TEXAS ASSOCIATION OF CLEAN WATER AGENCIES
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Playing 3-Shell Monte with Peak Flows – A Technical-Economical Analysis of Storm Flow Management Alternatives

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carollo 90 YEARS

Names for Wet-weather treatment

- Wet-weather treatment
- Blending (out-dated)
- Parallel Treatment
- Select Treatment
- Storm Flow Auxiliary Treatment

Why Consider Wet Weather Treatment

- Higher intensity storms and I&I are affecting utilities' performance during peak flow events.
- Handling peak flow in main treatment trains results in a large footprint that is not feasible to accommodate within site limitations/constraints.
- Designing the main treatment train for the peak flow results in high capital costs and facilities that remain unused for most of the year.

Regulatory Background

TCEQ 217.B.(1) requires the use of 2-year 24-hour storm event

Wet Weather - Regulatory Background

- **Prior to 1994:** Blending used to treat excess wet weather flow
  - Non-uniform acceptance of blending practice by EPA regions
- **1994:** CSO Policy establishes basis for "CSO-related bypass"
  - Blending for WWTPs served by separate sewer systems not addressed
- **2005:** EPA proposal mirroring approach taken by 1994 CSO Policy
  - Blending would be authorized as an anticipated bypass if a "No Feasible Alternatives Analysis" was conducted
  - Never released by OMB

Wet Weather - Regulatory Background

- **Post-2005:** EPA Headquarters took the position that blending had ALWAYS been a bypass
  - » EPA Headquarters took the position that all WWTPS served by separate sewer systems must provide biological treatment to ALL flows

- **2013:** 8th Circuit Decision *Iowa League of Cities v EPA*
  - » Court found that EPA was improperly applying 2005 policy (proposal) as a rule
  - » CWA secondary treatment standards apply only at "end of pipe"
  - » EPA is only applying ruling within 8th Circuit jurisdiction

- **2018:** EPA announces plan for rulemaking to resolve blending issue
  - » Rule not released by time previous Administration ended. Presumed dead.

TSS and CBOD5 Performance – CFR § 133.101&102

Parameter	Stipulated Effluent Criteria	
	30-day Average	**7-day Average**
TSS, mg/L	30	45
BOD_5, mg/L	30	45

- Facilities eligible for treatment equivalent to secondary treatment.

  (1).....

  (2).....

  (3) The treatment works provide significant biological treatment of municipal wastewater

Potential Treatment Options

- Without Biological Step
  - » Primary Filters
    - Cloth media
    - Compressible media
    - Ceramic membrane
  - » Chemically Enhanced Primary Filtration
  - » High-rate Clarification
    - Sand ballasted systems (e.g. Actiflo®, Dynasand)
    - Magnetite ballasted systems (Co-mag)
    - High solids contact systems (DensaDeg
- With Biological Step
  - » Bio-Actiflo®
  - » Bio-Mag
  - » Contact Stabilization plus clarification
- Other
  - » Step-Feed in Aeration Basins
  - » Equalization

Non-Economic Comparison of Wet Weather Treatment Options

TREATMENT TYPE	ADVANTAGES	DISADVANTAGES
Peak Flow Storage	Reduces size of treatment processes and effluent outfall. Does not rely on combining effluents to meet effluent limits. Does not require special approval by regulators.	Larger footprint than auxiliary treatment. Potential odor concerns. Basin wash-down is labor-intensive. Limited sustained peak flow capacity. When it's full, it's full.
Secondary Treatment Enhancements	Does not rely on combining effluents to meet effluent limits. For conventional processes, it does not require special approval by regulators.	Providing more or larger clarifiers is costly and requires a large footprint. Biological system may become stressed during peak flow events. May add complexity to secondary system operation.
Auxiliary Treatment	Smaller footprint than other alternatives. Can handle sustained design peak flow. Certain technologies can serve dual purpose (tertiary and wet weather treatments).	Relies on combining effluents to meet permitted limits. Lower treatment efficiency than the main treatment train. Limited number of full-scale installations. Backwash or solids wasting must be returned upstream of primary clarifiers. May require special approval by regulators.

Calculating Storm Impacts on Facility

ISWM 2-Year 24 Hour Storm Event

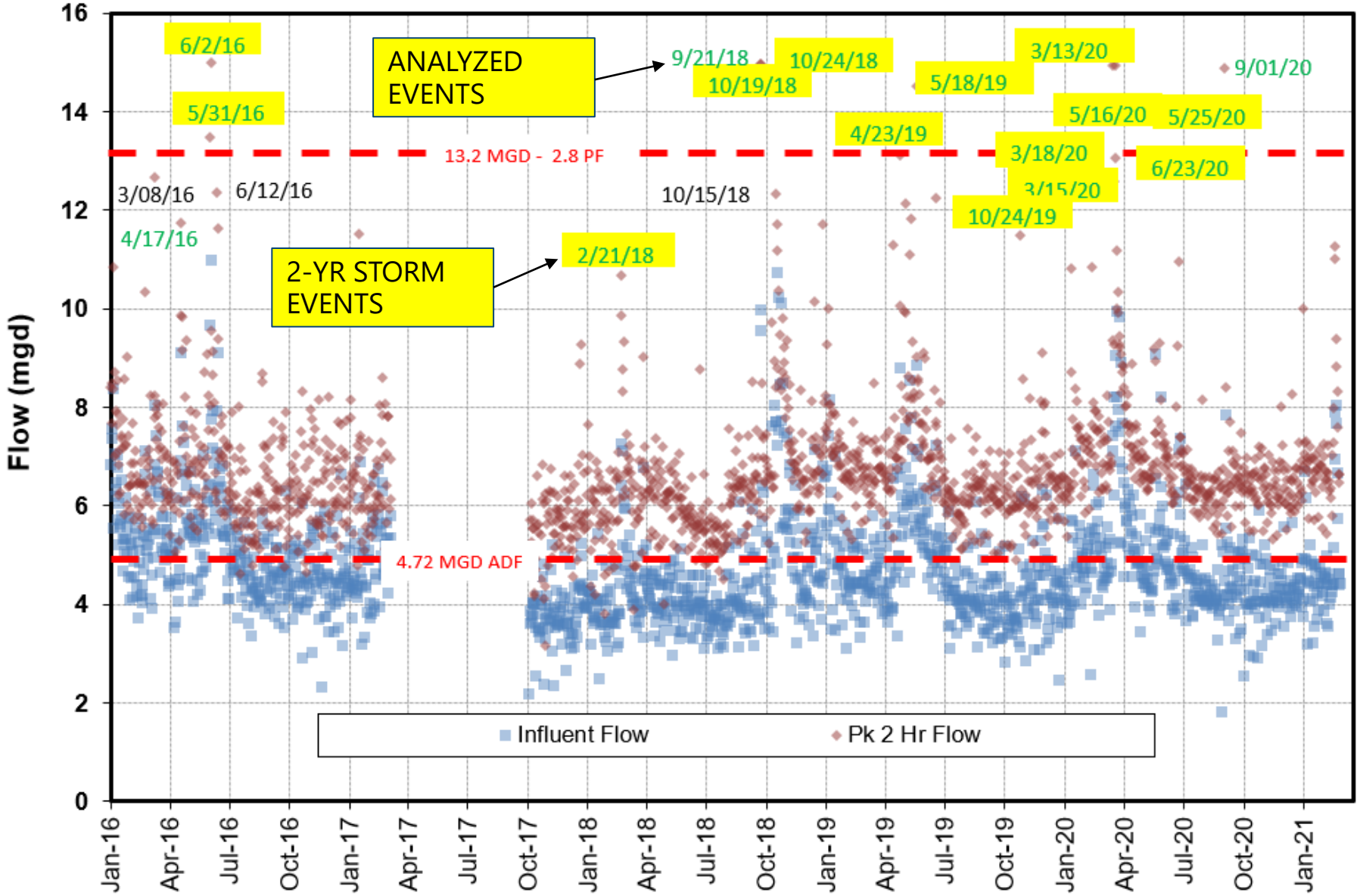
TCEQ 217.B.(1) requires the use of 2-year 24-hour storm event

