Next Generation Nutrient Recovery at Clean Water Services Rock Creek AWWTF

Presenters
- Nate Cullen: Clean Water Services
- Rick Shanley: Carollo Engineers

carollo
Engineers...Working Wonders With Water®

Clean Water Services

Outline

- Background
- Treatment Process
- Economic Analysis
- Project Delivery Approach
- Questions

Background

Clean Water Services

- Established in 1970
- Sanitary sewer and surface water management provider
- Serves over 530,000 customers and industries in urban Washington County, Oregon
- 4 wastewater treatment facilities
- 1,000 miles sanitary and storm sewers and 41 pump stations.

Previous Generation Nutrient Recovery Facility

- Durham AWWTF
- Three Pearl 500 reactors
- Operational in May 2009
- First nutrient recovery facility

Rock Creek AWWTF

- 35 mgd tertiary plant discharges to the Tualatin River
- 0.10 mg/L T-PO4 monthly median permit May 1 to October 31
- 0.2 mg/L NH3-N weekly median permit May 1 to November 15
- 5 mg/L BOD and TSS

Next Generation Nutrient Recovery Facility

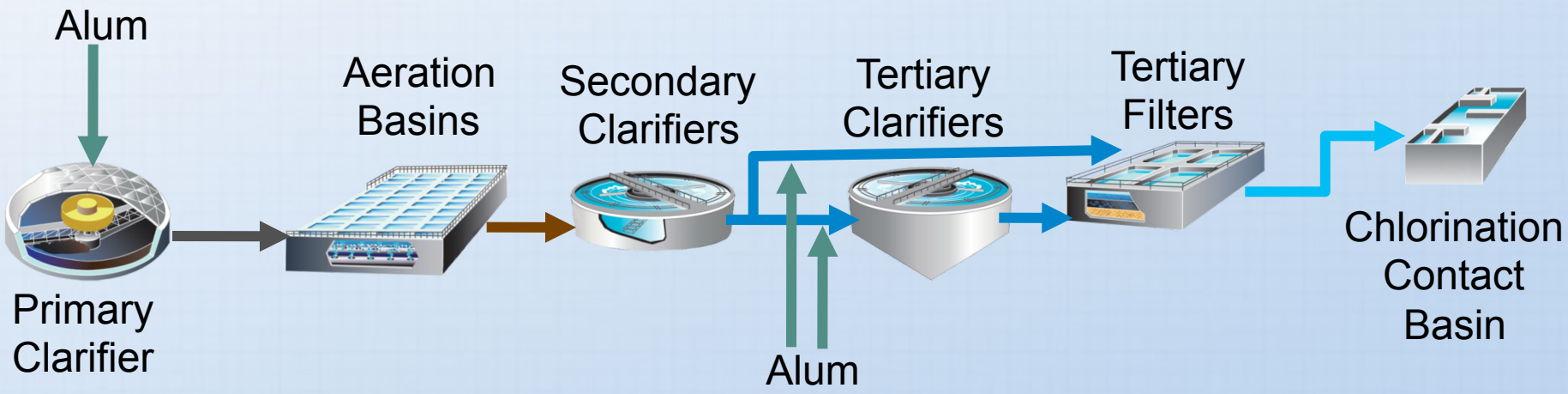
- Rock Creek AWWTF
- Two Pearl 2000 units
- Operational May 2012
- First Pearl 2000 Nutrient Recovery Facility

Project Challenges

- Convert Rock Creek from Chem-P to Bio-P
- Achieve a favorable payback
- Meet an aggressive design/build schedule

