

Stormwater Harvesting in the Santa Cruz Tributaries of Nogales, Sonora (tentative MA thesis project)

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Hans Huth (ADEQ)**



Flooding in Nogales, Sonora



Infrastructure Damage and Garbage dispersal resulting from floods



Wash Tunnel Damage results in stormwater infiltration and sediment clogging of International Outfall Interceptor (sewage conveyance).



Photo from IBWC

El Tecnologico Wash Erosion

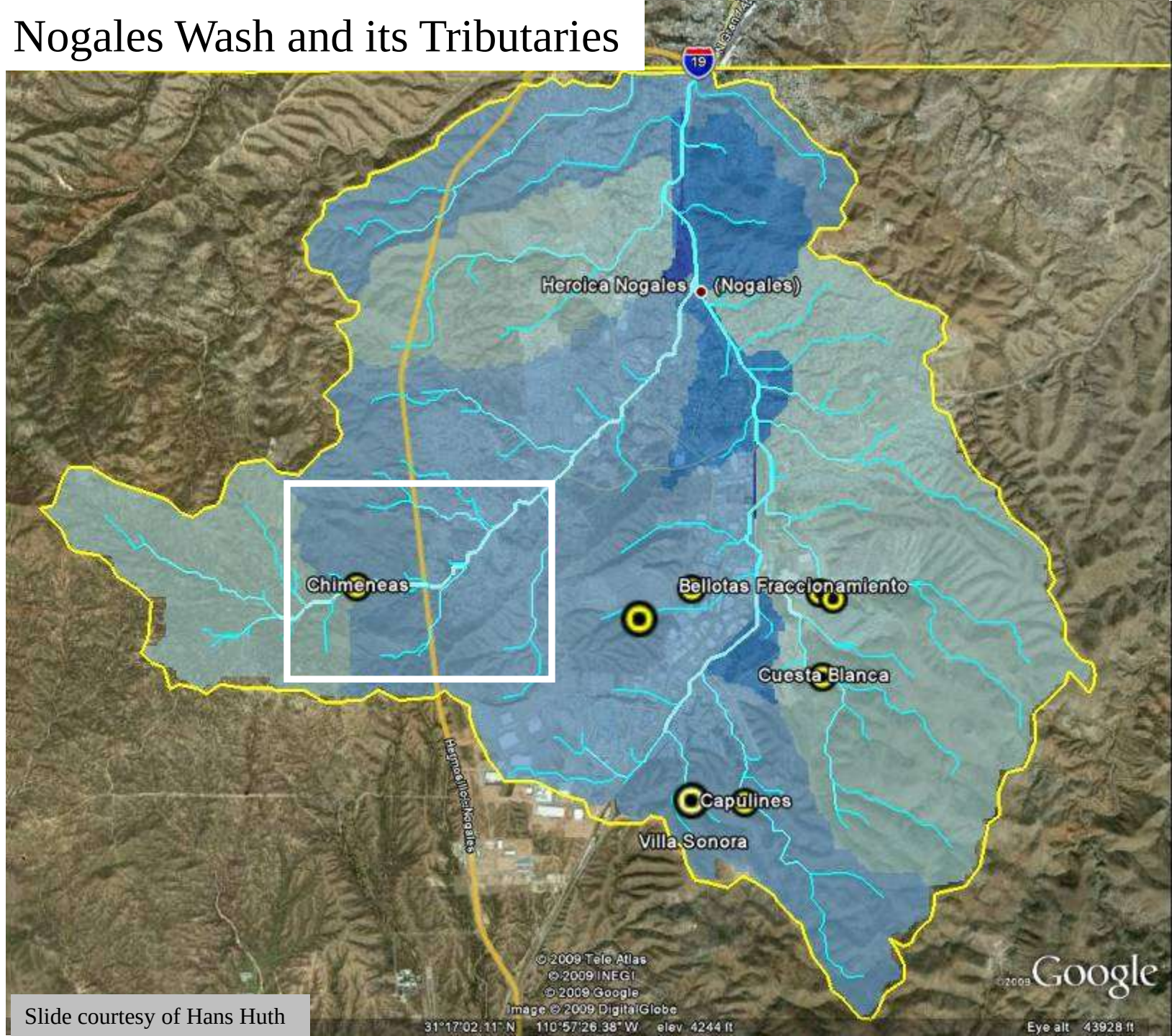


Photo courtesy of Hans Huth

These gabion structures (5 total) were put into place in 2008 and 2009 (and are still being constructed) in order to slow stormwater flows and allow more water infiltration into the floor of the earthen washes.



Nogales Wash and its Tributaries



Work Site- Chimeneas Detention Feature and Downstream Residential Flood Zones, Southwestern Nogales, Sonora, Mexico

