Commission Workshop and Infrastructure Task Force Meeting

Fiveash Water Treatment Plant Replacement

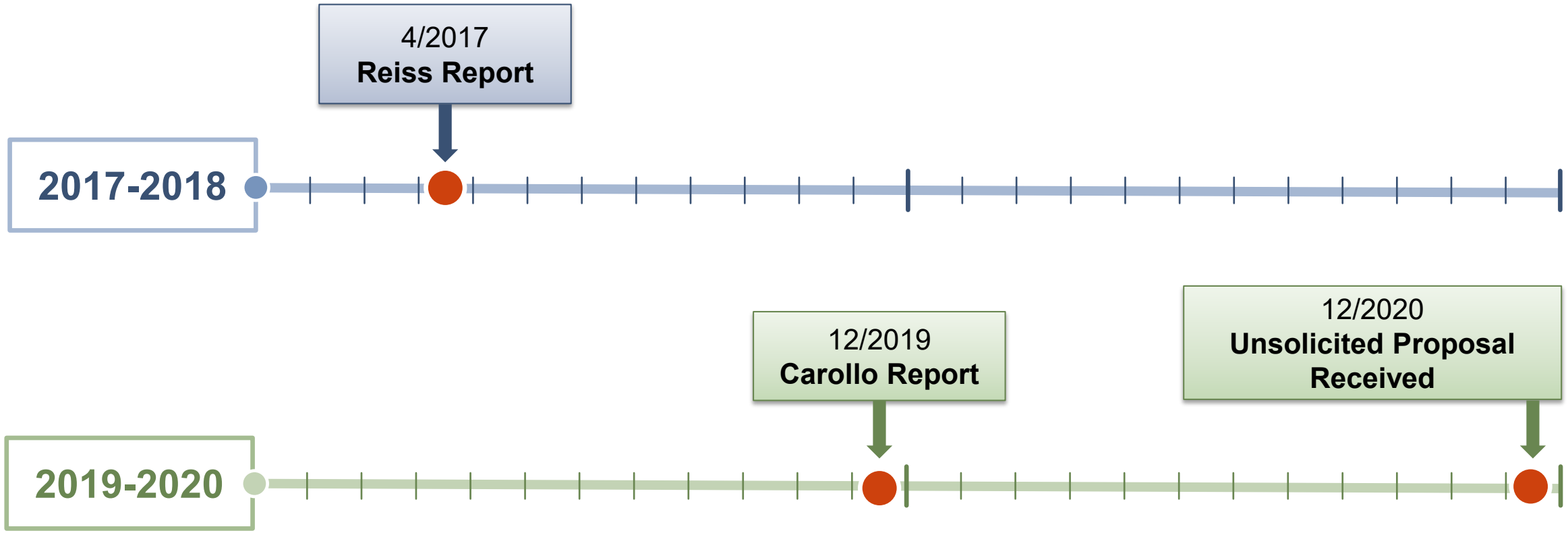
January 10, 2023

Agenda

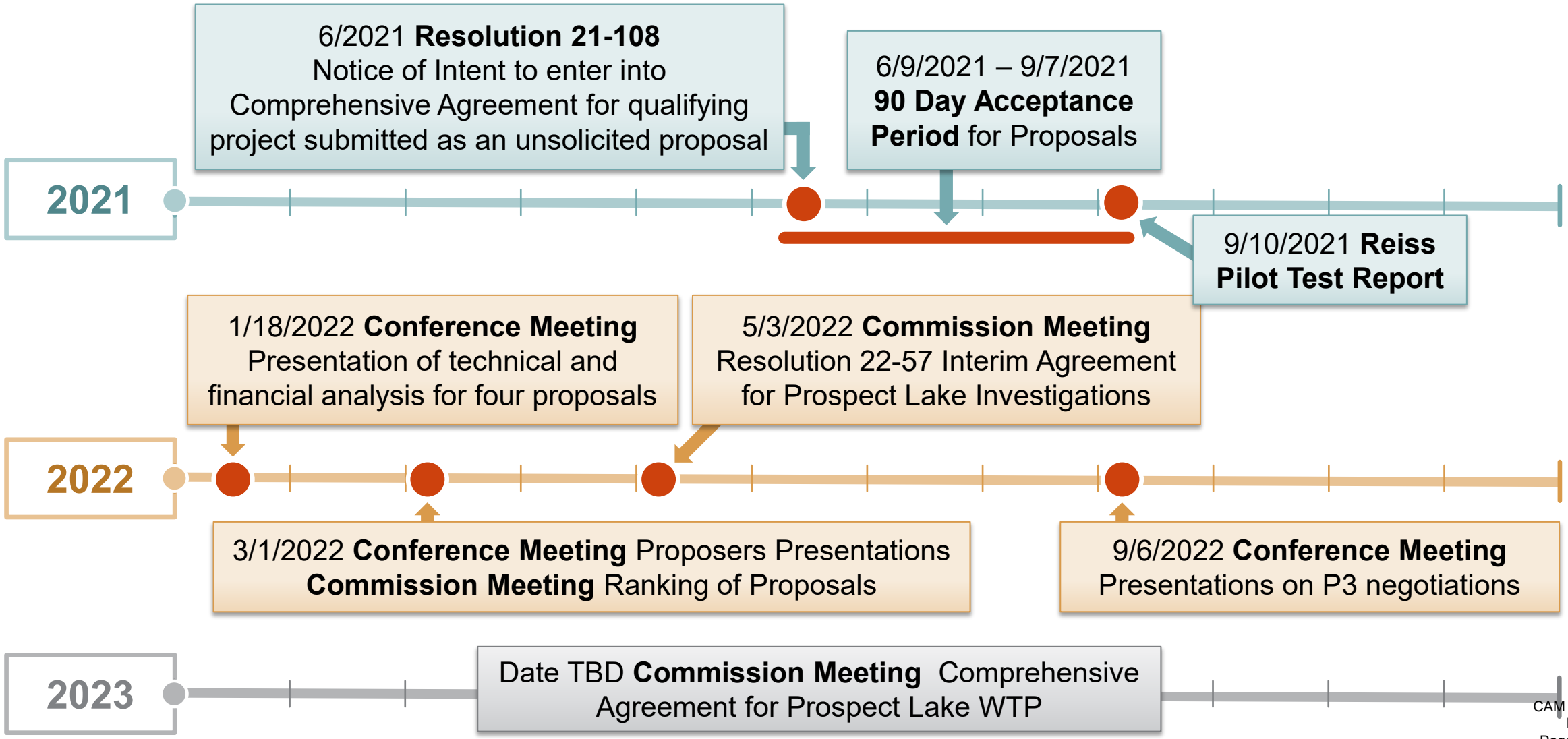
CITY OF FORT LAUDERDALE

1. Introductions by Alan Dodd (Public Works Director)
2. Hazen and Sawyer (Owner's Representative) Opinions and Observations Relative to the Proposed Fiveash Water Plant Replacement
3. Ridgewood/IDE (P3)
4. Financial Overview
5. Q&A

The Reiss Report recommend testing of GAC and Ozone in 2017. Carollo completed the GAC testing and recommended a new water plant using nanofiltration and ion exchange technology in 2019.



The City decided to proceed with P3 procurement to replace Fiveash with a new water plant in 2022



Hazen and Sawyer (Owner's Representative)

Opinions and Observations Relative to the Proposed Fiveash Water Plant Replacement

Hazen received a Task Order in May 2022 to provide advice relative to the technical requirements of the proposed P3 agreement.

Hazen has in-depth knowledge of the City's water system.

Hazen provides international expertise in the design and operation of water treatment facilities.

Hazen's Drinking Water Practice Group closely tracks pending and possible water quality regulations.

Key members of Hazen's advising team include:

Janeen Wietgrefe, PE, PMP

- Experience: 28 years
- Janeen led the design of City's Peele-Dixie WTP (2002 to 2008)

George A. Brown, PE

- Experience: 27 years
- In-depth knowledge of the existing Fiveash WTP; completed multiple designs for City (1998 to present)

Peele-Dixie WTP

Fiveash WTP

Hazen's most senior national water quality expert, Dr. Bill Becker, provides input on technical elements of the City's proposed WTP

William Becker, PhD, PE

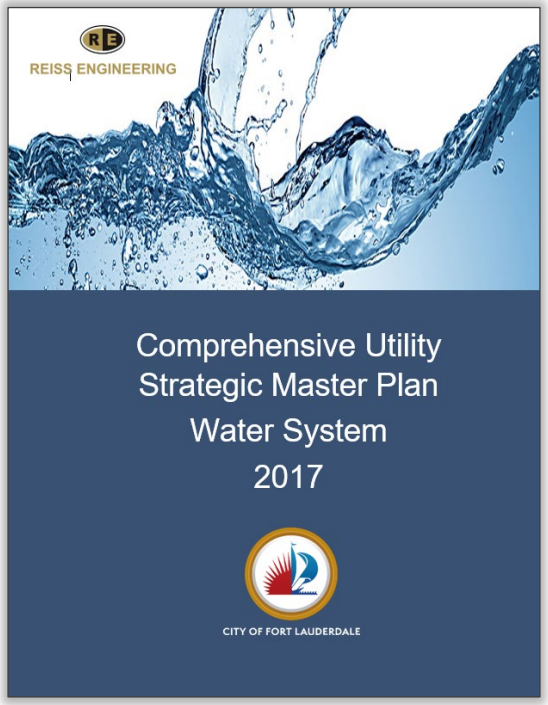
- 40 years of experience in water engineering
- Appointed to EPA Science Advisory Board Drinking Water Committee (2020)
- Senior Drinking Water Practice Leader at Hazen
- PhD degree from the Johns Hopkins University

In addition to his role at Hazen, Dr. Becker has been or is currently a professor at:

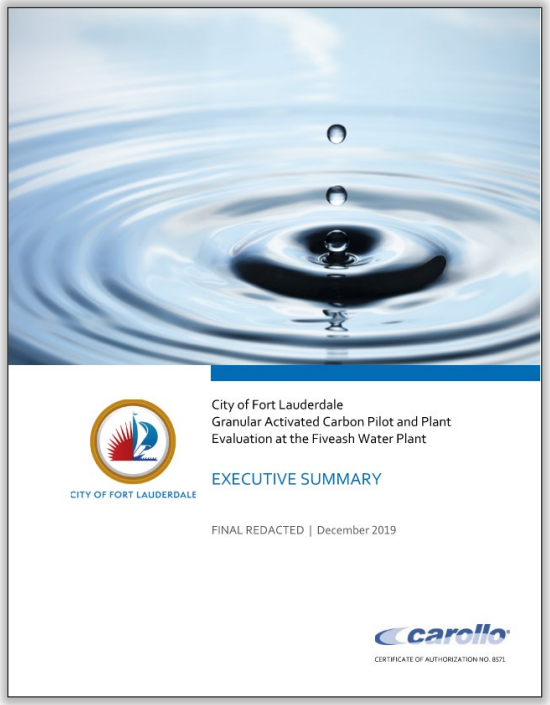
COLUMBIA WATER CENTER
THE EARTH INSTITUTE AT COLUMBIA UNIVERSITY

University of Colorado Boulder

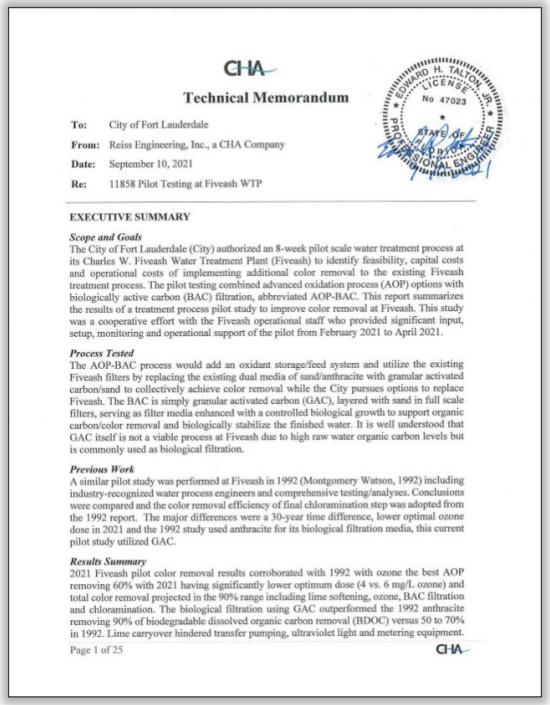
The City completed multiple studies that form the basis for the decision to replace the Fiveash WTP…



2017



2019



2021

…Hazen's opinions and observations on the findings of these reports are summarized in this presentation

This presentation will address the following:

1. What constitutes the City's "water infrastructure" for today's discussion?
2. Does the City's water meet required standards?
3. Why is a new water plant needed?
4. What did the Reiss and Carollo Reports find?
5. Is the technology proposed by Carollo likely to meet all three of the fundamental City goals?
6. Are there alternatives to the current P3 delivery approach?
7. How does the current Ridgewood/IDE cost compare to the Carollo estimate?

1 What constitutes the City's "water infrastructure" for today's discussion?

Water system infrastructure includes the following:

1

Water Supply

Water Treatment Plants

Residuals Disposal

Water Distribution

Focus of today's presentation

1. What constitutes the City's "water infrastructure" for today's discussion?

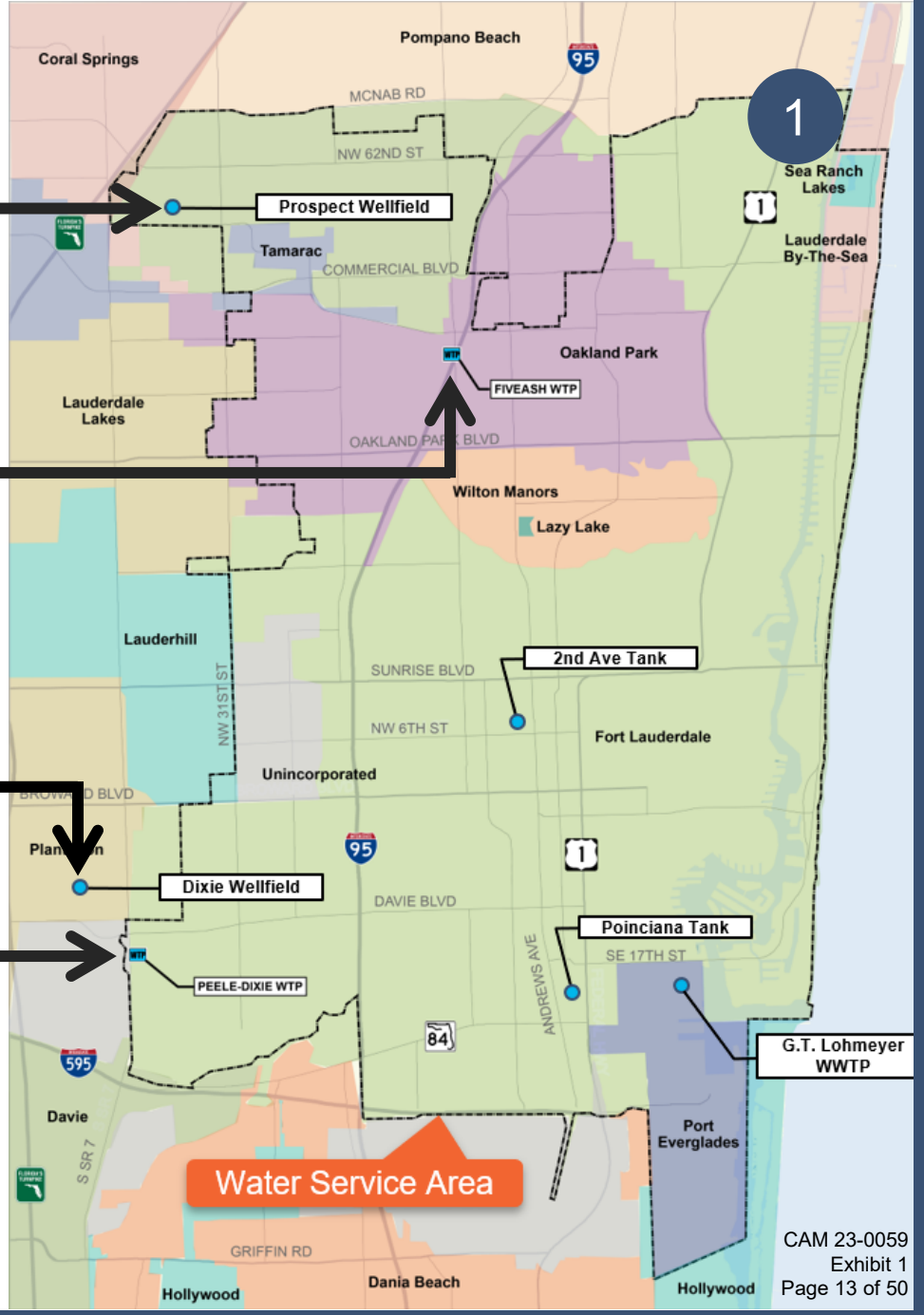
The City's key water supply/treatment infrastructure

Prospect Wellfield

Fiveash WTP

Dixie Wellfield

Peele-Dixie WTP



CAM 23-0059
Exhibit 1
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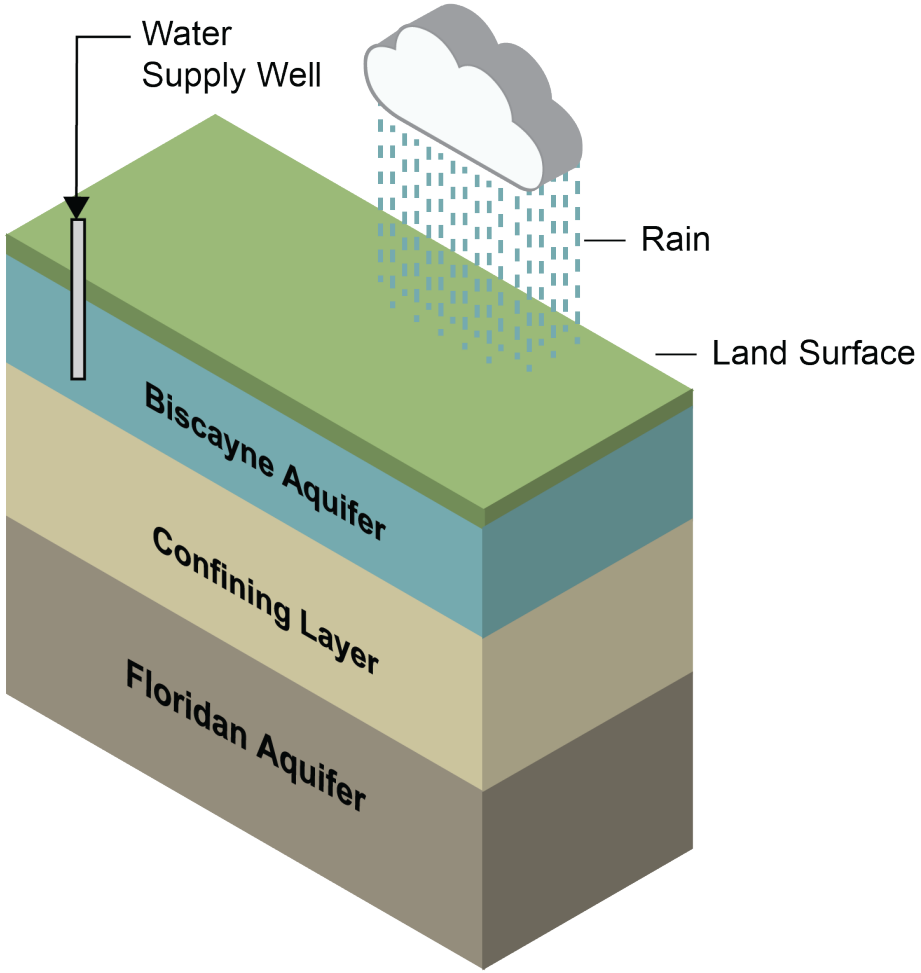
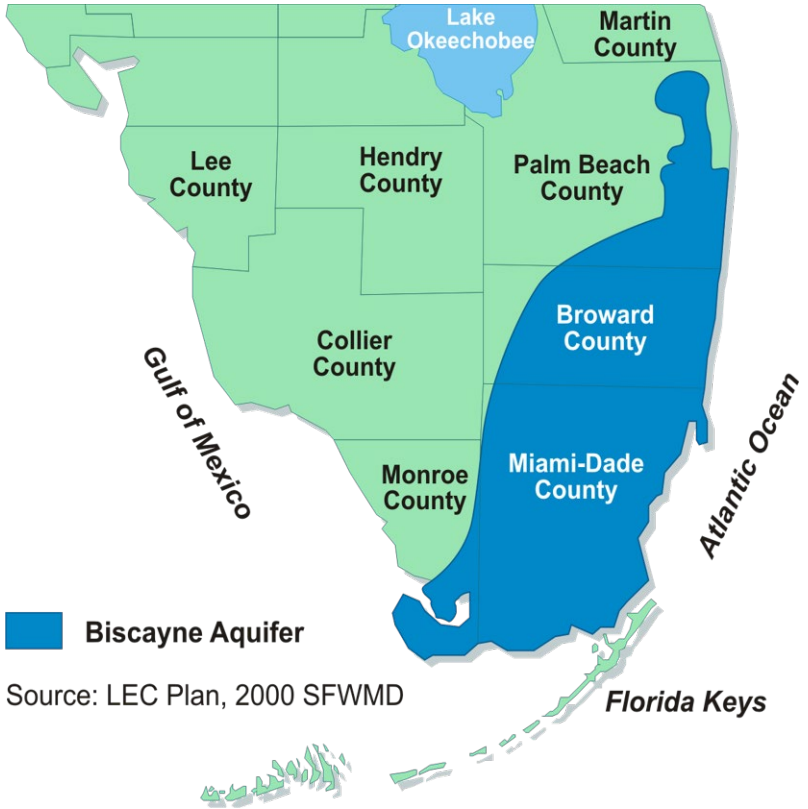
1. What constitutes the City's "water infrastructure" for today's discussion?

