Storm Drainage Design for Flooding of Moscú Avenue and Barrio Los Pinos

Focus Engineering

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International Senior Design 2007

Outline

I. Introduction
II. Background
III. Existing Conditions
IV. Project Implications
V. Design Options
VI. Recommendations
VII. Benefits

Introduction

Background


SANTA CRUZ BOLIVIA
Barrio
Los Pinos
Anillos
Primer
Segundo
Tercer
Cuarto
Quinto
Sexto
Septimo
Octavo

While In Bolivia…

1. Walked project site
2. Surveyed
3. Collected soil samples

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While In Bolivia…

1. Walked project site
2. Surveyed
3. Collected soil samples

While In Bolivia…

4. Met with government officials and local residents

Flooding Along Moscú Avenue

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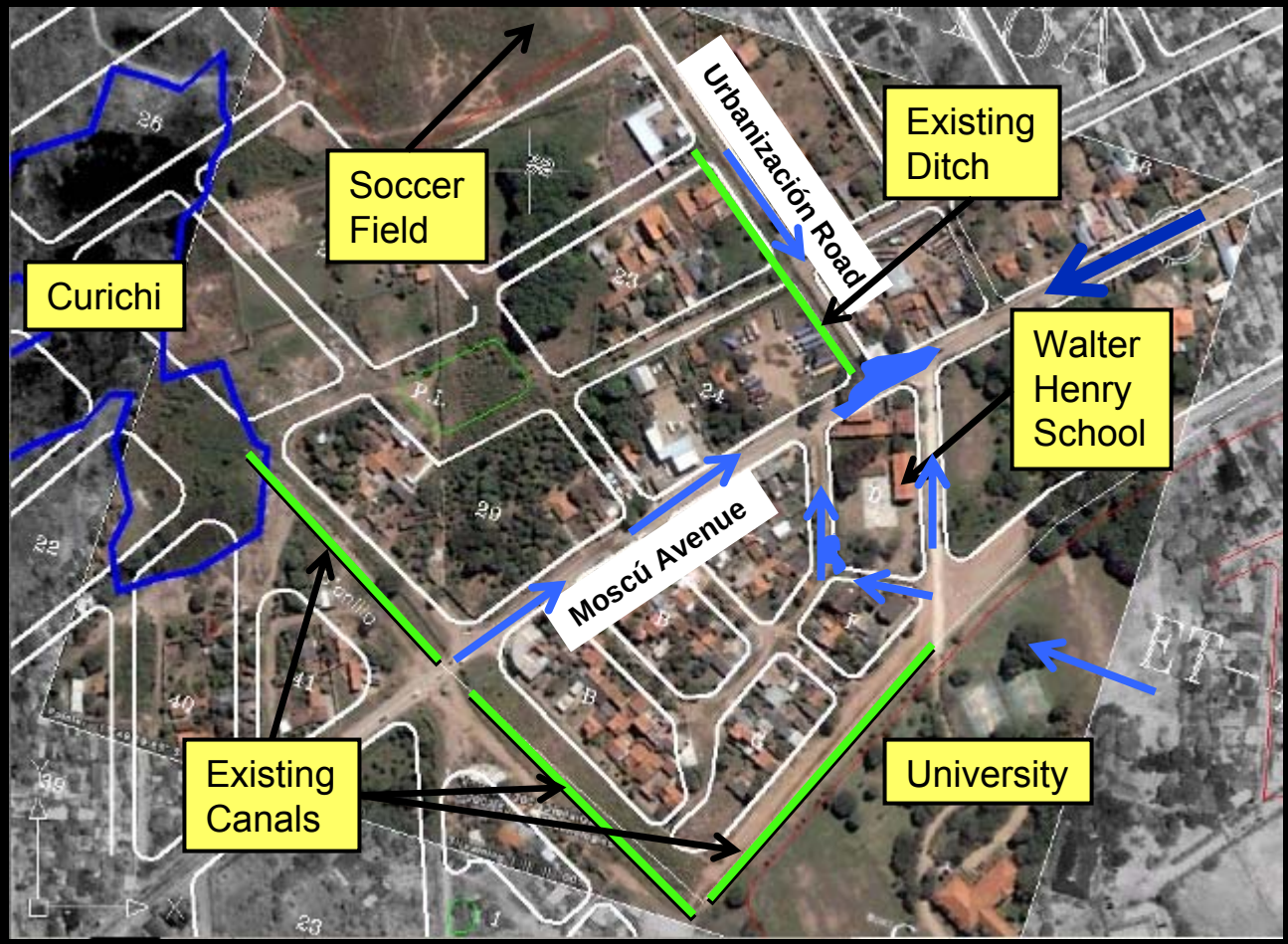
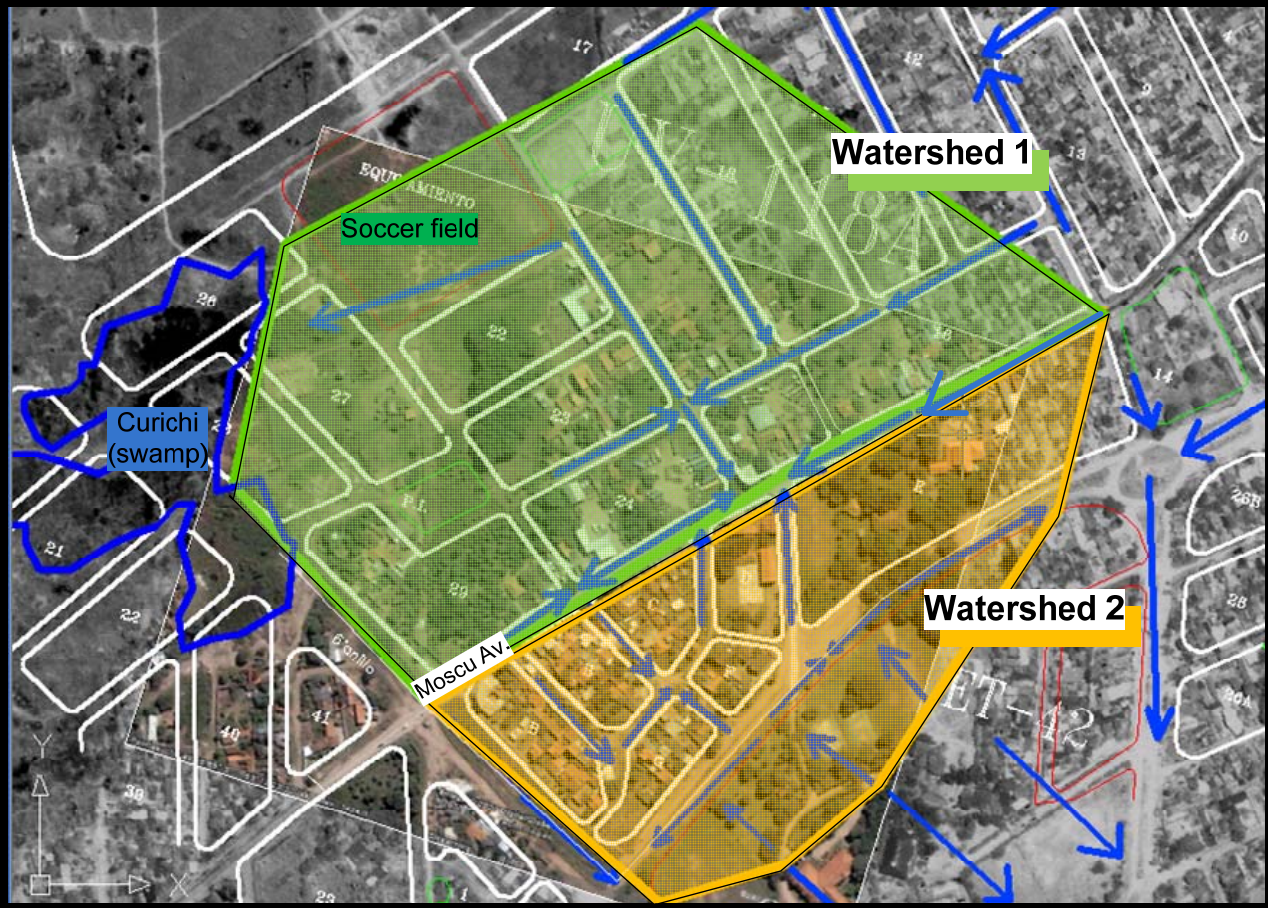
Flooding At Intersection of Moscú Avenue and Urbanización Road

