

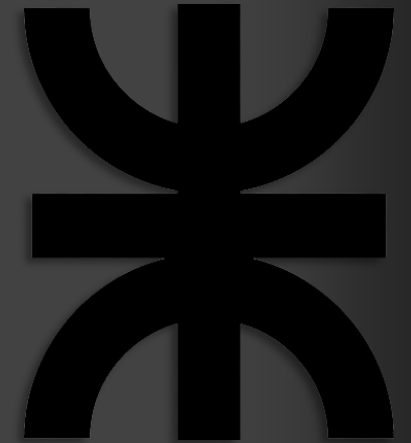
URBAN FLOODING: IMPROVEMENT OF PLUVIAL DRAINAGE SYSTEM AGAINST SATURATIONS ON RONDEAU AVENUE IN PARANÁ

Universidad Tecnológica Nacional

Facultad Regional Paraná

Civil Engineering Department, Inglés I

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2023

INTRODUCTION

General Contextualization



- Urban drainage problems in Paraná during a heavy rain
- Drainage system's poor performance and high runoff flows

Rondeau Avenue, between Fraternidad Street and Raúl L.
Uranga Avenue, on a rainy day

The Purpose of This Presentation

- To address the urban flooding problem on Rondeau Avenue in Paraná

The Solution

- To improve the poor stormwater drainage system maintenance and to incorporate storm retarders

Map of the Presentation

- Description of the Context
- Problem Statement
- Description of Scenes that Help Picture the Problematic Situation
- Identification and Analysis of the Causes that Give Rise to the Problem
- Identification and Description of the Consequences
- Problem Approach
- Strengths and Weaknesses of the Proposal

Work Impact

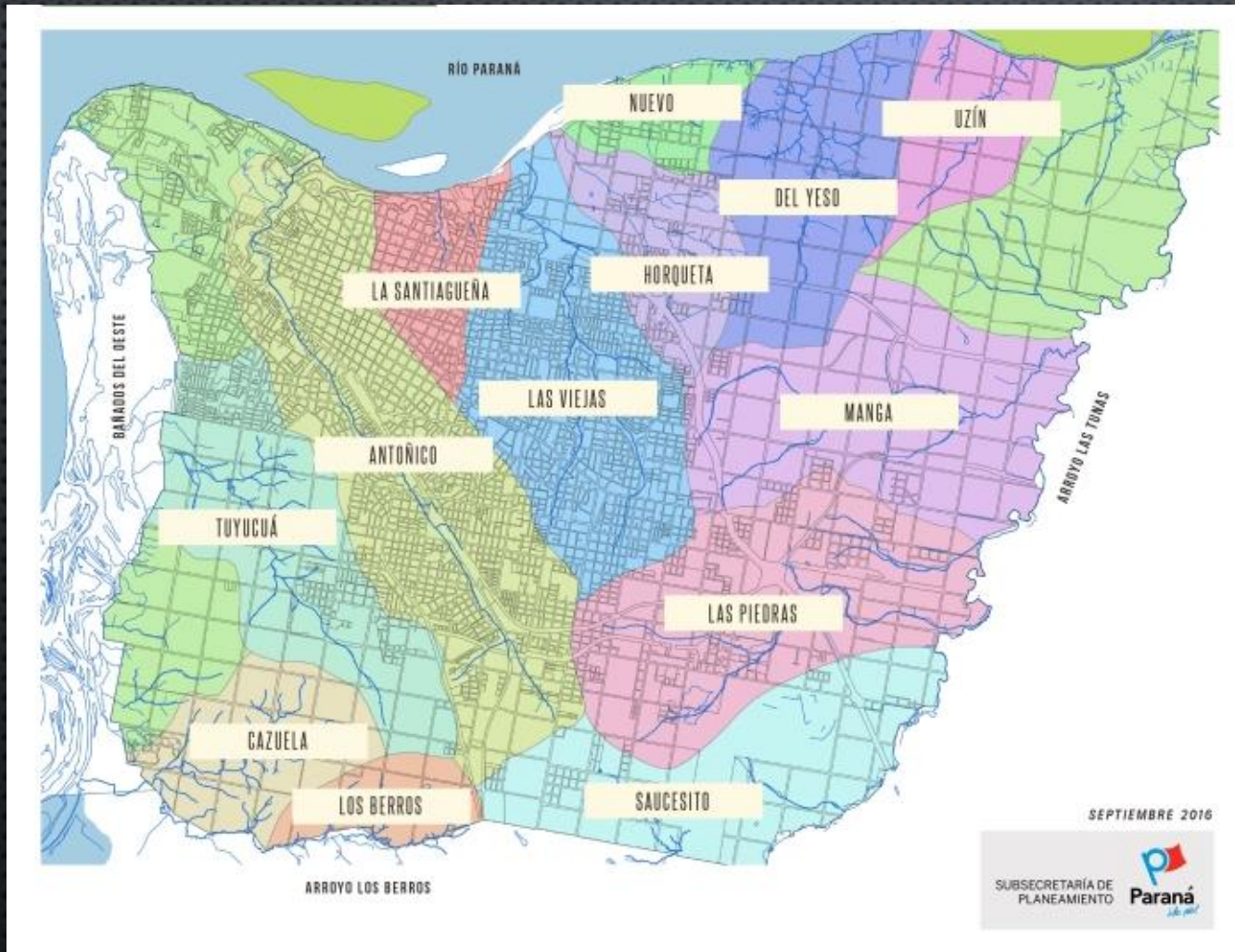
- General vision and understanding of the problem, addressing it through innovate solutions



