NOTICE OF STUDY SESSION
Storm Water Commission Presentation – Historic Flood
CITY HALL, Fifth Floor
6801 Delmar Blvd., University City, Missouri 63130
Monday, January 9, 2023
5:30 p.m.

AGENDA

1. Meeting called to order
2. Changes to Regular Agenda
3. Storm Water Commission Presentation RE: Historic Flood
4. Adjournment

The public may also observe via:
Live Stream via YouTube:
https://www.youtube.com/channel/UCyN1EJ_-Q22918E9EZimWoQ

Posted 6th day of January 2023.
LaRette Reese
City Clerk, MRCC

Urban Flash Floods: Preventable Damages

Flash Flood Character

Are Floods Getting Worse? Why?

July 2022 Flood Synopsis: Rainfall & Hydrologic Response

Recommendations

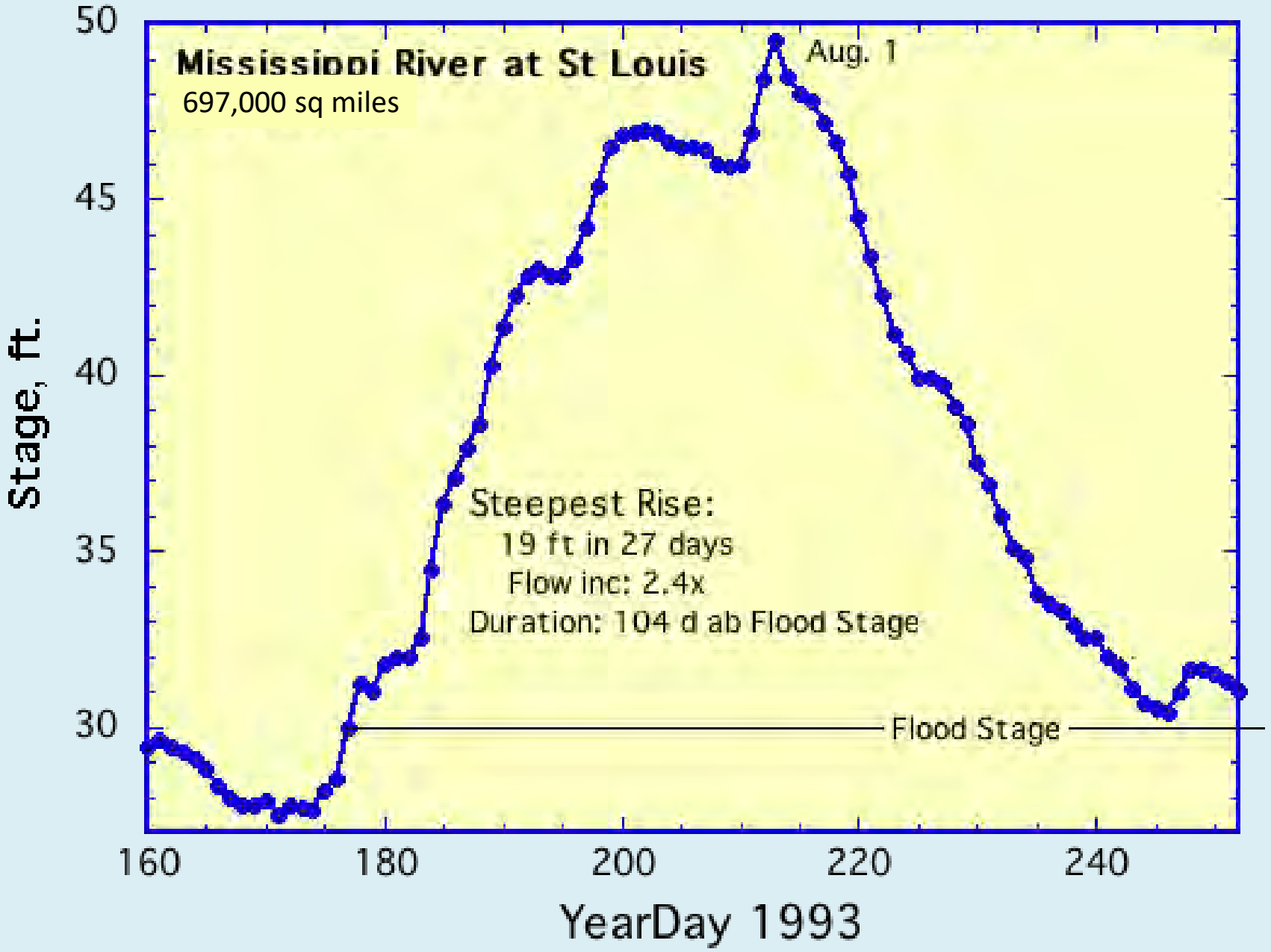
University City, July 2022

Criss

Aug. 14, 1991

Aug. 19, 1993

NASA

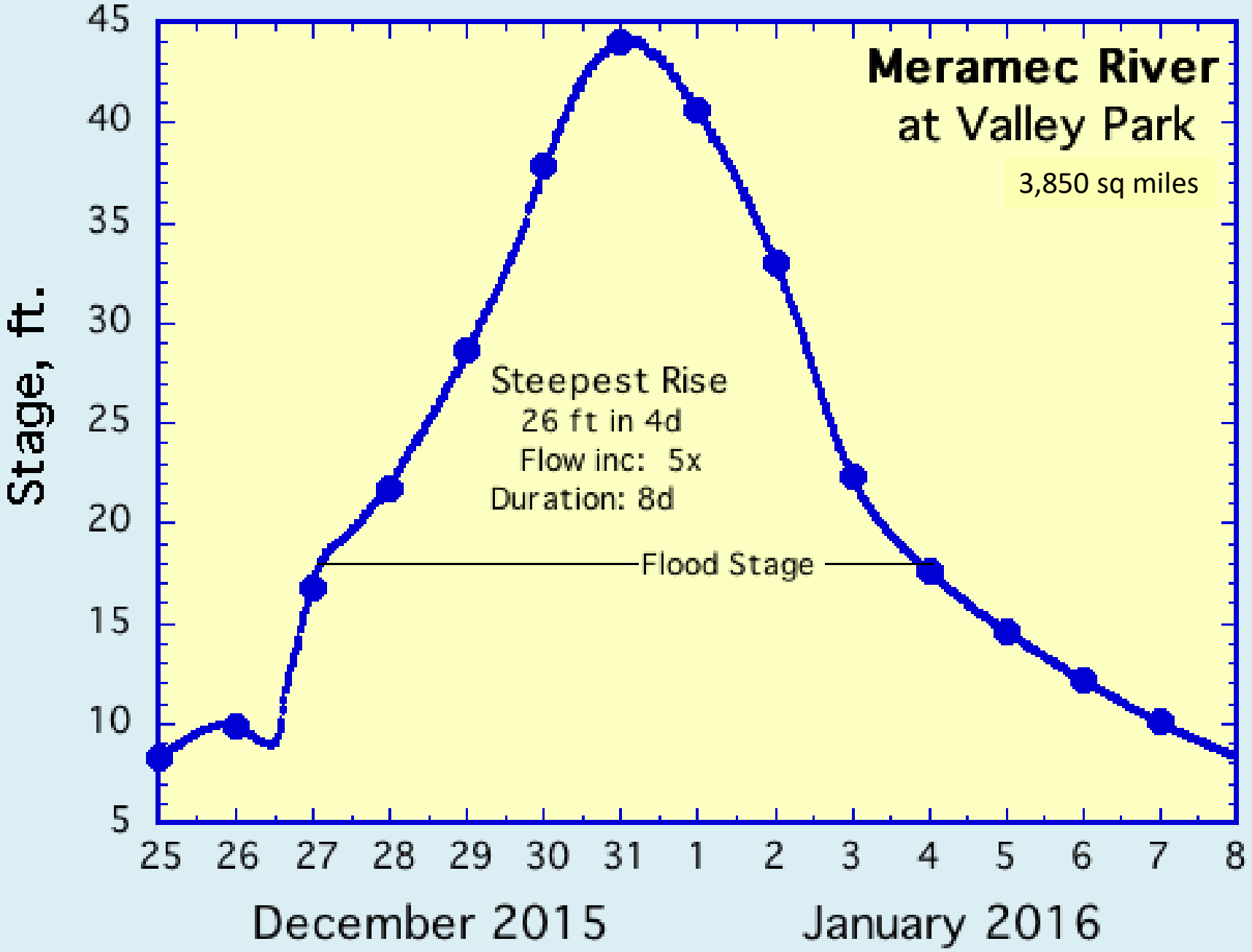

Mississippi River at St Louis
697,000 sq miles
Aug. 1
Steepest Rise:
19 ft in 27 days
Flow inc: 2.4x
Duration: 104 d ab Flood Stage
Flood Stage
Stage, ft.
50
45
40
35
30
160
180
200
220
240
YearDay 1993