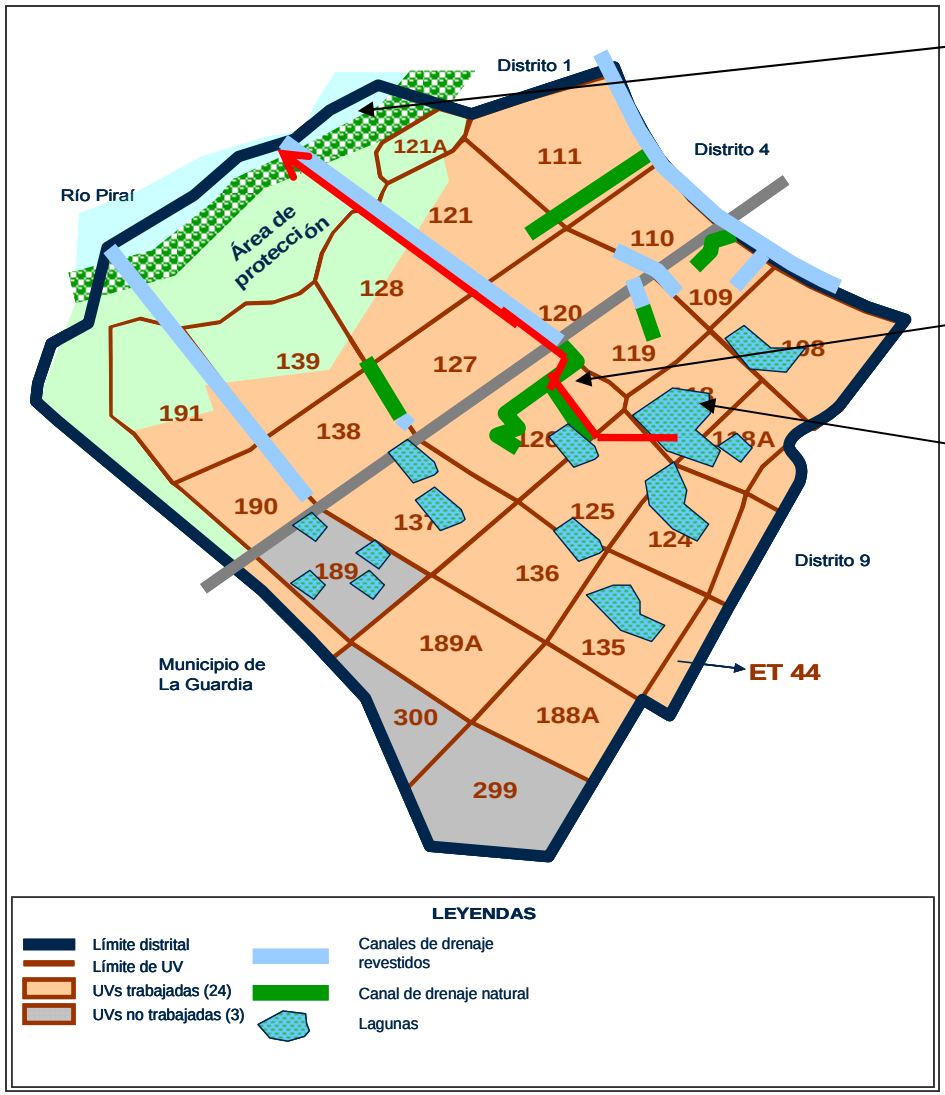
Existing Conditions



Existing Conditions



Watershed Areas and Directions of Flow



Piraí River

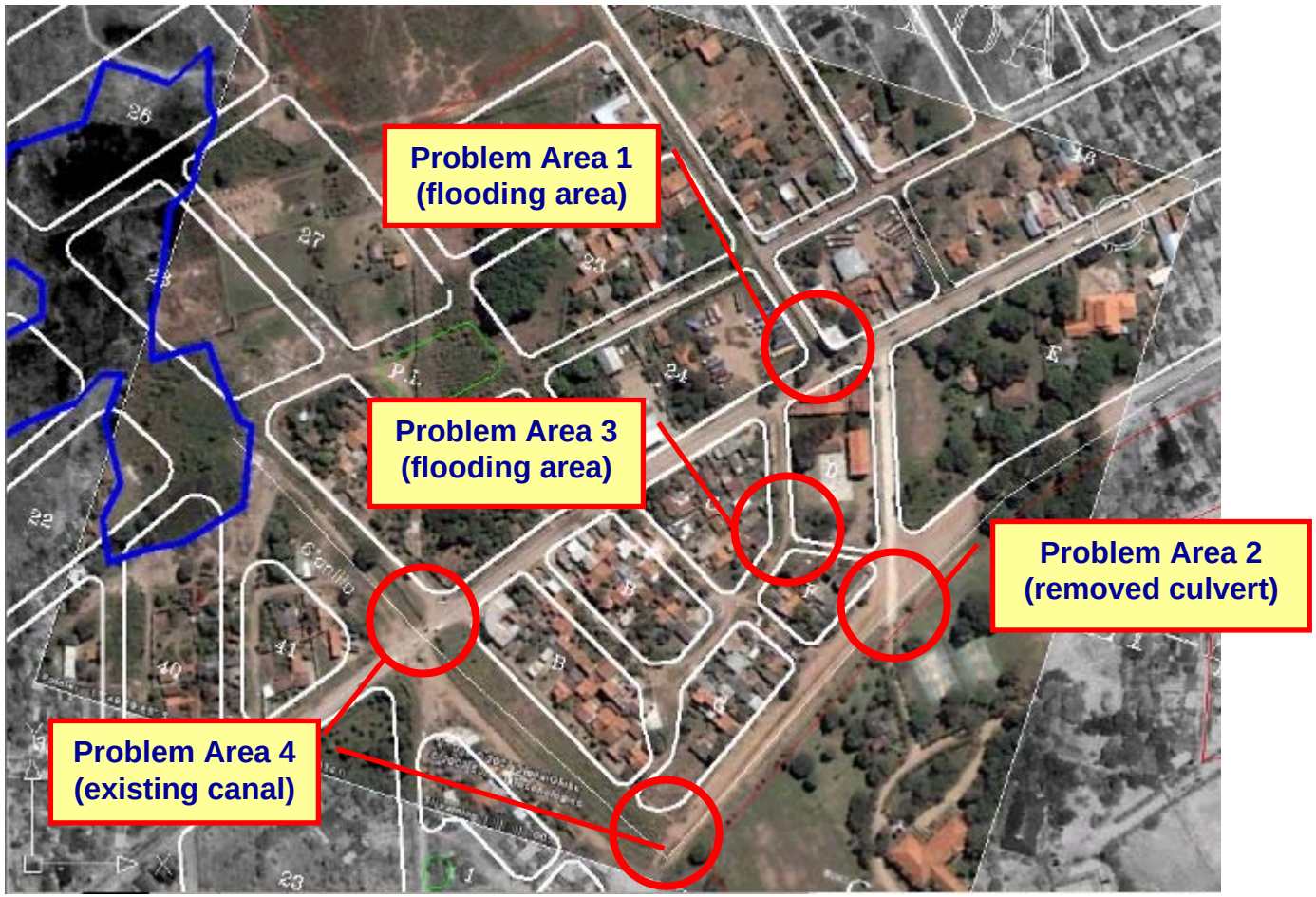
Watt's Canal

Curichi (swampy pond area)

