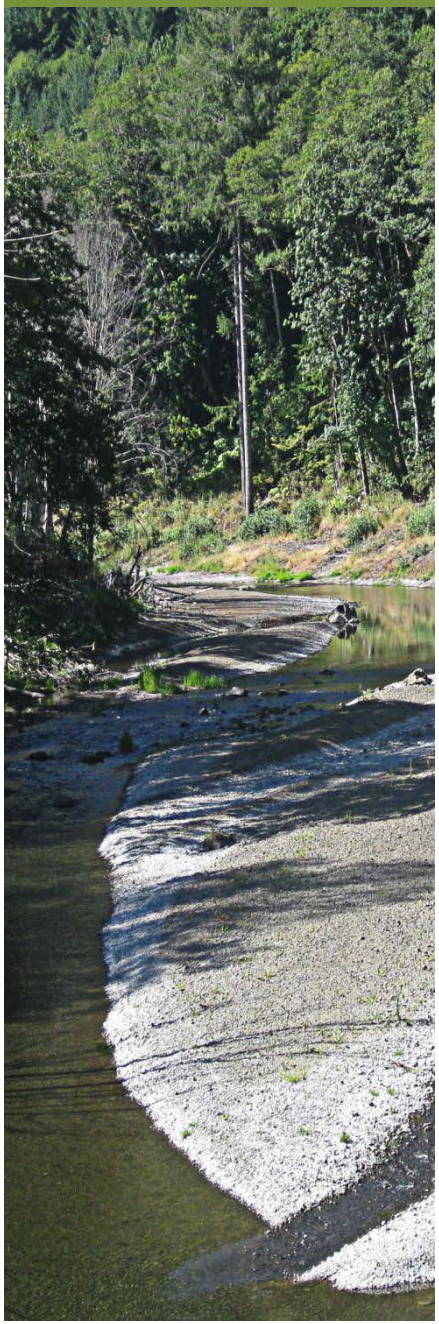
Chehalis Basin Strategy

Policy Workshop

Flooding in the Chehalis River Basin

May 22, 2014



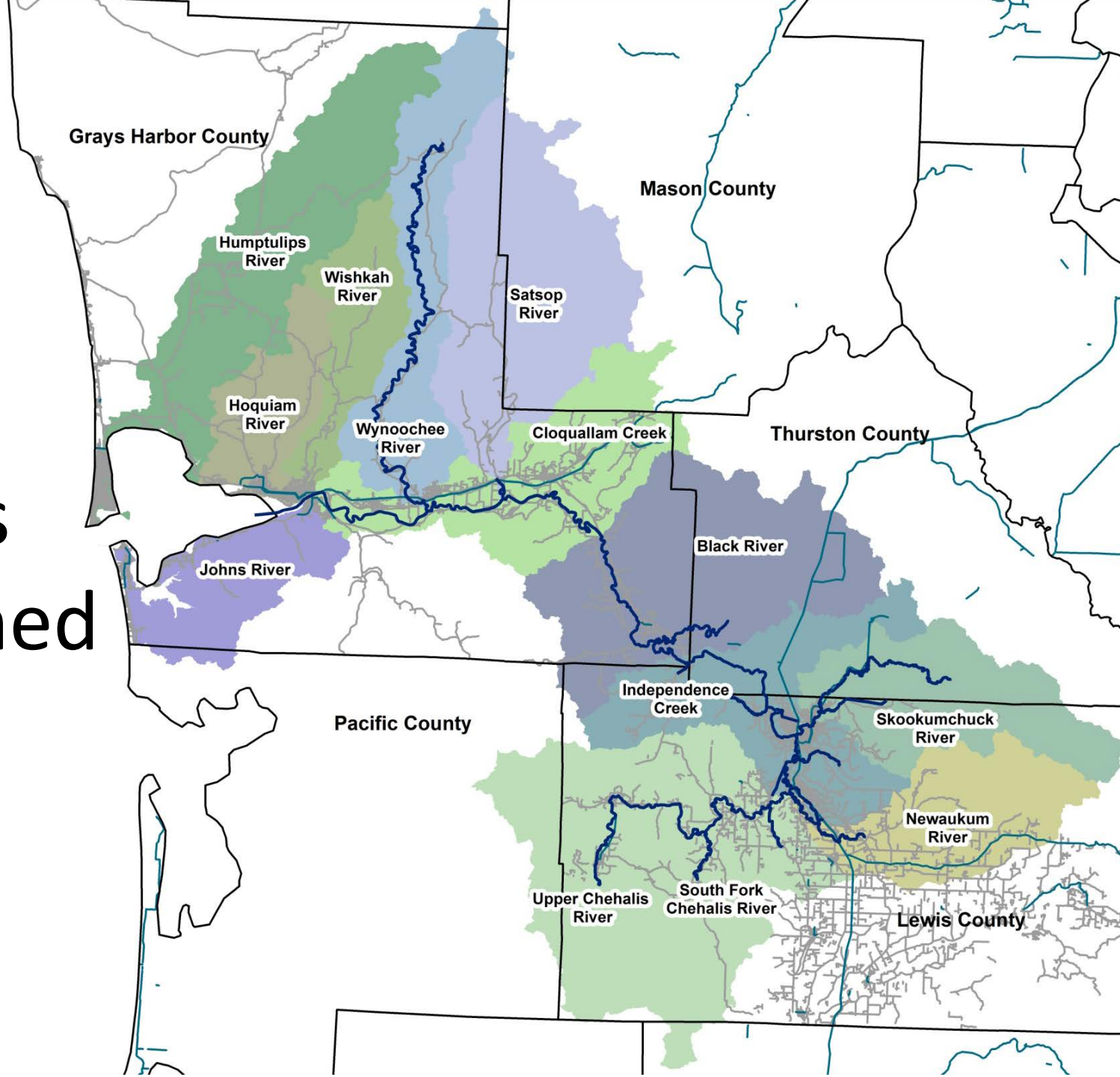
Overview of Flooding

- Flood Events Being Evaluated
- Climate Change
- Hydraulic Model Development
- Structure Survey and Data

Summary of Key Assumptions for Economic Analysis

- Use 10, 20, 100 and 500 year flood frequencies.
- Climate change
- Number of structures of significant value.
- Extrapolation of surveyed structures to total structures in floodplain.

Chehalis Watershed



Design Flood Events

Design flood events being simulated for this project:

- Economic analysis based on 10-, 20-, 100-, and 500-year flood events, focused on main stem Chehalis River (at Grand Mound)
- 2-year event also being simulated
- Also simulating historical storms of December 2007, February 1996, and January 2009