Treatment Process

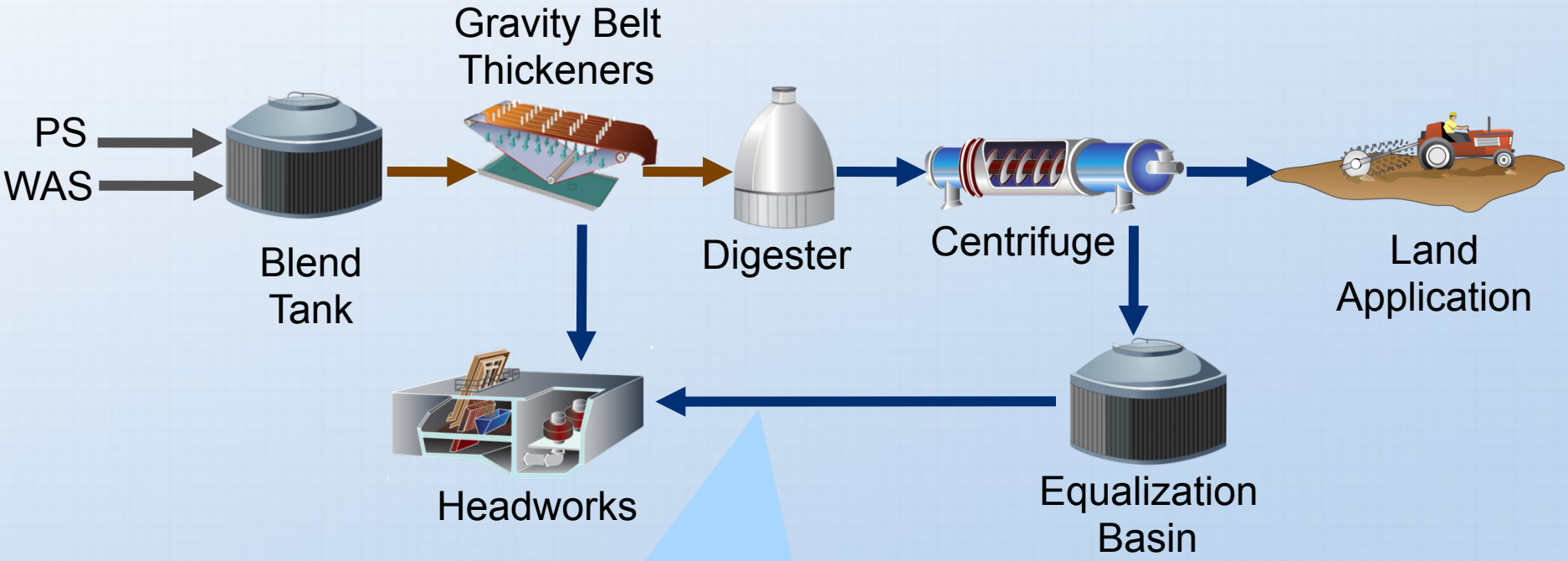
Stringent Effluent Phosphorus Limits are Met Through Bio-P + Alum



Modifications to Enhance Bio-P

- Physical improvements
  - Partitioned anoxic & anaerobic zones
  - Reduced mixing energy
  - Decreased mixed liquor return
- Increased VFAs
  - Added “corn-squeezins”
  - Fed blueberry process waste
  - Imported sugar waste
  - Build a temporary fermenter

