Blue Roof System

Saving cities, one drop at a time!

By Team Bleu

Nov 26
9am-4pm

GO OPEN DATA

MISSISSAUGA

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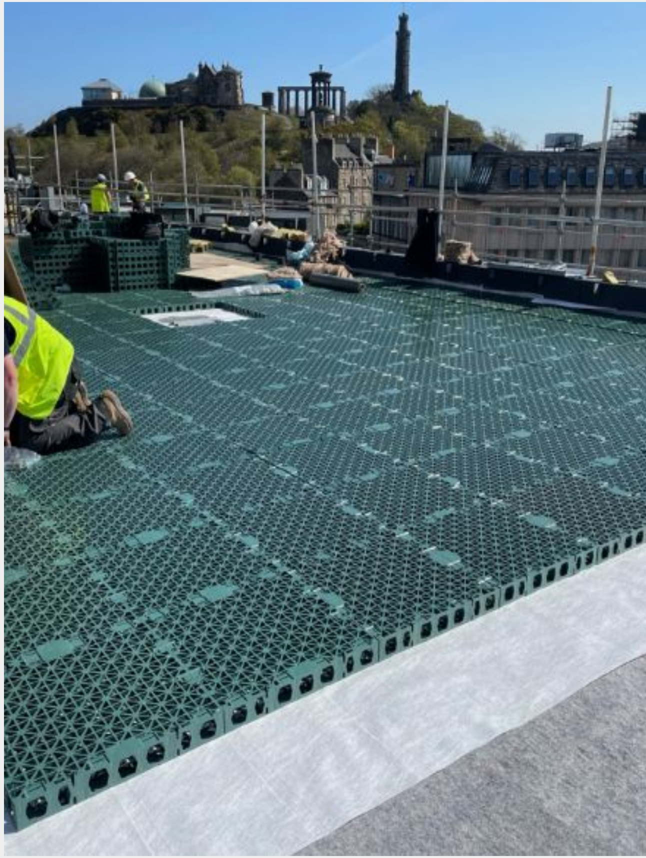
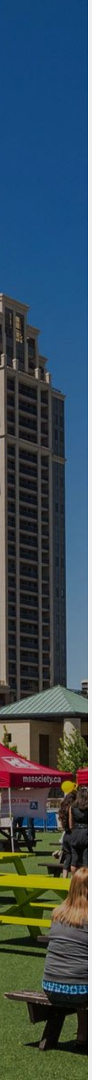




You have been challenged!

How can we leverage Roof tops to address issues related to climate change?

01 The Big Problem

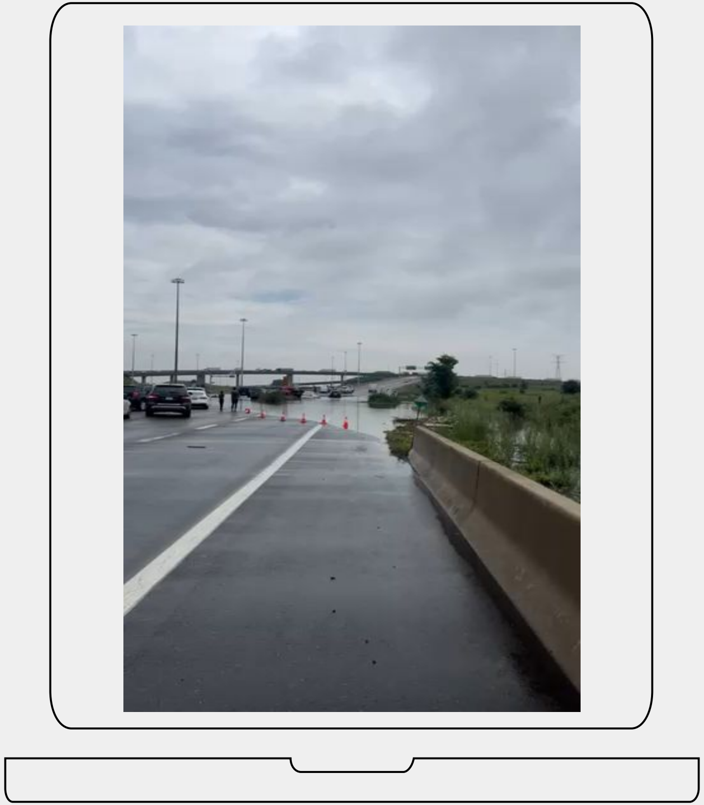
Adaquete rainfall is crucial for urban life however, where does all that water go?

