

The Four Faces of I/I in Public Sewer Systems



George E. Kurz, P.E., DEE, Consulting Engineer,
Independent Researcher



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#1 Problem is I/I (Leaking Sewers)



**I/I is never acceptable – it is
always causing problems !**



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The Good, the Bad, & the Ugly

4 examples of how I/I occurs in Sewage Collection Systems

The Bad:

I/I measured statewide in Tennessee & North Carolina

The Ugly:

Cost of I/I to users is underestimated

The Good:

Rehabilitation is effective for I/I reduction and it is easy to document the results



Matrix of Four I/I System Categories

The Presence of I/I is
Sometimes Masked

but

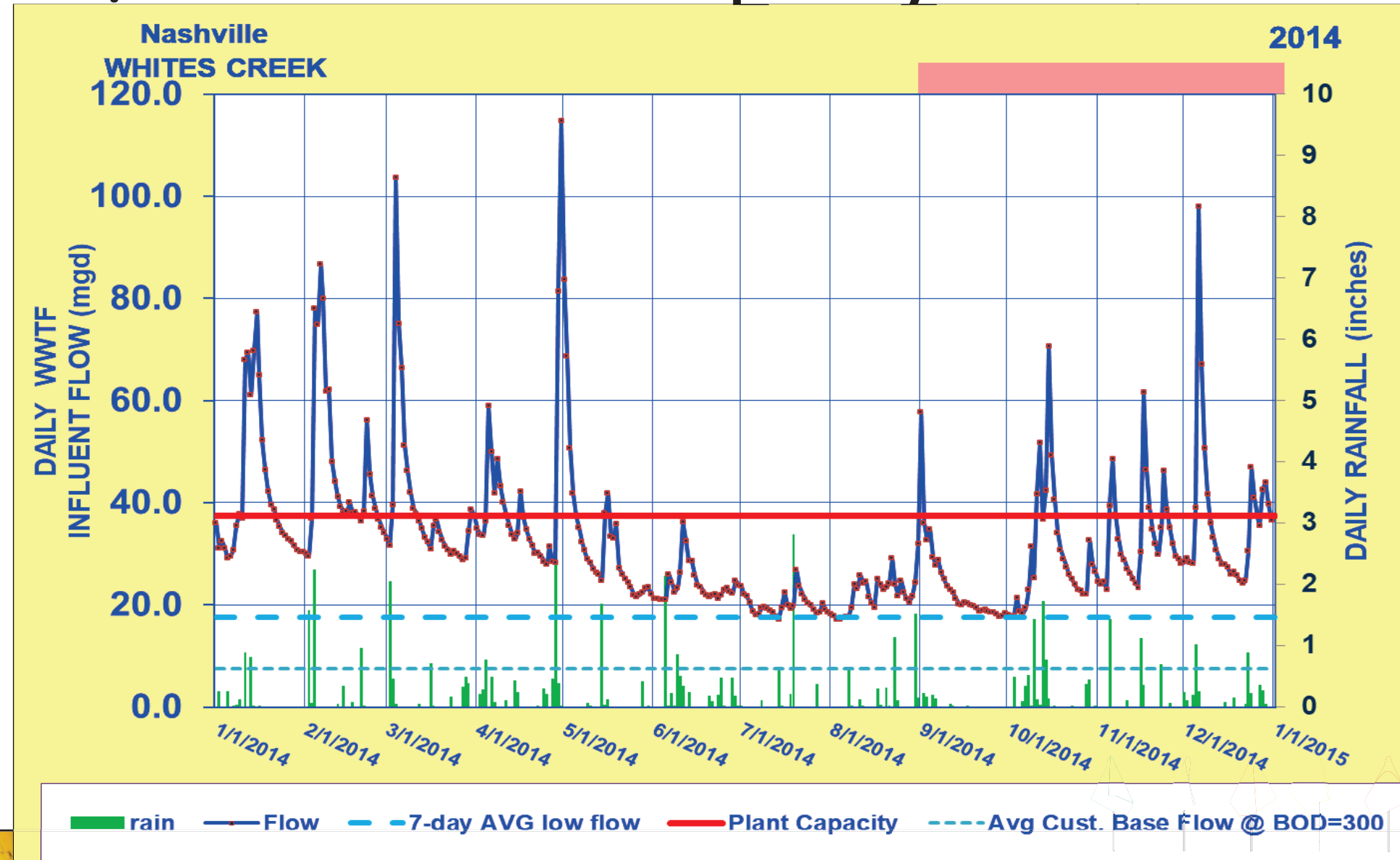
I/I is NEVER OK

	Limited Capacity	Excess Capacity
HIGH ↑ I/I ↑ LOW		



High Level of I/I with Limited Capacity

- 77% Annual I/I
- Avg BOD = 79 mg/l
- Capacity Exceeded 83 days
- 1" rain causes exceedance
- Significant dry-weather I/I



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High Level of I/I with Limited Capacity

