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Risks and Rehabilitation of Sewer Assets with Info360 Asset

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- Learn about the pressing challenges of sewer infrastructure assets in City of Oakland.
- Learn about asset management practices in City of Oakland.
- Learn about the benefits of digital and physical infrastructure integration - cloud solutions.
- Learn how Info360 Asset risk and rehabilitation tools can be leveraged to help cities make informed decisions.

Description

The City of Oakland addresses its aging infrastructure challenges with the use of a risk prioritization and mitigation plan. This talk discusses the asset management challenges that the city faces and its use of digital tools such as the cloud based Info360 Asset to make more informed, holistic, and efficient decisions.

Speaker(s)

Wen Chen is a supervising engineer in charge of the sanitary sewer CIP program in the City of Oakland Public Works Department. He has over two decades of professional experience in water resources, stormwater management, and CIP master planning. He obtained his doctor's degree specializing in water resources at Arizona State University. He is a licensed professional Civil Engineer in the state of California.

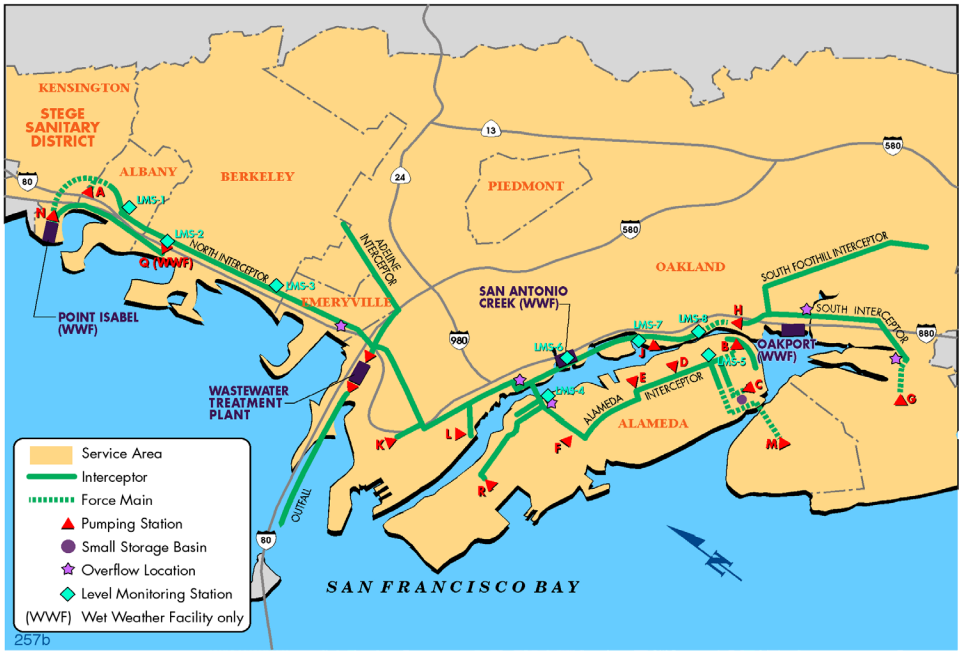
Martha Nunez is the customer success manager for the asset management software Info360 Asset. Her professional experience has been dedicated to helping water and sewer utilities solve their aging infrastructure challenges. At her current job she works closely with clients by driving the usage of digital solutions to increase efficiency and save costs. She graduated with a master's degree in environmental engineering from Colorado State University and is a licensed professional engineer in the state of Colorado.

Introduction:

Aging infrastructure has been the number one challenge in the water industry for the past several years. It is an issue that water and sewer utilities are currently facing and is resulting in costly repairs and negative impact to public health and the environment. With external pressures such as climate change, inflation, and population growth, this issue becomes exponentially challenging year after year. The need for efficient asset management practices that help utilities save time and costs, is imminent. This document presents the story of how City of Oakland manages aging infrastructure challenges and how Info360 Asset was added to the city's toolbox to develop a holistic and efficient solution for a problem most cities around the word face today.

Pressing challenges of sewer infrastructure:

The City of Oakland owns and operates a sanitary sewage collection system that serves approximately 400,000 residents within the city. The collection system includes approximately 934 miles of gravity main, less than two miles of pressure force main, and eleven sewage pump stations. There are approximately 102,000 private lateral sewer connections to the collection system.



Aging Infrastructure Challenges:

Some of the City's first sanitary sewer pipes were installed around 1852 (166 years ago) when Oakland was incorporated as a town. In average the Sewer Collection System surpasses its service life. There are inadequate conveyance capacities due to land development and city expansion. Capacity is further reduced or blocked as debris, root intrusion, and illicit dumps enter the system. As a result, there are more than 100 sanitary sewage overflows annually, particularly in heavy storm events. Inflows and infiltrations produce up to 7 times of peak flow from dry weather that far exceeds wastewater treatment plant's capacity. There are limited funds and work force to improve the system which makes these problems more challenging.

EPA Consent decree:

Negotiations among the cities and districts, state and federal regulators, and local environmental groups have resulted in a sewer consent decree that was finalized on September 22, 2014. This settlement gives the defendants East Bay Municipal Utility District (EBMUD) and the seven Satellite Agencies to include the Cities of Alameda, Albany, Berkeley, Emeryville, Oakland, Piedmont, and Stege Sanitary District) until 2036 to repair and replace sewer lines, reduce the amount of inflow and infiltration (I/I), and reduce discharges into San Francisco Bay during heavy storms and reduce sanitary sewer overflows (SSOs).

Among all other requirements, the City has been mandated to complete rehabilitation of 13 miles of sanitary sewer system and root foaming treatment to 50 miles of the sewer pipelines every year till the full term of the Consent Decree.

Asset management practices:

Historically, asset management practices at the city were done in a reactive manner where asset repair, replacement, and maintenance were conducted based on field inspections or regular maintenance schedules. In addition, prioritization assessments were conducted with the use of complex spreadsheets and custom calculations with limited data.

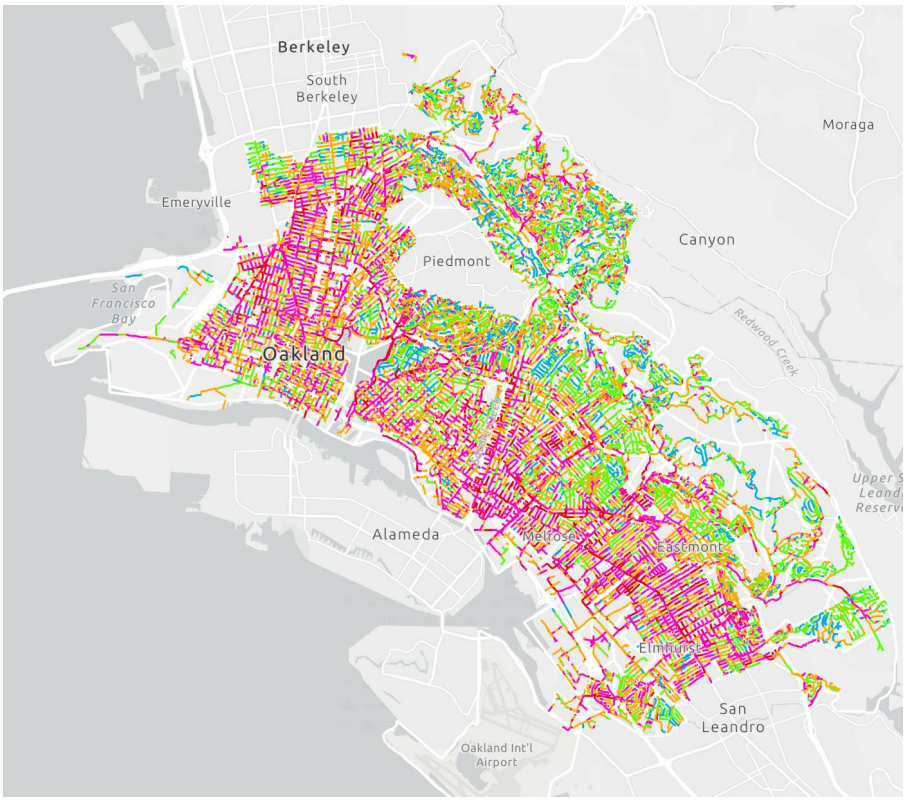
To overcome the challenges to meet City of Oakland's goals, efficient strategies were needed. This meant improving the asset management approach by leveraging digital tools that involved data important for the decision-making processes at the city. This included Geographic Information System data (GIS), video inspection data (CCTV), computerized maintenance management system data (CMMS), and hydraulic modeling results.

In addition to data collection and storage systems, there was a need for an integrated solution that would combine and analyze all the data silos to help the city make more informed decisions. This resulted in the city's pursue of asset management solutions with risk analysis and risk mitigation planning capabilities.

Digital tools at City of Oakland:

The City of Oakland has modernized its sewer asset management since 2006. The central GIS data from the city's sewer collection system is stored in ESRI's ArcGIS platform. To collect, and view CCTV inspection data, the city acquired the systems GraniteNet and IT Pipes. Their main CMMS system where service requests and work orders are communicated and recorded is the platform Cityworks. The city also uses ArcGIS Online for reporting and tracking KPIs. Since 2016, the city has implemented InfoAsset Planner (precursor to Info360 Asset) to manage the sewer collection system by:

- Developing a risk prioritization plan based on likelihood and consequence of failure.
- Balancing between preventative and replacement work.
- Balancing between short-term and long-term strategies (budget analysis).



Risk based master plan:

City of Oakland developed a risk prioritization master plan with the help of the consulting company Black and Veatch. The risk is delineated through quantitative factors to calculate sewer infrastructure's likelihood of failure (LOF) and consequence of failure (COF).