Table 5.3 AMS-based precipitation frequency estimates for Denton County (inches)

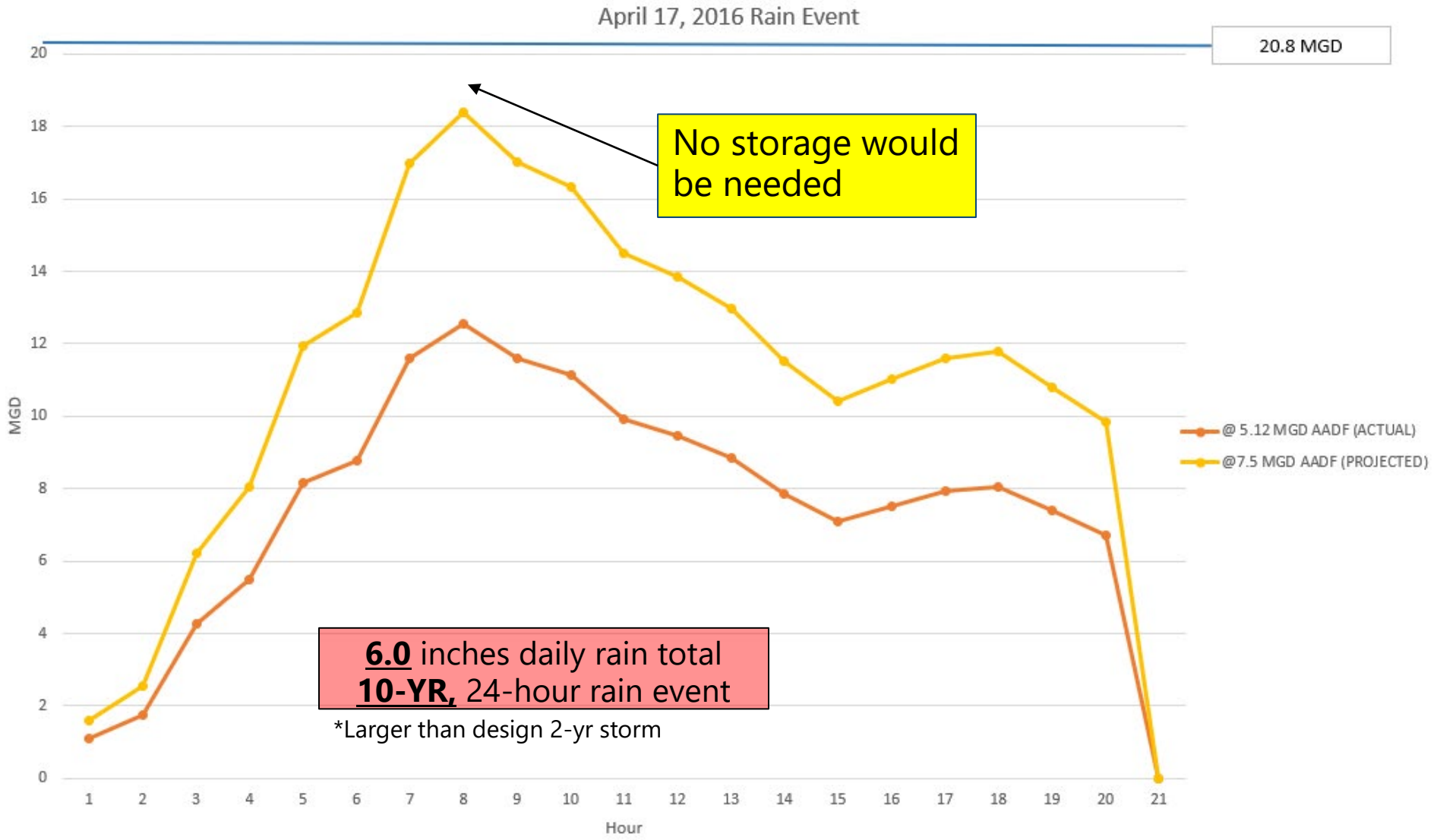
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.419	0.452	0.584	0.682	0.808	0.901	0.992	1.085	1.207	1.299
10-min	0.671	0.725	0.936	1.094	1.298	1.448	1.595	1.737	1.920	2.055
15-min	0.836	0.902	1.162	1.356	1.606	1.788	1.967	2.148	2.387	2.568
30-min	1.162	1.252	1.610	1.875	2.217	2.463	2.708	2.959	3.297	3.557
60-min	1.508	1.627	2.100	2.452	2.907	3.237	3.569	3.915	4.388	4.757
2-hr	1.842	2.000	2.612	3.076	3.690	4.149	4.621	5.121	5.814	6.363
3-hr	2.040	2.223	2.927	3.465	4.189	4.741	5.315	5.927	6.779	7.460
6-hr	2.407	2.635	3.502	4.172	5.085	5.791	6.536	7.335	8.458	9.363
12-hr	2.833	3.106	4.143	4.944	6.033	6.872	7.760	8.723	10.088	11.194
24-hr	3.310	**3.63**	4.847	5.785	7.056	8.030	9.062	10.189	11.796	13.105
48-hr	3.838	4.206	5.606	6.684	8.143	9.258	10.440	11.732	13.573	15.074
3-day	4.180	4.580	6.102	7.275	8.867	10.088	11.382	12.794	14.806	16.444
4-day	4.420	4.848	6.465	7.718	9.429	10.753	12.162	13.696	15.880	17.659
7-day	4.922	5.413	7.241	8.677	10.672	12.253	13.954	15.795	18.416	20.548
10-day	5.362	5.901	7.896	9.470	11.665	13.416	15.302	17.335	20.222	22.567
20-day	6.930	7.566	9.970	11.833	14.377	16.347	18.442	20.713	23.939	26.559
30-day	8.254	8.968	11.704	13.798	16.614	18.752	20.998	23.431	26.872	29.657
45-day	10.090	10.933	14.181	16.657	19.966	22.475	25.066	27.801	31.580	34.576
60-day	11.723	12.687	16.403	19.233	23.012	25.891	28.826	31.841	35.918	39.080

