The Review Was Approved — Then It Flooded

Grant Moore PE CFM

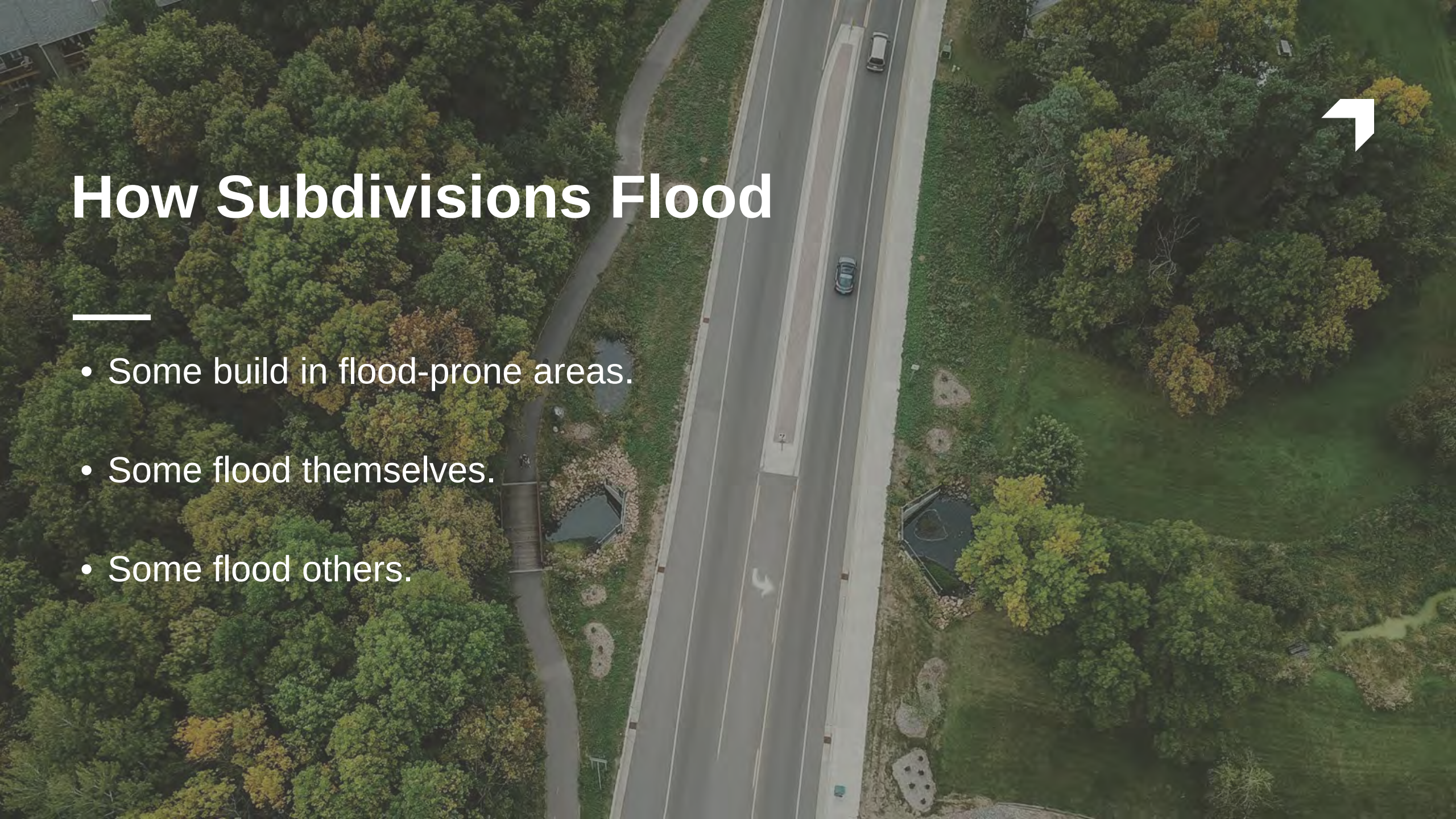
Agenda

- Regulatory Tension
- Case Studies
- Root Causes
- What we can do differently.