What is this Big Problem?

Flooding Challenges in Urban Areas:

- Frequent **flooding events** disrupt daily life and damage infrastructure. Ie. **Highway 410.**
- Current urban stormwater systems **struggle to handle peak rainwater volumes.**
- **Mississauga's growing urbanization** has reduced permeable surfaces, increasing the risk of flooding.
- Excess rainwater often **overwhelms drainage systems.**
- Climate change is **increasing the intensity and frequency of storms,** exacerbating these issues.

Highway 410 Flooding – July 16, 2024



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What are Blue Roofs?

02

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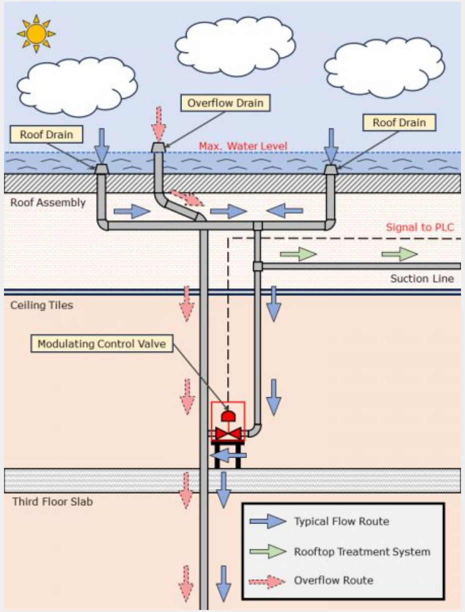
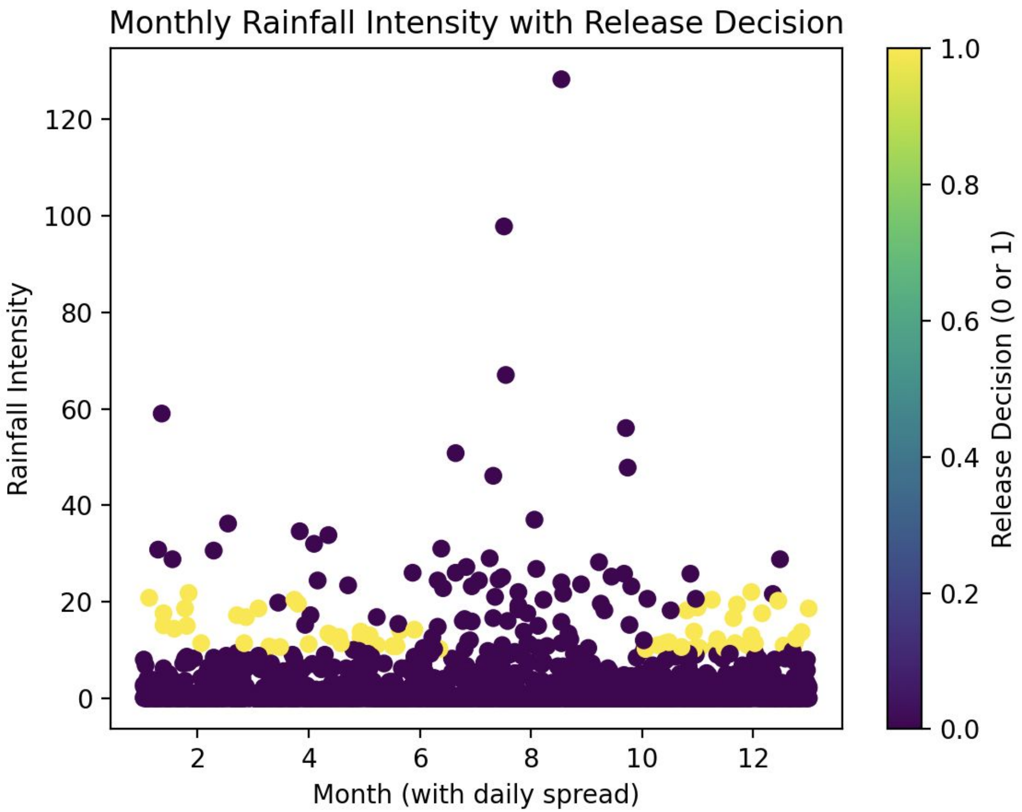
Summary about Blue Roofs!

