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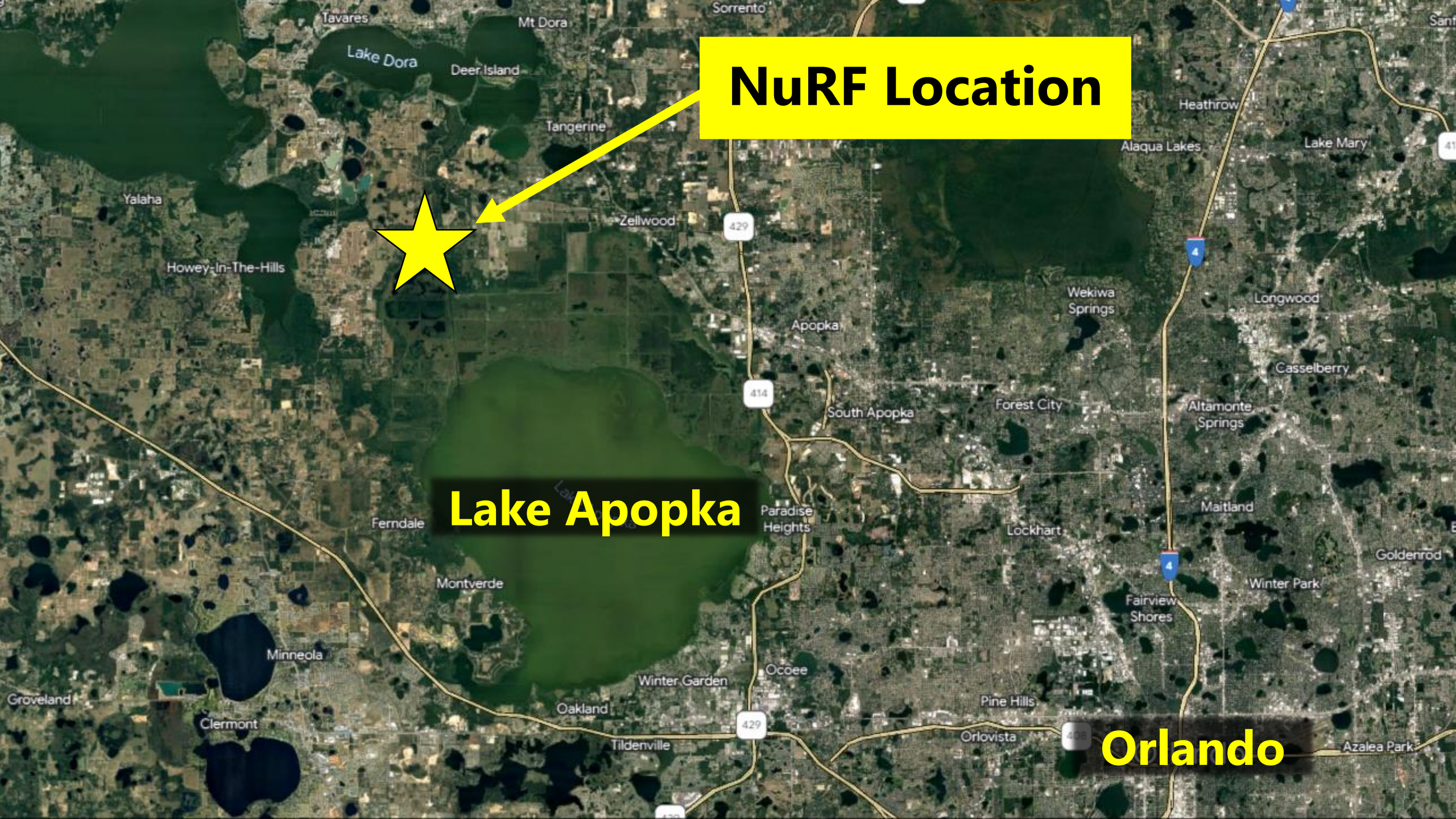
