

AGENDA

- Pipeline Replacement Priorization Overview
- Risk Model Overview
- Workflow and GIS Processing
- Current Process and Looking Ahead

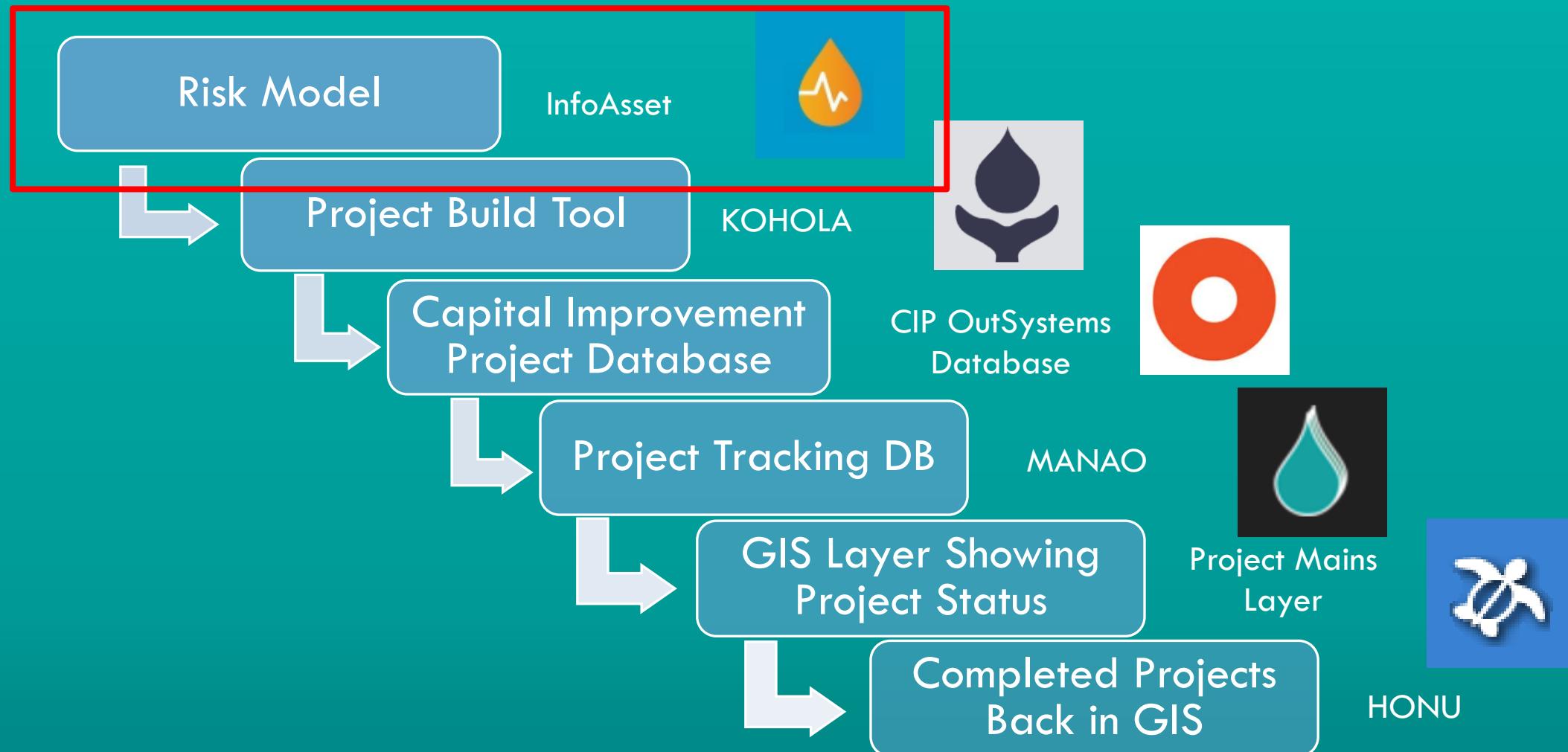


PIPELINE REPLACEMENT PRIORITIZATION

- Island-wide prioritization of pipeline replacement based on risk
- Utilizing GIS and Hydraulic Modeling to identify “high risk” pipes
- Create pipeline replacement projects based on risk results



OVERALL PROCESS



RISK MODEL OVERVIEW



Risk Calculation

- Consequence of Failure (COF)
- Likelihood of Failure (LOF)

Risk by Grading

- Risk Matrix
- Negligible to Extreme

Decision Framework

- In CIP
- Inspection
- No Action
- Replace

Hot Spot

- Create cluster of pipes based on Risk Scores and Decision Framework Outcome

KOHOLA

- Build projects based on Risk and Hot Spots



RISK CALCULATION

Risk = Consequence of Failure (COF) x Likelihood of Failure (LOF)

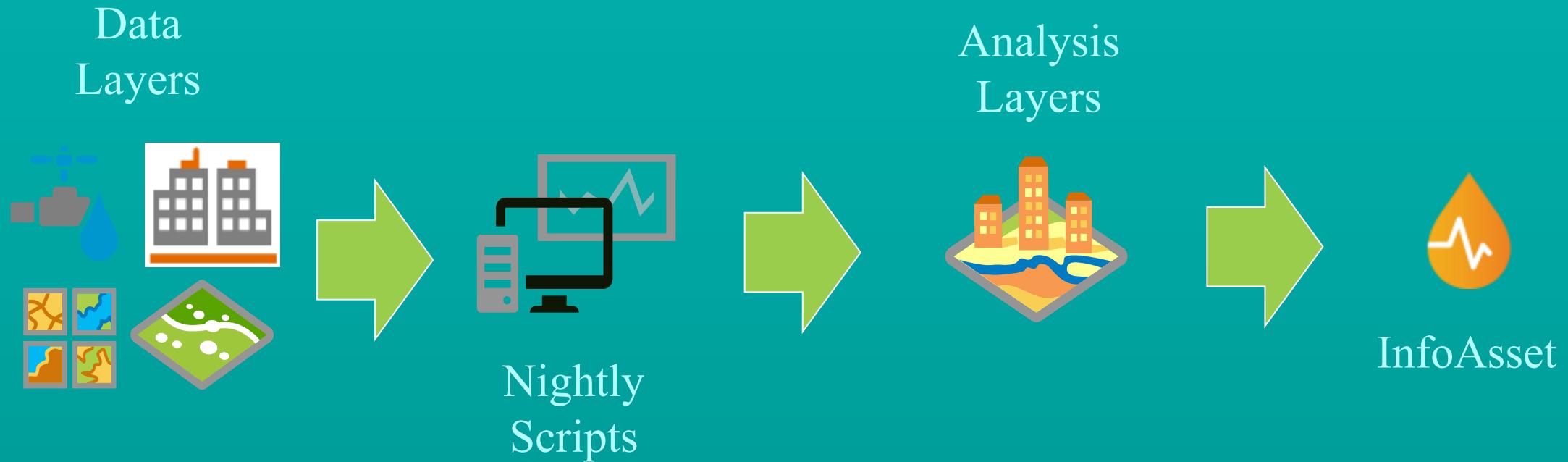


CONSEQUENCE OF FAILURE

- COF: Determine the impacts of a particular water main breaking
 - Various Characteristics Considered
 - Disruption, Damage, Traffic Volume, Outage, Water System Performance Impacts, and Density



GIS PROCESSES TO SUPPORT MODEL



Various data layers used to create the COF and LOF are pulled and massaged via nightly scripts to create the summarized analysis layers in the correct format ready for InfoAsset to consume



LIKELIHOOD OF FAILURE

- LOF: Determine how likely a particular water main will break
- Based on various characteristics, determine a predictive break number for a given pipe
 - Age, Soil, Diameter, Pressure, Previous Breaks, etc...
- Different Potential Models
 - Statistical Model (Casses – LEYP) - Linear Regression Model
 - Machine Learning Model - Pilot utilizing machine learning to better calculate the likelihood of failure factors for water mains



BWS RISK MATRIX

- Risk by Grading:
 - Negligible – (1)
 - Low – (2)
 - Medium – (3)
 - High – (4)
 - Extreme – (5)

