


# Lake Ontario Collaborative Group



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City of Toronto





# Lake Ontario Water Quality Forecasting System

Liza Ballantyne, City of Toronto

# Development of a Decision Support System

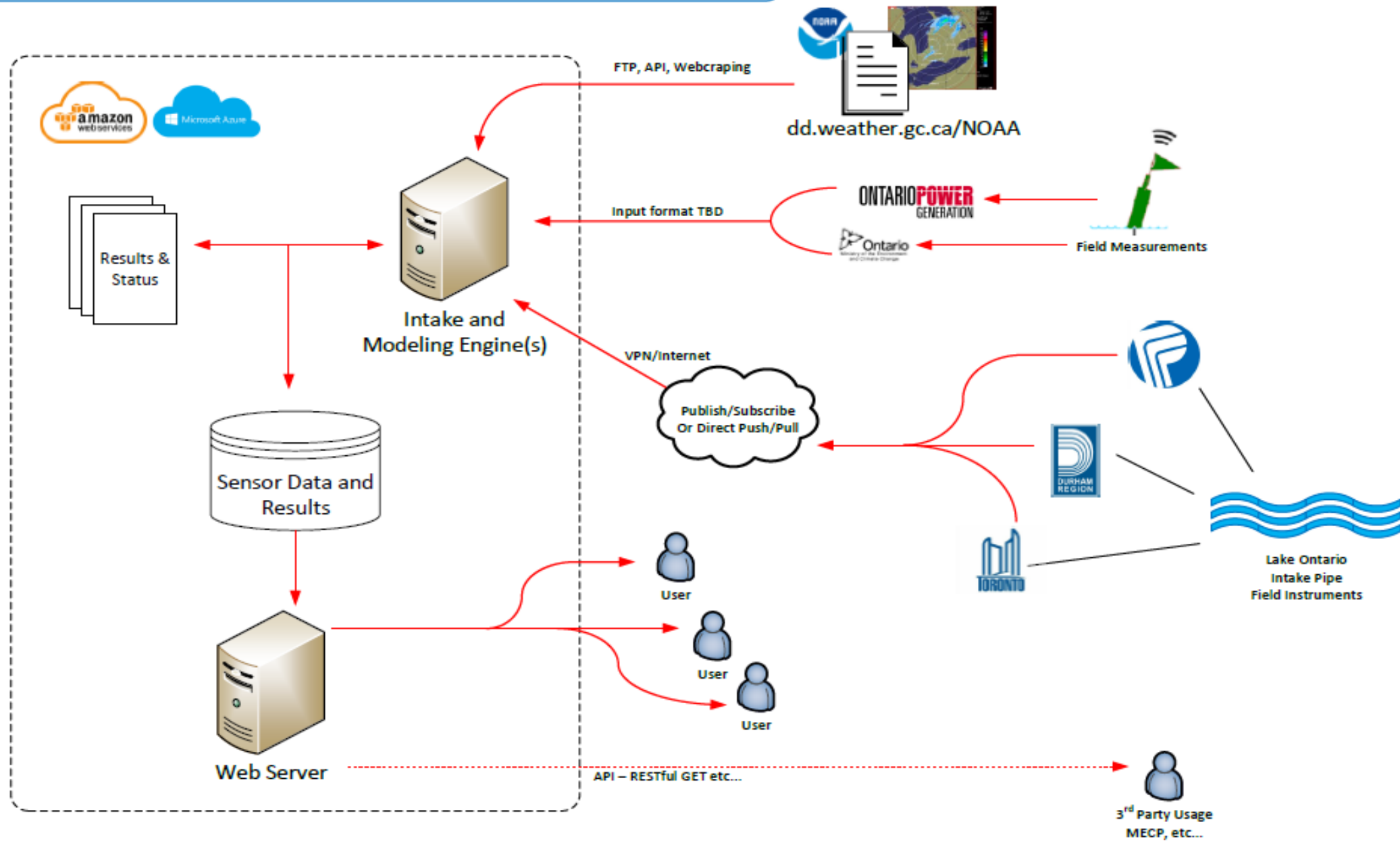
- Web-based platform to input data from several sources to a **MIKE 3 model**
- Provide ongoing real-time hydrodynamic and water quality forecasting
- Dashboard in each water treatment plant
- Improved water quality predictions for unusual water quality conditions (algae, lake turnover/upwelling/downwelling)
- Capability of inputting specific spills parameters to rapidly predict impacts

Where is the spill going?  
What is the  
Concentration?