Example Storm Event

Plant Meter Data



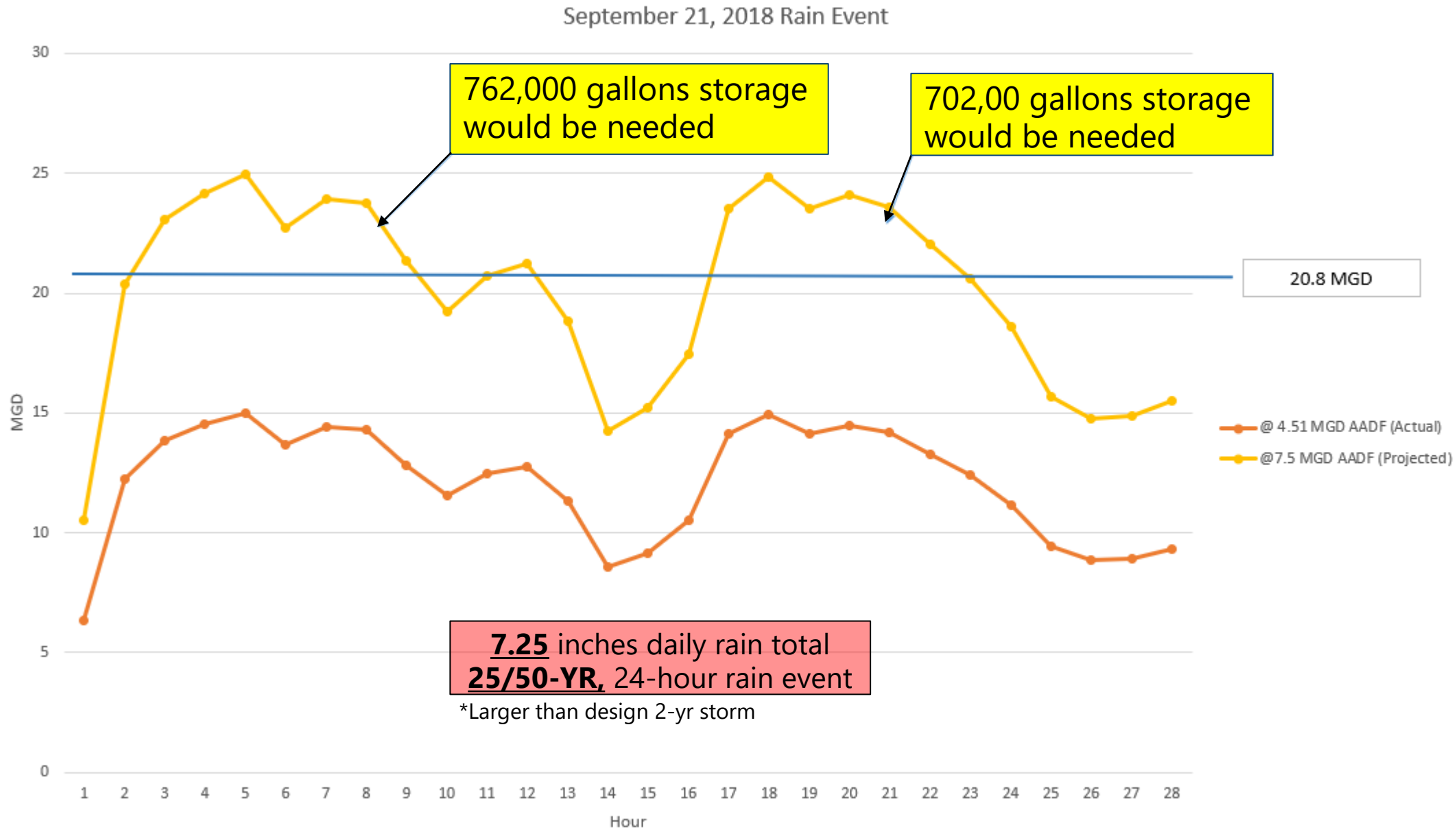
Rain Events – April 17, 2016



6.0 inches daily rain total
10-YR, 24-hour rain event

*Larger than design 2-yr storm

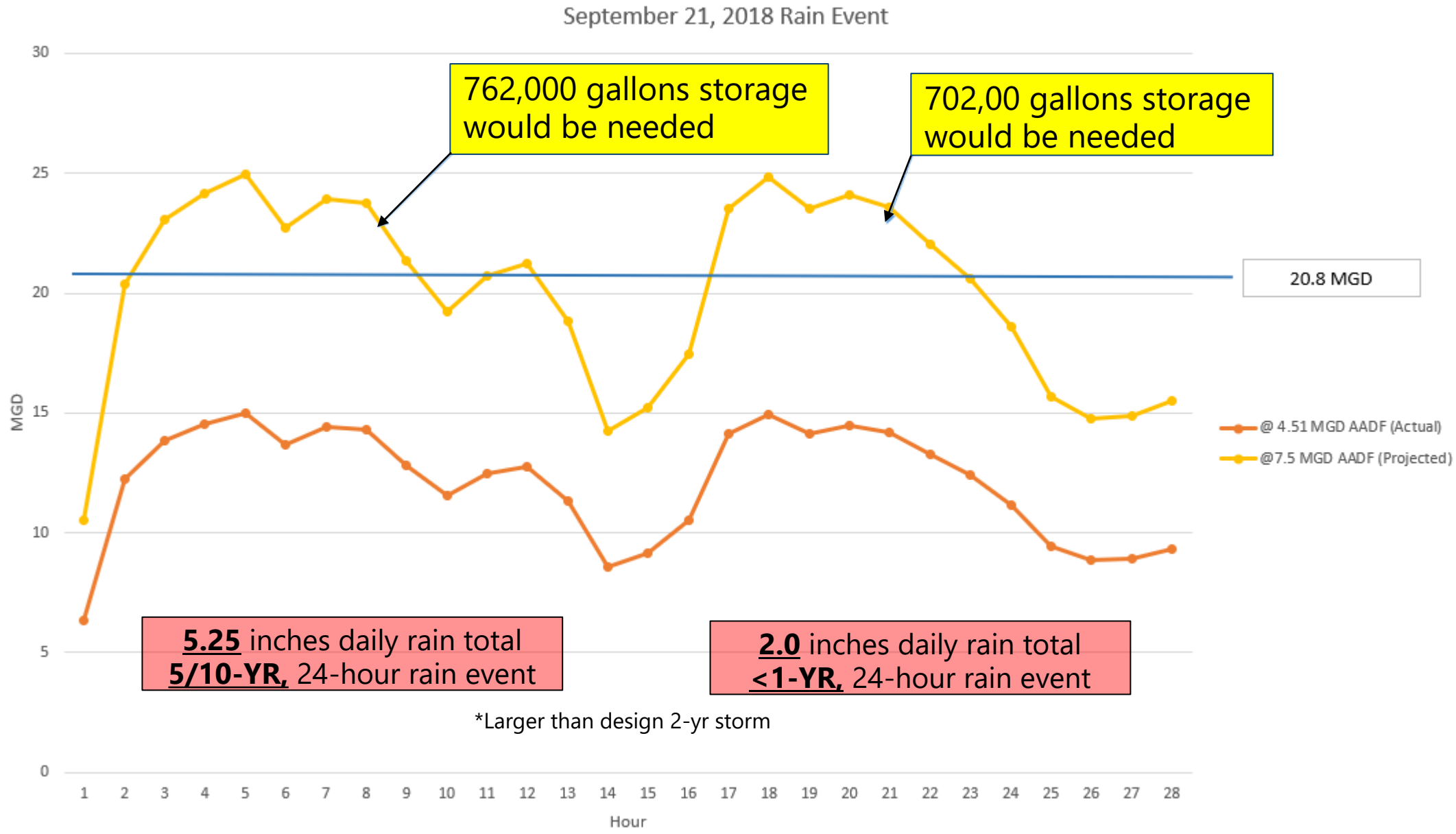