Project Implications

- Health
- Environmental
- Economic
- Safety
- Sustainability

Problem Areas



Design Options

1 – Sump Pump

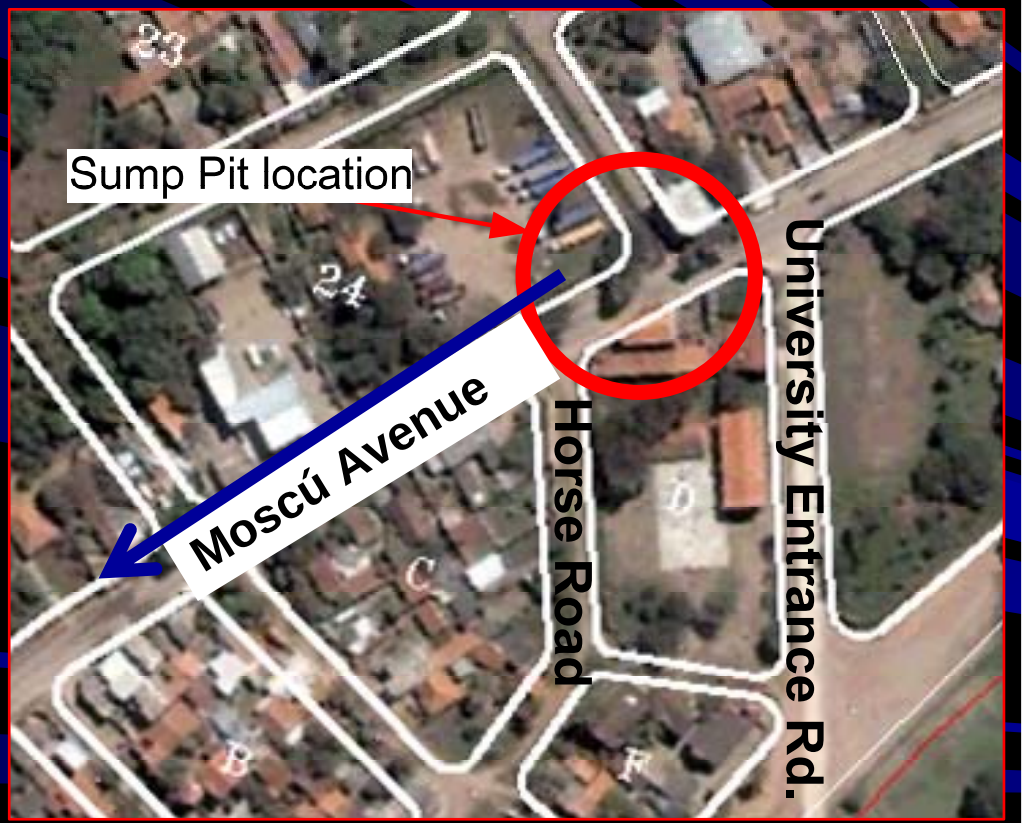
2 – Underground Storm Sewer and Earthen Canal

