Introduction

Who?
- Wild West Engineering (WWE)

What?
- International Senior Design Team

Where?
- Santa Cruz, Bolivia

When?
- July 26th – August 5th

Why?
- Alleviate flooding and improve living conditions
Outline

- Background
- Existing Conditions
- Methods
- Design Options
- Recommendation
- Benefits
- Conclusion
Background

Santa Cruz

Bolivia

Flamingo Neighborhood
BOLIVIA

- Politics
- Economy
- Education
SANTA CRUZ

La Flamingo Neighborhood
FLAMINGO NEIGHBORHOOD

- Dense Population
- Residential Area
- Flooding
  - Up to 2 feet
  - Bacteria/Mold Growth
  - Mosquitoes
Existing Conditions

Doble via La Guardia

5th Ring Canal & Road

Flamingo Ave

San Martin
Flamingo Avenue
CONCRETE CANAL ALONG SAN MARTIN
EARTHEN CANAL ALONG SAN MARTIN
5th Ring Canal

Doble via La Guardia

Flamingo Ave
5th Ring & 16.5 Road Intersection
Preparations

- Pre-trip
  - Research
  - Meetings
  - Professional Mentors

- In Bolivia
  - Meetings with Officials
  - Toured Neighborhood
Surveying

- Topcon Total Station
- Cross Sections
- Saguapac
Soil Analysis

- Soil Samples
- Hydrometer
Watershed and Design Flow

- Watershed Boundaries
- Calculations
  - Rational Method
  - Manning’s Equation
- AutoCAD Civil 3D
Design Options

- Paving Flamingo Avenue
- Redesign 5th Ring Canal
- Water Drainage
Flamingo Ave Proposed Cross Section

9 Meters
Flamingo Avenue Pavement Option - Asphalt

- **Advantages**
  - Less Expensive to Place

- **Disadvantages**
  - Uncommon
  - Maintenance
  - Not used for Avenues
Flamingo Avenue
Pavement Options - Concrete

Advantages
- Common for avenue construction
- Longer Life
- Appearance
- Preference

Disadvantages
- More expensive
5th Ring Canal

Existing Cross Section

Proposed Cross Section
Drainage Design

5th Ring Canal

Flamingo Ave
Curb and Gutter

**Advantages**
- Common Design

**Disadvantages**
- Mosquitoes
- Sediment
- Garbage
- Difficult to Clean
Box Culvert Design

**Advantages**
- Grate limits debris
- Simple Design
- Easily cleaned
- Grate is a large inlet

**Disadvantages**
- Sediment could enter the system
Curb Inlets

**Advantages**
- Simple Design
- Easily Maintained
- Large water flow
- Common Design

**Disadvantages**
- Sediment & Debris in system
Flooding Areas

Flamingo Ave

Flooding Area C
Final Recommendations

- **Pave Flamingo Avenue**
  - **Cost** - $121,200 USD

- **Rehabilitate 5th Ring Canal**
  - **Cost** - $18,200 USD

- **Install curb inlet along 5th Ring Canal**
  - **Cost** - $1200 USD

- **Use excess cut to fill areas B and C**
PROJECT BENEFITS
Conclusion

- Appropriate sustainable solution
- Easily maintained
- Alleviated storm water flooding
- Improved transportation
- Reduced health risks
THANK YOU!!!

Linda Phillips
Dennis Magolan
Marilyn Phillips
ISD Mentors
Other ISD students
Our friends & family

We couldn’t have done it without you!
Questions are guaranteed in life; Answers aren't.