

FLOOD PLAIN MODELING: A TOOL FOR SUSTAINABLE INFRASTRUCTURE DEVELOPMENT AND PLANNING

Carlneus Johnson and Christopher Burgess

JIE Caribbean Infrastructure Conference, September
22, 2011



Floodplain Mapping as a Tool for
Development Planning



Outline

1. Meteorology
2. The Issues
3. Development Planning
4. Setting Elevations of Critical facilities and minimum floor levels
5. Potential development Impacts
6. Assessing Infrastructure Needs
7. Summary and Recommendations

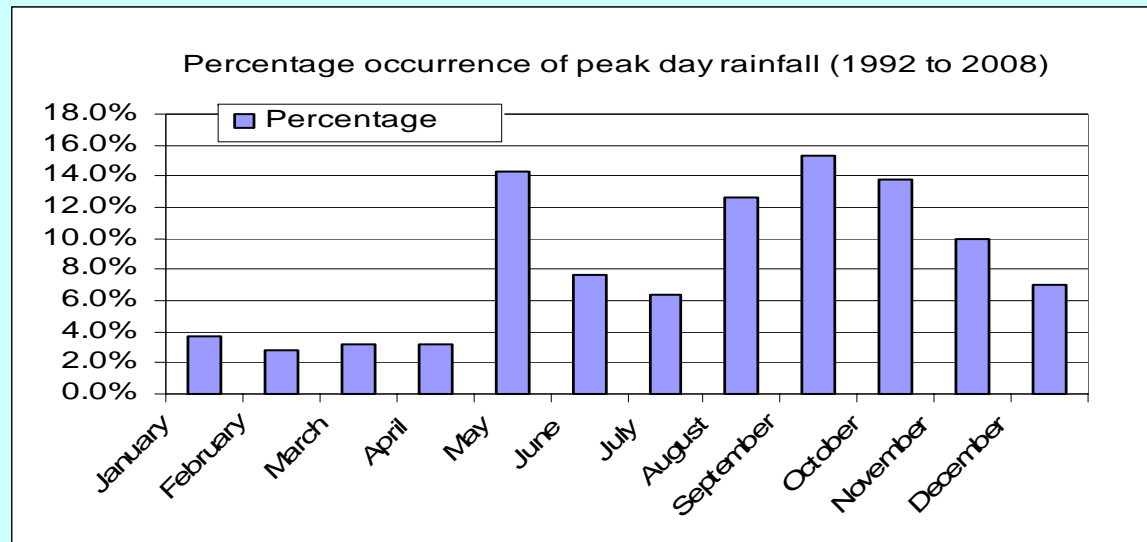


Meteorology

There are two distinct rainy seasons

- 1) May – June (early)
- 2) September – November (late)

Month	Percentage occurrence of peak day rainfall (1992 to 2008)	Wet season summary
January	3.7%	
February	2.9%	
March	3.2%	
April	3.2%	
May	14.3%	
June	7.7%	22.0%
July	6.4%	
August	12.6%	
September	15.3%	39.0%
October	13.8%	
November	10.0%	
December	7.0%	