Likelihood of failure parameters define how "likely" or "probable" it is that an asset in a system will fail. On the other hand, consequence of failure defines the public health, environmental, or economic hazard of an asset failure in a system. When analyzing the risk of a pipe, different LOF and COF criteria are considered. Each criterion is scored from 1-5, 5 being the most severe scenario. The tables below show the different criteria that is analyzed by City of Oakland for LOF and COF respectively.

Likelihood of failure:

The table below shows the likelihood of failure criteria comprised by three main categories: structural failure, maintenance failure, and hydraulic capacity failure. The structural failure category analyzes the installation year of the asset and the structural condition score from CCTV data. The maintenance failure category analyzes maintenance condition scores from CCTV data, maintenance cleaning observations from the CMMS system (grease and debris), SSO occurrences, and cleaning frequencies. Finally, the hydraulic capacity category analyzes hydraulic modeling results (d/D), maximum flows, and infiltration and inflow (I&I) per basin. The categories were weighed 44.45%, 33.3%, and 22.2% respectively.

Table A.1 - Likelihood of Gravity Main Failure Criteria

	Criteria	Scoring Criteria					Scoring Weight
		1	2	3	4	5	
Structural Failure	Condition: PACP Structural Peak Score	0 (No Defects Noted) or 1	2	3	4	5	44.45%[1]
	Installation Year/Rehab Year	> 1990	1971 - 1990	1951 – 1970; unknown	<=1950	Not Used	
Maintenance Failure	Condition: PACP O&M Peak Score	0 (No Defects Noted) or 1	2	3	4	5	33.33%[2]
	Roots/Grease Observed During Cleaning	Clear; Not Observed (N/A, Blank)	Not Used	Light	Moderate	Heavy	
	Debris Observed During Cleaning	Clear; Not Observed (N/A, Blank)	Light	Moderate	Heavy	Not Used	
	SSO occurrences at pipe locations	No documented SSOs	Not Used	Not Used	1 SSO	> 1 SSO	
	Condition (Based on Cleaning Frequency)	Pipes not identified for frequent cleaning	Pipes identified for 12-month cleaning frequency	Pipes identified for 6-month cleaning frequency	Pipes identified for 3-month cleaning frequency	Pipes identified for weekly cleaning frequency	
Hydraulic Capacity Failure	Modeled Capacity - Identified Restrictions (d/D)	≤ 0.5 (< 50% full)	0.5 - 0.75 (50% - 75% full)	0.75 - 1.0 (75% - 100% full)	Surcharge due to Backwater	Surcharge due to Capacity Exceedance	22.22%[3]
	Infiltration per meter basin	0 - 3.99%	4.00-9.99%	10.00-19.99%	20.00-39.99%	≥ 40.00%	
	Total LOF Score						**100%**

Consequence of failure:

The table below shows the consequence of failure criteria comprised by five main categories: potential spill volume, environmental impact, public exposure, social equity, and emergency response and construction impact. The potential spill volume category analyzes hydraulic modeling results for spill volume from maximum peak flow during wet weather in addition to pipe size. The environmental impact category analyzes proximity of the pipe asset to waterways (creeks, lakes, and FEMA 100-year flood zones). The public exposure category analyzes proximity of the pipe asset to pedestrian zones and critical facilities (schools, hospitals, etc.). The social equity category analyzes pipe asset proximity to underserved communities, and areas with historical, cultural, and natural importance. Finally, the construction impact category analyzes pipes based on difficulty of repair, for example pipe proximity to major roads, railroads, hills, etc. in addition to pipe depth. The categories were weighed 20%, 22%, 23%, 23%, 12% respectively.

Table A.2 - Consequence of Gravity Main Failure Criteria

	Criteria	Scoring Criteria					Scoring Weight
		1	2	3	4	5	
Potential Spill Volume	Potential Spill Volume (Based on Modeled Peak Wet Weather Flow)	< 0.25 mgd	0.25 mgd - 0.50mgd	0.51 - 1.0 mgd	1.01 mgd - 3.0mgd	> 3.0 mgd	20%[1]
	Estimated Spill Volume Based on Pipe Diameter	< = 6 in	7in - 8 in; Unknown	9 in - 10 in	12 in	> 12 in	
Environmental Impact	Proximity to Water Ways	Greater than 250ft of water body or outside FEMA 100-yr Flood Zone	Within FEMA 100-year Flood Zone	Within 100 - 250 ft of water body	Within 50 - 100 ft of water body	Crosses or within 50 ft of water body	22%[2]
Public Exposure	Pedestrian Traffic	Not within proximity	*Not Used*	Within 75 - 150 ft of high pedestrian traffic area	Within 25 - 75 ft of high pedestrian traffic area	Intersecting or within 25ft high pedestrian traffic area	23%[3]
	Near Facility of Concern	Not within proximity	*Not Used*	Within 150 ft of Commercial Area	Within 150 ft of Schools	Within 150 ft of Hospitals, Medical Facilities, Nursing Homes	
Social Equity	Equity/ Investment In Underserved Oakland Communities	Lowest Priority Neighborhood; Neighborhood not assigned a priority	Low Priority Neighborhood	Medium Priority Neighborhood	High Priority Neighborhood or Medium Priority Neighborhood and within 1/4-mile proximity to affordable housing	Highest Priority Neighborhood or High Priority Neighborhood and within 1/4-mile proximity to affordable housing	23%[4]
		Not within areas of primary/secondary importance		Within areas of primary/secondary importance			
Emergency Response and Construction Impact	Proximity to Road/Railroad and Easement Access	Within 30 ft of Local Street road centerline	Within 40 ft of Minor/Major Collector road centerline	Within 50 ft to 100 ft of railroad centerline	Within 75 ft of Other Principal Arterial, Minor Arterial road centerline; Within steep hills designated area and within 10 ft of road centerline; Sewer gravity main outside designated road width for local/collector/arterial.	Within 75 ft of Interstate, Other Freeways or Expressways road centerline; Within steep hills designated area and outside of 10 ft road centerline; Within 50ft of railroad centerline	12%[5]
	Difficulty of Repair/ Potential Contaminated Soils (Brownfield Sites)	Greater than 300 ft from contaminated site	Not Used	Not Used	Within 300 ft of contaminated site	Not Used	
	Difficulty of Repair/Depth of Pipe	< 10 ft; Unknown	Not Used	10 ft - 12 ft	12 ft - 18 ft	> 18 ft	
	Total COF Score						**100%**

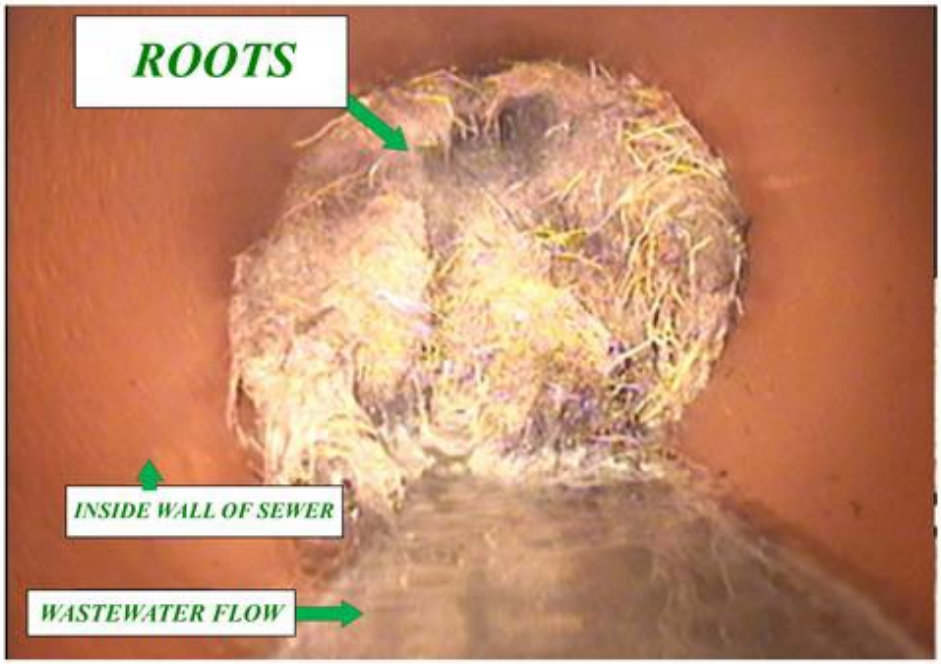
Risk calculation:

The total risk is calculated as the product of the sum of LOF scores and the sum of COF scores for every pipe asset in the system. In addition, pipes are categorized from negligible to high based on the total LOF and COF scores. Pipes with both high LOF and COF scores are categorized as high.

To track overall system performance and health, a comprehensive risk dashboard is developed in ArcGIS Online to highlight critical elements that are of high risks. This dashboard feeds information from the risk analysis results. Moving forward, the city will implement a citywide master plan to mitigate overall risk in the sewer collection system through O&M and CIP programs.

Root control and management:

Root intrusion can significantly reduce system conveyance capacity. Using the decision-making model build tree module in InfoAsset Planner, the city has developed a root control management plan to perform chemical root foaming treatment. Over 50 miles of sewer pipelines are treated annually. The treatment locations are based on root presence in pipelines and their risk ratings, which identify those with higher likelihood of failures (LOF) and consequence of failures (COF) d of root intrusion.