PROBLEM DEFINITION AND ANALYSIS

DESCRIPTION OF THE CONTEXT

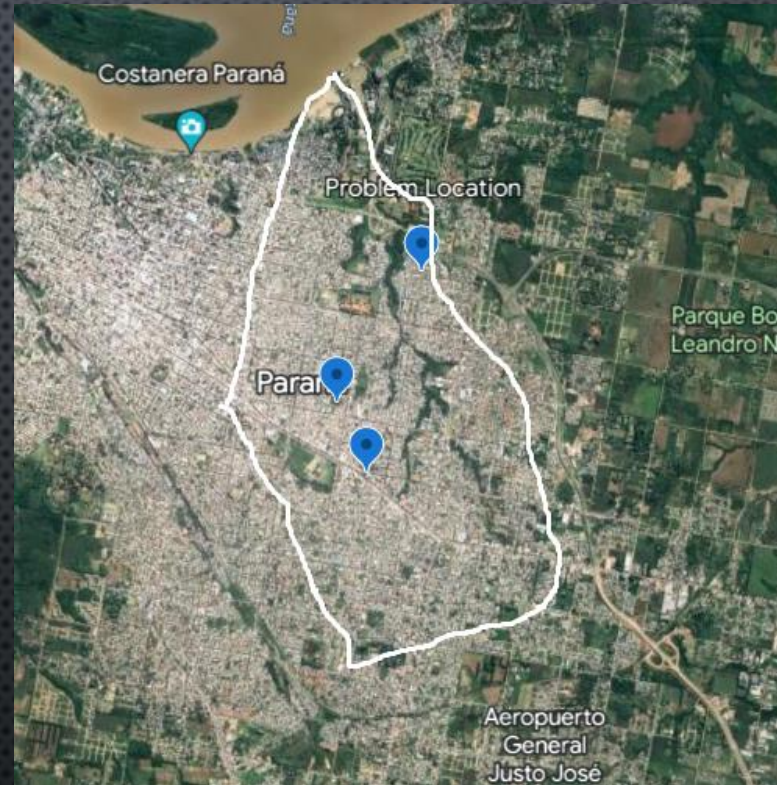
Map of the Basins in Paraná City



General Information

- 280,087 inhabitants
- 137 square kilometers of surface area
