



Figure 1: Flooding in the market area. Currently the market is a relative low spot where water collects with no effective outlet.

Road and Drainage Project in the Los Bosques Neighborhood

2007 International Senior Design: Santa Cruz, Bolivia

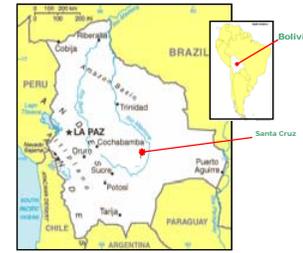


Figure 6: Location map

Problem Description

Flat terrain coupled with heavy rainfall leads to frequent flooding along the 5th Ring road. The market area within the project site is especially affected by the flooding. Standing water creates breeding grounds for mosquitoes which carry diseases such as malaria and dengue fever.

Site Description

The project site is located along the 5th Ring between Doble Via La Guardia and Radial 17.5 road.

A portion of a concrete lined canal already exists on the 5th Ring road. Only one side of 5th Ring road is paved. Culverts lead into the underground storm sewer along Doble Via and also into the earthen canal along Radial 17.5. Within the project area there is a market and multiple truck tire changing businesses.

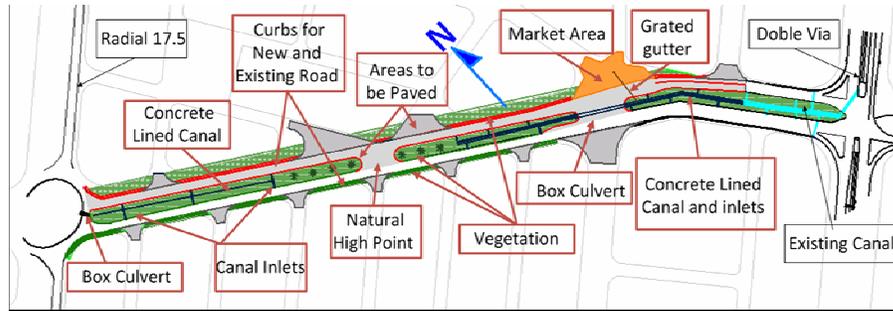


Figure 3: Recommended Design outlined in red, existing structures outlined in black

Recommended Design

- Divide drainage system at natural high point
- Construct open trapezoidal concrete lined canal
- Pave 2nd half of 5th Ring with curbs
- Install box culvert at market area and Radial 17.5
- Pave market entrance area
- Install grated gutter to drain market area
- Install sidewalks
- Pave side street entrances with curbs
- Grade side roads
- Plant vegetation within project area

Implementation Benefits

- Reduces market flooding and encourages commerce
- Reduces roadway flooding and traffic obstruction
- Sediment control prevents sediment from reaching canal
- Protects and extends lifespan of road and canal
- Improves pedestrian travel
- Reduces mosquito breeding grounds and disease occurrence

Estimated Cost: 6,042,000 Bolivianos (\$797,000 US)

Cost includes all design components, labor, and materials. To reduce cost client may choose not to implement all components, however this will reduce effectiveness. Since this major ring road project is integral to the overall city drainage plan, it is recommended that all design components be implemented.

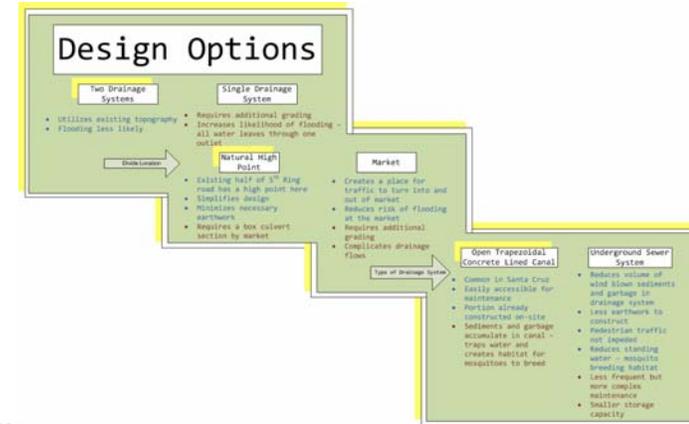


Figure 4: Trucks and tire piles in project area. Heavy truck traffic and market activities have created uneven terrain that traps water.



Figure 5: Existing canal during rainy season.



Figure 2: Culvert leading from existing canal to Doble Via. Regular cleaning of the existing and proposed canals is essential for proper functioning.



Figure 7: Kids within project area

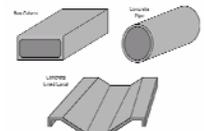


Figure 8: Possible drainage structures

Project Implications

- Reduced storm water infiltration
- Contributes to urban heat island effect
- Regular maintenance is essential
- Sediments not removed from storm water



Figure 9: Mosquitoes and other insects which breed in stagnant waters carry illnesses such as malaria. Reducing this hazard is a primary motivation for improving drainage.