The decision logic focuses on pipes with a high risk and excludes force mains, interceptors, and trunks. It utilizes information from historical work orders such as heavy cleanings, and rehabs, in addition to CCTV observations in the past few years to determine the likelihood of root intrusion. For example, if a pipe is not scheduled for frequent cleaning, has not been rehabbed in 10 years, and root intrusion defects have been in CCTV inspections in the last 10 years, then the pipe asset might have a high likelihood of root intrusion. On another hand if the asset had a

chemical root foaming in the past two years but a SSO occurred after the root foaming, then the pipe asset must be scheduled for root foaming immediately.

Technical trending cloud solutions:

Historically, Innovyze, and Autodesk company has developed desktop solutions for asset management purposes such as InfoAsset Planner. The InfoAsset Planner software is an extension of ESRI's ArcMap, so it is a file geodabase with back-end tables that store the information of the risk analyses, rehabilitation planning, etc. The database can be stored local to a user's machine or on a server which can be shared with others in the organization. However, most of the challenges of desktop solutions include limited data sharing within the organization, limited integration with other systems, and data security challenges.

In recent years, the City of Oakland has moved its asset management practices toward cloud solutions. All city's management tools have cloud capabilities including ArcGIS Online, and water level monitoring network. In 2023 City of Oakland worked with Autodesk to migrate their InfoAsset Planner desktop model to Info360 Asset.

Benefits of cloud solution:

City of Oakland has identified the main aspects of cloud solutions that will benefit their decision-making practices.

Data sharing:

With maximum data accessibility, the information in cloud-based systems can be best exchanged with stakeholders and clients and respond to emergencies in timely manner. In Info360 Asset accessing data is very easy. Just by logging into http://asset.info360.com the city's stakeholders can access their data if they have a subscription assigned to them.

Data security:

Cloud solutions may enhance city's data security. In February 2023, the city suffered from a ransomware attack. All data on local severs were severely impacted but data on the cloud were safe and sound. Since Info360 Asset is on AWS servers the city has guarantee that the data security of the system is top-tier and will protect the city's data from future attacks.

Integrations and Automation:

Cloud solutions enable the city to monitor the system in near-real time fashion. Integrations with other cloud systems are possible. The goal of the city is to have cloud-based systems that integrate with each other so that large dataset can be utilized for each system's purpose. The integration of Info360 Asset with ArcGIS Online is just the beginning. The city will work with Autodesk to continue integrating their systems into Info360 Asset as functionality becomes available in the product.

Risk based decision making using Info360 Asset:

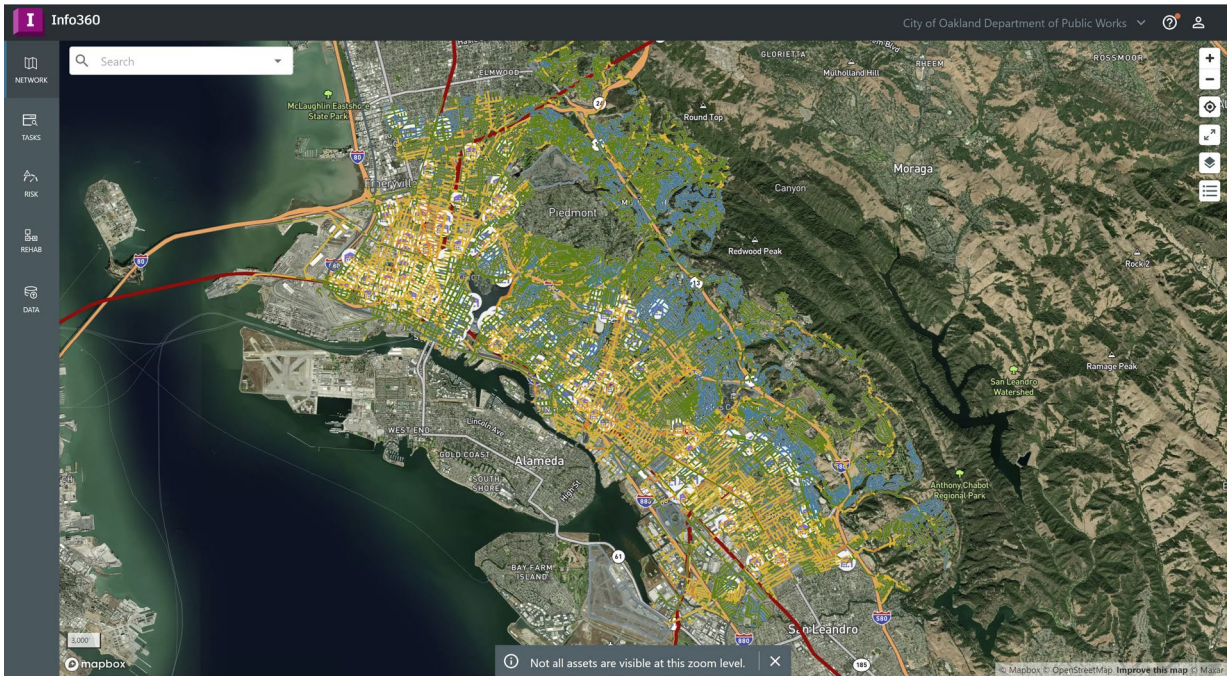
Info360 Asset overview and capabilities:

The Info360 Asset application is a cloud-based platform developed by Autodesk and launched globally in late 2021. It was developed for water and sewer utilities to help them improve their asset management practices by providing a centralized database where they can make informed decisions and collaborate with the team members at the organization. The core tools of Info360 Asset are CCTV Management, Risk Analysis, and Rehab Analysis.

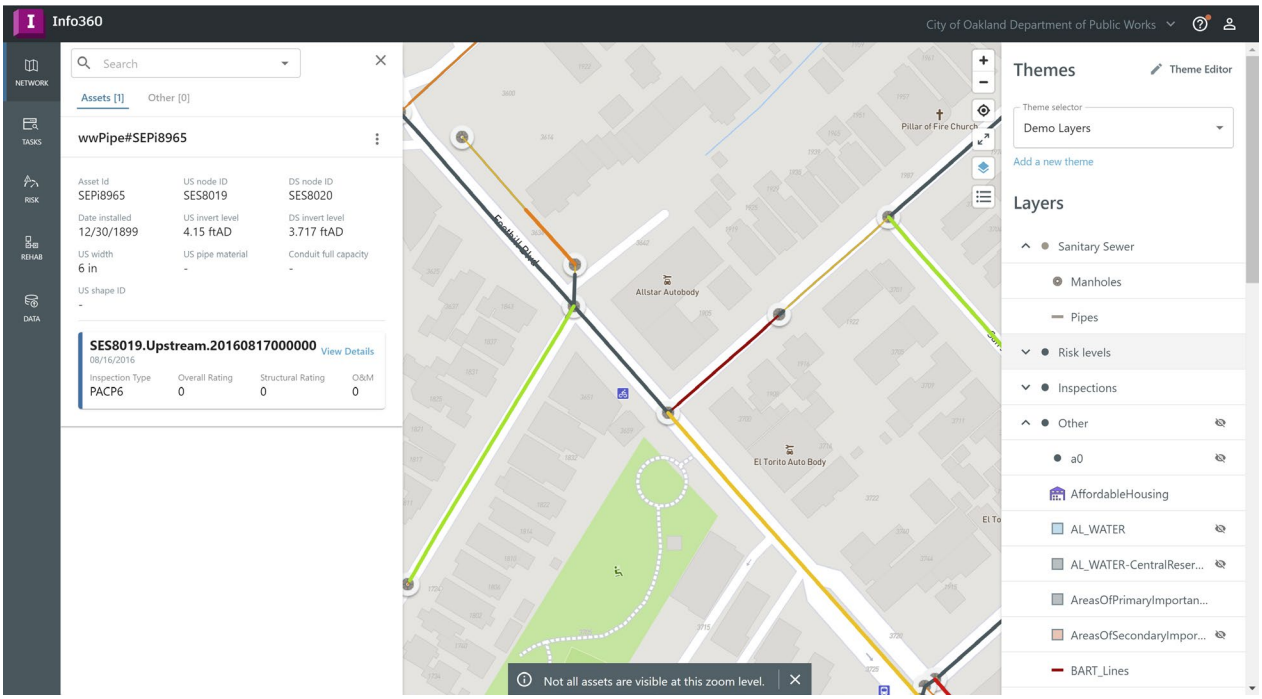
With Info360 Asset, City of Oakland aims to utilize many of the capabilities of InfoAsset Planner while improving the collaboration between teams and protecting its data. The Autodesk development maintained the value of the InfoAsset Planner desktop tools but also developed a more user-friendly interface where data sources and analysis criteria can be easily tracked and updated. The sections below aim to describe the processes and tools that were used to develop the InfoAsset Planner models in Info360 Asset and highlight the value that it provides the city today.