Rain Events – September 21/22, 2018



7.25 inches daily rain total
25/50-YR, 24-hour rain event

*Larger than design 2-yr storm

Rain Events – September 21/22, 2018



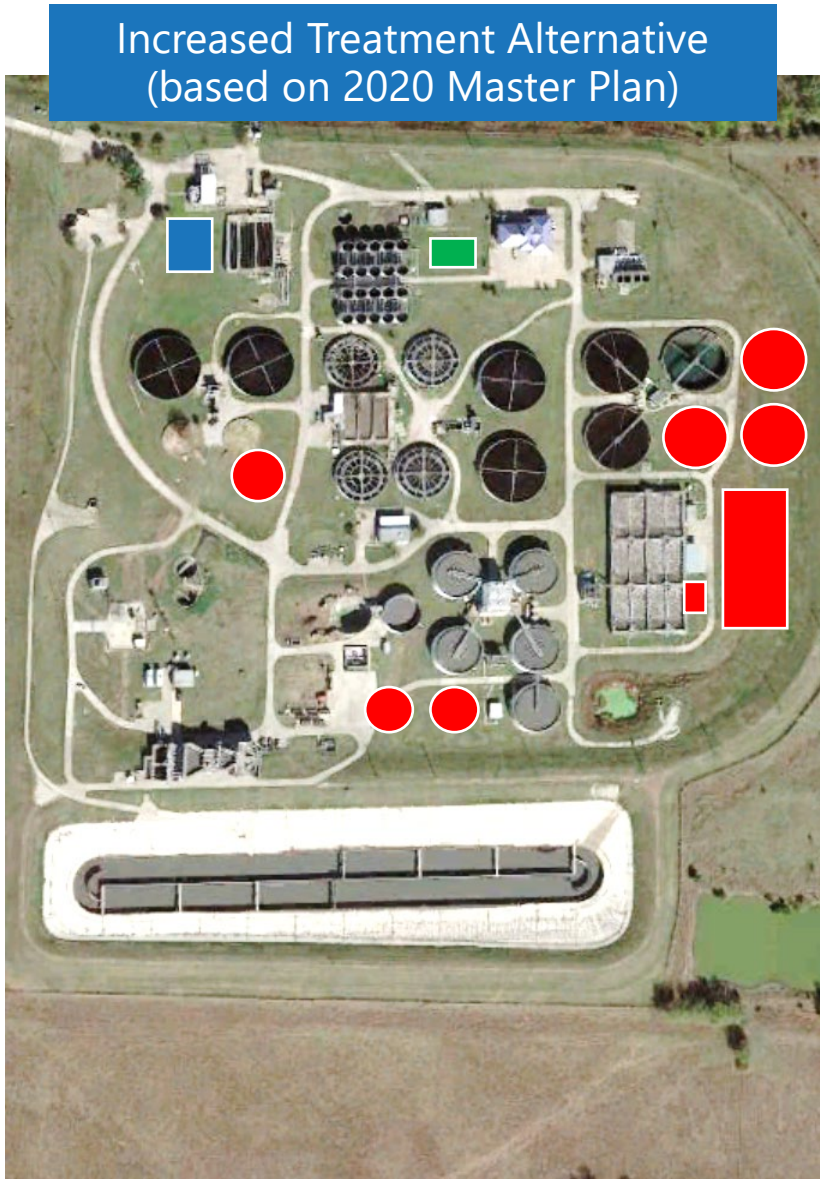
5.25 inches daily rain total
5/10-YR, 24-hour rain event