- 13 basins

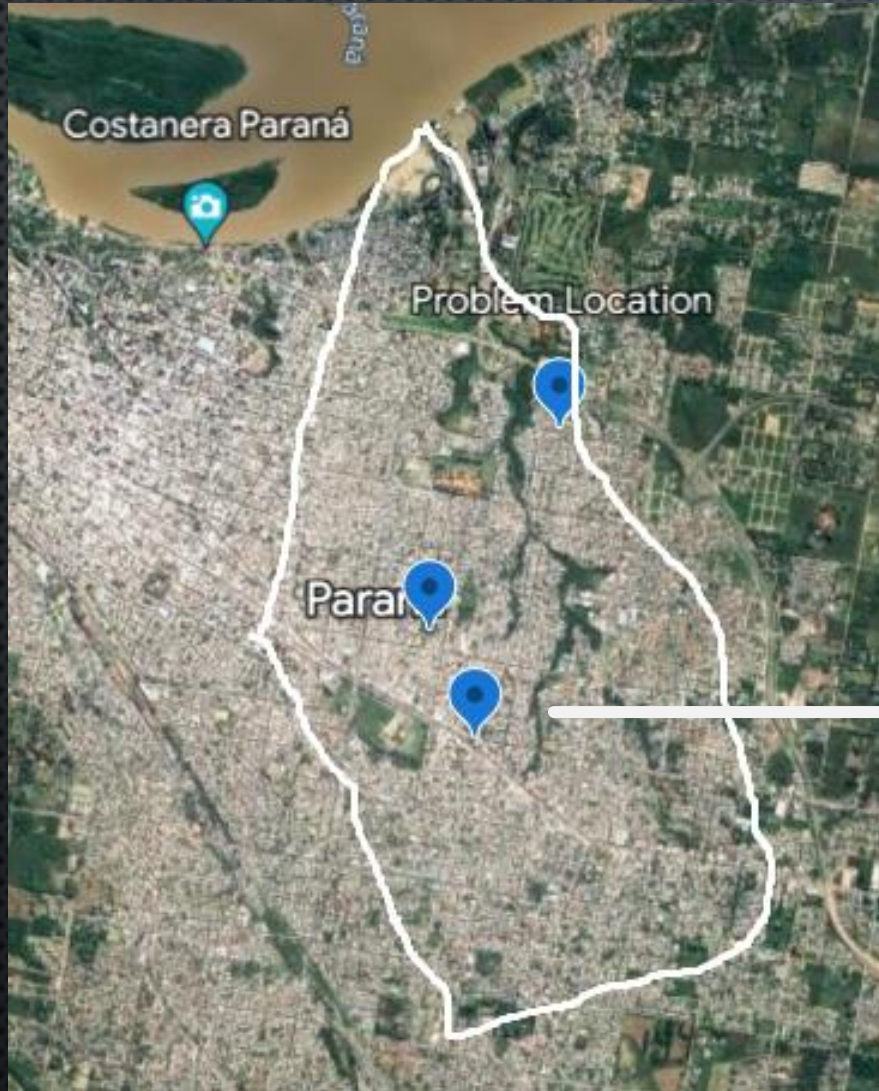
Las Viejas Stream's Basin



Characteristics

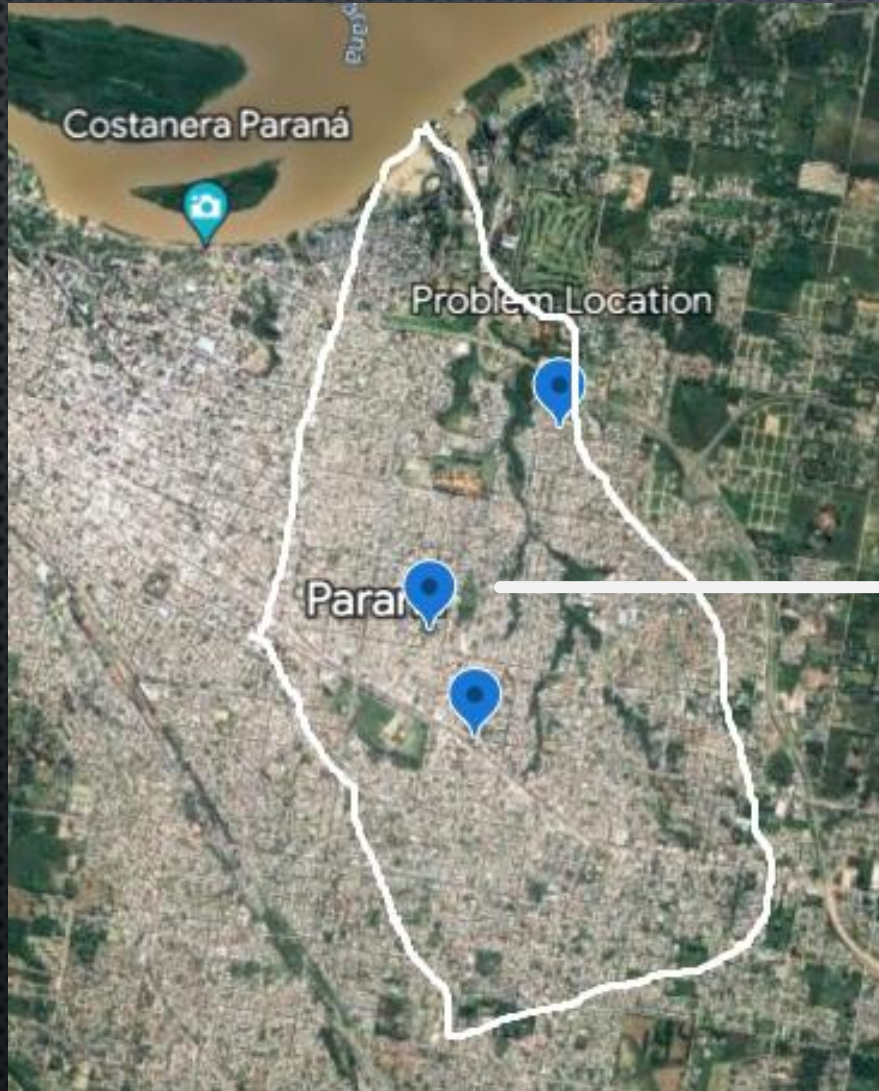
- Located in the north of the city
- Surface of 12,3 Km²