GIS and data import

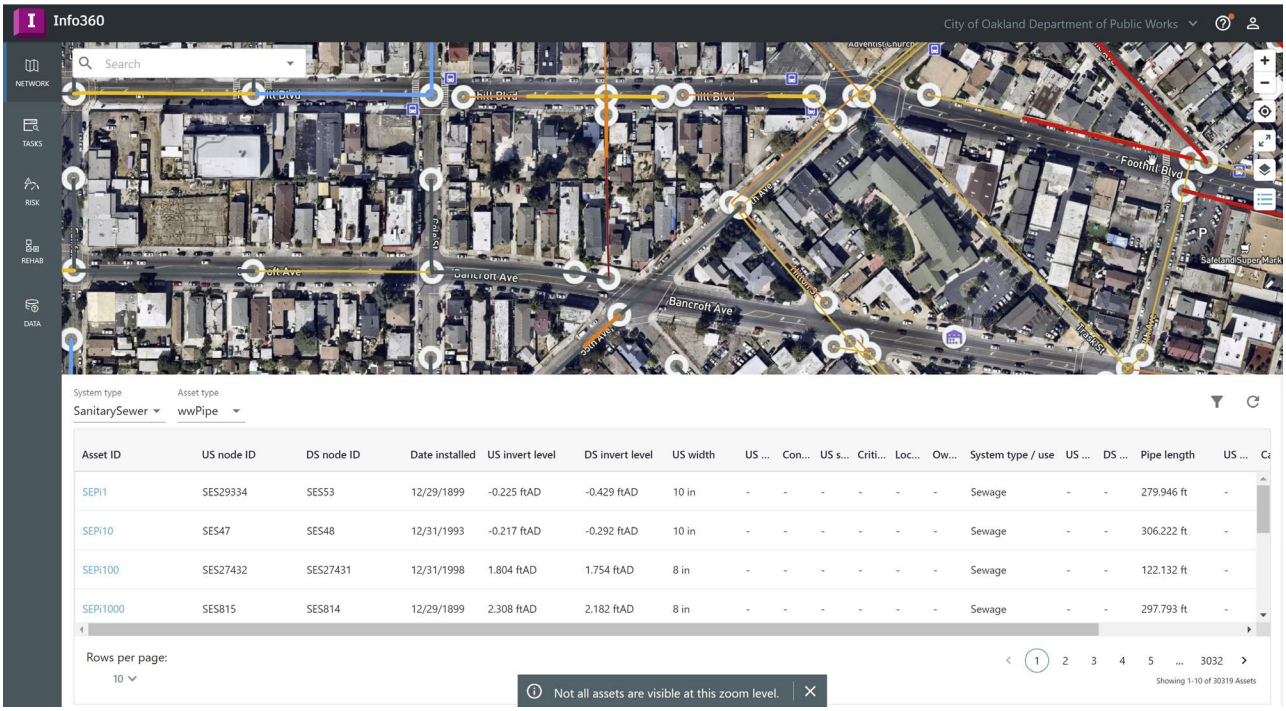
Importing GIS data into Info360 Asset is a simple process of uploading the GIS file, mapping required and useful fields, and importing the file. GIS data can be imported into Info360 Asset as a GeoJSON file, or an ArcGIS Online import. The data from City of Oakland's InfoAsset Planner model was converted from a File Geodatabase Feature Class to a GeoJSON using ArcGIS Tools.



Once imported into the Info360 Asset environment the GIS data can be viewed in different ways. From the Network interface City of Oakland can view all their assets and look up an asset based on an asset ID or customer address.



In addition, attribute data from pipes and manholes can also be viewed in an asset attribute table as seen below.



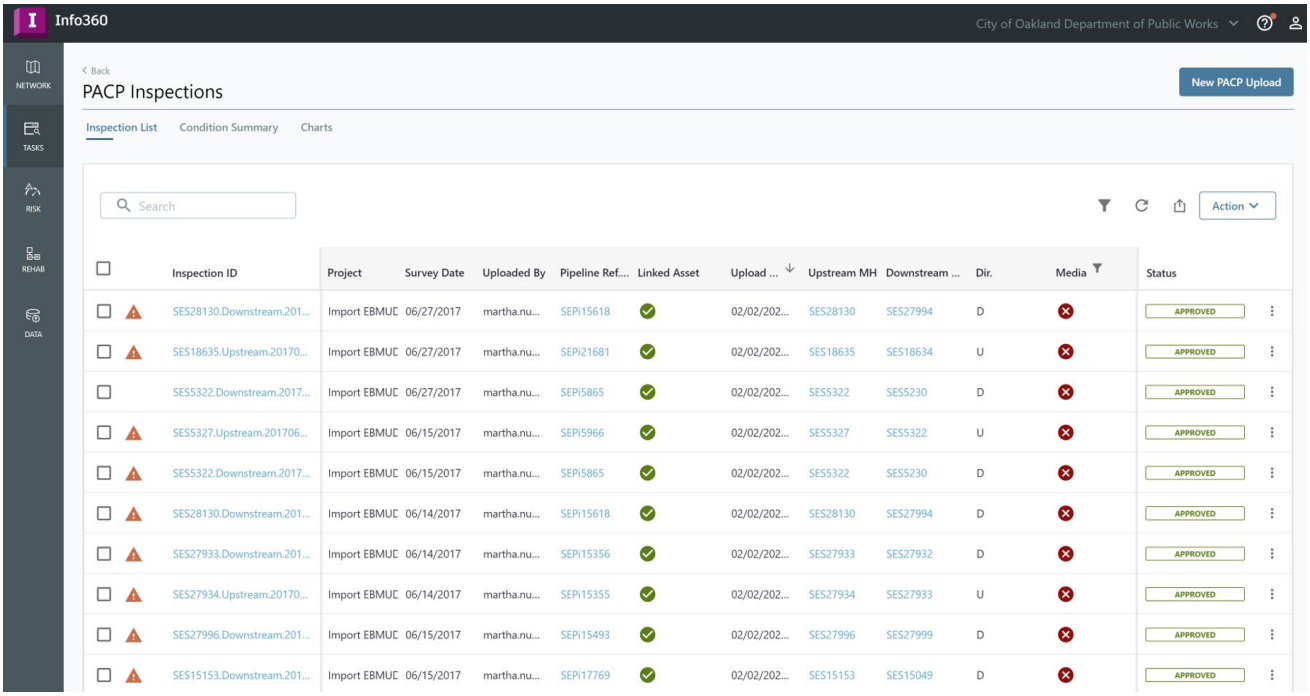
In addition to asset GIS data (pipes and manholes), the spatial layers to be used in the risk model were also imported. Some examples are the waterbodies, affordable housing, Bart lines, roads and highways, hills, flood zones, etc. These layers are visible in the Network page and

could be used as part of supporting analyzes where the city evaluated parameters such as the proximity of the asset to a critical facility (e.g., Hospitals, Schools, etc.).

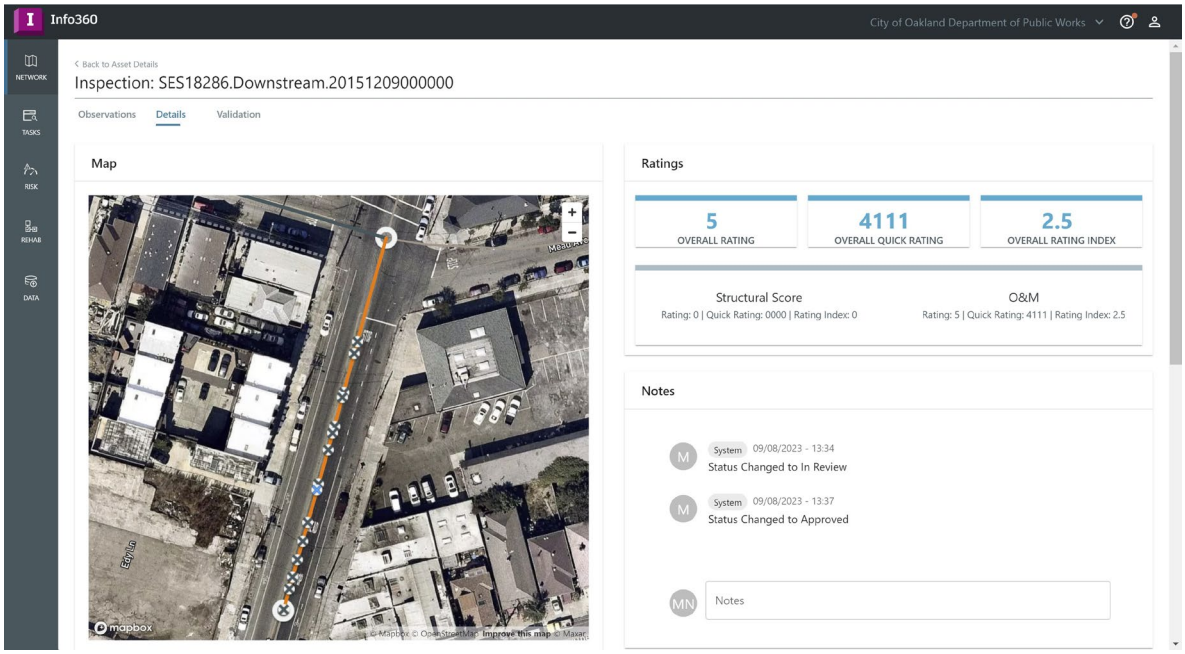
CCTV management

The CCTV inspection management functionality in Info360 Asset allows City of Oakland to store, manage, and analyze historical inspection information. A total of 17064 inspections were transferred from the InfoAsset Planner model to Info360 Asset. The inspections were pre-processed to be converted to the NASSCO standardized Access database. Once the database was created, the inspections were imported and approved in the Info360 Asset platform.

Under the Tasks page all the CCTV inspections can be viewed and managed. This easy-to-use interface allows City of Oakland to QAQC their data by allowing the city to filter inspections that are not linked to the asset due to mismatching manhole references. The manhole references can be edited in-app to match the pipe GIS so that the inspection is re-linked to the asset. In addition, this interface allows the city to review and edit the inspections and 'Approve' them. Upon approval, the inspections are scored based on the NASSCO standard PACP scores, and ready to be used in the Risk analysis.



Upon inspection approval, the CCTV inspections are also geocoded. All the conditions such as structural and maintenance defects, and taps recorded within the inspection can be viewed in the map. The conditions are geocoded based on the 'Distance' field recorded in the CCTV inspection video record. This results on a visual where City of Oakland can determine the location of the defect along the length of the pipe for informed planning when conducting repair operations. Under the 'Asset Details' page the city can access the map information, as well as the standard structural, O&M, and overall scores dictated by the CCTV standard.