CHIMENEAS

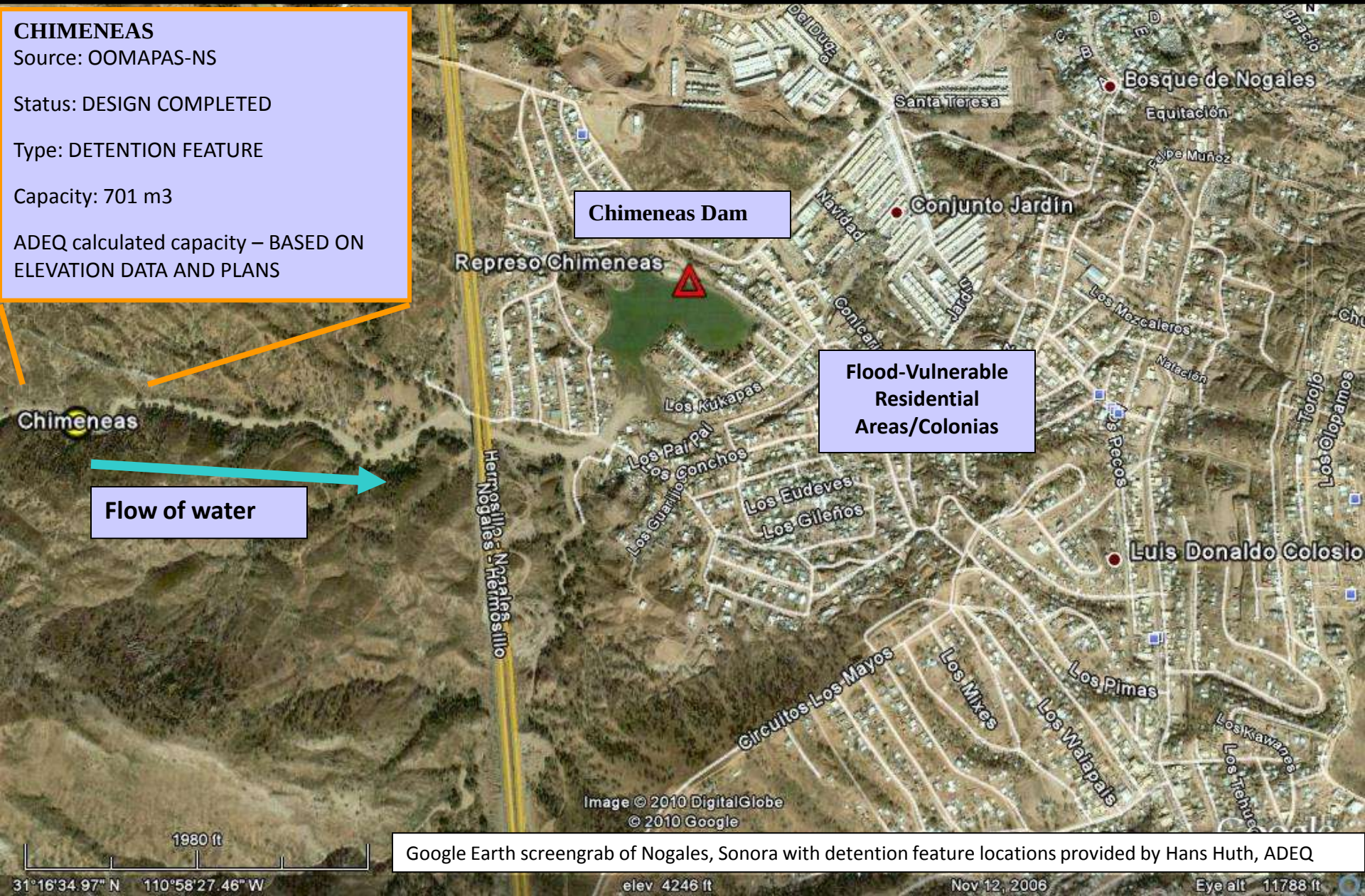
Source: OOMAPAS-NS

Status: DESIGN COMPLETED

Type: DETENTION FEATURE

Capacity: 701 m³

ADEQ calculated capacity – BASED ON ELEVATION DATA AND PLANS



Chimeneas Detention Basin Assessment

Tentative Master's Research, Summer 2010-Spring 2011

Purpose:

1. Determine to what degree the detention structure is impeding flow by comparing a) hydrographs from models of unimpeded flow with b) hydrographs from measurements of downstream flow under monsoonal storm precipitation conditions.
2. Calculate approximate infiltration of stormwater and predicted groundwater recharge based on field measurements.
3. Create a map of modeled flood zones in nearby colonias to compare with the modeled flooding before the detention basin was put in place.

1. Past v. Present Peak Flows

- Take on-site measurements to calibrate USGS models: GPS waypoint gathering, soil infiltrometer measurements, and physical measurements of detention feature.