Regulatory Tension

Loose	Strict
Growth	Safety
Speed	Strength
Short-term	Long-term

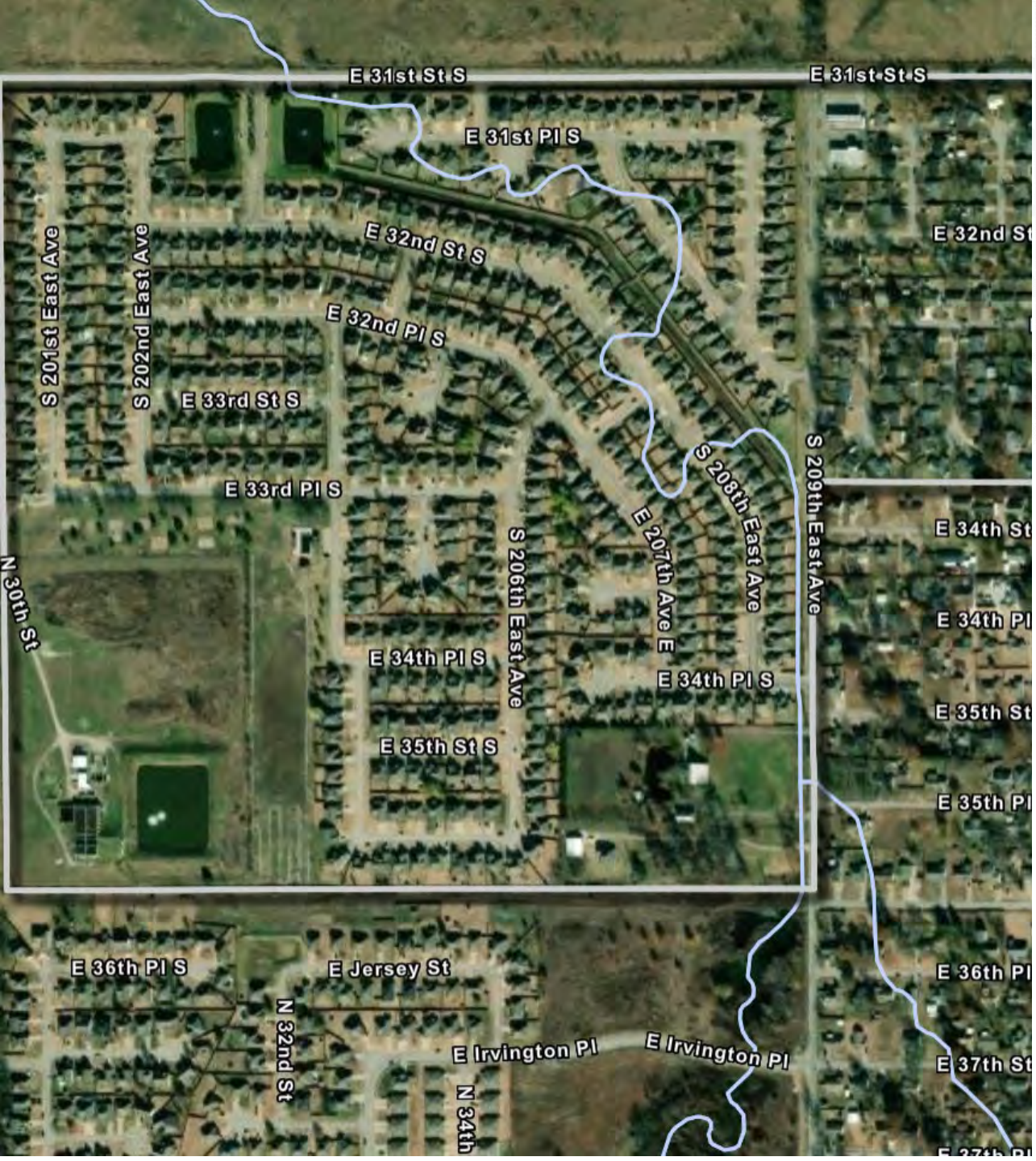
The ideal is somewhere in the middle.

