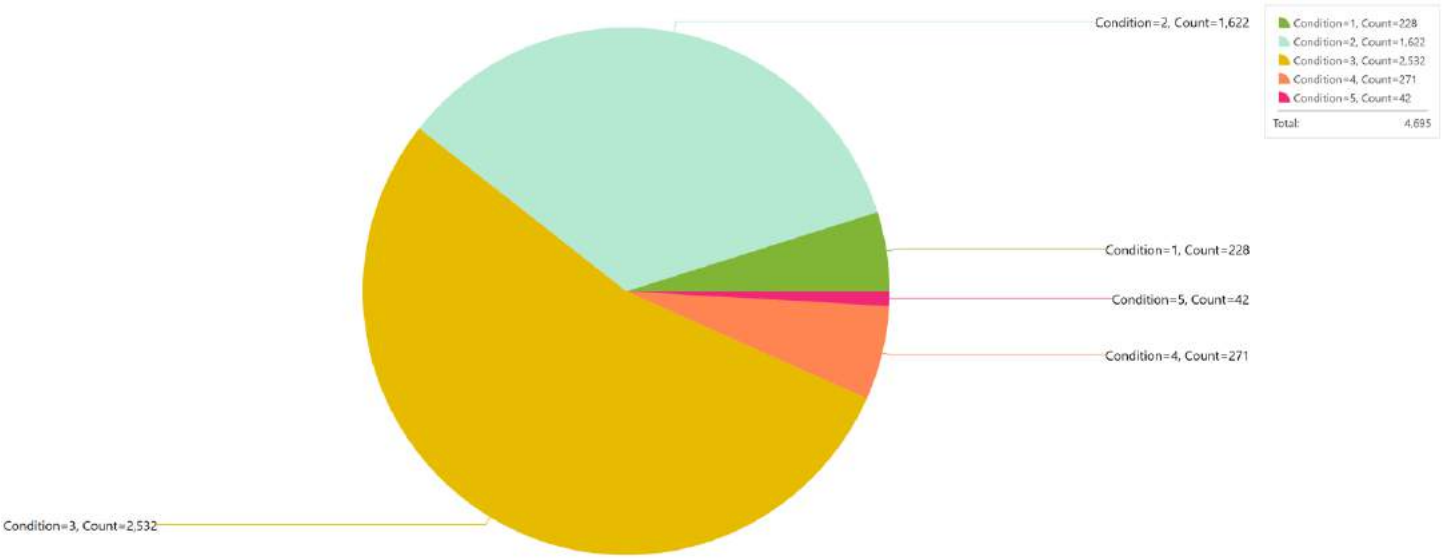


Figure 11-2 Traffic Sign Condition Assessment Results

The majority of the Town's traffic signs are in good to excellent condition. Similarly, the pavement markings are in good condition given that the Town ran pavement markings projects yearly for the past couple of years. Some signs throughout the Town are nearing the end of their lives or need replacement right away. Of those failing signs, 89% are regulatory signs with a total replacement cost of $1,330. Of the failing regulatory signs, 60% are No Parking signs. Figure 11-3 below shows the location of these poor condition signs.

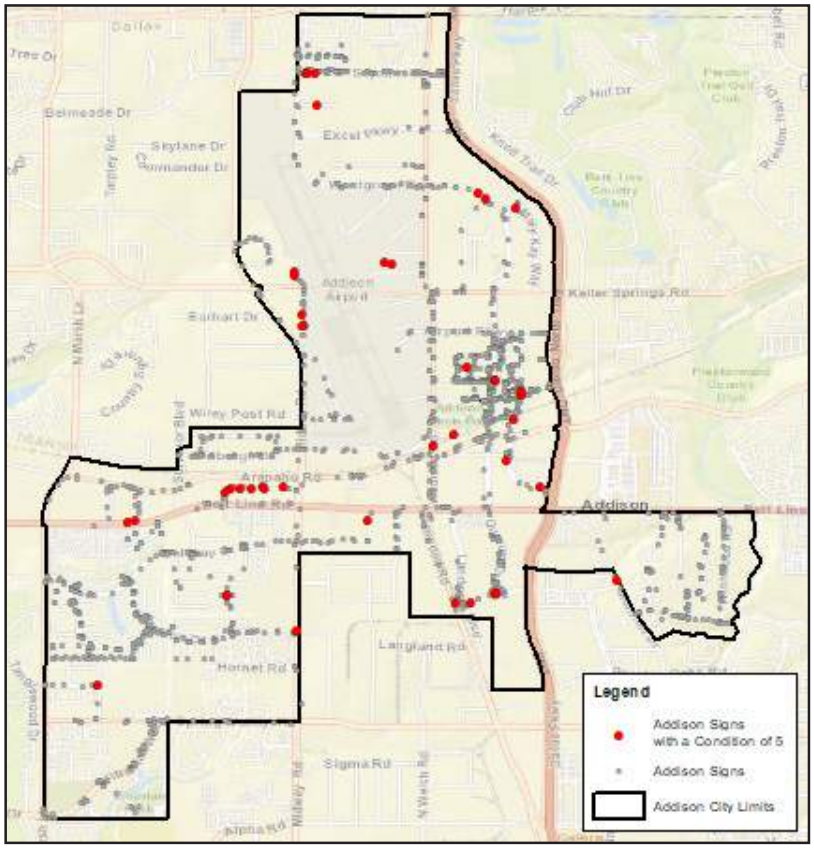


Figure 11-3 Traffic Sign Condition Distribution

What Does the Town Need to Sustain the Delivery of Services?

In order to estimate the long-term asset replacement and rehabilitation needs for the Traffic Sign Management System, a life-cycle cost analysis was performed each asset. Each asset class was assigned a life cycle cost logic or management strategy that includes the rehabilitation and replacement activities to best characterize the life cycle investment needs for the asset.

In consultation with the Town staff, it was found that signs facing south and west were subjected to more rapid deterioration due to the direct sunlight. These signs were given a shorter useful life. Of the Town's signs, just over half (52%) were found to face south or west. For pavement markings, the more frequently traveled roads and intersections experienced more rapid deterioration due to greater use.

For the decorative poles, rehabilitation (i.e., paint) is required to keep the asset visually functional or to realize the end of useful life.

Below is a list of management strategies developed to calculate the life cycle costs of the traffic sign assets. The useful life represents how long the asset is expected to last before needing replacement.

Table 11-6 Traffic Sign Management Strategies

Management Strategy	Useful Life	Rehabilitation	Frequency	Rehab Cost
Sign Facing South or West	8			
Sign Facing North or East	10			
Management Strategy	**Useful Life**	**Rehabilitation**	**Frequency**	**Rehab Cost**
Decorative Pole	40	Painting	10	$25
Standard Pole	40			
Management Strategy	**Useful Life**	**Rehabilitation**	**Frequency**	**Rehab Cost**
Pavement Markings	3			

The following figure illustrates the 30-year replacement and rehabilitation needs for the Traffic Sign Management System. Utilizing a deterministic model, the average annual replacement and rehabilitation needs over the 30-year planning horizon is approximately $224,000.

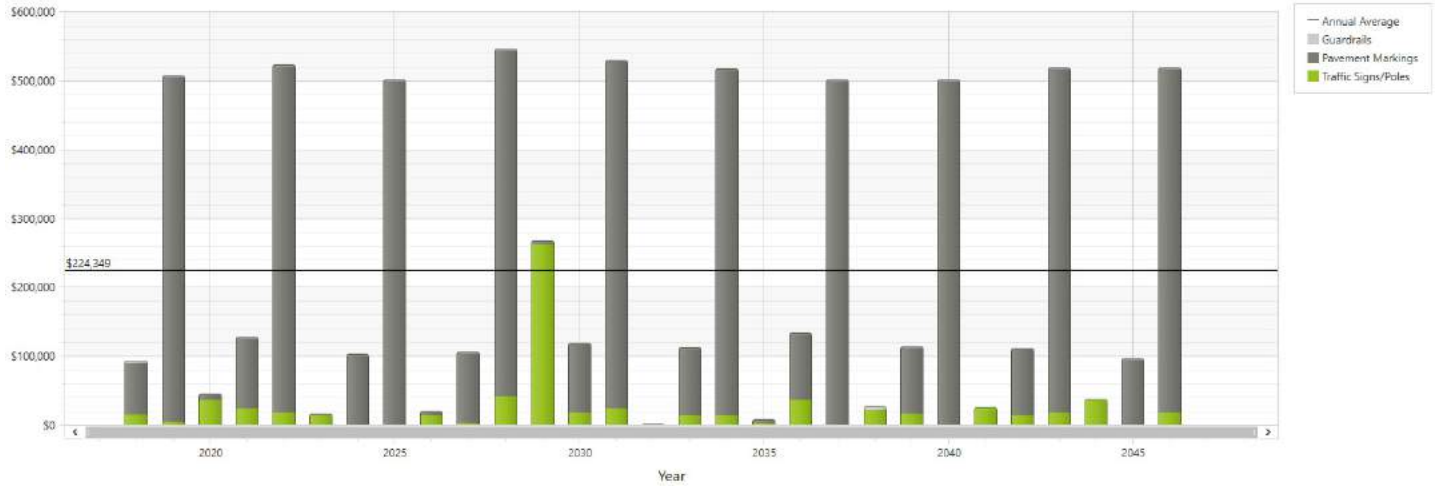


Figure 11-4 30-Year Traffic Sign Replacement and Rehabilitation Profile (Deterministic Model)

To further break down the annual replacement and rehabilitation cost of the deterministic model ($224,000), pavement markings require a need of approximately $200,000 and traffic signs require a need of approximately $24,000. These values make up the combined annual need of $224,000 for the Traffic Sign Management System.

The 30-year life cycle cost analysis was repeated utilizing a probabilistic model, in which asset failures were smoothed to represent a more realistic expectation. The probabilistic model predicts the annual replacement and rehabilitation needs to be approximately $220,000.

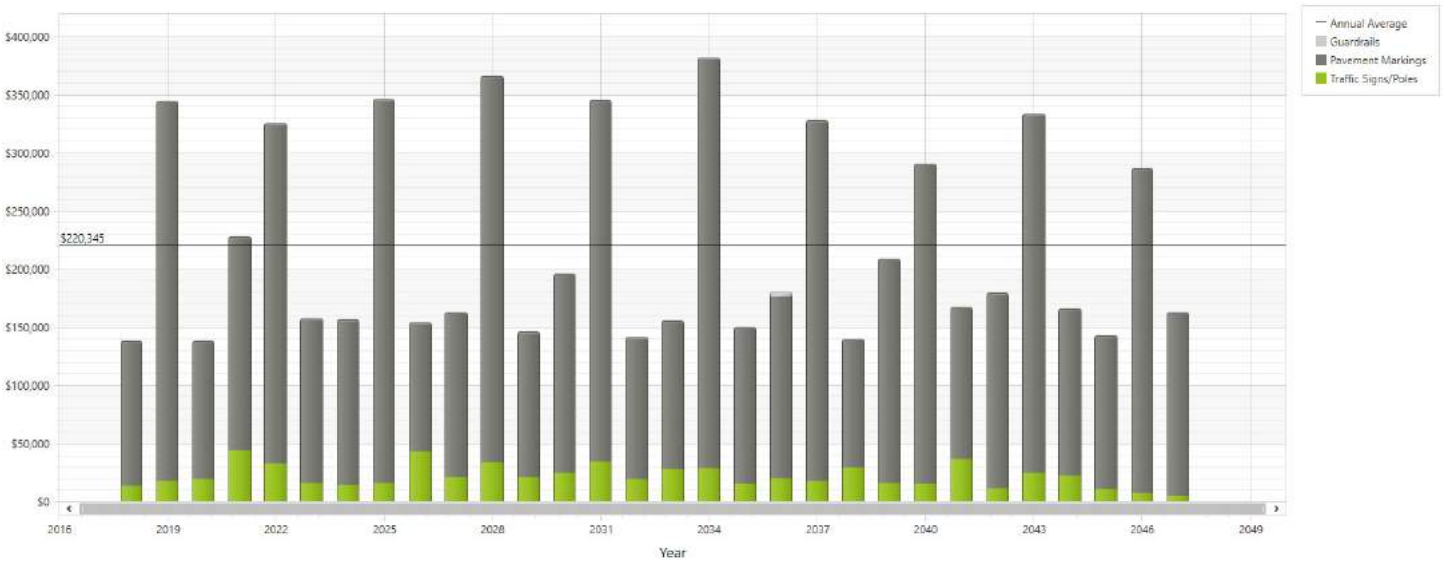


Figure 11-5 30-Year Traffic Sign Replacement and Rehabilitation Profile (Probabilistic Model)

Both analyses above represented results in today's dollars (2018). Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from approximately $224,000 per year to $352,000 per year. Similarly, for the probabilistic model, the annual investment need increased from $220,000 per year to $347,000 per year. The results of these analyses are summarized in the table below.

Table 11-7 Traffic Sign Management System 30-Year Summary

30-Year	Annual Average
Deterministic	$224,000/yr
Probabilistic	$220,000/yr
Deterministic with 3% Inflation	$352,000/yr
Probabilistic with 3% Inflation	$347,000/yr

How Should the Town Prioritize?

In order to prioritize the limited budget available to address the ongoing replacement and rehabilitation needs of the traffic sign assets, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was utilized. A multi-tier, risk-based prioritization system was developed. The prioritization scheme considers the type and location of the signs.

In the first-tier, the location of the sign was considered. Road class category was used as the representative indicator of location criticality. The road class represented the volume of traffic and speed. The higher the volume and speed of traffic (e.g., arterial), the higher the criticality of the roadway. For instance, a traffic sign along an arterial road was given a higher criticality than a traffic sign along a residential road. The ranking of the road class criticality is shown in the table below. Based on conversations with the Town, the Addison Circle Area was given a higher critically ranking as well. This area is a main gathering point in the Town, and it has high vehicular and pedestrian traffic. For pavement markings, the road class of all the intersection legs was considered when assigning criticality. For instance, pavement markings at the intersection of two arterial roads was given a higher criticality than pavement markings at the intersection of an arterial road and a collector road. The ranking of the road class criticality is shown in the table below with traffic sign criticality represented in the left-most column and pavement marking criticality represented in the right-most column.

Table 11-8 Road Class Criticality

Road Class - Traffic Signs	Criticality	Road Class - Pavement Markings
Arterial	High	Arterial/Arterial
Major Collector		Arterial/Major Collector
Major Commercial		Arterial/Major Commercial
Major Local		Arterial/Major Local
Major Residential		Arterial/Minor Local
Minor Collector		Arterial/Pedestrian Crossing
Minor Commercial		Arterial/Private
Minor Local		Major Collector/Major Collector
Minor Residential		Major Collector/Major Local
		Major Collector/Minor Local
		Major Local/Major Local

In the second tier, sign type was considered. The leading factor in consideration of criticality was safety. All regulatory, warning, and school signs are critical. They directly relate to the safety of the motorists and pedestrians. Directional and guide signs help enhance the level of service. As such, regulatory, school and warning signs received the highest criticality, while directional and guide signs were considered to be less critical. Table 11-9 summarizes the two-tier criticality methodology used for the Traffic Sign Management System.

Table 11-9 Traffic Sign Asset-Level Criticality

Road Class	Regulatory	Warning	School	Directional	Guide
Arterial	5	5	5	4	3
Major Collector	5	5	5	4	3
Minor Collector	5	5	5	4	3
Major Local	4	4	5	3	2
Minor Local	4	4	5	3	2
Major Commercial	4	4	5	3	1
Minor Commercial	4	4	5	3	1
Major Residential	4	4	5	3	1
Minor Residential	4	4	5	3	1

The following figure shows the resulting overall risk profile for Town-owned and managed traffic sign assets. Currently, there are 122 high-risk assets for a total replacement cost of $35,976.

Figure 11-6 Traffic Sign Risk Matrix

Although there are relatively little assets in the high-risk zone, there are approximately $129,000 worth of assets (13%) in the medium-risk zone, which means many of these assets will begin to fall in the high-risk zone in the near future.