The City's water supply is the Biscayne Aquifer (largely recharged by rainfall)…

1



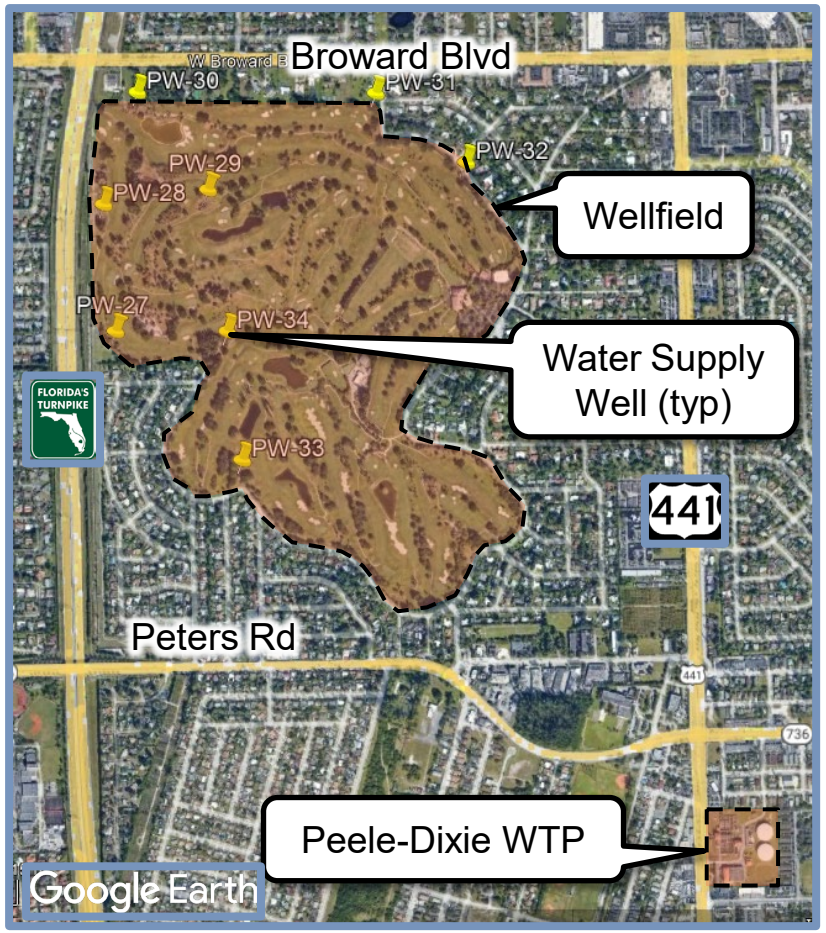


1. What constitutes the City's "water infrastructure" for today's discussion?

Both City wellfields withdraw from the Biscayne Aquifer.

1

Prospect Wellfield Supplies the Fiveash WTP



Dixie Wellfield Supplies the Peele-Dixie WTP

1. What constitutes the City's "water infrastructure" for today's discussion?

The City has also invested in alternative water supply sources for the future

1

C-51 Reservoir Project
(City purchased 3 mgd offset)

Floridan Aquifer Test Wells
(City Constructed Two Wells)

The City owns/operates an old WTP and a new state-of-the-art WTP

1

Fiveash WTP

- Year Constructed: **1953**
- Technology: Lime Softening
- Capacity: 70 mgd
- Expanded multiple times over the last 70 years

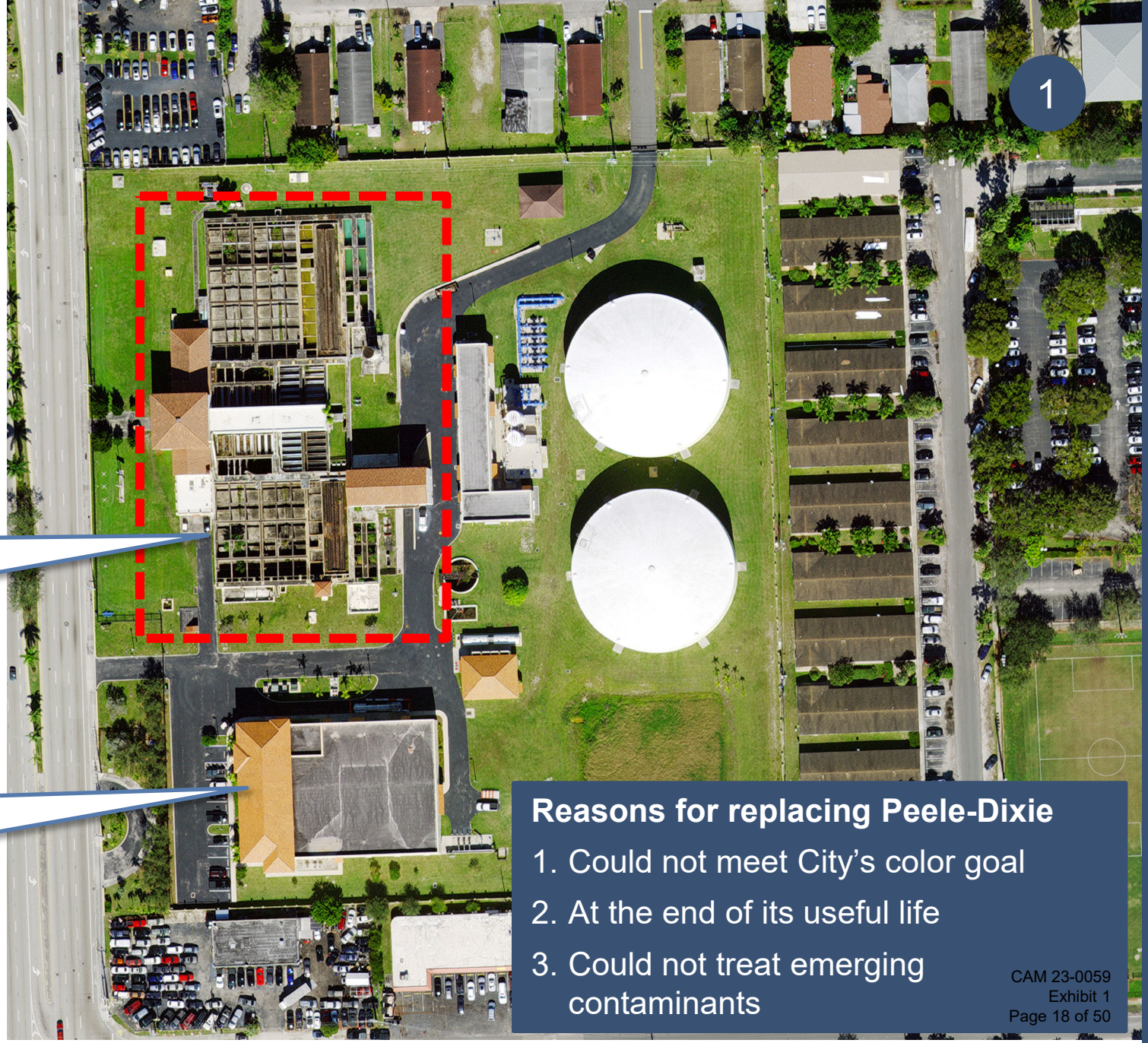
Peele-Dixie WTP

- Year Constructed: **2008**
- Technology: Membranes (state-of-the-art)
- Capacity: 12 mgd
- Expansion Capability: Expandable by 6-mgd using reverse osmosis to treat the salty Floridan Aquifer

The Peele-Dixie WTP was replaced in 2008 for the same reasons that the City is planning the Fiveash WTP replacement

1920s era lime softening plant decommissioned in 2008

State-of-the-art nanofiltration (membrane) plant designed and constructed from 2002 to 2008



Reasons for replacing Peele-Dixie

1. Could not meet City's color goal
2. At the end of its useful life
3. Could not treat emerging contaminants

CAM 23-0059
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1. What constitutes the City's "water infrastructure" for today's discussion?

The Fiveash WTP utilizes the same lime softening treatment technology that was replaced in 2008 at the Peele-Dixie WTP

1

The last expansion of Fiveash was 40 years ago (1983). Recent investments focused on reliability

1

Fiveash "Maintenance" Type Projects

Project	Completion Date	Construction Cost (millions)
Reliability Upgrades	2008	$12.5
Filter Rehabilitation	2008	$3.3
Hydrotreator 3	2010	$1.2
Hydrotreator 4	2012	$1.3
Hydrotreator 1	2014	$0.70
Influent Vault	2018	$0.62
Filter Media Replacement	2020	$1.9
Filter Rehab	2022	$3.4
	Total	**$24.9**

1. What constitutes the City's "water infrastructure" for today's discussion?

2 Does the City's water meet required standards?

Yes, the City's drinking water complies with local, state and federal primary standards