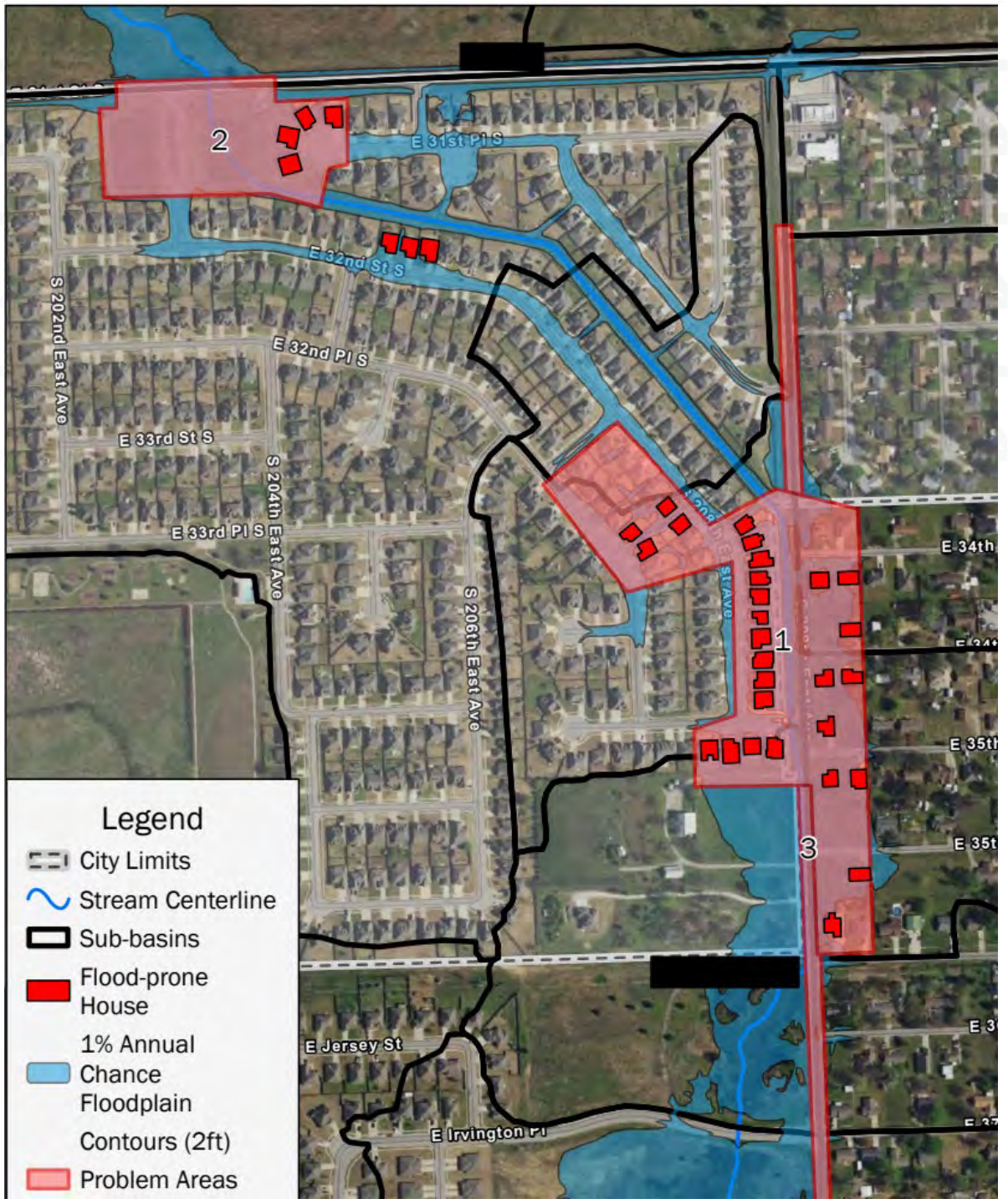


How Subdivisions Flood

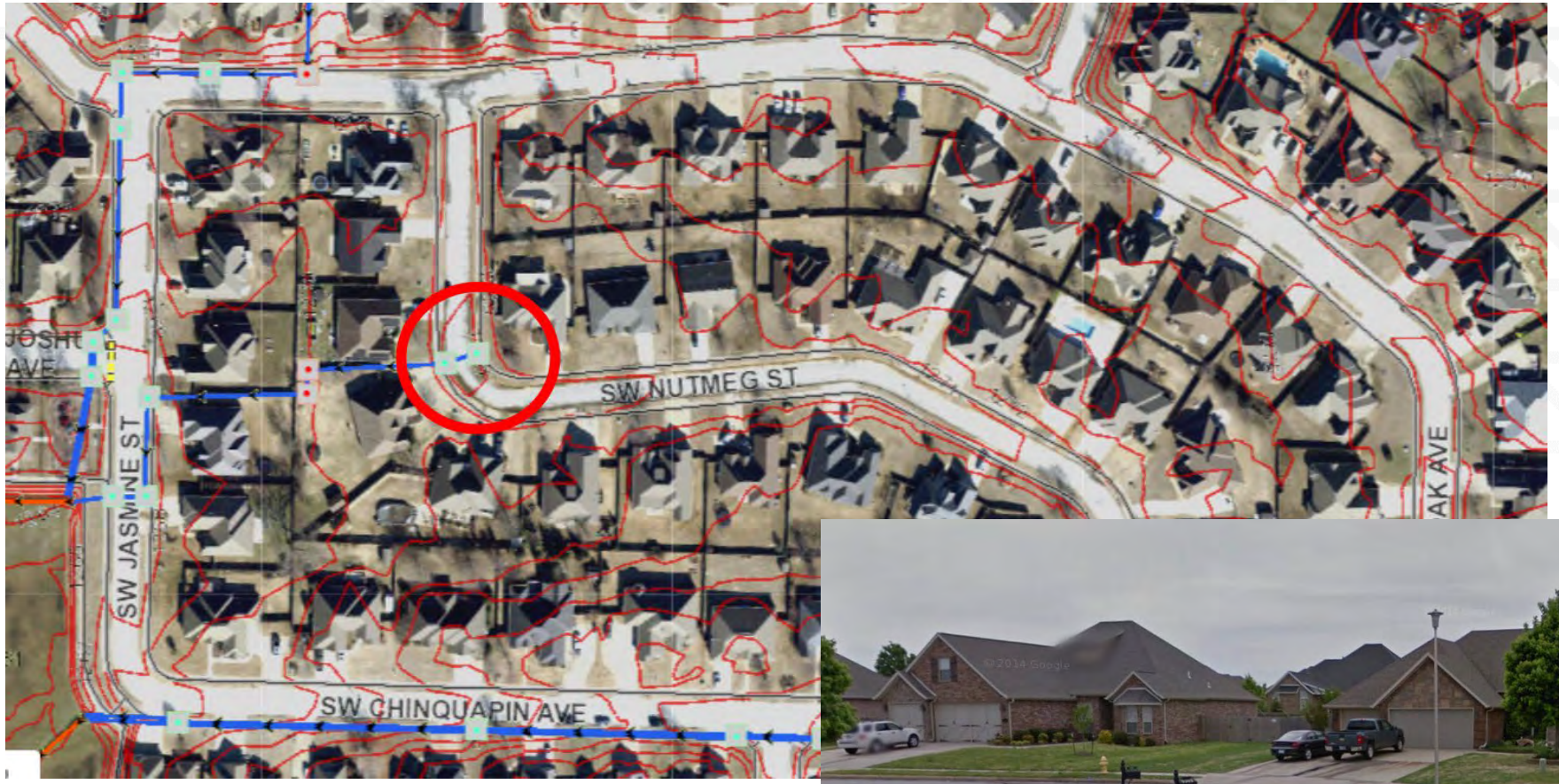
- Some build in flood-prone areas.
- Some flood themselves.
- Some flood others.