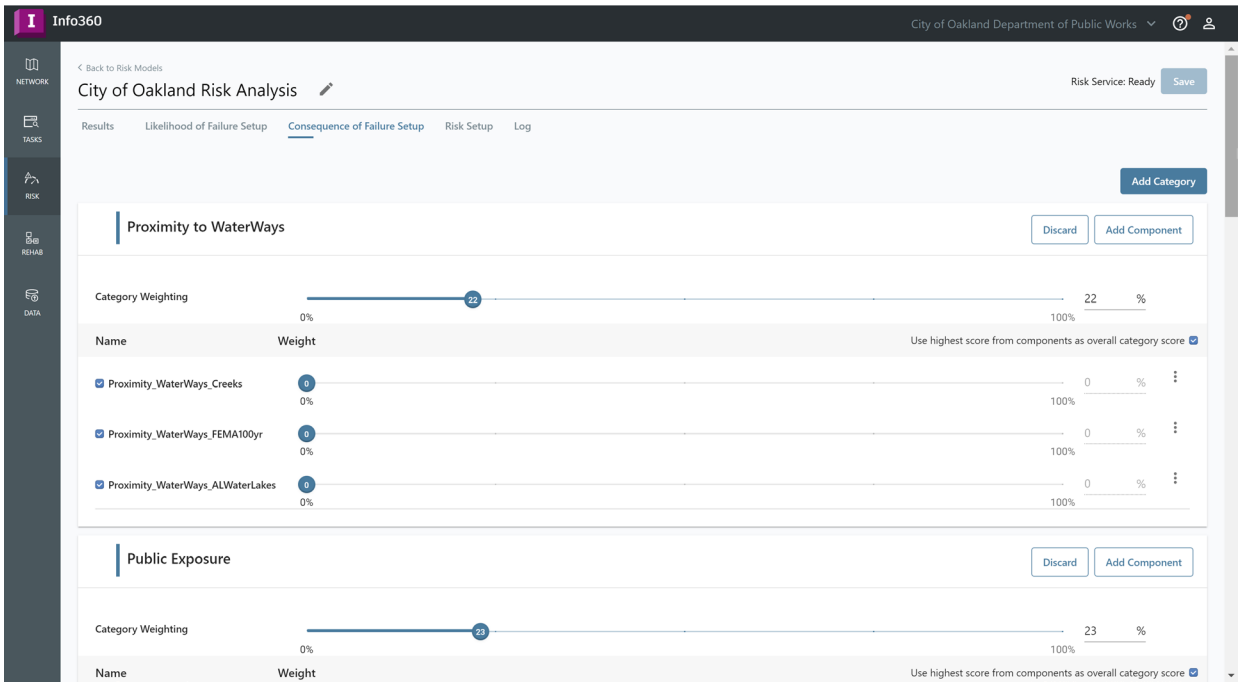


With this information readily available on the cloud the team at City of Oakland will have maximum accessibility to the condition of their network as they plan for their future CIP projects. With the easy-to-use upload functionality, the city can export the data from their GraniteNet system in a NASSCO standardized format and upload it regularly to Info360 Asset so that the network condition data is up to date during their risk assessment and risk mitigation practices.

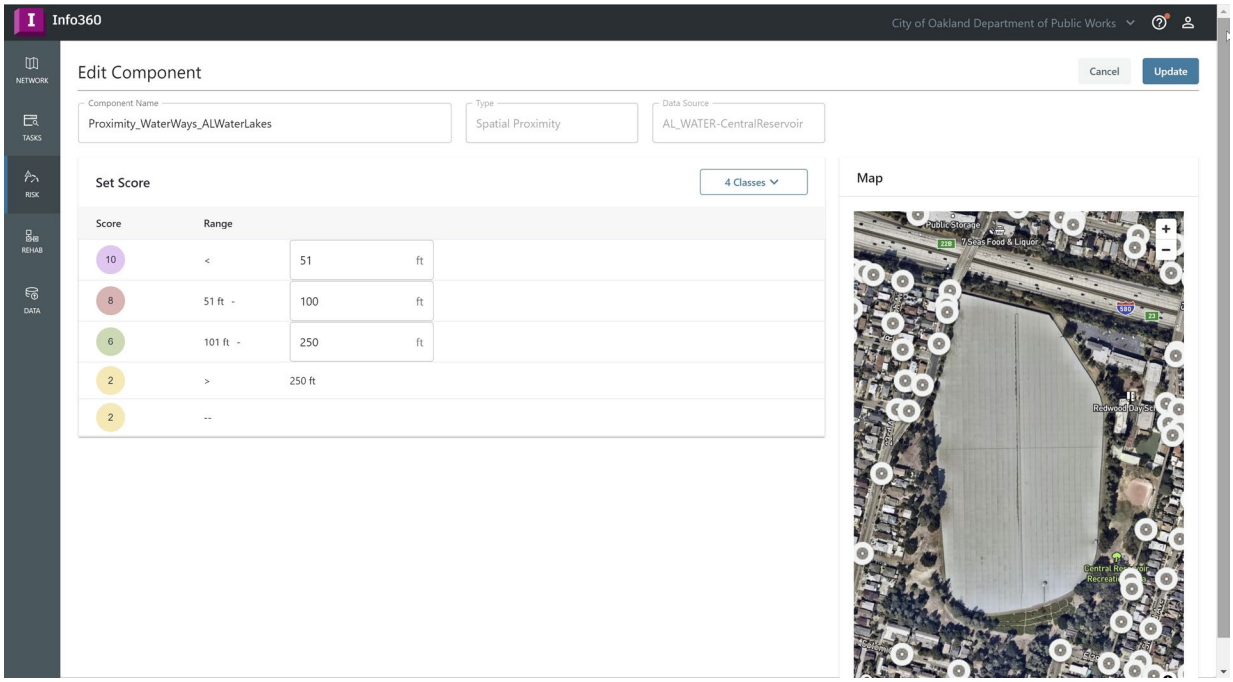
Risk analysis

The risk analysis tool allows City of Oakland to leverage the information from different data sources to generate a prioritization report of their sewer network. The process of developing the risk analysis consisted in replicating the Likelihood of Failure and Consequence of Failure analyses from the InfoAsset Planner model. Once these analyses were created, the total risk and risk class were calculated for every asset in the system.

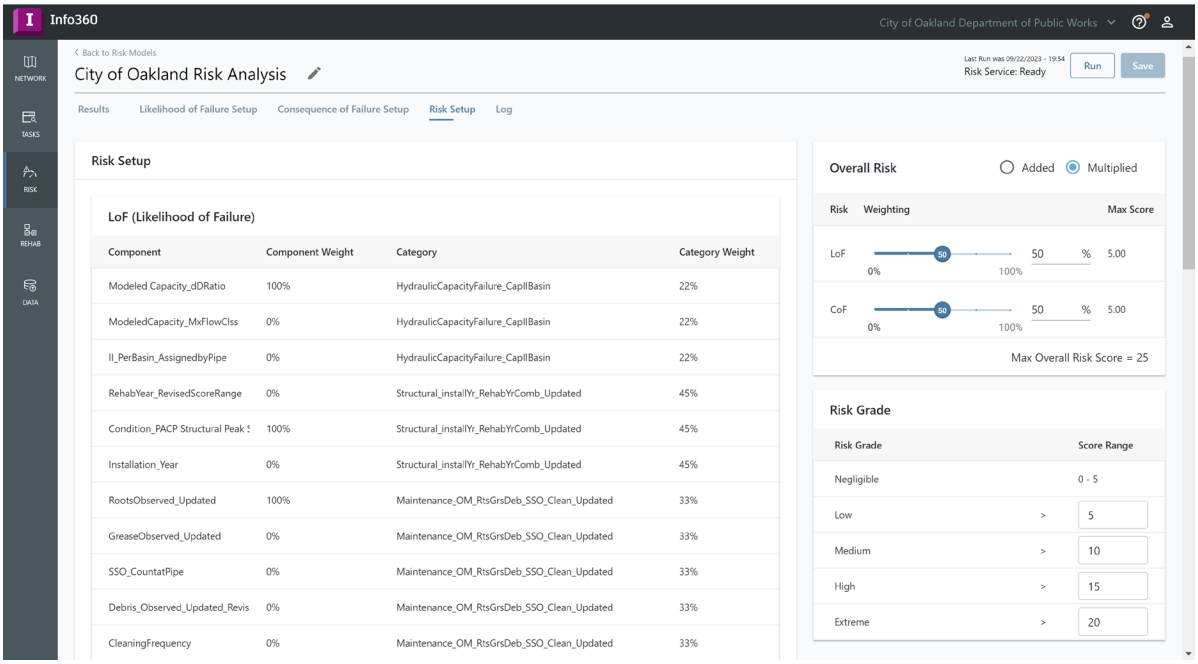
Under the Likelihood of Failure and Consequence of Failure tabs of the Risk page the categories and components for the criteria to be scored, were created. Each category and component were given a name equivalent to the naming convention in the InfoAsset Planner model. For example, the category ‘Proximity to Waterways’ was comprised of the components ‘Proximity_WaterWays_Creeks’, ‘Proximity_WaterWays_FEMA100yr’, and ‘Proximity_WaterWays_ALLWaterLakes’. The category weights were applied by sliding the Category Weighing slide bar to the corresponding weight (e.g., 22%). For all instances of City of Oakland’s risk analysis, the individual components did not have a weight applied to them. Instead, the maximum score of any component dictates the unweighted score of the category. This is accomplished by selecting the “Use highest score from components as overall category score” option for the category.