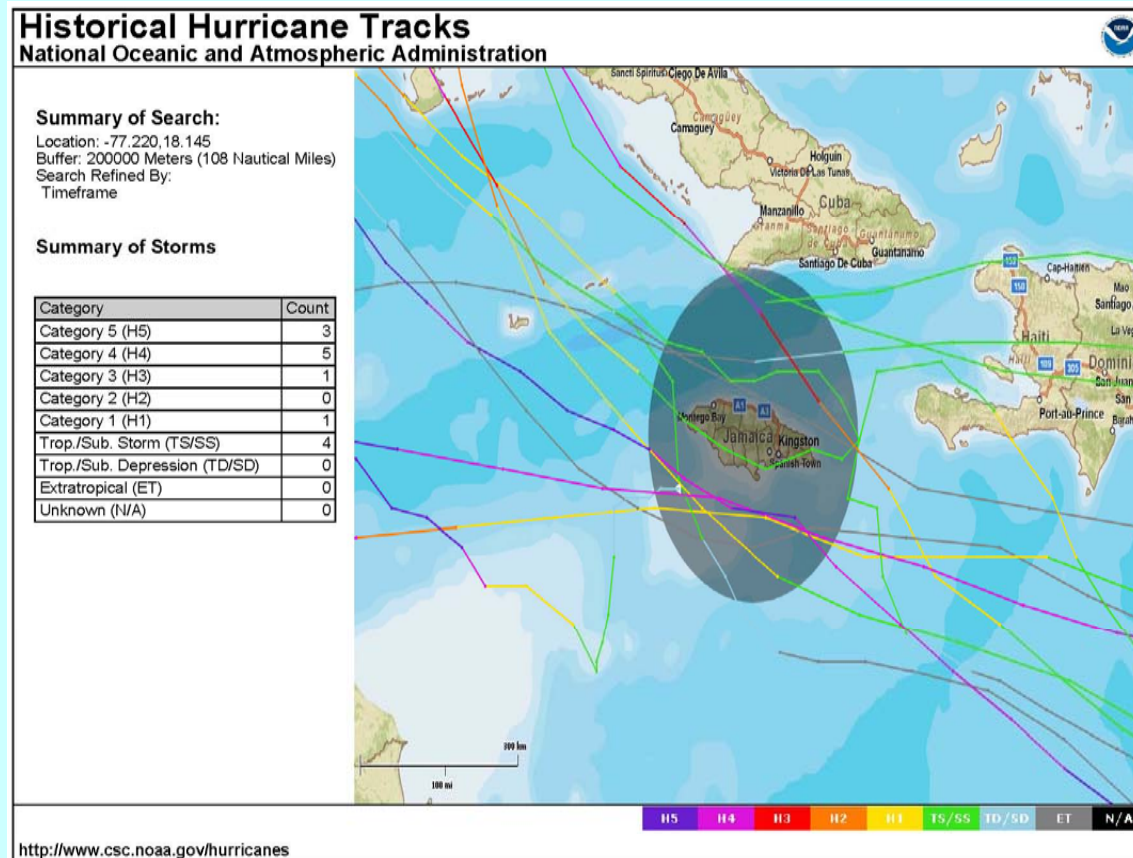
Meteorology

Rainfall and Hurricanes:

- Hurricane season: June 1 to November 30
- Fourteen of these systems have passed within 100km of Jamaica from 2001 to 2010
- Hurricane and tropical systems have resulted in major flooding events. Such as:
 - May 22 to June 7, 2002 (Weather system)
 - September 2002 (Hurricane Isidore and Tropical Storm Lili)
 - September 10 to 12, 2004 (Hurricane Ivan)
 - October 15 to 18, 2005 (Hurricane Wilma)
 - August 19, 2007 (Hurricane Dean)
 - August, 2008 (Hurricane Gustav)
 - October, 2010 (Tropical Storm Nicole)



Meteorology



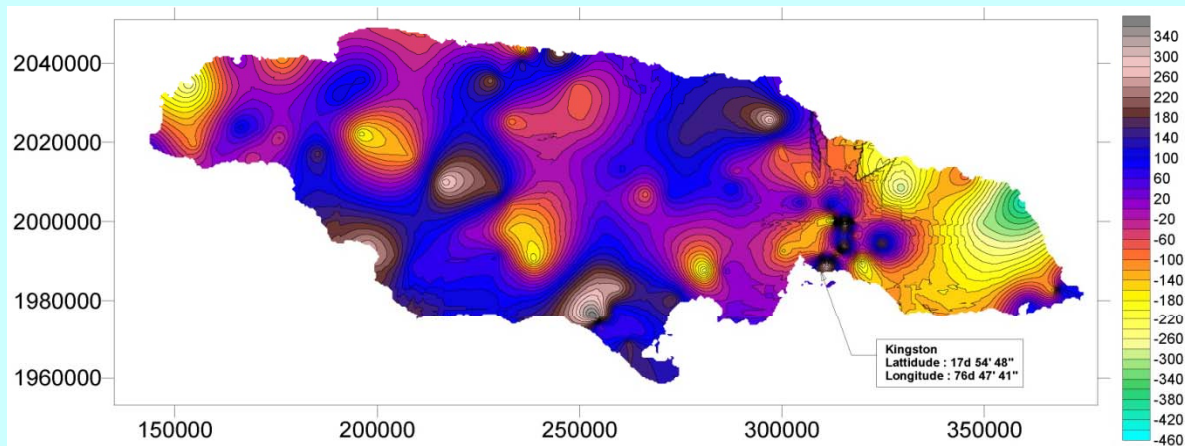
Floodplain Mapping as a Tool for
Development Planning