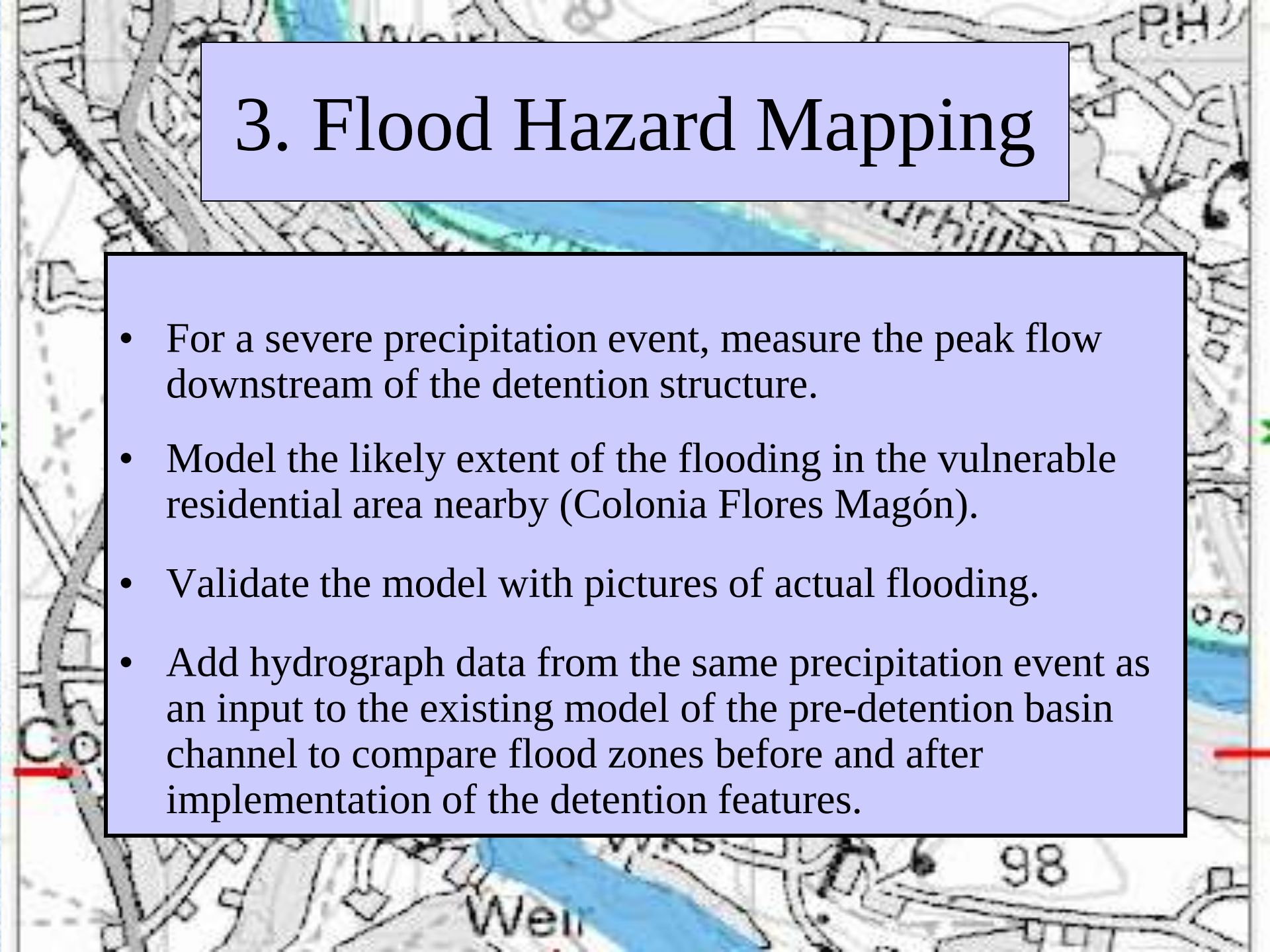
EXAMPLE INPUTS

BASIN NAME	Location of Dam		Description of Dam		Basin Characteristics			
	Easting or x-coord	Northing or y-coord	Outflow structure description	Dam Dimensions	Basin Depth at Dam (ft)	Top Surface Area (acres)	Bottom surface area (acres)	Calculated Detention Storage (acre-ft)
Chimeneas			3-18"dia tubes at 2 ft above ground surface, plus one 10m x 1m spillway	25 ft wide x 15 ft high	19.69	2.6	0.72	19.58

- Use a current meter to measure peak flow/discharge downstream of the barrier.
- Create a hydrograph
- Compare hydrographs from current meter readings and from the modeled arroyo flow without the detention feature.

2. Stormwater infiltration, groundwater recharge

- Use a Soil Infiltrometer to determine hydraulic conductivity, then plug values (wet/dry) into Green Ampt equation to predict how much infiltration takes place.
- Use a tripod and camera (with waterproof casing) to take timed pictures every minute to see the stage of the water behind the barrier.
- Use rain gauges with dataloggers to record precipitation intensity every 5 minutes for model inputs.
- Volumes can then be compared to field measurements and model predictions of runoff, infiltration, and evaporation.

The background of the slide is a map. It shows a river flowing horizontally across the upper middle. To the left of the river, there are several buildings and a road. To the right, there are more buildings and a road. The map is in grayscale, with the river highlighted in blue. There are some labels on the map, such as 'Well' and '98'.

3. Flood Hazard Mapping

- For a severe precipitation event, measure the peak flow downstream of the detention structure.
- Model the likely extent of the flooding in the vulnerable residential area nearby (Colonia Flores Magón).
- Validate the model with pictures of actual flooding.
- Add hydrograph data from the same precipitation event as an input to the existing model of the pre-detention basin channel to compare flood zones before and after implementation of the detention features.

Significance

- These detention features have not yet been studied on the ground (to my knowledge); this will be their inaugural test during Monsoon Season 2010.
- This research could be helpful in Emergency Flood Response Planning
- The stormwater infiltration measurements will contribute to the body of knowledge on the water balance of Nogales, Sonora
- My field measurements will help calibrate models and provide data for engineers who may improve the design of these or other planned detention features.