2.0 inches daily rain total
<1-YR, 24-hour rain event

*Larger than design 2-yr storm

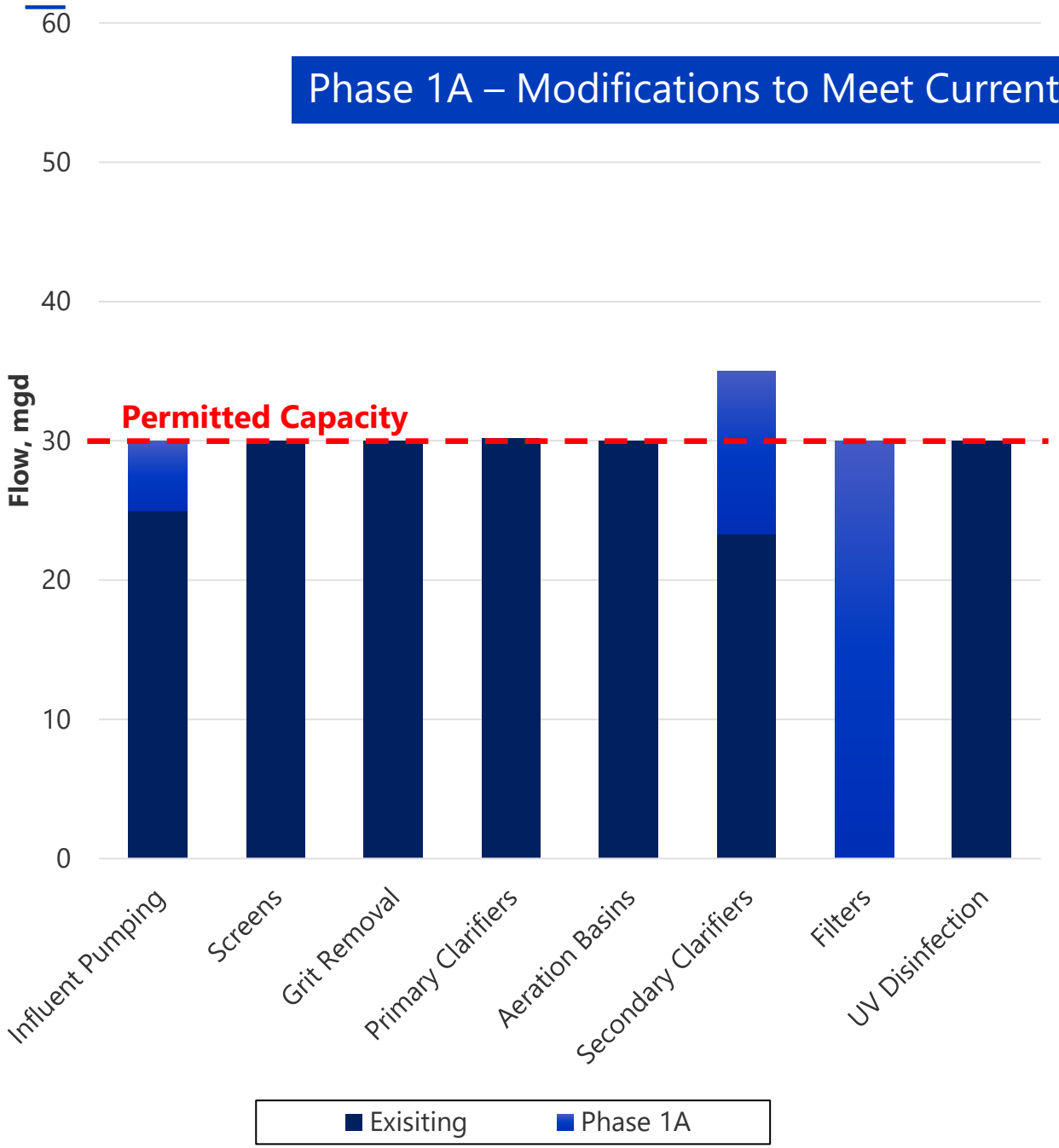
Treatment

Increasing secondary treatment to manage storm flows is expensive and unnecessary