The following table displays the total Catch Up, or the total replacement and rehabilitation costs in 2018 as well as the Keep Up for a 30-year planning horizon. These amounts are represented in current year (2018) dollars.

Table 11-10 Catch Up and Keep Up Values

Category	Cost
Catch Up	$35,975
Keep Up	$223,150/yr

What Level of Service Should the Town Provide?

Level of service allows the Town to evaluate the impact of the budget with respect to the projected work backlog. Two scenarios were developed: Preferred Level of Service and Minimum Level of Service.

As shown in Figure 11-4, the estimated annual needs over a 30-year horizon for the Preferred Level of Service was approximately $224,000.

The typical Minimum Level of Service (i.e., replacing only high-risk assets) is not a feasible scenario for signs. Due to the signs' direct impact on public safety and level of service, replacing only high-risk asset is not an option. For the Traffic Sign Management System, the Minimum Level of Service will match the Preferred Level of Service.

12 | Street Light Management System

Physical Health Score A

What Does the Town Own and Manage?

The Town is responsible for a total of 385 street lights along Belt Line Road, Spectrum Drive, Arapaho Road, and Spring Valley Road. The following map shows Town-owned street light locations in red. The grey dots represent street lights located within the Town but maintained by a different department (i.e., Parks and Recreation), the utility company and/or the City of Dallas.

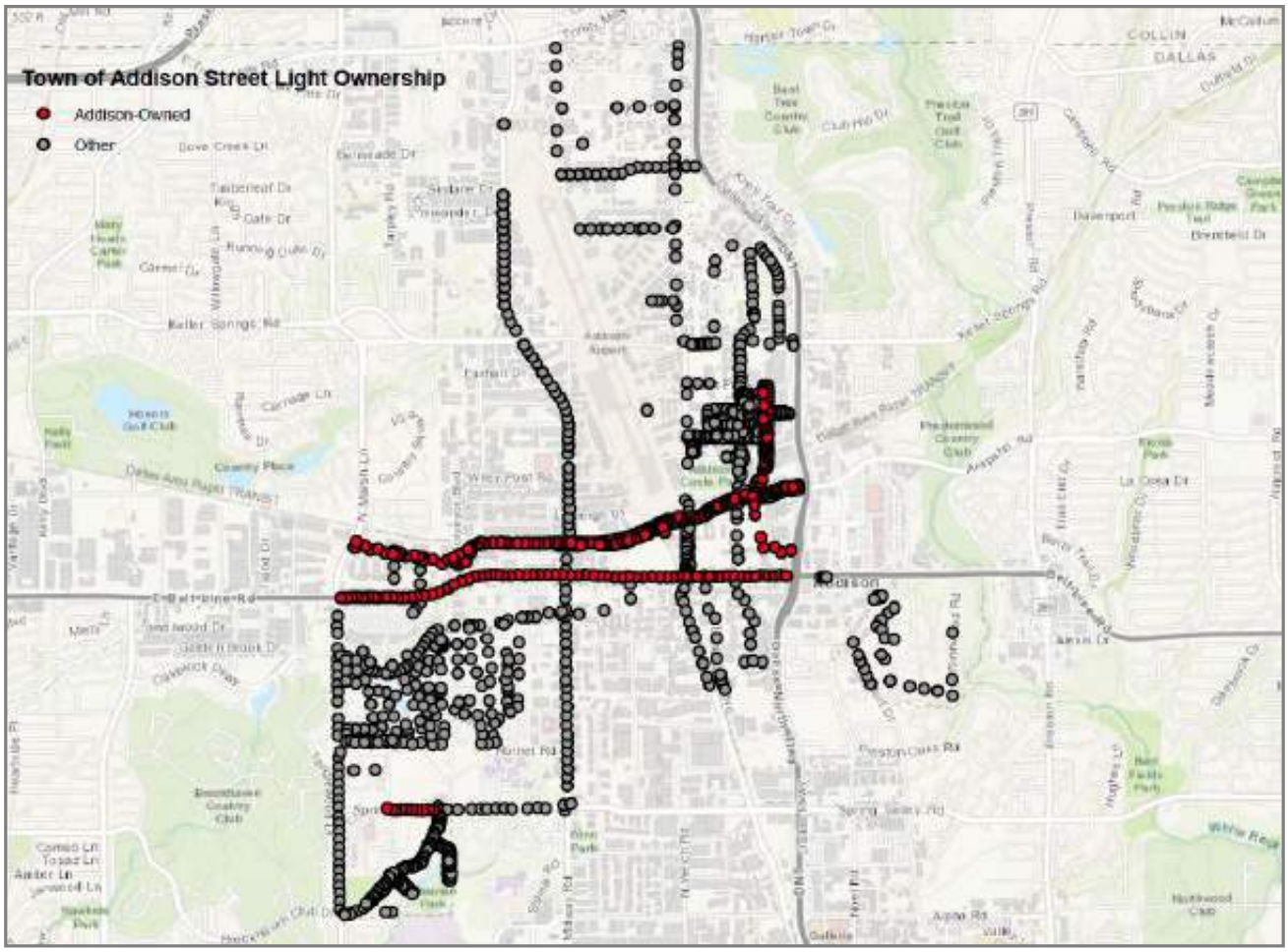


Figure 12-1 Map of Addison Street Lights

What is an Asset?

Each Town-owned street light is considered an asset in the Street Light Management System. The figure below provides examples of the different Town-owned street lights.

Figure 12-2 Examples of Addison Street Lights (From left to right: Arapaho Rd, Belt Line Rd,)

What is the Replacement Value of the Town's Assets?

In total, there are almost 400 assets in the Street Light Management System. The estimated replacement cost for street lights was based on the Town's staff estimate and historical cost database. The sum of all replacement costs for the Street Light Management System, in 2018 dollars, is approximately $2.4 million.

The table below summarizes the total asset replacement cost by location.

Table 12-1 Summary of Street Light Replacement Costs by Location

Location	Number of Assets	Replacement Cost
Arapaho Rd	236	$1,029,000
Belt Line Rd	71	$1,030,500
Spectrum Dr	68	$242,000
Spring Valley Rd	10	$90,000
Total	**385**	**$2,391,500**

What is the Condition of the Town's Assets?

During the inventory verification and development process, each street light in the register was visited and assessed. The asset condition was assessed during these visits, and assets requiring immediate replacement, rehabilitation, and maintenance needs were noted and highlighted.

Figure 12-3 presents a summary of the results of the asset inventory and condition assessment. Over 90% of street lights are in good to excellent condition. The assets that received condition of 4 or 5 were a result of physical impacts (e.g., car impact) beyond the Town's control. Poor condition lights were not a result of age or structural deterioration.

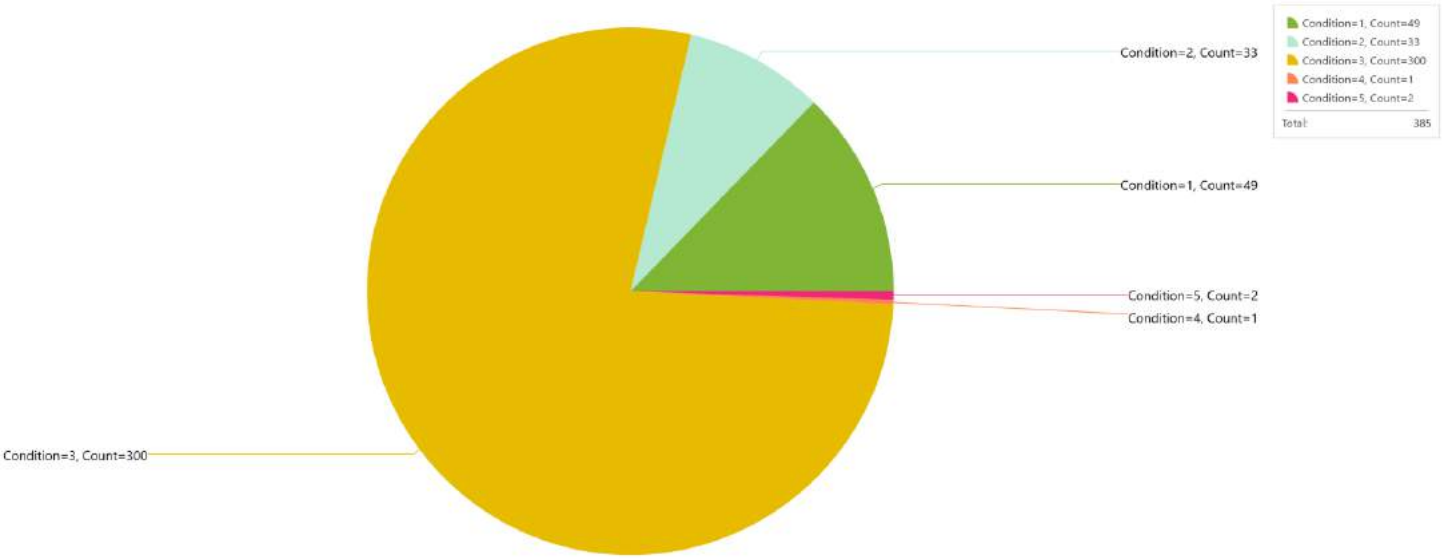


Figure 12-3 Street Light Condition Assessment Results

What Does the Town Need to Sustain the Delivery of Services?

In order to estimate the long-term investment needs for the Street Light Management System, a life cycle cost analysis was performed. Life cycle cost logic or management strategies were developed for the street light assets. Each asset class was assigned a management strategy that includes the rehabilitation and replacement activities to best characterize the life cycle investment needs for the asset. Below is a complete list of management strategies used to calculate the life cycle costs of the street light assets.

Table 12-2 Street Light Management Strategies

Asset Class/Location	Useful Life	Rehabilitation	Frequency	Rehab Cost
Street Light	30	Paint	10	$150
Arapaho Street Light	30	Paint	10	$150
Belt Line Street Light	30	Paint	10	$150
Vitruvian Street Light	30	Paint	10	$150

The following figure illustrates the 30-year replacement and rehabilitation needs for the Street Light Management System. Utilizing a deterministic model, the average annual replacement and rehabilitation needs over the 30-year planning horizon is approximately $74,000.

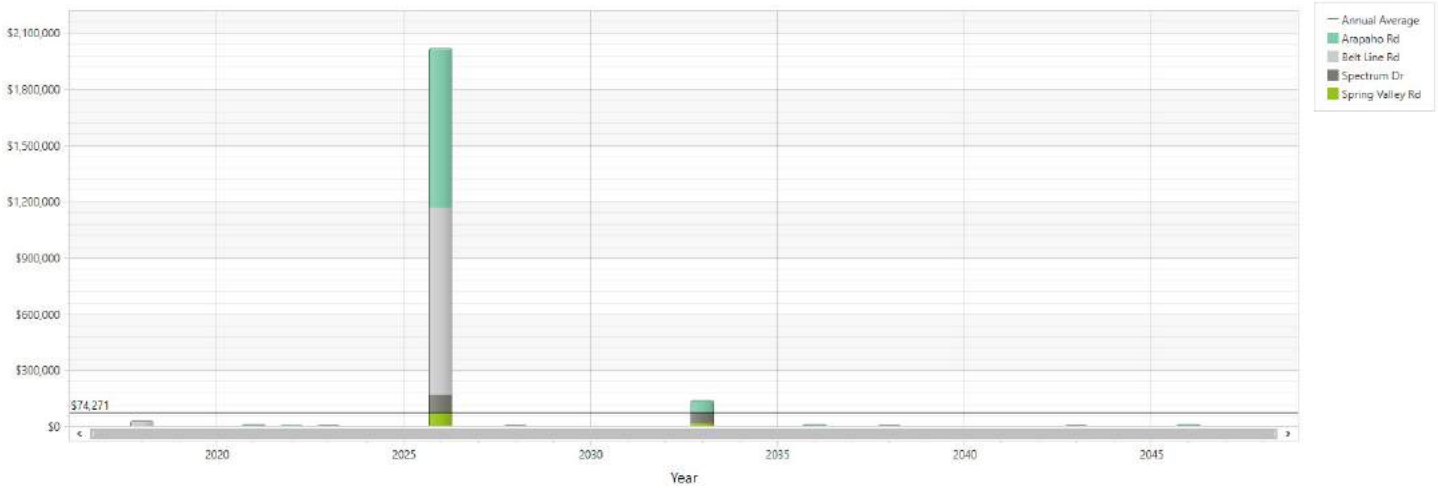


Figure 12-4 30-Year Street Light Replacement and Rehabilitation Profile (Deterministic Model)

The 30-year life cycle cost analysis was repeated utilizing a probabilistic model, in which asset failures were smoothed to represent a more realistic expectation. The probabilistic model predicts the annual replacement and rehabilitation needs to be approximately $70,000.

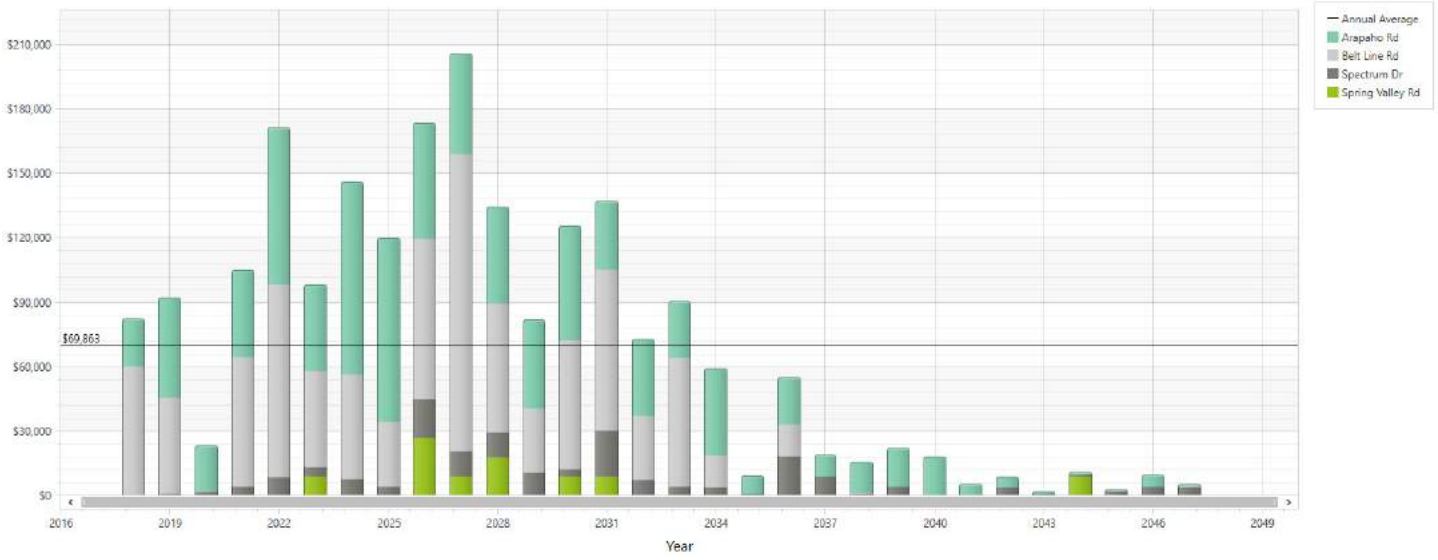


Figure 12-5 30-Year Street Light Replacement and Rehabilitation Profile (Probabilistic Model)

Both analyses above represented results in today's dollars (2018). Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from approximately $74,000 per year to $96,000 per year. Similarly, for the probabilistic model, the annual investment need increased from approximately $70,000 per year to $179,000 per year. The results of these analyses are summarized in the following table.

Table 12-3 Street Light Management System 30-Year Summary

30-Year	Annual Average
Deterministic	$74,000/yr
Probabilistic	$70,000/yr
Deterministic with 3% Inflation	$96,000/yr
Probabilistic with 3% Inflation	$93,000/yr

How Should the Town Prioritize?

In order to prioritize the limited budget available to address the ongoing replacement and rehabilitation needs of the street lights, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was utilized. When assigning criticality to the street lights, road class was taken into account in order to determine levels of traffic and pedestrian use. The table below highlights street light criticality by road class.