Meteorology

Climate Change:

- Events are becoming more intense (analysis of 1930-1980 rainfall data in comparison to 1992 to 2008). Therefore more flooding likely



Difference (mm per 24 hours) between the 1930-1988 and 1992 to 2008 24-hours Extreme rainfall intensities for the 100 Year Return Period Event

Minimum recommended increase in intensity per decade for 24 hour extremes

	Return Period					
	2	5	10	25	50	100
Increase per decade	5.6%	2.7%	1.2%	1.0%	1.0%	0.7%



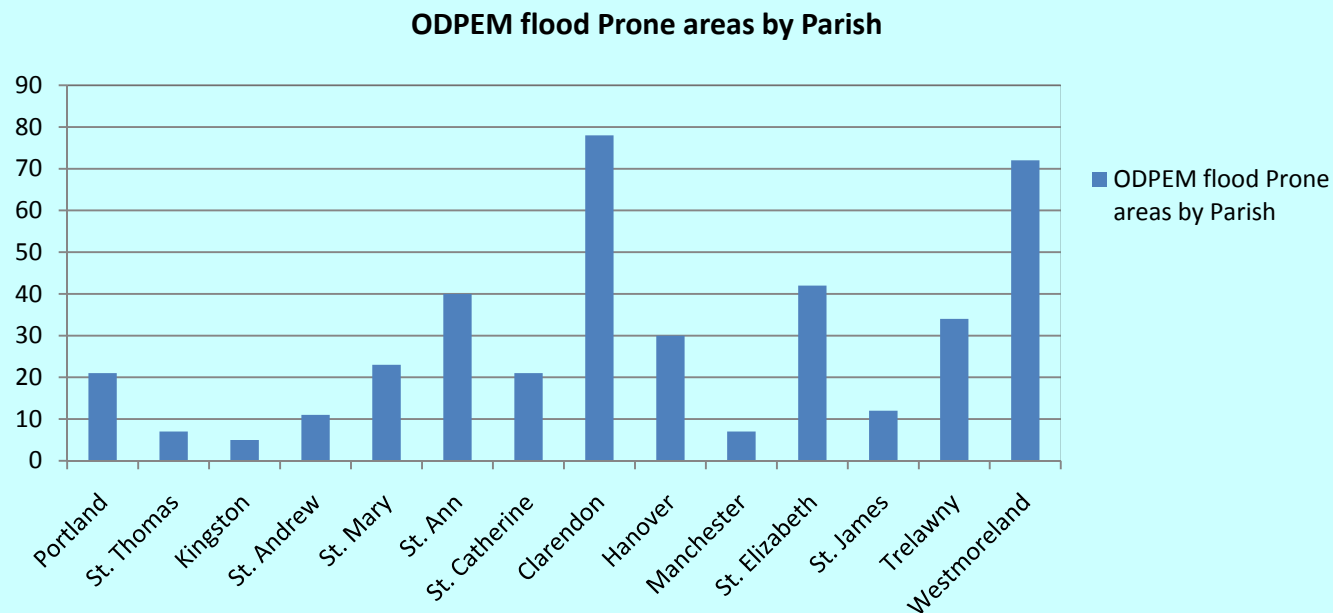
Floodplain Mapping as a Tool for
Development Planning



The Issues

Flood Prone and Historical Flooding Areas:

- A total of 403 such areas are highlighted by ODPEM



The Issues

Flood Prone and Historical Flooding Areas:

- Flooding of developments under construction



Floodplain Mapping as a Tool for
Development Planning



The Issues

Flood Prone and Historical Flooding Areas:

- Flooding of newly constructed developments



The Issues

Flood Prone and Historical Flooding Areas:

- Flooding of existing developments



Development Flooding



The Issues

Flood Prone and Historical Flooding Areas:

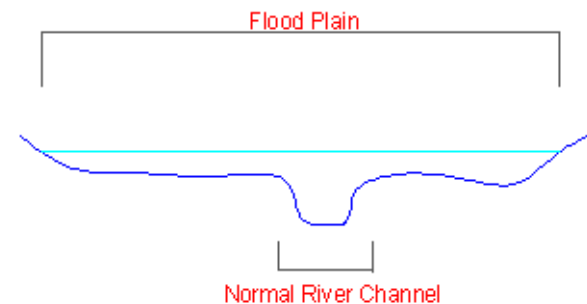
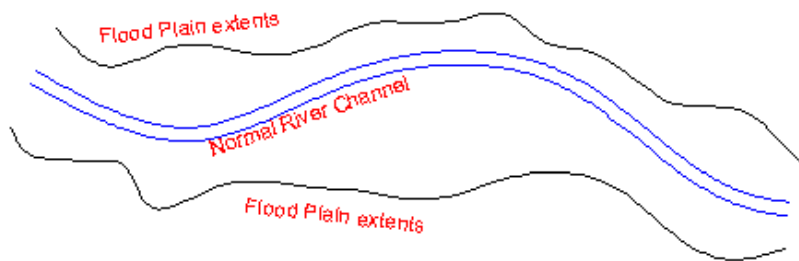
- Flooding of existing towns



FLOOD PLAIN MAPPING

Definition: Flood Plain

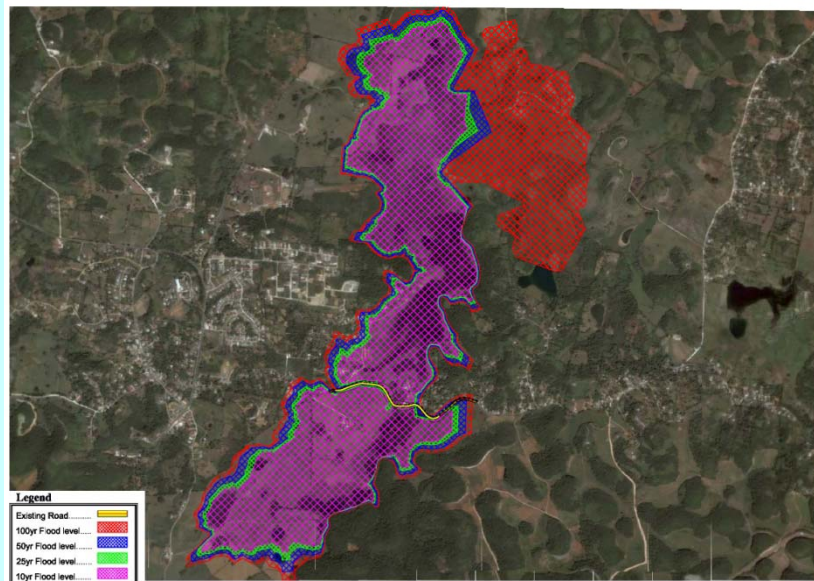
Low plain adjacent to a river that is subject to flooding



FLOOD PLAIN MAPPING

Definition: Flood Plain Mapping

A combination of satellite imageries or planimetric survey maps, elevation/contour data and flood information determined by use of hydraulic models.