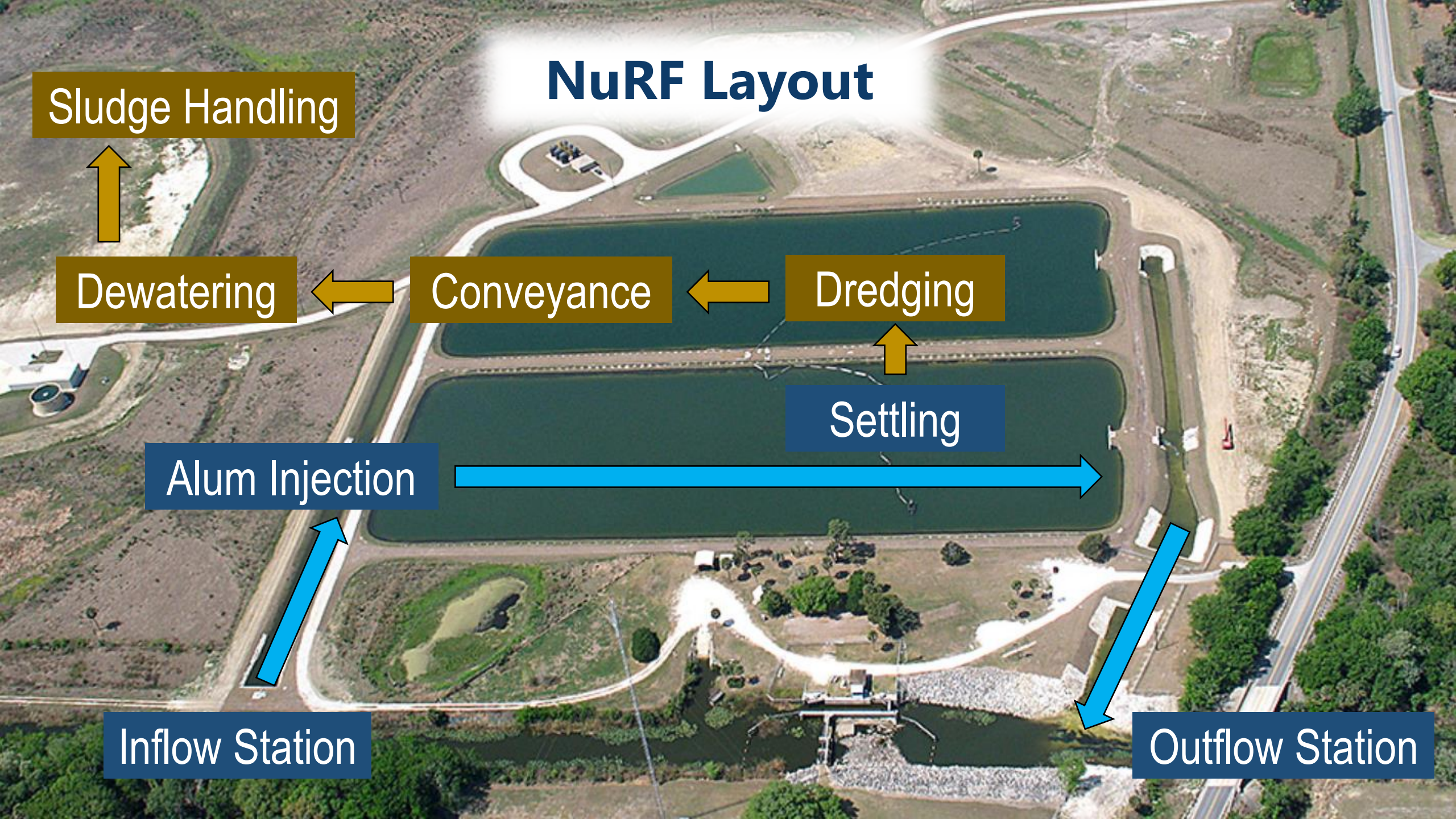
Improving Resiliency and Life Cycle Costs of Nutrient Reduction