2

Florida HEALTH

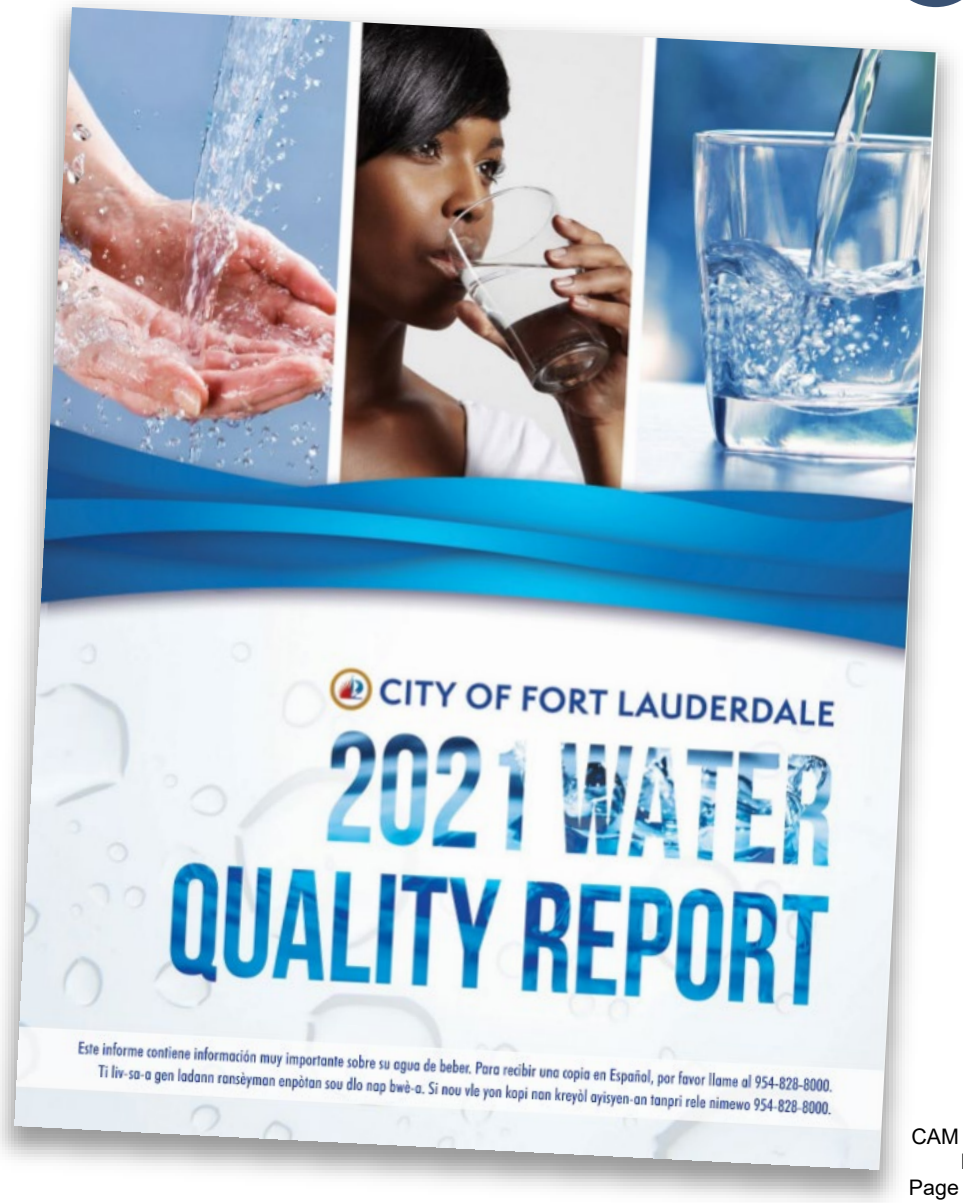
Complies

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Complies

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Complies



To document compliance, the City's Environmental Lab tests the water approximately 65,000 times per year to ensure its customers are protected

2

Certifications

City lab provides sampling and testing services to the City 365 days a year

Water Supply Testing

Water Plants Testing

Distribution System Testing

2. Does the City's water meet required standards?

CAM 23-0059
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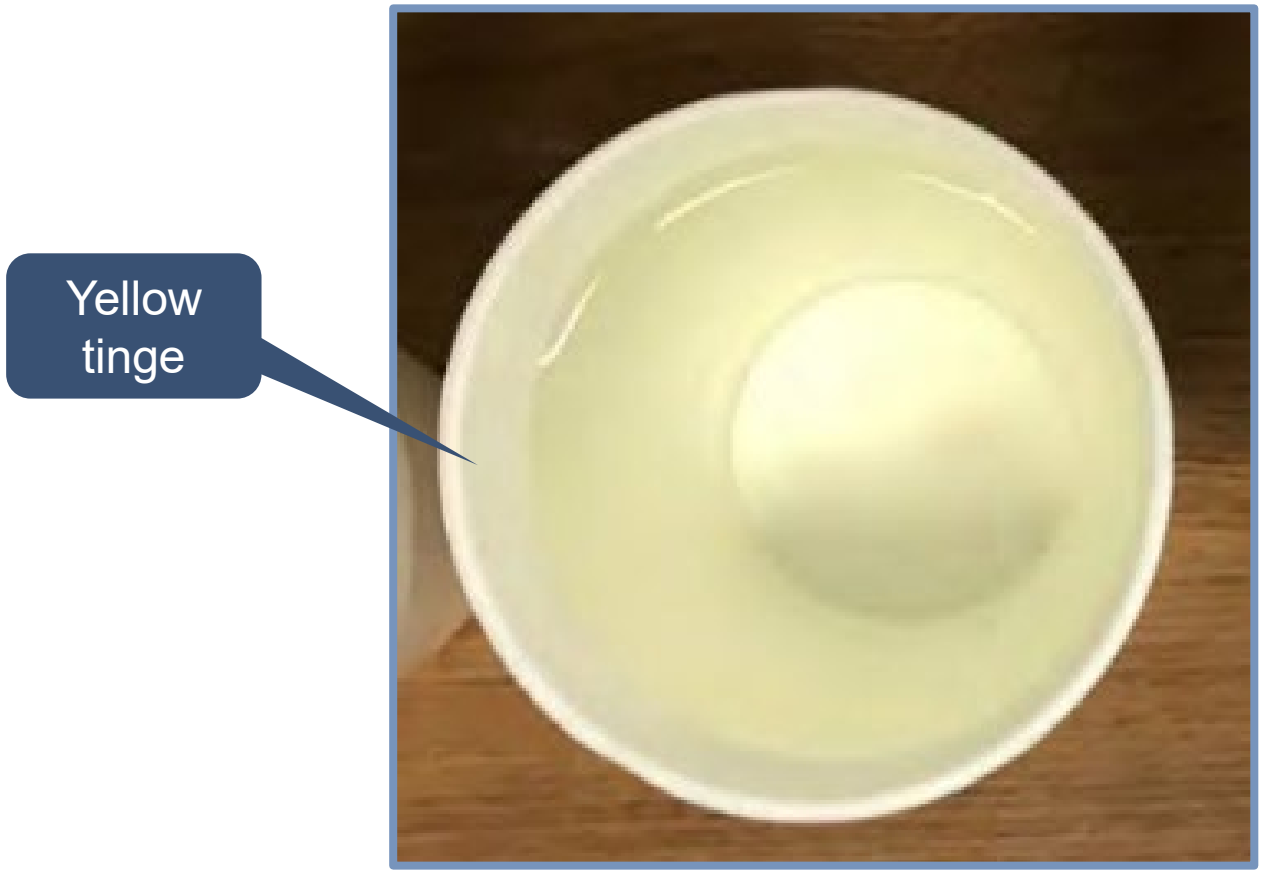
3 Why is a new water plant needed?

There are three key reasons for replacing the Fiveash WTP

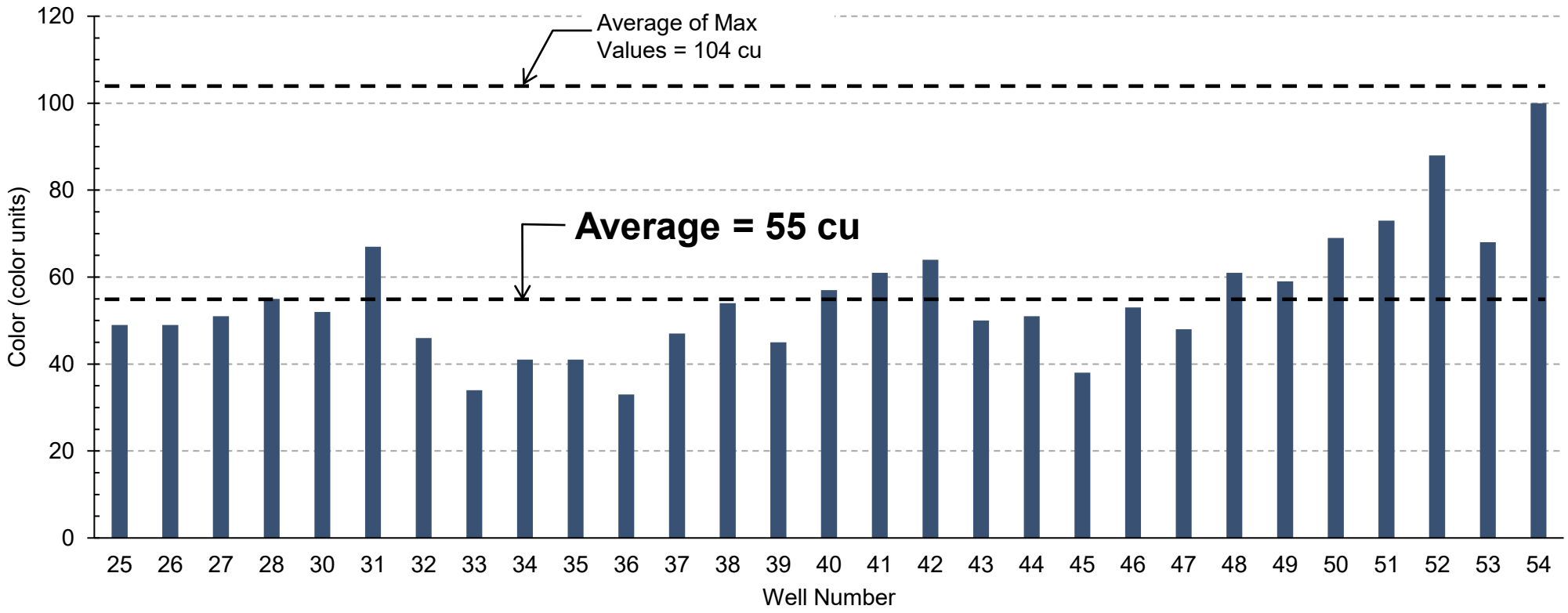
Reason 1:

The existing Fiveash WTP cannot meet the City's goal of clear water



Fiveash Finished Water
(2021 Average = 16 color units)

