



# PIPE DREAMS: OPTIMIZING PIPELINE REHAB AND REPLACEMENT

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October 15, 2025  
HWWA 2025 Conference



# AGENDA

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

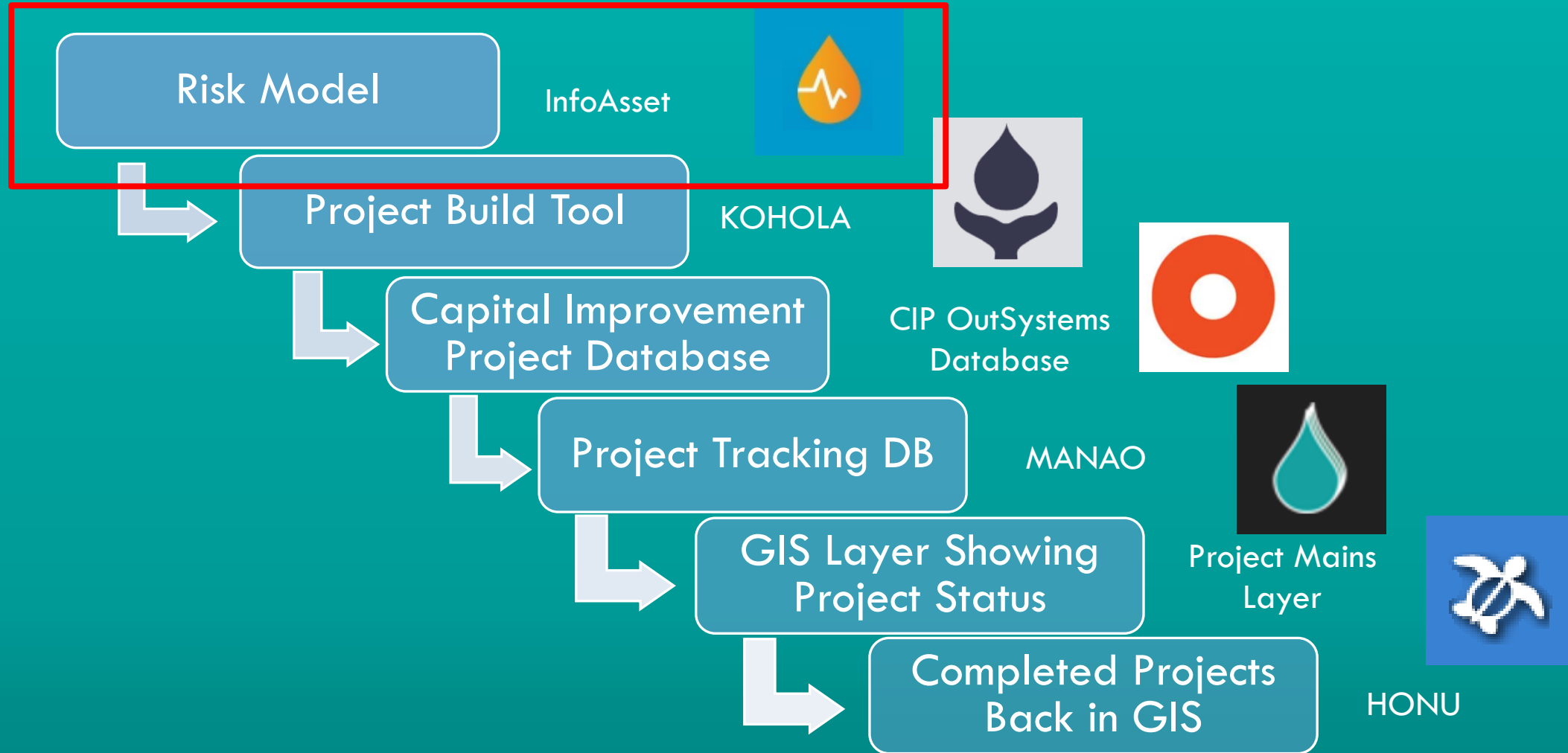


# PIPELINE REPLACEMENT PRIORITIZATION

- 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)*



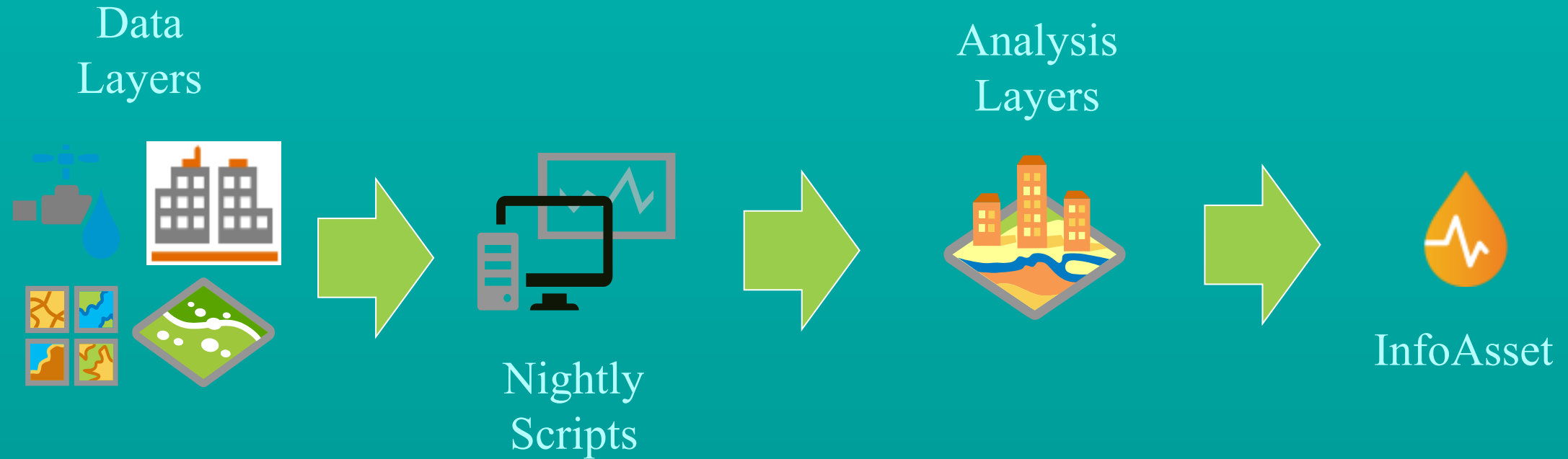
# CONSEQUENCE OF FAILURE

- 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					
	High					
	Medium					
	Low					
	Negligible					