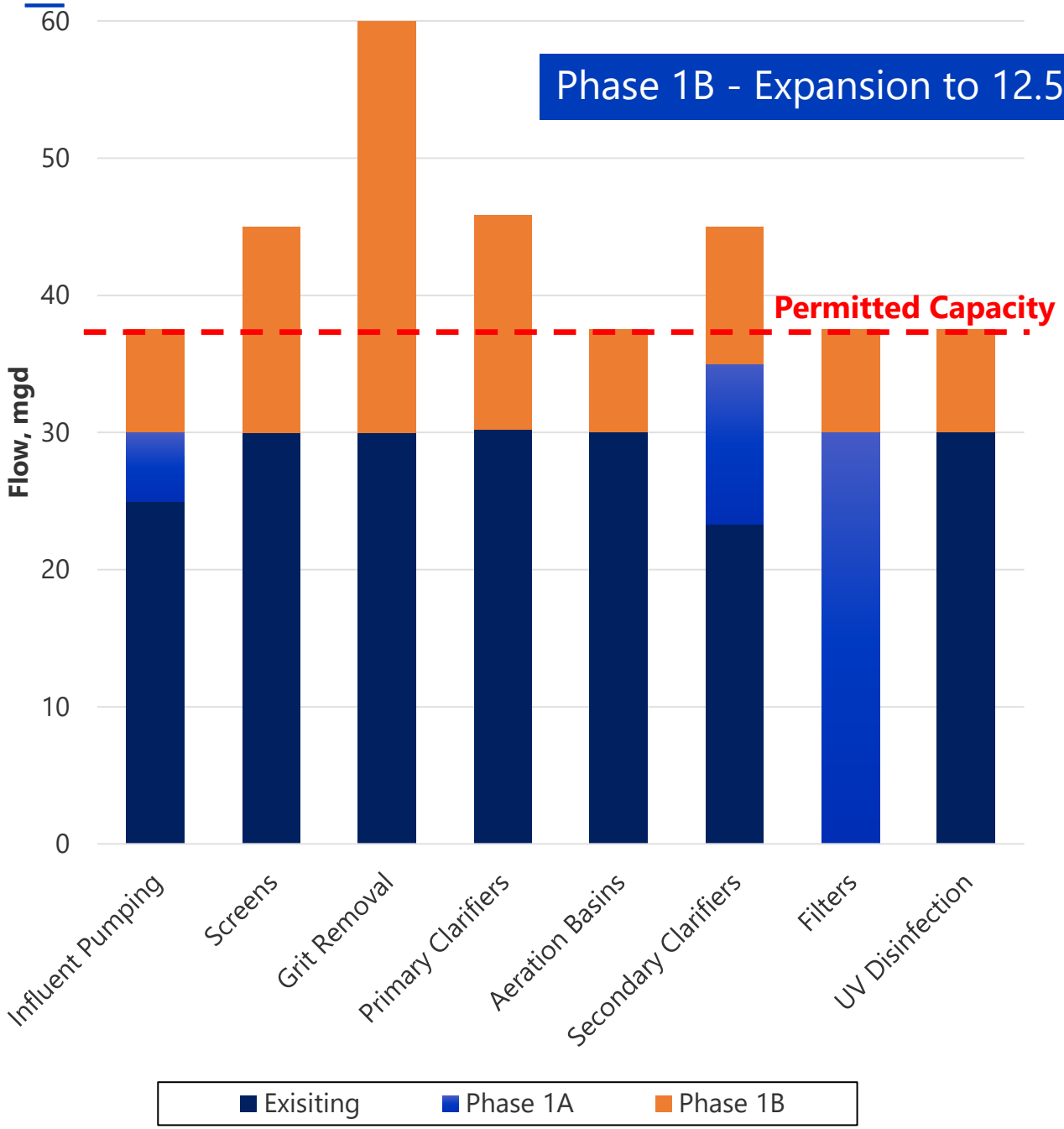


Storage

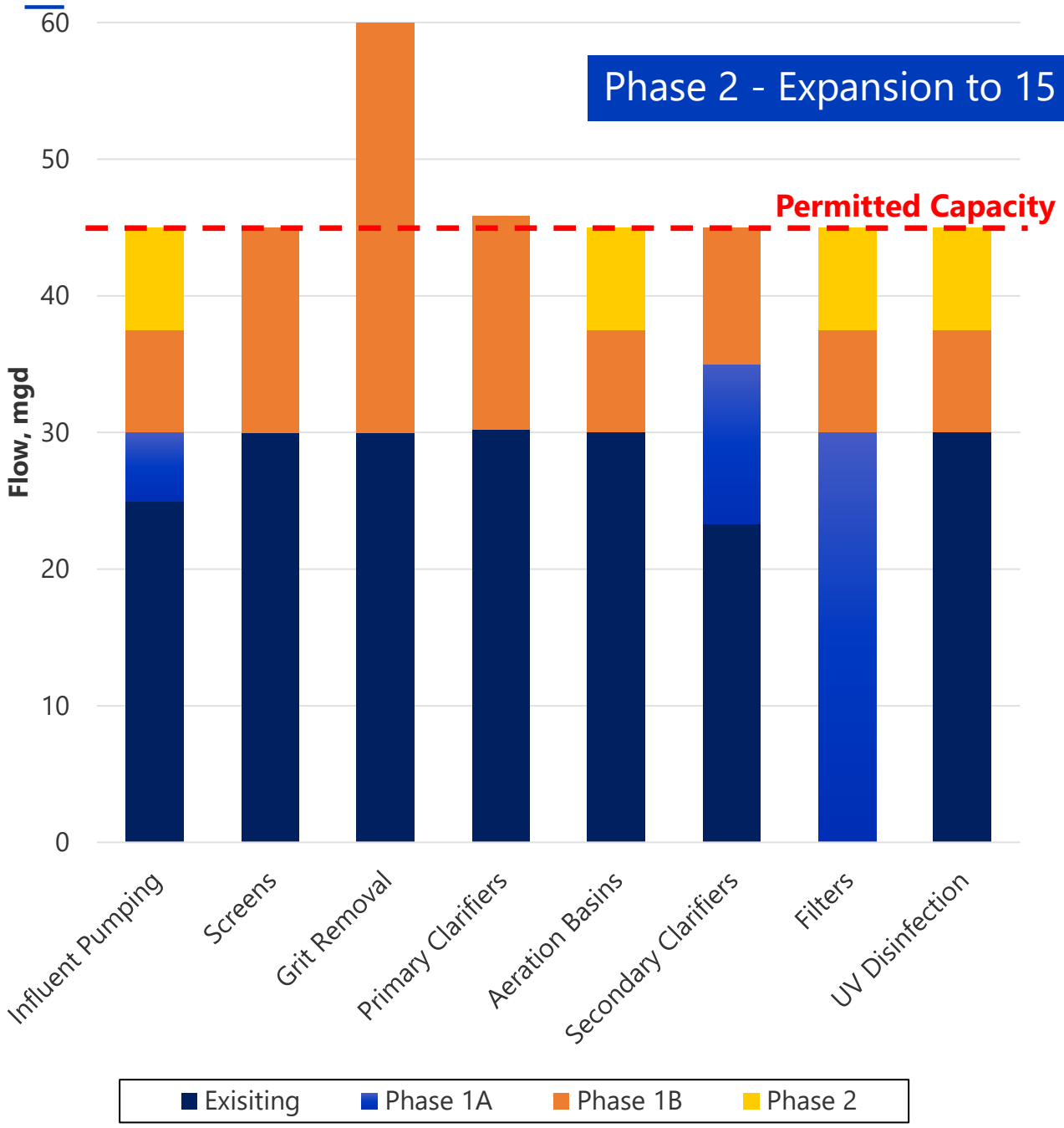
Phase 1A – Modifications to Meet Current Permit