		Likelihood				
		Negligible	Low	Medium	High	Extreme
Consequence	Extreme	Yellow	Yellow	Orange	Red	Red
	High	Yellow	Yellow	Yellow	Orange	Red
	Medium	Green	Yellow	Yellow	Orange	Orange
	Low	Blue	Green	Yellow	Yellow	Orange
	Negligible	Blue	Blue	Green	Yellow	Orange



RISK EXAMPLES

		Likelihood				
		Negligible	Low	Medium	High	Extreme
Consequence	Extreme					
	High					
	Medium					
	Low					
	Negligible					



Low COF – minimal services, dead end street, small diameter

High LOF – old pipe, a lot of breaks



High COF – busy roadway, serves hospital, large diameter

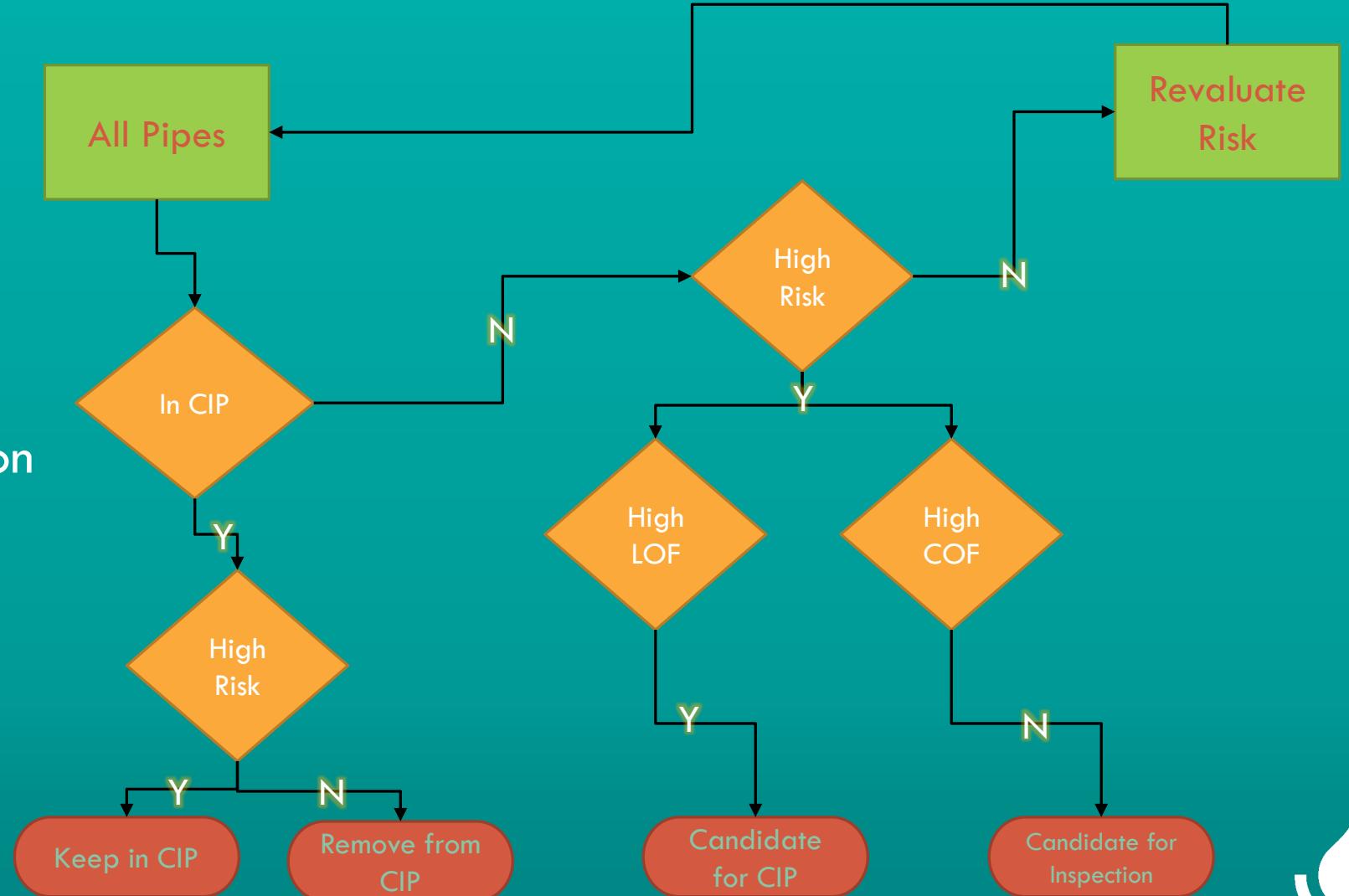
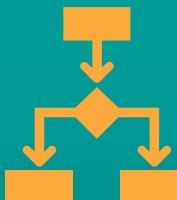
Low LOF – new pipe, no break history