# 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

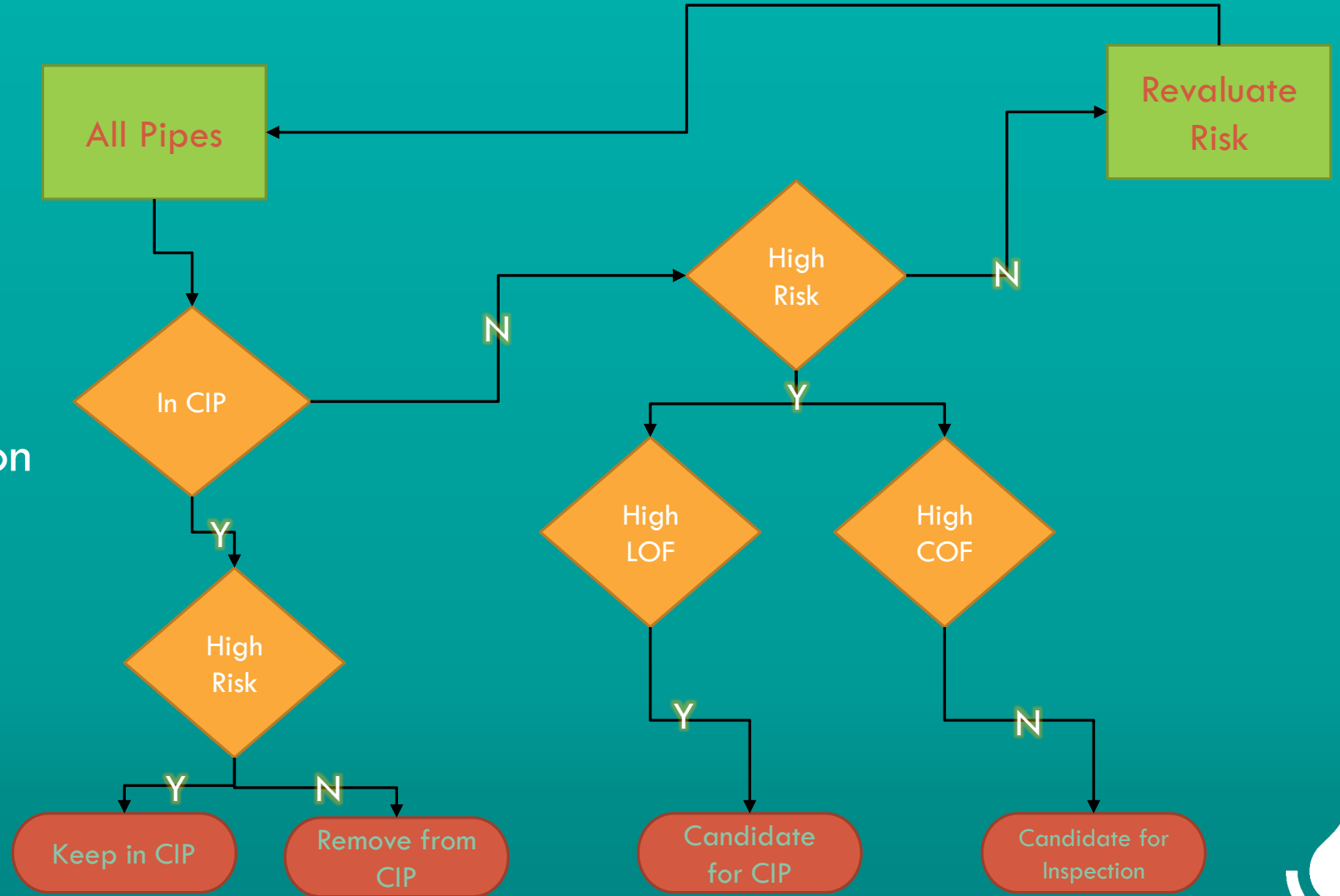
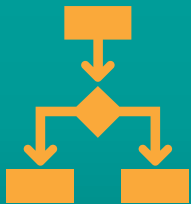