The Prospect Wellfield raw water color has historically averaged 55 color units…



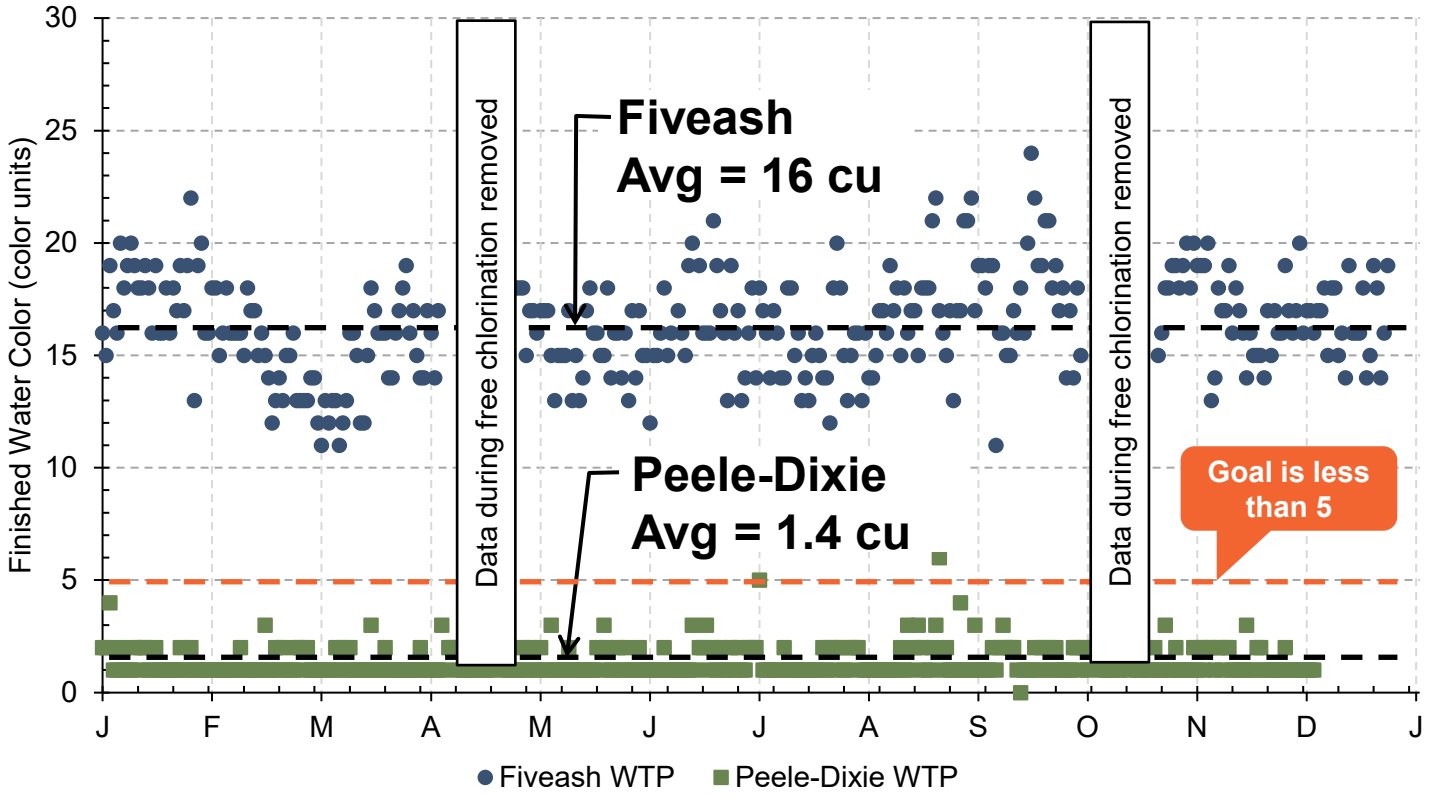
Average Raw Water Color of the Prospect Wells

Source: *Adapted from CMA, 2021 Table 4; Hazen spreadsheet "Prospect Raw Water Iron and Color Data - CMA Report.xlsx"*

…high raw water color is characteristic of the Biscayne Aquifer in this area

The Fiveash WTP cannot achieve the City's finished water color goal of less than 5 (color units); 5 is below the visible detection limit

3



Year 2021 Finished Water Color Data

Fiveash Finished Water
(2021 Average = 16 color units)

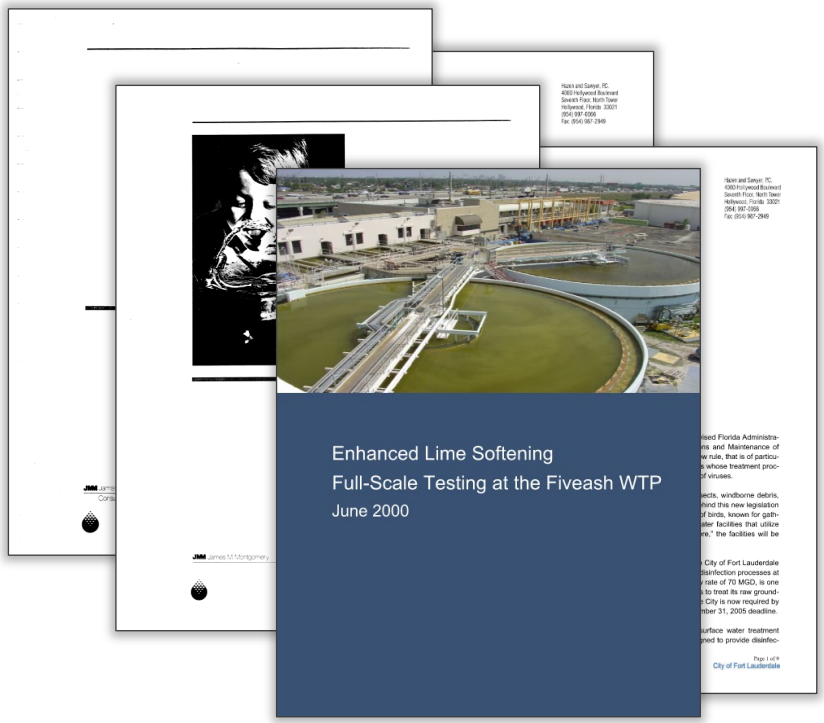
Note: The new Peele-Dixie WTP does meet the City's color goal.

Why is a new water plant needed?

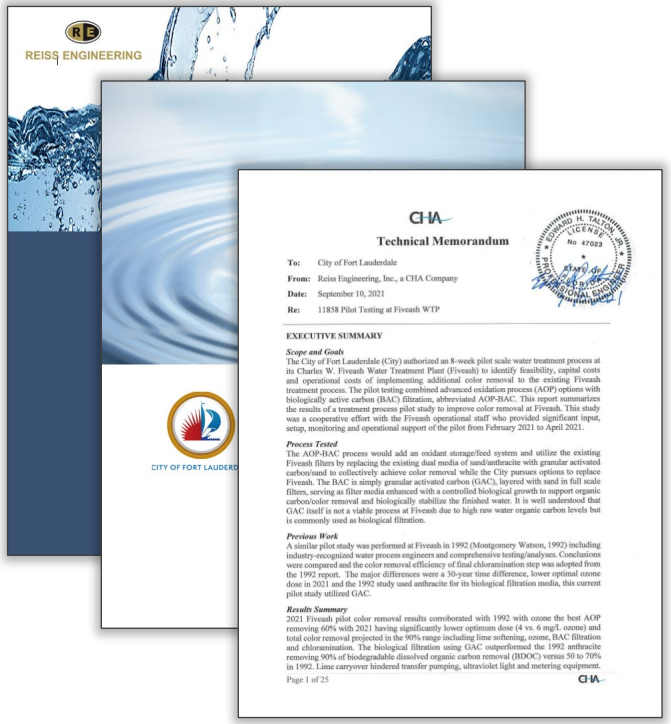
The City has invested an estimated $2 million in Fiveash color removal studies since 1991…

3

Old Reports



New Reports



Focus of Today's Presentation

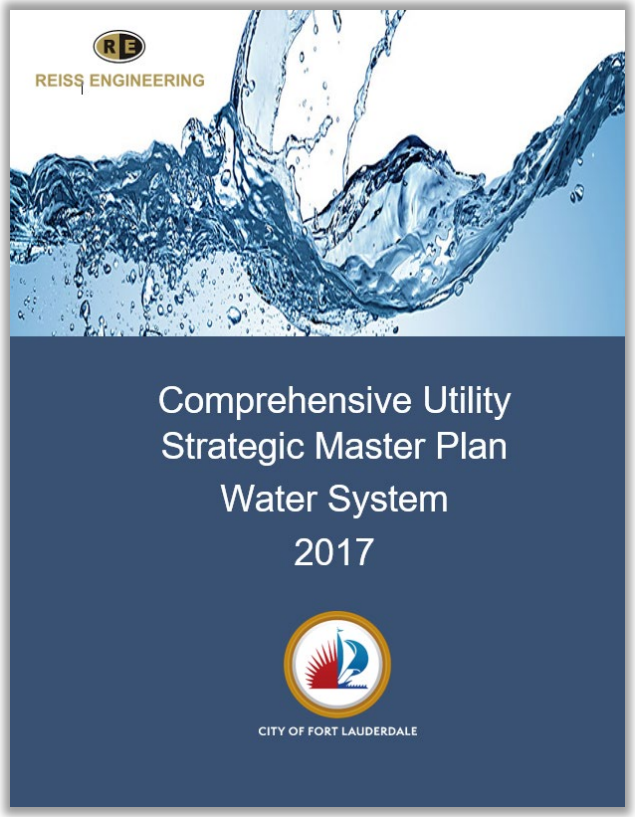
…no report has proven that retrofitting Fiveash with a color removal process would achieve the City's water quality goals.