Data: USACE

Interstate 44 @ Valley Park

March 3 2022

Dec. 30, 2015

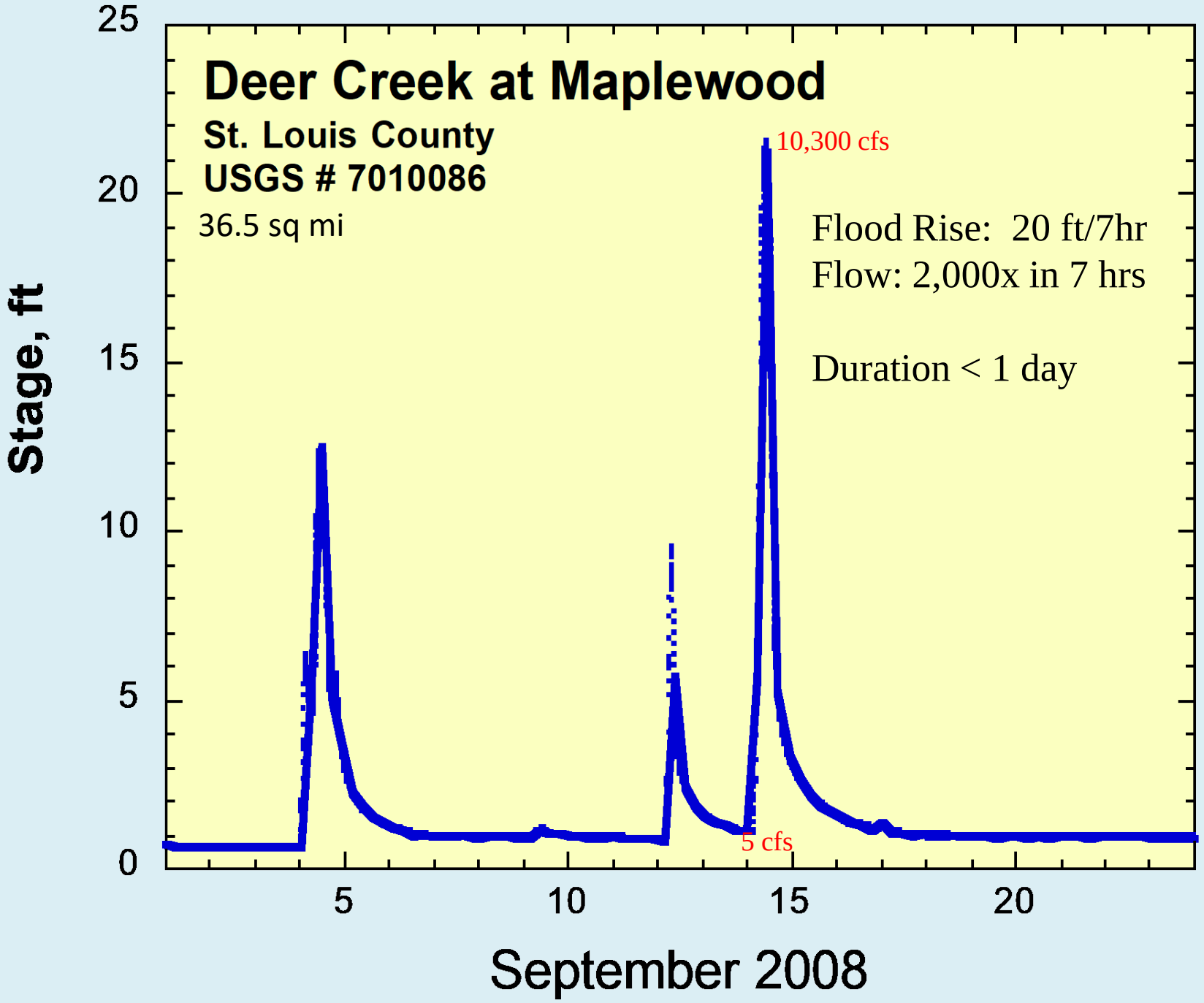

Meramec River
at Valley Park
3,850 sq miles
Steepest Rise
26 ft in 4d
Flow inc: 5x
Duration: 8d
Flood Stage
Stage, ft.
45
40
35
30
25
20
15
10
5
25 26 27 28 29 30 31 1 2 3 4 5 6 7 8
December 2015
January 2016

Data: USGS

Deer Creek bridge at McKnight Rd

Normal: Oct. 2008

Sept. 14, 2008 flood


Deer Creek at Maplewood
St. Louis County
USGS # 7010086
36.5 sq mi
10,300 cfs
5 cfs
Flood Rise: 20 ft/7hr
Flow: 2,000x in 7 hrs
Duration < 1 day
Stage, ft
0
5
10
15
20
25
5
10
15
20
September 2008