Limited Capacity

Excess Capacity



HIGH



I/I



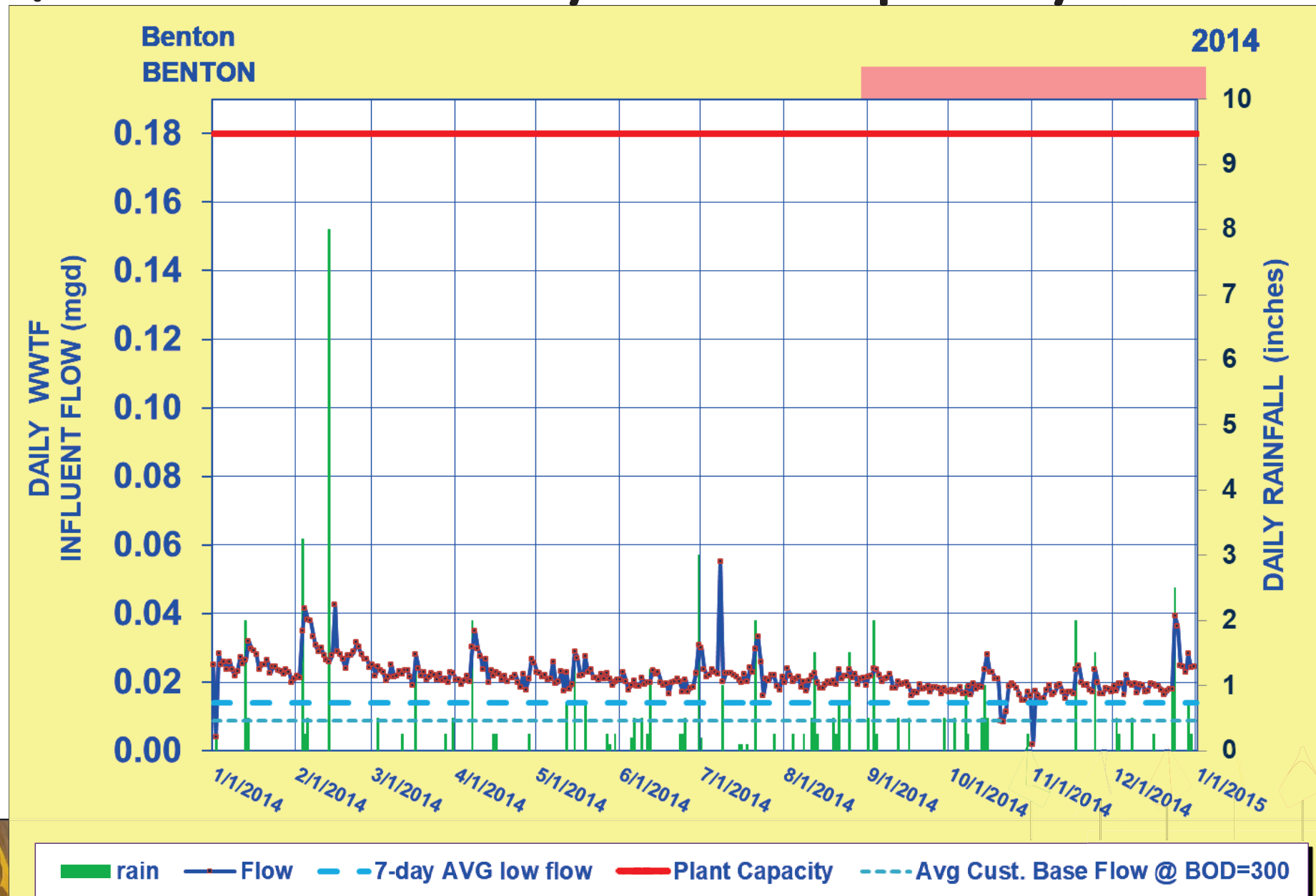
LOW

- SSOs
- Backups (& Flooding?)
- Wasted money for new facilities
- Wasted money for treatment



High Level of I/I with Excess System Capacity

- 56% Annual I/I
- Avg BOD = 132 mg/l
- RDI/I does not get near capacity
- Dry weather Infiltration problem



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High Level of I/I with Excess System Capacity

Limited Capacity

Excess Capacity

HIGH



- Wasted money
for excess
treatment
capacity



LOW

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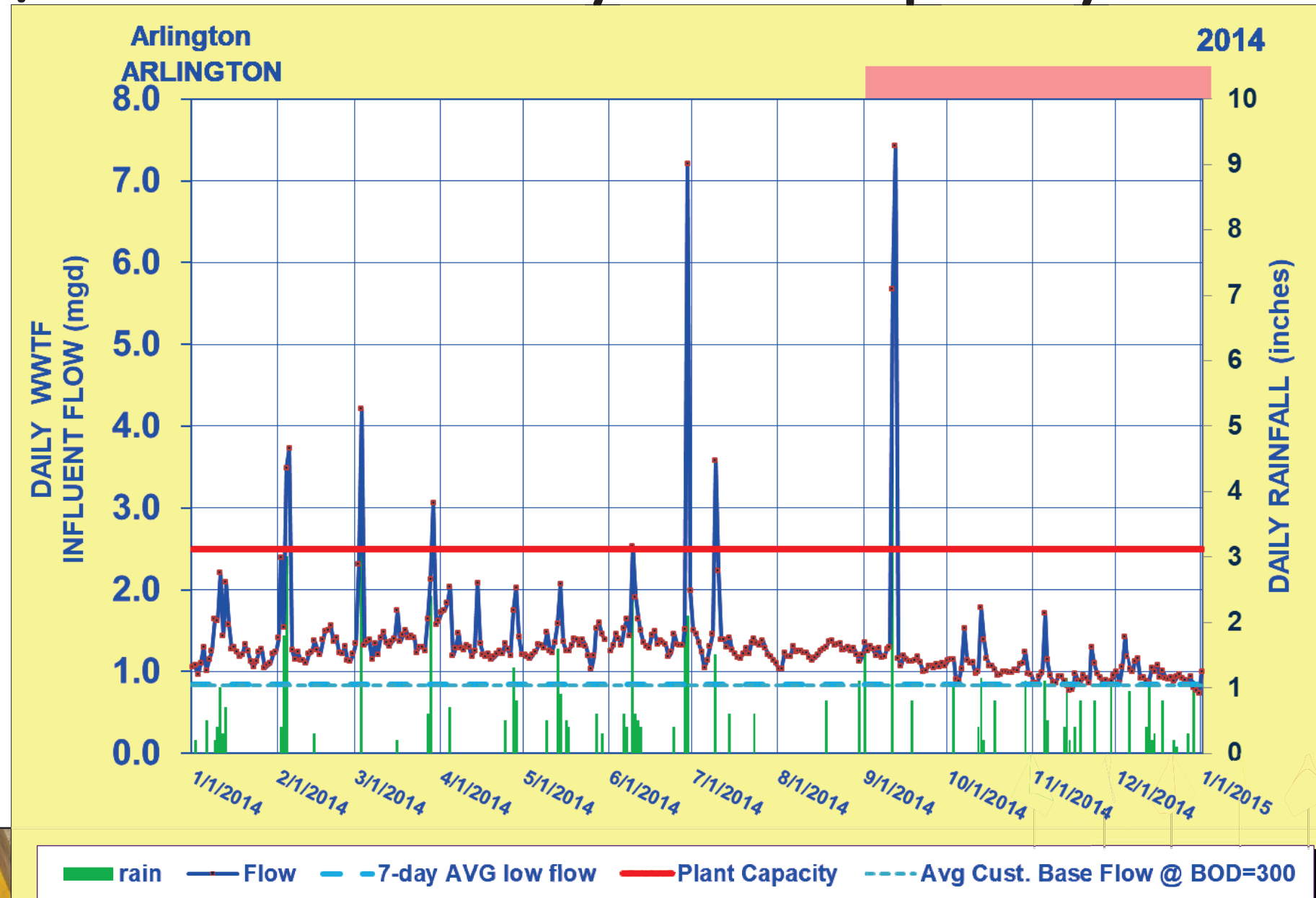
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Low Level of I/I with Limited System Capacity