Example #1 – Flood-prone Area

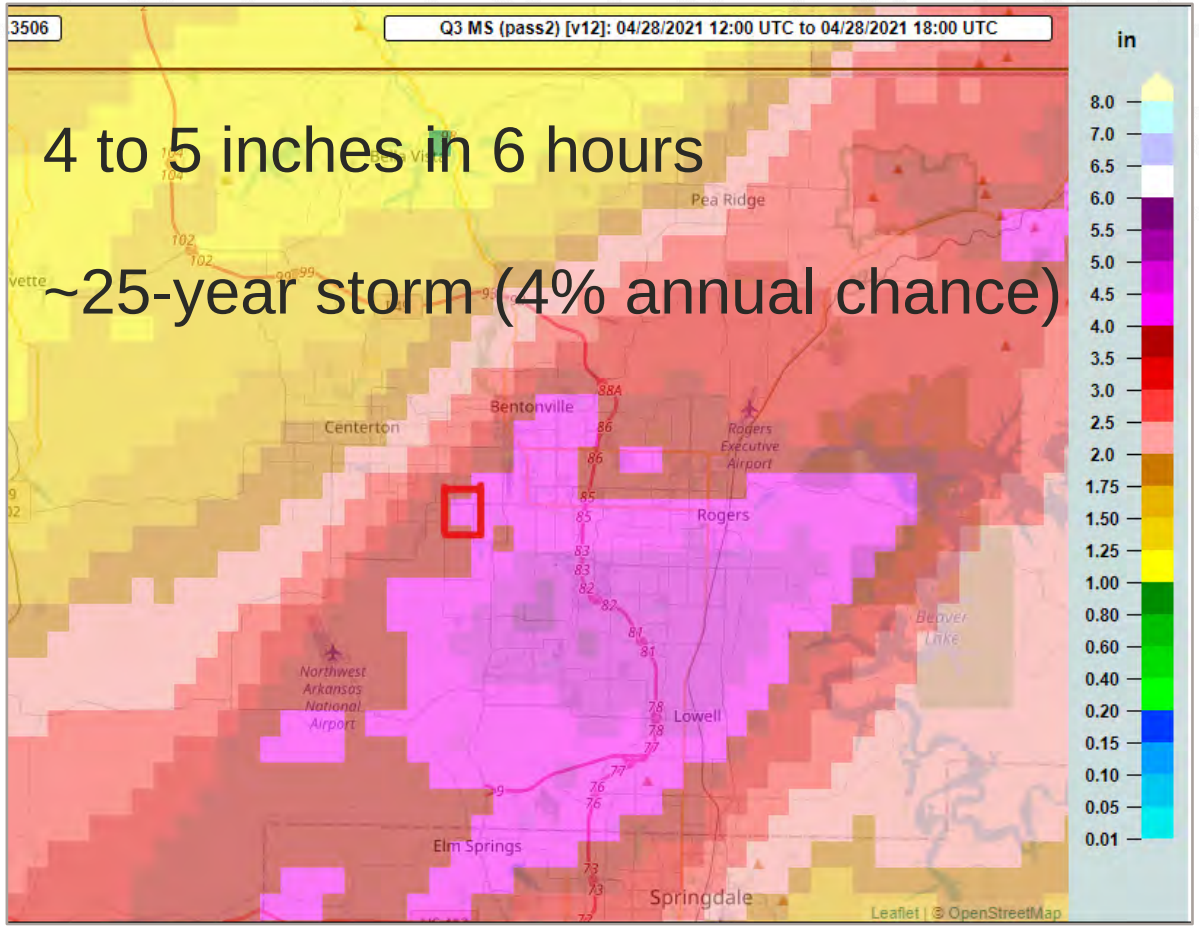

E 31st St S
E 31st St S
E 31st Pl S
E 32nd St S
E 32nd St
E 32nd Pl S
S 201st East Ave
S 202nd East Ave
E 33rd St S
E 33rd Pl S
S 208th East Ave
S 209th East Ave
E 207th Ave E
S 206th East Ave
N 30th St
E 34th St
E 34th Pl
E 34th Pl S
E 34th Pl S
E 35th St
E 35th St S
E 35th Pl
E 36th Pl S
E Jersey St
N 32nd St
E Irvington Pl
E Irvington Pl
N 34th
E 36th Pl
E 37th St


2
E 31st Pl S
E 32nd St S
S 202nd East Ave
E 32nd Pl S
E 33rd St S
S 204th East Ave
E 33rd Pl S
S 206th East Ave
1
3
E 34th
E 35th
E 35t
E 3
E Jersey St
E Irvington Pl
Legend
City Limits
Stream Centerline
Sub-basins
Flood-prone House
1% Annual Chance Floodplain
Contours (2ft)
Problem Areas