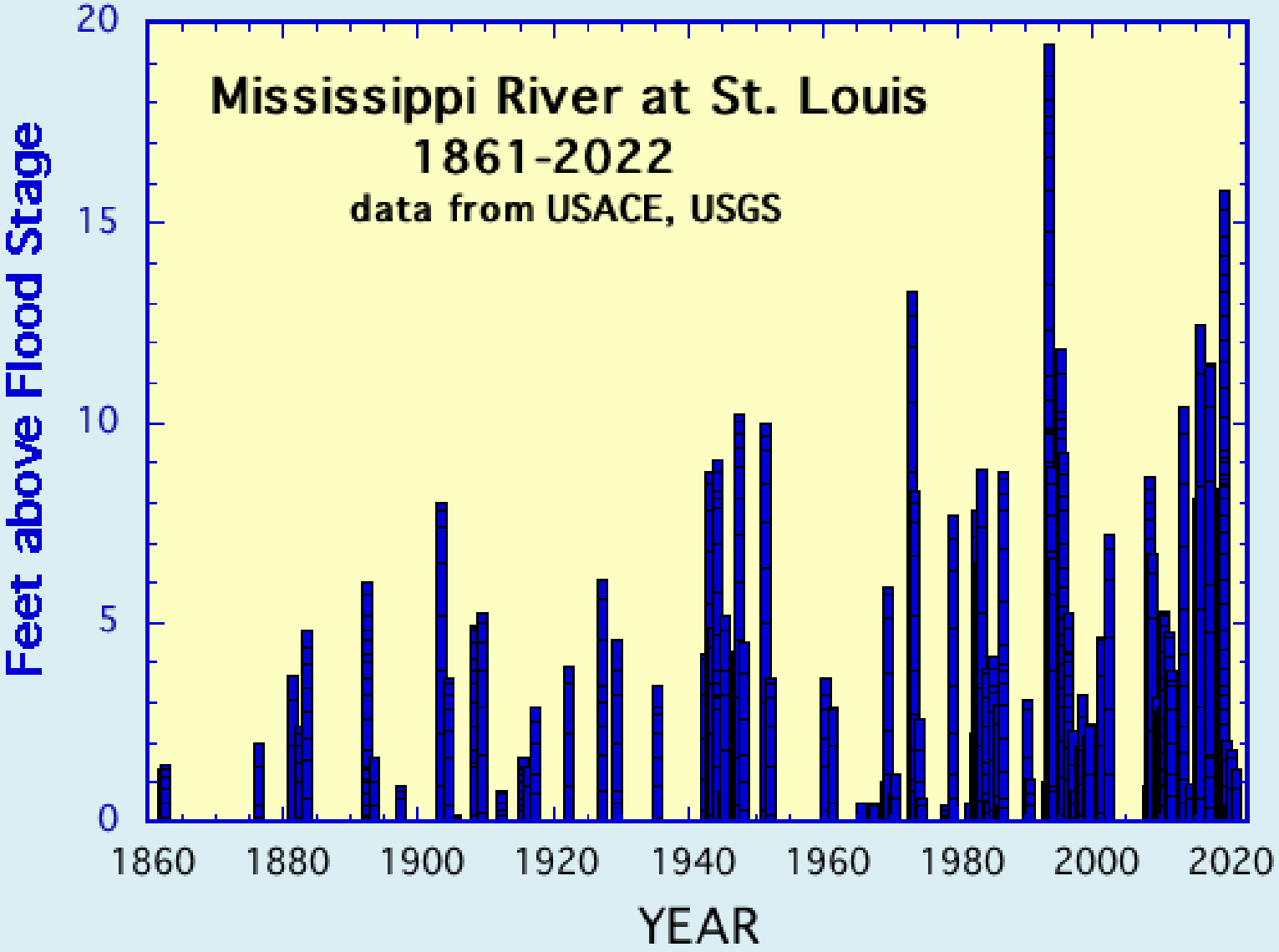
Data: USGS

Summary: Part 1

Flash Floods in Small Basins

1. Develop very suddenly
1. Occur frequently, close to people
1. Cause large damages and fatalities; vehicles!
1. Feature large, sudden stage increases
2. Have peak flows 1,000's of times greater than normal flows
6. Estimates of flow magnitudes and flood frequencies are too low

ARE FLOODS GETTING WORSE? WHY?



Flow Impedance

=> Higher Floods

FLOW =
WIDTH x
DEPTH x
VELOCITY

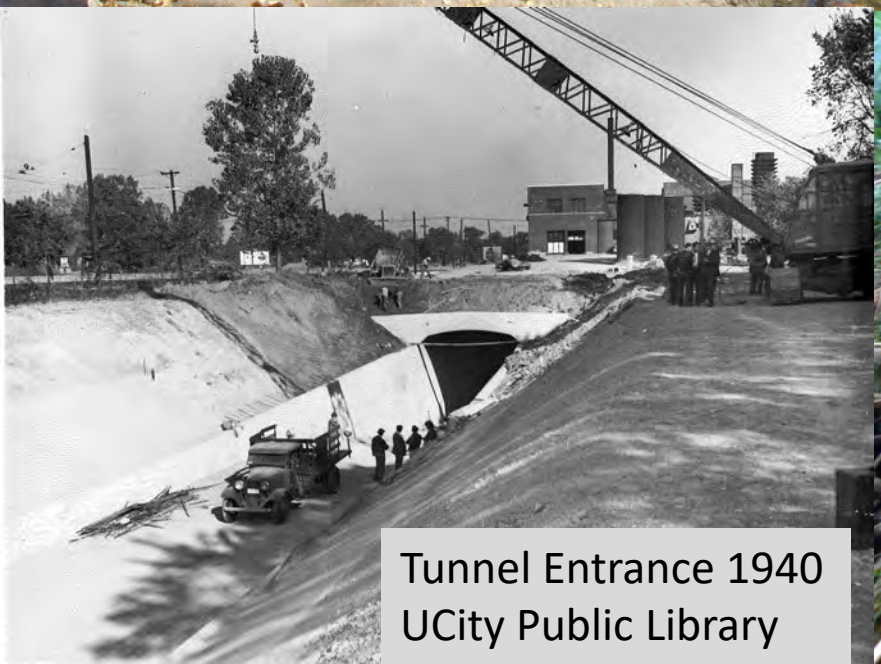
Photo: Pinter & Thomas 2003

Flow Impedance

upper RdP

Channelization

near Midland Ave



Tunnel Entrance 1940

UCity Public Library

Debris Clogging

Hanley Rd

Upper River des Peres: 43.5% Impervious

Google Earth

1909 Plat Book, StL Co.

Reprinted by: St. Louis Genealogical Soc

2022 Inundation Map

Criss, Stein & Nelson 2022

The River des Peres is the most flash flood prone stream in Missouri

Natural Factors:

1. Small Watershed
2. West to East Flow, along predominant storm track
3. Pennsylvanian bedrock has low permeability

Human Factors: Floodwater Acceleration

1. Extremely high impervious area (43.5%)
2. Channelization, Straightening, Loss of Storage
3. Storm Sewers
4. Destruction of Riparian Borders
5. Undersized and clogged bridges
6. Floodplain construction: Higher Floods *and* More Damage
7. Climate Change: More Intense Storms