Table 12-4 Street Light Asset-Level Criticality by Road Class

Criticality - 5	Criticality - 4	Criticality - 3	Criticality - 2	Criticality - 1
Critical				Non-Essential
• Arterial • Major Collector • Minor Collector • Major Local • Minor Local	• N/A	• Major Commercial	• N/A	• N/A

The following table shows the number of street lights in each criticality category.

Table 12-5 Street Light CoF Results

CoF	Quantity
5	327
3	58

As shown in the table above, nearly all street lights are critical since they are directly related to traffic and public safety.

The following figure shows the resulting overall risk profile for Town-owned and managed street lights. Currently, there are only 3 assets in the high-risk (red) zone.

Figure 12-6 Street Light Risk Matrix

The high-risk assets are street lights located on Arapaho Road and Belt Line Road. Although there are relatively few assets in the high-risk zone, approximately $1.7 million worth of assets (73%) are in the medium-risk zone. Many of these medium-risk assets will begin to fall in the high-risk zone in the near future.

The following table displays the total Catch Up, or the total replacement and rehabilitation costs in 2018 as well as the Keep Up for a 30-year planning horizon. These amounts are represented in current year (2018) dollars.

Table 12-6 Catch Up and Keep Up Values

Category	Cost
Catch Up	$34,500
Keep Up	$73,100/yr

What Level of Service Should the Town Provide?

Level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Two scenarios were developed: Preferred Level of Service and Minimum Level of Service.

As shown in Figure 12-4, the estimated annual needs over a 30-year horizon for the Preferred Level of Service was approximately $74,000 per year. In the Minimum Level of Service, only high-risk assets would be maintained, rehabilitated, and replaced.

The figure below shows the rehabilitation and replacement profile over a 30-year horizon for the Minimum Level of Service, where only high-risk assets (with CoF 4 or higher) are addressed. The annual average needs for the Minimum Level of Service is approximately $64,000 per year.

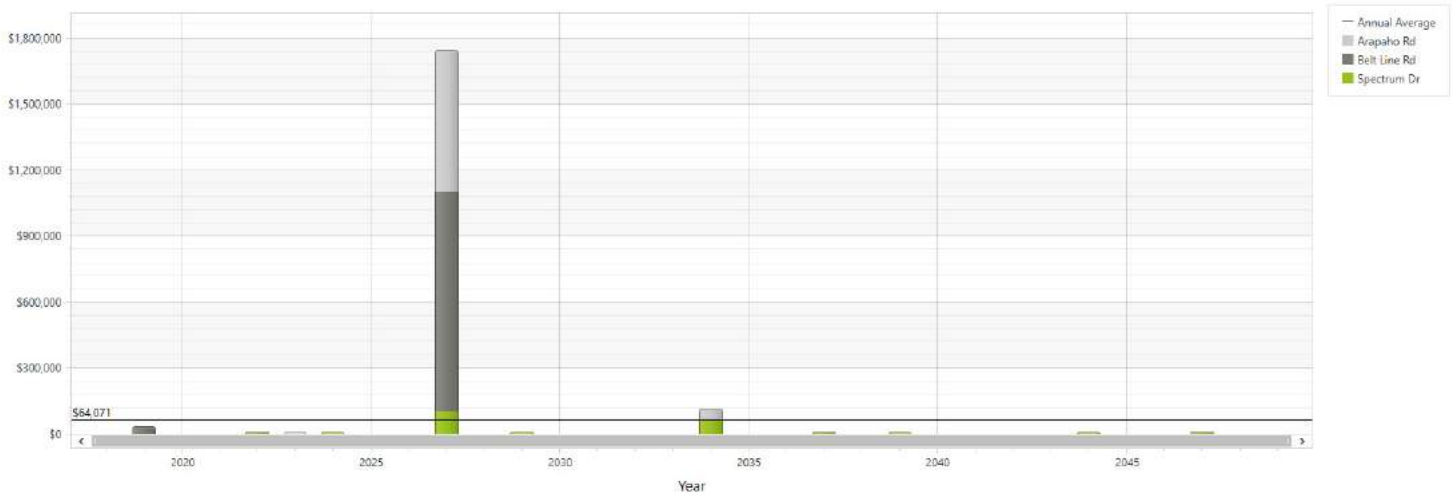


Figure 12-7 Minimum Level of Service Replacement and Rehabilitation Profile

While funding only the high-risk assets would allow the Town to prioritize the more critical needs, this Minimum Level of Service would not address several of the Town's street lights. As such, the Minimum Level of Service is not recommended. The Minimum Level of Service scenario is only performed to present the lower spectrum of the funding requirements.

13 | Fleet Management System

Physical Health Score B

What Does the Town Own and Manage?

The Town owns and manages a total of 191 fleet assets, including vehicles and equipment, for 9 Town departments. The following table summarizes the fleet inventory for the Town.

Table 13-1 Fleet Inventory by Department

Department	Number of Assets
Airport Dept	31
Developmental Services Dept	5
Fire Dept	15
General Services Dept	8
Infrastructure Dept	21
Parks Dept	44
Police Dept	43
Special Events	1
Streets Dept	23

What is an Asset?

In the case of fleet, each vehicle or piece of equipment (e.g., ambulance, utility trailer, sand spreader) is considered an asset. A full list of fleet asset classes is shown in the table below.

Table 13-2 Fleet Asset Classes

Asset Class	Number of Assets	Example
Ambulance	4	Frazer Ambulance
Boat	1	Aluminum Boat
Equipment	25	Air Compressor, Chipper, Crack Sealing Machine, etc.
Equipment Vehicle	8	Bobcat Utility Vehicle, Kubota R-11, John Deere Utility Cart, etc.
Fire Truck	6	AARF Diesel, Sutphen Pumper, etc.
Heavy Equipment	4	Backhoe, 7410 Tractor, etc.
Heavy Equipment Vehicle	11	Bucket Truck, Sweeper, Vactor, etc.
Motorcycle	4	Police Motorcycle
Mower	4	John Deere Mower
Passenger Vehicle	17	Chevy Impala, Ford Fusion, etc.
Police Vehicle	19	Dodge Charger PTR, K-9 Unit, etc.
Trailer	27	Box Trailer, Flat Bed, etc.
Truck	61	Ford F150 Truck, Ford Excursion, etc.

What is the Replacement Value of the Town's Assets?

The replacement cost for each vehicle or piece of equipment was based on the purchase values obtained from the Town's financial records. Where the initial purchase cost was not recent, it was escalated to reflect current year replacement cost in 2018 dollars. A 2% escalation factor (average inflation rate for the last 20 years) was utilized. Where a recent (i.e., 2017, 2018) vehicle or equipment cost is available, the replacement cost of the assets was assumed to be similar. For example, if a police patrol vehicle cost the town $45,000 in 2017, it was assumed that 2018 replacement cost for all police patrol vehicles was approximately $45,000.

Based on the replacement cost assessment, it is estimated that if the Town were to replace all fleet assets in 2018, it will need to budget about $13.6 million.

The table below summarizes the total asset replacement cost for the Town-owned fleet assets.

Table 13-3 Summary of Fleet Asset Replacement Costs

Department Name	Number of Assets	Replacement Cost
Airport Dept	31	$978,109
Developmental Services Dept	5	$102,320
Fire Dept	15	$6,859,769
General Services Dept	8	$334,646
Infrastructure Dept	21	$968,214
Parks Dept	44	$1,222,177
Police Dept	43	$2,285,341
Special Events	1	$13,519
Streets Dept	23	$872,716
Total	**191**	**$13,636,810**

What is the Current State of the Town's Assets?

For the Fleet Management System, age was the major factor used to determine the current state of the vehicle or piece of equipment. This reflects the Town's current replacement practice (e.g., police patrol vehicles are replaced every 2 years). Purchase dates from the Town's financial system were compared to the estimated replacement cycles of the fleet assets. The following figure summarizes the overall age-based condition profile for the Fleet Management System. Approximately 77% of the assets are relatively new and are assumed to be in good to excellent condition. It is estimated that approximately 23% of the assets are nearing the end of their useful lives. These assets mostly include equipment (e.g., air compressor), trucks, passenger vehicles, and police motorcycles.

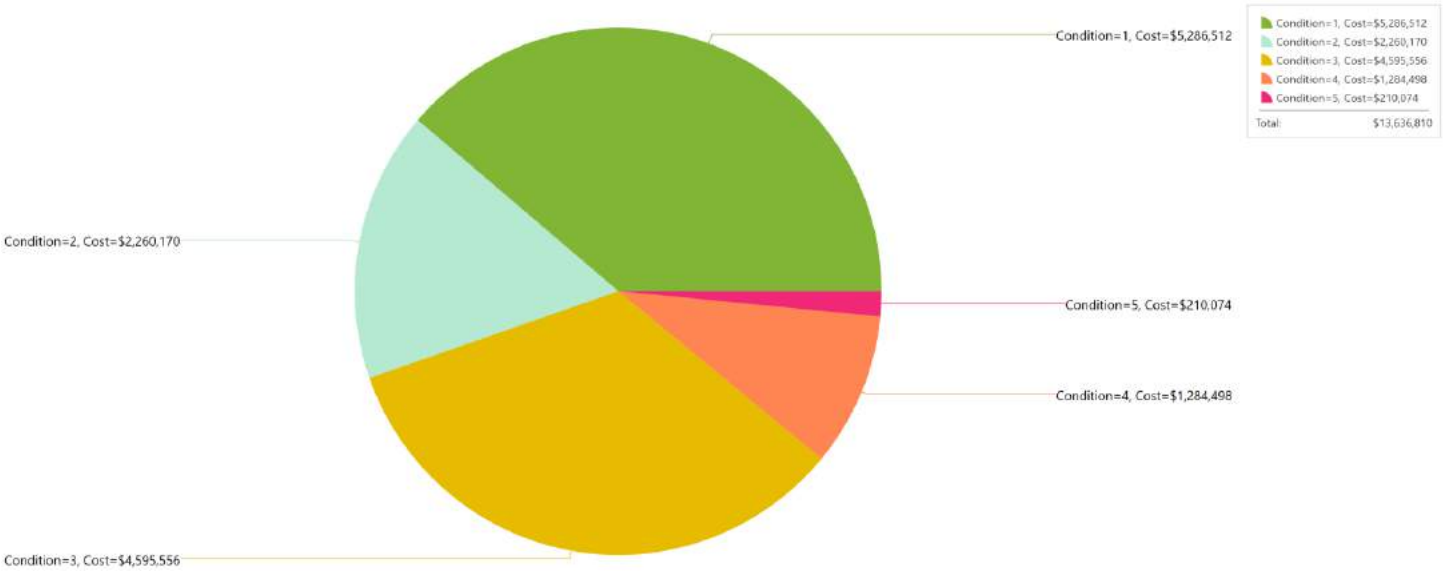


Figure 13-1 Condition Assessment Results

What Does the Town Need to Sustain the Delivery of Services?

In order to estimate the long-term asset replacement needs for the Fleet Management System, a life-cycle cost analysis was performed each asset. Each asset class was assigned a management strategy specifying a useful life that represents the Town's replacement cycle (i.e., how many years does the town utilize the vehicle/equipment before replacing it). Maintenance and refurbishment costs are not considered in the life cycle cost analysis; oil changes, tune-ups,and other maintenance and overhaul costs are not reflected. Those costs are tracked by the fleet manager. The table below summarizes the replacement cycle for each asset class.

Table 13-4 Fleet Management Strategies

Management Strategy ID	Replacement Cycle
Ambulance	12
Boat	60
Equipment	20
Equipment Vehicle	25
Fire Truck	15
Heavy Equipment	35
Heavy Equipment Vehicle	35
Motorcycle	6
Mower	10
Passenger Vehicle	12
Police Vehicle	2
Trailer	40
Truck	12

The figure below displays the 30-year replacement needs for the Fleet Management System. Utilizing a deterministic model, the average needs are approximately $1.2 million per year.

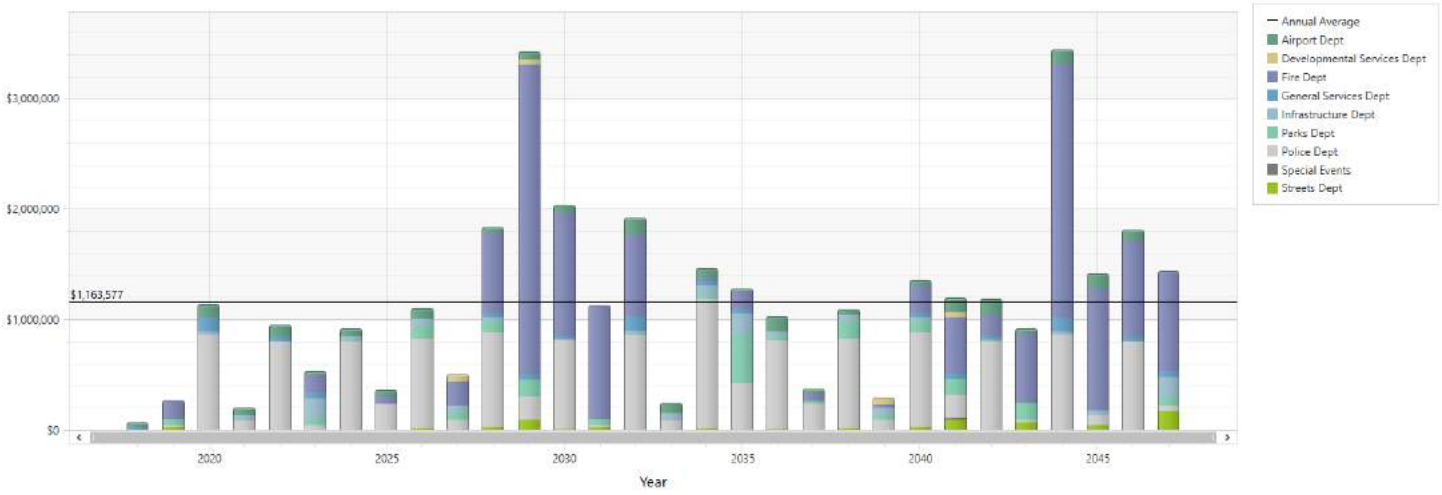


Figure 13-2 30-Year Fleet Replacement and Rehabilitation Profile (Deterministic Model)

The 30-year life cycle cost analysis was repeated utilizing a probabilistic model, in which asset failures were smoothed to represent a more realistic expectation. For example, some vehicles will be replaced earlier while others will be delayed. The probabilistic model predicts the annual replacement needs to be approximately $1.1 million per year.

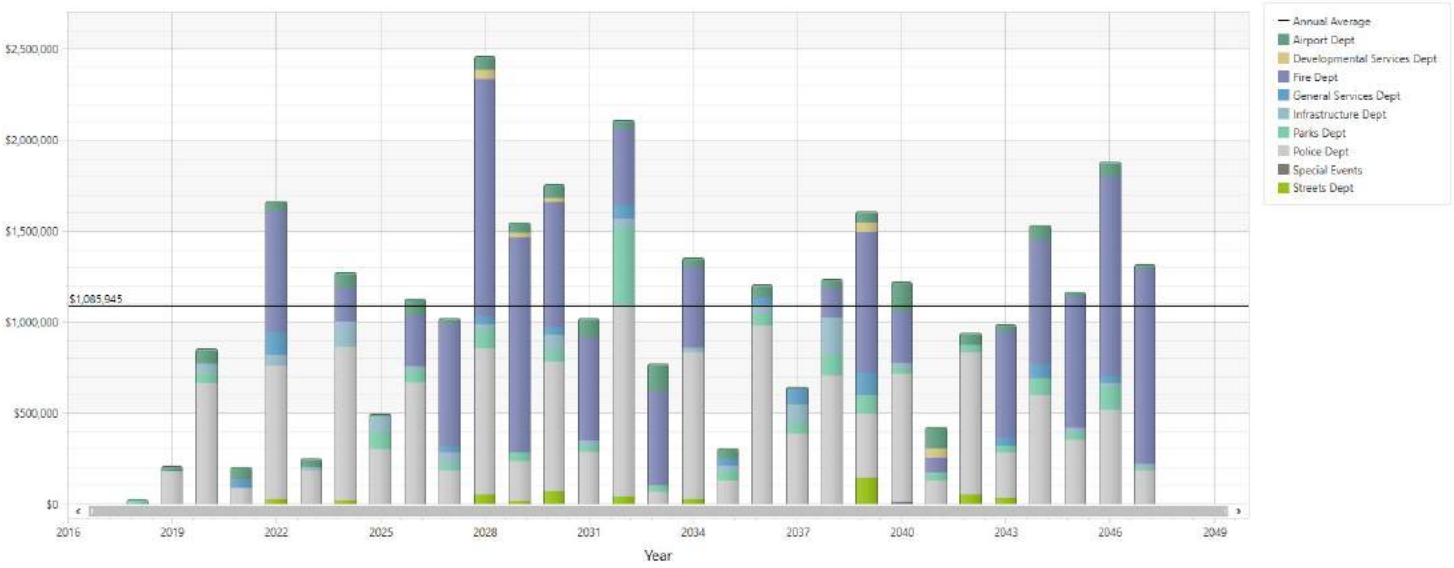


Figure 13-3 30-Year Fleet Replacement and Rehabilitation Profile (Probabilistic Model)

Both analyses above represented results in today's dollars (2018). Expecting the cost will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from $1.2 million per year to $2.0 million per year. Similarly, for the probabilistic model, the annual investment need increased from $1.1 million per year to $1.8 million per year. The results of these analyses are summarized in the table below.