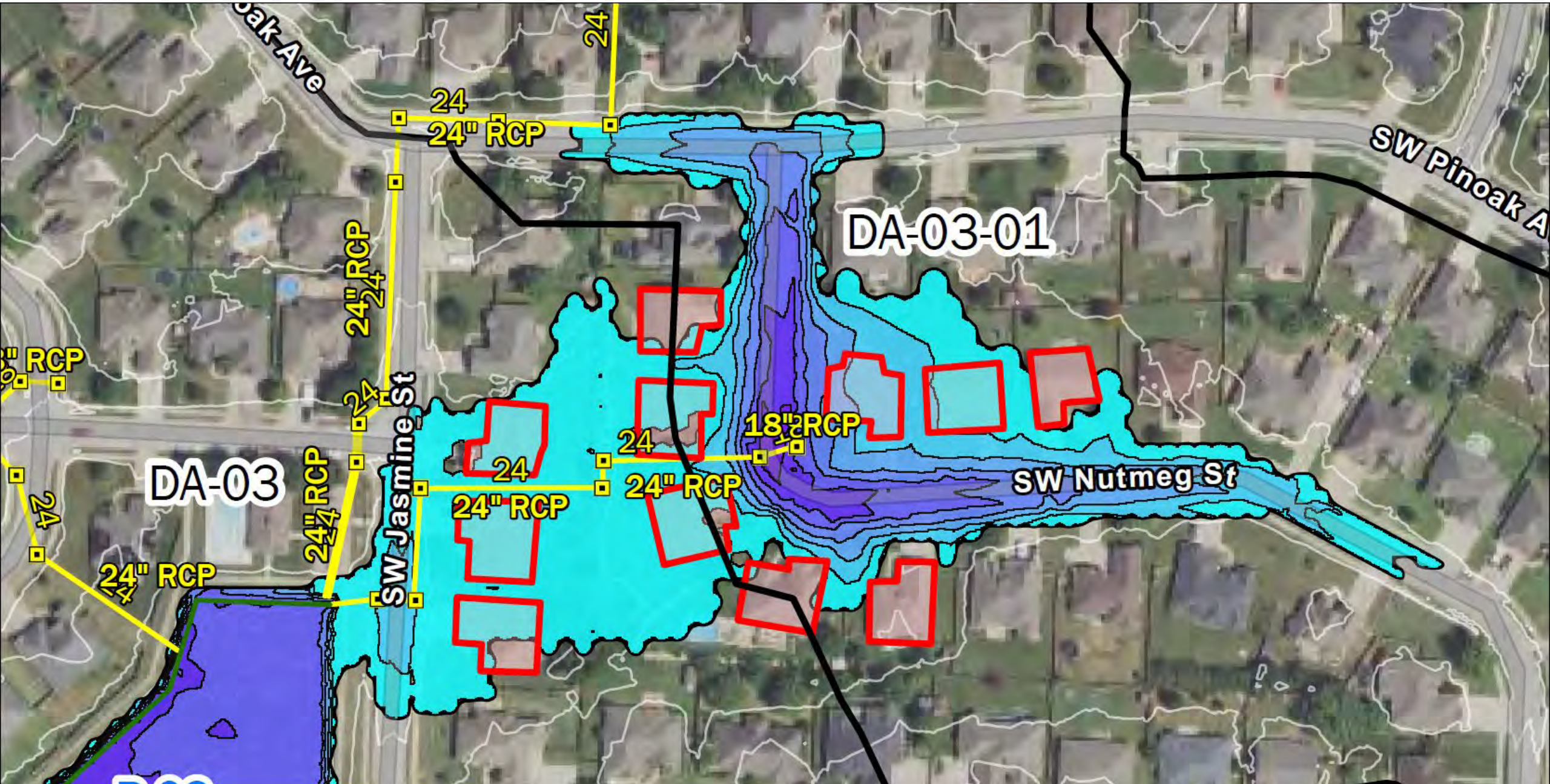
Example #2 – Some Flood Themselves


SW NUTMEG ST
SW JASMINE ST
SW CHINQUAPIN AVE


SW Nutmeg St


3506
Q3 MS (pass2) [v12]: 04/28/2021 12:00 UTC to 04/28/2021 18:00 UTC
in
8.0
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.75
1.50
1.25
1.00
0.80
0.60
0.40
0.20
0.15
0.10
0.05
0.01
4 to 5 inches in 6 hours
~25-year storm (4% annual chance)
Pea Ridge
Centerton
Bentonville
Rogers Executive Airport
Rogers
Beaver Lake
Northwest Arkansas National Airport
Lowell
Elm Springs
Springdale
Leaflet | © OpenStreetMap