Florida Stormwater Association
Annual Conference
June 16, 2023

Scott Shannon, PE
Josh Schmitz, PE


NuRF Location
Lake Apopka
Orlando
Tavares
Mt Dora
Sorrento
Lake Dora
Deer Island
Tangerine
Heathrow
Alaqua Lakes
Lake Mary
Yalaha
Zellwood
Howey-In-The-Hills
Wekiwa Springs
Longwood
Apopka
Casselberry
South Apopka
Forest City
Altamonte Springs
Ferndale
Paradise Heights
Lockhart
Maitland
Goldenrod
Montverde
Winter Park
Fairview Shores
Minneola
Ocoee
Winter Garden
Groveland
Oakland
Pine Hills
Clermont
Tildenville
Orlovista
Azalea Park
429
414
4


NuRF Layout
Sludge Handling
Dewatering
Conveyance
Dredging
Settling
Alum Injection
Inflow Station
Outflow Station

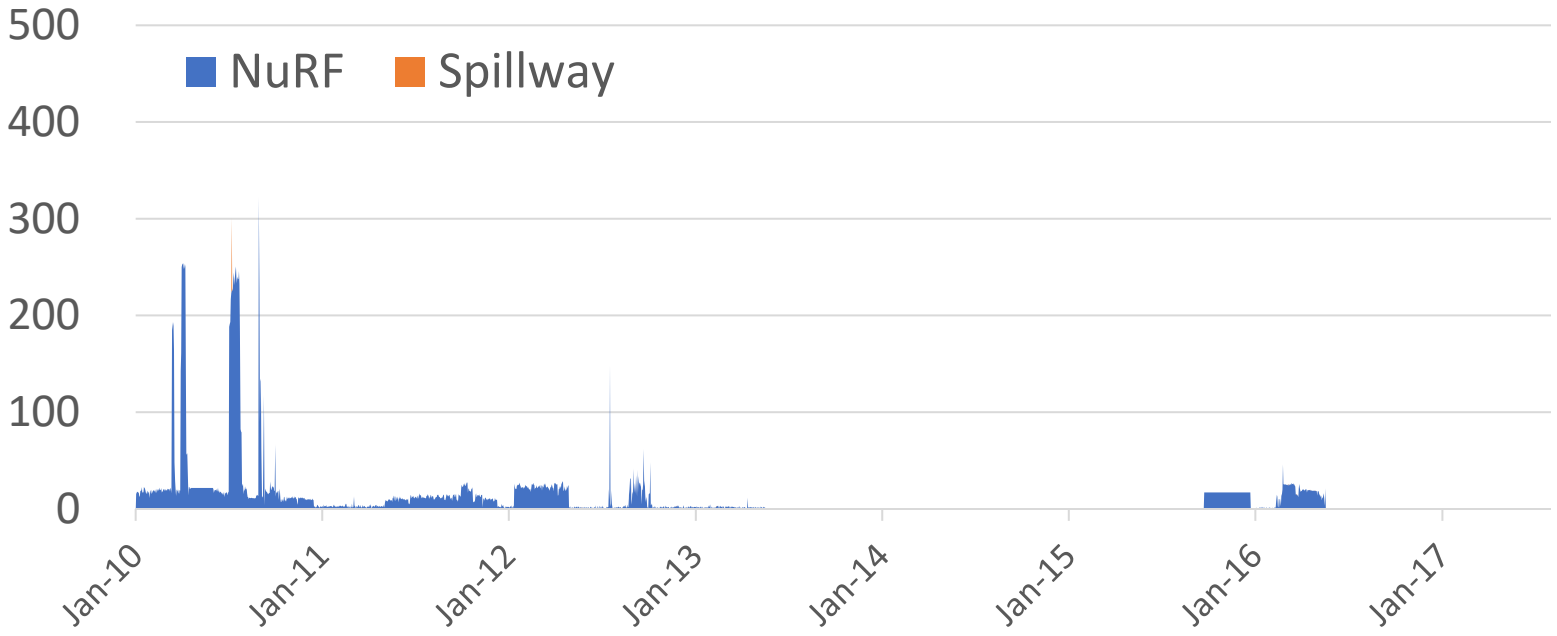
LCWA Objective and Historical Flows

"To reliably treat the entire volume of water flowing through the Apopka-Beauclair Canal, sustaining up to a maximum flow rate of 300 cubic feet per second"

Flow Regime	Flow Range (cfs)	Number of Days	Days (%)
Low	1 to 49	1470	71.8%
Mid	50 to 149	310	15.2%
High	150 to 299	266	11.4%
Very High (Design)	> 299	32	1.6%

Capacity of 300 cfs treats entire canal flow greater than 98% of the time.

Operational History (2010-2021)



March 2009 – August 2017
Average Flow Rate: 18 cfs
Total Throughput: 16.6 Billion gallons

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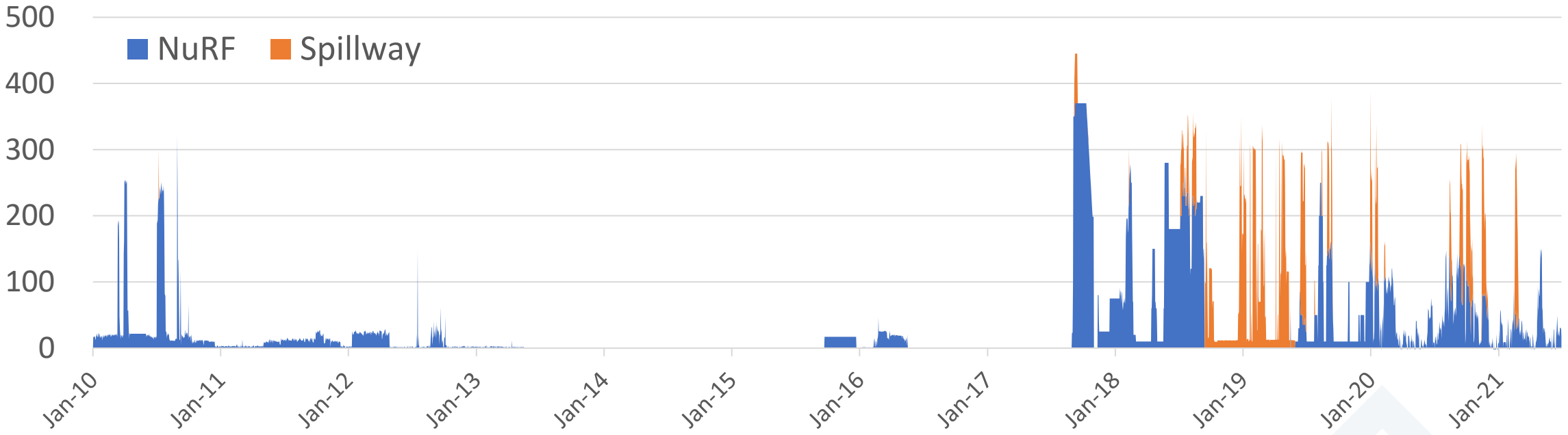
Operational History (2010-2021)



March 2009 – August 2017
Average Flow Rate: 18 cfs
Total Throughput: 16.6 Billion gallons

September 2009 – June 2021
Average Flow Rate: 64 cfs
Throughput: 57.6 Billion gallons
A-B Canal: 85.4 Billion gallons