U City Flood of July 26, 2022

Monitoring System in Place

- 3 rain gauges
- 9 in stream stage loggers plus USGS gauge
- Capability for flood mark survey

HOBO level logger

Total Station (WU loan)

GNSS Receiver (rental)

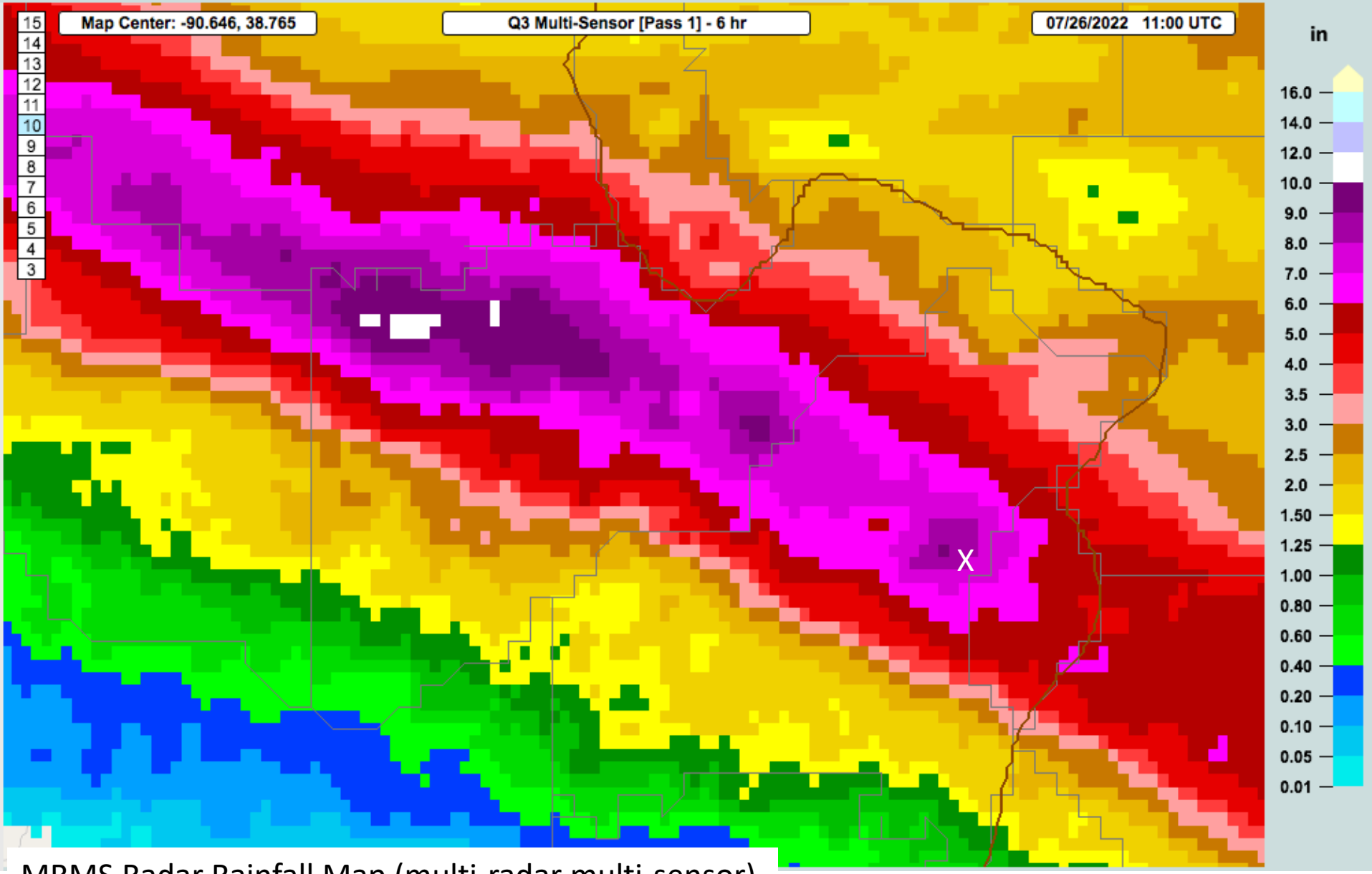
Rain Gauge RG1


July 2022 Flood
Trinity & Dartmouth
September 9, 2022
Amy Dorsch


Trinity & Dartmouth
July 26, 2022 5:45AM
Amy Dorsch


Olive Blvd
July 26, 2022 5:26 AM
Eric Karch

Operational Product Viewer



MRMS Radar Rainfall Map (multi-radar multi-sensor)
6 hr interval ending 4AM central, 7.26.22

NOAA

East St Louis

Precipitation Frequency E

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr
1	0.40	0.62	0.76	1.01	1.23	1.45	1.55	1.86	2.22	2.62
2	0.47	0.74	0.91	1.21	1.49	1.76	1.87	2.24	2.66	3.14
5	0.56	0.88	1.08	1.47	1.85	2.19	2.35	2.80	3.31	3.88
10	0.64	0.98	1.21	1.68	2.13	2.55	2.74	3.27	3.85	4.53
25	0.73	1.12	1.38	1.95	2.52	3.08	3.33	3.98	4.66	5.57
50	0.81	1.22	1.51	2.16	2.85	3.55	3.85	4.61	5.38	6.53
100	0.88	1.33	1.65	2.38	3.18	4.07	4.44	5.31	6.17	7.67
200	0.97	1.44	1.79	2.62	3.55	4.65	5.11	6.12	7.09	9.02
500	1.08	1.59	1.99	2.94	4.07	5.55	6.14	7.38	8.51	11.22
1000	1.18	1.72	2.15	3.22	4.52	6.34	7.07	8.51	9.77	13.27

