# Lessons Learned and Shared

### Plan for the worst.

#### Hope for the best.

Remember that hope is not a strategy.

Agnes





State	Damage (1972 Dollars)	Deaths
ennsylvania	\$2,119,269,000	48
ew York	702,502,000	24
rginia	125,987,000	13
aryland	110,186,000	19
ew Jersey	15,000,000	1
orida	8,243,000	9
/est Virginia	7,753,000	0
hio	6,818,000	0
orth Carolina	6,558,380	2
eorgia	205,000	0
outh Carolina	50,000	0
elaware	Light	1
DTAL	\$3,102,571,380	117

SSW









- **1. Identify Susceptible Communities**
- 2. Develop a Plan
- 3. Threat Recognition
- 4. Review Response Times
- 5. Training: Practice the Plan
- 6. Responding: Organization, Communication
- 7. Recovery
- 8. Debriefing and Revising the plan



# Lesson 1 Identify Susceptible Communities

## **Identify Communities**





2003 Flooding in New Alexandria; subject to tidal flooding June 2006, Huntington Flooding; subject to flooding from short intense storms and a combination of tide/rain

### **Identify Communities**



Susceptible to both tidal and riverine flooding

Tidal flooding dominates

e.g. Hurricane
 Isabel
 September
 2003, 9.6 ft.
 tidal surge and
 0.5 inches rain



### **Identify Communities**



Susceptible to both tidal and riverine flooding

- Riverine flooding dominates
- Lake located upstream
- e.g. Storm of June 2006, 4.0 ft. tide and 8.3 inches rain





# Lesson 2 Develop a Plan

### **Basic Elements of a Plan**





### Basic Elements of a Plan Goals



## Prevent loss of life

# >Minimize property damage

## Reduce disruptions to

- commerce
- human activities

# >Meet regulatory requirements

### Basic Elements of a plan Goals continued

**Reaching these goals requires:** Threat identification >Minimizing response times Goals achieved through Effective planning Effective communication Community involvement **Education** 





# Lesson 3 Threat Recognition Develop predictive tools

### **Prediction Tools Analysis**

- Rainfall run-off hydrologic modeling SCS
- Tidal hydrology and review of historical tidal records
- HEC-RAS Hydraulic analysis and water surface profile determination





### Prediction Tools Development continued





- Determine the topographic elevation at which the community starts to flood
- Use hydraulic simulations to determine WSEs with various tidal and discharge combinations
- Use hydraulic model to determine flood wave travel times and appropriate response times
- Develop mathematical tools that identify the combinations of tide and discharges that cause flooding above a <u>targeted</u> level
- Develop triggers (tides and rainfall) that cause flooding above the targeted level

### Prediction Tools Flow Prediction Tool



SEC 1389				
		Qgauge		
Actual Tide	Р	-	Q	Q
4	3			8210
Model Tidal	Qgauge reg. for USGS		Qhunt (based on USGS	
Value		Q		WSE
4	6899	0	8210	7.0

#### NOTES

- 1) Maximum Q=35,000;
- Maximum tide = 16'
- 2) P is rainfall in inches. For forecasting (prior to the event) use 24 hr storm duration.

For monitoring during the event use12 hr duration.

## Prediction Tools Maps





### **Rainfall/Tidal Flooding Chart**



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# Lesson 4 Review Response Times

### Prediction Tools Response Time



### **Response Time - Two Critical Parts**

Hydrologic lead times: Time of concentration and hydrograph travel time (rainfall, antecedent moisture, basin characteristics)

### Agency response time:

-emergency personnel and equipment placement -implement flood mitigation (i.e. sand bags) and evacuation

- decision and communication time

### **Effective lead time =**

Hydrologic lead time - Agency response



# Lesson 5 Training: Practice the plan

# The Flood Response Plan Safety

How to get to the site

### What to expect in the field

- Where to park
- Where to stand
- Field instructions
- Unified command





### Training

### Training How to get to the site







# Lesson 6 Responding Organization and Communications

### **Information Flow During a Flooding Event**



#### Note:

This communications flow diagram is a combination of prediction, detection, oversight, County management, and emergency responders.