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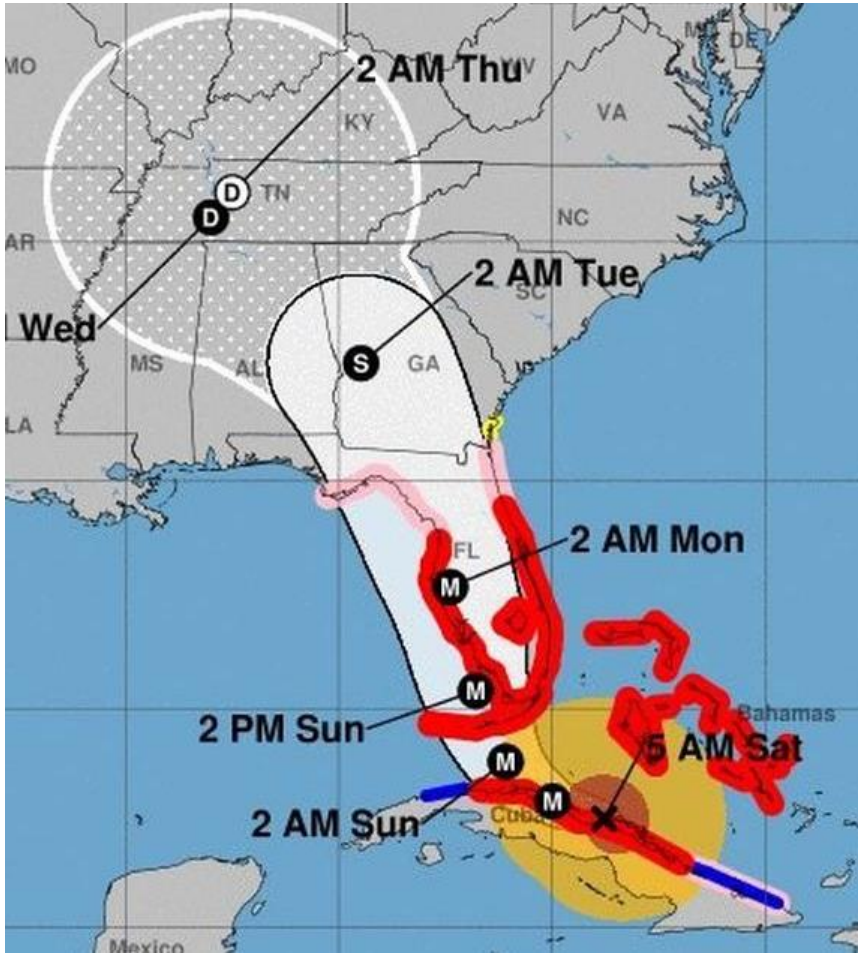
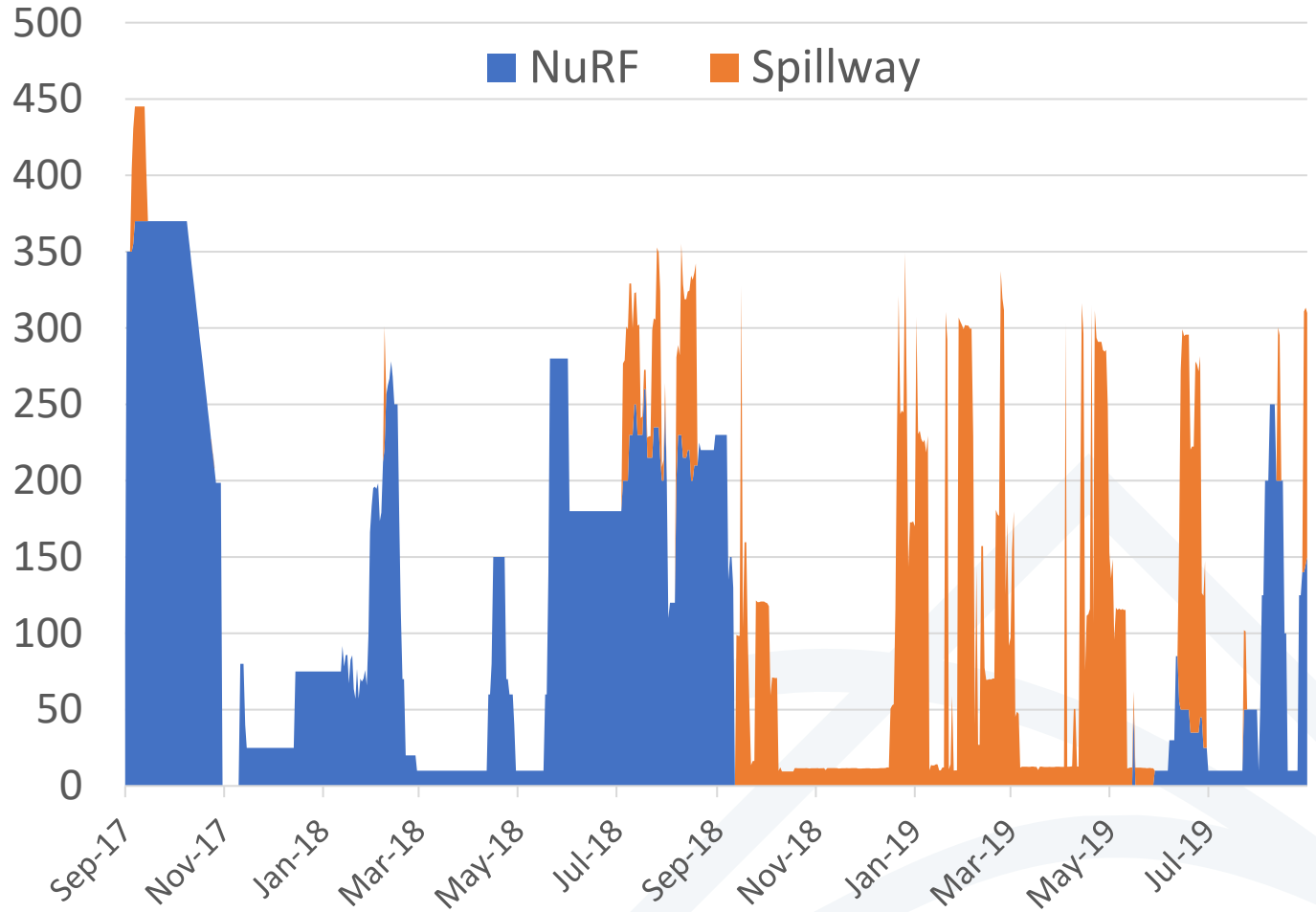
Hurricane Irma (2017) and Aftermath