* These precipitation frequency estimates are based on a partial duration series. ARI is the Average F
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates nea

East St Louis

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2	0.47	0.74	0.91	1.21	1.49	1.76	1.87	2.24	2.66	3.14
5	0.56	0.88	1.08	1.47	1.85	2.19	2.35	2.80	3.31	3.88
10	0.64	0.98	1.21	1.68	2.13	2.55	2.74	3.27	3.85	4.53
25	0.73	1.12	1.38	1.95	2.52	3.08	3.33	3.98	4.66	5.57
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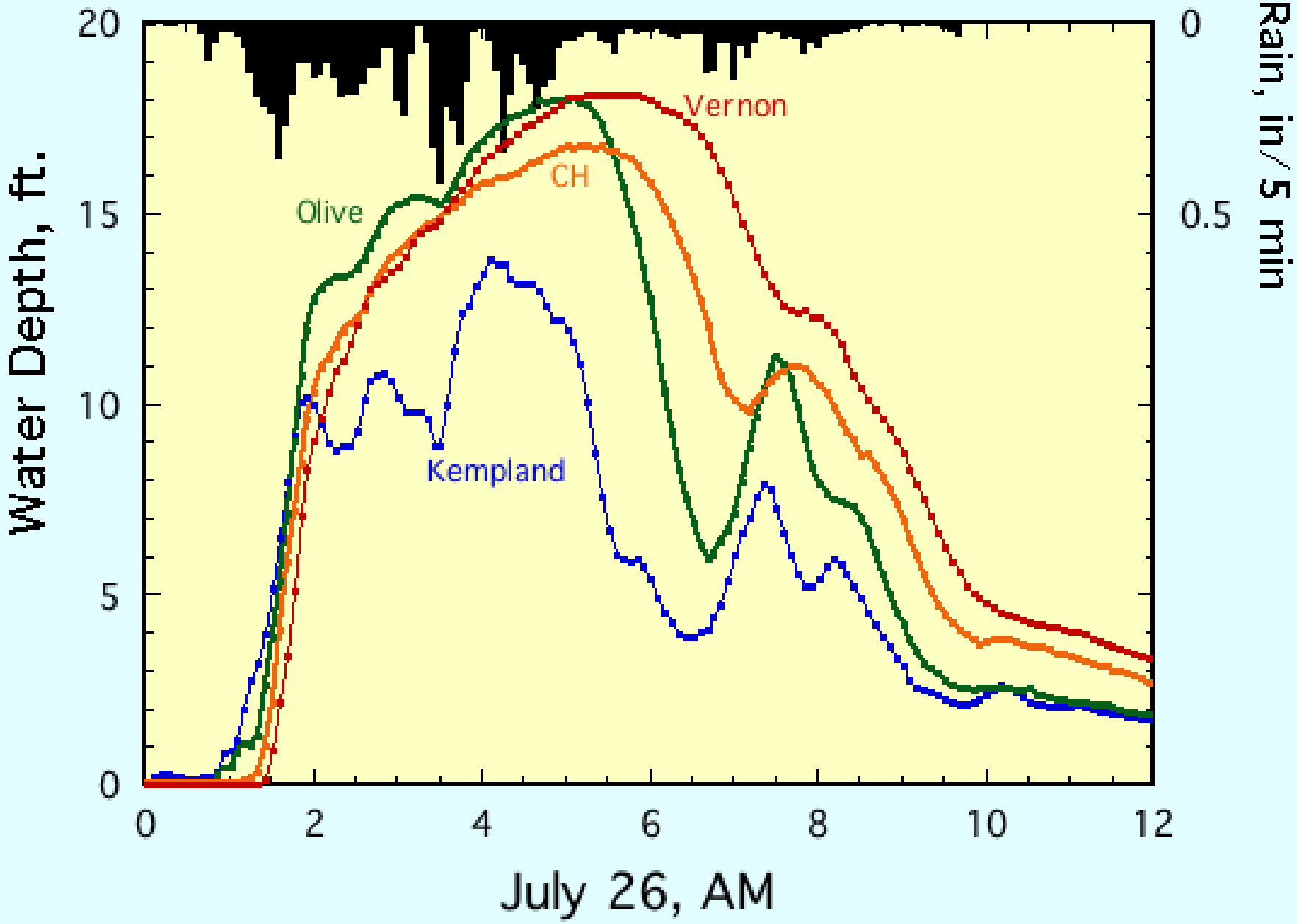
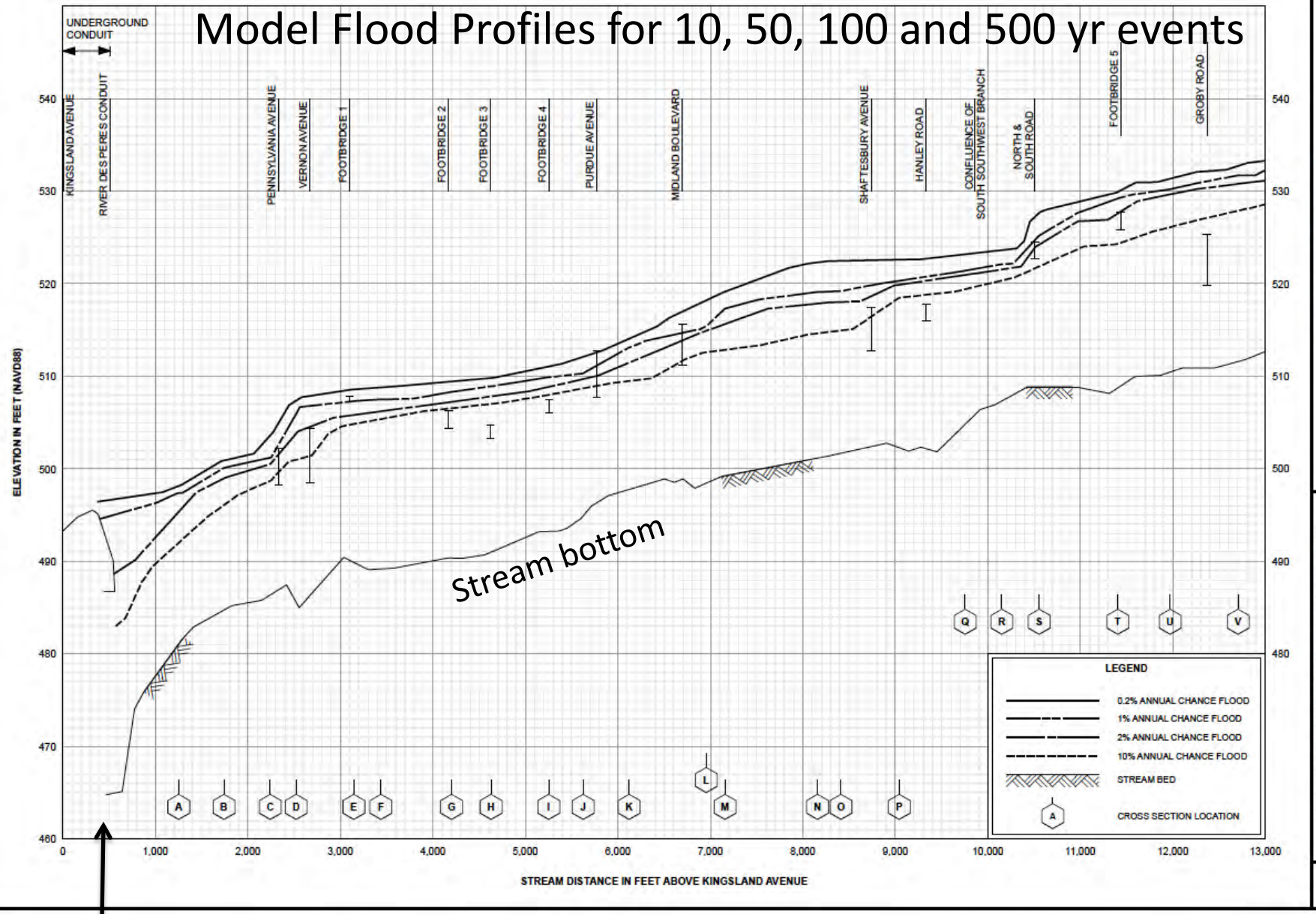