REHAB FRAMEWORK

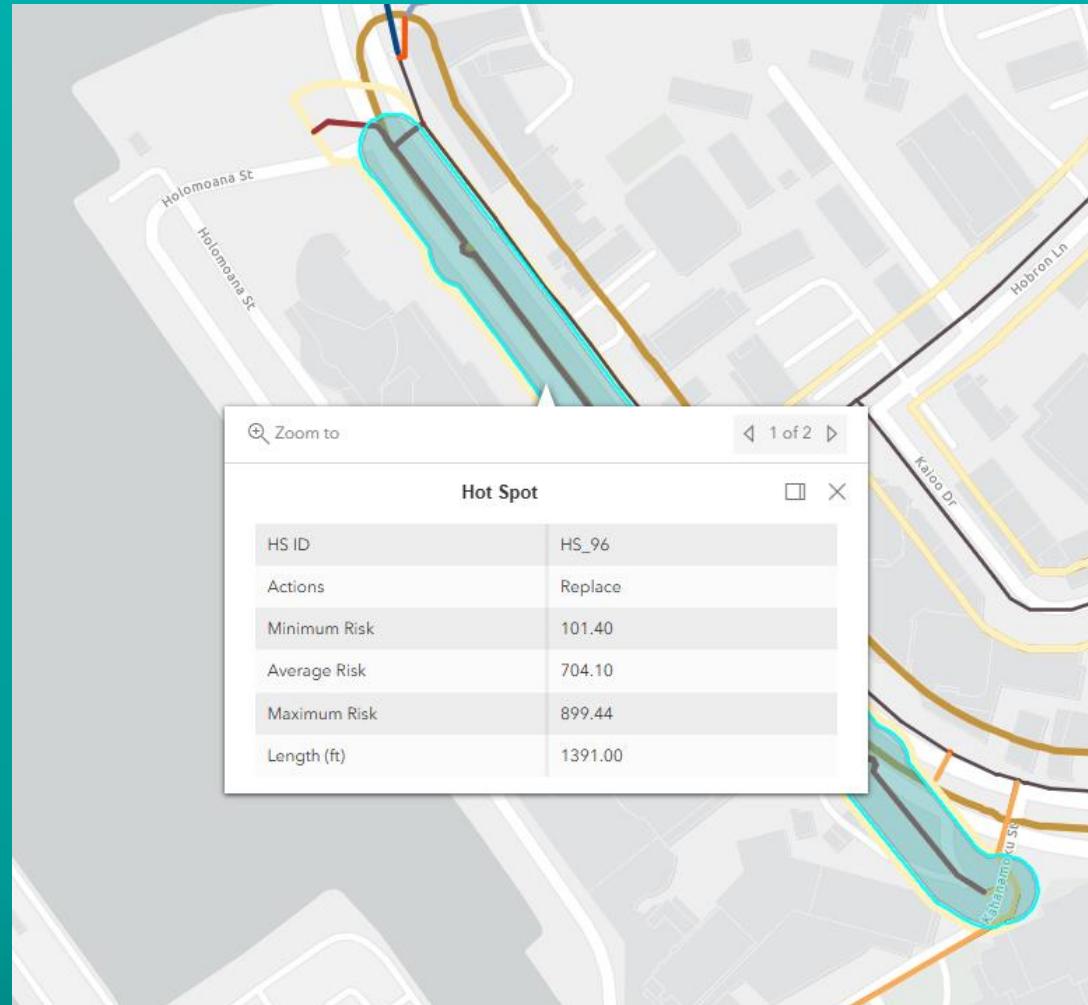


Apply logic to drive action

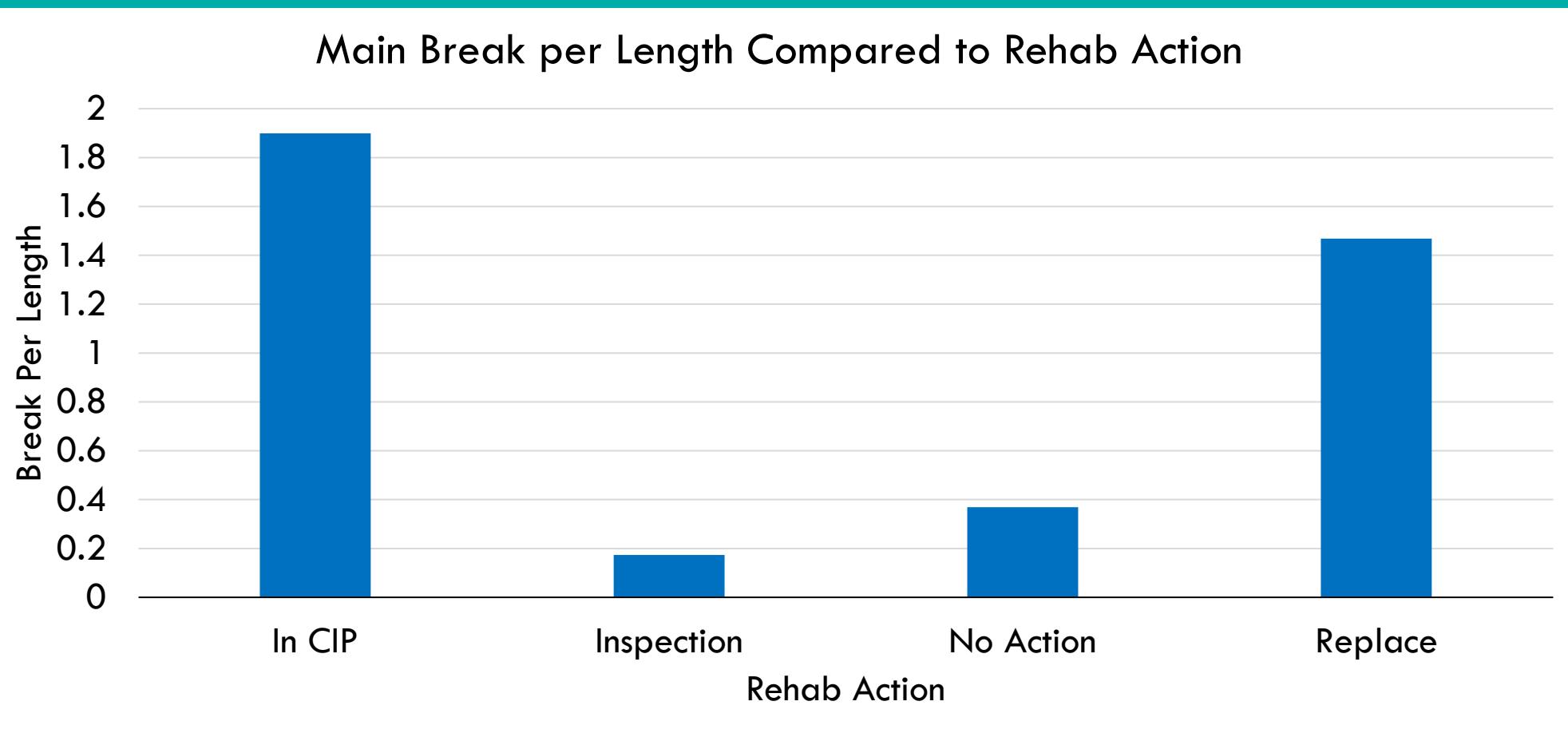


HOT SPOTS

- Help identify groups of pipes that should be turned into projects
- This was generally based on high risk and identified pipes for replacement.