3 – Replace Culvert Removed in 2006

4 – Fill and Grade Horse Road

5 – Retrench Existing Canals

Design Option #1 – Sump Pump



Advantages

→Most direct route

→Minimal earthwork

→Lower initial expense

Disadvantages

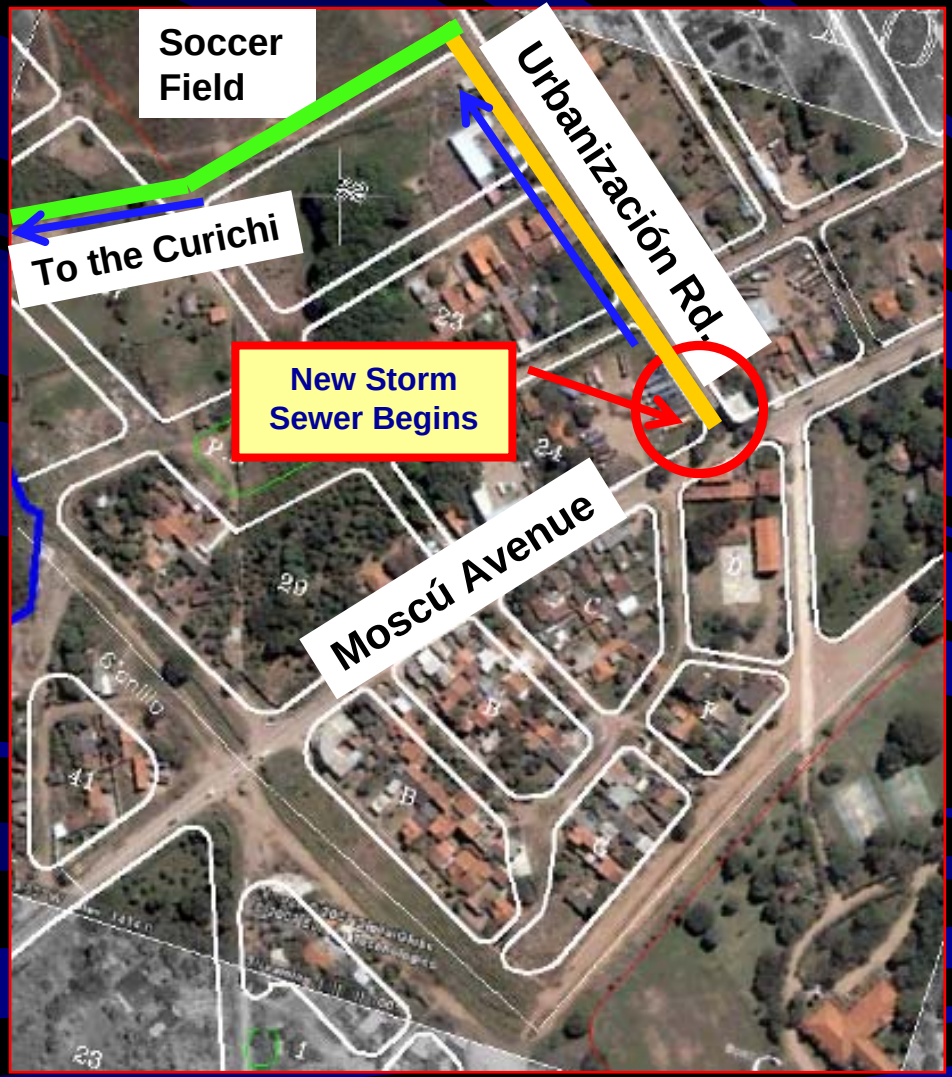
→Extensive maintenance

→Sediment causes additional upkeep

→No space

→Slow water removal rate

Design Option #2 – Underground Storm Sewer and Earthen Canal