3. Why is a new water plant needed?

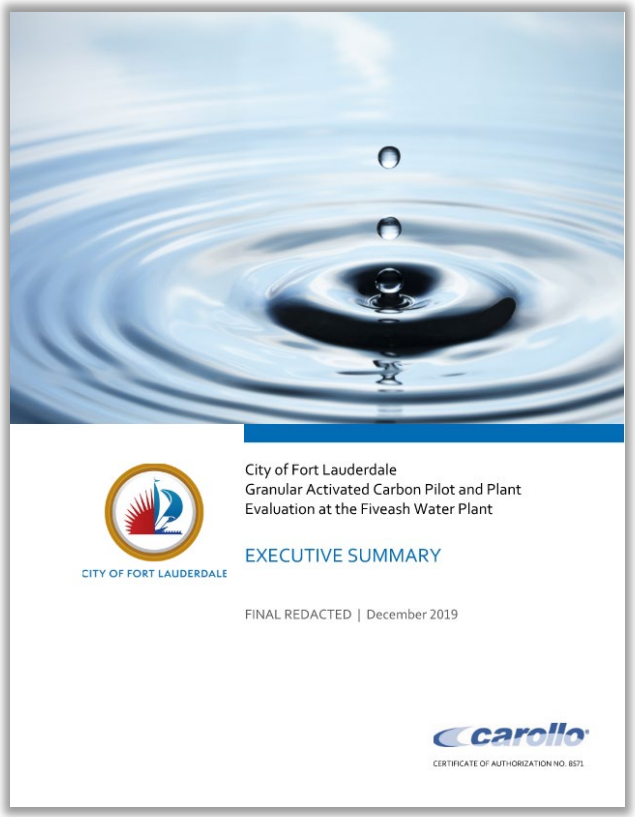
There are three key reasons for replacing the Fiveash WTP

Reason 2:

The existing Fiveash WTP is near the end of its useful life



REISS ENGINEERING



carollo

Water treatment plants do not last forever…

Component	Typical Useful Life (Years)	Current Age at Fiveash WTP (Years)
Treatment Structures	40-50	**43, 60 and 70**
Filter Valves	20	15
Pumps	20	Varies; 12 - **42**
Electrical	30	**> 40**
Instruments	1-10	**> 10**
Shutoff Valves	30	**> 40**
Chemical Systems	20	Varies; 17 - **42**

Source: Table above is adapted from Table WA 8.4 titled "*Fiveash WTP 2015 Renewal and Replacement Requirement Analysis*" (Reiss, 2017)

Filter structure exposed rebar repaired in 2012

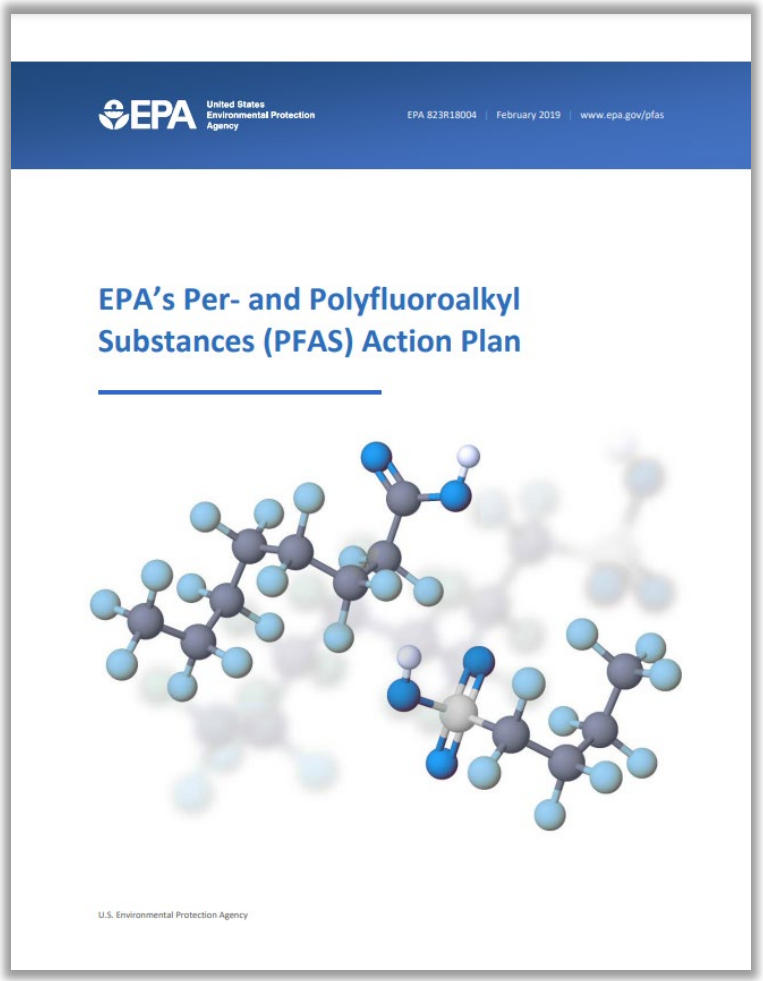
…nearly all components of Fiveash are at the end of their useful life.

There are three key reasons for replacing the Fiveash WTP

Reason 3:

The existing Fiveash technology is ineffective at removal of important emerging contaminants such as PFAS.

No current regulatory limit for PFAS

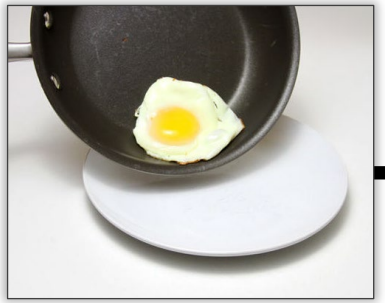


Exposure to high levels of PFAS chemicals are probably linked to negative health effects in test animals.

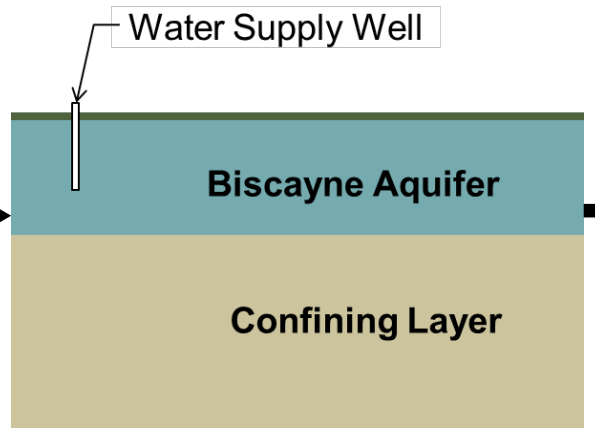
Regulation is imminent.

Emerging contaminants, including PFAS, exist in our water…

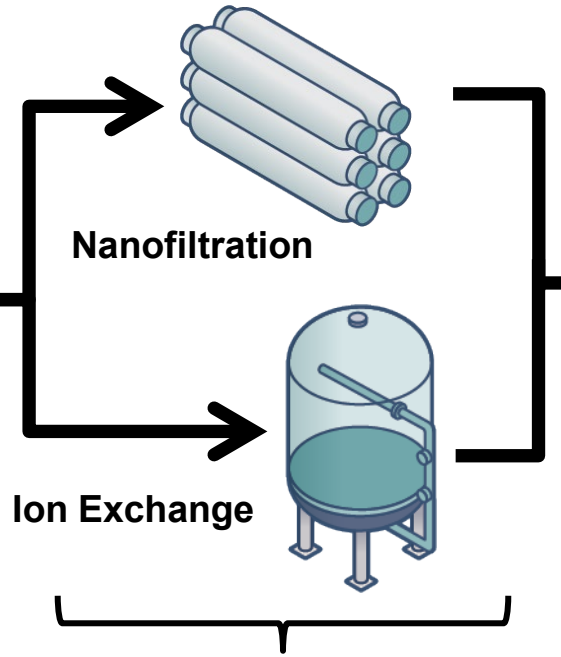
PFAS Sources



PFAS Persist in the Environment



PFAS Removal



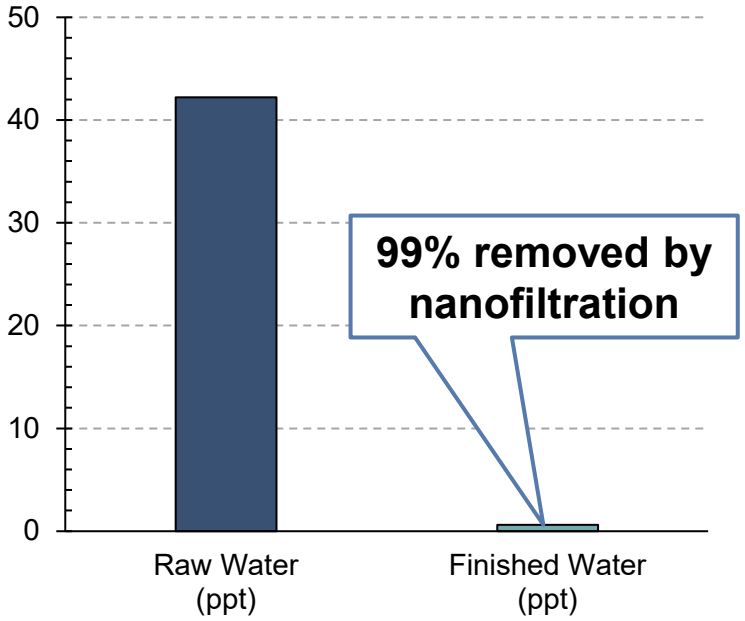
Drinking Water

…replacing Fiveash with state-of-the-art treatment technology for removal of these contaminants is a key City goal.

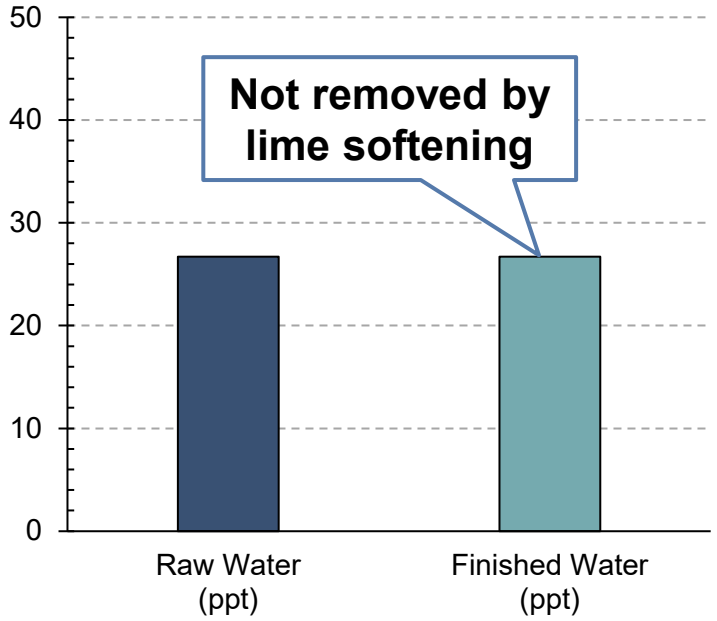
The Proposed Fiveash Replacement Treatment Technology can remove PFAS

The existing Fiveash technology is ineffective at removal of PFAS…

Peele-Dixie PFAS Data*



Fiveash PFAS Data*



* = Represents one sampling event for PFAS (PFOA + PFOS)

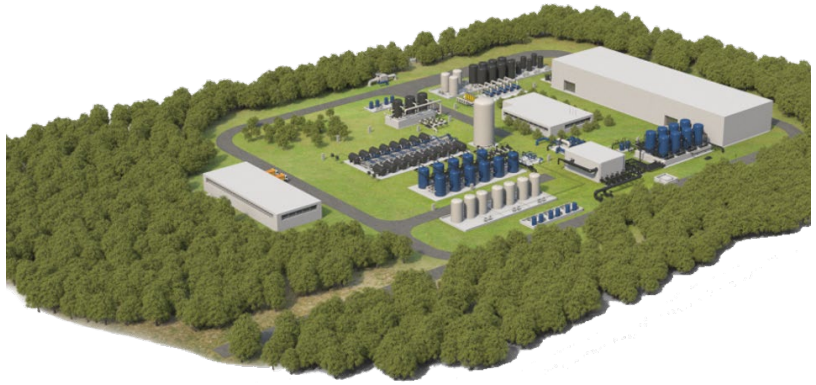
…the technologies for the proposed Fiveash replacement (ion exchange and nanofiltration) are effective at PFAS removal.