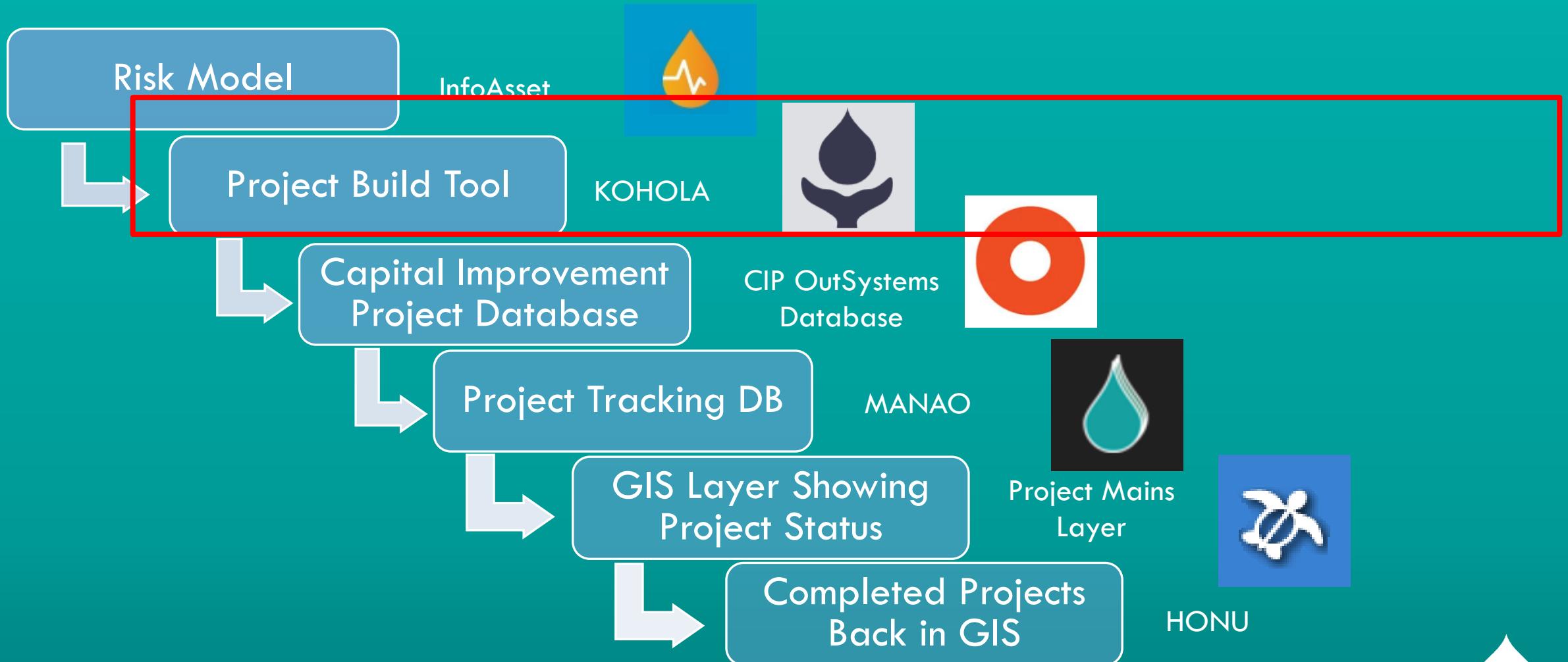
OVERALL PROGRESS



CREATING PROJECTS FROM RISK MODEL DATA

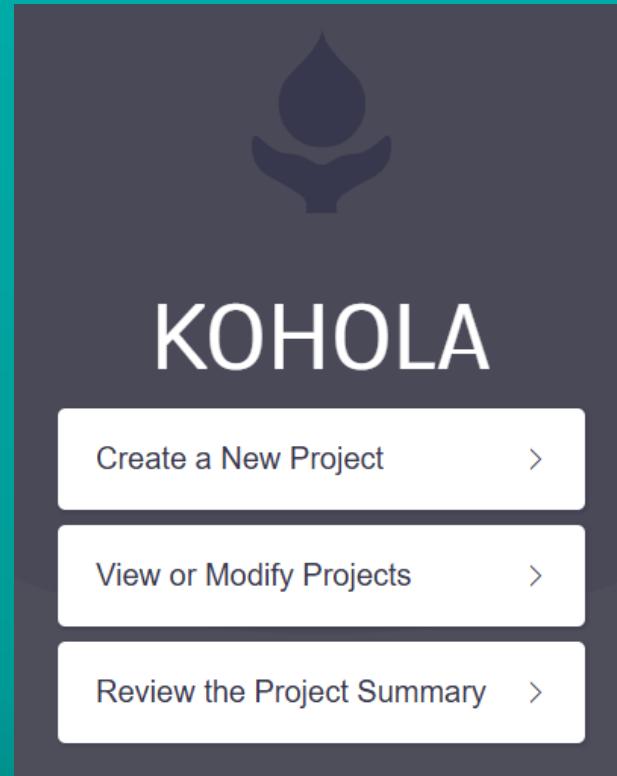


OVERALL PROCESS



KOHOLA

- KOHOLA is a custom web-application developed to view risk results for pipeline replacement.
- Simple UI to select and create projects
- Project summary and draft and planned project tracking
- Print project map



WORKFLOW - KOHOLA

InfoAsset Results
Import to KOHOLA

Project Build
with
KOHOLA

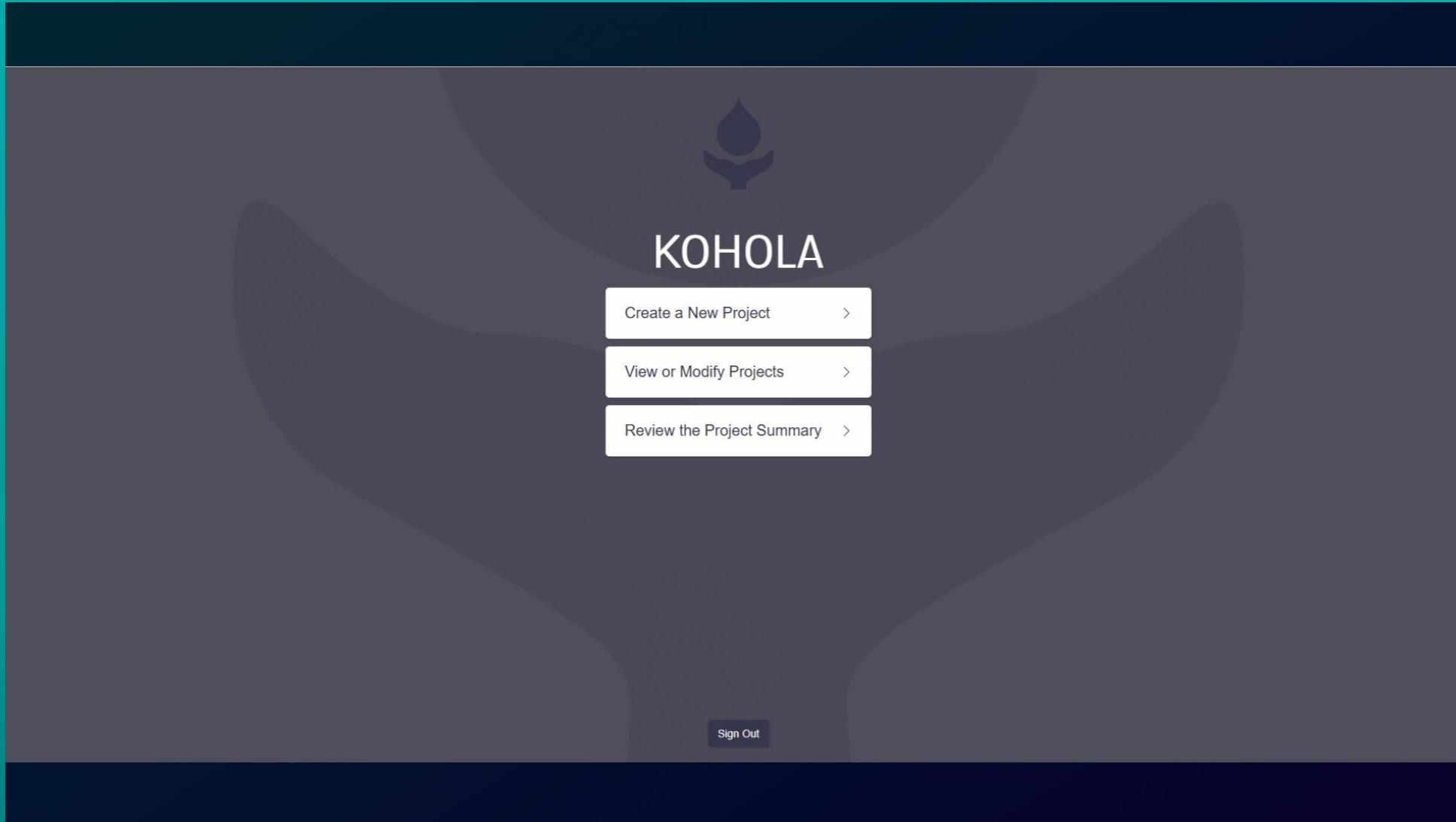
Projects tie to 6
year CIP List

Project Revision
done in
KOHOLA

Once Planned
project is ready
—will feed into
Capital Project
DB and Projects
Mains Layer in
the GIS



KOHOLA DEMO



The image shows a screenshot of the Kohola demo landing page. The background is a dark grey with a subtle circular pattern. At the top center is a small, stylized blue flower logo. Below it, the word "KOHOLA" is written in a large, white, sans-serif font. Underneath the title are three white rectangular buttons with black text and arrows. The first button says "Create a New Project >". The second button says "View or Modify Projects >". The third button says "Review the Project Summary >". At the bottom center is a small "Sign Out" button. The overall design is clean and modern.



KOHOLA DEMO

[← Back to Projects](#) [Edit](#) [Share](#) [Print](#)

Demo Test Project

Last updated: 10/2/2025, 1:28:14 PM by bwsntianlshing

Project Summary: PLML-0160

Status	Draft	Design Year	2025	Construction Year	2028
Manao Link	undefined				

Pipeline Description
805 ft of 12 in pipe, 25 ft of 8 in pipe, 741 ft of 6 in pipe, 631 ft of 4 in pipe. Pending description of project streets.

Project Description
Test Project

Comments

Districts

Neighborhood Board: Waikiki

City Council District: Hawai'i Kai, Kuli'ou'ou, Niu Valley, 'Āina Haina, Wai'ulupe, Wai'aleae Iki, Kalani Valley, Kāhala, Wilihelmina Rise, Kaimuki, Kāpāhulu, Diamond Head, and Waikīkī