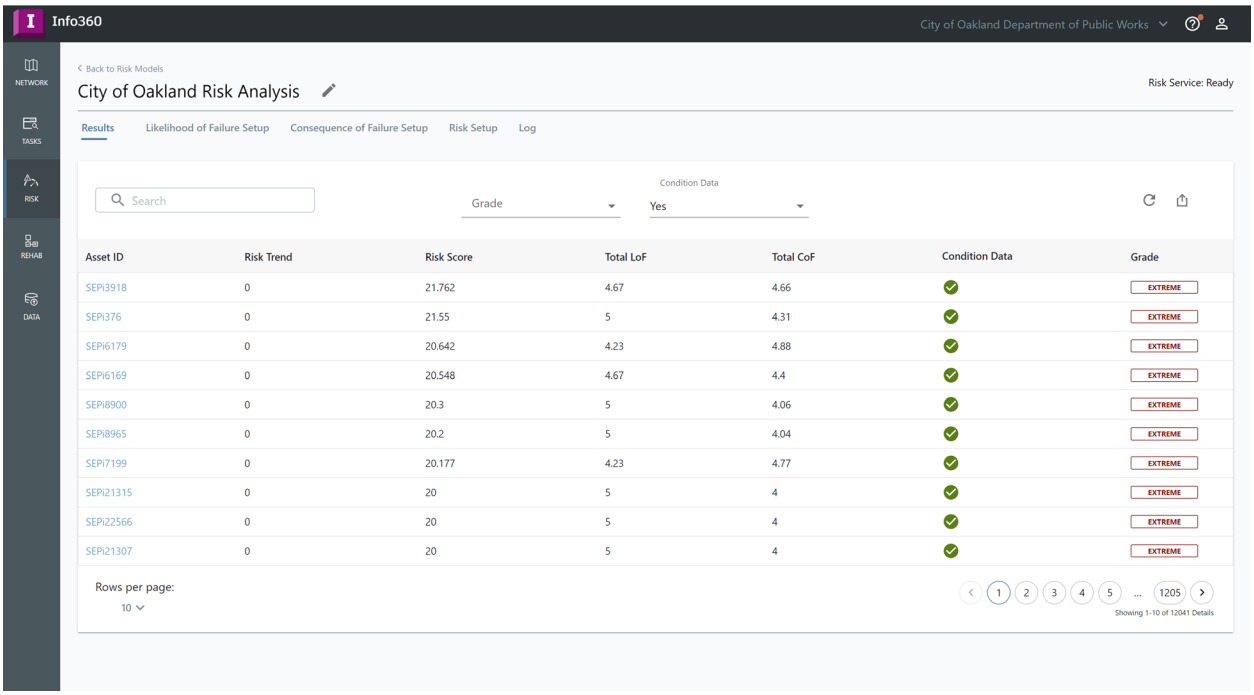
The individual components scoring was conducted under the Edit Component page after the component was added to the corresponding category. The component types available in Info360 Asset are ‘Condition’, ‘Attribute’, ‘Spatial Proximity’, ‘Spatial Proximity Attribute’, and ‘Custom Table’. Each component type was used to score different criteria from the risk model depending on the source of the data: CCTV condition data, pipe attribute data from GIS, proximity to a spatial layer, an attribute from a spatial layer, or data from an external table respectively. The example below shows a spatial proximity component scoring where assets were scored from 0 to 10 based on their proximity to City of Oakland’s Central Reservoir.



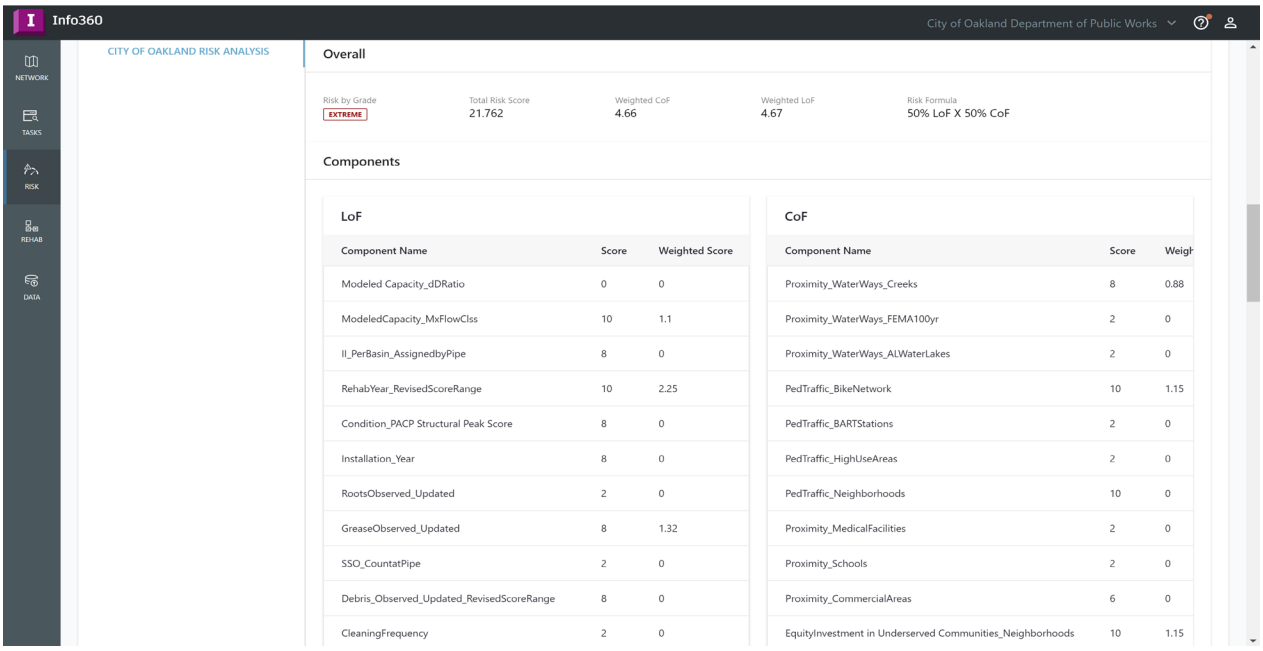
Once all the Likelihood of Failure and Consequence of Failure categories and components were created the total risk was determined under the Risk Details page. In this page, a summary of all the categories, components, and weights can be found. In addition, the risk calculation, LoF and CoF weighting, and Risk Grade can be specified.



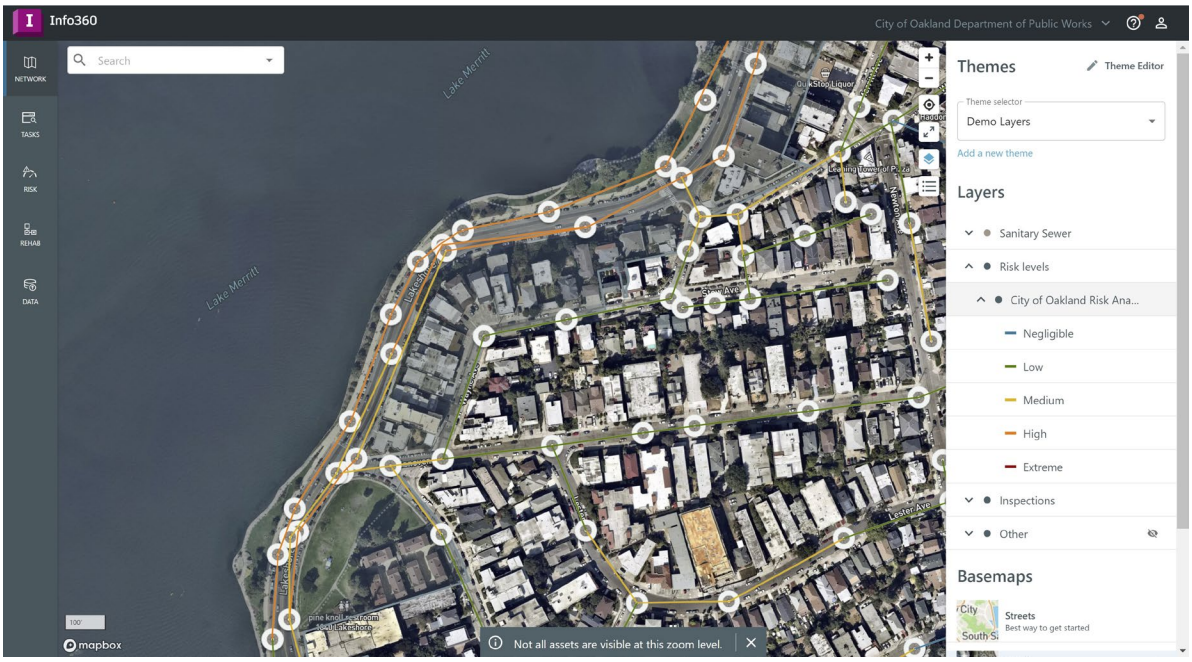
After running the risk model Info360 Asset provided City of Oakland with comprehensive reporting and viewing options to assess the risk of its assets. The risk results can be viewed in a report form, in the map view, and the asset details page of any asset in the system. In the Results report, the city can view the total risk score, risk grade, LoF and CoF for every asset in the system. In addition, the city will be able to track the risk trend as new CCTV is uploaded and the asset condition changes. This way, the city can focus on their riskiest assets by tracking risk over time, maximizing proactive risk mitigation practices.



When clicking on an asset ID in the report, City of Oakland can view the asset detail information in addition to the risk breakdown for that asset. Each LoF component and CoF component is summarized with their corresponding score and weighted score. The higher the score, the higher the severity of the asset for that component. In the example below, the asset scored 21.762 total risk (extreme) which was calculated by multiplying the total weighted CoF of 4.66 and LoF of 4.67. The total weighted LoF and CoF scores are the sum of the individual component weighted scores. The asset below has a high score due to capacity issues (max flow), high CCTV score (rehab score), observed grease, proximity to a waterway, proximity to a bike lane, proximity to a high-risk neighborhood, and proximity to an underserved community.