Advantages

→Less maintenance than sump pump

→Follows typical Bolivian design

Disadvantages

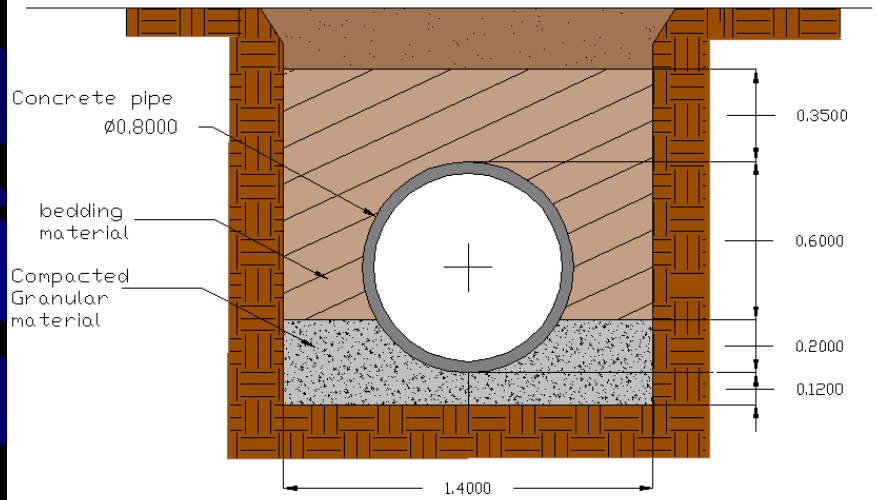
→Longer route

→More earthwork

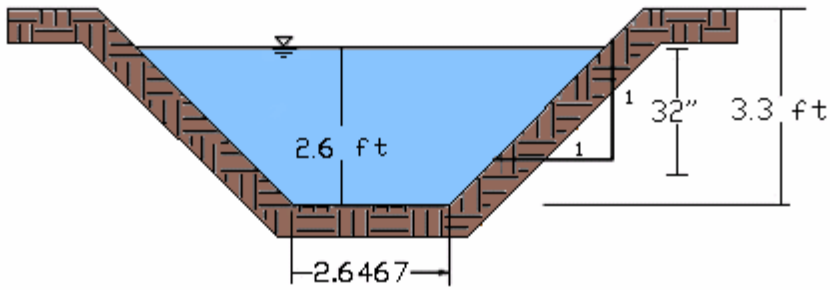
→Higher upfront costs

Design Option #2 – Underground Storm Sewer and Earthen Canal

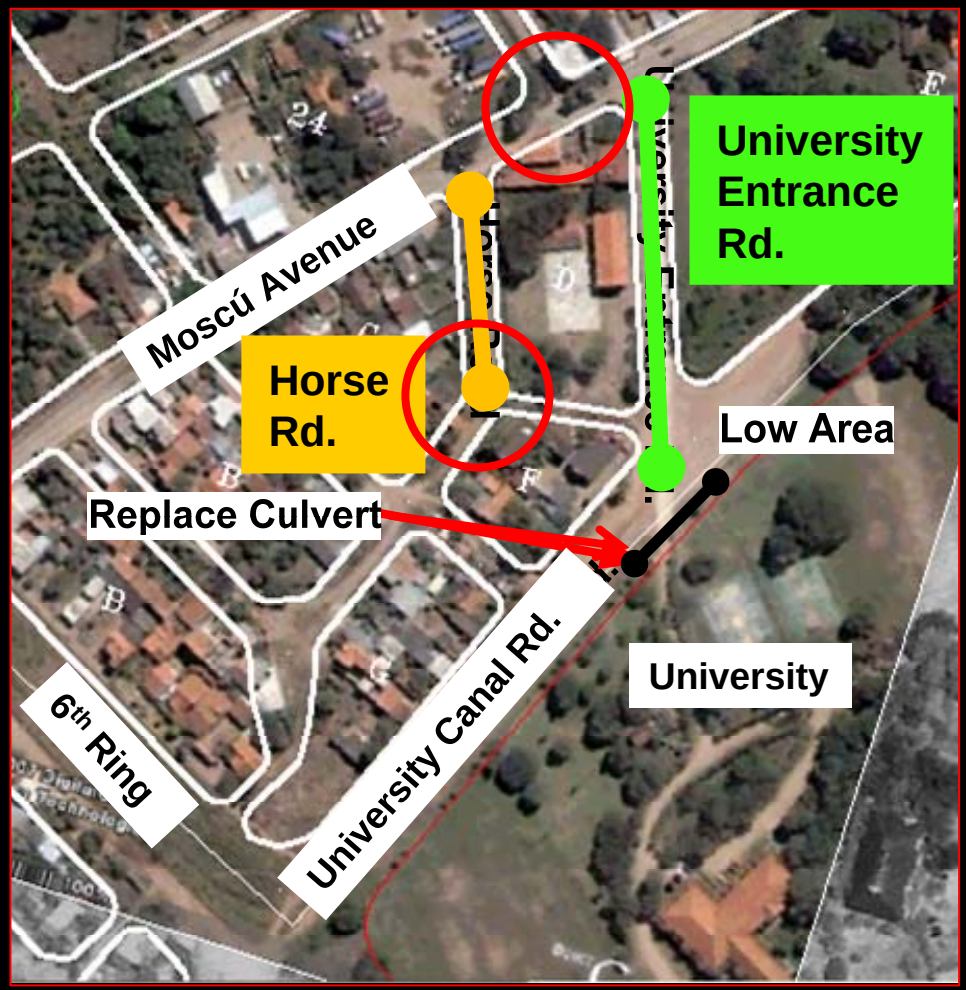
Proposed New Pipe Along Urbanización Road