# REHAB FRAMEWORK

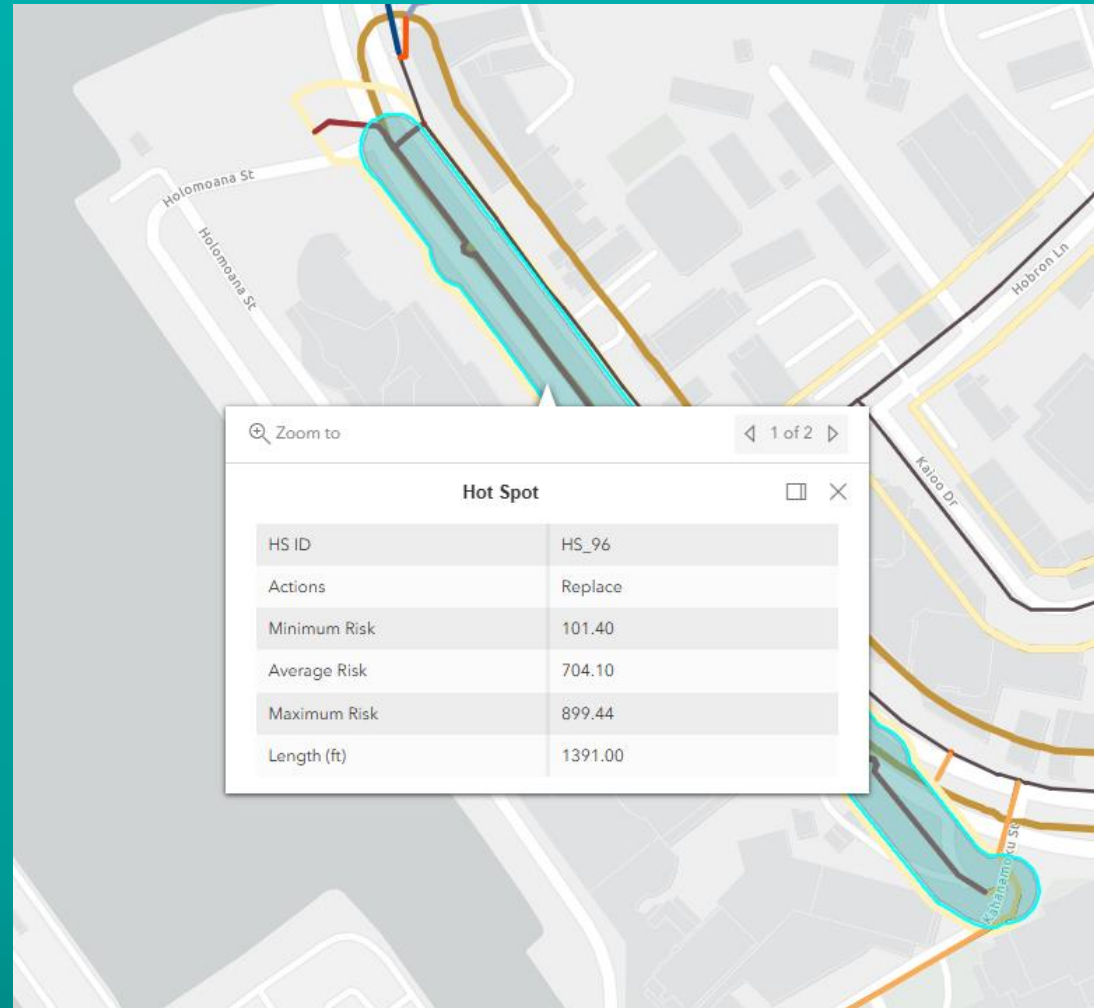


Apply logic to drive action

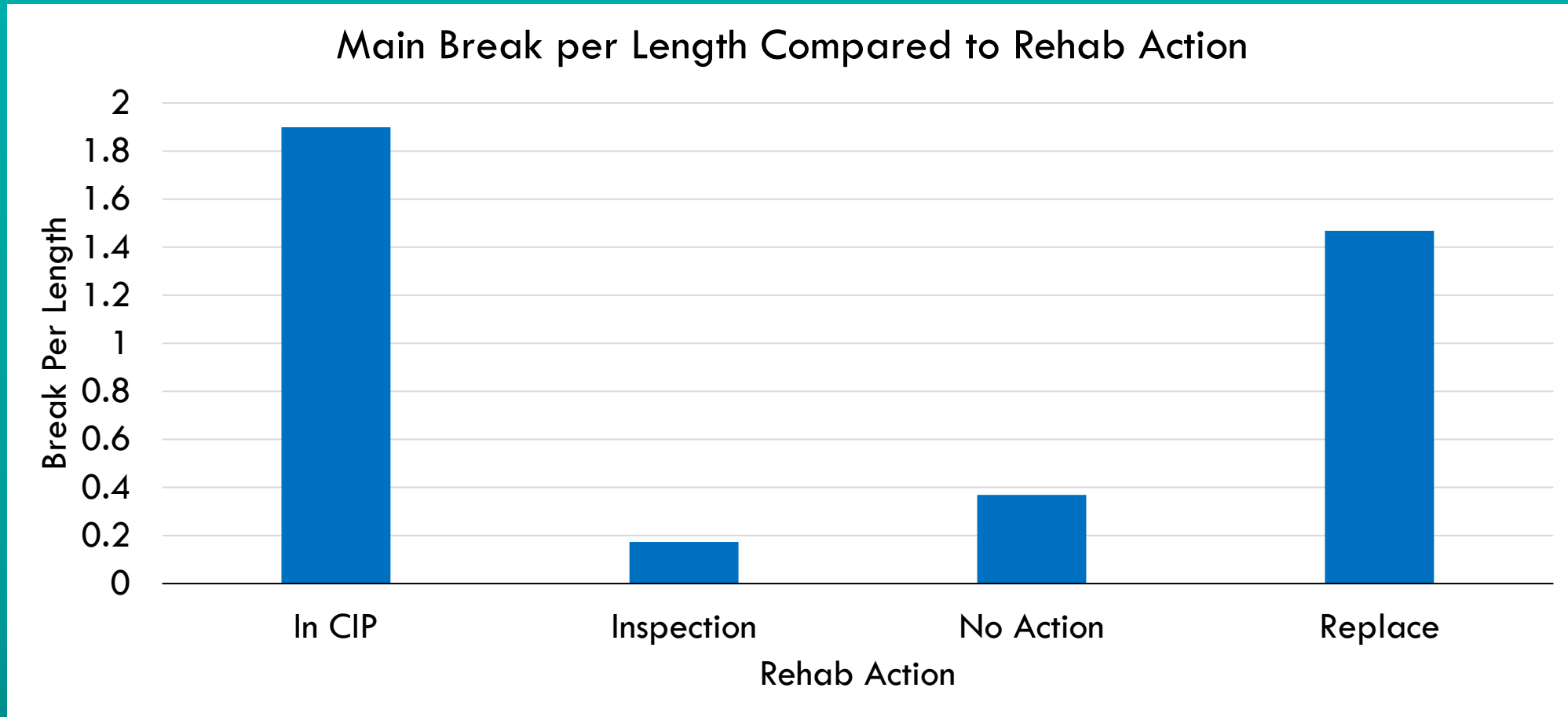


# HOT SPOTS

- 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

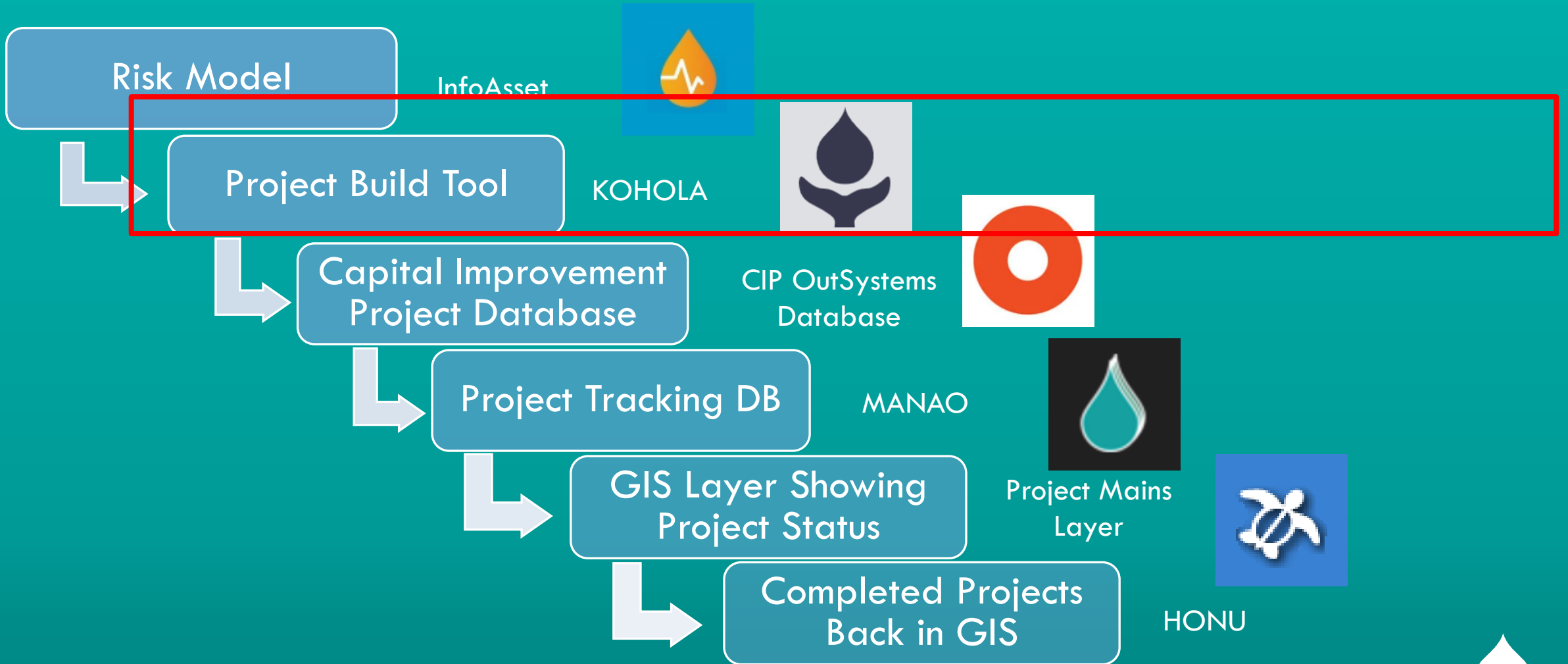


# CREATING PROJECTS FROM RISK MODEL DATA



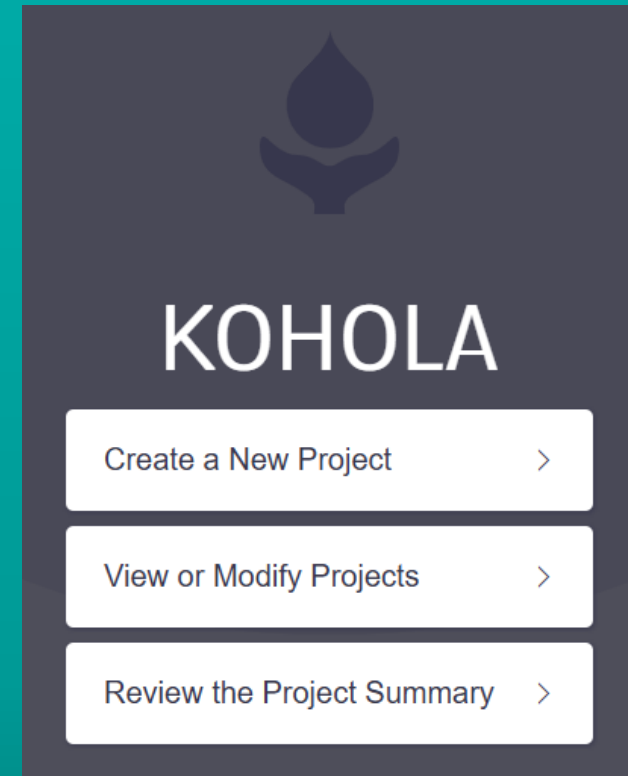


# OVERALL PROCESS



# 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**

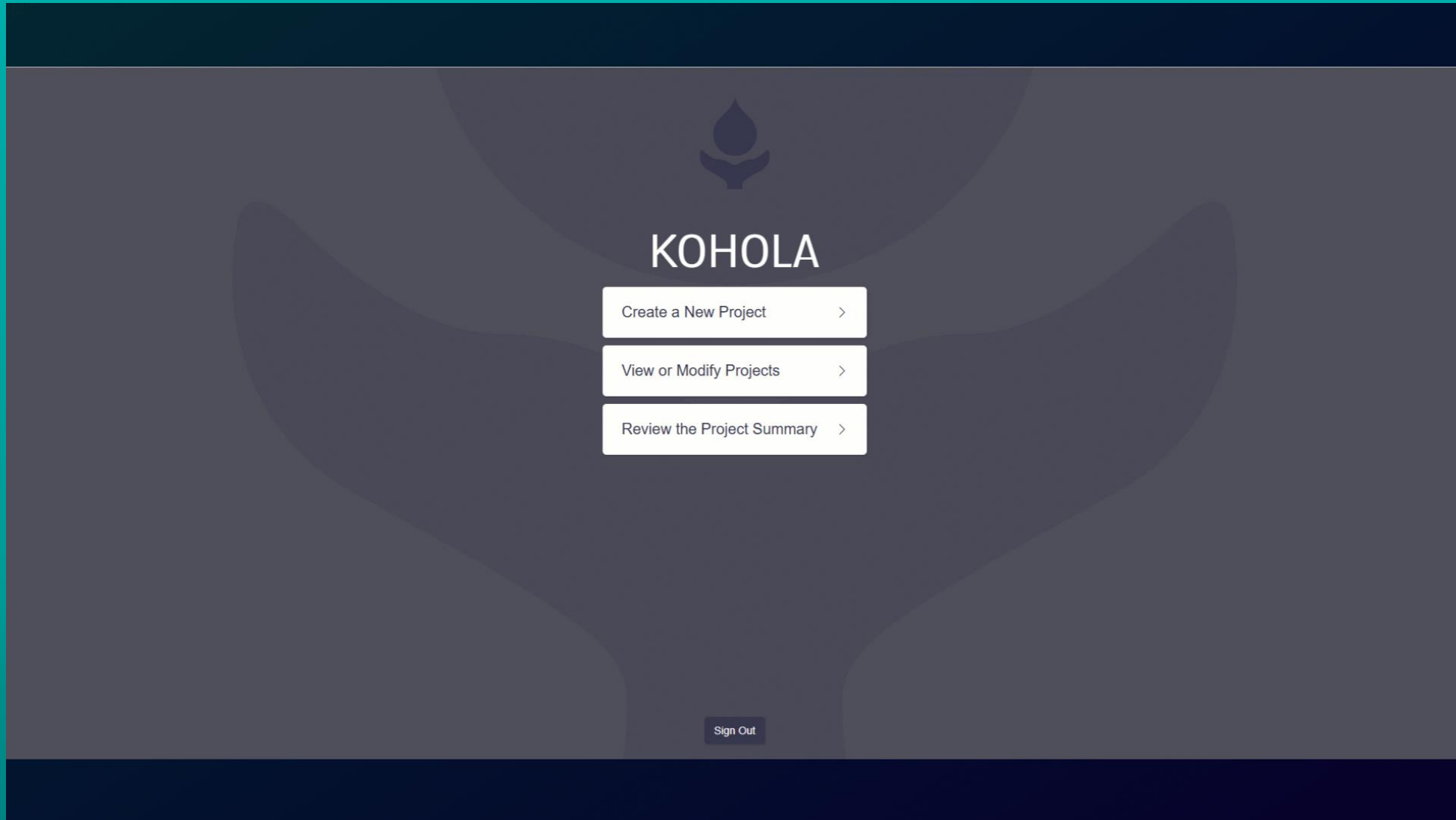
**Projects tie to 6  
year CIP List**

**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





# KOHOLA DEMO

← Back to Projects

EditSharePrint

Demo Test Project

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

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, Wailupe, Wai'ālae Iki, Kalani Valley, Kāhala, Wilhemina Rise, Kaimuki, Kapahulu, Diamond Head, and Waikiki**