### Organization Incident Command



### Response Report to the Doc

**Pick up** Safety equipment **≻GO** bag **≻**Sign out **Before heading out to** the field

Sign in and briefing

<image>



### Flood Response – DOC Staff Continuous Event Monitoring



- Purpose: to provide appropriate lead time for any action that may be required
- Monitor conditions and sensors every (5 to 15) minutes
- ➢Record data
- Analyze data for trends
- Data used in deciding when to act and what to do

	Storm 5/11/08														
RAINFALL DATA						DISCHAR	GE DATA	TIDAL DATA							
Date	Time	NWS Reagan National	CHAN 7 St Mary's Catholic	CHAN 7 Jefferson Houston	CHAN 7 West Potomac	Q barcroft	Q Cameron Run USGS gauge	Normal Tidal elev DC (MLLW)	Observed Tidal Elev DC (MLLW)	Tide Gate Low	Tide gate upper	Residual	Normal Tidal elev DC (NGVD29)	Observed Tidal Elev DC (NGVD29)	
5/11/2008	20:00	0.75				548									
5/11/2008	20:30					718	1420	0.54	1.98			1.44	-0.08	1.36	
5/11/2008	21:00	1.12				901	2670								
5/11/2008	21:16					1375	3940	0.29	2.09			1.8	-0.33	1.47	
5/11/2008	22:00	1.54				1101	4490								
5/11/2008	23:00	1.92													
5/11/2008	23:25		2.61	1.99	1.95	901	4420	1.47	4.43			2.96	0.85	3.81	
5/11/2008	23:55	2.37	2.81	2.15	2.05	714	4150	1.87	4.79			2.92	1.25	4.17	
5/12/2008	0:25		2.97	2.27	2.13	714	3800	2.22	4.95			2.73	1.6	4.33	
5/12/2008	0:55	2.62	3.12	2.38	2.22	548	3380	2.52	5.06			2.54	1.9	4.44	
5/12/2008	1:25		3.27	2.47	2.30	714	2690	2.75	5.12			2.37	2.13	4.50	
5/12/2008	1:55	2.76	3.38	2.54	2.34	548	2490	2.91	5.03			2.12	2.29	4.41	
5/12/2008	2:05						2310	2.95	4.97	4.61	4.5	2.02	2.33	4.35	
5/12/2008	2:25		3.49	2.64	2.38	548	2125	2.97	4.94			1.97	2.35	4.32	
5/12/2008	2:30		* Pump station read 4.2 at 2:45				2110	2.99	4.86	4.5	4.5	1.87	2.37	4.24	
5/12/2008	2:55	2.91	3.60	2.70	2.42	279	1747	2.98	4.76			1.78	2.36	4.14	
5/12/2008	18:00	4.29	5.06	3.73	3.6	176	831	1.94	4.43			2.49	1.32	3.81	



### **Response - Doc staff** Flood Monitoring



Daily forecasts

- NATIONAL WEATHER SERVICE: Regional forecast
- Private meteorological services (e.g., Weather Bug Accuweather): More localized forecasts
- Track the event on radar prior to its arrival in our area
- Frequently monitor weather reports on local TV and radio





### Response Field Staff



- > Appropriate response time is critical
- Response activities include:
  - Moving vehicles/equipment from low areas
  - Flood-fighting efforts sandbagging and pumping
  - Road closures
  - Evacuation
  - ➢ Rescue





# Lesson 7

# Recovery















# Lesson 8 Debriefing & Revising the plan

# Debriefing





### **Revising the Plan Revise Prediction Tools**



# Post analysis: review data and compare these with our predicted outcomes

#### Use these data to refine models



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			DAINEAL											
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The Flood Response Plan is revised annually in the fall after the end of hurricane season



### **Discussion / Questions?**



## **Contact Information**





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#### September 8, 2011





Tower 424 in Reston at Richmond Highway and Lorton Road



#### September 8, 2011



Tower 424 in Reston at Richmond Highway and Lorton Road



# Thank You.