Senate District: **Senate District 12**

House of Representative District: **State House District 24**

Development Plan Area: **PRIMARY URBAN CENTER**

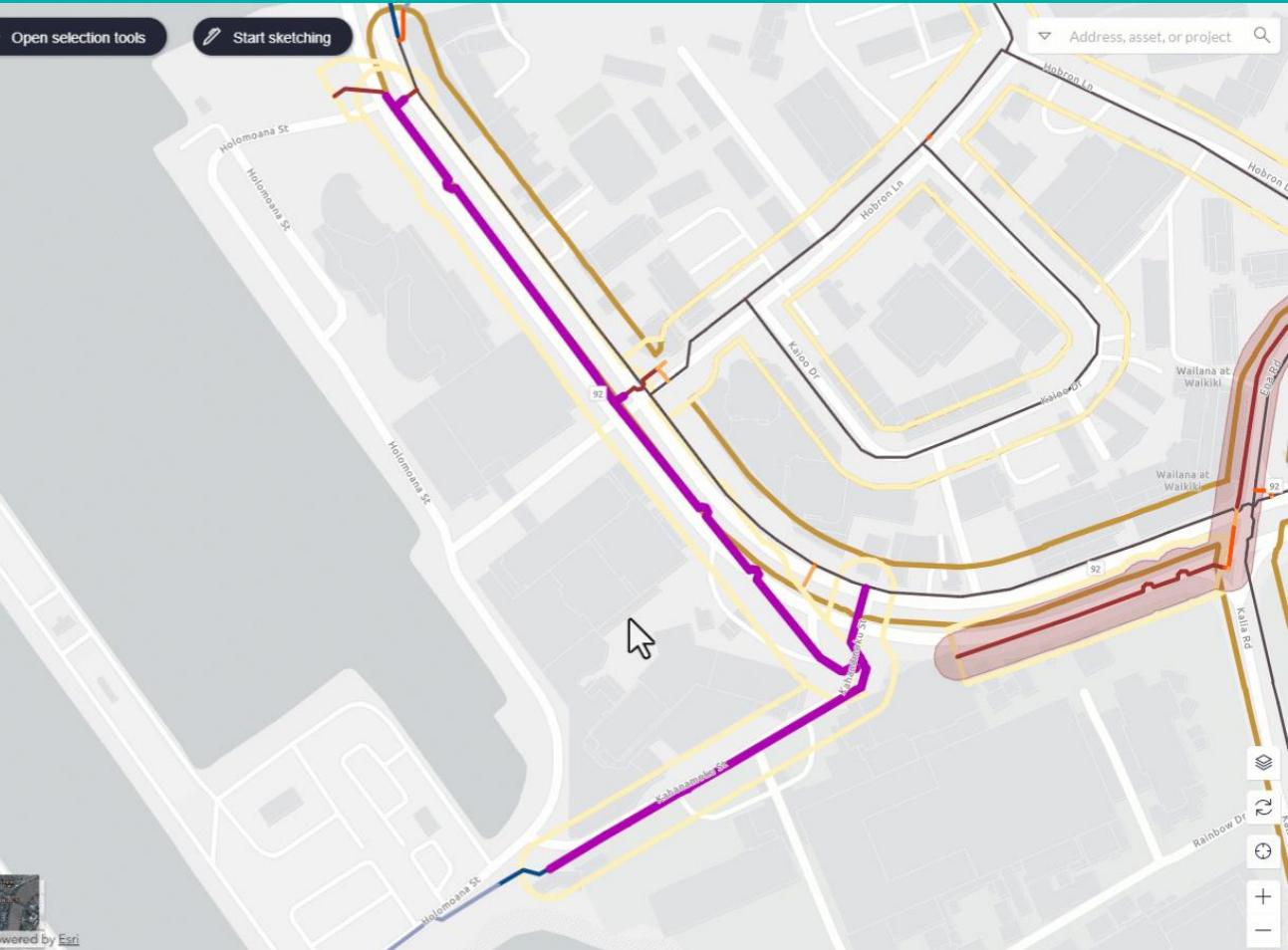
Department of Highway System: **HONOLULU-WINDWARD-PEARL HARBOR**

Cost Assessment

Pipe Length (ft)	Design Cost	Construction Cost	Total Replacement Cost
2,202	\$189k	\$1.26M	\$1.45M

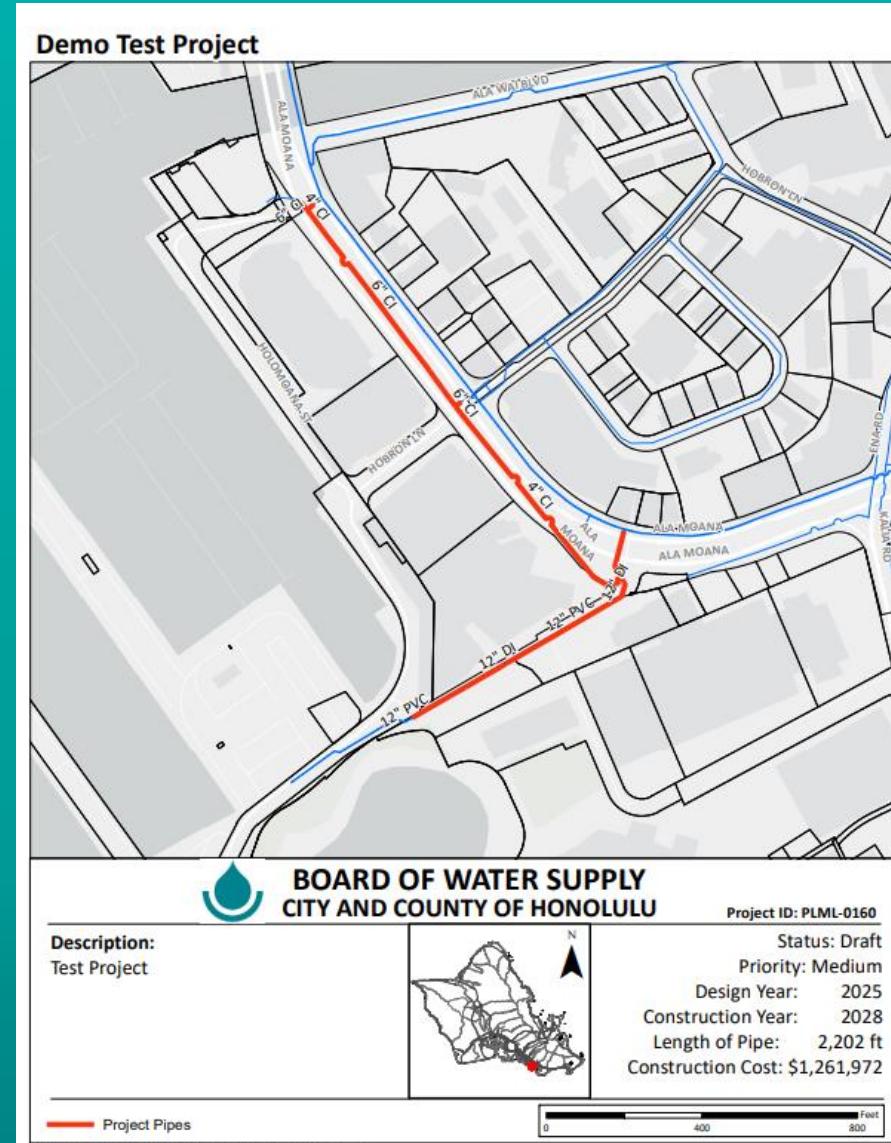
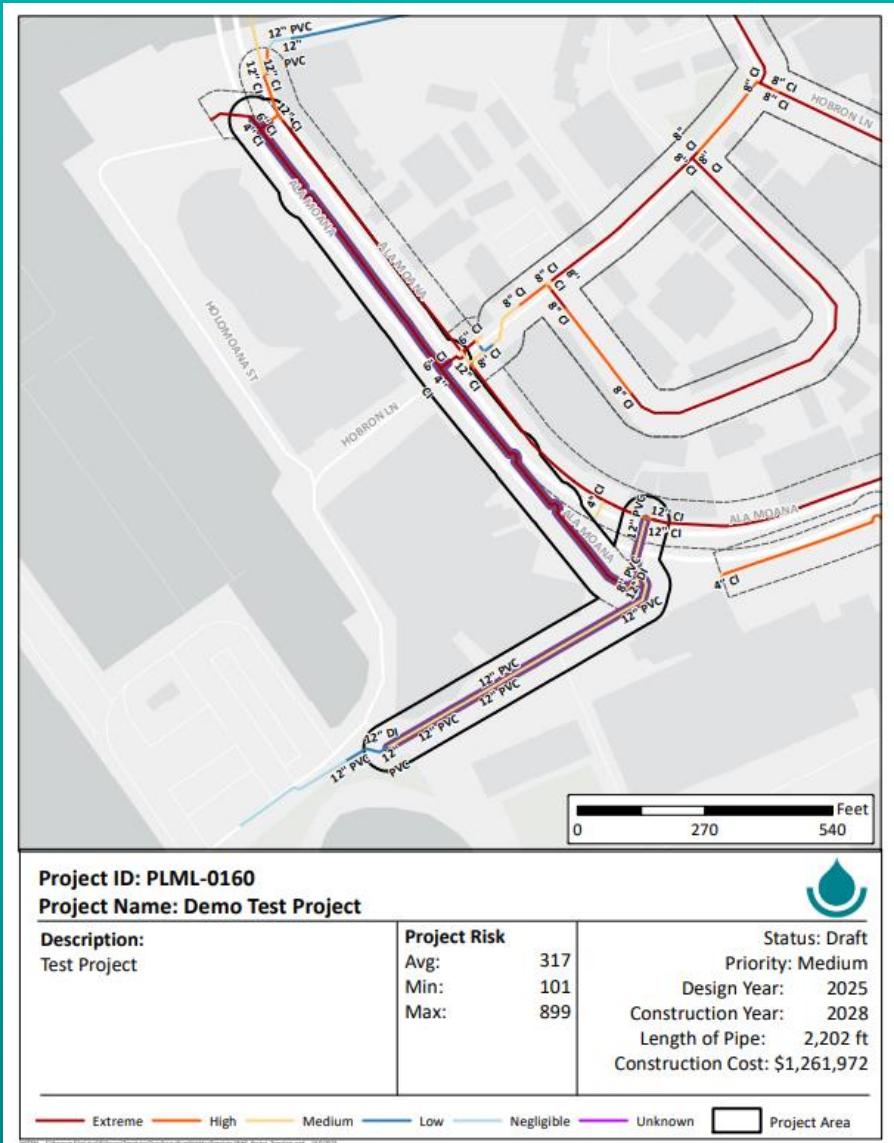
[Open selection tools](#) [Start sketching](#)