Will any WTPs be  
affected? If so, when?

Is a plant shutdown  
required? Is it safe to  
return to service?

# LOCG – Lake Ontario Hydrodynamic and Water Quality Forecasting Systems Workflow Overview



# Installation of Year-Round In-Lake Instrumentation



From Associated Engineering, *City of Toronto Zebra Mussel Control System, Tech Memo No. 5 – Lake Current Monitoring Systems*, Dec 2017

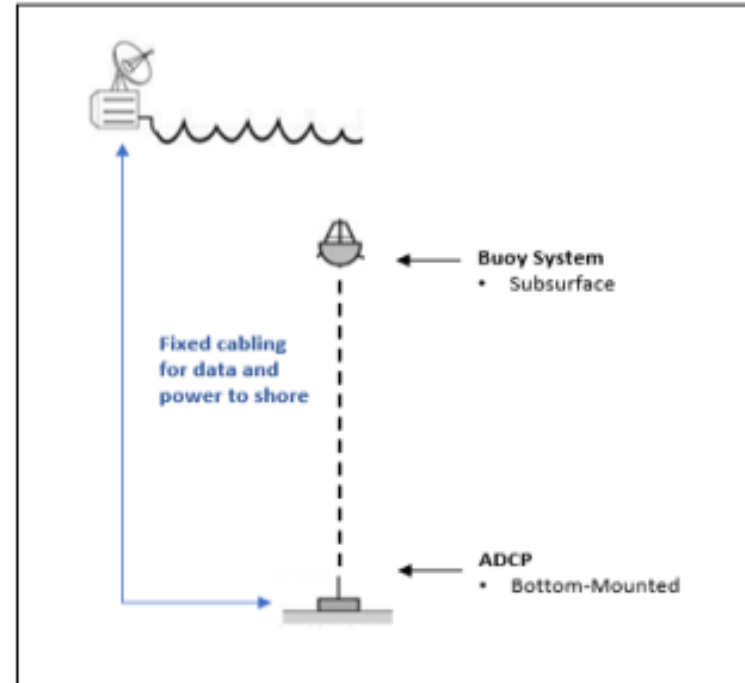


Figure 3-2  
Alternative 1 – Cabling to Shore

Parameters include:

- Conductivity
- Temperature
- Turbidity
- Current speed, direction
- Phycocyanin
- Chlorophyll

Data feeds into the model to improve forecasts near WTP intakes

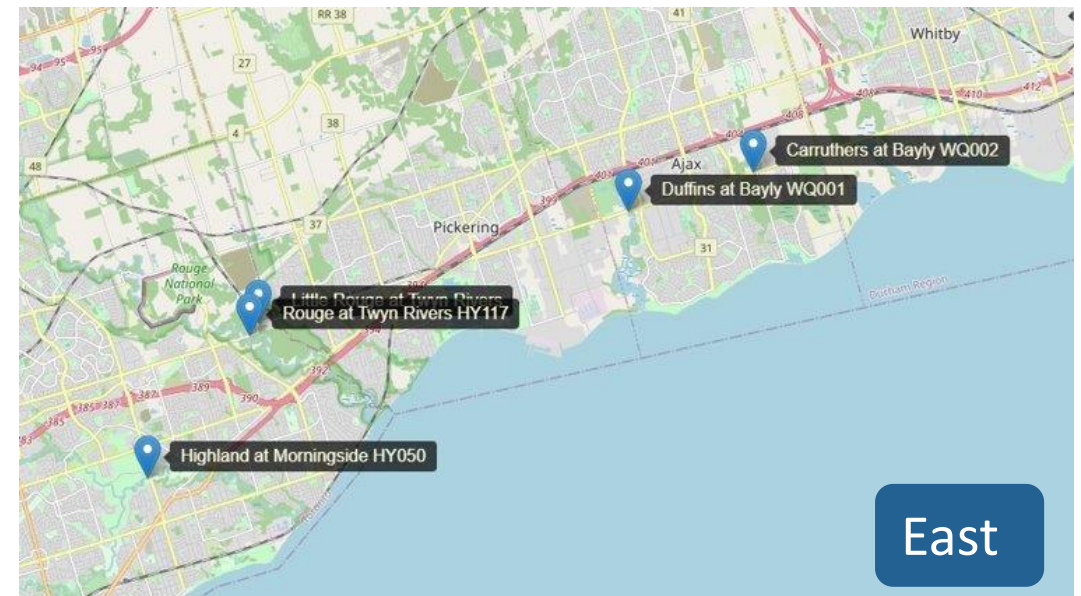
# Tributary Monitoring

Parameters include:

- Conductivity
- Temperature
- Turbidity
- Flow

Tributary Monitoring provided by TRCA, CVC and CLOCA

Data feeds into the model to improve predictions and tributary spill forecasts





# Instrumentation – Status Update



Clark WTP ADCP Installation – Sept 2022

## Lake Current Monitoring System (LCMS)

- Clark WTP - deployed in Sept 2022 and to be commissioned in January 2023
- Harris WTP - tender in February 2023

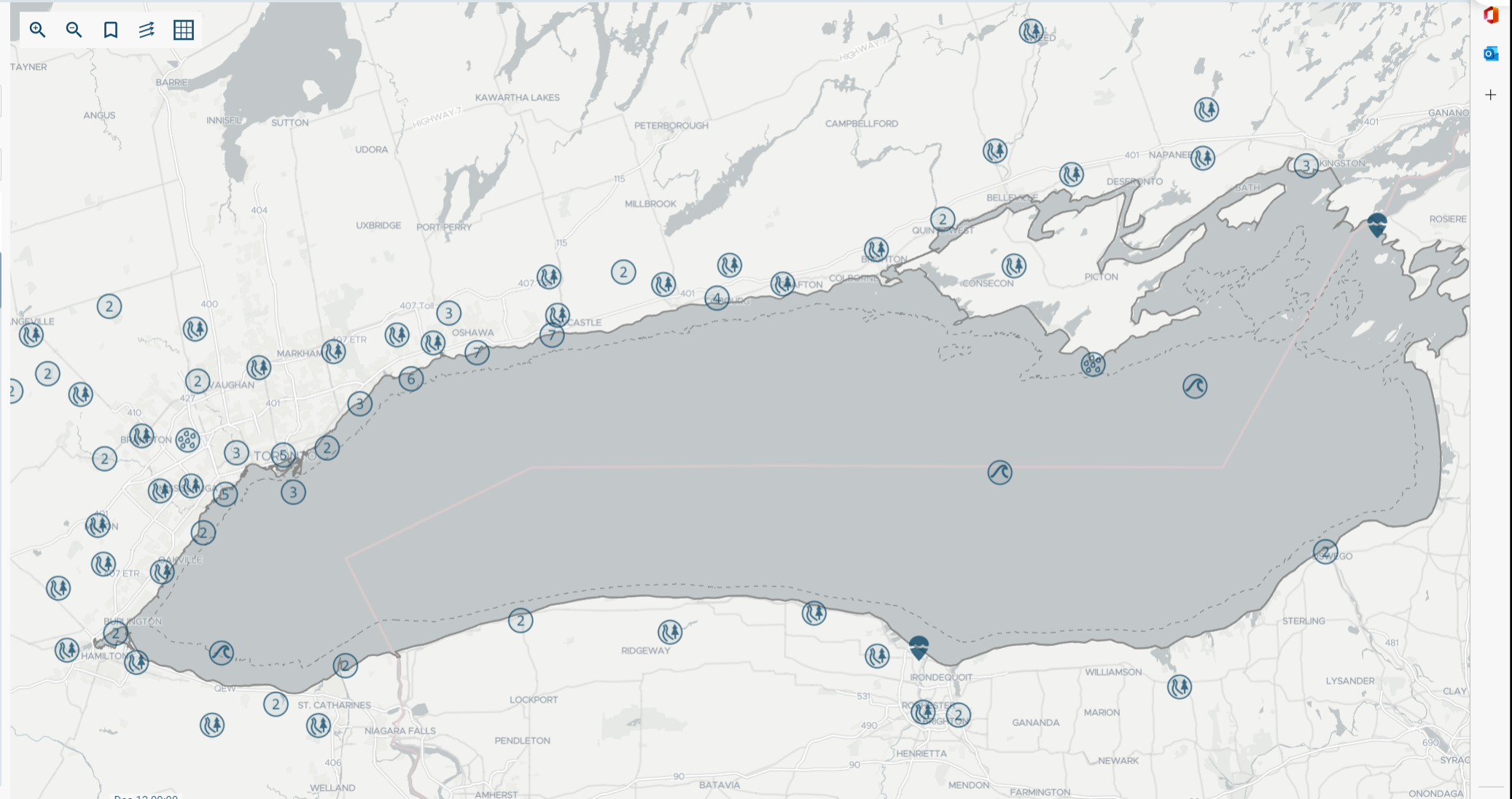
## Future Installations

- A.P. Kennedy WTP (Peel): 2022-2024
- Lorne Park WTP (Peel): 2025-2027
- Whitby WTP (Durham): 2025-2027

Existing Conditions | Spill Forecasting | Intake Source Tracking

Type filter: Select...  
Name filter: Select...

Name	Type
<input type="checkbox"/> ADCP at Ajax	ADCP
<input type="checkbox"/> ADCP at Etobicoke	ADCP