Landmarks



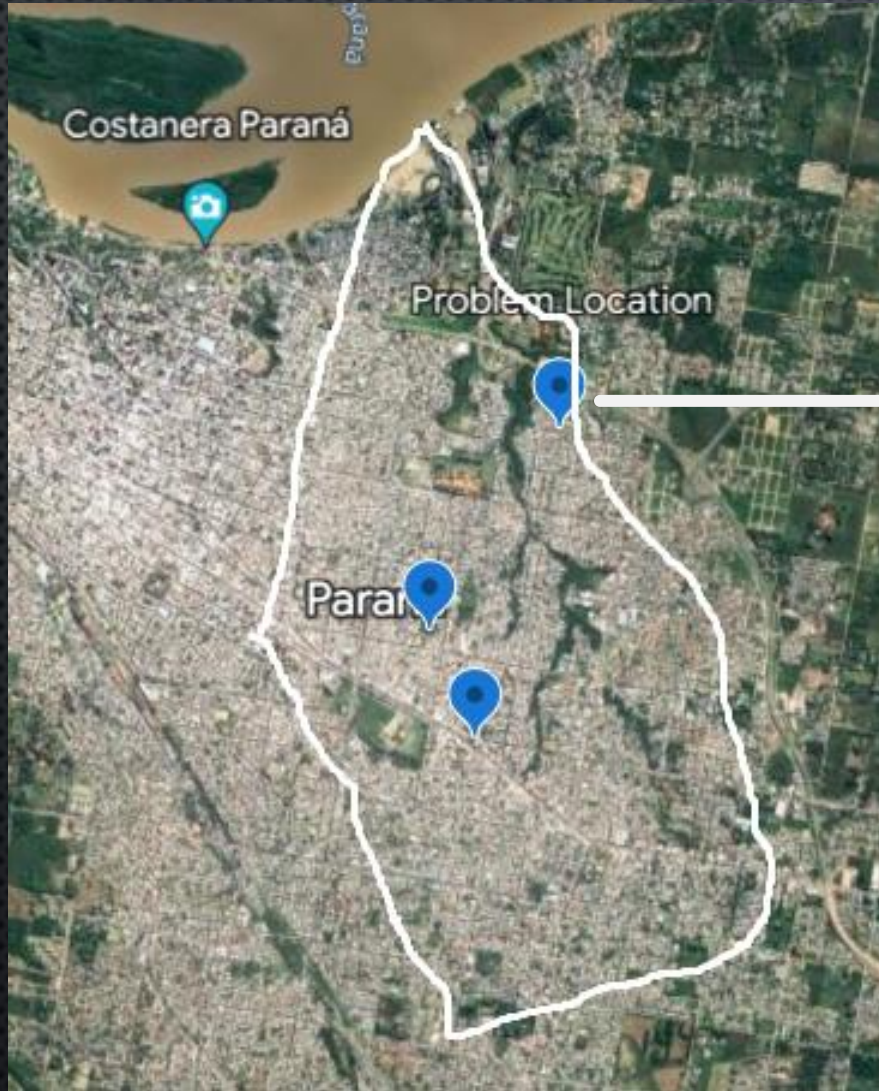
National Technological University, an important engineering university on Almafuerde Avenue