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**

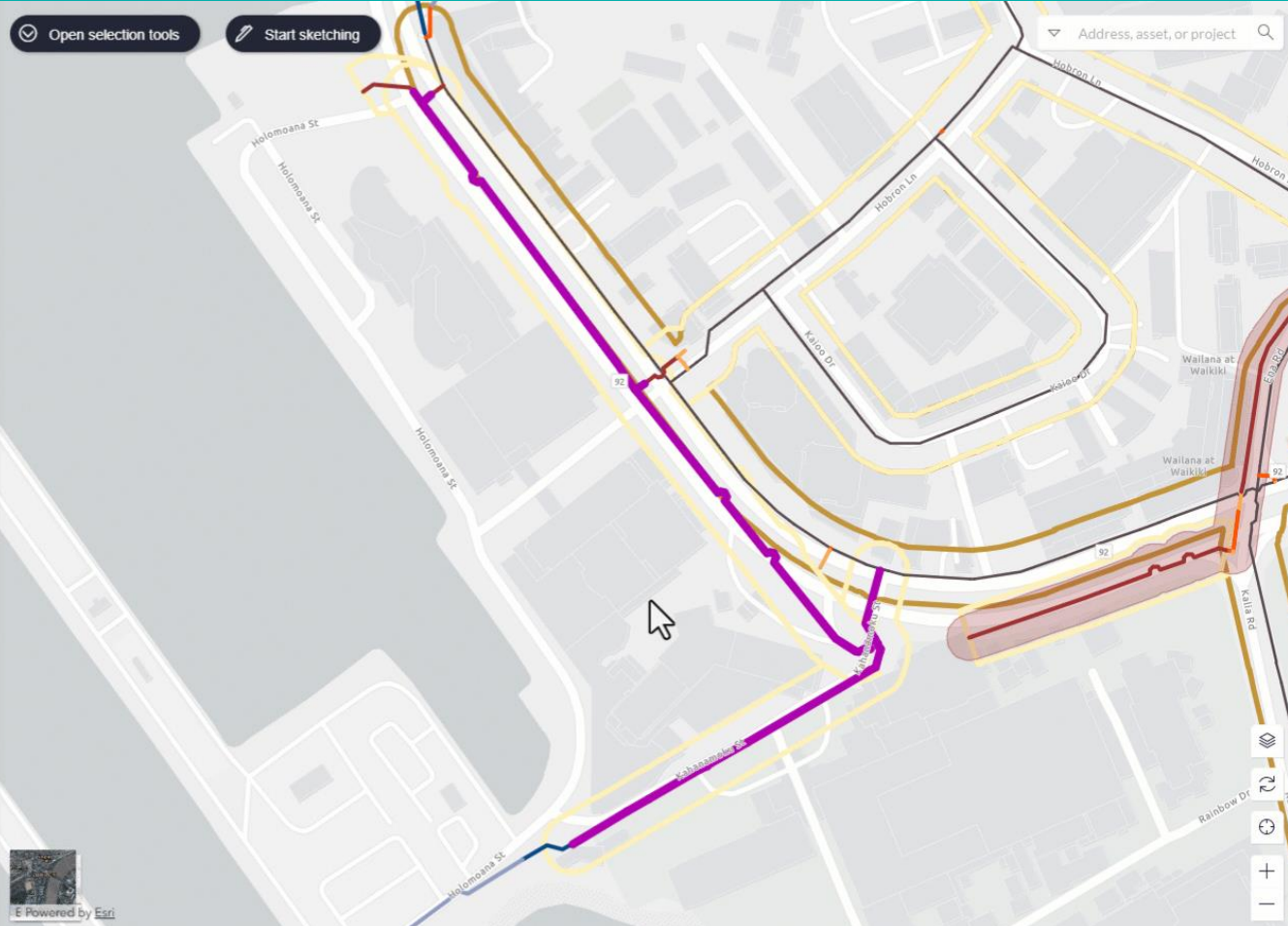
Cost Assessment

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