Current Solids Operation Recycles P to Head of Plant

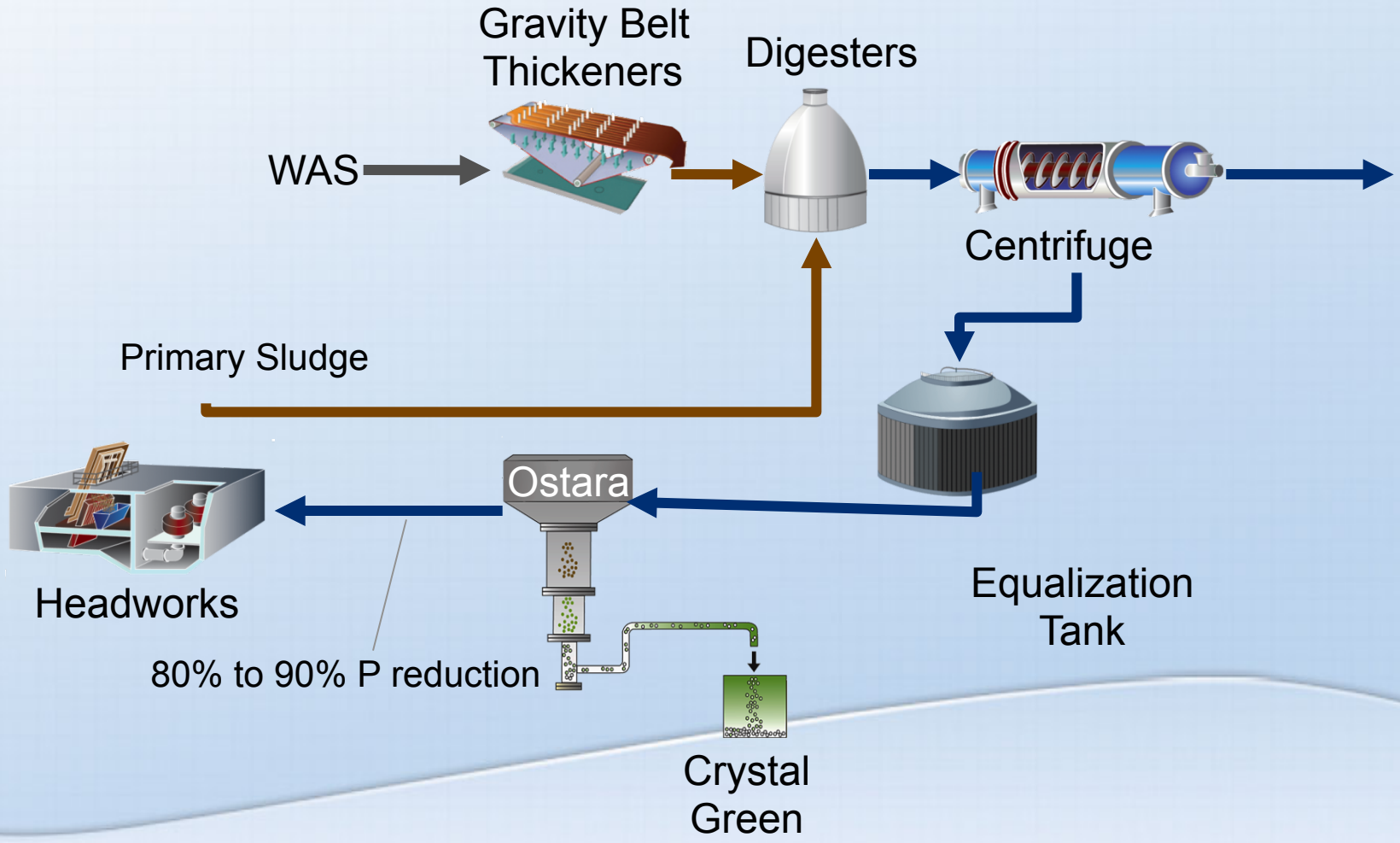


Approx. 500 lbs/day of P

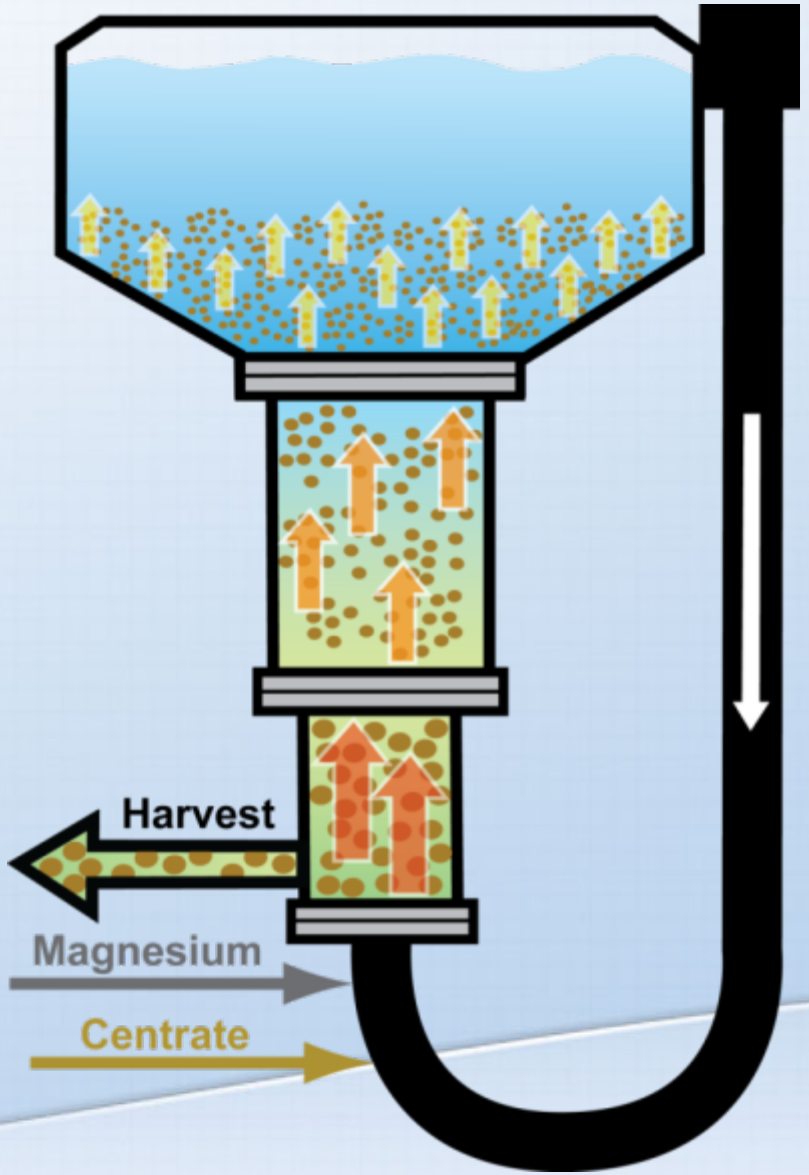
Nutrient Recovery Provides Financial and Process Benefits