The blue roof system is an innovative, distributed solution to alleviate stormwater pressure during peak events.



- **Manages stormwater effectively**
- **Reduces urban flooding** during heavy rainfall.
- **Cost-efficient solution** $1 – $2 per square foot.
- **Promotes urban cooling** by reducing rooftop heat and improving air quality.
- **Improves water quality** by filtering out pollutants before release.
- **Supports sustainability goals** by integrating with green infrastructure initiatives.

03 Optimization Model

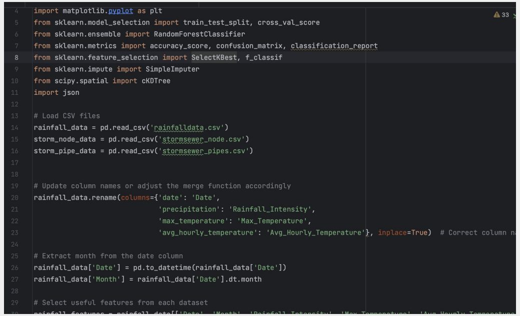


The graph above shows monthly rainfall intensity against the decision to release or retain stormwater.

Our Optimization Model

- Optimization model for blue roof systems takes in data sets and checks if the blue roof should release or sustain water based on factors.
- To show this works, we provided a simulation model using a front-end application which can display this data and run simulations.
- Machine learning models could predict peak flow times and automatically control the release of water from blue roofs.

How The ML Model Works



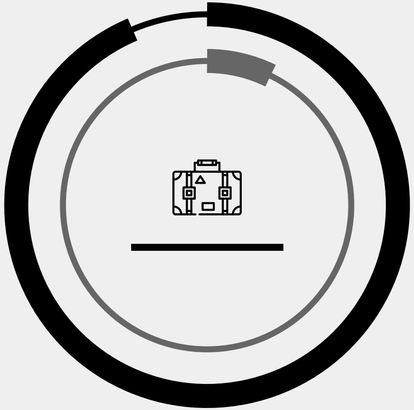
```
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split, cross_val_score
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import accuracy_score, confusion_matrix, classification_report
from sklearn.feature_selection import SelectKBest, f_classif
from sklearn.impute import SimpleImputer
from scipy.spatial import cKDTree
import json

# Load CSV files
rainfall_data = pd.read_csv('rainfalldata.csv')
storm_node_data = pd.read_csv('stormsewer_node.csv')
storm_pipe_data = pd.read_csv('stormsewer_pipes.csv')


# Update column names or adjust the merge function accordingly
rainfall_data.rename(columns={'date': 'Date',
                              'precipitation': 'Rainfall_Intensity',
                              'max_temperature': 'Max_Temperature',
                              'avg_hourly_temperature': 'Avg_Hourly_Temperature'}, inplace=True)  # Correct column n

# Extract month from the date column
rainfall_data['Date'] = pd.to_datetime(rainfall_data['Date'])
rainfall_data['Month'] = rainfall_data['Date'].dt.month

# Select useful features from each dataset
```

- **Data Integration**: We combined rainfall data with information about the stormwater infrastructure (nodes and pipes).
- **Machine Learning Model**: A Random Forest model algorithm was trained to make retention and release decisions based on historical rainfall and infrastructure data in Mississauga.
- **Evaluation**: Compared the outcomes of stormwater captured with and without the machine learning-enabled blue roof system.
- **Results**: Our model predicts when a blue roof should release or retain water to prevent overloading the storm sewer.

Analysis

80%

Retention efficiency in reducing stormwater runoff.



34%

Of Storm water volume prevented from reaching storm sewers at peak time

Thank You!

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