Open selection tools

Start sketching

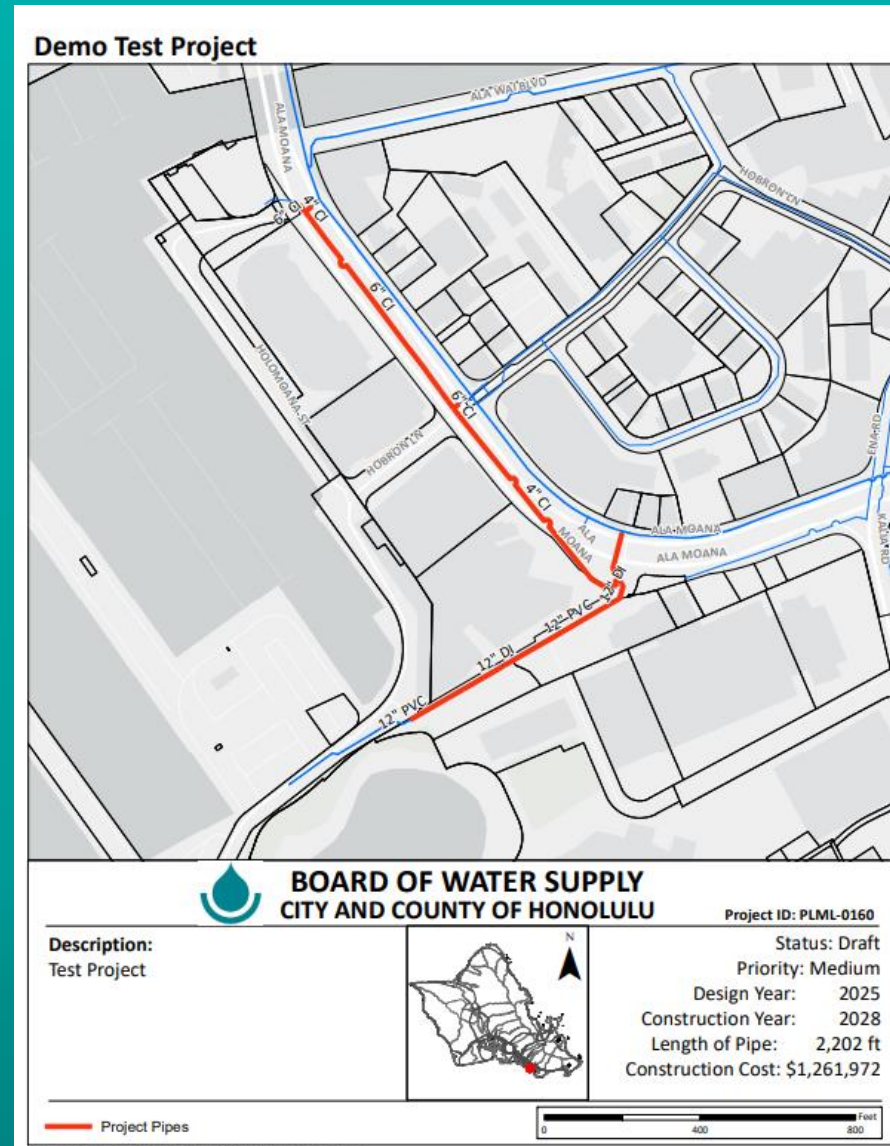
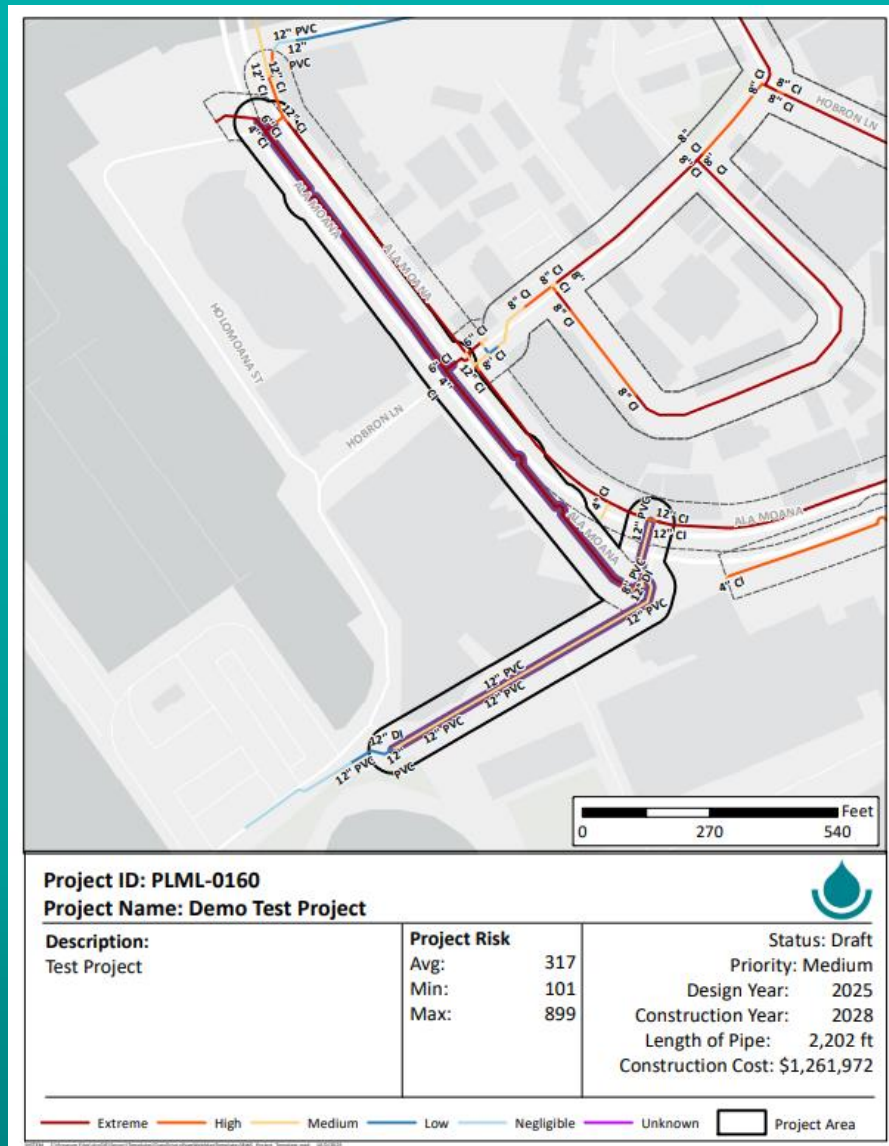
Address, asset, or project