<input type="checkbox"/> adminstation	flow
<input type="checkbox"/> Ajax WTP	Intake
<input type="checkbox"/> Allen Creek Near Rochester	Streamflow
<input type="checkbox"/> Arthur P. Kennedy WTP	Intake
<input type="checkbox"/> Ashbridges WWTP	Outfall
<input type="checkbox"/> Baltimore Creek at Baltimore	Streamflow
<input type="checkbox"/> Black River at Watertown	Streamflow
<input type="checkbox"/> Bowmanville Creek at Bowmanville	Streamflow
<input type="checkbox"/> Bowmanville WTP	Intake
<input type="checkbox"/> Bronte Creek at Carlisle	Streamflow
<input type="checkbox"/> Bronte Creek near Zimmerman	Streamflow
<input type="checkbox"/> Clarkson WWTP	Outfall



Create Analysis



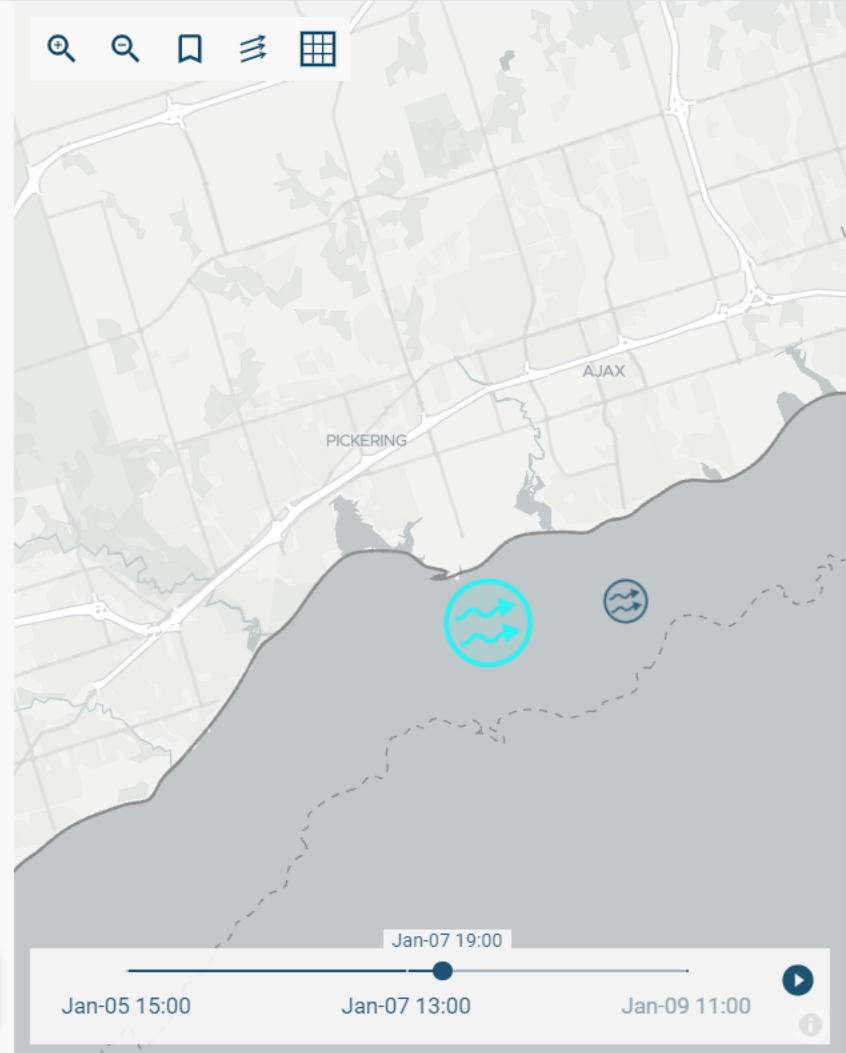
Existing Conditions | Spill Forecasting | Intake Source Tracking