- 38% Annual I/I
- Avg BOD = 194 mg/l
- Exceeds capacity with 3" rain
- RDI/I problem

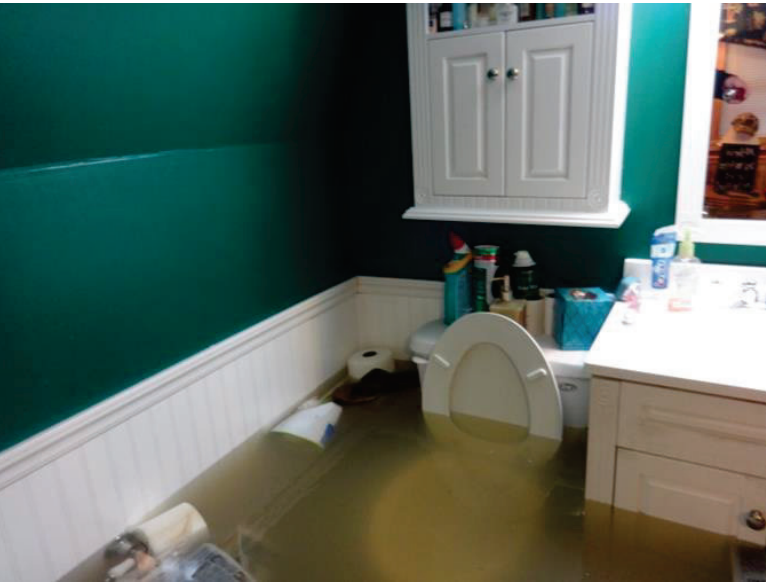


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Low Level of I/I with Limited System Capacity