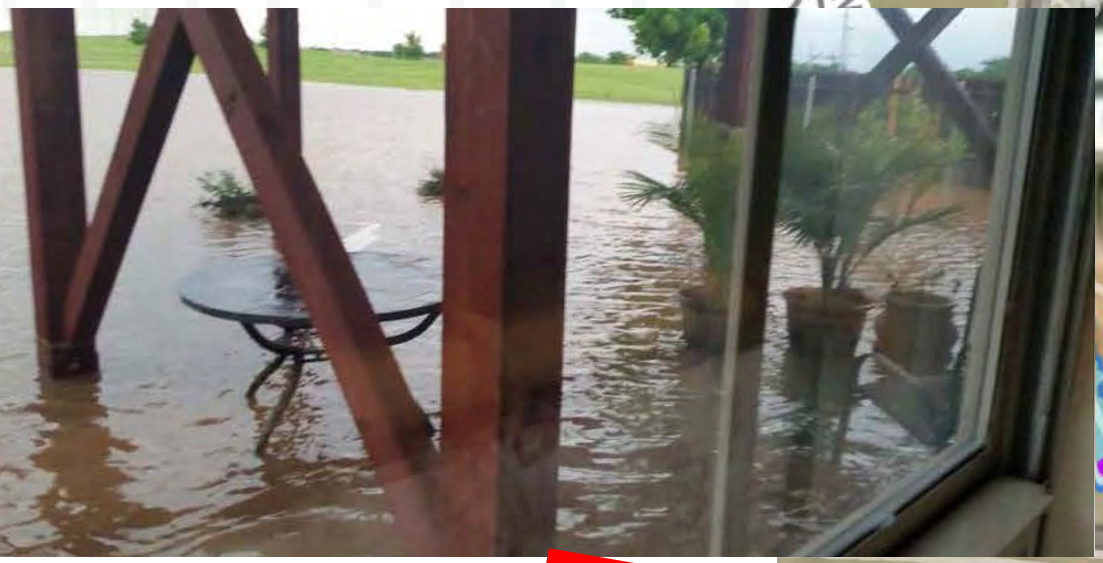

Inlet


DA-03-01
DA-03
SW Pinoak A
SW Nutmeg St
SW Jasmine St
24" RCP
18" RCP
24

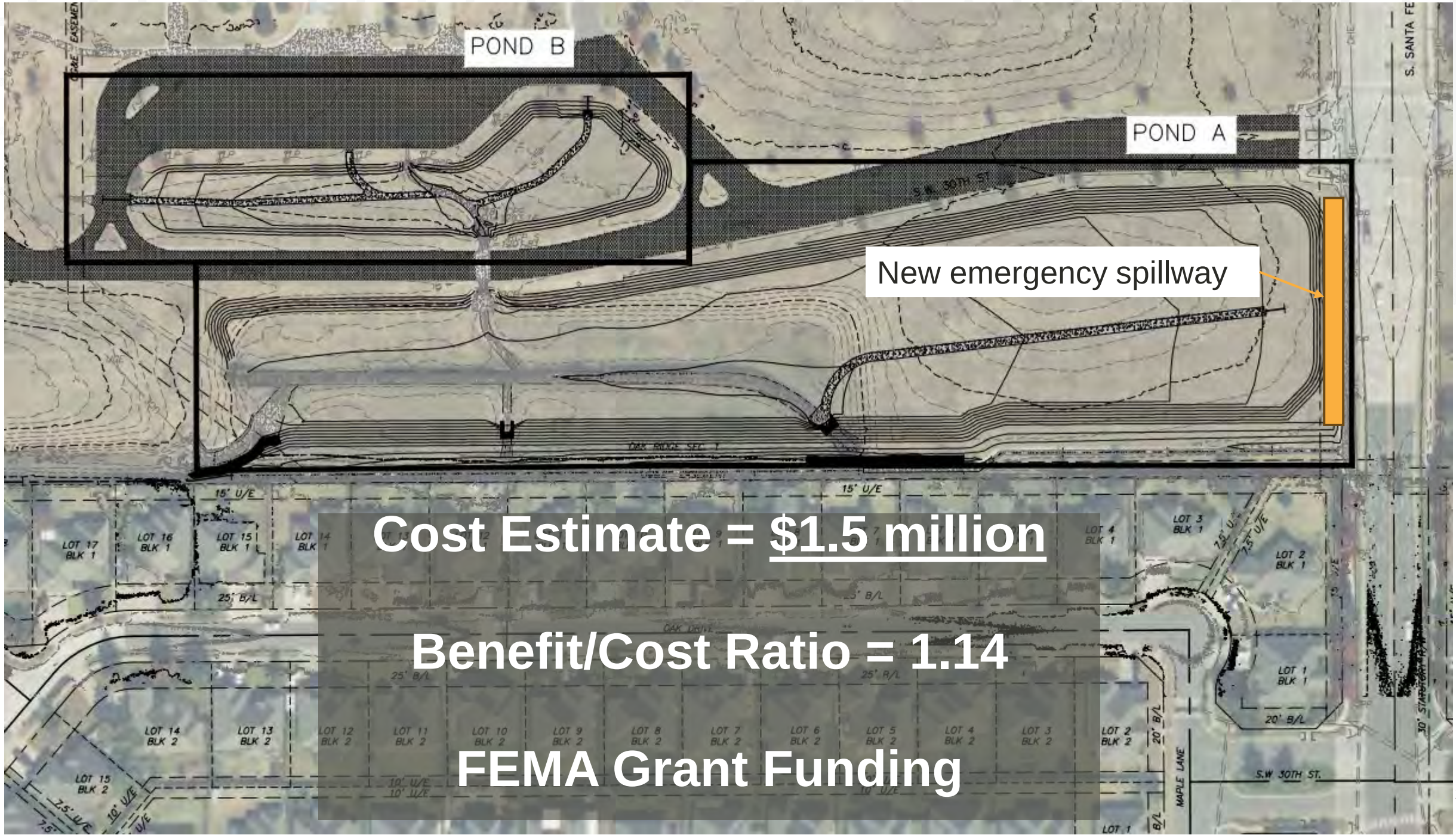
	2000 Design	2022 Second Look
Hydrology Method	Rational Method	Curve Number
Drainage Area	15.4 acres	17.7 acres
Time of Concentration	53 mins	20.9 mins
10-year Flow	13.8 CFS	59 CFS
100-year Flow	5.2 CFS?	95 CFS
Calculated 24” Pipe capacity	24.6 CFS	15 CFS

- 8’x3’ RCB
- Inlet Upgrades
- Lower Pond ~1.5’
- Downstream Channelization
- Cost Estimate = $1.7 million

Example #3 – Some Flood Others




1212
1216
1206
1206
1216
1204
Existing
Spillway
Oak Dr
Oak Dr
1204
1204
SW 31st St
1210


POND B
POND A
New emergency spillway
Cost Estimate = $1.5 million
Benefit/Cost Ratio = 1.14
FEMA Grant Funding

Root Causes

1 Poor Design

- Cost-cutting bias
- Not considering key design constraints (offsite runoff, tailwater, downstream capacities)
- No emergency flow paths

2 Poor Criteria

- Outdated
- Too loose

3 Poor Review

- Understaffed
- Time constraints

Criteria Considerations

- Rational Method
  - Limit use to 40-acres or less OR a maximum time of concentration
  - Use the Wright-Mclaughlin Factor
  - Never allow Modified Rational Method for detention pond design
- Limit overland lengths to 100 feet or less
  - per NRCS National Engineering Handbook
- Require detailed H&H for DAs > 40-acres
  - Establish 100-year elevations where none exist
- 2-foot freeboard minimum from 100-year
- Require explicit tailwater considerations with justifications
  - Culverts, storm sewer outlets, pond outlets
- Require emergency overflow paths from sumps

$$Q = C_f CIA$$

C_f = 1.0 for 10-year or less recurrence interval
1.1 for 25-year
1.2 for 50-year
1.25 for 100-year

"Since a hydrograph produced by the Rational method does not reflect the total runoff or the intensity variations of a real storm, it is not recommended for the design and analysis of detention ponds. It is strongly advised that the SCS-UH or SBUH methods be used when pond routing calculations will be performed."

HydroCAD Guidance
- https://www.hydrocad.net/rational.htm

THANK YOU

Grant Moore PE CFM
grant.moore@wsbeng.com