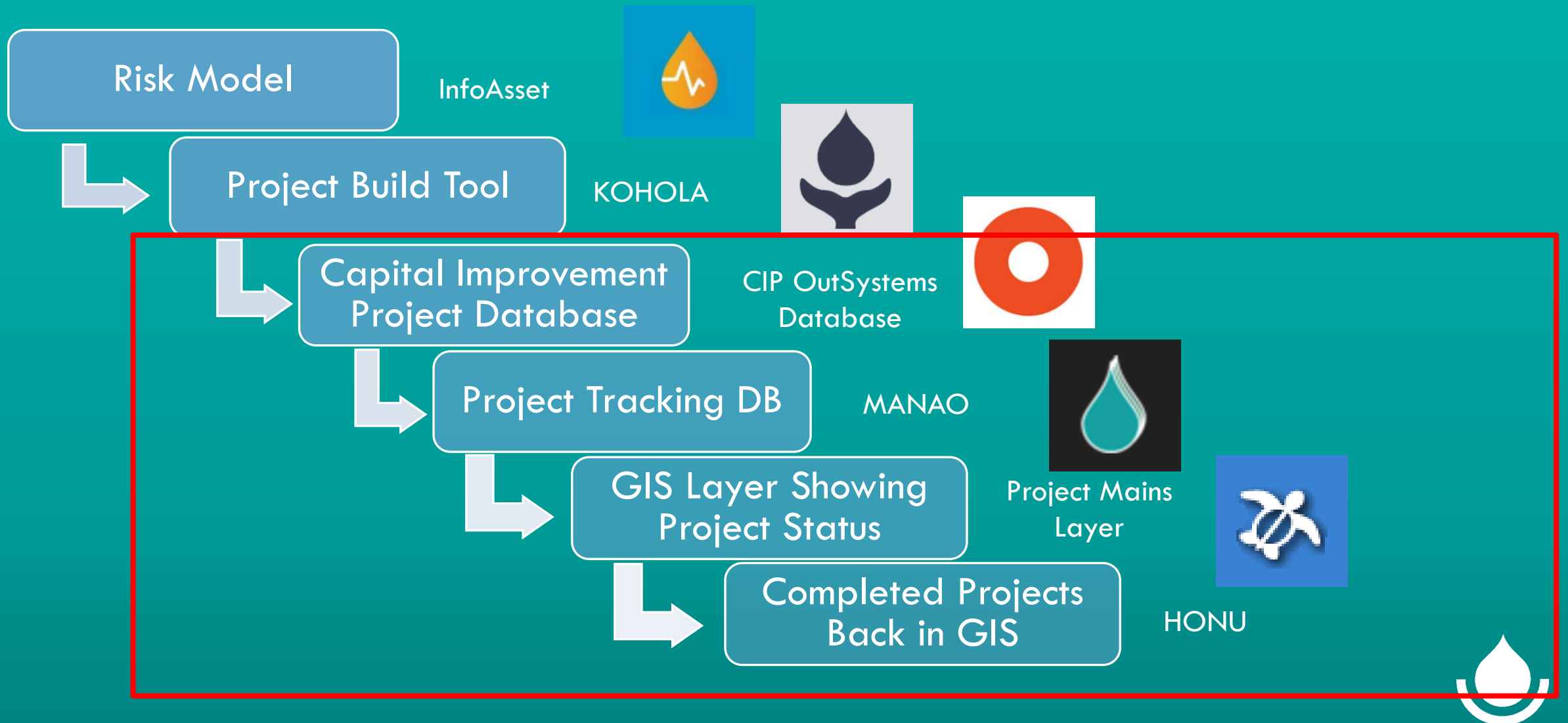
Powered by Esri



# PROJECT MAPS



# OVERALL PROCESS



# SYSTEM INTEGRATION

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

← Back to Projects

Share Print

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

Manoa Link

(CD30DE2A-5D14-ED11-B3A4-00155D684832)

Pipeline Description

Project Description

Comments

Districts

Neighborhood Board:

City Council District:

Senate District:

House of Representative District:

Development Plan Area:

Department of Highway System:

Open selection tools

Address, asset, or project

Kawaihoa Beach

Haleiwa

Kaliaka Bay Beach Park

Ukapa Pond

Pu'u o Mahuka Heiau State Historic Site

Elehehe Stream

Powered by Esri





# KOHOLA TO CIP OS

KAMEHAMEHA HIGHWAY - HALEIWA WATER SYSTEM IMPROVEM...

Delete Project

DESCRIPTION

INACTIVE ☐ ACTIVE ☒

Kohola ID: PLNS-0044a

Kohola DataKohola Map

Project Type\*

PL: Pipeline

Model System\*

NS: Nor

Status\*

Planned

Last Modified

09-02-2024

Modified

Project Name\*

KAMEHAMEHA HIGHWAY - HALEIWA WATER SYSTEM IMPROVEM

CIP Type

Pipelines

6-Year Type

Pipelines

Category

Renewal and Replacement (R&R)

Nalu Title

Growth/No Growth

No Growth

SEQ

600

Save

Cancel

Project Divisions

Division

Capital Projects

Add Record

Kohola Data

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

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

Uppers Beach Park

2022-029H - Haleiwa ...

2 of 2

Kawailoa Beach

Waimea

Ashley Rd

Cane Haul Rd

0.3mi

-158.079 21.622 Degrees

Esri, NASA, NGA, USGS, FEMA | Es...

esri

A white logo on a teal background, consisting of a stylized water drop shape with a circular element at the bottom.

# MANAO

Project

BROWSEPROJECTPAGE

SHAREFOLLOW

MANAOHomeContractor Project ListProject CenterMy TasksReports

Search this site

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

Status: Checked-inLast Modified:

\* Indicates a required field

Project Details - Des

Project Site

HomeContractor Project ListProject CenterMy TasksReports

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  
Monthly review comments.  
(gets overwritten each month)

Project Roles

Division

Branch

Owner

Project Info

Name \*  
Specify a name for the Design Pipeline Project

Budget Item Number \*

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

Estimated Start Date

Estimated Project Duration (calendar da

Estimated Construction Amount

Design Length of Pipe (LF)