Proposed New Soccer Field Canal



Design Option #3 – Add Culvert Under University Entrance Road



Advantages

→Decreases flooding

→Simple solution

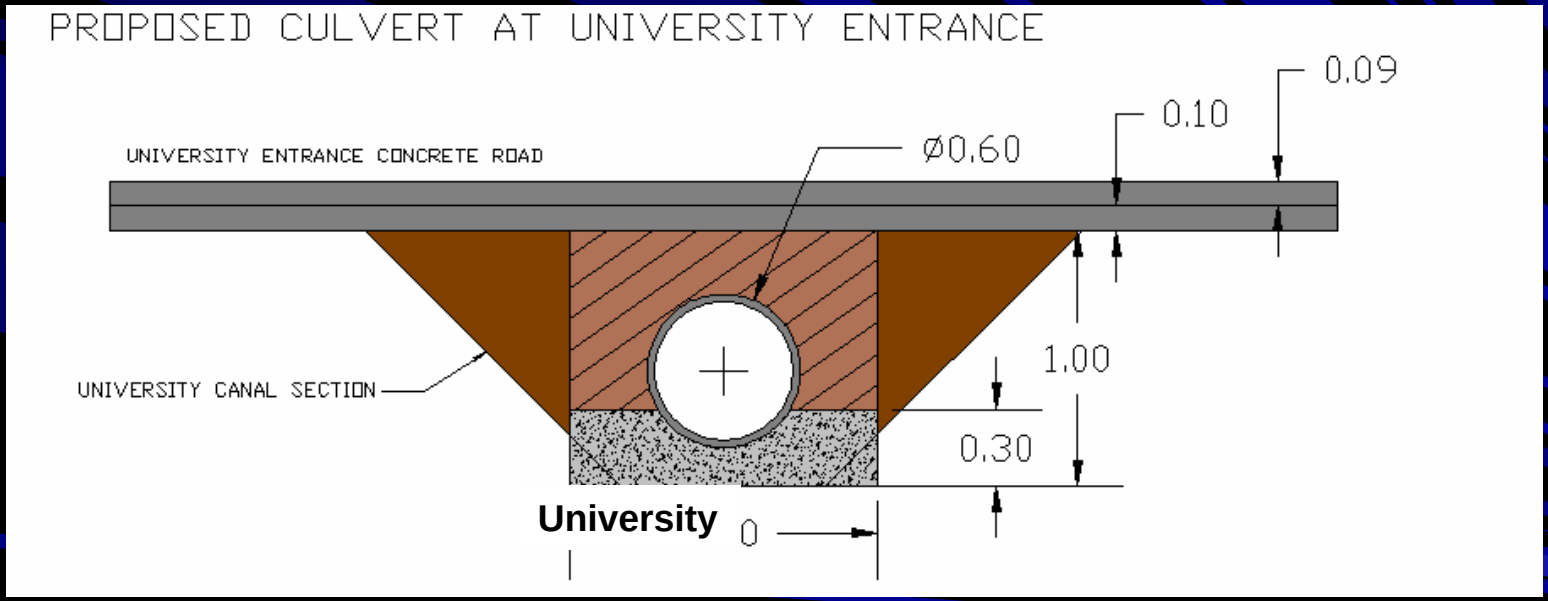
→Low maintenance

Disadvantages

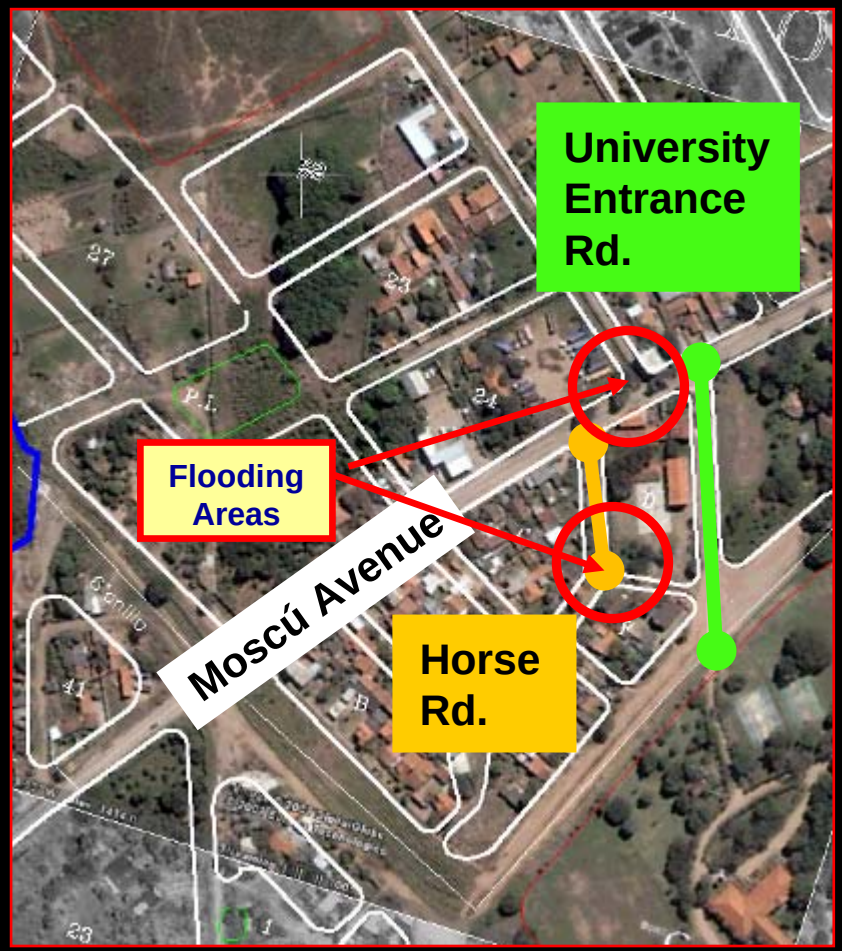
→Redoing previous work

→Paved road – costly, more work

Design Option #3 – Add Culvert Under University Entrance Road



Design Option #4 – Filling & Grading Horse Road



Advantages

→Low cost

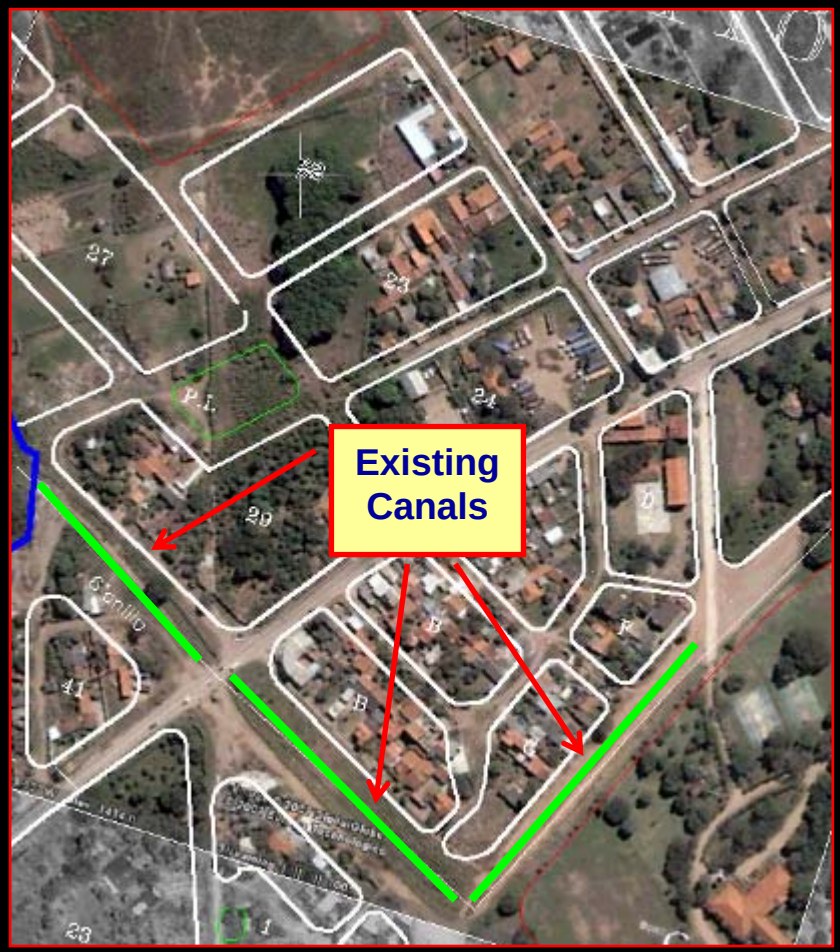
→Simple solution

Disadvantages