Address, asset, or project

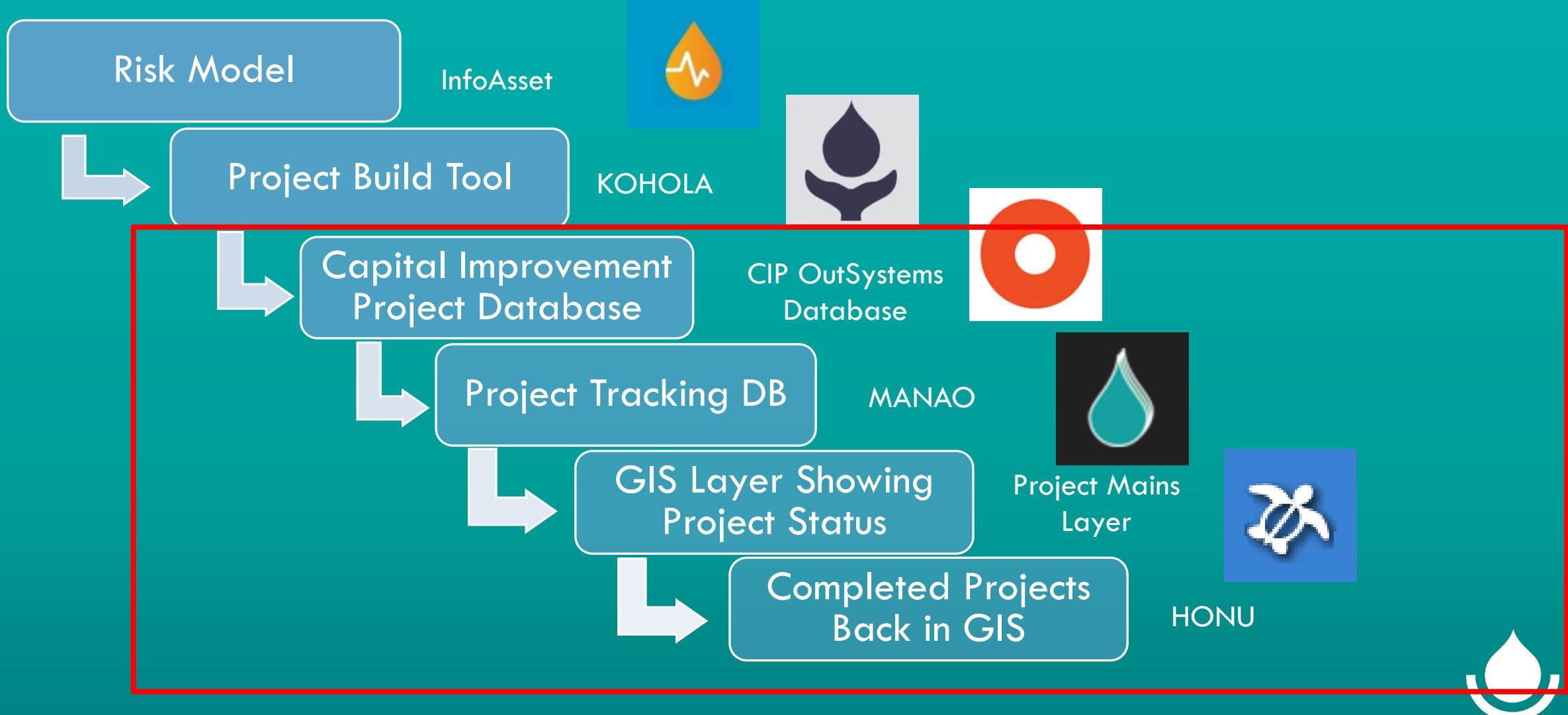




PROJECT MAPS



OVERALL PROCESS



SYSTEM INTEGRATION

PLNS-0044a - Haleiwa Water System Improvements Part 1 and 2

← Back to Projects Share Print Open selection tools

KAMEHAMEHA HIGHWAY - HALEIWA WATER SYSTEM IMPROVEMENTS, PARTS I & II

Last updated: 1/23/2024, 5:00:16 PM by KOHOLA

Project Summary: **PLNS-0044a**

Status: **Design** Design Year: **2022** Construction Year:

Manao Link: [\(CD30DE2A-5D14-ED11-B3A4-00155D684832\)](#)

Pipeline Description: [Redacted]

Project Description: [Redacted]

Comments: [Redacted]

Districts:

Neighborhood Board: [Redacted]

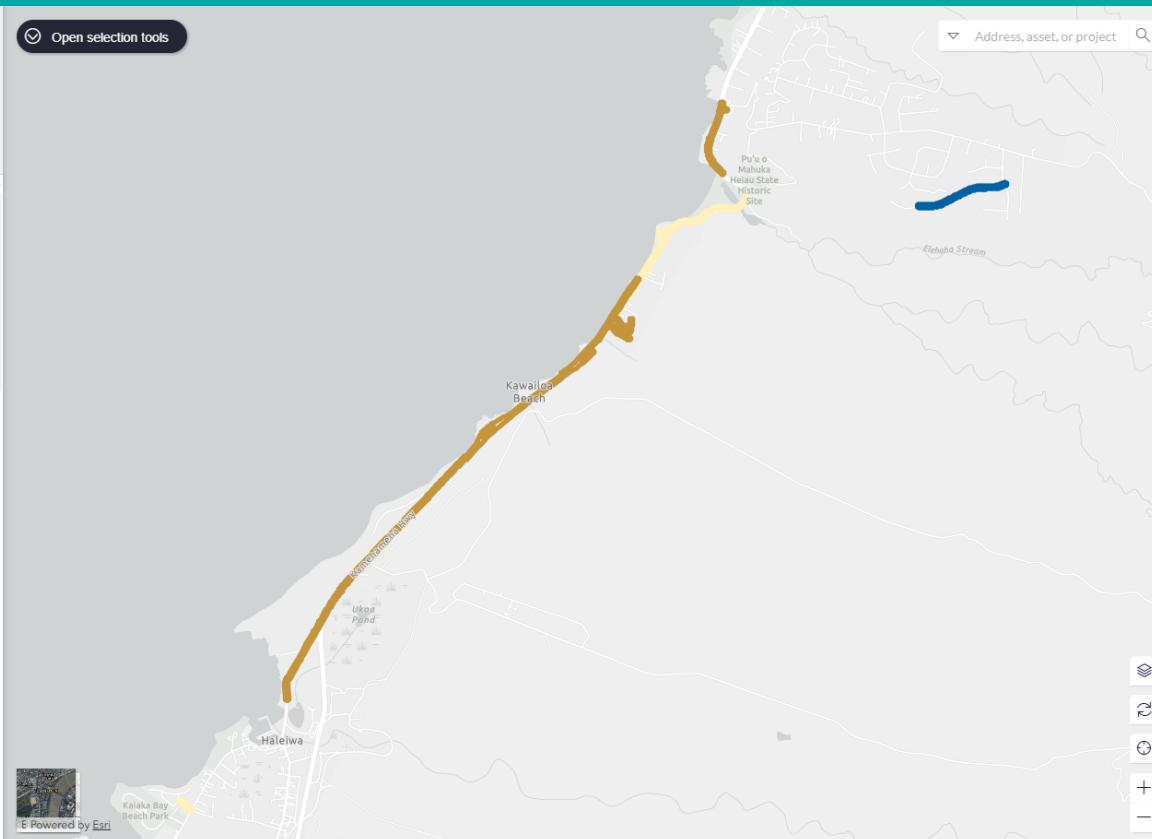
City Council District: [Redacted]