- Reduce potential struvite formation in solids processes
- Reduce nutrient recycles
  - Improved BPR stability
  - Reduce costs associated with
    - Chemicals
    - Solids disposal
- Revenue from sale of struvite as fertilizer

Controlled Struvite Precipitation Removes Nutrients From Recycle Stream



Ostara Pearl Reactor

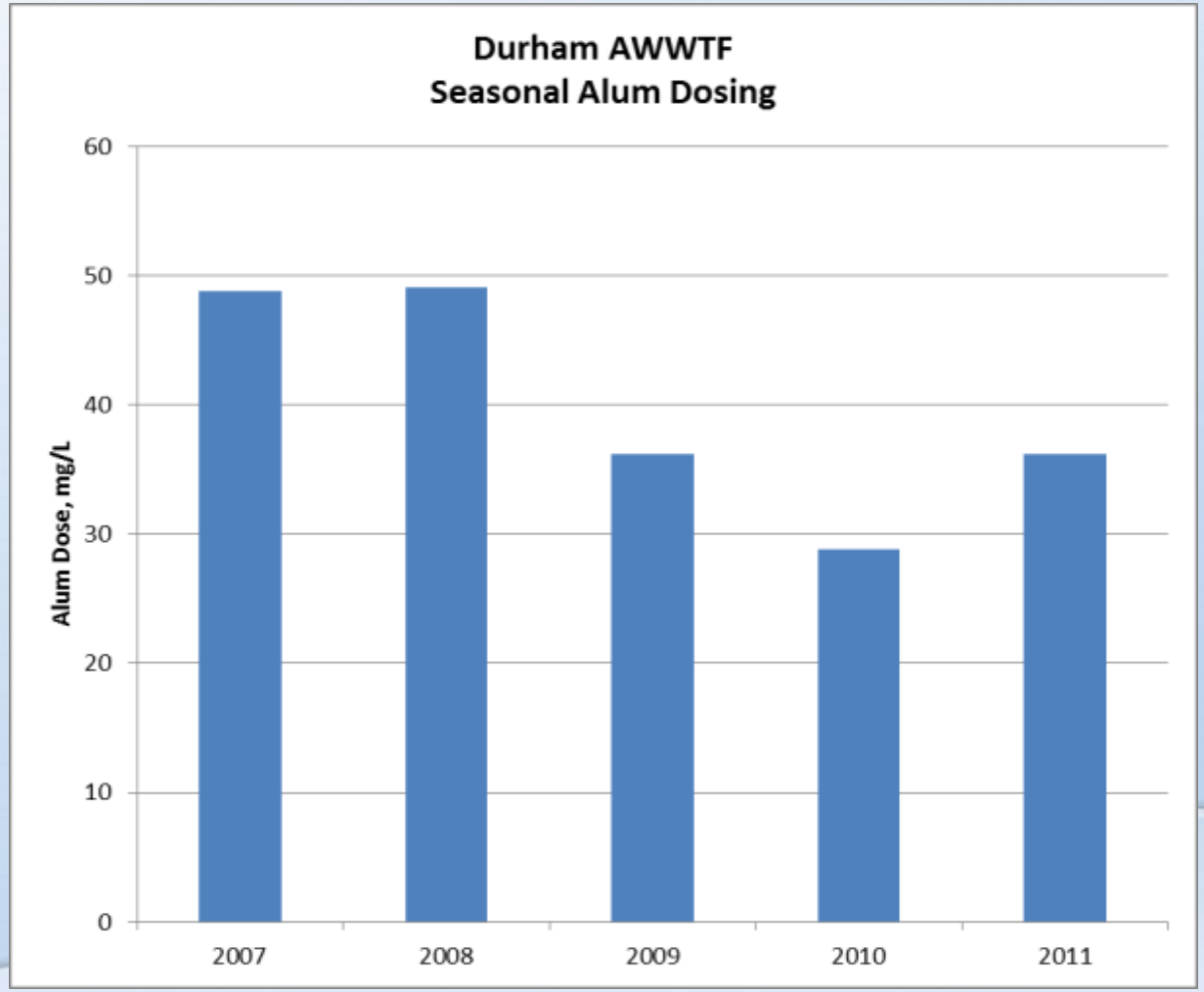


Crystal Green

- Premium slow release fertilizer
- 5-28-0 10%Mg
- Container plants, golf courses, and sports fields
- NOT A BIOSOLID
- Source of revenue

Economic Analysis

Financial Benefits Go Beyond the Fertilizer Revenue



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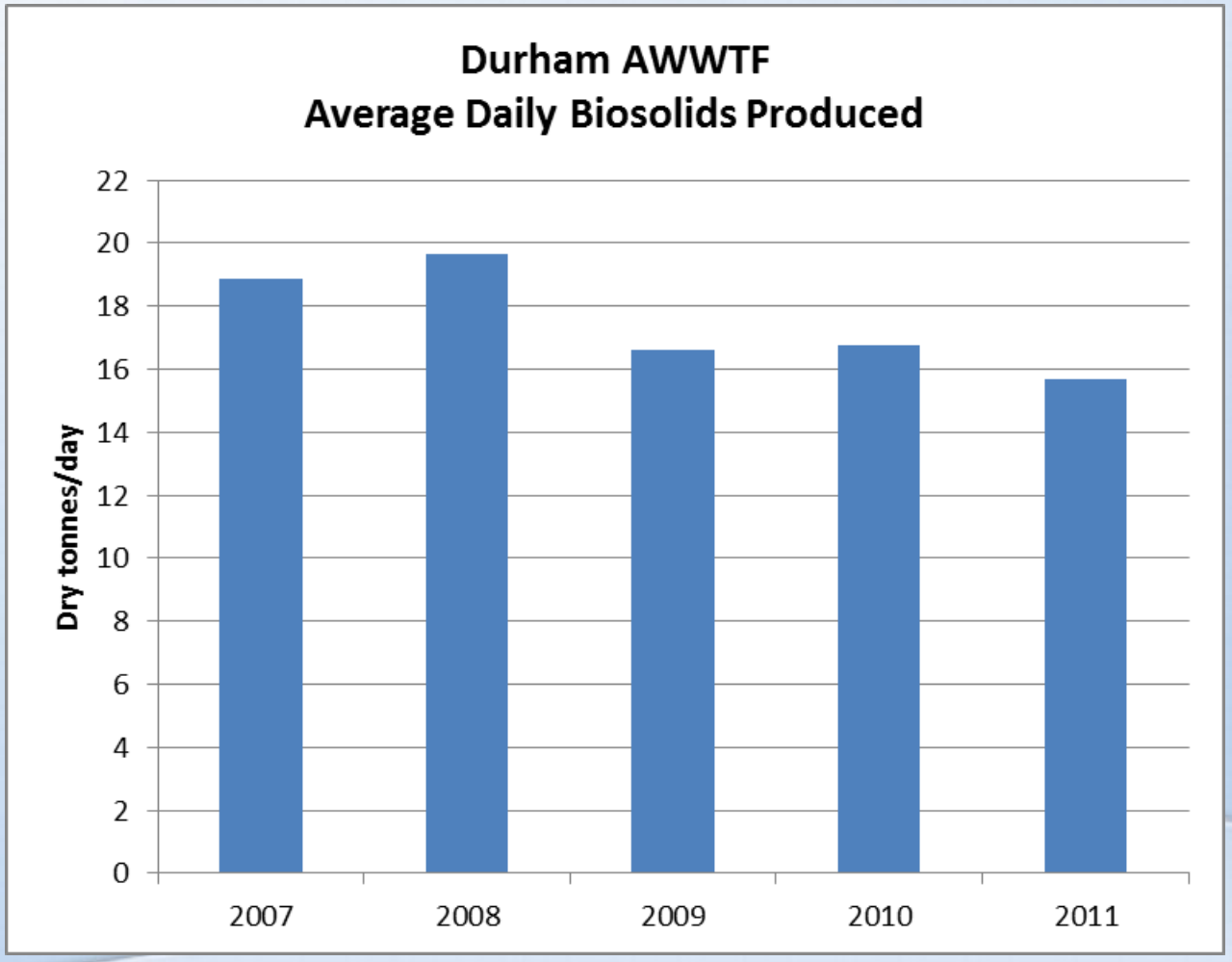