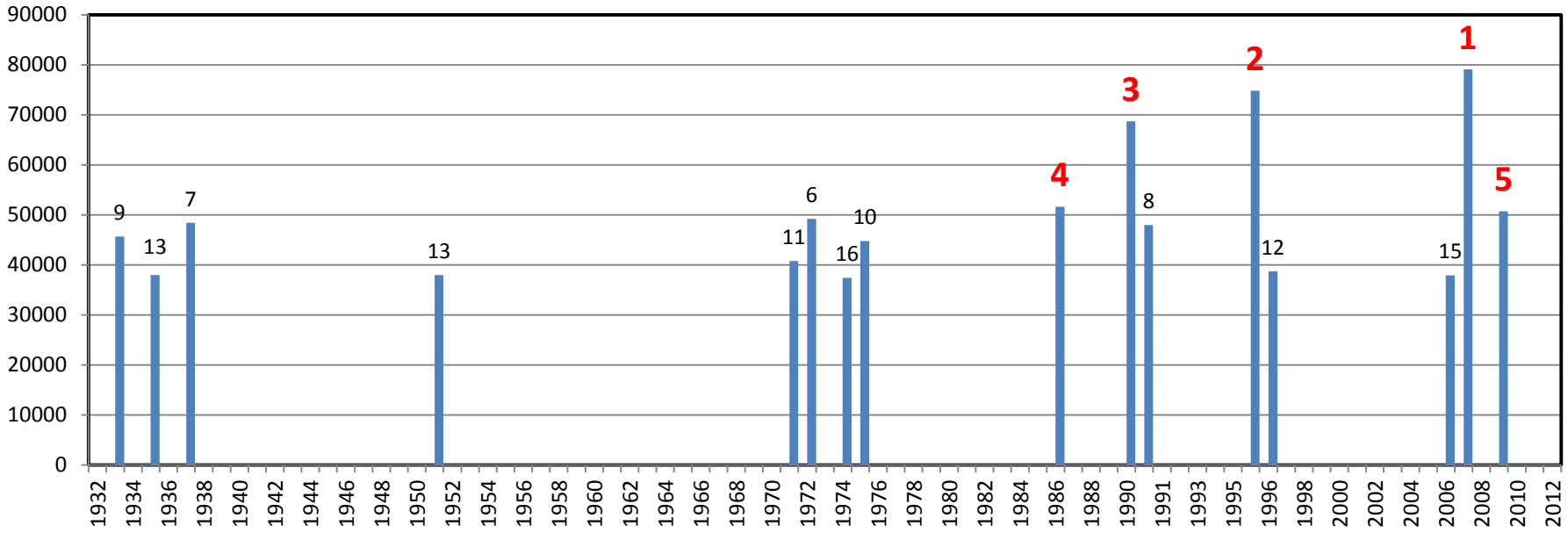
RANKED HIGH-FLOW EVENTS:

Chehalis River Flow Rates near Grand Mound (cubic ft./sec.)

Interstate 5 closed 1990, 1996, 2007, 2009

Five largest events have all occurred since 1986 -- Frequent floods are getting worse and damage is increasing . . .

100 year flood estimate increase 33% in last 30 years, 11-26% more by 2080.



Characteristics of Historical Large Floods

December 2007 - Classic atmospheric river (pineapple express) type event with a fairly narrow focus of extreme rainfall. Highest rainfall center concentrated in the Willapa Hills in the Upper Chehalis River Basin (main stem and South Fork). Set records for 24-hour precipitation in the upper basin (heaviest precipitation was actually over about 12 hours or less).

February 1996 - Large frontal storm with very broad rainfall (from north of Seattle to southern Oregon). 24-hour rainfall totals ranged from 10+ year to 100+ year recurrence

January 2009 - Focused primarily in the eastern and northern portions of the basin. Significant rain still fell in the upper Chehalis but flooding of Interstate 5 was caused by high flows on the Newaukum. The January 2009 event also had very high flows in lower basin tributaries (Satsop, Black, etc.).

Chehalis River at Grand Mound

Percent Chance Exceedence	Return Interval	Flow (cfs)
0.2	500	100,300
0.5	200	85,200
1	100	74,700
2	50	64,900
4	25	55,800
10	10	44,600
20	5	36,500
50	2	25,600