4 What did the Reiss and Carollo Reports find?

The 2017 Reiss Report presented the following key conclusions:

Fiveash produces safe drinking water

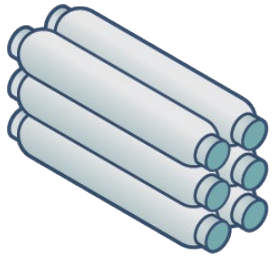
Fiveash is at the end of its useful life



Building a new, innovative water treatment plant may be the best option for the City.

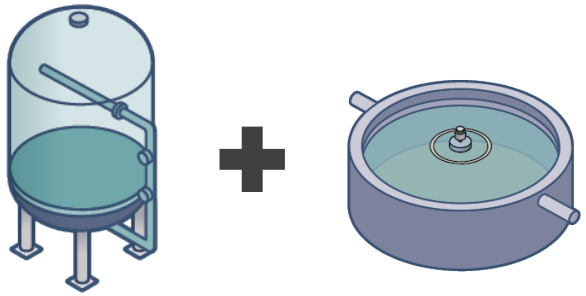
The 2017 Reiss Report evaluated 8 potential color removal strategies and concluded one these technologies would be needed to meet the City color goal.

1



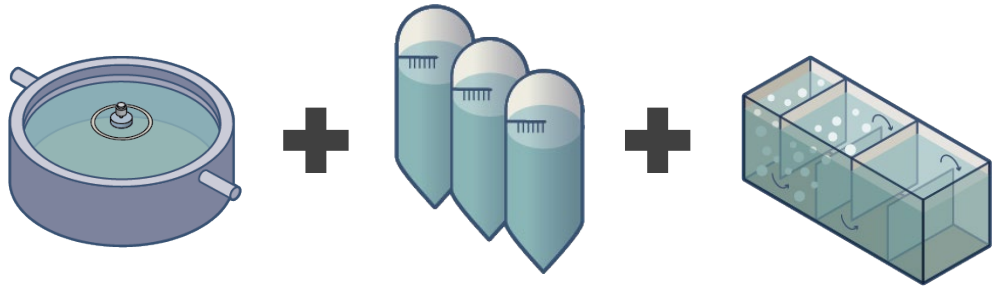
Nanofiltration

2



Ion Exchange + Lime Softening

3



Lime Softening + GAC + Ozone

Reiss recommended pilot testing ozone and GAC as the preferred color removal process to confirm viability.

The 2019 Carollo Report performed the recommended GAC pilot testing.

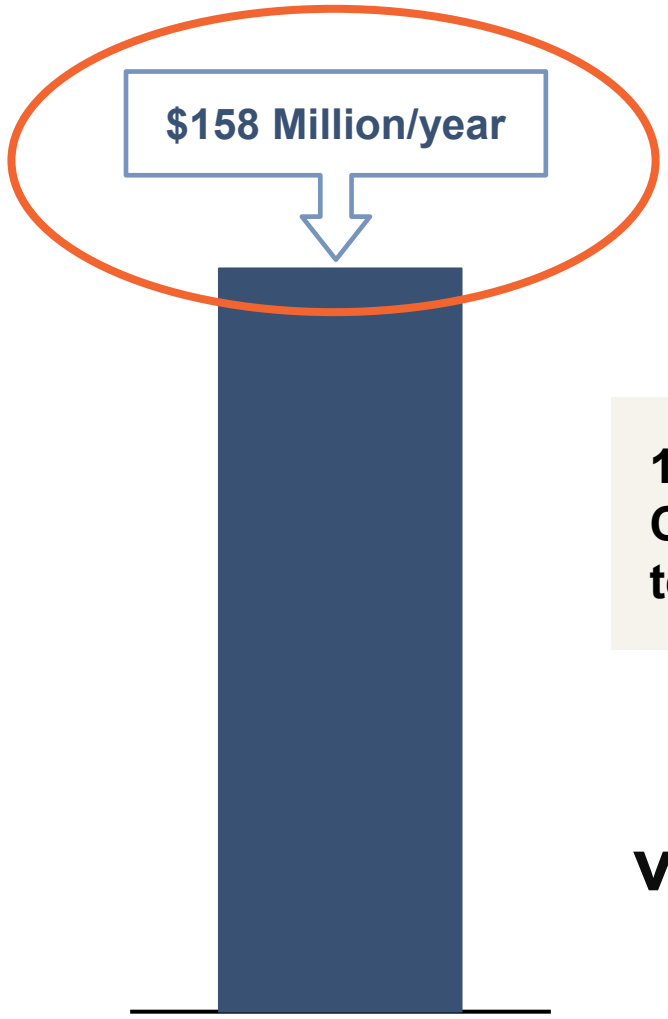
4

Fiveash produces safe drinking water

Fiveash is at the end of its useful life

GAC pilot indicated this technology is not feasible from a cost perspective

Carollo conducted GAC pilot testing (as recommended by Reiss) and concluded GAC is not feasible due to high operating cost and operational practicalities.



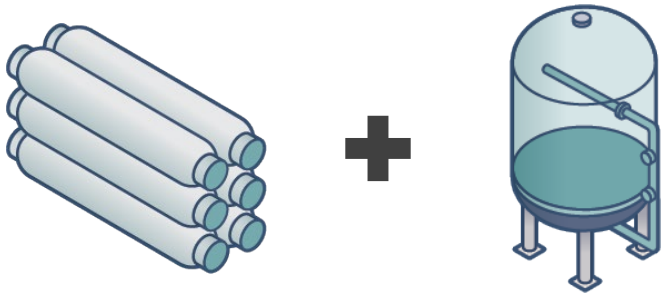
GAC Annual Regeneration Cost (estimated by Carollo)

10X Operating Cost of Carollo recommended technology

vs.

Annual O&M for Technology Recommended by Carollo (estimated by Carollo)

The 2019 Carollo Report also evaluated 17 potential color removal schemes and recommended a new WTP with nanofiltration + ion exchange technology



70% Nanofiltration + 30% Ion Exchange

Recommended Technology

Recommended Location at Prospect Wellfield

The 2019 alternatives screening report issued by Carollo was the basis used by the unsolicited proposers

Can the City's goals be achieved by implementing the new treatment plant as recommended in the 2019 Carollo Report ?

Goal 1:

Finished water color less than 5 units

Yes, P3 agreed to contractual requirement of:

- **< 5 at 90% of the time**
- **< 8 at 98% of the time**

Goal 2:

Replace Fiveash, it is at the end of its useful life

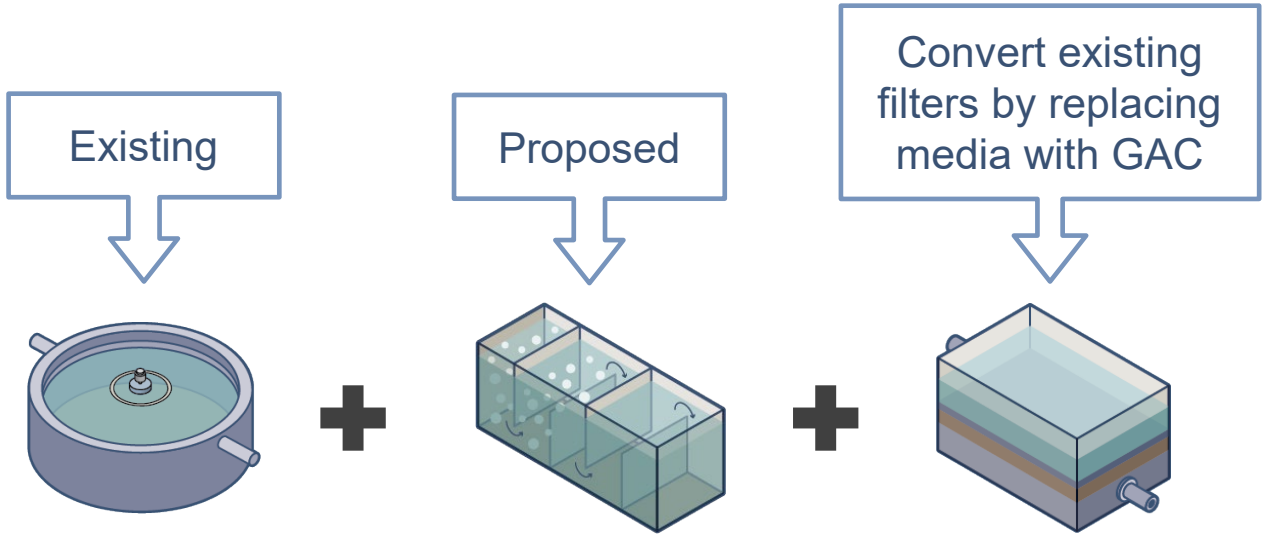
Yes, in part. All Fiveash treatment facilities would be replaced by the Prospect Lake WTP. The Fiveash storage tanks, high service pumps, clearwells and admin bldg would continue in operation.

Goal 3:

Provide effective PFAS removal

Yes, highest likelihood of the alternatives evaluated.

The City decided in late 2020 to pilot a short-term color removal process for Fiveash WTP while the City pursued replacing Fiveash.



Lime Softening + Ozone + BAC Filtration

Reiss pilot tested advanced oxidation process (AOP) combined with biologically active carbon (BAC) filtration

In September 2021, Reiss completed the AOP-BAC pilot testing…

4

Findings Summary:

- Ozone reduced color by 60%, but results were highly variable.
- BAC finished color values varied between 10 and 40 CU
- Capital Cost = $171 million
- Annual O&M = $23 million/yr

…City staff determined further testing not recommended; BAC was not viable.