Type filter: ADCP x

Name filter: Select...

Name	Type
<input type="checkbox"/> ADCP at Ajax	ADCP
<input type="checkbox"/> ADCP at Etobicoke	ADCP
<input type="checkbox"/> Darlington NGS	ADCP
<input checked="" type="checkbox"/> Pickering NGS	ADCP

Create Analysis



Existing Condition Analysis

Station filter: Pickering NGS x

Parameter filter: Current Speed x

Depth Filter: Top x

Time Period: 1 Month

Current Speed : m/s

Legend: ADCP Pickering-Top (measured) (blue line), ADCP Pickering-Top (simulated) (orange line)

## Scenario Manager



Active Scenarios

**New Scenario**

Archived Scenarios

Scenario Name

Spill Start

December 12th 09:08 p.m.

Spill Location

Discharge Type

Scenario Description

Spill End

December 15th 09:08 p.m.

Concentration Start ()

Spill Type

Simulation End

December 16th 02:08 a.m.

Concentration End ()

Pollutant

Scenario Archive

January 17th 09:08 a.m.

Threshold Concentration

0

Alerts Enabled

Concentration Unit

Save

Execute

### Lake Ontario WQ Forecasting System

Existing Conditions **Spill Forecasting** Intake Source Tracking

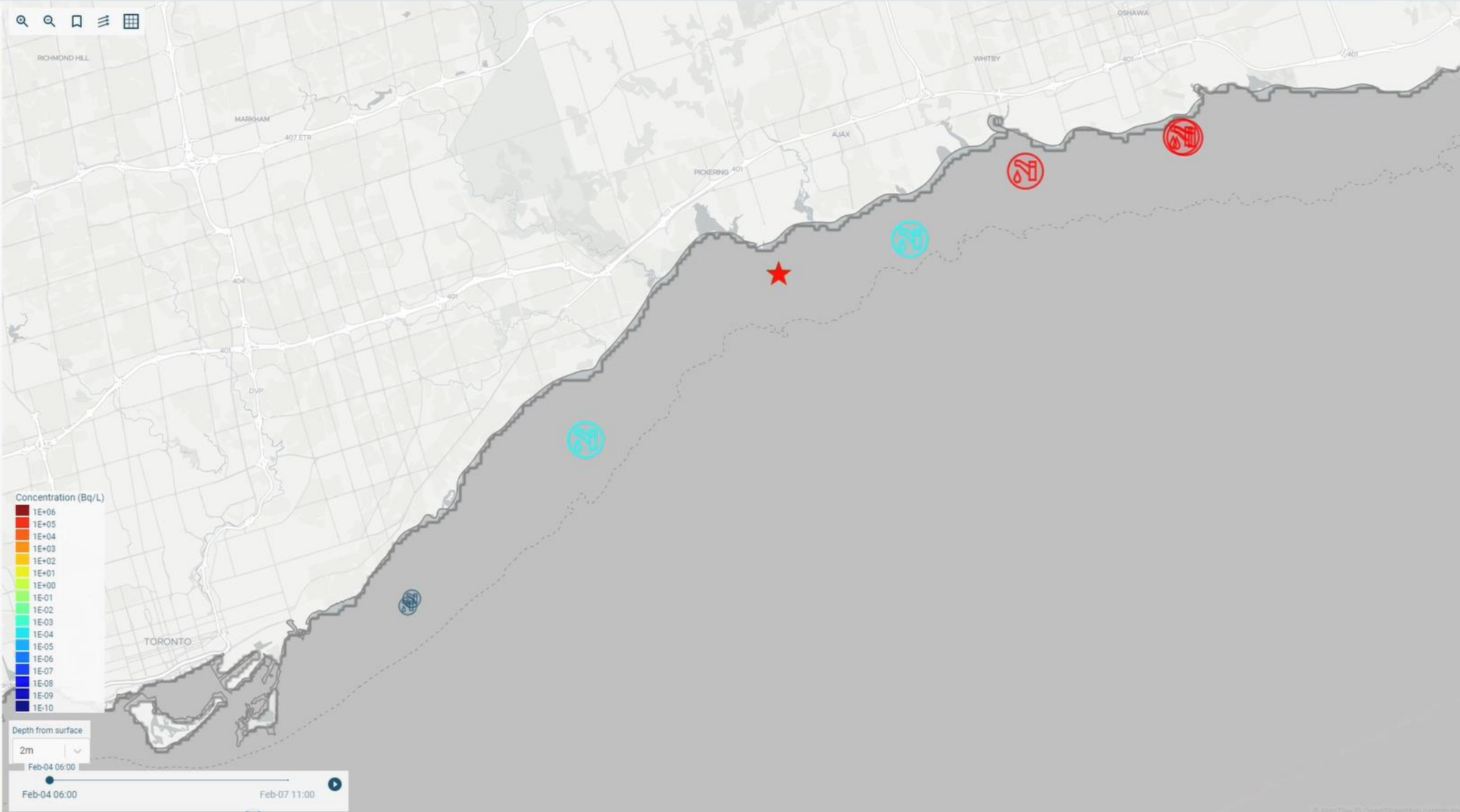
Tritium Spill at Pickering

Created By: pad  
Pollutant: Tritium  
Threshold: 5000 (Bq/L)  
Start: 2022-02-04 06:04:05

<input type="checkbox"/>	Name	Owner
<input checked="" type="checkbox"/>	Ajax WTP	Durham
<input type="checkbox"/>	Arthur P. Kennedy WTP	Peel
<input type="checkbox"/>	Bowmanville WTP	Durham
<input checked="" type="checkbox"/>	F.J. Horgan WTP	Toronto
<input type="checkbox"/>	Lorne Park WTP	Peel
<input type="checkbox"/>	Newcastle WTP	Durham
<input checked="" type="checkbox"/>	Oshawa WTP (1)	Durham
<input checked="" type="checkbox"/>	Oshawa WTP (2)	Durham
<input type="checkbox"/>	R.C. Harris WTP (NE)	Toronto
<input type="checkbox"/>	R.C. Harris WTP (SW)	Toronto
<input type="checkbox"/>	R.L. Clark WTP	Toronto
<input type="checkbox"/>	Toronto Island WTP (East)	Toronto
<input type="checkbox"/>	Toronto Island WTP (Middle)	Toronto
<input type="checkbox"/>	Toronto Island WTP (West)	Toronto
<input checked="" type="checkbox"/>	Whitby WTP	Durham