December 2007 – 79,100 cfs

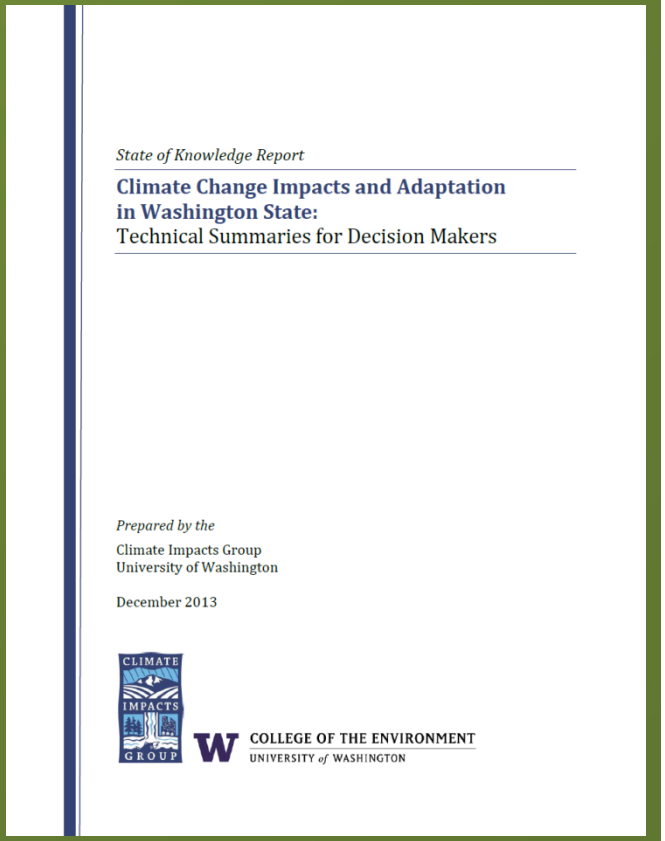
February 1996 – 74,800 cfs

January 2009 – 50,700 cfs

Climate Change Effects on Peak Flows

Latest report from the UW Climate Impacts Group (CIG) suggests:

- Rain dominant basins (like the Chehalis) will see increase in 100-year flood of 11% to 26%
- Average increase is 18%
- Does not include projected changes in heavy rainfall
- Hamlet et.al. suggests increase may be 10 – 50% or more (forthcoming paper)



Structure Survey and Data Development

Improved Flood Damage Estimates

- Previous analyses relied on parcel boundaries and depth of water on ground
- Current analyses use actual structure locations and depth of water in buildings
- Allow specific statements about potential impacts and benefits of alternatives on particular structures