→Contributes more water to largest flooding area on Moscú

→Potential to create new flooding areas

Design Option #5 – Retrench Existing Canals



Advantages

→Low cost

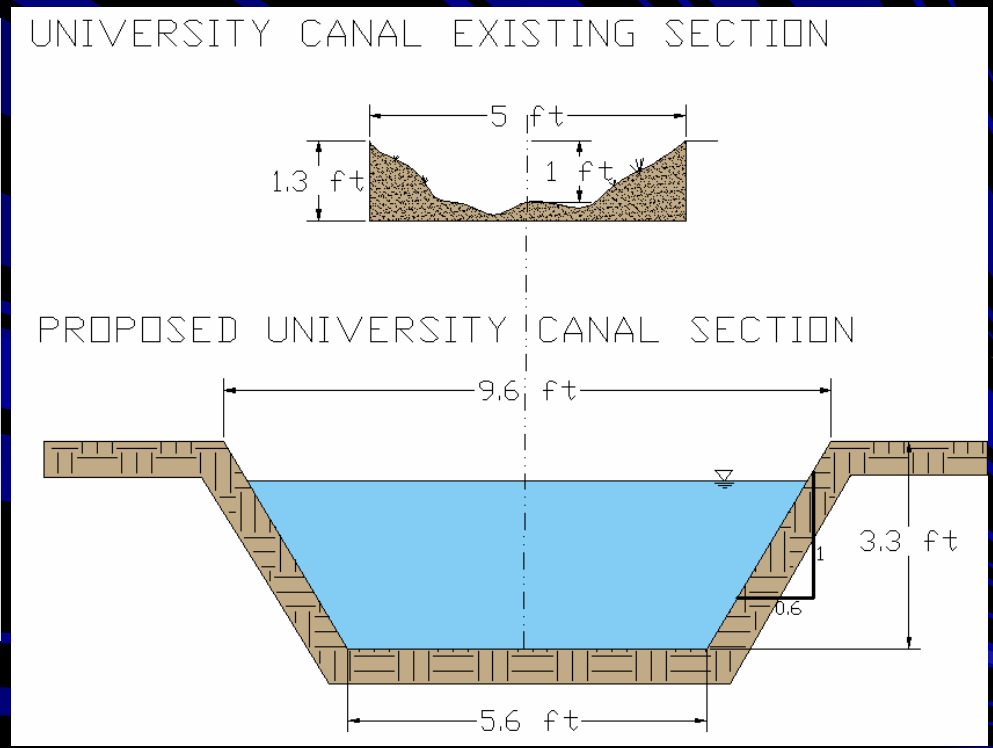
→Simple maintenance

→Canals function properly

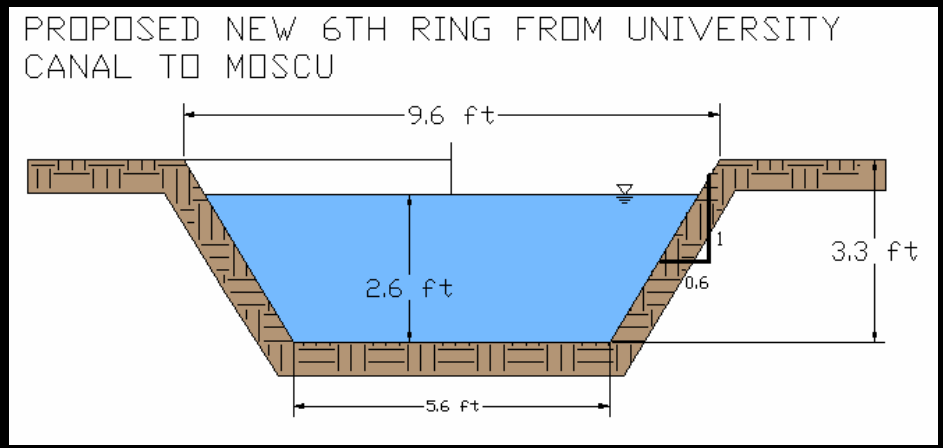
Disadvantages

→Slight cost compared to doing nothing

Design Option #5 – Retrench Existing Canals

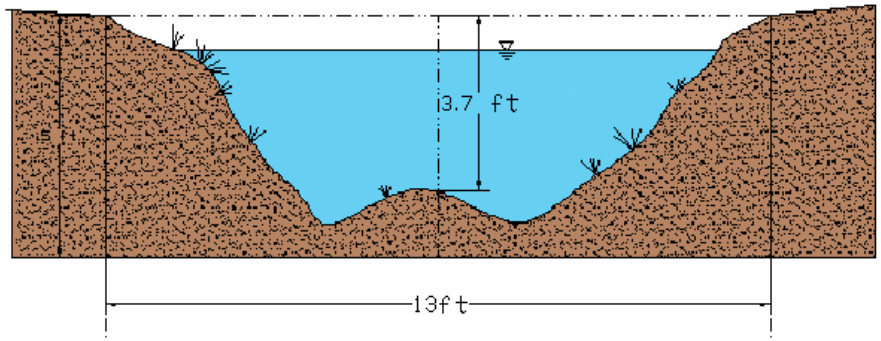


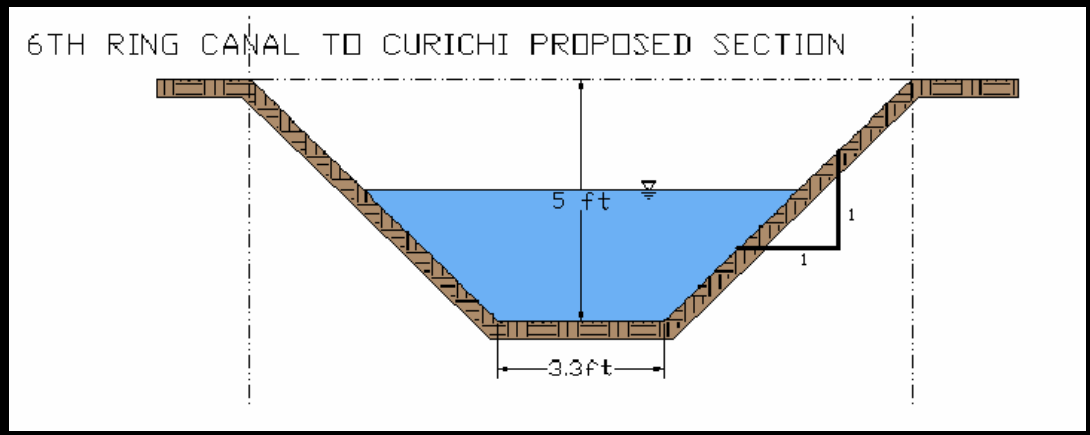
Design Option #5 – Retrench Existing Canals