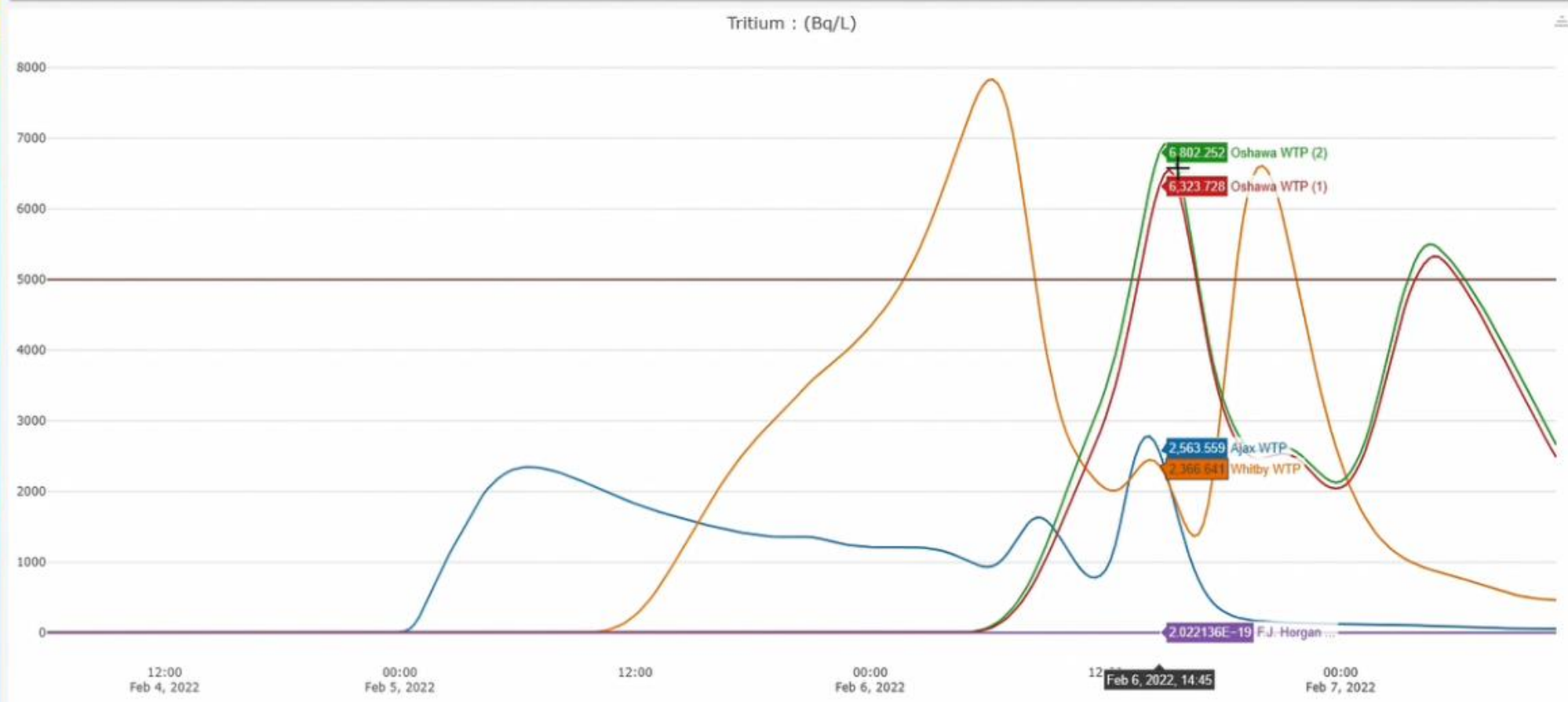
Owner filter  
Select...

Create Analysis

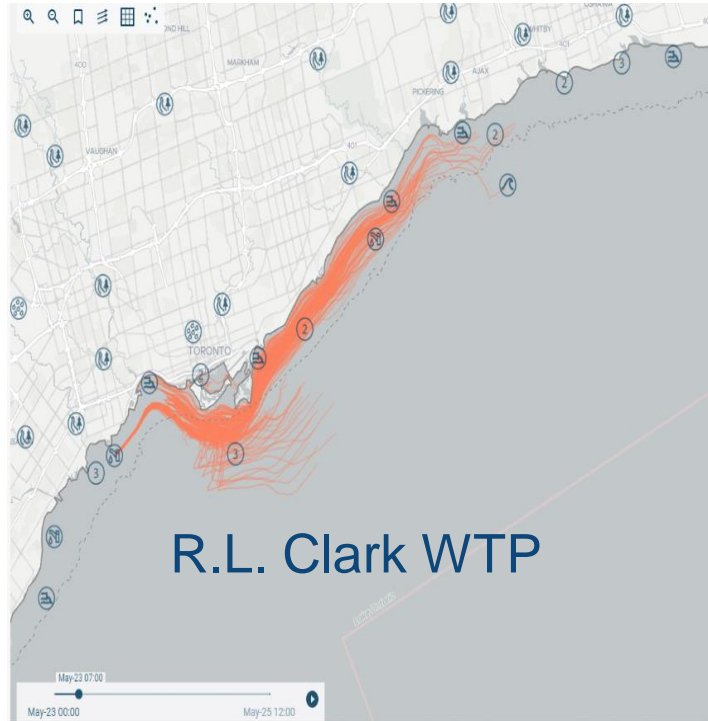


Intake	Time of Max Conc	Max Conc (Bq/L)	Exceedence Duration (h)	Time of Exceedence	Time of No Exceedence
Whitby WTP	2022-02-06T06:15:00	7.84e+3	9	2022-02-06T01:43:00	2022-02-06T21:44:00
Oshawa WTP (2)	2022-02-06T15:00:00	6.92e+3	6	2022-02-06T13:21:00	2022-02-07T06:20:00
Oshawa WTP (1)	2022-02-06T15:15:00	6.56e+3	5	2022-02-06T13:41:00	2022-02-07T06:01:00