Senate District: [Redacted]

House of Representative District: [Redacted]

Development Plan Area: [Redacted]

Department of Highway System: [Redacted]



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KOHOLA TO CIP OS

KAMEHAMEHA HIGHWAY - HALEIWA WATER SYSTEM IMPROVEM...

[Delete Project](#)

DESCRIPTION

INACTIVE ACTIVE

Kohola ID: **PLNS-0044a**

[Kohola Data](#) [Kohola Map](#)

Project Type *: PL: Pipeline

Status *: Planned

Last Modified: 09-02-2024

Project Name *: KAMEHAMEHA HIGHWAY - HALEIWA WATER SYSTEM IMPROVEMENTS, PARTS I & II

CIP Type: Pipelines

Category: Renewal and Replacement (R&R)

Nalu Title:

Growth/No Growth: No Growth

SEQ: 600

[Save](#) [Cancel](#)

Kohola Data

KAMEHAMEHA HIGHWAY - HALEIWA WATER SYSTEM IMPROVEMENTS, PARTS I & II

Modified: 09-02-2024

Priority: Assets: Pipeline FT:

Status: Design Year: Construction Year:

Estimated Cost:

Estimated Design Cost:

Estimated Construction Cost:

Pipeline Description:

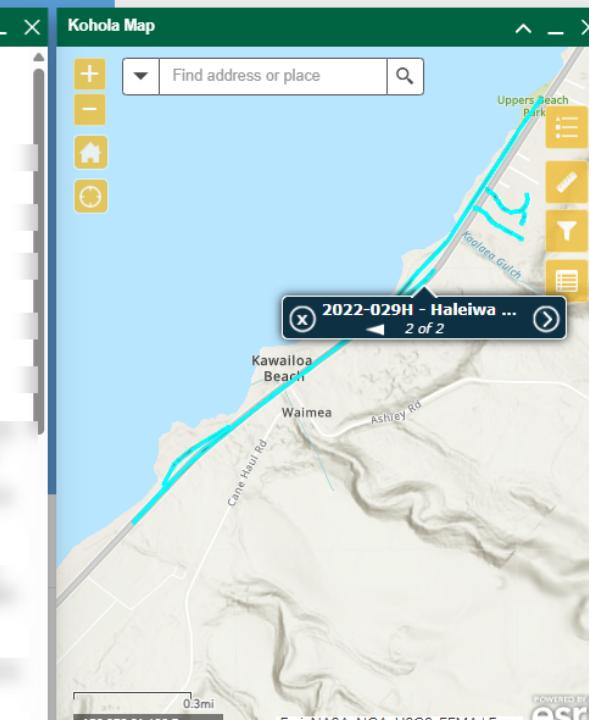
Project Desc Streets:

Project Description:

Comments:

Kohola Map

Find address or place



0.3mi

-158.079 21.622 Degrees

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MANAO

Project

BROWSE PROJECT PAGE

MANAO Home Contractor Project List Project Center My Tasks Reports

Search this site

Project Details - Des

2022-029H - Haleiwa Water System Improvements Part 1 and 2

Schedule

Project Details - Des

Project Site

You are Entering Project Details for a Design Project.

Please enter Name as: DesignNumber-Name (YYYY-XXX-Name)

Enter Budget Item Number as: JobNumber (YYYY-XXX)

Enter Related Project Budget Item Numbers as JobNumbers separated by commas (,)

Last Edit Info

Last Modified

Last Published

Month End Comment

Estimated Start Date

Estimated Project Duration (calendar days)

Estimated Construction Amount

Design Length of Pipe (LF)

Study Only Project

KOHLA Project ID

PLNS-0044a

Project Info

Name * 2022-029H - Haleiwa Water System Improvements Part 1 and 2

Specify a name for the Design Pipeline Project

Budget Item Number *

Project Roles

Division

Branch

Owner



PROJECT MAINS

HONU Honolulu Online Utilities

Attributes: Mains Projects - Active

OBJECTID: 72

KOHOLA_PROJECT_ID: **PLNS-0044a**

PROJECT_ACTUAL_START_DATE:

PROJECT_ACTUAL_FINISH_DATE:

PROJECT_PERCENT_COMPLETED:

BUDGET_ITEM_NUMBER:

MANAO_PROJECT_NAME:

PROJECT_PHASE:

CONTRACT_STATUS:

BWSCM:

BWS_PROJECT_ENGINEER:

PROJECTID_URL:

BWS_INSPECTOR:

CONSTRUCT_CONTRACT_COMPANY:

DESIGN_CONSULT_COMPANY:

Shape_Length:

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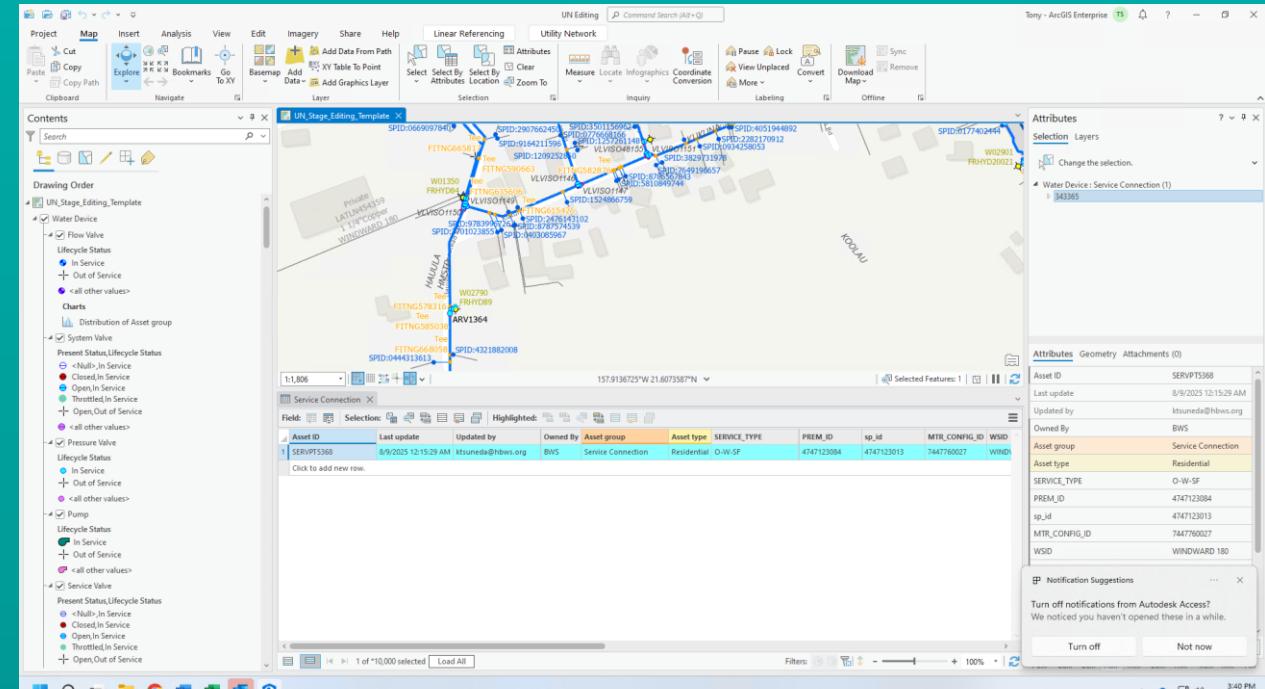
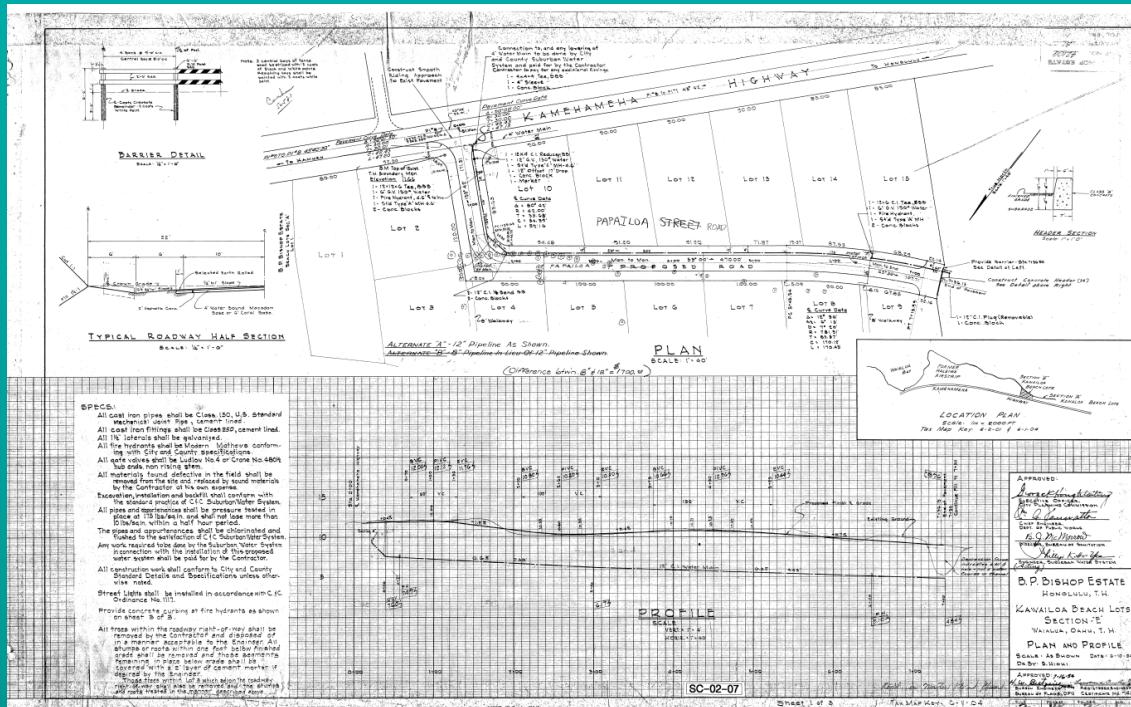
Honolulu Board of Water Supply

3D

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BACK INTO GIS



KEY TAKE AWAYS

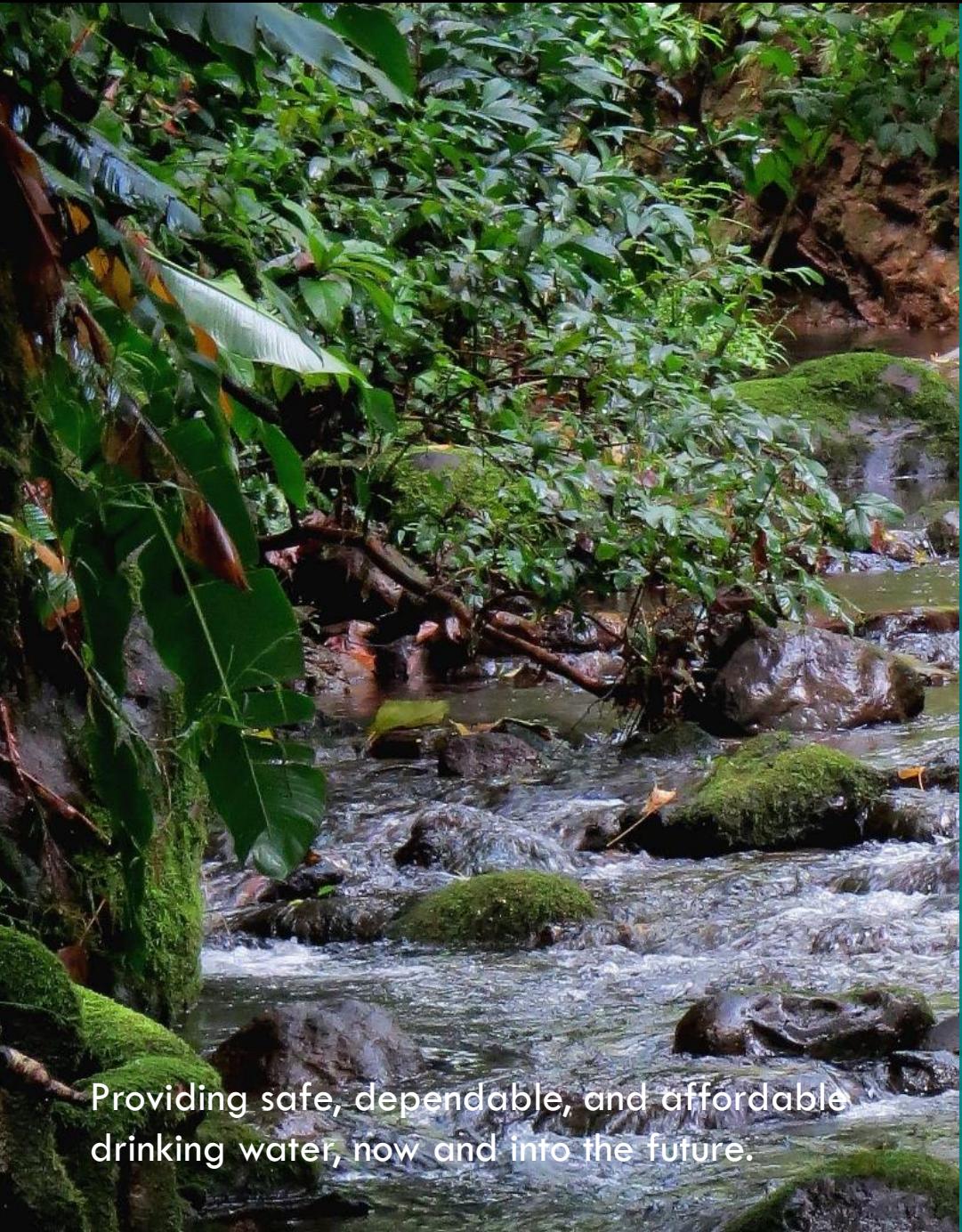
- Good data
 - Break data
 - Pipeline
 - Hydraulic Model
- Keep a unique ID across systems
- Keep things simple
- Opportunity to update outdated processes



CURRENT PROCESS AND LOOKING AHEAD

- Currently in contract to conduct an update of the risk results using newer data
- Likelihood of Failure –
 - Look into further the use of AI and Machine Learning
 - Previous analysis used statistical modeling (linear regression)
- Overall, has provided a common platform for creating pipeline projects using a prioritization process which incorporates the various data and characteristics





Providing safe, dependable, and affordable drinking water, now and into the future.



Mahalo!

PIPE DREAMS: OPTIMIZING PIPELINE REHAB AND REPLACEMENT

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