Projected Payback

$$\text{Payback} = \frac{\text{Capital Cost}}{\text{Revenue} + \text{Operational Savings}}$$

- Operational savings from:
  - Reduced phosphorus removing chemicals
  - Reduced biosolids disposal

Projected Payback

$$\text{Payback} = \frac{\$4{,}850{,}000^*}{\$690{,}000}$$

Payback = 7 years

*Price reflects an incentive from Ostara for being the first to install Pearl 2000 reactors

Project Payback

$$\text{Payback} = \frac{\$4{,}700{,}000}{\$690{,}000}$$

- Add change orders ($0.5 million)
- Add engineering ($0.5 million)
- Subtract Business Energy Tax Credit ($1.15 M)

Payback = 7 years

Actual Payback

$$\text{Payback} = \frac{\$4{,}700{,}000}{\$690{,}000 \text{ +/– ??}}$$

- How much chemicals are we actually saving?
- How much reduction in biosolids are we seeing?
- Are we producing as much fertilizer as planned?
- Does it take more labor to operate and maintain than budgeted?

To determine the actual payback, we are conducting a Business Case Analysis to rigorously account for all costs and revenues.

“Creating Value from Waste”

- Reduced chemical use and biosolids production
- Driver to convert to bio-P process
- Meeting payback projection
- Producing sustainable fertilizer

Producing Sustainable Fertilizer

Retail Opportunities

- Local product in development.
- Demonstrate that a circle of recovery and use is possible and profitable for local communities.
- Local use further increases the environmental benefit to local communities.

Project Delivery

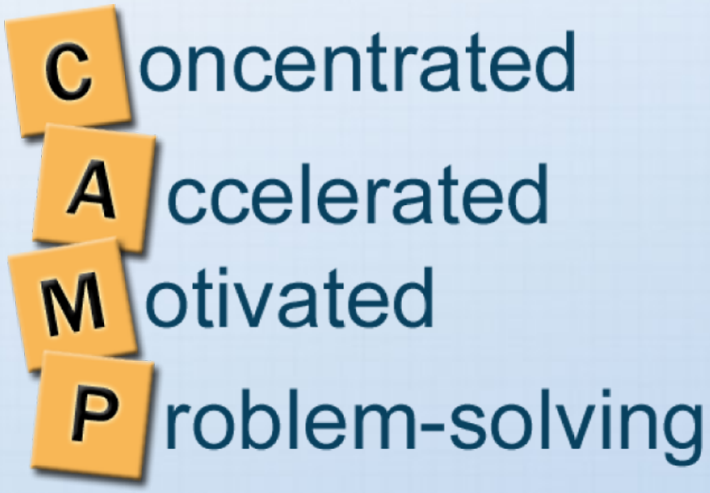
District and Ostara Motivated to Fast-Track Project

- Ostara
  - Reference for new system
  - Process debugging
- District
  - Price negotiations
  - Integrate O&M benefits