Limited Capacity

Excess Capacity

HIGH



I/I



LOW

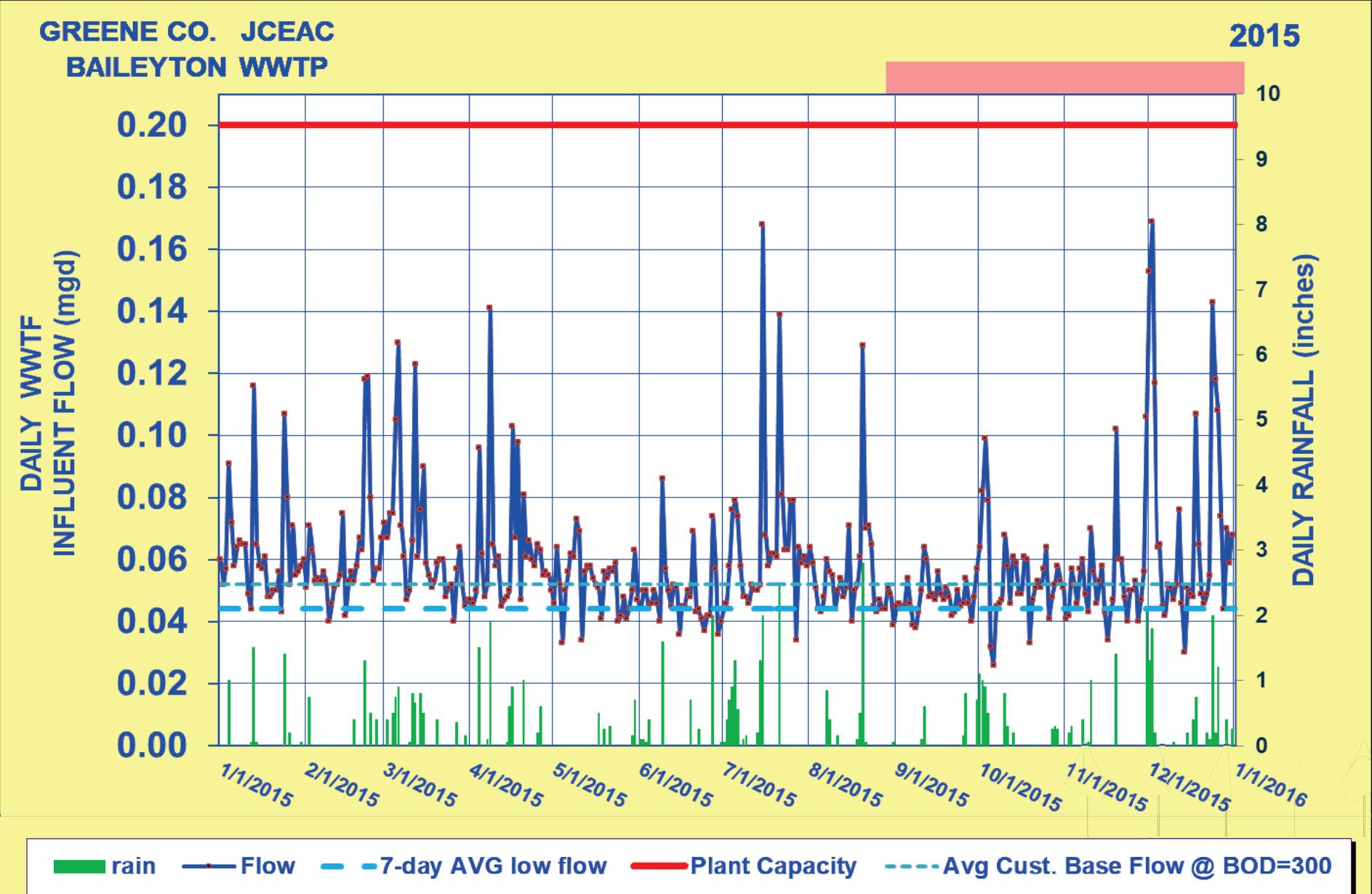
- SSOs

- Backups



Low Level of I/I with Excess System Capacity

- 24% Annual I/I
- Avg BOD = 265 mg/l
- Capacity for 5 year rain event



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Low Level of I/I with Excess System Capacity

Limited Capacity

Excess Capacity



HIGH



I/I



LOW

	- Deposition of Solids due to low velocity



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I/I: The Big Picture

- I/I is NEVER OK
- All Experience loss of soil – leading to structural failure

HIGH



I/I



LOW

Limited Capacity

Excess Capacity

<ul style="list-style-type: none">- SSOs- Backups (& Flooding?)- Wasted money for new facilities- Wasted money for treatment	<ul style="list-style-type: none">- Wasted money for treatment capacity
<ul style="list-style-type: none">- SSOs- Backups	<ul style="list-style-type: none">- Deposition of Solids due to low velocity



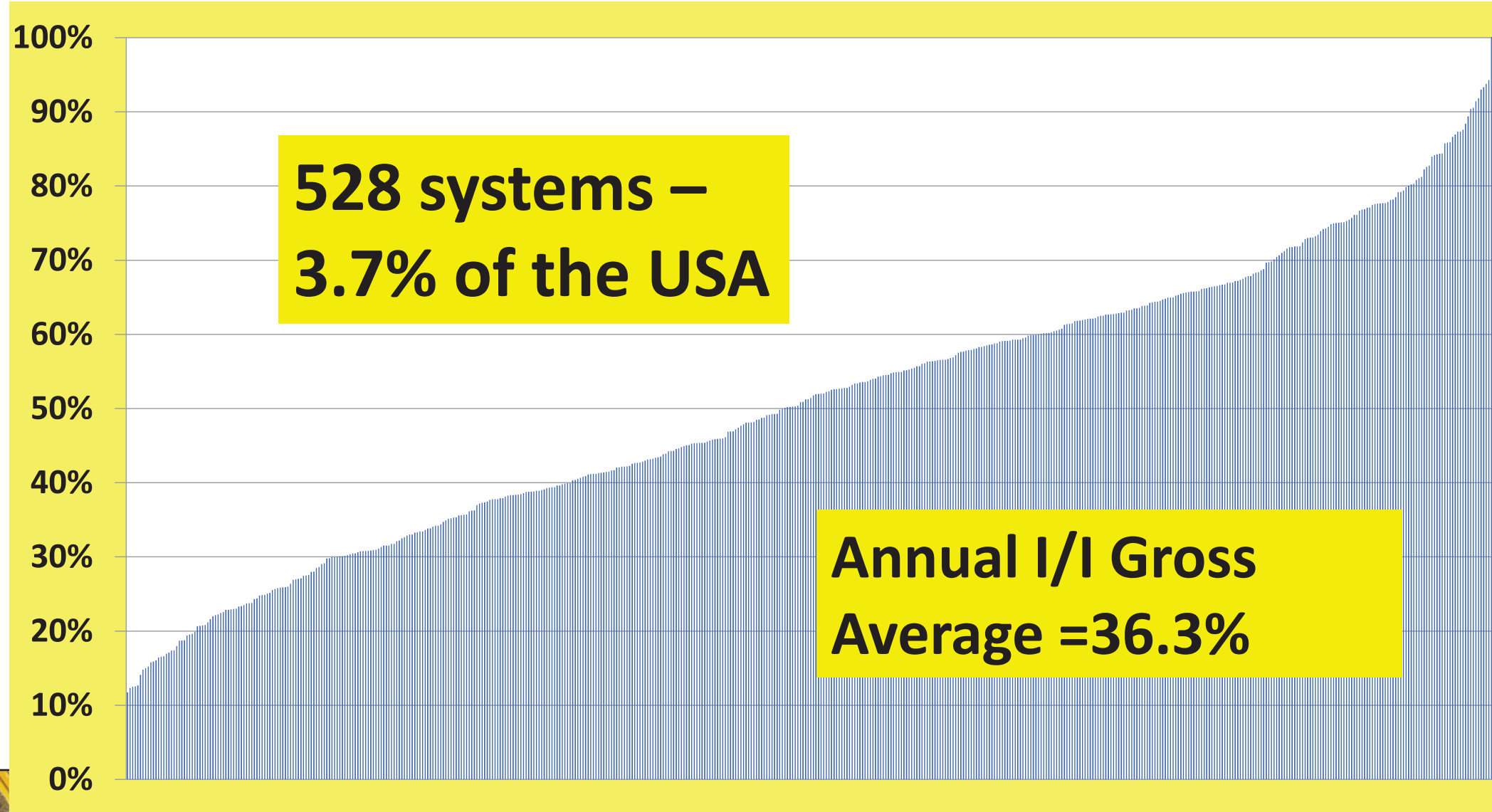
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Range of % Annual I/I