Table 13-5 Fleet Management System 30-Year Summary

30-Year	Annual Average
Deterministic	$1.2 M/yr
Probabilistic	$1.1 M/yr
Deterministic with 3% Inflation	$2.0 M/yr
Probabilistic with 3% Inflation	$1.8 M/yr

The Town is currently spending about $800,000 per year to address the needs of the fleet assets. Compared to the projected long-range needs, there is a deficit of about $350,000 per year. Although the fleet assets are currently in good condition, the current funding rate will not be able to cover all anticipated asset replacement needs. This will result in rapid deterioration of asset condition and decreased level of service.

While the $800,000 annual budget does cover the replacement of all high-risk assets, some non-critical assets will need to be operated as run-to-failure and will only be replaced as needed.

Given the budget of $800,000, assets with replacement costs of approximately $800,000 and higher were assigned replacement schedules that were divided up into 2 to 3 years of funding installments. For example, in the early 2030s, the current annual budget of $800,000 will not be able to fund the replacement of a fire truck costing approximately $1.8 million. The replacement of this fire truck is split up into 3 years, so that by the time the asset is scheduled to be replaced, there is enough funding accumulated to cover the cost of the fire truck.

How Should the Town Prioritize?

In order to prioritize the limited budget available to address the ongoing replacement and rehabilitation needs of the fleet assets, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was utilized. Criticality assessment took place through a logic based on each asset class' importance to the system relative to other asset classes.

The main considerations in assessing the criticality of an asset were safety and level of service. Any asset with direct impact on public safety received the highest CoF score of 5. Any equipment that directly impacts the level of service received a CoF of 4. Passenger vehicles and trucks received a lower criticality as replacements could be rented in cases of failures. The same can be said for heavy equipment; however, the availability of heavy equipment for rental is much more limited. Mowers were given a lower consequence of failure score since they can easily be replaced or the Town can easily contract out the mowing and trimming work.

The table below highlights asset class criticality.

Table 13-6 Fleet Asset-Level Criticality Examples

Criticality – 5	Criticality – 4	Criticality – 3	Criticality – 2	Criticality – 1
Critical				Non-Essential
• Ambulance • Fire Truck • Police Motorcycle • Police Vehicle	• 5310 Tractor • Aerial/Bucket Truck • Arrow Board • Sewer Truck	• Ford F250 Truck • Jeep Cherokee • Van	• Utility Trailer • Chipping Vacuum • Mower • Sand Spreader	• Boat

The following figure shows the resulting overall risk profile for the Fleet Management System. Currently, there are 2 assets in the high-risk zone with a total replacement cost of about $53,000. These high-risk assets are police motorcycles that are existing past their useful lives, and they should be addressed in the near future.

Figure 13-4 Fleet Risk Matrix

The following table displays approximate values for the total Catch Up and Keep Up for a 30-year planning horizon. These amounts are represented in current year (2018) dollars.

Table 13-8 Catch Up and Keep Up Values

Category	Cost
Catch Up	$ 53,085
Keep Up	$ 1.2 M/yr

What Level of Service Should the Town Provide?

Level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Two scenarios were developed: Preferred Level of Service and Minimum Level of Service.

As shown in Figure 13-2, the estimated annual needs over a 30-year horizon for the Preferred Level of Service was approximately $1.2 million.

The figure below shows the rehabilitation and replacement profile over a 30-year horizon for the Minimum Level of Service, where only high-risk assets (with CoF 4 or higher) are addressed. The annual average needs for the Minimum Level of Service is approximately $935,000 per year.

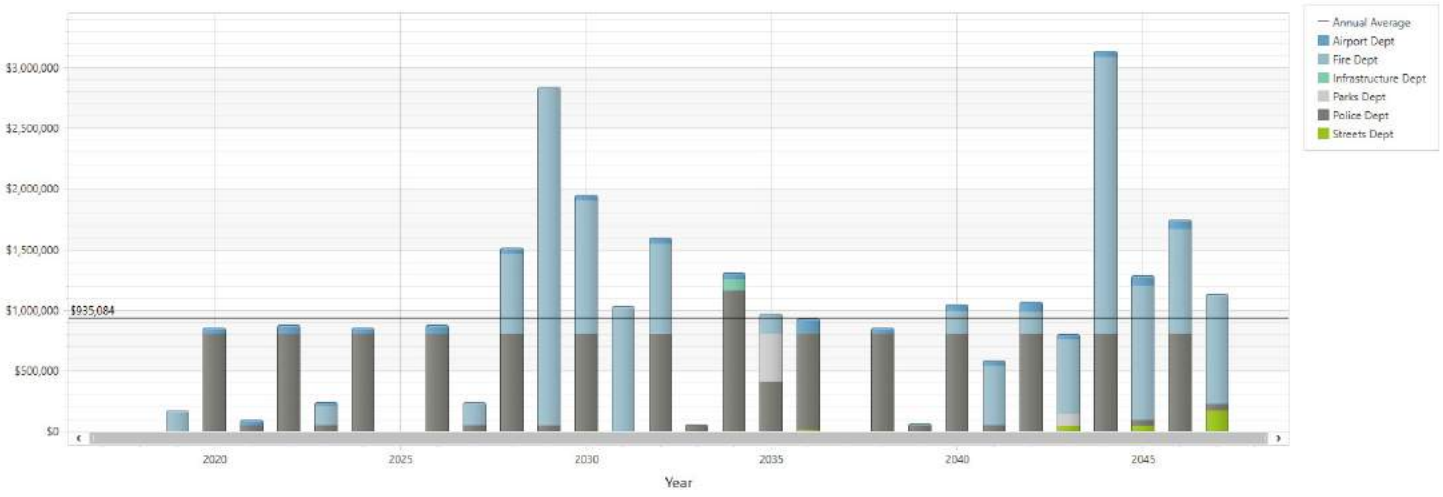


Figure 13-5 Minimum Level of Service Replacement and Rehabilitation Profile

While funding only the high-risk assets would allow the Town to prioritize the more critical needs, this Minimum Level of Service would not address several of the Town's fleet assets. As such, the Minimum Level of Service is not recommended. The Minimum Level of Service scenario is only performed to present the lower spectrum of the funding requirements.

14 | Airport Management System

Physical Health Score B

What Does the Town Own and Manage?

Addison Airport owns and manages almost 10,000 assets. This includes over 8,000 assets at 46 facilities, approximately 1,000 site/airfield assets, and about 6 million square feet of pavement. The table below summarizes the Airport-owned assets.

Table 14-1 Airport-Owned Assets

Asset	Number of Assets
Facilities	46 facilities
	8,624 assets
Site/Airfield	1,047
Pavement	396 segments
	6 million sq. ft.
Total	**10,067**

The following map, provided by Addison Airport staff, shows the locations of all Airport property and all Airport taxiways.

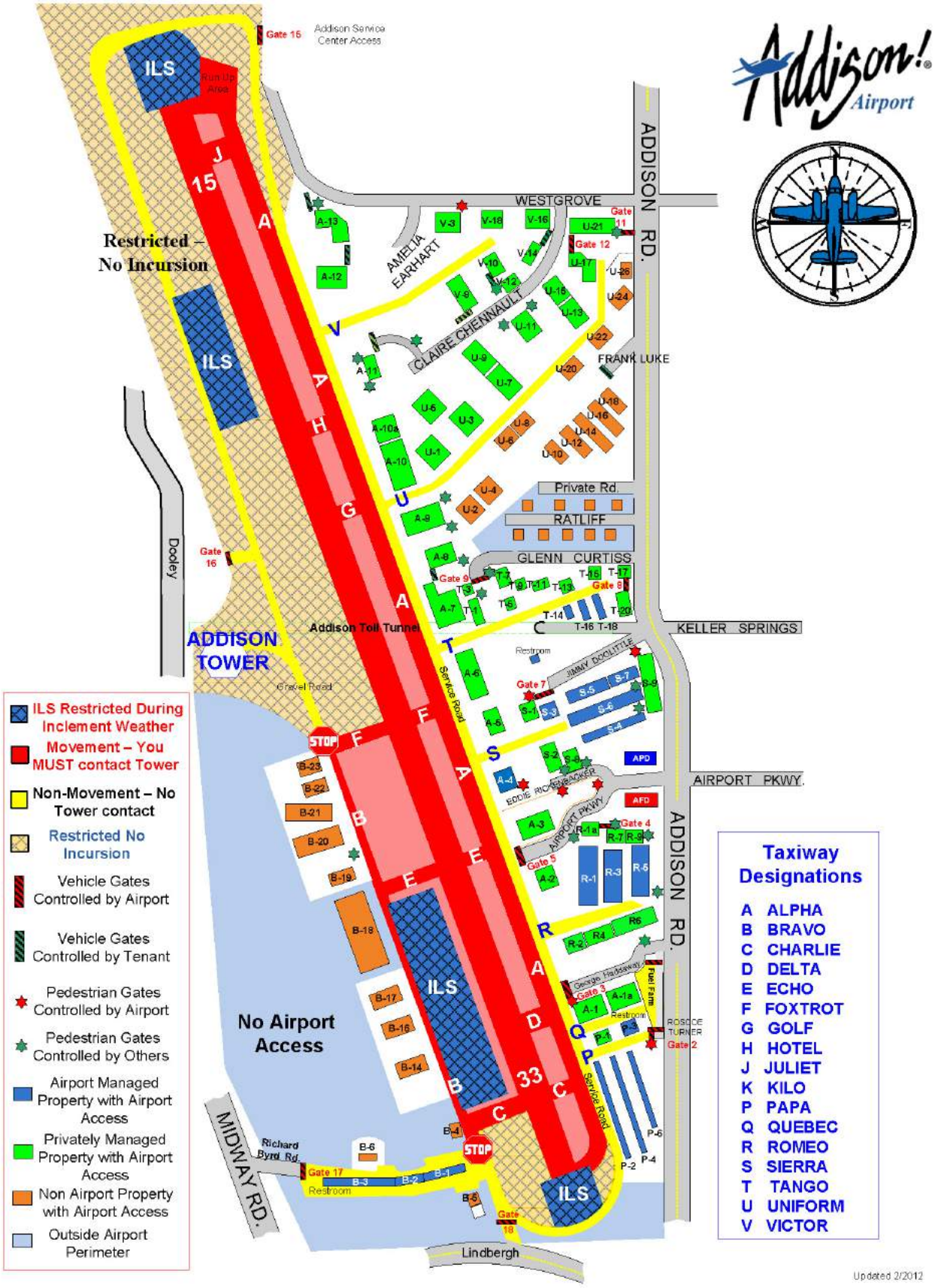


*Figure 14-1 Addison Airport Map (*Photo Owned by Addison Airport)*

What is an Asset?

An asset in the Airport Management System is defined as something with value that is owned and managed by Addison Airport. Airport assets include facility assets (e.g., flooring, interior walls), site/airfield assets (e.g., windsocks, taxiway lighting), and pavement (e.g., runway, ramp). A full list of airport asset classes is shown below.

Table 14-2 Airport Asset Classes

Asset Classes			
Access Keypad	Exterior Walls	Medium Intensity Taxiway Lighting (MITL)	Supervisory Control and Data Acquisition (SCADA)
Actuator	Exterior Windows	Monument	Service Road
Airport Rotating Beacon	Fencing	Motor	Shade Structure
Airport Signs	Filter	North Run Up	Shell
Anchor	Floor	Parking Lot	Signage
Battery Backup Power	Gate	Pavement	South Run Up
Bird Netting	Gate Actuator	Plumbing	Stairway
Bollard	Gate Pedestrian Door	Pole	Structure
Ceiling	Geardrive	Precision Approach Path Indicators (PAPI)	Tank
Check-In Desk	Generator	Pulsation Dampener	Taxiway
Concrete Column	Grating	Pump	Transformer
Control Panel	Helicopter Pad	Railing	Valve
Door	Hose	Ramp	Vent
Drinking Fountain	Heating, Ventilation, and Air Conditioning (HVAC)	Road Way	Wall
Duct Boxes	Instrument Landing System (ILS)	Roof	Window
Electrical	Inclined Plate	Runway	Windsocks
Electrical Lines	Instrumentation	Runway End Identifier Lights (REIL)	
Enclosure	Ladder	Runway Guard Lights (RGL)	
Entry Way	Lighting	Runway Light Numbers	
Exterior Doors	Motor Control Center (MCC)	Safety/Security	

What is the Replacement Value of the Town's Assets?

In total, there are over 10,000 assets in the Airport Management System. The sum of all replacement costs for each Airport Management System asset is estimated, in 2018 dollars, to be approximately $232 million.

The tables below summarize the total asset replacement costs of the airport facility assets, site/airfield assets, and pavement.

Table 14-3 Summary of Airport Facility Asset Replacement Costs

Facility	Number of Assets	Replacement Cost
A-7	1,179	$ 5,756,441
A-8	270	$ 2,405,755
A-9	502	$ 3,708,784
Automated Weather Observing System (AWOS)	15	$ 116,500
B-1 - T Hangar	68	$ 1,209,675
B-2 - T Hangar	37	$ 838,772
B-3 - T Hangar	108	$ 1,697,527
Electrical Vault	36	$ 463,060
Fuel Farm	1,010	$ 4,568,938
North Pilot Lounge	18	$ 74,980
R-1A	84	$ 1,176,748
R-1 - Patio Hangar	92	$ 337,504
R-3 - T Hangar	75	$ 1,571,495
R-3	120	$ 499,972
R-5 - T Hangar	59	$ 1,261,535
S-1	49	$ 1,116,932
S-2	148	$ 1,794,509
S-3	59	$ 965,604
S-4 - T Hangar	68	$ 2,311,503
S-5 - T Hangar	35	$ 1,207,547
S-6 - Patio Hangar	128	$ 844,224
S-7 - T Hangar	35	$ 1,015,991
T-1	154	$ 1,719,932
T-3	70	$ 464,774
T-5	35	$ 840,716
T-7	131	$ 1,597,189

Facility	Number of Assets	Replacement Cost
T-9	84	$ 1,190,463
T-11	60	$ 1,332,289
T-13	99	$ 1,433,084
T-14 - T Hangar	25	$ 553,691
T-15	103	$ 966,795
T-16 - Patio Hangar	48	$ 398,372
T-18 - T Hangar	39	$ 1,157,717
U-2B	151	$ 644,853
U-2	285	$ 2,435,204
U-3	116	$ 1,472,438
U-4	378	$ 3,073,273
U-5	142	$ 1,438,100
U-7	369	$ 2,098,223
U-9	309	$ 2,239,957
U-11	567	$ 2,587,134
U-13	208	$ 1,800,503
U-15	168	$ 1,685,522
V-12	115	$ 2,054,729
Wiley Post (4310)	659	$ 3,388,563
Wiley Post Annex (4308)	114	$ 1,286,853
Total	**8,624**	**$ 72,804,368**

Table 14-4 Summary of Airport Site/Airfield Asset Replacement Costs

Asset Type	Number of Assets	Replacement Cost
Airport Rotating Beacon	1	$ 6,000
Airport Signs	80	$ 24,000
Gate Assets	126	$ 116,900
Duct Boxes	33	$ 16,500
Electrical Lines	51	$ 35,581
Perimeter Fencing	70	$ 562,306
Medium Intensity Taxiway Lighting (MITL)	500	$ 150,000
Precision Approach Path Indicators (PAPI)	2	$ 30,000
Runway End Identifier Lights (REIL)	3	$ 35,000
Runway Guard Lights (RGL)	72	$ 216,000
Runway Light Numbers	104	$ 260,000
Windsocks	2	$ 300
Miscellaneous (e.g., pedestal signs)	3	$ 33,500
Total	**1,047**	**$ 1,486,087**

Table 14-5 Summary of Airport Pavement Replacement Costs

Asset Type	Number of Segments	Size (sq. ft)	Replacement Cost
Entry Way	56	80,209	$ 2,003,475
Helicopter Pad	2	1,755	$ 43,876
ILS	1	17,425	$ 313,654
North Run Up	2	41,994	$ 1,049,855
Parking Lot	47	595,161	$ 13,717,407
Ramp	164	2,702,484	$ 61,148,361
Roadway	33	362,795	$ 8,513,696
Runway	20	734,837	$ 27,188,956
Service Road	26	235,747	$ 5,363,437
South Run Up	1	39,624	$ 990,611
Taxiway	44	1,186,981	$ 37,630,340
Total	**396**	**5,999,013**	**$ 157,963,667**

What is the Condition of the Town's Assets?