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Operational Impacts

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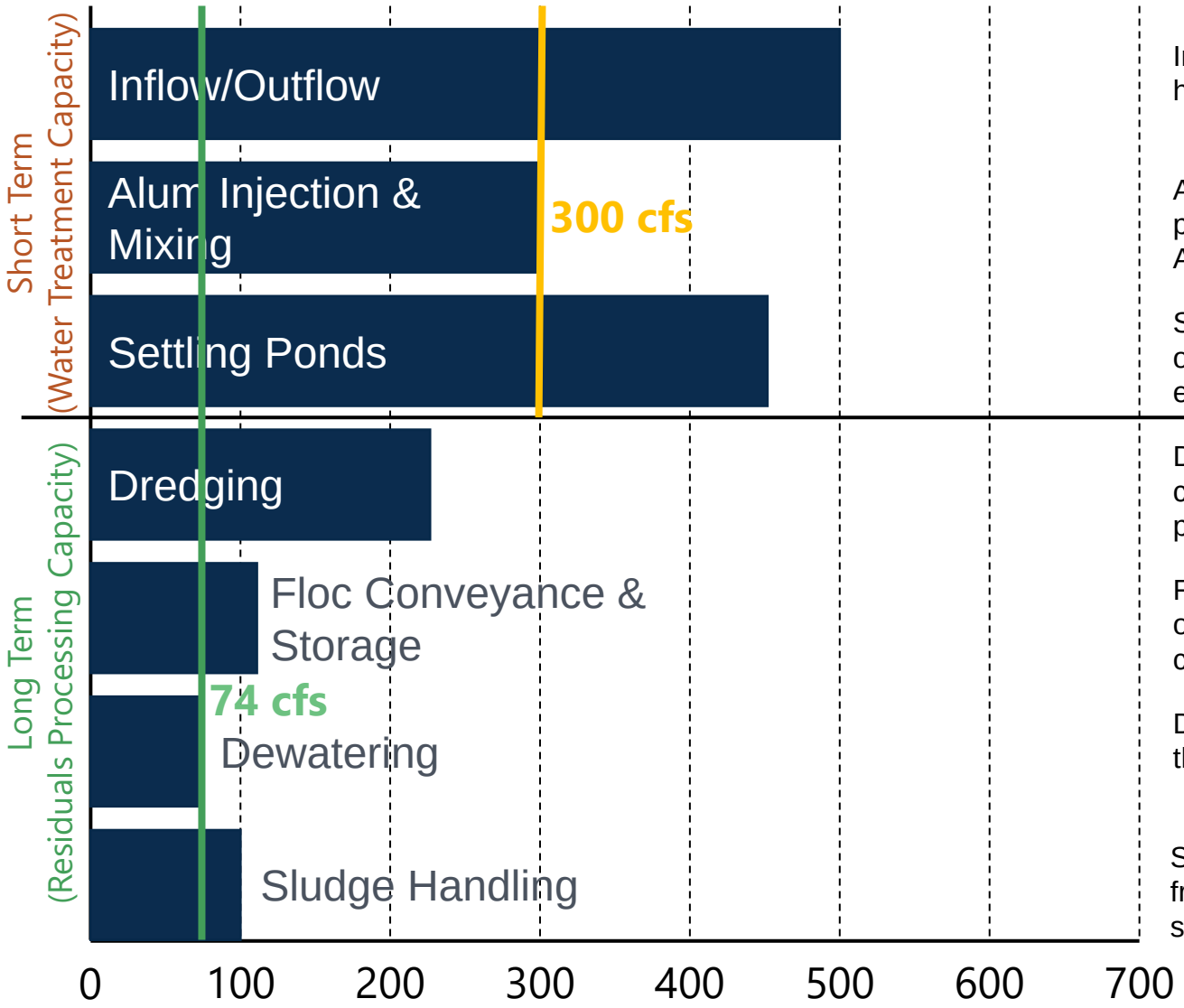
Capacity of NuRF Processes



Inflow/Outflow capacity assumed capable of 500+ cfs. Max observed historical flow of Apopka-Beauclair Canal is 754 cfs.

Alum injection capacity (300 cfs) limited by 30 gpm max output of one alum pump. Fixed dose rate of 13 mg Al / liter equates to 1 gpm per 10 cfs. Assumes sufficient mixing.

Settling pond capacity (450 cfs) based on max average flow rate sustained over 10-day period, starting with fully dredged pond, until floc accumulation exceeds 1.5 hr detention time requirement at 300 cfs, without dredging.

Dredging capacity (222 cfs) based on each dredge (2) pumping at 600 gpm capacity for eight hours per day, and that such capacity just balances out floc production assuming dredge mix is 50% floc by volume.

Floc Conveyance & Storage capacity (111 cfs) based on dredge pipe capacity of 600 gpm limited to one dredge operating at a time, reducing dredge capacity above by half.

Dewatering capacity (74 cfs) based on 400 gpm of dredge material (50% floc) throughput of single centrifuge operating eight hours per day.

Sludge Handling capacity (99 cfs) based on reported output of 18 cy sludge from centrifuge when operating continuously at 400 gpm for eight hours, and staff reported capability to dispose 24 cy on site per 8 hr shift.