Landmarks



Presbítero Bartolomé Grella Stadium of
Atlético Patronato Club

Landmarks



Rondeau Avenue's Analyzed Section

PROBLEM DEFINITION AND ANALYSIS

PROBLEM STATEMENT

Name _____

Signature _____

Date _____

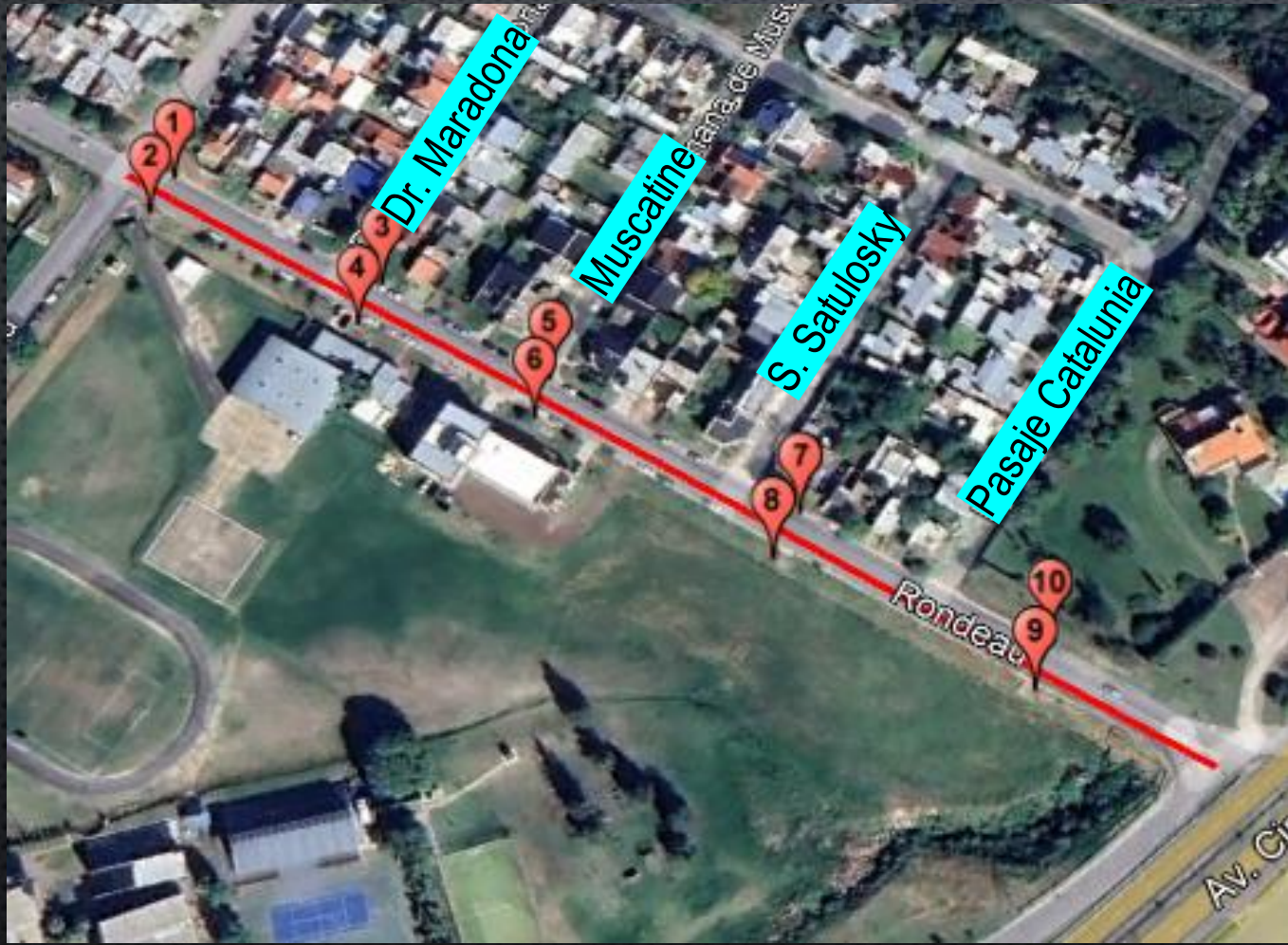
Rondeau Avenue's Analyzed Section



Characteristics

- Length of 340 meters
- Unevenness of 7 meters
- High longitudinal slope

Rondeau Avenue's Analyzed Section



Characteristics

- Drainage system integrated by 10 sumps
- Water runoff from other elevated streets when it rains



PROBLEM DEFINITION AND ANALYSIS

DESCRIPTION OF SCENES THAT HELP
PICTURE THE PROBLEMATIC SITUATION

Rondeau Avenue's Flooding



Characteristics

- The street is overflowed from side to side and also advances onto the edges of the sidewalk.