Airport Facilities

During the inventory verification and development process, each facility in the register was visited and assessed. The asset condition was assessed during these visits, and assets requiring immediate replacement and rehabilitation were noted and highlighted.

Some issues found during the condition assessment process are illustrated below. These images depict failed or failing (condition 5) assets.

Figure 14-2 Failed/Failing (Condition 5) Building Assets

The most commonly used rating tool in the building industry and the tool used for the Airport's facilities is the Facility Condition Index (FCI). This index score is typically denoted as a percentage representing the physical condition of a facility in terms of value. FCI is calculated using the following formula:

$$FCI = \frac{Unweighted\ Repair\ Costs}{Replacement\ Value}$$

The unweighted repair costs include any costs for needed repairs and deferred maintenance. The replacement value is the estimated cost to replace the assets in the entire facility. The higher the FCI percentage, the poorer the relative facility condition. In the asset management plan, the sum of replacement costs was used as the facility's replacement value. It should be noted that the methodology may present a more conservative representation of the FCI as the sum of asset replacement costs is typically less than the overall market value of the facility.

Table 14-6 displays the facility condition description corresponding to each FCI range. The table shows the industry standard Facility Condition levels. However, past experience has shown that the industry standard levels can be unrealistic representations of the facilities. An adjusted FCI rating was used instead to more accurately capture the condition of the facilities in the Airport. The adjusted value provides a more reasonable view of the facility's overall conditional health.

Table 14-6 FCI Rating Scores

Facility Condition	Standard FCI	Adjusted FCI
Good	0 - 4.9%	0 – 9.9%
Fair	5 - 9.9%	10 – 29.9%
Poor	10% and Above	30% and Above

The following table presents the FCI score for each Airport facility.

Table 14-7 FCI by Facility

Facility	FCI Score	FCI Rating
A-7	9.8%	Good
A-9	0.9%	Good
Automated Weather Observing System (AWOS)	0.0%	Good
Electrical Vault	1.6%	Good
R-1A	0.1%	Good
T-3	6.7%	Good
U-2	1.5%	Good
U-4	0.0%	Good
U-9	1.2%	Good
B-1 - T Hangar	0.0%	Good
B-2 - T Hangar	0.0%	Good
B-3 - T Hangar	0.0%	Good
Fuel Farm	3.9%	Good
North Pilot Lounge	0.8%	Good
R-3	4.5%	Good
S-3	0.4%	Good
S-1	0.0%	Good
T-14 - T Hangar	0.9%	Good
T-15	8.0%	Good
T-5	4.3%	Good
U-11	0.1%	Good
U-13	1.4%	Good
U-15	1.3%	Good

Facility	FCI Score	FCI Rating
U-2B	3.9%	Good
U-3	3.9%	Good
U-5	3.3%	Good
U-7	5.8%	Good
Wiley Post	6.3%	Good
Wiley Post Annex	0.0%	Good
S-2	10.9%	Fair
S-4 - T Hangar	16.0%	Fair
S-5 - T Hangar	15.5%	Fair
A-8	19.1%	Fair
R-3 - T Hangar	28.3%	Fair
R-5 - T Hangar	24.8%	Fair
S-7 - T Hangar	15.6%	Fair
T-18 - T Hangar	15.2%	Fair
T-1	13.3%	Fair
T-7	11.0%	Fair
V-12	13.1%	Fair
S-6 - Patio Hangar	15.7%	Fair
T-16 - Patio Hangar	16.0%	Fair
R-1 - Patio Hangar	47.9%	Poor
T-11	63.0%	Poor
T-13	66.6%	Poor
T-9	58.7%	Poor

Site/Airfield Assets

For the airfield assets, such as runway lighting, airport rotating beacon, and windsocks, the asset conditions were not visited and assessed due to safety and regulatory issues with being on the airfield. However, given that all airfield assets should always be in working condition, all airfield assets were assigned an assumed condition of 3 (good condition). For the site assets, such as gates and fences, each asset in the register was visited and assessed. The asset condition was assessed during these visits, and assets requiring immediate replacement and rehabilitation were noted and highlighted. About 97% of the site assets were in good to very good condition.

Pavement

A comprehensive pavement condition database was developed recording a pavement condition index number for every pavement segment at the Airport.

The condition of the pavement surface is represented as a Pavement Condition Index (PCI) score. PCI scores range between 0 (completely failed) and 100 (new). Factors that influence a PCI score include cracking, distortion, patching, cuts, rutting, and weathering. The following graph summarizes the spread of PCI scores for the Airport pavement. As illustrated, over 60% of the Airport's pavement condition is a PCI score of 80 or higher. Of all the Airport's pavement, 3% falls below a PCI score of 50, which include some ramps, entry ways, and parking lots. These pavement areas need to be replaced in the near future.

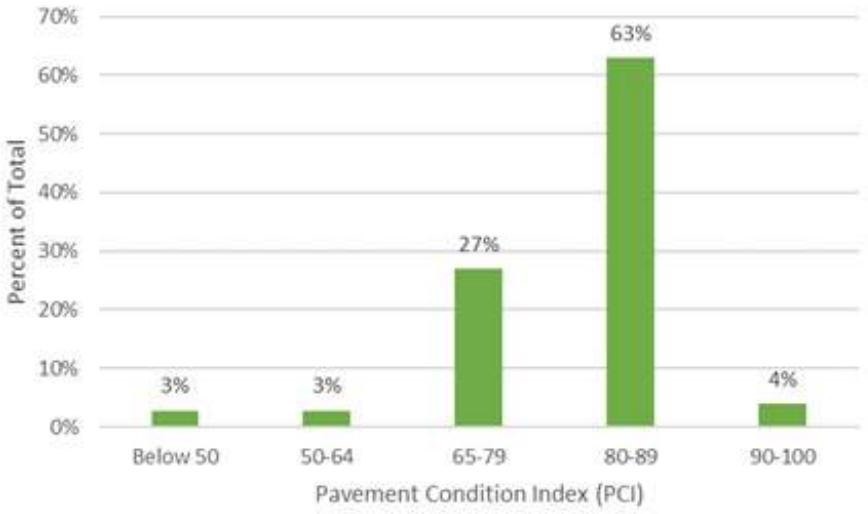


Figure 14-3 Addison Airport Pavement Condition Summary

In order to make the pavement condition rating align with the condition rating of other asset management systems (e.g., building, parks, water, wastewater), the PCI scores were translated into the standard asset management condition scores. The following table summarizes the conversion scale.

Table 14-8 Pavement Condition Ratings Scale

Condition	PCI	Pavement Condition
1	90 - 100	Excellent
2	80 - 89	Very Good
3	65 - 79	Good/Fair
4	50 - 64	Poor
5	Below 50	Failed/Critical

The following graph summarizes the overall condition profile of the Airport pavement. Almost 6% of the pavement is in fair to poor condition, as reflected by the conditions of various ramps, entry ways, and parking lots. On the other hand, over 65% of the pavement is in very good to excellent condition.

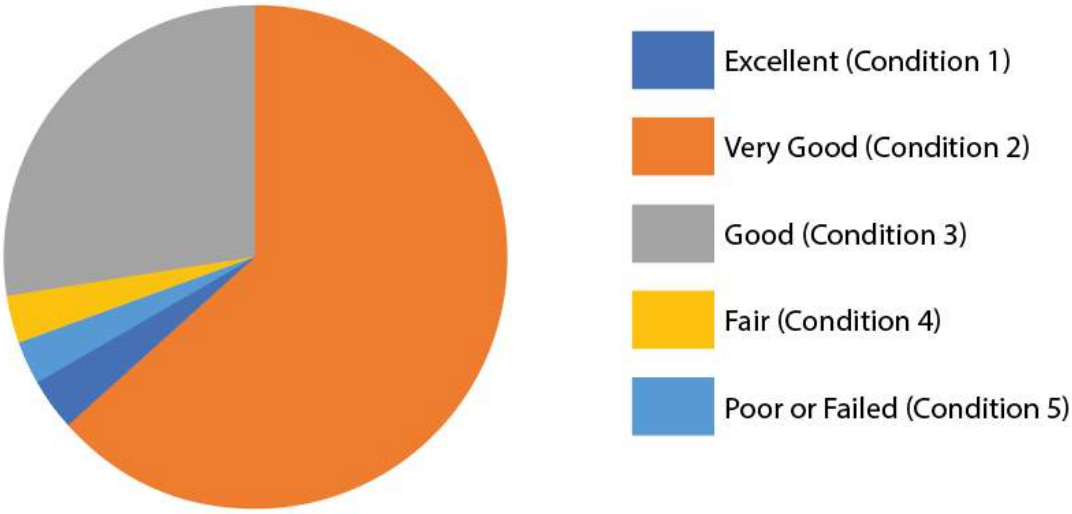


Figure 14-4 Addison Airport Pavement Condition Assessment Results

What Does the Town Need to Sustain the Delivery of Services?

In order to estimate the long-term investment needs for the Airport Management System, a life cycle cost analysis was performed. Each asset class was assigned a management strategy that includes the rehabilitation and replacement activities to best characterize the life cycle investment needs for the asset. Below is a sample list of management strategies used to calculate the life cycle costs of the Airport assets.

Table 14-9 Examples of Airport Management Strategies

Management Strategy ID	Useful Life	Rehabilitation	Frequency	Rehabilitation	Frequency
Airport Rotating Beacon	15				
Fencing - Chainlink	15				
Flooring - Epoxy Concrete	75	Repair (2% of floors)	15		
Fuel Farm Structure	75				
Hangar Structure - Corrugated Metal	50	Paint	15		
Pavement, Asphalt, PCI 90-100		Slurry seal	5	Mill and fill	15

The following figure presents the 30-year replacement and rehabilitation needs for the Airport Management System. Utilizing a deterministic model, the average annual replacement and rehabilitation investment needs for the Airport assets is approximately $5.2 million.

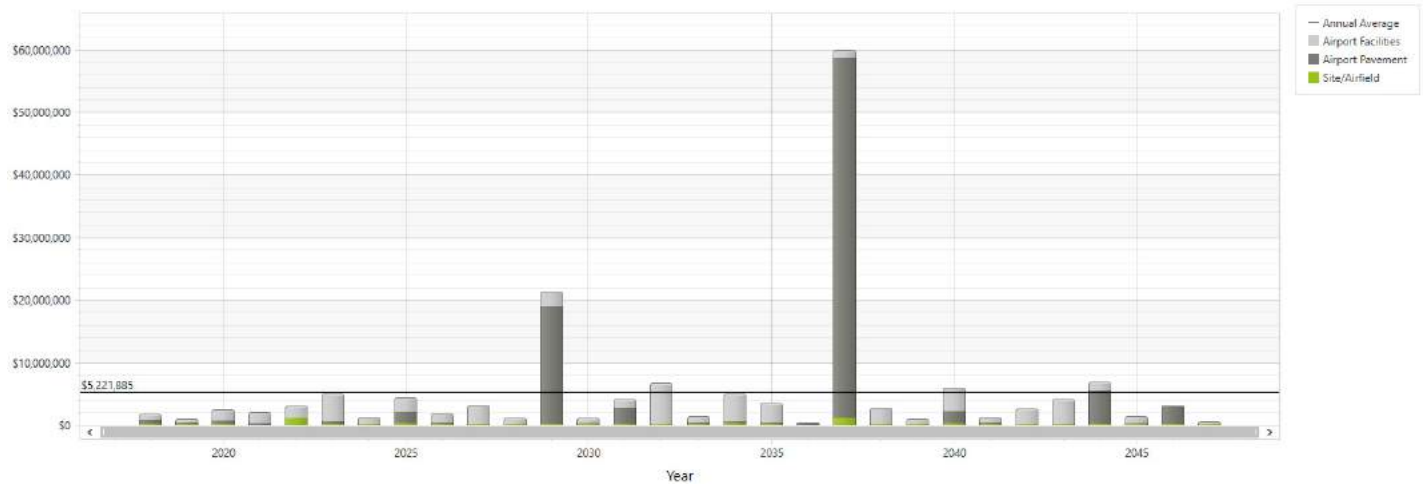


Figure 14-5 30-Year Airport Replacement and Rehabilitation Profile (Deterministic Model)

The 30-year life cycle cost analysis was repeated utilizing a probabilistic model, in which asset failures were smoothed to represent a more realistic expectation. The probabilistic model predicts the annual replacement and rehabilitation needs to be approximately $4.7 million.

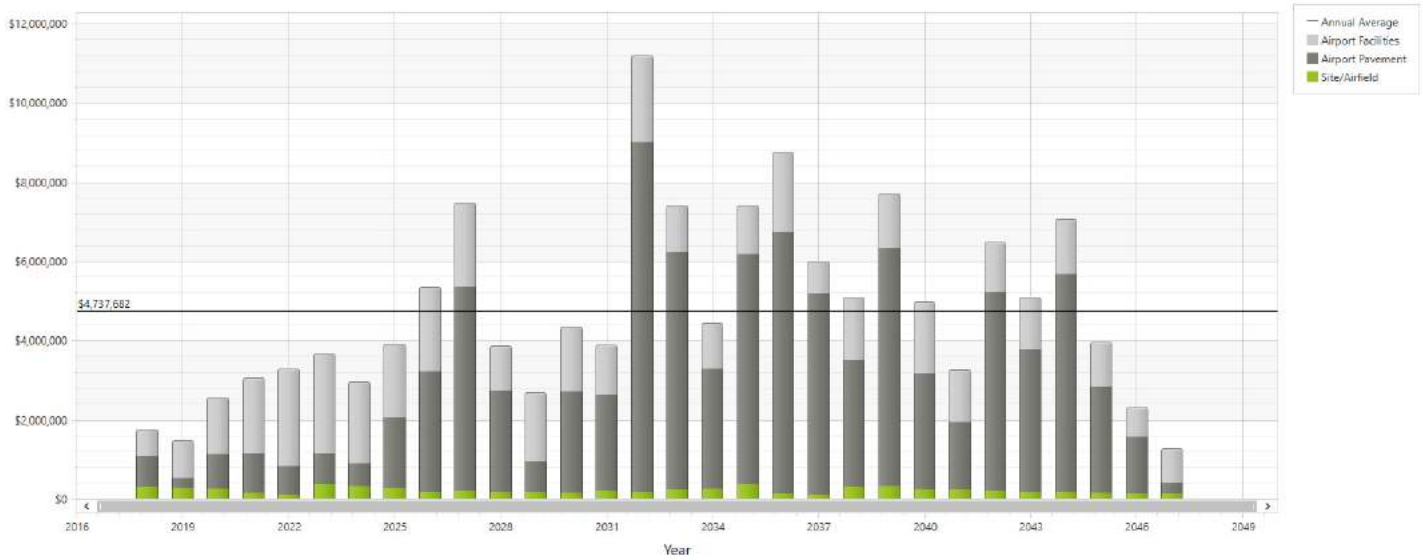


Figure 14-6 30-Year Building Asset Replacement and Rehabilitation Profile (Probabilistic Model)

The costs in both the deterministic and probabilistic analyses are in 2018 dollars. Because the cost of construction is expected to increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from $5.2 million per year to $8.5 million per year. Similarly, for the probabilistic model, the annual investment need increased from $4.7 million per year to $7.7 million per year. The results of these analyses are presented in the table below.