5 Is the technology proposed by Carollo likely to meet all three of the fundamental City goals?

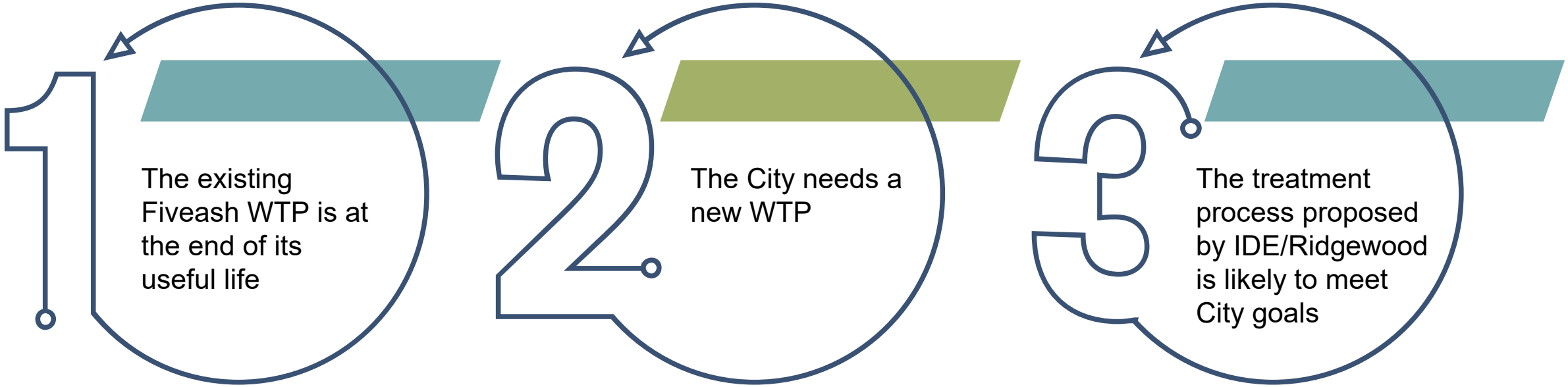
In Hazen's opinion, the technology Carollo recommended is likely to meet current City goals and expected regulations

Finished water color should be below the City's goal (less than 5) at least 90% of the time and be below the EPA's secondary drinking water standard of 15

Replaces Fiveash treatment, which is at the end of its useful life

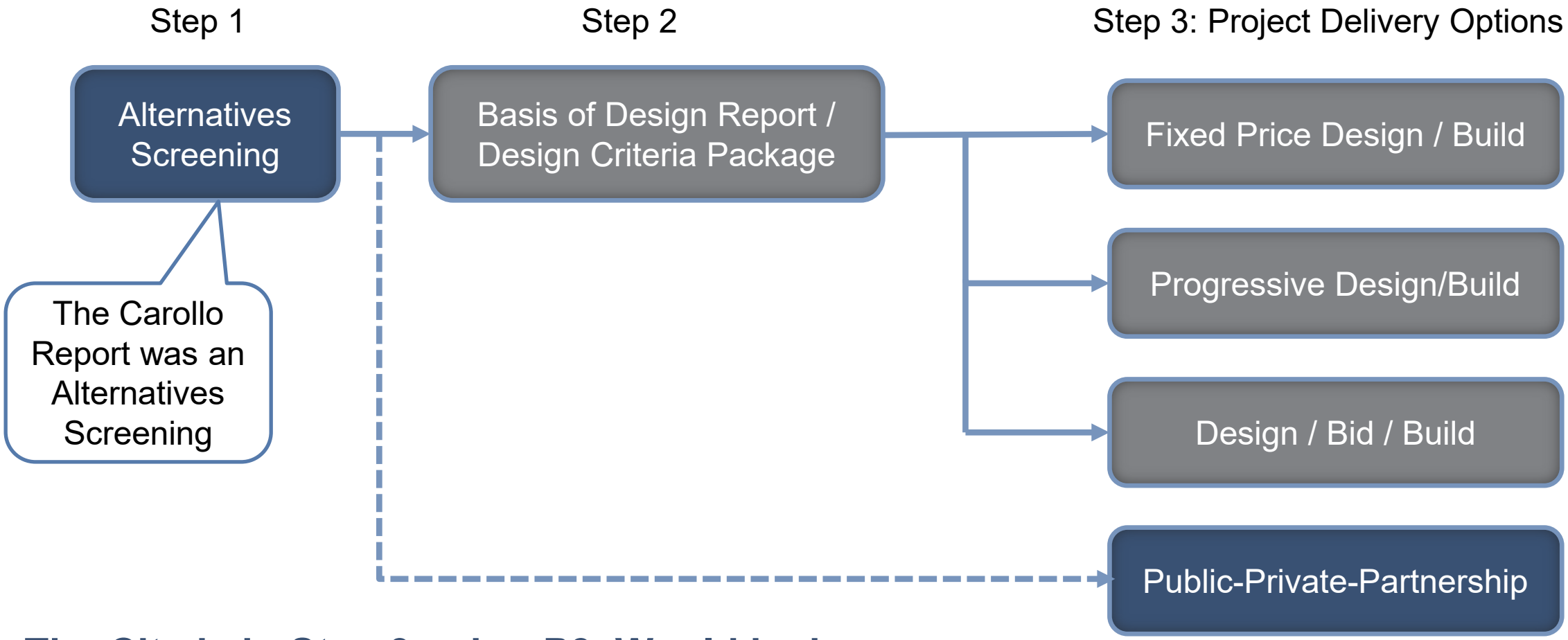
Regulation of PFAS in drinking water is imminent. **The proposed technology is state-of-the-art for PFAS removal.**

Summary and conclusions regarding water treatment process



6 Are there alternatives to the current P3 project delivery approach?

Yes, but there are pros and cons to every project delivery method



The City is in Step 3 using P3. Would be in Step 2 if another method now chosen.

At this point, P3 may be faster than other approaches…

…abandoning P3 to implement a traditional delivery process would add approximately 18 to 25 months to the schedule based on the IDE/Ridgewood's proposed schedule.

ID	Task Name	Duration	Start	Finish
1	**Decide on Delivery Method**	**0 days**	**Tue 1/10/23**	**Tue 1/10/23**
2				
3				
4	**Design-Bid-Build Delivery**	**1384 days**	**Tue 1/17/23**	**Fri 5/5/28**
5	Write Soliciatation for Designer	66 days	Tue 1/17/23	Tue 4/18/23
6	Procure Designer	132 days	Wed 4/19/23	Thu 10/19/23
7	Design and Permit	396 days	Fri 10/20/23	Fri 4/25/25
8	Solicit Contractor	132 days	Mon 4/28/25	Tue 10/28/25
9	Build Plant	658 days	Wed 10/29/25	Fri 5/5/28
10				
11				
12	**Progressive Design-Build Delivery**	**1396 days**	**Tue 1/17/23**	**Tue 5/23/28**
13	Write Soliciatation for PDCP Consultant	66 days	Tue 1/17/23	Tue 4/18/23
14	Procure PDCP Consultant	132 days	Wed 4/19/23	Thu 10/19/23
15	Prepare PDCP	88 days	Fri 10/20/23	Tue 2/20/24
16	Solicit PDB-er	198 days	Wed 2/21/24	Fri 11/22/24
17	Design and Build Plant	912 days	Mon 11/25/24	Tue 5/23/28
18				
19				
20	**Fixed Price Design-Build Deliver**	**1528 days**	**Tue 1/17/23**	**Thu 11/23/28**
21	Write Soliciatation for DCP Consultant	66 days	Tue 1/17/23	Tue 4/18/23
22	Procure DCP Consultant	132 days	Wed 4/19/23	Thu 10/19/23
23	Prepare DCP	198 days	Fri 10/20/23	Tue 7/23/24
24	Solicit DB-er	220 days	Wed 7/24/24	Tue 5/27/25
25	Design and Build Plant	912 days	Wed 5/28/25	Thu 11/23/28
26				
27				
28	**Existing P3 - starting from today**	**978 days**	**Tue 1/17/23**	**Thu 10/15/26**
29	Finish Agreement and issue NTP	66 days	Tue 1/17/23	Tue 4/18/23
30	P3 stated Design and Construction Time	912 days	Wed 4/19/23	Thu 10/15/26

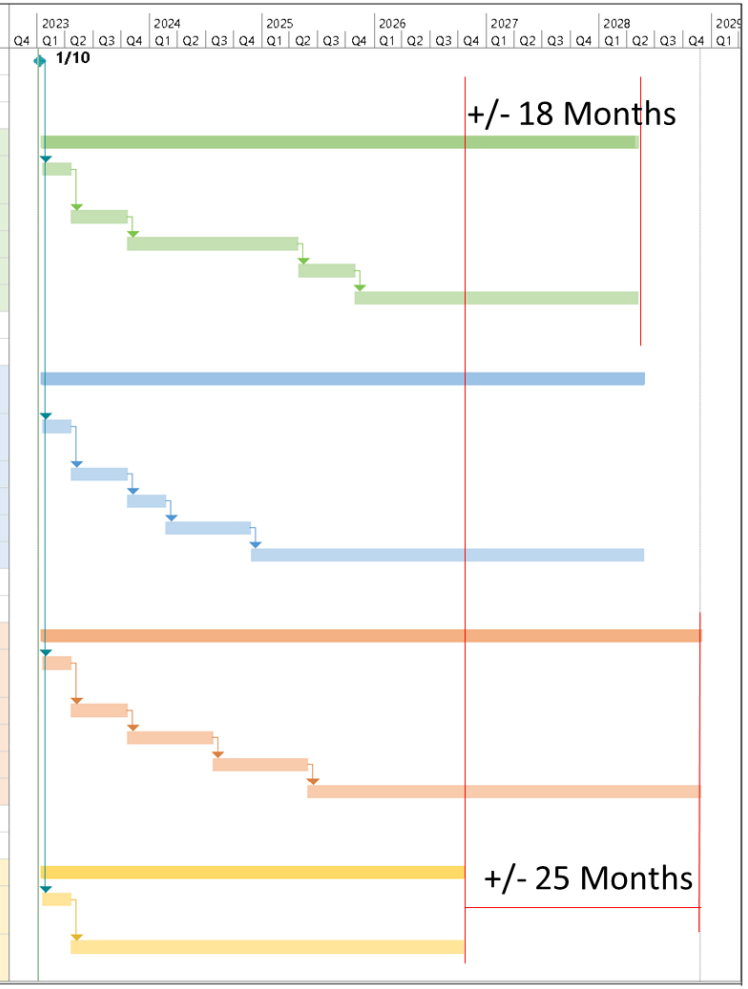


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Exhibit 1
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7 How does the current Ridgewood/IDE cost compare to the Carollo estimate?

The current Ridgewood/IDE proposed costs are roughly equivalent to the Carollo estimate

Carollo Estimate with Enabling Works, Escalated	$644 Million
Ridgewood/IDE Price with Enabling Works	$666 Million

Notes:

1. The Carollo estimate was escalated using Engineering News Record Construction Cost Index (CCI) from date of report to the mid-point of construction using a forecasted CCI.
2. Enabling works estimates were included in both estimates.
3. Estimating accuracy for the Carollo estimate is Class 5 as defined by AACE International.
4. Estimating accuracy for the enabling works is Class 5 as defined by AACE International.