Rondeau Avenue's Flooding



Characteristics

- The water flowing from east to west, following the direction of the North access route
- Drains cannot cope with the volume of this flow.

PROBLEM DEFINITION AND ANALYSIS: DESCRIPTION OF SCENES THAT HELP PICTURE THE PROBLEMATIC SITUATION

Rondeau Avenue's Sedimentation



Characteristics

- A lot of sediments are accumulated on the asphalt after rainfall.



PROBLEM DEFINITION AND ANALYSIS

IDENTIFICATION AND ANALYSIS OF CAUSES
OR FACTORS THAT GIVE RISE TO THE
PROBLEM

Obstruction of Storm Drains



Description

- Inadequate maintenance of the stormwater drainage system
- Progressive sediment accumulation due to rain
- Three out of ten storm drains need for comprehensive unclogging

PROBLEM DEFINITION AND ANALYSIS: IDENTIFICATION AND ANALYSIS OF CAUSES OR FACTORS THAT GIVE RISE TO THE PROBLEM

Excessive Longitudinal Slope



Description

- The presence of curb opening inlet type storm drains
- Efficiency of this type of sink for longitudinal slopes less than 3%
- Existence of an area with a longitudinal slope exceeding this percentage

PROBLEM DEFINITION AND ANALYSIS: IDENTIFICATION AND ANALYSIS OF CAUSES OR FACTORS THAT GIVE RISE TO THE PROBLEM

Reduction of Absorbent Surface



Description

- Decreased water runoff due to limited absorbent surface caused by urban expansion
- Recent significant urban growth in the region

PROBLEM DEFINITION AND ANALYSIS

IDENTIFICATION AND DESCRIPTION OF THE
CONSEQUENCES

Pavement Breakage and Safety Risks



Description

- Risk to vehicular and pedestrian safety due to poor pavement grip and visibility
- Gradual pavement cracks and their increase due to traffic from floods
- Skidding risk for vehicles at the junction curve between Rondeau Avenue and Uranga Avenue