Table 14-10 Airport Management System 30-Year Summary

30-Year	Annual Average
Deterministic	$ 5.2 M/yr
Probabilistic	$ 4.7 M/yr
Deterministic with 3% Inflation	$ 8.5 M/yr
Probabilistic with 3% Inflation	$ 7.7 M/yr

How Should the Town Prioritize?

In order to prioritize the limited budget available to address the ongoing replacement and rehabilitation needs of the Airport assets, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was utilized.

Airport Facilities

For the Airport facility assets, a multi-tier methodology was deployed as shown in the figure below.

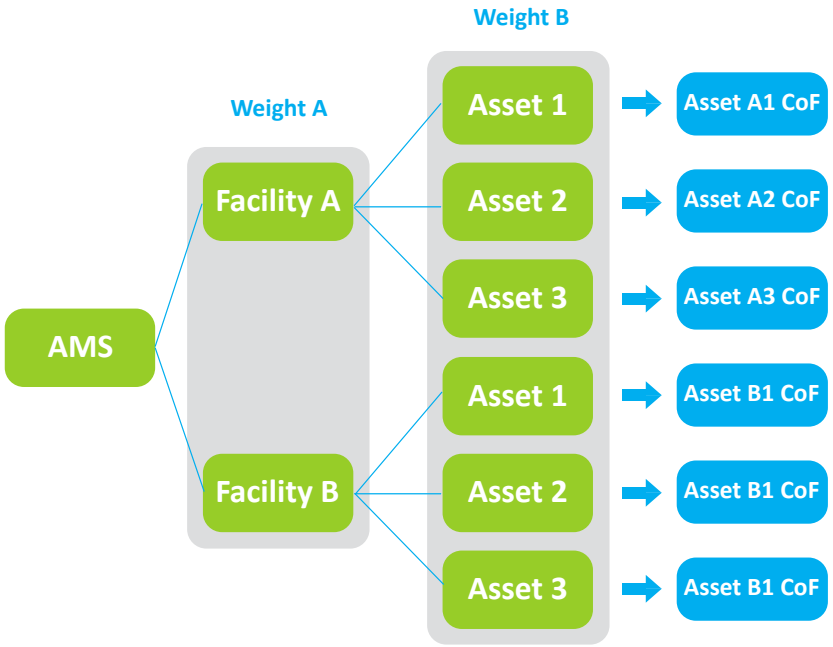


Figure 14-7 Multi-Tier Logic CoF Rating Methodology

In the first tier, criticality was assessed at the facility level based on the importance of the facility to the Airport. The assessment considered the type of services provided, utilization of the facility, and impact to the Airport in case of facility shut down. In the second tier, asset level criticality was evaluated. How critical is the asset with respect to disrupting the overall service? Will the asset failure prevent the facility operations? The larger the impact of the asset failure, the higher the criticality.

The first-tier criticality rating, assigned by Airport staff, is summarized in the following table.

Table 14-11 Facility Criticality Categories

Criticality Category	Facility
High	Automated Weather Observing System (AWOS) Electrical Vault Fuel Farm R-1A R-3 U-2 U-4 4310 Wiley Post 4308 Wiley Post
Medium	All T-Hangars (B-1, B-2, B-3, R-3, R-5, S-4, S-5, S-7, T-14, T-18) North Pilot Lounge S-1 S-3 T-9 T-11 U-2B
Low	All Patio Hangars (R-1, S-6, T-16) A-7 A-8 A-9 S-2 T-1 T-3 T-5 T-7 T-13 T-15 U-3, U-5, U-7, U-9 U-11 U-13 U-15 V-12

The second-tier criticality at the asset level is presented in the following table. These criticality scores were based on the importance of the asset class to the overall function of the building. For example, a hangar door was considered critical, while an exterior awning was considered non-essential.

Table 14-12 Examples of Facility Asset-Level Criticality

Criticality - 5	Criticality - 4	Criticality - 3	Criticality - 2	Criticality - 1
Critical				Non-Essential
• Hangar Door • Pump Assembly • Wind Sensor • Roof Covering	• Exterior Window • Interior Lighting • Roll-Up Door • Water Heater	• Interior Door • Ceiling • Flooring • Interior Wall	• Ceiling Fan • Check-In Desk • Bird Netting	• Insulation • Exterior Awning

Site/Airfield Assets and Pavement

For the site/airfield assets and for all pavement types, criticality was assigned at the asset level only. These criticality scores were based on the importance of the asset class to the overall function of the Airport. For example, the airport rotating beacon was considered critical, while a bollard was considered non-essential. Similarly, the runway was considered critical, while a service road was considered non-essential. The taxiways were ranked based on the level of traffic and number of facilities they serve. The tables below highlight samples of asset level criticality for the site/airfield assets and the pavement.

Table 14-13 Examples of Site/Airfield Asset-Level Criticality

Criticality - 5	Criticality - 4	Criticality - 3	Criticality - 2	Criticality - 1
Critical				Non-Essential
• Airport Rotating Beacon • Windsocks • Gate • Electrical Lines	• Gate Actuator • Taxiway Lighting • Runway Light Numbers • Runway End Identifier Lights	• Airport Signs	• Bollard • Gate Pedestrian Door • Monument	• N/A

Table 14-14 Pavement Asset-Level Criticality

Criticality - 5	Criticality - 4	Criticality - 3	Criticality - 2	Criticality - 1
Critical				Non-Essential
• Runway • Taxiway Alpha	• Taxiway Bravo • Taxiway Charlie • Taxiway Foxtrot	• North Run Up Area • Taxiway Tango	• Ramp • Entry Way • Parking Lot	• Service Road • ILS

The following figure shows the resulting risk profile for the Airport Management System. In total, 133 assets were identified as high-risk assets. Summing up the replacement of all high-risk assets (red zone) equated to approximately $385,000. These high-risk assets mainly include poor condition gates and fences along the perimeter of the Airport and various instrumentation components that are past their useful lives at the Fuel Farm, a high-criticality facility.

Figure 14-8 Airport Risk Matrix

The following table displays the total Catch Up and the Keep Up for a 30-year planning horizon. These dollars are represented in current year (2018) dollars.

Table 14-15 Catch Up and Keep Up Values

Category	Cost
Catch Up	$ 380,200
Keep Up	$ 5.2 M/yr

What Level of Service Should the Town Provide?

Level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Two scenarios were developed: Preferred Level of Service and Minimum Level of Service.

As shown in Figure 14-5, the estimated annual needs over a 30-year horizon for the Preferred Level of Service was approximately $5.2 million.

The figure below shows the rehabilitation and replacement profile over a 30-year horizon for the Minimum Level of Service, where only the high-risk assets (with CoF 4 or higher) are addressed. The annual average needs for the Minimum Level of Service is approximately $1 million per year.

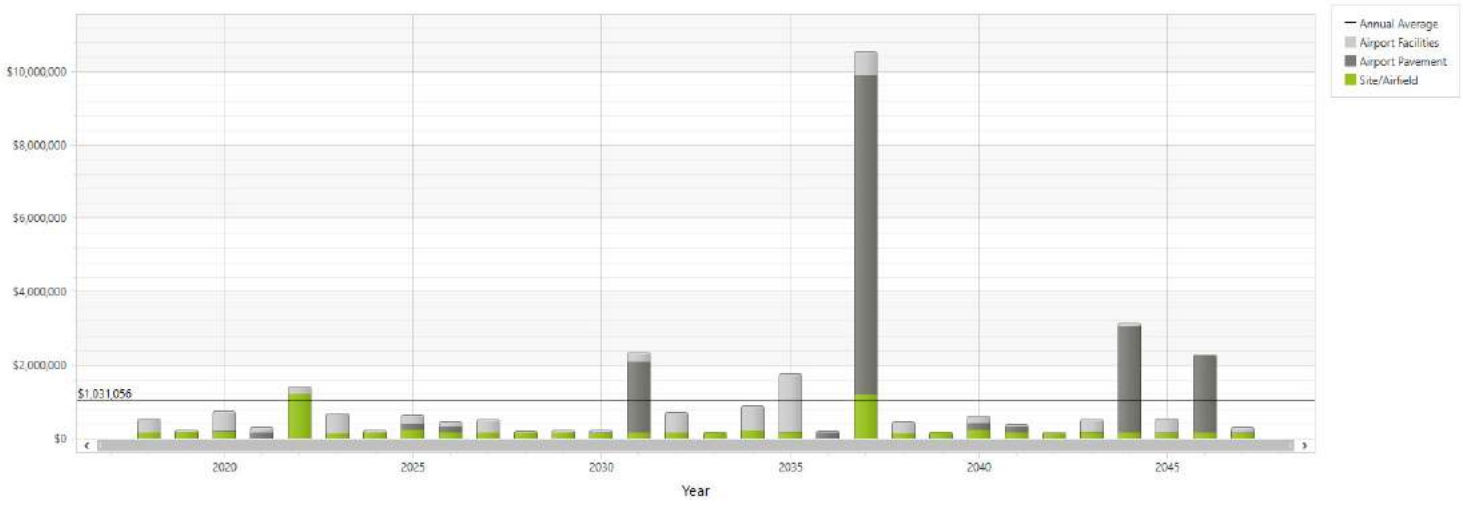


Figure 14-9 Minimum Level of Service Replacement and Rehabilitation Profile

While funding only the high-risk assets would allow the Airport to prioritize the more critical needs, this Minimum Level of Service would not fund several of the Airport's assets. The Minimum Level of Service scenario is not recommended, and it is only performed to present the lower spectrum of the funding requirements.

15 | Storm Water Management System

Physical Health Score A

What Does the Town Own and Manage?

The Town owns and manages a total of 5,855 Storm Water Management System assets. The system is composed of approximately 78 miles of storm water lines (i.e. gravity mains), 4 miles of open channels, and various other assets. The table below summarizes the items included in the Storm Water Management System.

Table 15-1 Storm Water Management System Asset Inventory

Asset	Quantity	Length
Culverts	48	
Detention Areas	6	
Discharge Points (Outfalls)	61	
Gravity Mains		78 mi
Headwalls	11	
Inlets	1,938	
Manholes	121	
Network Structures	28	
Open Channels	68	4 mi

Table 15-2 Storm Water Line Inventory by Material

Material	Length (mi)
ADS Plastic	0.4
Corrugated Metal	0.1
High Density Polyethylene	0.2
PVC	1.7
Reinforced Concrete	75.5

What is an Asset?

An asset in the Storm Water Management System is defined as something with value that is owned and managed by the Town.

Assets are grouped into classes to more efficiently model and manage the assets. Below is a complete list of asset classes in the Storm Water Management System.

Table 15-3 Storm Water Asset Classes

Asset Classes - Storm Water		
Culvert	Gravity Mains	Manhole
Detention Area	Headwall	Network Structure
Discharge Point	Inlet	Open Channel

What is the Replacement Value of the Town's Assets?

In total, there are 5,855 assets in the Storm Water Management System. The replacement cost for each asset was estimated. It should be noted that replacement cost represents an estimated cost to replace the asset either by Town staff or by contractor. It does not represent a project cost that includes engineering, management, insurance, contingency, etc., costs. In many cases, project costs can add an extra 15% to 30% to the replacement cost. The sum of all replacement costs in the Storm Water Management System, in 2018 dollars, is approximately $244 million.

The following figure shows the total asset replacement cost of the Storm Water Management System by major asset categories. Gravity mains make up most of the value of the Storm Water Management System at approximately $224 million (92%), followed by open channels, inlets, and culverts. The remaining valuation is made up of headwalls, manholes, network structures, detention areas, and discharge points.

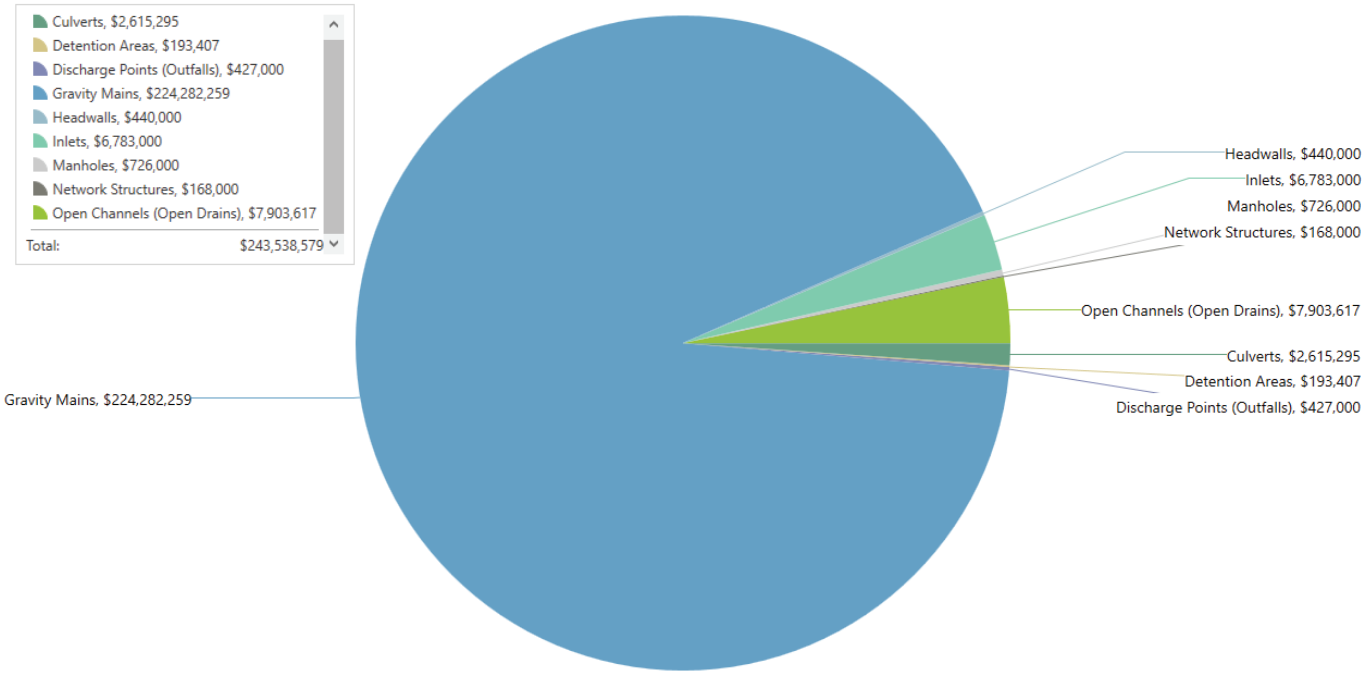


Figure 15-1 Storm Water Management System Valuation

The following table summarizes the estimated total asset replacement cost by asset class.

Table 15-4 Summary of Storm Water Asset Replacement Costs

Asset	Quantity	Length	Replacement Cost
Culverts	8		$ 2,615,295
Detention Areas	6		$ 193,407
Discharge Points (Outfalls)	61		$ 427,000
Gravity Mains	3,574	78 mi	$ 224,282,259
Headwalls	11		$ 440,000
Inlets	1,938		$ 6,783,000
Manholes	121		$ 726,000
Network Structures	28		$ 168,000
Open Channels	68	4 mi	$ 7,903,617
Total	**5,855**	**82 mi**	**$ 243,538,579**

What is the Condition of the Town's Assets?