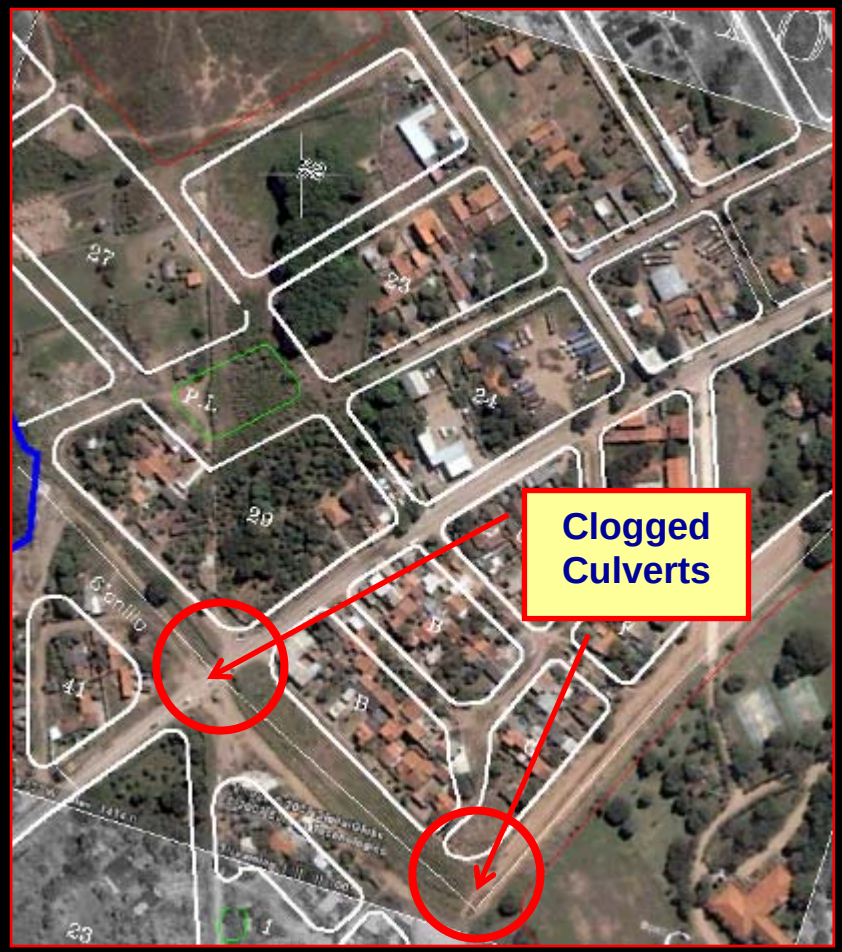
Design Option #5 – Retrench Existing Canals

6th Ring Canal to Curichi – Existing Section Type I

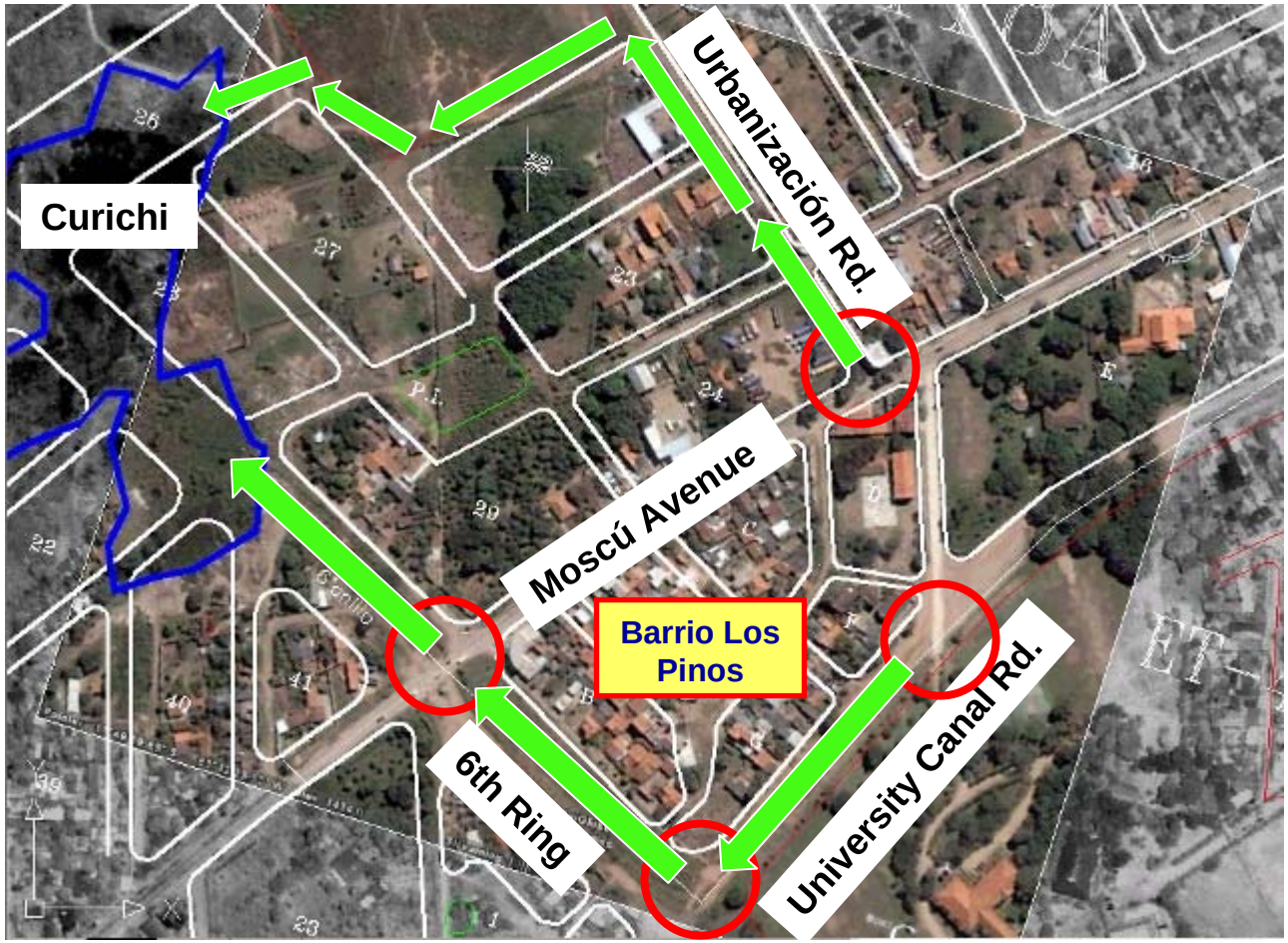




Clean Out Culverts



Recommendations



Costs

Implement Design Options

2 – Underground Storm Sewer and Earthen Canal

$86,510

3 – Replace Culvert Removed in 2006

$ 7,722

5 – Retrench Existing Canals

$18,112

AND Clean Out Existing Culverts

$156

Total Estimated Cost = $112,500

Benefits

- Eliminates Standing Water
- Less Potential for Disease
- Increases Property Values
- Increases Safety
- Allows Proper Storm Drainage

Conclusion