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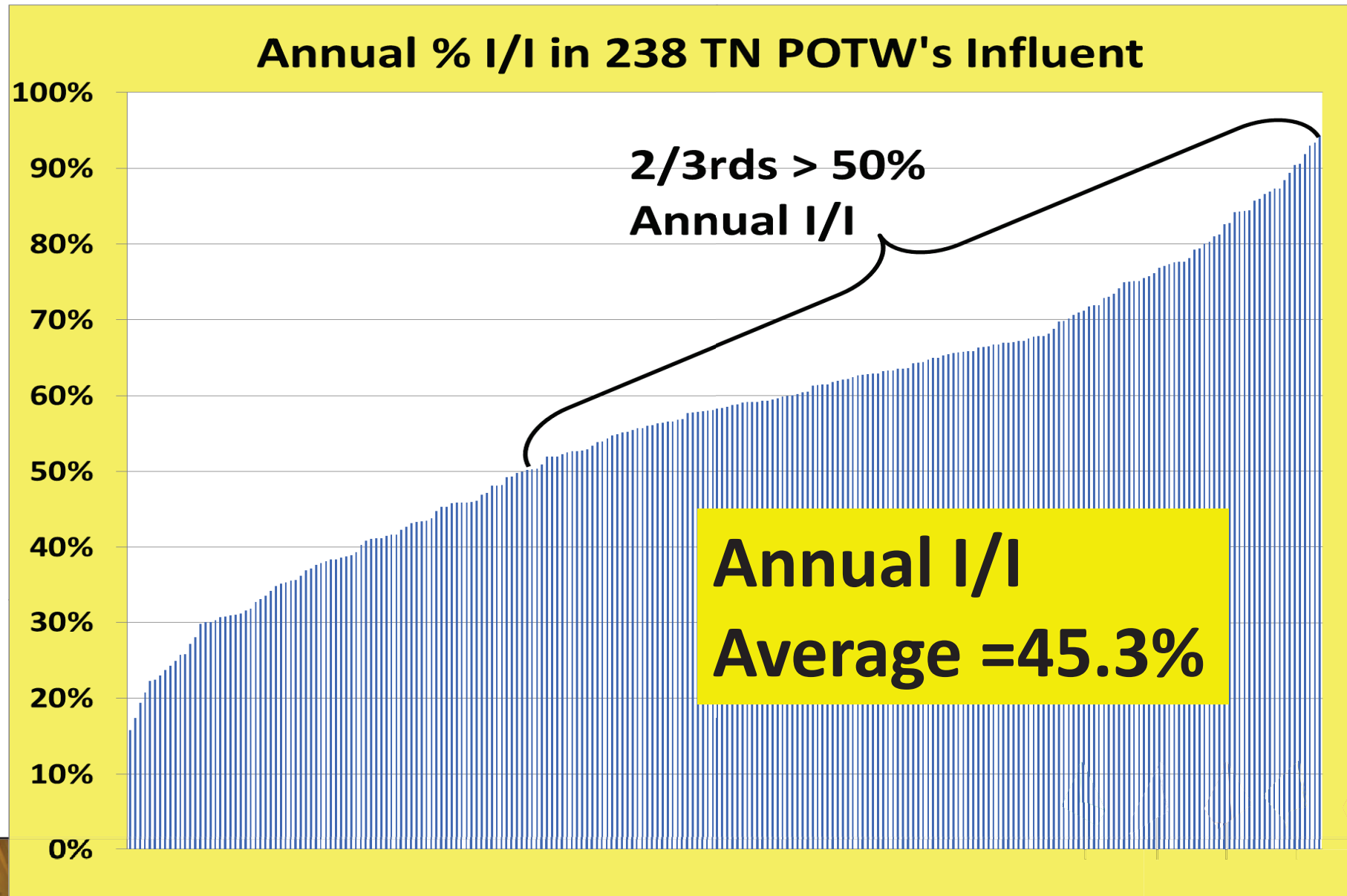
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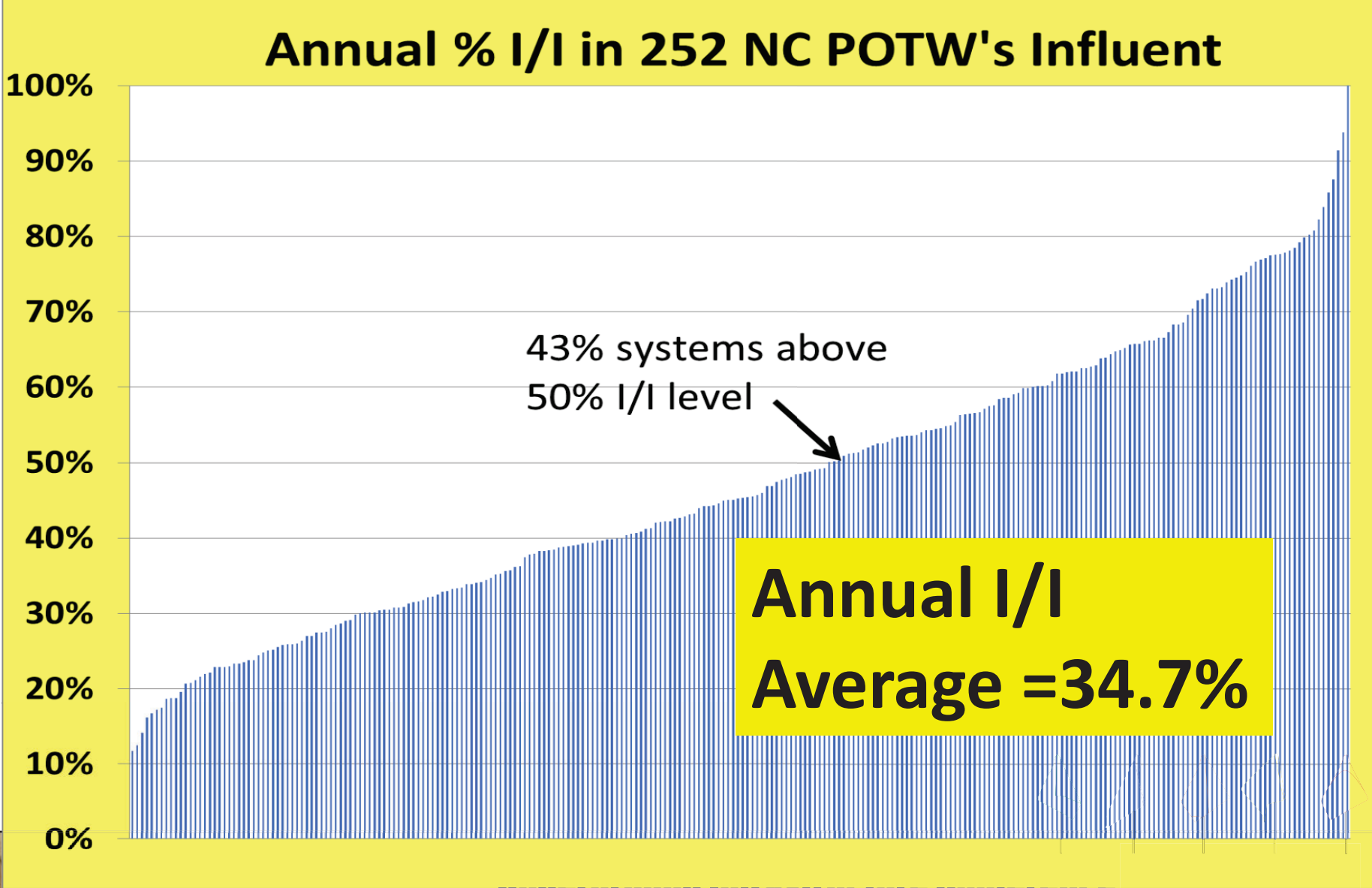
I/I Differences between States