Finally, the risk results can also be viewed in the form of a heat map where the assets are color coded based on the risk grade which can be Negligible, Low, Medium, High, or Extreme. In the map below the orange (high risk) pipes can be viewed along the bike path near a moderately trafficked road by Lake Merritt. This type of visual is useful when assessing risk in a particular management area as well as planning for efficient operations in the field.

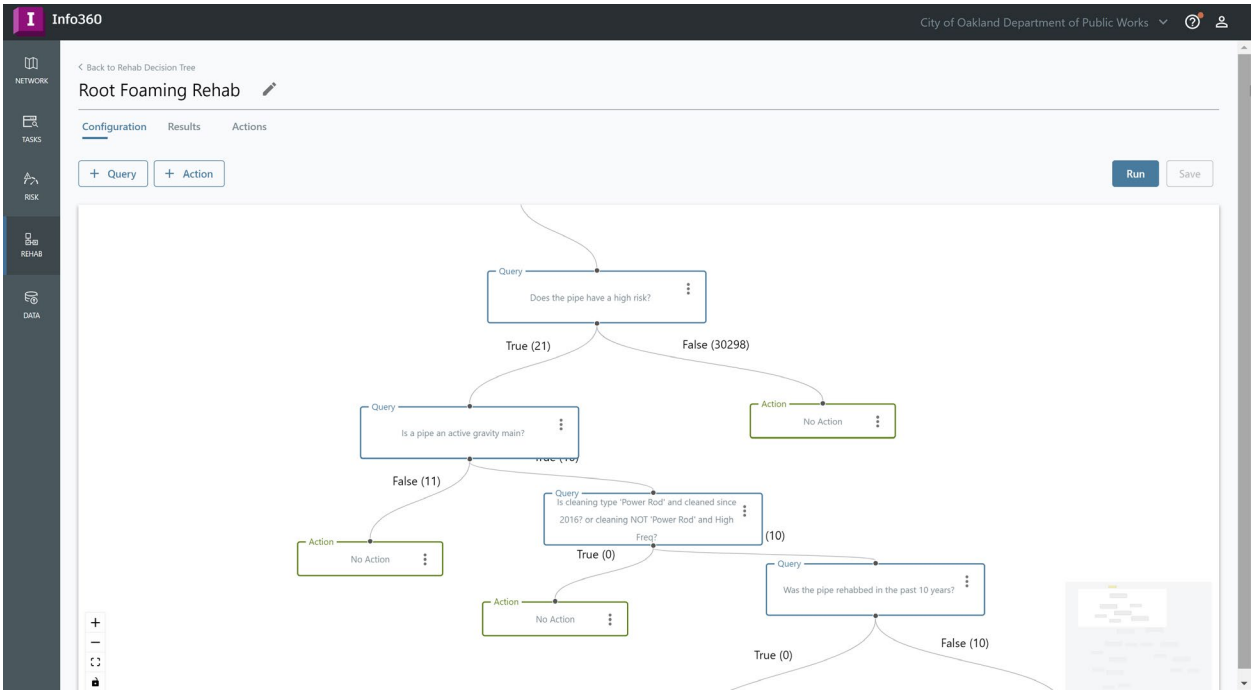


The results of the risk analysis can be shared across the organization in-app, by exporting the results to CSV, or exporting the results to ArcGIS Online. Info360 Asset has an ArcGIS Online integration which allows the city to import and export the results directly from, and to the ArcGIS Online platform that is hosted by the city's consultant. The Autodesk team will be working with the city and their consultant to synchronize the ArcGIS Online dashboard with the Info360 Asset results. In the future, City of Oakland will have a more integrated and automated process to update the risk results of their network and track the KPIs that are important to the organization's stakeholders and decision makers.

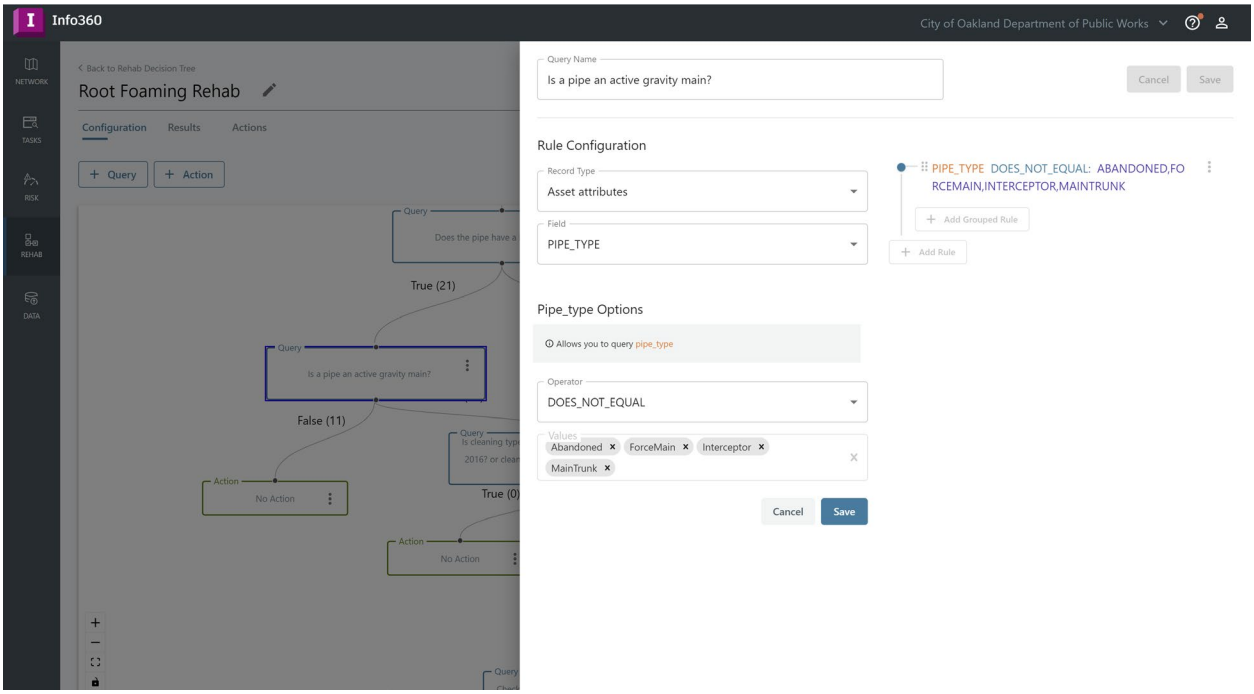
Preventative maintenance

The Rehab functionality in Info360 Asset helped City of Oakland leverage the results of the risk analysis, and other information from CCTV, GIS, and CMMS to develop a holistic action plan to mitigate risk. The development of the decision tree in Info360 Asset consisted in replicating the InfoAsset Planner decision tree to generate the same results from the legacy desktop application.

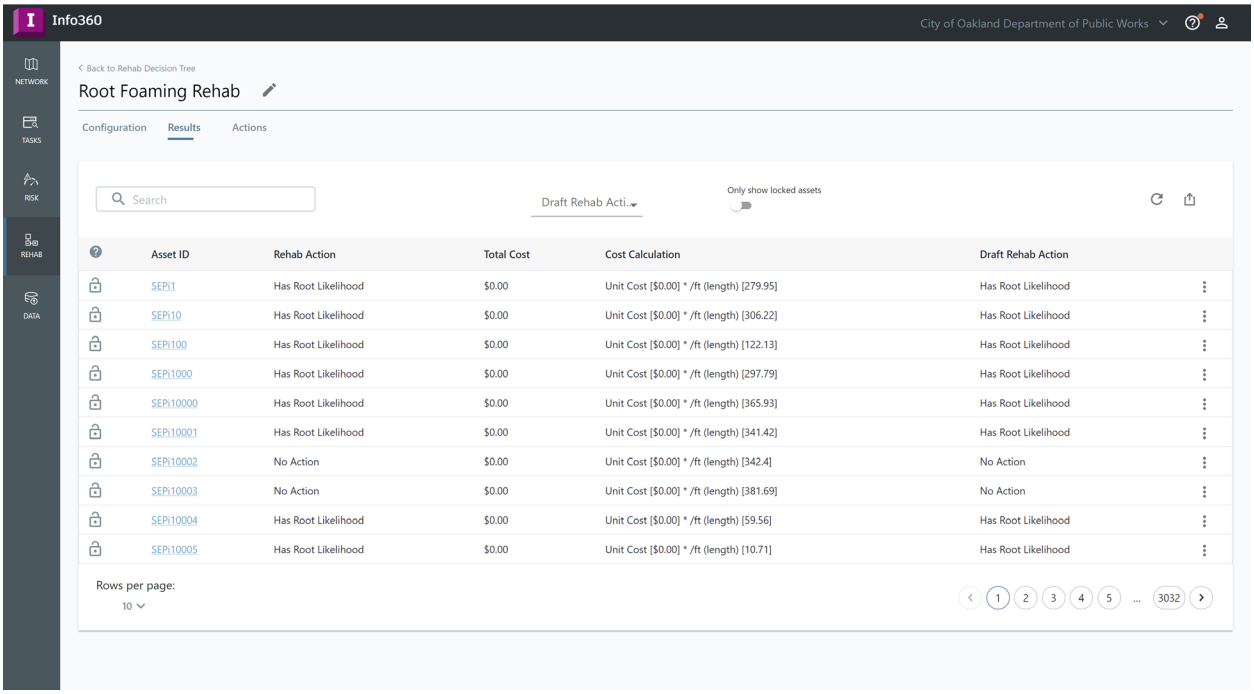
Under the Rehab page the Root Foaming rehab tree was created. The queries were replicated to match the conditions in the InfoAsset Planner model. Each query references information from the risk analysis (e.g., 'Does the pipe have a high risk?'), pipe attribute data from GIS (e.g., 'Is the pipe an active gravity main'), or an external table (e.g., 'Has the pipe been rehabbed in the past 10 years?'). The rehab actions were 'Has Root likelihood' or 'Root foaming ALERT'.