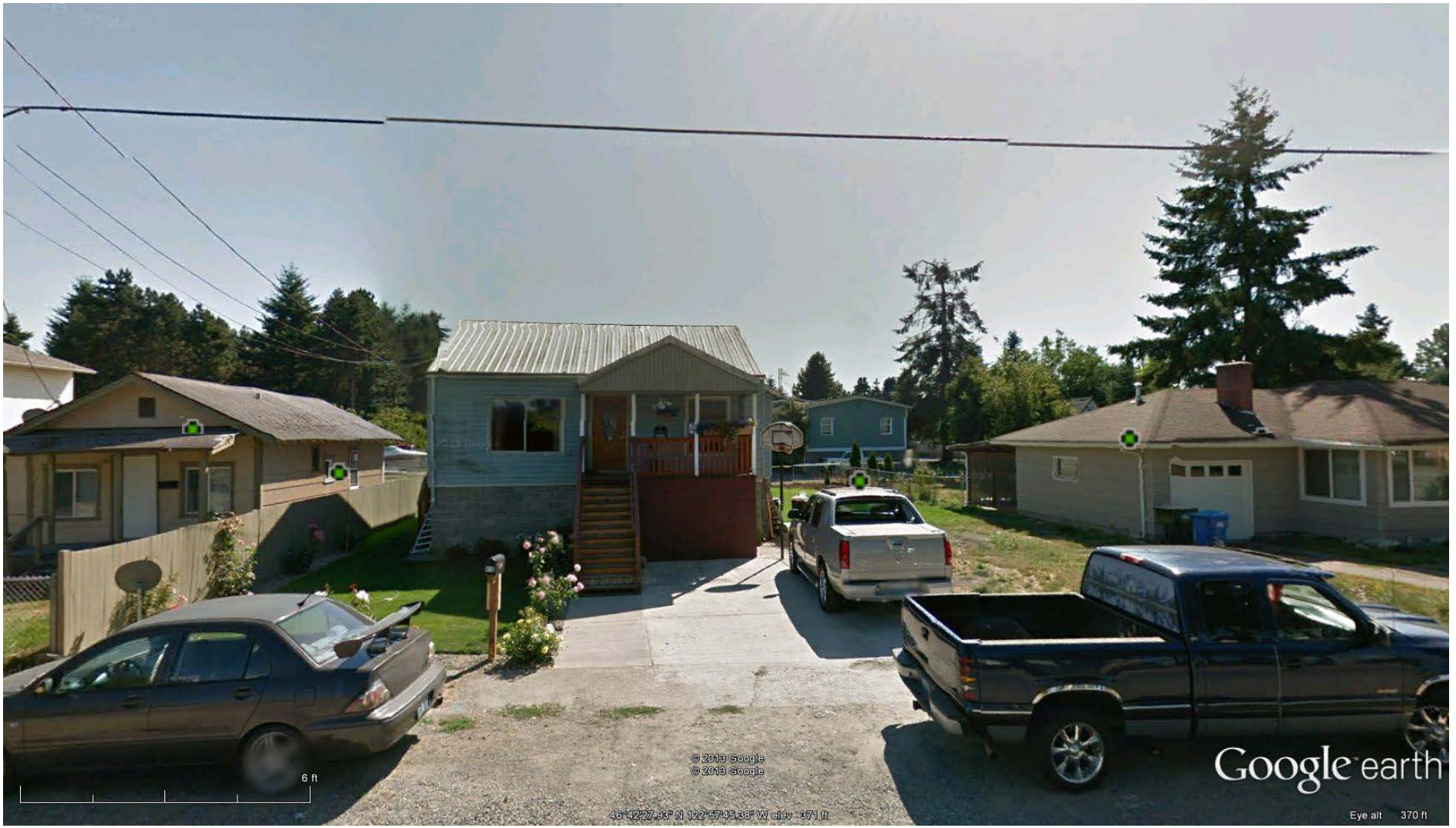
Parcels with Structures

Actual Structure Delineations

Additional Information Developed

- Height of finished floor above ground
  - 178 structures field surveyed
  - 2804 structures estimated using Google Street View
  - 2630 structures estimated using statistical averages
- Type of Structure (MOB, RES, COMM, AGR)
- Estimated value of structures using assessor data
- Area and perimeter of structures estimated

Google Street View finished floor data



Structure Survey Results

9,087 Structures Evaluated

Type of Structure	Lewis County	Thurston County	Grays Harbor County	Totals
Mobile Homes	363	98	0	461
Residential Structures	5,348	201	405	5,954
Commercial	1,567	34	470	2,071
Agricultural	10	161	430	601
Totals	7,288	494	1,305	9,087

5,512 “of significant value” structures; 3,575 others not assigned a value

178 finished floors surveyed, 2804 estimated using Google, 2600 estimated using average height above ground

Total Assessed Value $607 Million

Structures Affected – Baseline

Summary of Structures At Risk of Flooding in Chehalis River Floodplain					
Number of Structures	**Baseline**				
	Dec 07	**500-Year**	**100-Year**	**20-Year**	**10-Year**
Flooded	2040	3645	1384	372	175
>1.0 feet	1368	2743	829	167	83
>2.0 feet	820	1926	489	76	28
>3.0 feet	470	1159	293	22	7
>4.0 feet	263	657	155	6	2
>5.0 feet	159	385	76	1	0
Assessed Value of Improvements Inundated ($Million)	$238	$411	$137	$30	$13

Structures Affected – Climate Change

Summary of Structures At Risk of Flooding in Chehalis River Floodplain			
Number of Structures	**Baseline**	**100-Year w Climate Change**	
	100-Year	**100-Year**	**Change vs Base**
Flooded	1384	2202	59%
>1.0 feet	829	1462	76%
>2.0 feet	489	830	70%
>3.0 feet	293	481	64%
>4.0 feet	155	301	94%
>5.0 feet	76	161	112%
Assessed Value of Improvements Inundated ($Million)	$137	$255	86%

Summary of Key Assumptions for Economic Analysis

- Use 10, 20, 100 and 500 year flood frequencies.
- Climate change – 18% increase in peak flows
- Number of structures of significant value.
- Extrapolation of surveyed structures to total structures in floodplain.

Discussion