Tennessee



I/I Differences between States

North
Carolina



Comparison to EPA 2012 CWNS

(Clean Water Needs Survey)

EPA CWNS (Item 3a)

- 42 systems with I/I problems
- Estimated Cost: \$290 mill
- Based on survey of agencies

Tenn. Study

- 182 systems exceed plant capacity for 2-year storm
- 66 systems exceed plant capacity > 60 days/year
- Estimated cost to cut by 50%: \$1.14 billion (in 2016)
- **Based on 100% data**



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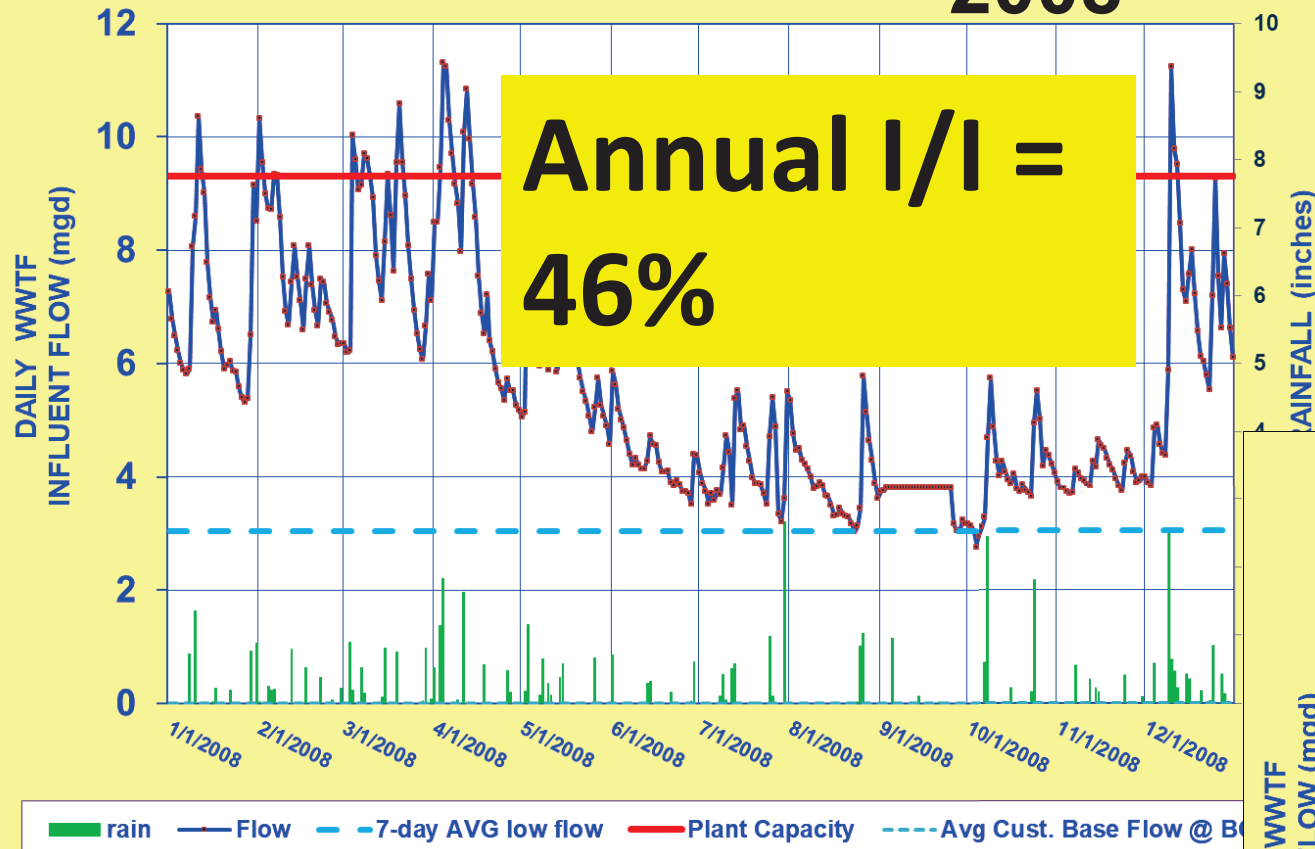
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Sewer Rehabilitation