Development Planning



FLOOD PLAIN MAPPING

Definition: **Flood Plain Mapping**

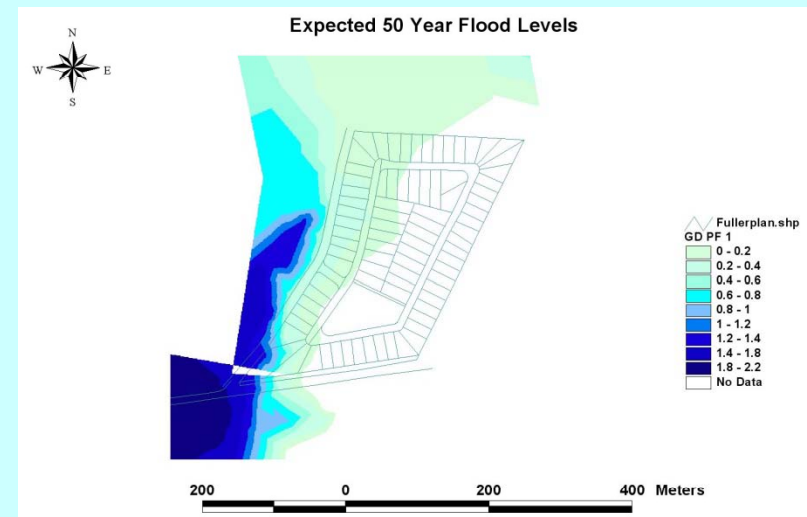
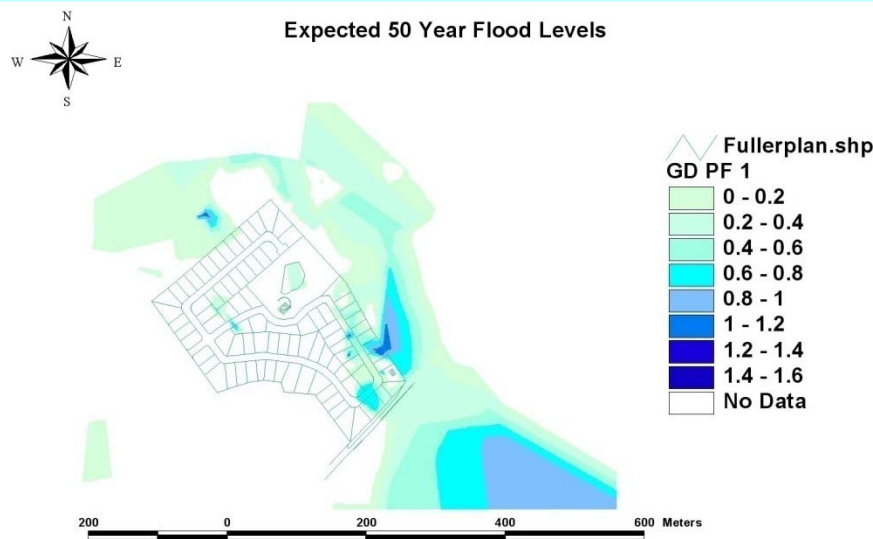
They will typically have the following information:

- the location of the main flow path
- surrounding features or developments (from maps or imagery)
- sometimes elevation contours
- flood levels and floodplain limits for the n-year flood)



DEVELOPMENT PLANNING

Identifying flood prone areas and suitable drainage solutions prior to development of housing infrastructures.



Floodplain Mapping as a Tool for
Development Planning



DEVELOPMENT PLANNING

Identifying flood prone areas and recommend suitable solutions/mitigation measure prior to development. These might include:

- Abandoning flood prone lots
- Use area for purposes that will have low consequences associated with being flooded. Such as:
 - playing field/open areas
 - Farm lots
- Raise level of houses/lots (in covenants on titles)
- Drainage infrastructure
- Berms/Dykes



MINIMUM FLOOR LEVELS

Citing of structures of importance and setting of critical infrastructure and floor levels .

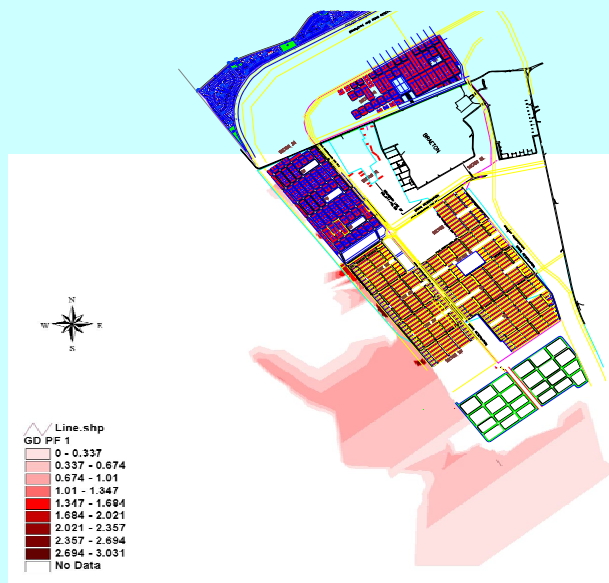
- Elevate the critical infrastructures above the 50 or 100 yr flood levels
- Rest of site raised above the 25yr levels. but kept below 50yr.