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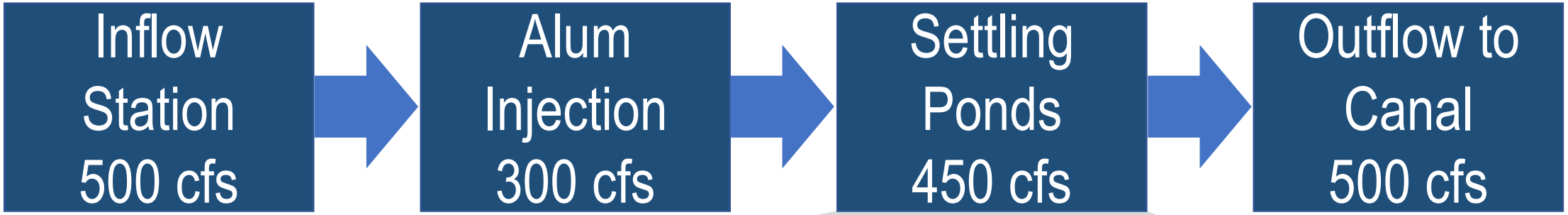
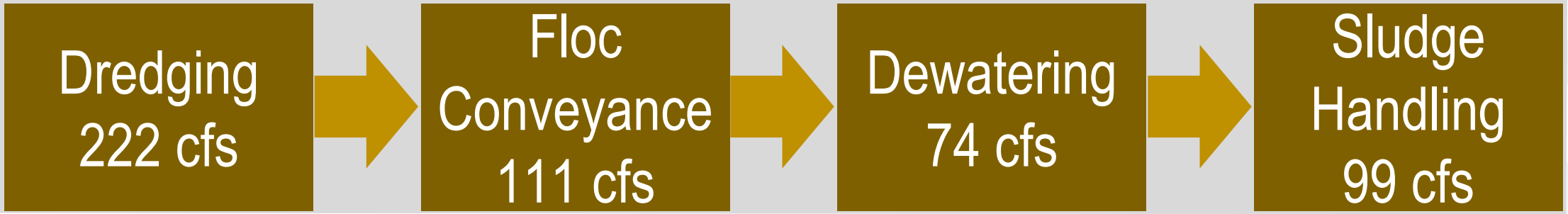
NuRF Process Diagram

Water Treatment Capacity = **300 cfs**



Residuals Processing Capacity = **74 cfs**



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How can we increase capacity and improve resiliency?

Primary Inflow Station

- Implement automated, self-cleaning screening system, such as a bar rack with traversing grab rake
- Will screen out floating and suspended debris
- Protects new dredges and allows them to operate within design conditions

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Alum Injection and Mixing

- Proceed with carrier water/alum and dispersed injection system to improve mixing
- Establish the primary alum feed at the intake structure with secondary feeds immediately upstream of the floc ponds
- Implement real time phosphorus monitoring to enable reduced alum usage

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Dredging

- Proceed with planned installation of new dredges
- The new dredges should be onboarded in a manner that ensures complete pond coverage and a consistent floc free of grit to the dewatering equipment, including an effective sand and grit prevention system.
- If the new dredges are unable to prevent sand and grit from adversely affecting the dewatering process, a dedicated grit removal technology should then be evaluated.
- Repair of dredge controls and rail guidance should be completed prior to dredges being activated

Dewatering

- Defer assessment of need for dewatering system expansion or improvements until prior improvements are completed, because these will change floc characteristics.
- Assessment should evaluate grit removal (if still necessary), polymer applicability, and type of additional capital equipment needed.

Dewatering Alternatives Evaluation

Estimated Daily Dewatering Rate (cfs)	1 Centrifuge with Increased Shifts	Potential Improvement to Floc Feed Density with 1 Centrifuge	2 Centrifuges with Increased Shifts	Potential Improvement to Floc Feed Density with 2 Centrifuges	Duration to Net Reduction in Floc after Irma (days)	Net Reduction in Floc < 10 days, or 300 cfs Dewatering?
37	1 centrifuge, 1 shift	No efficiency improvement			> 1,238	No
74	1 centrifuge, 1 shift	100% efficiency improvement			967	No
74	1 centrifuge, 2 shifts	No efficiency improvement	2 centrifuge, 1 shift	No efficiency improvement	967	No
111	1 centrifuge, 3 shifts	No efficiency improvement			486	No
148	1 centrifuge, 2 shifts	100% efficiency improvement	2 centrifuge, 1 shift	100% efficiency improvement	187	No
148			2 centrifuge, 2 shift	No efficiency improvement	187	No
222	1 centrifuge, 3 shifts	100% efficiency improvement			88	No
222			2 centrifuge, 3 shifts	No efficiency improvement	88	No
296			2 centrifuge, 2 shifts	100% efficiency improvement	4	Yes
444			2 centrifuge, 3 shifts	100% efficiency improvement	0	Yes

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On-Site Sludge Handling

- LCWA's highest priority should be to identify and arrange for an off-site disposal option and begin hauling dewatered sludge off-site as soon as possible.
- Defer onsite sludge handling improvements to account for long-term disposal and new operational requirements

Instrumentation and Controls

- Replace damaged controls and implement a single communication platform for ease of operations, automation and expandability.
- Evaluate new centrifuge control hardware, software, and programming to optimize output based on feed density (after dredging improvements have been implemented)