3 rows |< < 1-3 of 5 > >|



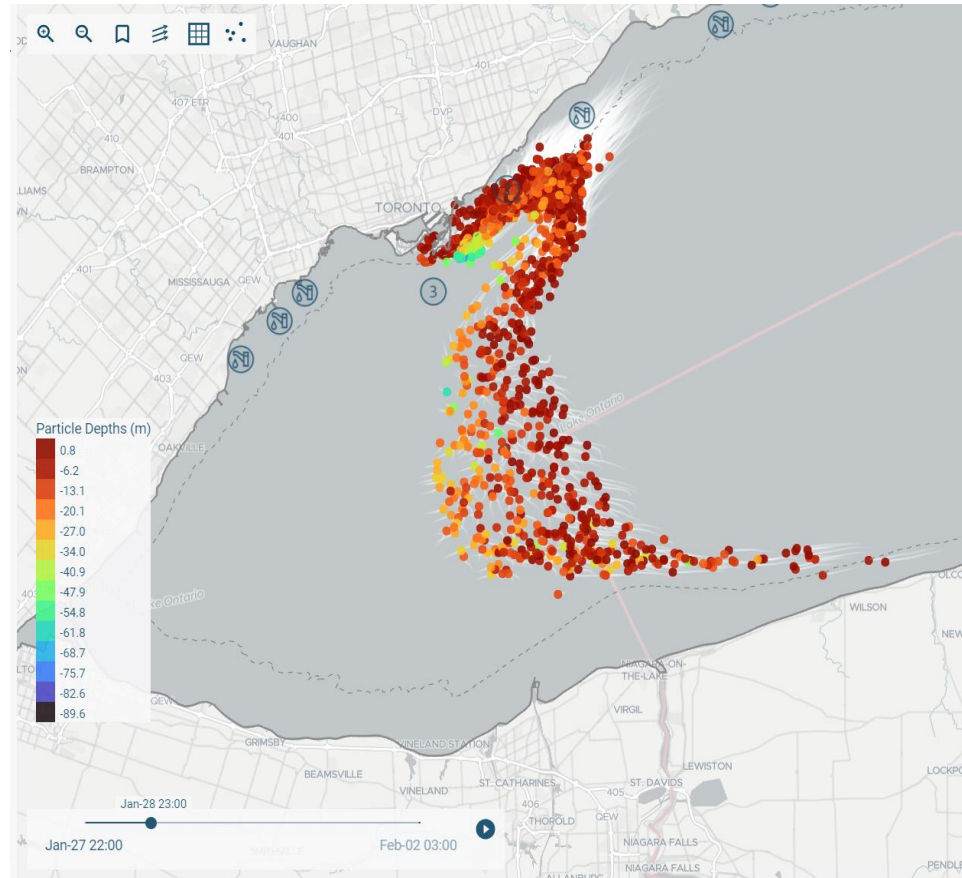
# Reverse Particle Tracking May 25, 2021 - Filter Clogging Event



Water hugs coastal shoreline



# Reverse Particle Tracking Jan 27 – Feb 2, 2021



Water travels across  
the lake

# DSS – Status Update

## Phase 1 - Complete

- Model is available and has been moved to Durham's server
- Municipal staff training completed Spring/Summer 2022
- Data validation with 2020-2022 data set completed
- Implementation is underway within each municipality to integrate this new tool into existing operational frameworks

# DSS – Status Update

## Phase 2 - Underway

- Improvements to model calibration
- Improvements to prediction of time of travel in tributaries
- Incorporate combined and storm sewer network
- Improvements to oil spills predictions by incorporating ECO Lab
- Incorporate new software features identified through use of DSS
- Cybersecurity improvements