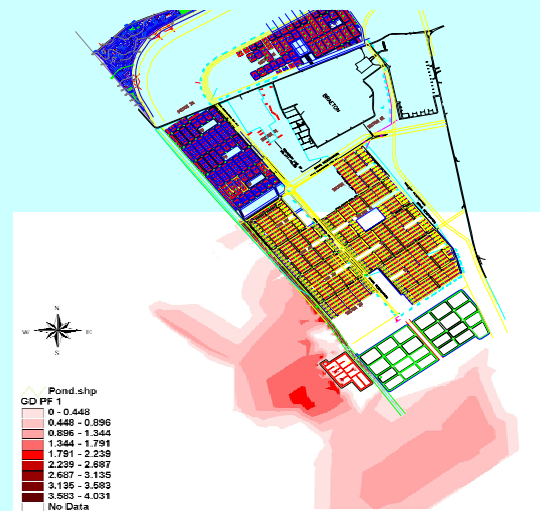
DEVELOPMENT IMPACTS

Identifying possible flooding impacts when implementing infrastructures

Pre-construction



Post-Construction



Outcome

WWTP will not impact adjacent development.



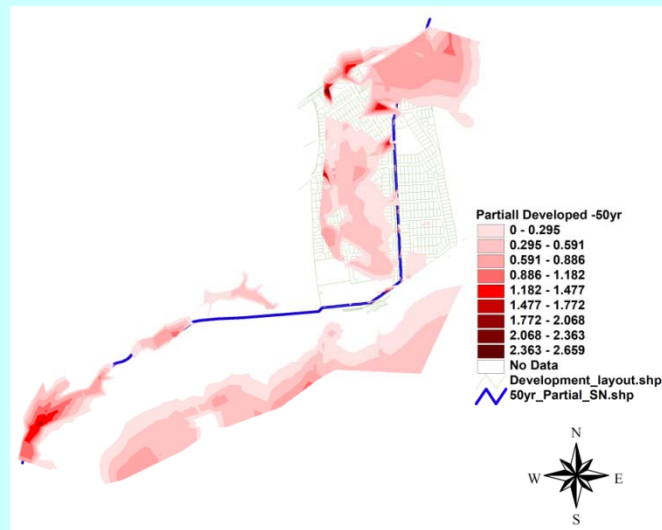
Floodplain Mapping as a Tool for
Development Planning



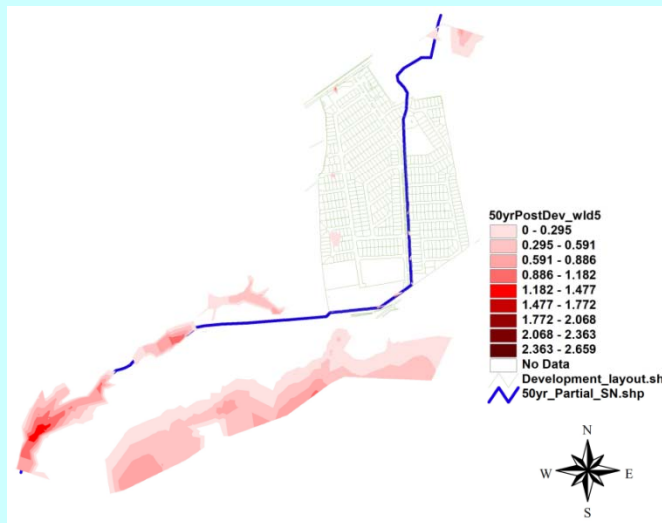
ASSESSING INFRASTRUCTURE NEEDS

Assessment of existing flood prone areas and implementation of suitable drainage solutions

Pre-construction



Post-Construction



Outcome

Proposed deep drains and dykes can minimize flooding.



Floodplain Mapping as a Tool for
Development Planning



CONCLUSION

- Flooding is usually observed in Hurricane season. Climate change is placing additional pressures on our local hydrology, with increases in rainfall intensity being observed.
- Several new sub-divisions have experienced flooding for rainfall events that are less severe than the 50 year return period.
- Flood plain mapping is a useful tool for determining the vulnerability and risks of developments to flooding based on their location.
- The risks can easily be identified and used for planning purposes.



RECOMMENDATIONS

- Flood mapping should be used by planning authorities to:
 - Identify vulnerable areas
 - Set minimum floor levels
 - Inform developers and regulators were to avoid placing critical infrastructure in development projects
 - To confirm suitability and sustainability under new hydrological regimes of climate change, where more intense rainfall events are anticipated.



RECOMMENDATIONS

- Commission island wide flood maps:
 - Flood recurrence intervals for 2, 5, 10, 25, 50 and 100 yr return periods.
 - Vulnerable areas.
 - Consider Climate change impacts on intensities over a 100 year planning horizon as an adaptation measure



THE END

Questions?



Floodplain Mapping as a Tool for
Development Planning