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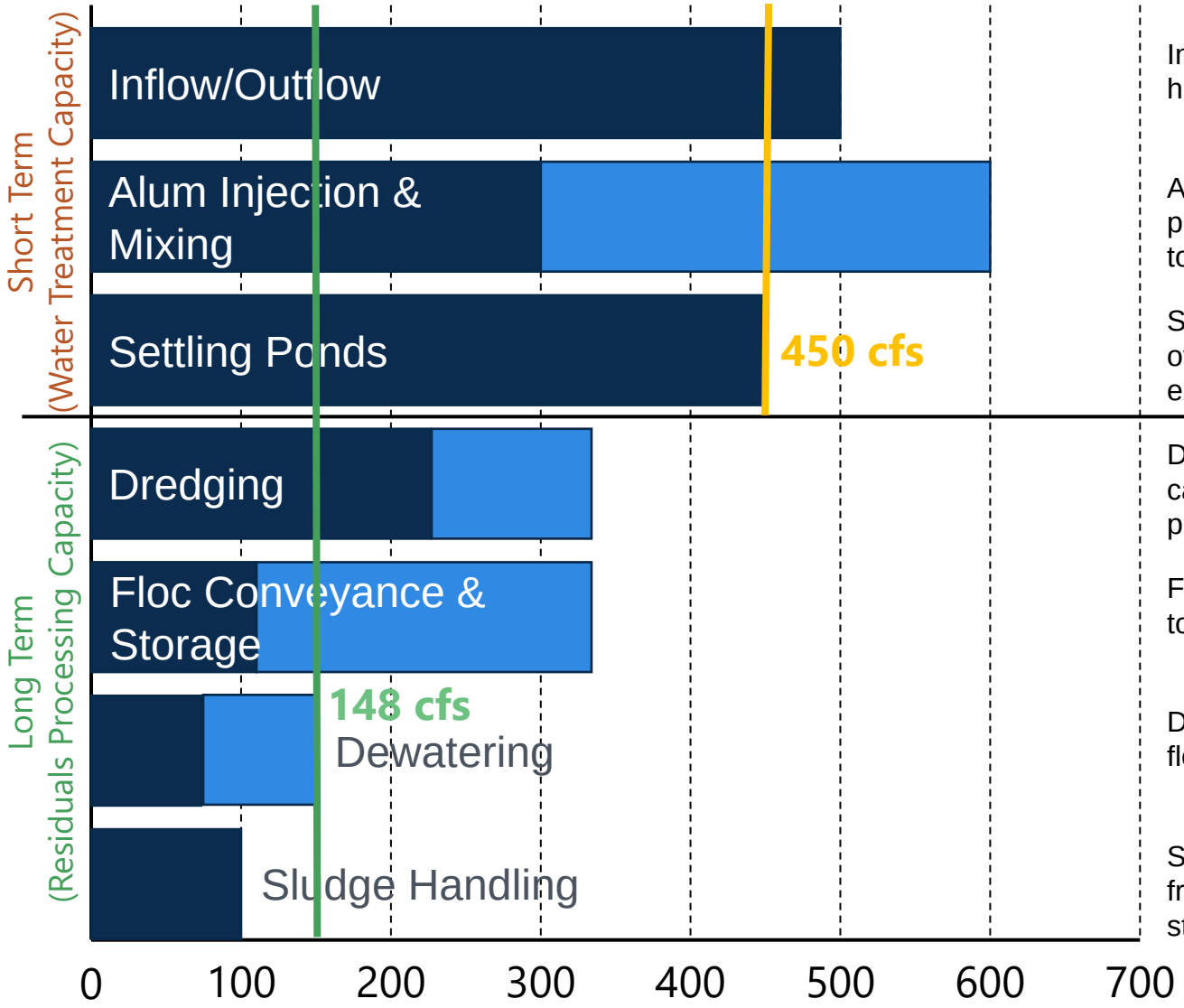
Projected Capacity Improvements



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Settling pond capacity (450 cfs) based on max average flow rate sustained over 10-day period, starting with fully dredged pond, until floc accumulation exceeds 1.5 hr detention time requirement at 300 cfs, without dredging.

Dredging capacity (333 cfs) based on each dredge (2) pumping at 900 gpm capacity for eight hours per day, and that such capacity just balances out floc production assuming dredge mix is 50% floc by volume.

Floc Conveyance & Storage capacity based on doubling dredge pipe capacity to handle full 900 gpm output of two dredges.

Dewatering capacity (148 cfs) based on 800 gpm of dredge material (50% floc) throughput of two centrifuges each operating eight hours per day.

Sludge Handling capacity (99 cfs) based on reported output of 18 cy sludge from centrifuge when operating continuously at 400 gpm for eight hours, and staff reported capability to dispose 24 cy on site per eight hour shift.

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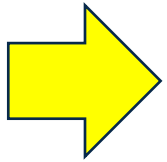
Progress to Date

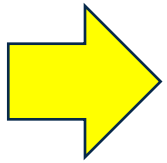
1. Continue with Dredging System Improvements

2. Implement automated screening system at Primary Inflow Station

3. Implement Alum Injection improvements, including real-time control



4. Then, assess Dewatering System to determine necessary improvements



5. Defer Sludge Handling improvements to align with off-site disposal needs

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Estimated Cost of Capital Improvements

Inflow Station	$1,545,000
Alum Injection	$359,000
Dredging	$621,466
Floc Conveyance	$250,075
Dewatering	None yet.
Sludge Handling	None yet.
Instrumentation	$195,000
TOTALS	**$2,971,000**

Total Represents
Net Savings of $1.5M
by avoiding capital cost of second centrifuge (estimated at $2.6M).