During the asset inventory process, the general condition of the asset was assessed or estimated. Where the asset was visible, a general assessment took place through visual inspection. In some cases, however, assets are not visible or visual assessment is not a good representation of the asset's condition. In such cases, the anticipated condition score was estimated based on the age of the asset. Age-based calculation required evaluation of the asset age, expected useful life, and anticipated decay curve.

The following figure represents the general condition of the Storm Water Management System pipes based on construction years. As is shown in the figure, many of the storm water pipes were installed beginning the 1970s. The condition of the pipes was estimated based on age. Compared to the water and wastewater pipes, the storm water pipes are, on average, about 20 to 30 years younger, which results in a better overall condition. However, there are some storm water pipes projected to need replacement in the near future. About 6.2% of the storm water pipes are over 50 years old and are nearing the end of their useful lives.

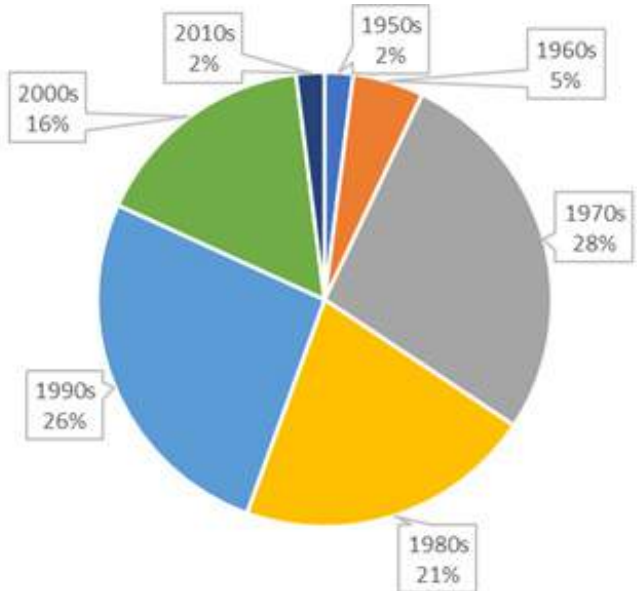


Figure 15-2 Storm Water Line Construction by Decade

Overall, the Storm Water Management System is in good condition. However, there were some issues found with the open channels during the condition assessment process. Given that the Town currently does not have a Storm Water maintenance schedule in place, the Town's open channels are in critical need of maintenance, including debris and sediment removal, vegetation control, and concrete repairs. In total, the Town's open channels require an immediate maintenance cost of approximately $156,000. The images below show examples of open channels that require immediate attention.

Table 15-5 Example of Storm Open Channel Maintenance Issues

Open Channel Example	Maintenance Issue
	The bottom of the channel is broken, allowing water to penetrate into the soil; this will cause failure of the substructure of the adjacent street and parking lot.
	The channel is full of debris and trees and will need to be cleaned.

What Does the Town Need to Sustain the Delivery of Services?

In order to estimate the long-term asset replacement and rehabilitation needs for the Storm Water Management System, a life-cycle cost analysis was performed for each asset. Each asset class was assigned a life cycle cost logic or management strategy that includes the rehabilitation and replacement activities to best characterize the life cycle investment needs for the asset. Below is a sample list of management strategies used to calculate the life-cycle costs of the storm water assets.

Table 15-6 Examples of Storm Water Asset Management Strategies

Asset Class	Useful Life	Rehabilitation Activity	Frequency	Rehabilitation Activity	Frequency
Storm Water Pipe - ACP	100				
Storm Water Pipe - PVC	100				
Concrete Channel	150	Concrete Rehabilitation	25	Debris/Sediment Removal	2
Headwall	100				
Discharge Point (Outfall)	50				

The figure below displays the 30-year replacement and rehabilitation needs for the Storm Water Management System. Utilizing a deterministic model, the average needs are approximately $155,000 per year. Given the relatively young pipe age, there are no significant costs to replace the storm water lines in the near future. The open channels, however, are currently in need of maintenance and should be addressed immediately.

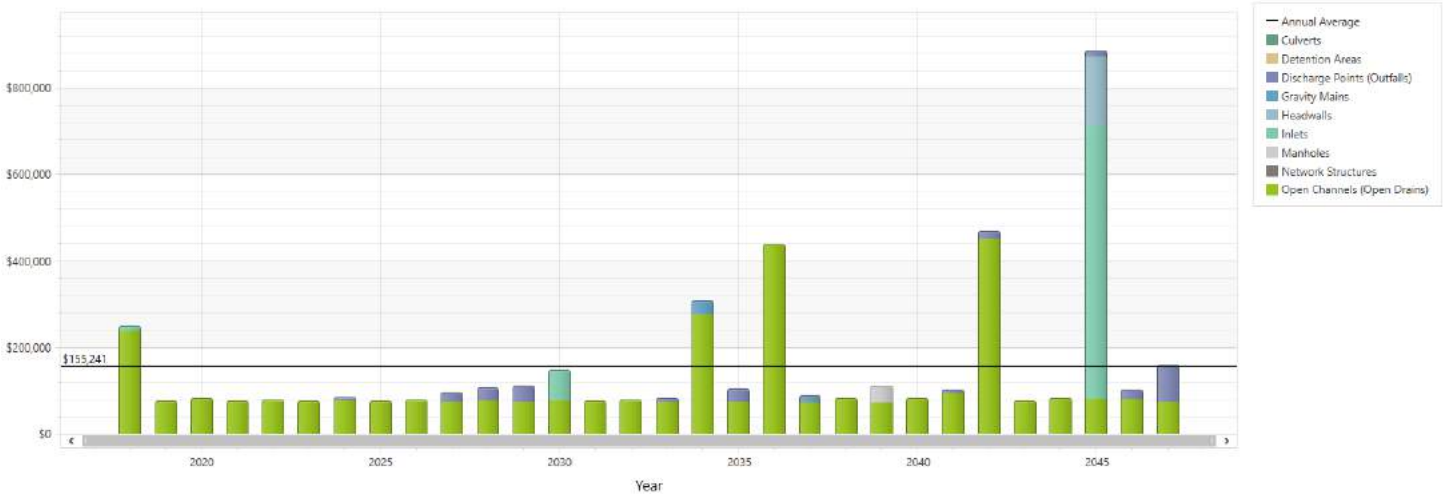


Figure 15-3 30-Year Storm Water Asset Replacement and Rehabilitation Profile (Deterministic Model)

As demonstrated in the figure above, the majority of pipes are relatively young and will not require replacement within the next 30 years.

The 30-year life cycle cost analysis was repeated utilizing a probabilistic model, in which asset failures were smoothed to represent a more realistic expectation. The probabilistic model predicts the annual replacement and rehabilitation needs to be approximately $120,000 per year.

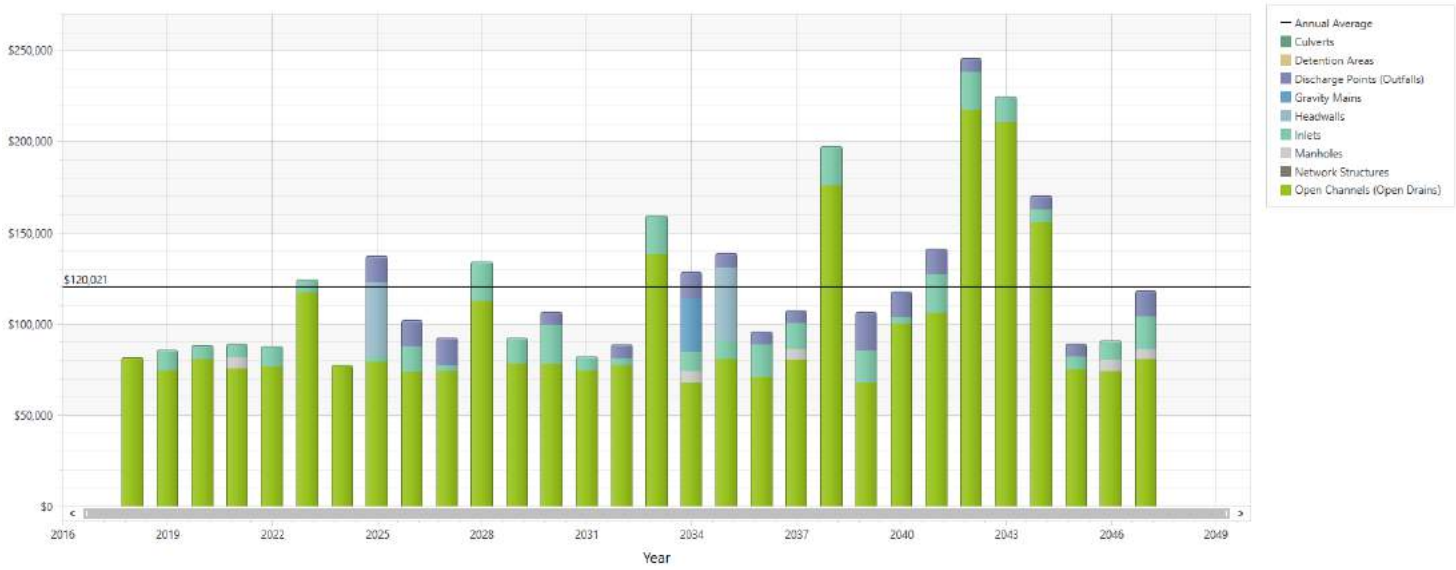


Figure 15-4 30-Year Storm Water Asset Replacement and Rehabilitation Profile (Probabilistic Model)

Both analyses above represented results in today's dollars (2018). Expecting the cost of construction will increase with time, a 3% annual inflation factor was utilized. With 3% inflation over the 30-year planning horizon, the projected annual investment need for the deterministic model jumped from approximately $155,000 per year to $270,000 per year. Similarly, for the probabilistic model, the annual investment need increased from approximately $120,000 per year to $198,000 per year. The results of these analyses are summarized in the table below.

Table 15-7 Storm Water Management System 30-Year Summary

30-Year	Annual Average
Deterministic	$ 155,000/yr
Probabilistic	$ 120,000/yr
Deterministic with 3% Inflation	$ 270,000/yr
Probabilistic with 3% Inflation	$ 198,000/yr

How Should the Town Prioritize?

In order to prioritize the limited budget available to address the ongoing replacement and rehabilitation needs of the storm water assets, a risk-based approach that incorporates Probability of Failure (PoF) and Consequence of Failure (CoF) was utilized.

The CoF scores of the Storm Water Management System conveyance assets (i.e., gravity mains, culverts, open channels) were assessed based on the social, economic, and environmental consequences of a failure. Conveyances were assessed based on their location. Asset failures that would cause disruptions to Addison Airport, businesses, and traffic were given higher CoF scores. The higher the cost (e.g., large pipe sizes, pipes under roads), the more social disruption (e.g., road closures), and the higher the environmental consequences (e.g., pipe breaks), the higher the overall CoF of the assets.

Pipe size, zoning classification of the asset location, and proximity to major roads were used as factors in the CoF score. These factors were weighted, and the factors were assigned for each conveyance asset. The following table summarizes the weight each factor was given to determine the overall CoF score.

Table 15-8 Conveyance Asset CoF Weighting Factors

CoF Factors	Weighting
Pipe Size	40%
Zoning	20%
Street	35%

The zoning or the use of the land at the location of the conveyance was considered when assigning CoF. This factor is used to highlight conveyances near businesses, where the impact of failure can be greater. The following table shows the zoning scores assigned to each asset.

Table 15-9 Zoning CoF Factor

Zoning Classification	CoF Score
Industrial/Airport	5
Commercial	5
Local Retail	5
Urban Center	5
Mixed Use	4
Apartment	3
Planned Development	3
Residential	3
Park	3

The proximity of the asset to major roads was also a major factor in the CoF. An asset failure that disrupts traffic flow and Airport operations has high social and economic consequences. As such, the CoF of assets within 100 feet of larger roads with higher traffic levels and assets near critical Airport taxiways were given higher CoF scores.

Table 15-10 Street CoF Factor

Street Classification	CoF Score
Airport - Runway	5
Airport - Taxiway Alpha	5
Tollway	5
Arterial	5
Collector	4
Airport - Taxiway Bravo	4
Airport - Taxiway Charlie	4
Airport - Taxiway Foxtrot	4
Airport - Taxiway Uniform	4
Airport - Taxiway Victor	4
Airport - Taxiway Sierra	3
Airport - Taxiway Tango	3
Airport - Taxiway Romeo	2
Local	2
Commercial	2
Residential	2
Airport - Entry Way	2
Airport - Ramp	2
Airport - Service Road	1
Private	1

The greater the size of the pipe or culvert, the greater the impact of failure as a larger diameter carries a greater water volume and would affect a larger area. In addition, the larger pipes and culverts are costlier to replace and are likely to be located under major roads. As such, the larger the pipe or culvert size, the higher the CoF. In the case of the open channels, all assets were given a CoF score of 5 for the size weighting.

Table 15-11 Pipe/Culvert Size CoF Factor

Pipe Diameter (in)	CoF Score
1	1
2	1
4	2
6	2
8	2
10	2
12	2
14	2
15	2
18	2
20	3
21	3
24	3
27	4
30	4
33	4
36	4

Pipe Diameter (in)	CoF Score
39	4
40	4
42	4
45	4
48	4
51	4
54	4
57	5
60	5
66	5
72	5
78	5
84	5
90	5
96	5
108	5
120	5

Other Assets

Detention areas, manholes, network structures, discharge points (outfalls), and inlets were assigned a CoF score based on the CoF of the storm water line to which they were connected. Headwalls were assigned a CoF score based on the CoF of the open channel to which they were connected.

The following figure gives a detailed look at the CoF levels of storm water lines. The CoF scores were based on multiple factors, including proximity to roads, pipe diameter, and zoning. Most of the storm water lines have medium CoF. Many lines marked in red, including pipes near the Airport and on arterials such as Midway Road and Belt Line Road, have high CoF.

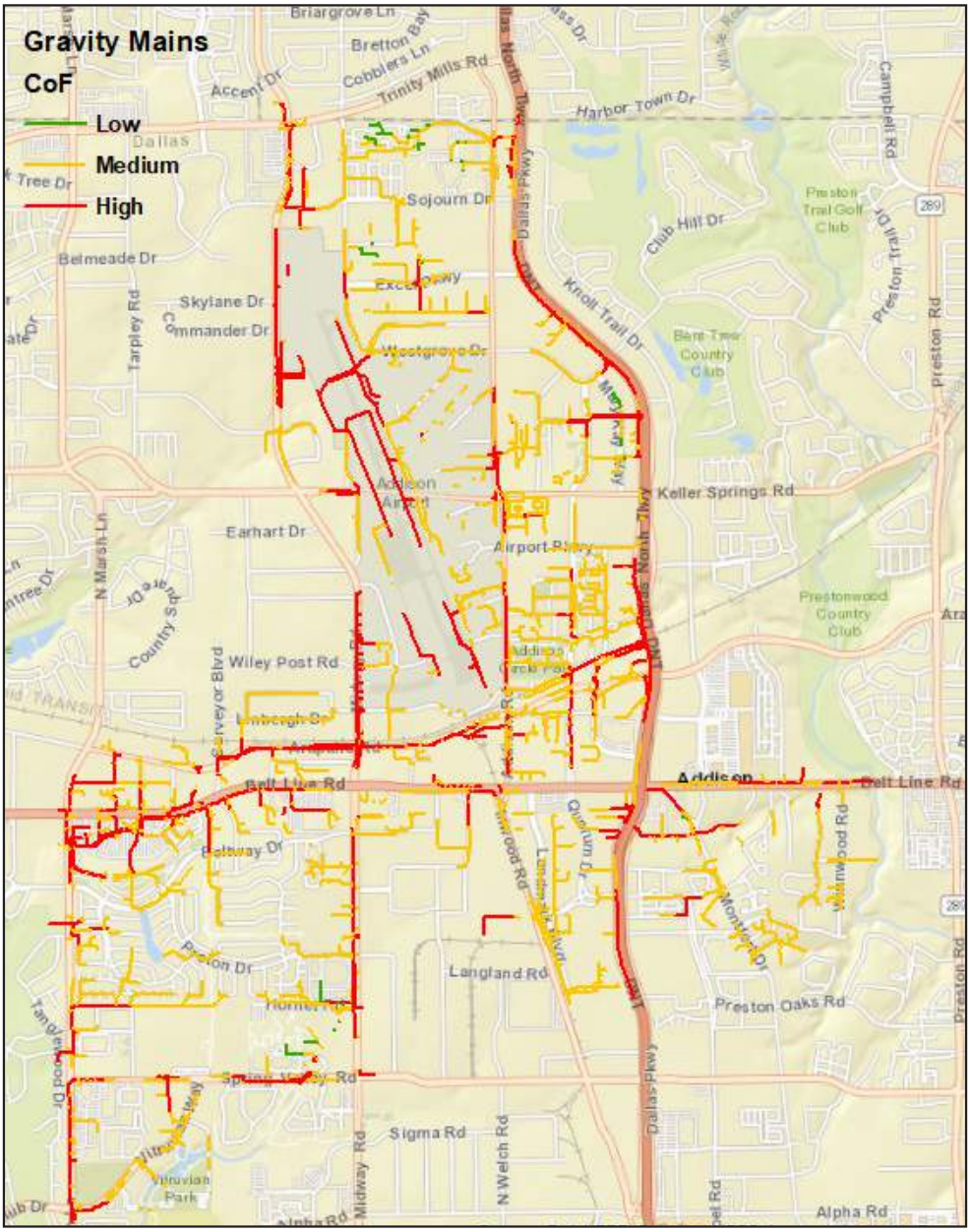


Figure 15-5 Storm Water Lines CoF Map

The following figure shows the resulting overall risk profile for the Storm Water Management System. Currently, there are only 10 assets in the high-risk zone with a total replacement cost of approximately $255,000. These high-risk assets include discharge points (outfalls) that are past their useful lives, inlets that are in poor condition, and open channels that are in poor condition and require maintenance. As such, the Storm Water Management System is relatively in good condition overall. The relatively young pipe age for the storm water lines leads to the overall level of risk for the pipes to be low.