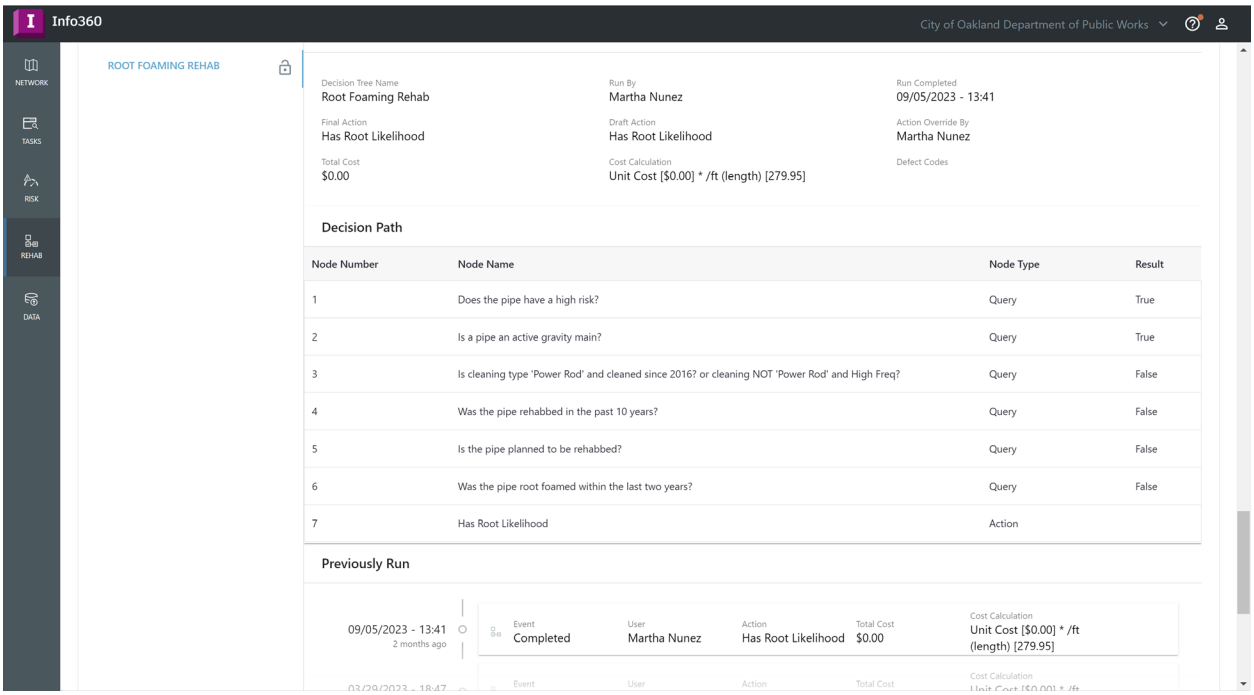
The query building process was simple and user friendly. After the data was imported into Info360 Asset the information could be accessed from the Query tool by selecting the record type from ‘Asset Attributes’, ‘Condition’, ‘Inspection’, ‘Risk’ and ‘Custom Table’. Then, the field, operator, and values were specified. This process resulted in a sequence of transparent and easy to read queries connected by ‘True’ or ‘False’ routes and ended in a final action for every asset in the system.



After running the decision tree, City of Oakland obtained a report that they could utilize to determine which assets need to be scheduled for immediate chemical root foaming or monitored due to the high likelihood of root intrusion. With this report, the city can filter assets based on the Rehab Action, as well as edit the action if the engineer at the city does not agree with the decision tree recommendation. If any costs are added for the rehab action, the Total Cost will also be available in the report. The report can be exported to ArcGIS Online, or CSV file.



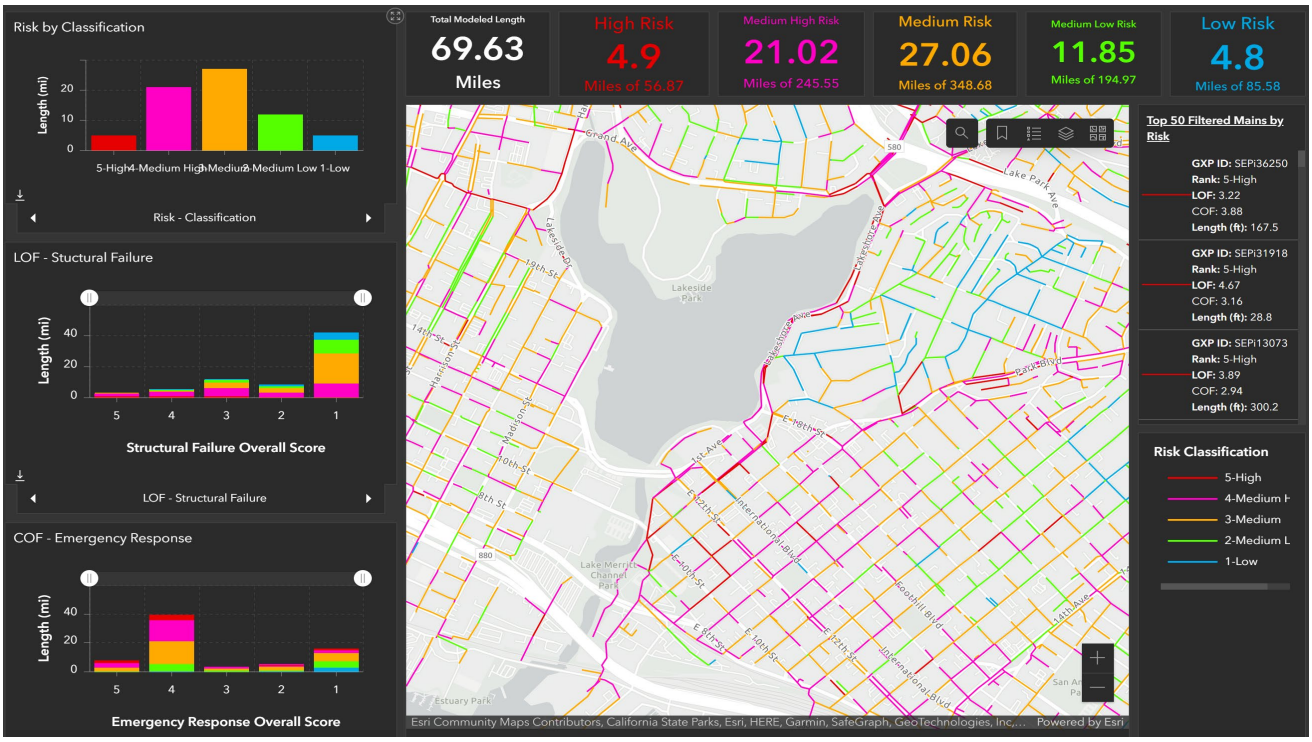
When clicking on an asset the decision tree results can be viewed under the Asset Details page. A breakdown of the decision path for the asset is available so the user has all the information to understand the results. The example below shows an asset with the ‘Has Root Likelihood’ action. The decision path shows that the asset does have a high risk (True) and is a gravity main (True). The asset has not had a heavy cleaning since 2016 and is not frequently cleaned (False). The asset has not been rehabbed in the last 10 years and it is not scheduled for rehab (False). Finally, the asset has not been root foamed in the last two years (False). Based on this logic, there is a high likelihood that the asset has root intrusion and should be monitored and treated if needed to mitigate risk of failure.



With this risk mitigation program, the city can save time and money by prioritizing the assets that need the most attention.

Future Work and Next steps:

The City of Oakland and Autodesk will continue to collaborate to improve the Info360 Asset model as well as the city's best practices using the tool. The next steps are to implement the multi-parameter tool, and 5x5 matrix that will increase the accuracy of the results to the InfoAsset Planner model results. Finally, the results will be exported to ArcGIS Online and integrated into the ArcGIS Online dashboard that the city developed with the help of its consultant. The dashboard summarizes the risk analysis results and it is used as the primary KPI tracking tool for the city's short term and long-term decision-making practices.



In the future, the city will move towards more integration and automation which mirrors the vision of the Info360 Asset product and development teams. The goal is that the city's risk analysis and decision tree will be updated at a regular basis with near-live updates of CCTV inspection and CMMS data such as repairs, cleanings, and incidents (SSOs). This strategy enables maximum efficiency which in return will save the city resources that they can utilize in more productive ways.

References:

If you are interested in learning more about the software solution Info360 Asset, here are some useful links:

- Getting started with Info360 Asset video series. Learn how to utilize the basic tools in Info360 Asset and navigate through the interface:

  https://help.autodesk.com/view/INF360A/ENU/?guid=GUID-EBCD3387-1E11-4596-8129-8BD2DC9FA3FB

- Learn about the asset management strategy developed by Autodesk and be up to date on upcoming tools, features, and feature improvements in Info360 Asset.

  https://blogs.autodesk.com/innovyze/#asset-management

- View the Info360 Asset roadmap and what was recently released.

  https://s.tiled.co/0OQtjB5/innovyze-info360-roadmap