Study Only Project

KOHOLA Project ID

PLNS-0044a



# PROJECT MAINS

**HONU** Honolulu Online Utilities

Honolulu Board of Water Supply

Attributes: Mains Projects - Active

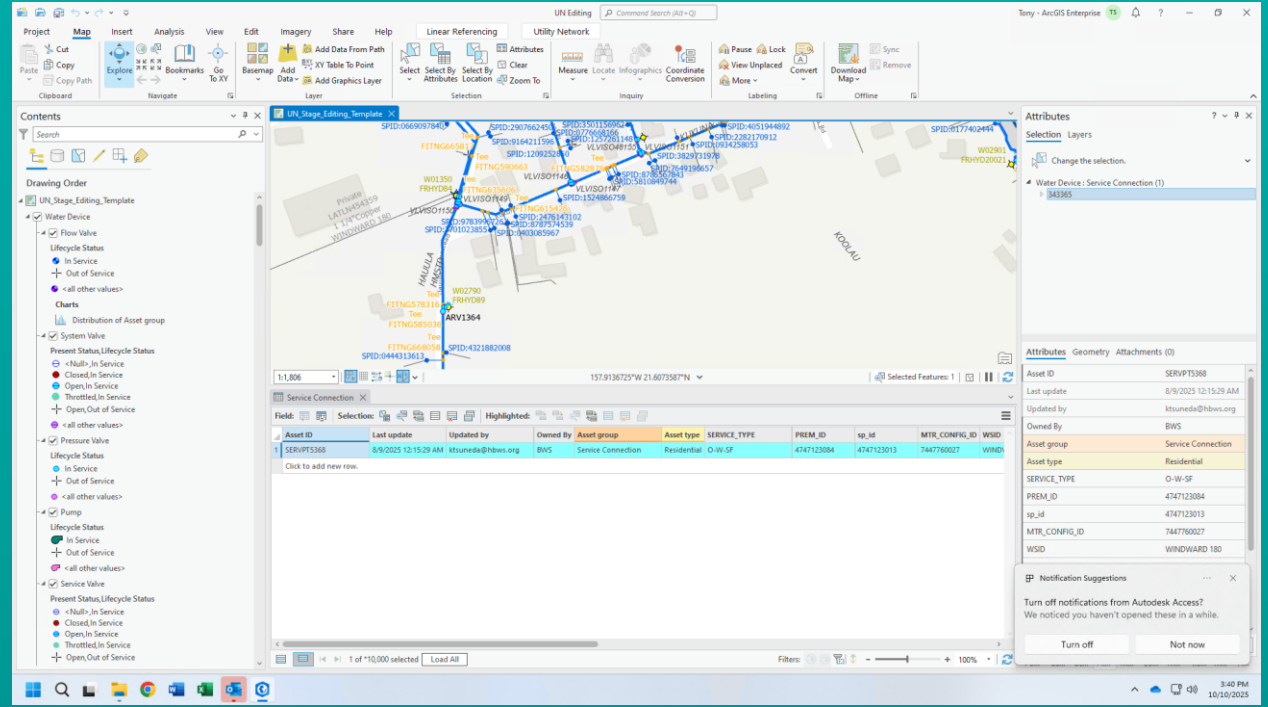
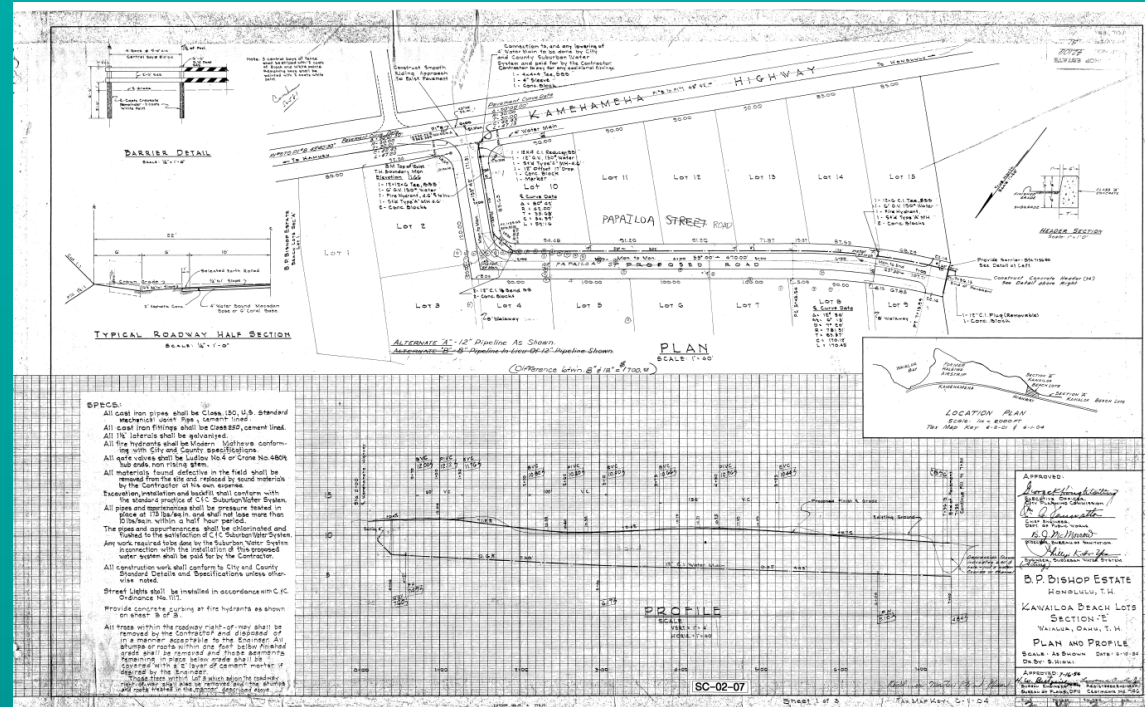
OBJECTID:	72
KOHOLA_PROJECT_ID:	PLNS-0044a
PROJECT_ACTUAL_START_DATE:	
PROJECT_ACTUAL_FINISH_DATE:	
PROJECT_PERCENT_COMPLETED:	
BUDGET_ITEM_NUMBER:	
MANAO_PROJECT_NAME:	
PROJECT_PHASE:	
CONTRACT_STATUS:	
BWSCM:	
BWS_PROJECT_ENGINEER:	
PROJECTID_URL:	
BWS_INSPECTOR:	
CONSTRUCT_CONTRACT_COMPANY:	
DESIGN_CONSULT_COMPANY:	
Shape_Length:	

Map labels: Kawaiolo Beach, Walmea, Ashley Rd, Cane Haul Rd, NORTH SHORE 725, Upolu's Beach Park, Kulekole Gulch, Leleha Stream, Komananui Stream, 224 m.

Map controls: Scale bar, North arrow, Map type selector, Full screen, Print, Share, etc.



# 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







# Mahalo!

## PIPE DREAMS: OPTIMIZING PIPELINE REHAB AND REPLACEMENT

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Tony Shing ([tshing@hbws.org](mailto:tshing@hbws.org))

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