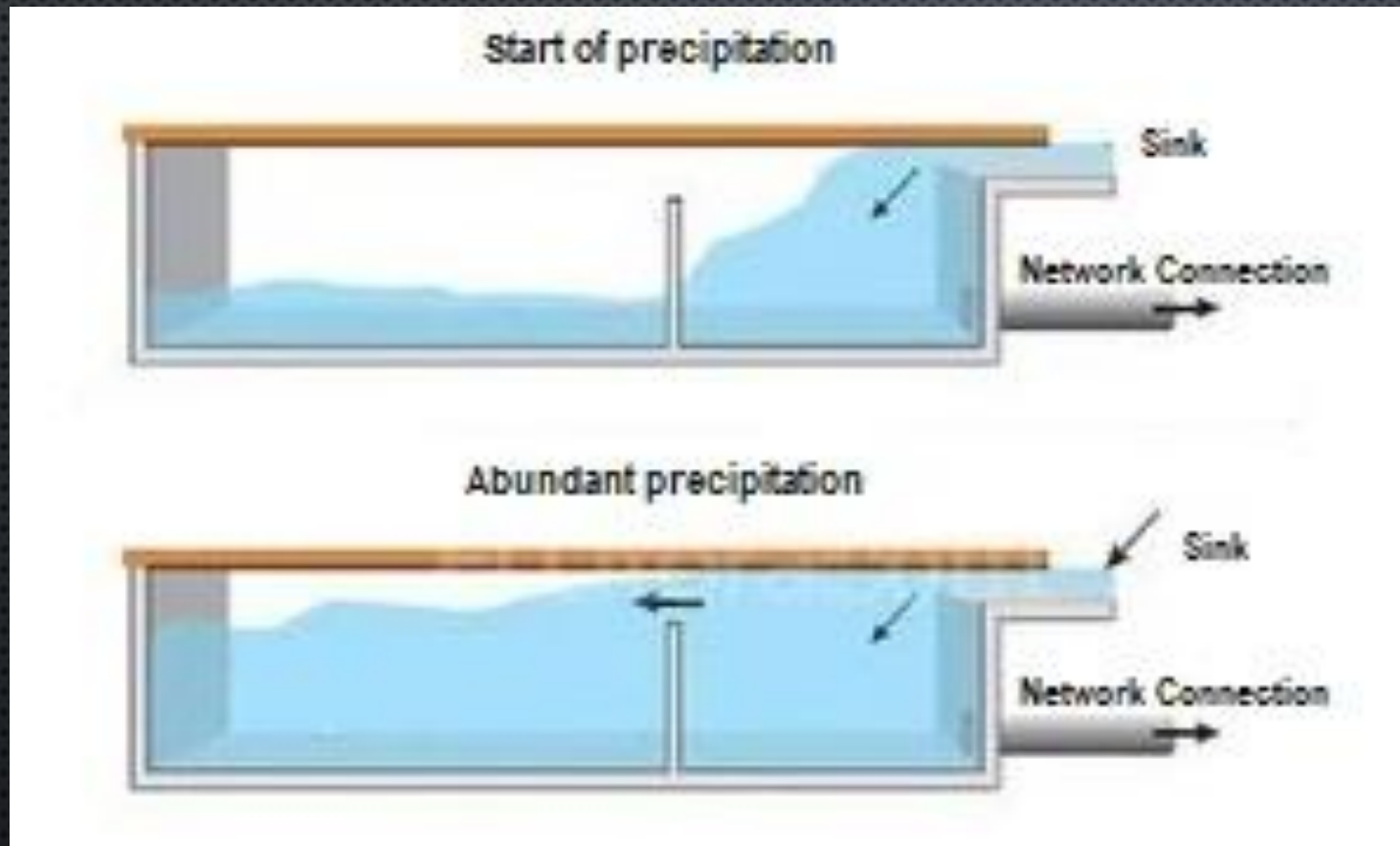
THE WAY FORWARD

PROBLEM APPROACH

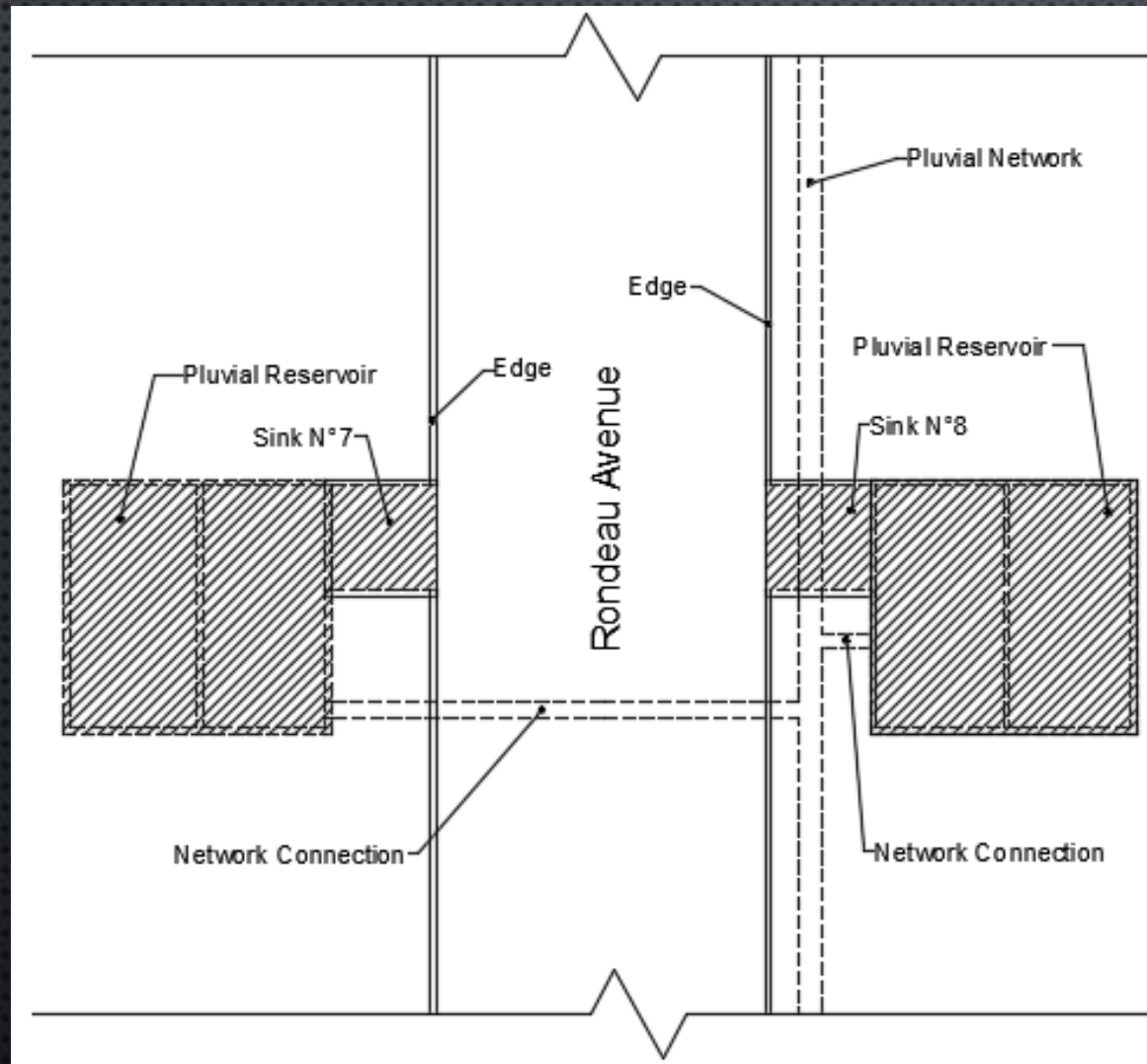
A Two-Step Approach is Required to Address the Problem