Water Depth, ft.
Rain, in/5 min
Vernon
CH
Olive
Kempland
20
15
10
5
0
0.5
0
2
4
6
8
10
12
July 26, AM

Model Flood Profiles for 10, 50, 100 and 500 yr events



FLOOD PROFILES

RIVER DES PERES

FEDERAL EMERGENCY MANAGEMENT AGENCY

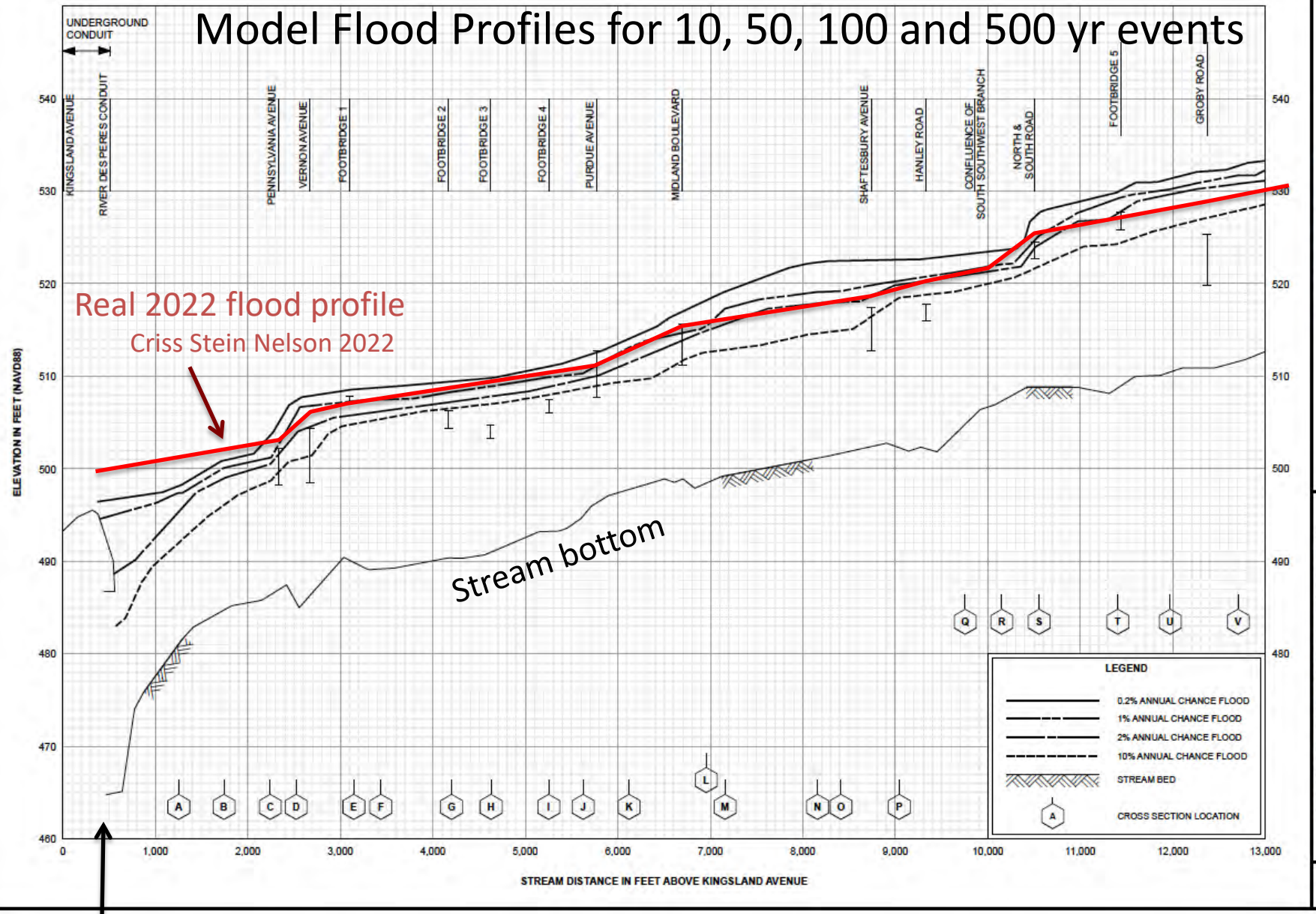
ST. LOUIS COUNTY, MO AND INCORPORATED AREAS

206P

RdP Tunnel Entrance

FEMA 2015

Model Flood Profiles for 10, 50, 100 and 500 yr events



FLOOD PROFILES

RIVER DES PERES

FEDERAL EMERGENCY MANAGEMENT AGENCY

ST. LOUIS COUNTY, MO AND INCORPORATED AREAS

206P

RdP Tunnel Entrance

FEMA 2015

Summary: July 26 Flash Flood

1. Cause: Intense Summer Thunderstorm, ~3h rainfall
2. Development Time < 5 h; Duration <1 day
3. 1000 year storm, but 50 y flood
4. Water Rise: ~18 ft.; Max Rise Rate >11 ft/ hr;
5. U City Damages: > $30M
   1 Fatality; > 50 rescues;
   >300 Condemned Homes; 100s of lost vehicles;
   MetroLink disruption
6. Worst Place: Geomorphological Floodplain,
   particularly in channelized reaches near confluences,
   undersized bridges, and near the RdP tunnel mouth

Average annual flood damages in UCity are several $M/y

RECOMMENDATIONS

1. The Commission needs a website, lecture series, and high water signs to provide helpful information to the public.
2. Connection of the Early Warning System to Code Red is Urgently Needed.
3. Better coordination with MSD is needed for channel maintenance, downspout disconnections, drainage improvements, record keeping, etc.
4. City staff need to work with the commission to integrate and routinely update data on condemned & damaged properties, FEMA information; etc.
5. Inspectors need a standardized protocol for collecting property information following a flood, that should include 1st floor and basement water levels.
6. City should strengthen codes for impervious surfaces.
7. City should require disclosure of flood history for rentals and home purchases, as suggested by SEMA, possibly as part of the occupancy permit.

2023 BUDGET ITEMS

1. $20k for additional stream monitoring and EWS Enhancement
2. $35k est; Top Priority. Contract with surveying company for 1st floor elevations of all properties subject to flooding, which are are needed to prioritize buyouts and floodproofing recommendations.

DATA DRIVEN FLOOD MANAGEMENT DECISIONS

- A database that documents the effect of flooding on UCity properties is essential for identifying the types of mitigation applicable to each property, including buyout priorities, and for preparing damage reports required by FEMA after a flood.
- Following the July flood, the Commission has made significant strides in developing such a tool for the city.
- A study performed by Commissioners Criss & Stein based on precise measurements of flood levels up and down the channel has allowed the development of an inundation map that may be the most precise ever developed for a flash flood of an urban stream. city.
- An Interactive Google Map and Excel database developed by Commissioner Holly has integrated this information with parcel information from St. Louis County, to show effects on individual properties. His presentation will demonstrate those tools.