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Additional Operational Improvements

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Add Technical Resources to Meet Varying Needs and Conditions

- Five dedicated staff members
  - On-site Plant Manager with 30 years experience
  - Chief Operator
  - Three O&M Technicians
- Additional support available 24/7 as needed
  - Innovation Team
  - Heath & Safety
  - Maintenance Specialists
  - Controls and Automation
  - Engineering
- **Enables emphasis on water quality and efficient, sustainable operation.**

Implement Technology to Improve Cost-Effectiveness

- Implement Geospatial Asset Management Plan
- Implement Operational Data Management System
- Equip and train staff to test and monitor water quality daily
- Track maintenance expenses with focus on cost controls
- Monthly Operating Reports to LCWA

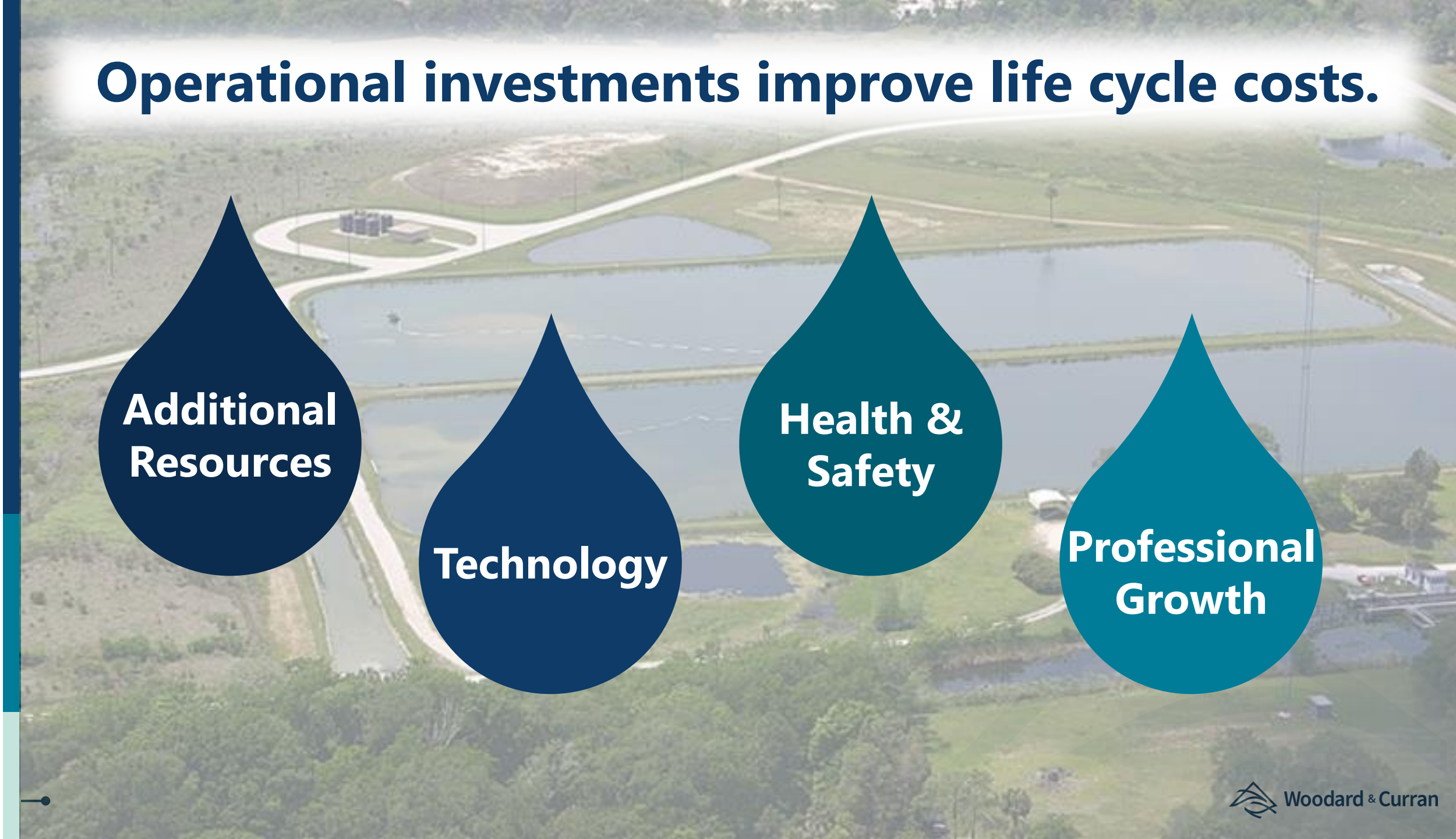
Create a Safer Working Environment

- Machine guarding of rotating parts
- Life rings for ponds and tanks
- Proper (GHS) labeling of chemical totes
- Flammable-resistant fuel storage
- Emergency lighting
- Shower and eye wash stations
- Lockout/tagout
- Arc flash analysis (NFPA 70E)
- Qualified electrical worker training

Foster Staff Growth Opportunities

- Improve technical skills: training equipment operators to be water quality technicians
- Safer working environment
- Career path, mentoring, and professional development
- Ownership opportunities

Operational investments improve life cycle costs.



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