Figure 15-6 Storm Water Risk Matrix

Although there are currently only 10 high-risk assets in the Storm Water Management System, the value of assets that will require replacement or rehabilitation in the next 10 years, is approximately $980,000. While the replacement cost of assets might be high, the risk can be mitigated by maintenance or rehabilitation, so the cost to lower the risk scores may be significantly less than the total value.

The following figure presents the risk results for the storm water lines. Although there are both high PoF and high CoF storm water lines, the combined scores resulted in all low risk storm water lines, as shown in the map. The relatively young age of the lines puts the assets at low risk.

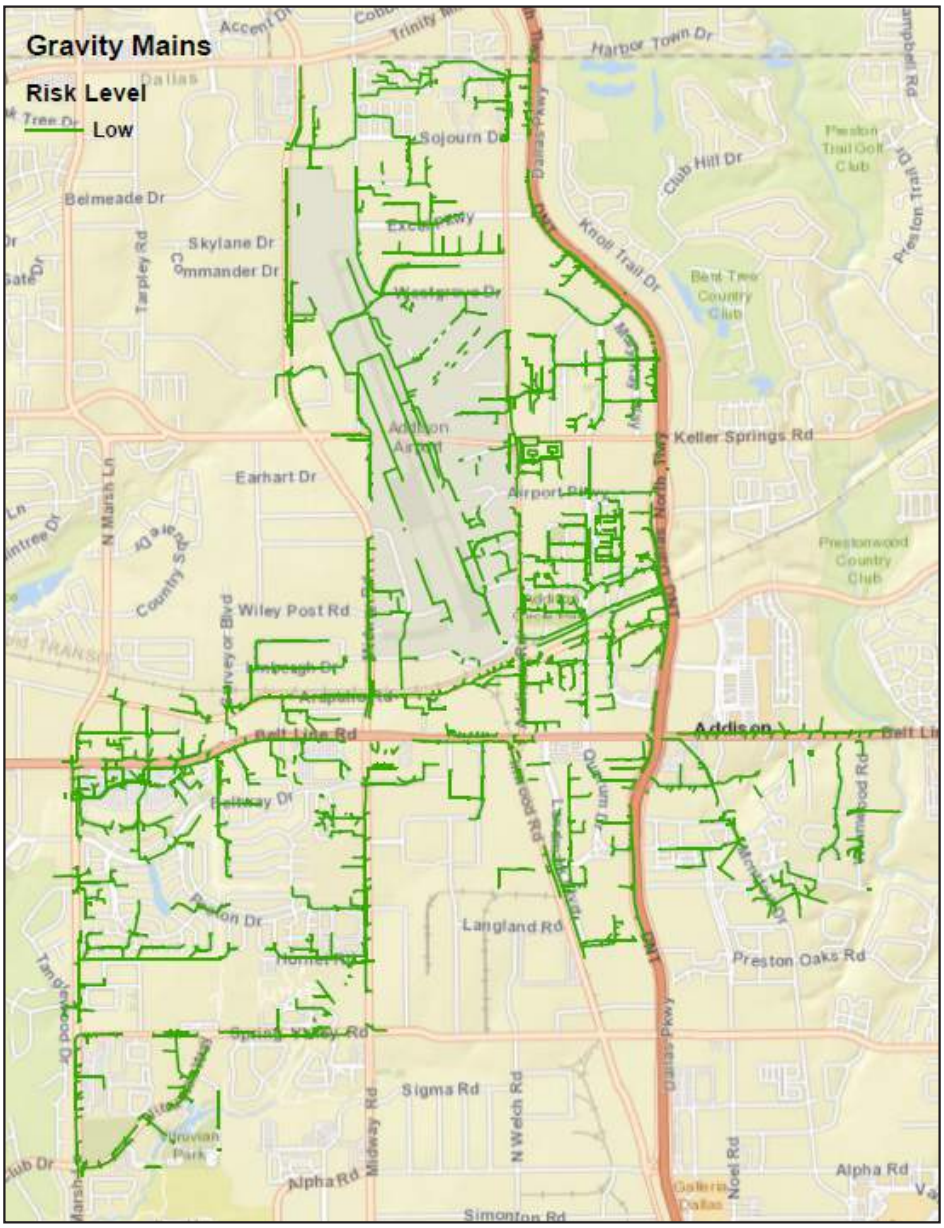


Figure 15-7 Storm Water Lines Risk Map

The following table displays the total Catch Up, or the total replacement and rehabilitation costs in 2018, as well as the Keep Up for a 30-year planning horizon. These amounts are represented in current year (2018) dollars.

Table 15-12 Catch Up and Keep Up Values

Category	Cost
Catch Up	$ 248,121
Keep Up	$ 148,822/yr

What Level of Service Should the Town Provide?

Level of service allows the Town to evaluate the impact of budget with respect to the projected work backlog. Two scenarios were developed: Preferred Level of Service and Minimum Level of Service.

As shown in Figure 15-3, the estimated annual needs over a 30-year horizon for the Preferred Level of Service was approximately $155,000.

The figure below shows the rehabilitation and replacement profile over a 30-year horizon for the Minimum Level of Service, where only high-risk assets (with CoF 4 or higher) are addressed. The annual average needs for the Minimum Level of Service is approximately $58,000 per year.

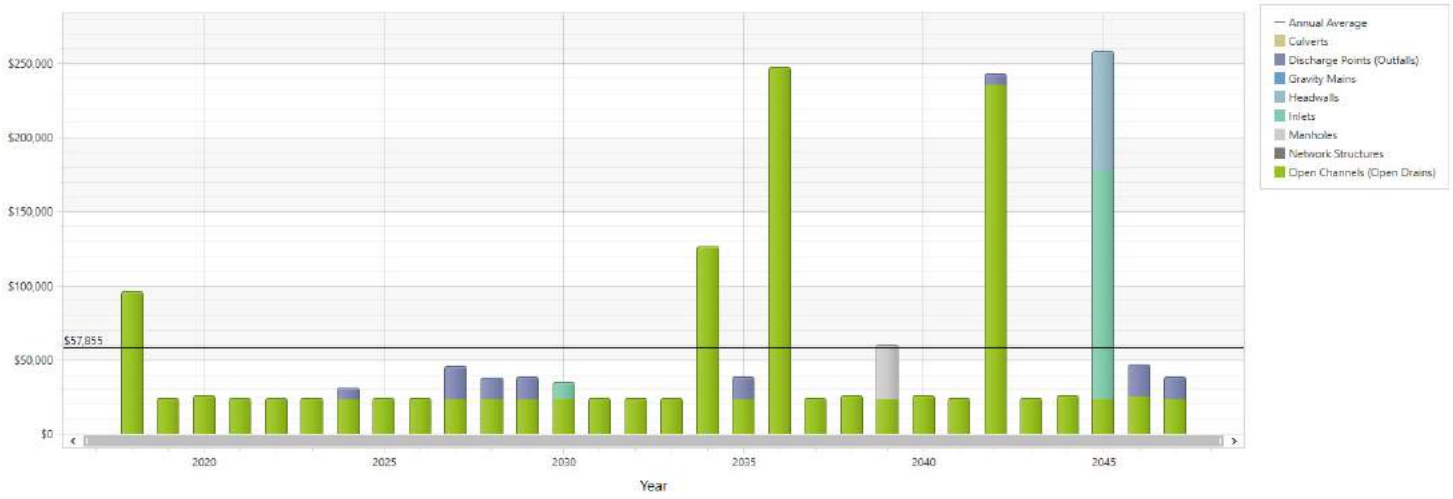


Figure 15-8 Minimum Level of Service Replacement and Rehabilitation Profile

While funding only the high-risk assets would allow the Town to prioritize the more critical needs, this Minimum Level of Service would not fund several of the Town's storm water assets. In addition, the Town does not have a Storm Water maintenance schedule in place. This could potentially be due to a resource problem, in which the Town does not have the workers or other resources to dedicate to addressing the storm water assets. The Minimum Level of Service will not cover the necessary maintenance needs of the Storm Water Management System, which will result in a decreased level of service. The Minimum Level of Service scenario is not recommended, and it is only performed to present the lower spectrum of the funding requirements.

Financial Assessment Snapshot

The Town's assets are currently in good shape. However, the physical condition of the assets is not the end of the story.

In order to better understand the financial health of the Town's infrastructure assets, a financial assessment snapshot was modeled. The following assumptions were used to develop the basis of the financial assessment snapshot:

- 10-year planning horizon
- Annual allocated FY2019 budget for each asset system expended for maintenance activities
- Major rehabilitation and minor replacements to be funded from Infrastructure Investment Fund*
    - FY2019 fund balance - $4.5 million
- Successful $15 million bond programs in 2019 and 2023 to fund street improvements
- Increase the Infrastructure Investment Fund (IIF) annual allocation to $500,000
    - The current portion of the property tax rate equal to $0.006201 plus extra contribution to equal $500,000
    - In FY2019, the IIF portion of the tax rate is scheduled to generate $282,600
- The Infrastructure Investment Fund will not be used to fund projects in Enterprise Funds

*The Infrastructure Investment Fund (IIF) was created in FY2015 to cash fund infrastructure projects. The IIF fund was used as the example as to how to fund the major rehabilitation and minor replacement projects because it is the only fund that is set with a definite contribution each year. Year-end savings is determined on a year-by-year basis, so it cannot always be predicted each year.

The following asset management systems were assessed in the financial assessment snapshot:

- Buildings
- Parks and Trails
- Landscape
- Pavement
- Vehicular Bridges*
- Curb Ramps*
- Sidewalk
- Traffic Signals
- Traffic Signs
- Street Lights

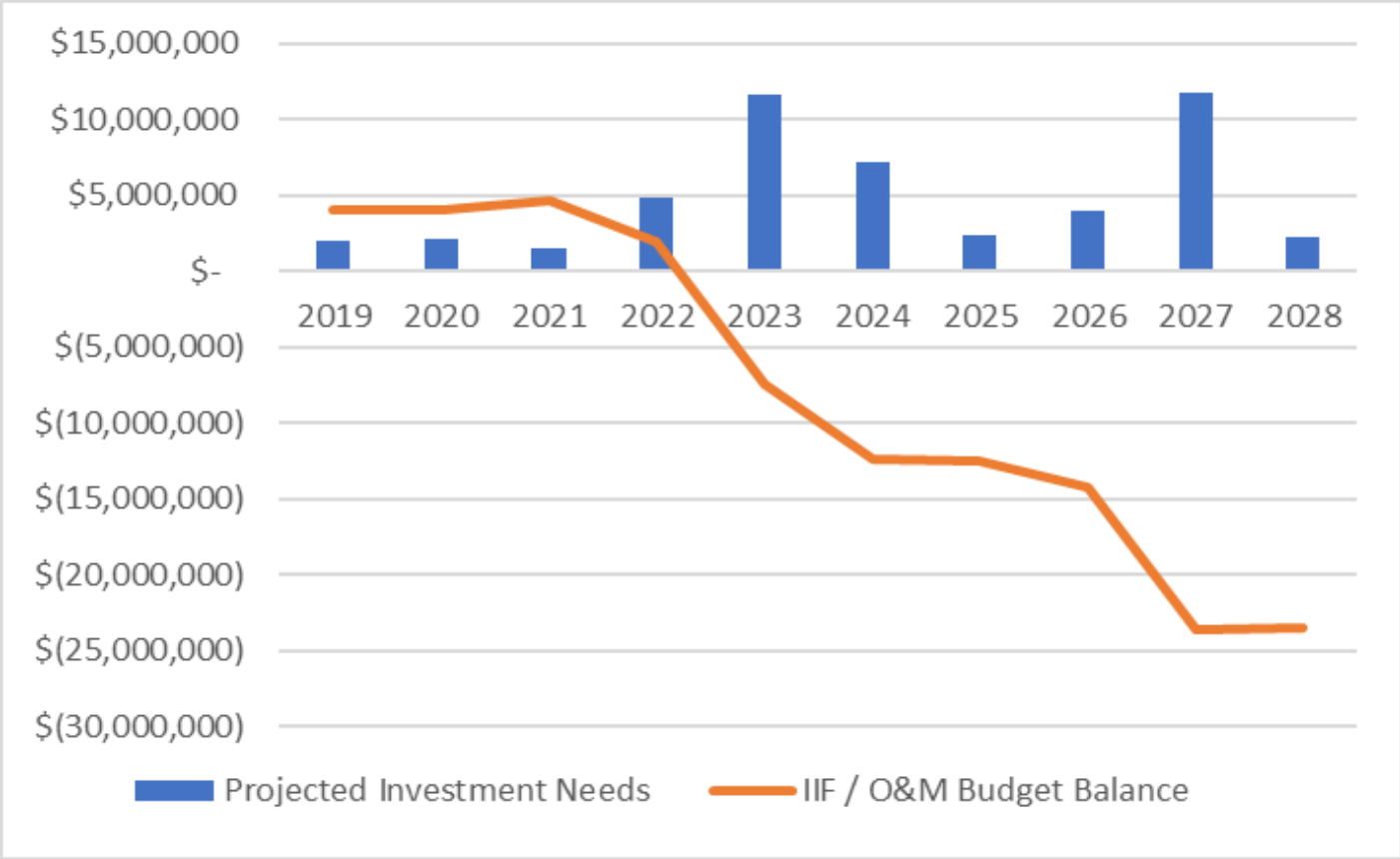
*Curb Ramps and Vehicular Bridges are included in the Pavement Management System

The following Enterprise Fund asset management systems were not included in the financial assessment snapshot:

- Fleet
- Water
- Wastewater
- Storm Water
- Airport

Financial Health Assessment

The financial assessment snapshot compared asset maintenance, rehabilitation, and replacement needs to the Infrastructure Investment Fund balance, combined with the department's annual maintenance budget allocations. Using this example, with the recommendation that the annual contribution to the IIF fund be increased to $500,000 per year, and using the annual budget allocations, the Town is able to keep up with their infrastructure asset needs for the next 4 years only.



If nothing changes before 2023, the Town will not be able to fund the projected infrastructure investment needs and it will not be able to maintain the level of service that it currently offers.