2008

Annual I/I =
46%

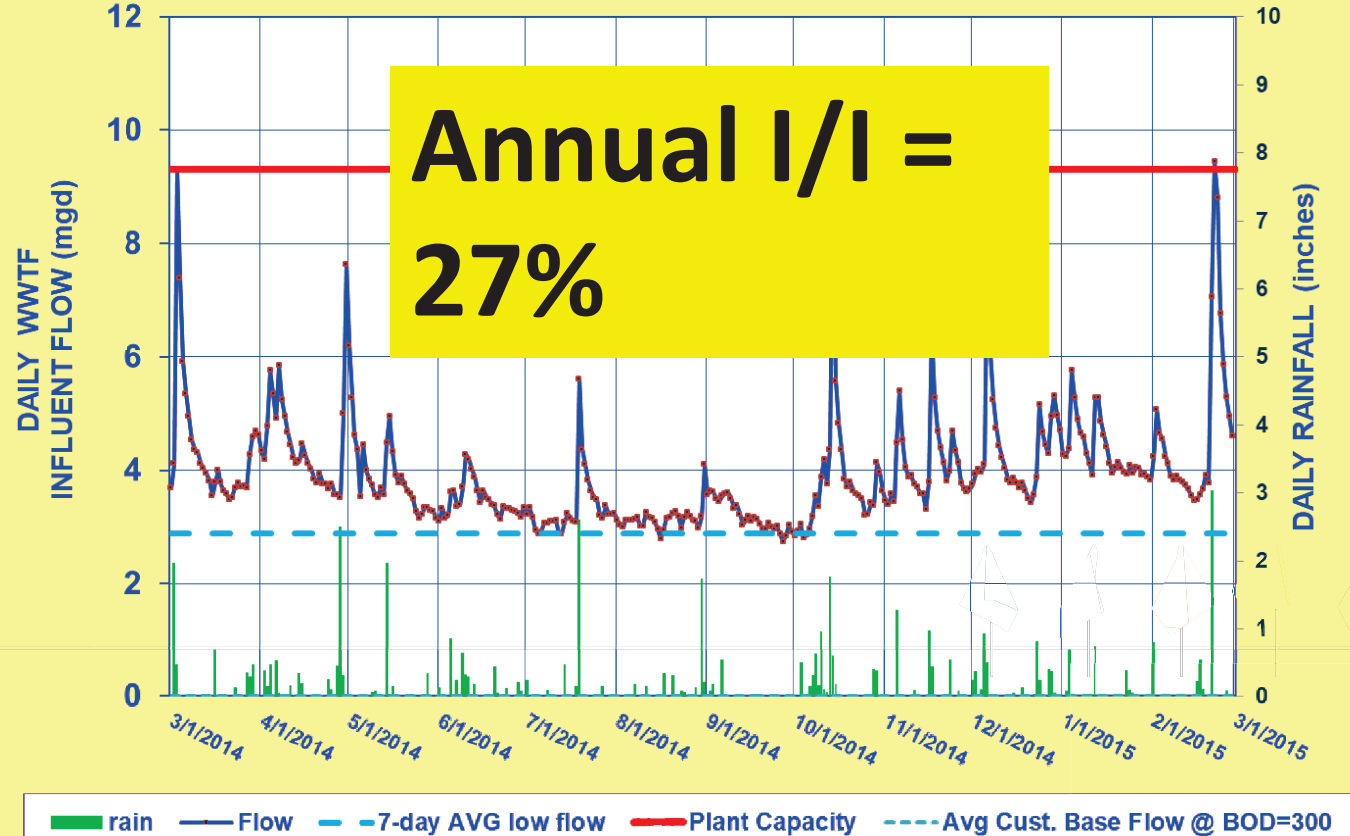


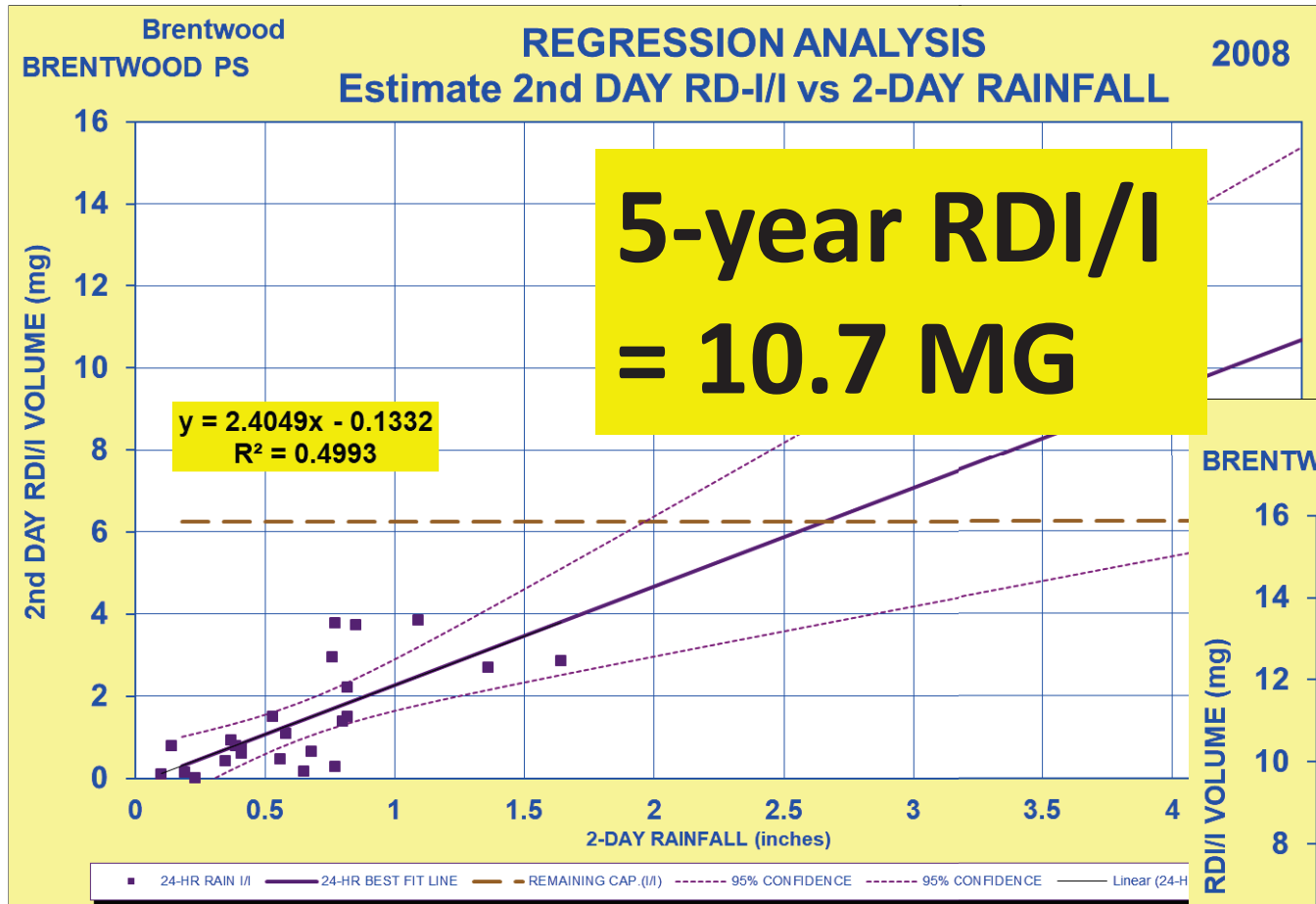
Annual I/I Reduction

Brentwood BRENTWOOD PS WWTF DAILY FLOW & RAINFALL

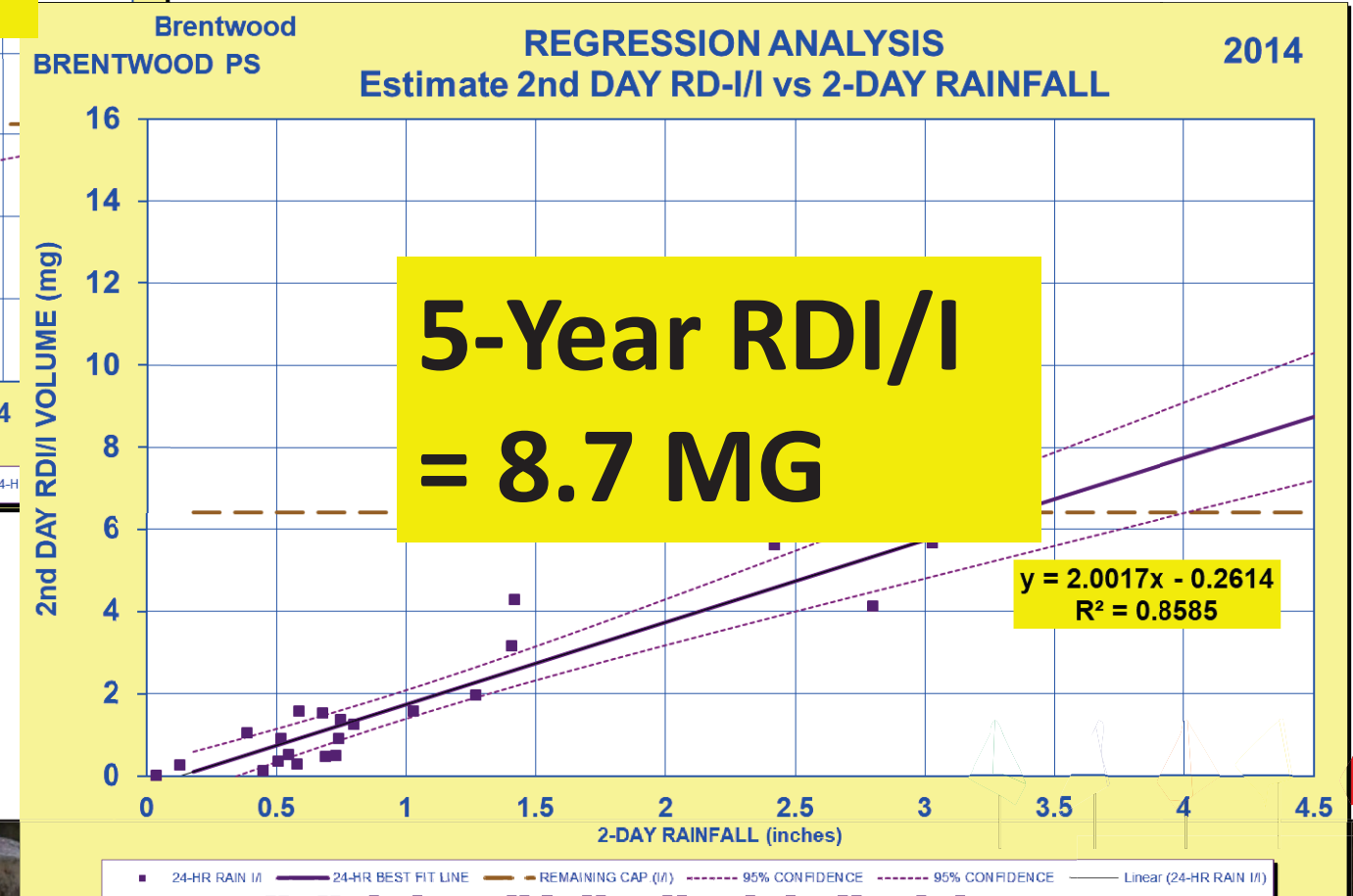
2014

Annual I/I =
27%





Sewer Rehabilitation



RDI/I Reduction



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Conclusions

- I/I is **STILL** a significant problem for public sewer systems.
- Without data we can only guess at the true cost
- I/I can be corrected by sewer rehabilitation
- Sewer Rehabilitation is cost effective – especially compared to the true extent and cost of I/I today.



Questions ?

George Kurz, P.E., DEE
615-714-6120

George.kurz@comcast.net

www.sewercapacitymanagement.weebly.com



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