First Step

- Pluvial retarders are needed.
- These are connected directly to the storm drains and to the drain network's pipelines.
- They are divided into two compartments.



Reservoir Functioning



Sketch of a System Part on Rondeau Avenue

Previous Tasks

- Excavate the sidewalk area next to each sink hole.
- Relocate underground utility facilities.
- Assemble prefabricated concrete panels to build the reservoirs.

Proposal Second Step

- Improve the maintenance service.

THE WAY FORWARD

STRENGTHS AND WEAKNESSES OF
THE PROPOSAL

Advantages

- It is a low-complexity work.
- It is a lasting solution.

Disadvantages

Expensive tasks such as:

- Excavating the required volume of land
- Conducting necessary shoring work
- Relocating service lines

CONCLUSION

Final Statement

- The problem affects a significant percentage of the population
- Due to the lack of maintenance, pavement deterioration and risks to the safety of users are generated.
- The incorporation of the reservoir and the improvement of the maintenance service guarantee feasible and economically reasonable engineering solutions.

References

[1] *URBAN DRAINAGE DESIGN MANUAL*, 1ER. ED. FEDERAL HIGHWAY ADMINISTRATION, WASHINGTON DC UNITED STATES, 1996.

[2] ELLITORAL.COM, “RETARDADORES PLUVIALES: QUIEREN QUE EL ESTADO LOS INSTALE EN ESPACIOS PÚBLICOS.” ACCESSED: OCT. 10, 2023. [ONLINE]. AVAILABLE: [HTTPS://WWW.ELLITORAL.COM/AREA-METROPOLITANA/RETARDADORES-PLUVIALES-QUIEREN-INSTALE-ESPACIOS-PUBLICOS_0_s3YRGLLDQ0.HTML](https://www.ellitoral.com/area-metropolitana/retardadores-pluviales-quieren-instale-espacios-publicos_0_s3YRGLLDQ0.html)

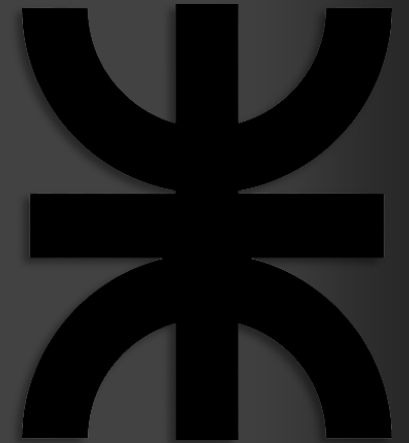
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