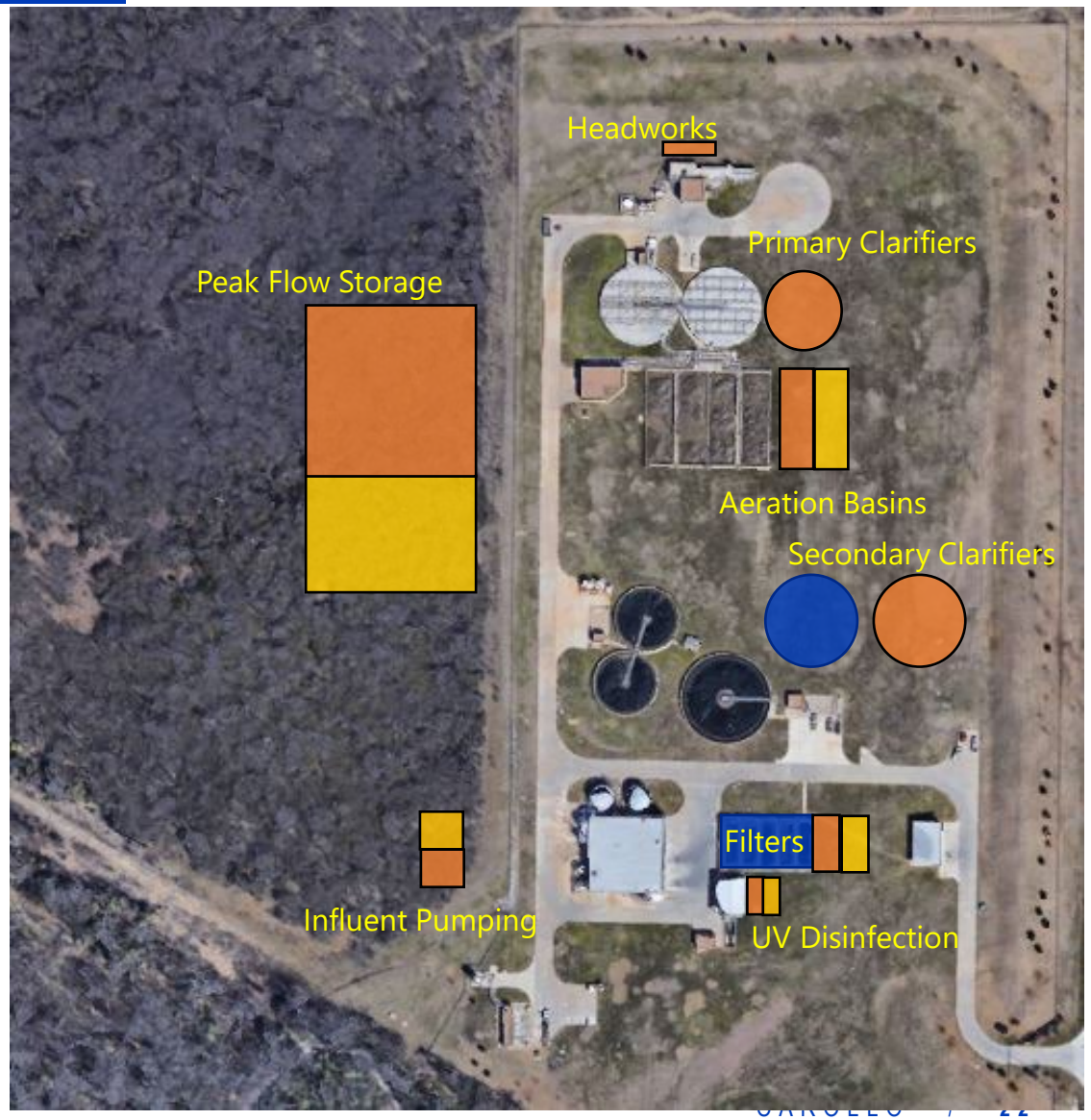


Phase 1B - Expansion to 12.5 mgd



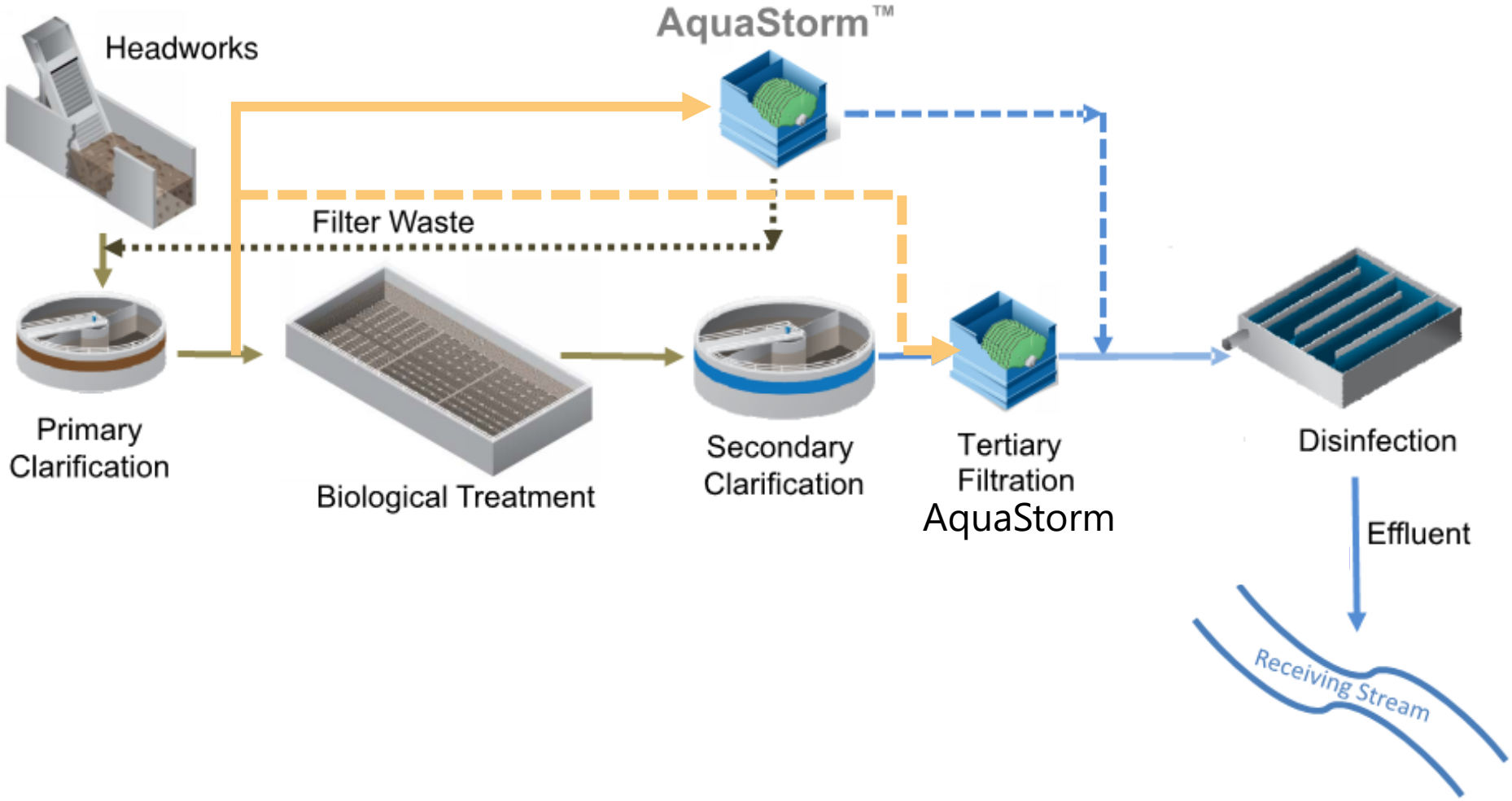
Phase 2 - Expansion to 15 mgd



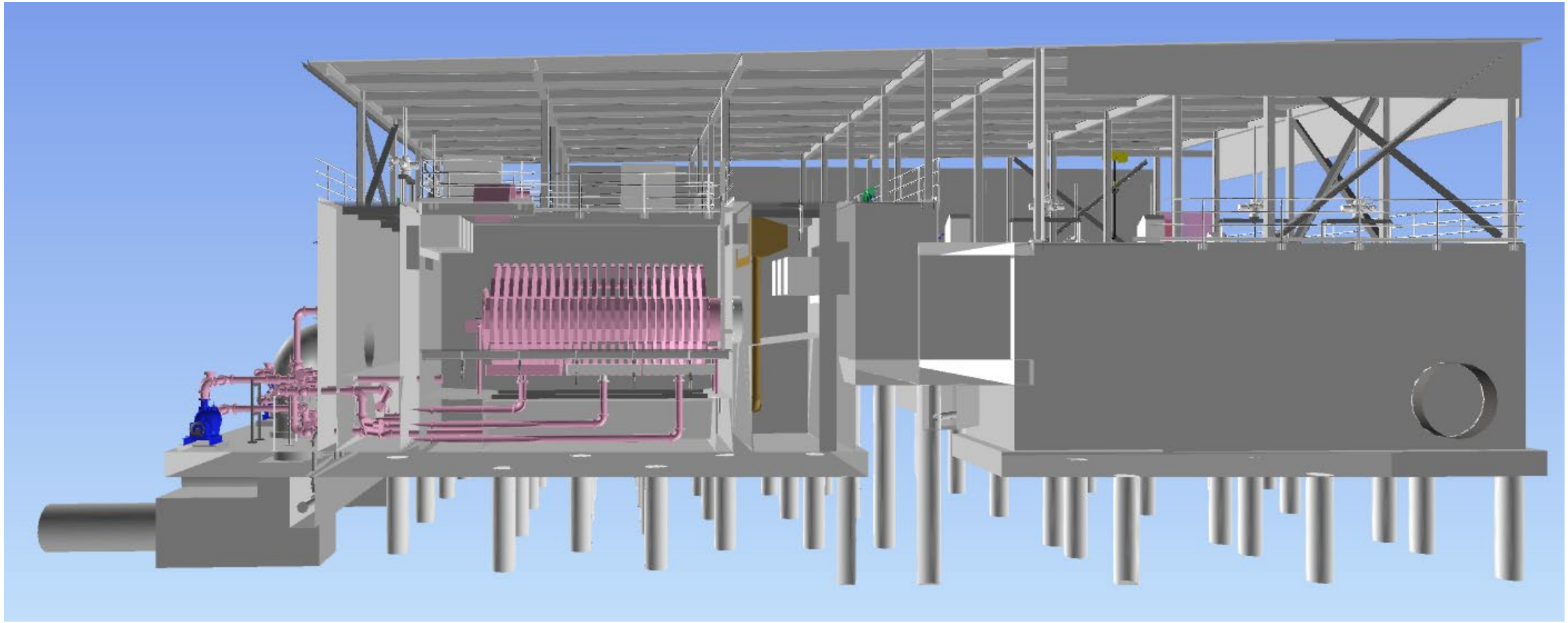


Emergency Storm Treatment

Typical Flow Schematic



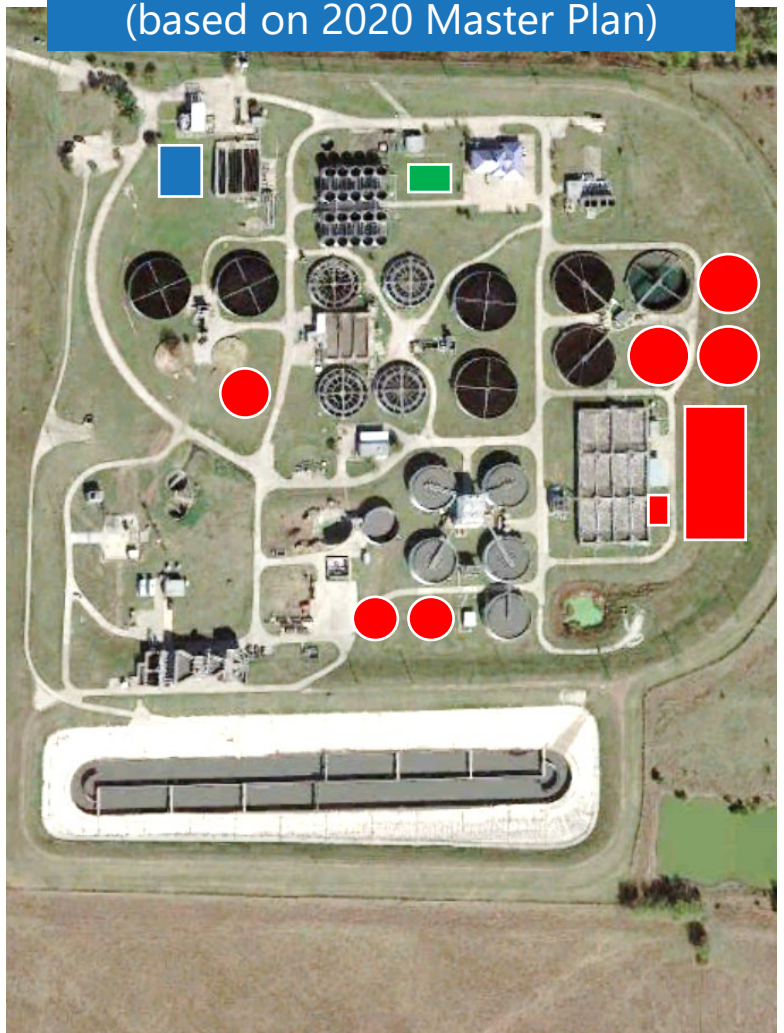
Proposed Storm-Treatment Filters



Selecting the right storm treatment reduces capital costs for improvements

Equalization Basin Alternative
(based on 2020 Master Plan)

Increased Treatment Alternative
(based on 2020 Master Plan)



Carollo's Proposed
Storm Flow Filtration Alternative

Questions

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