Alternative Delivery Approach Needed to Reduce Schedule

Unique Delivery Concepts Met Schedule and Cost Objectives

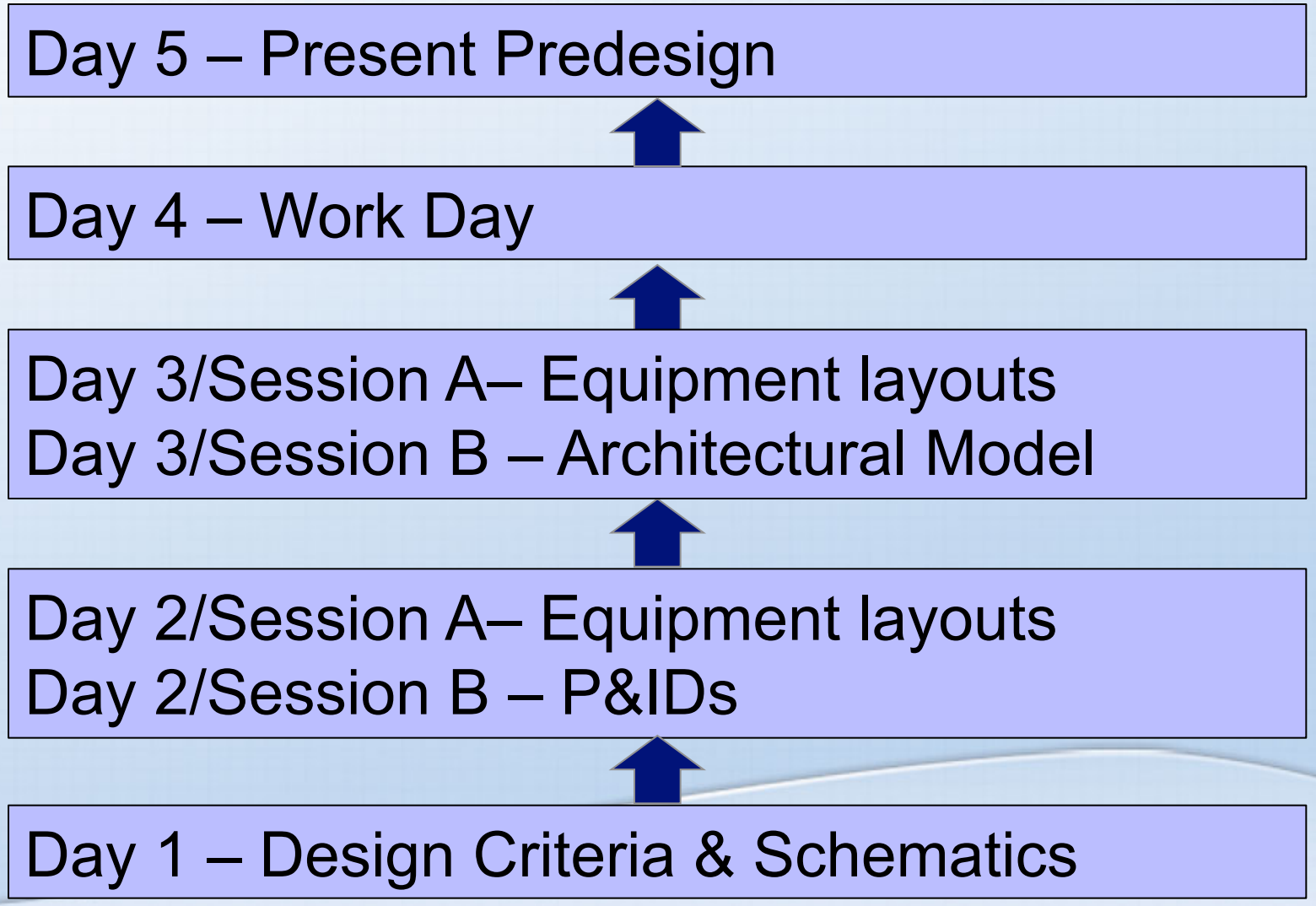
Design CAMP™



Contracting

Engineer
Procure
Construct

CAMP Moves Concepts to Predesign in One Week



Characteristics Required for a Successful CAMP

Characteristic	Description
Diversity of opinion	Engineers, O&M staff, EI&C, equipment suppliers, architect, structural, building contractor, etc
Independence	Not influenced by the group.
Aggregation	Turn private ideas into a **collective decision**.

EPC Contract Developed from CAMP

- Owner pays for:
  - Construction – Design/Build by Ostara
  - Long-term operation
- Ostara:
  - Leads Design/Build
  - Assists in start-up
  - Purchase of entire product for 15 years

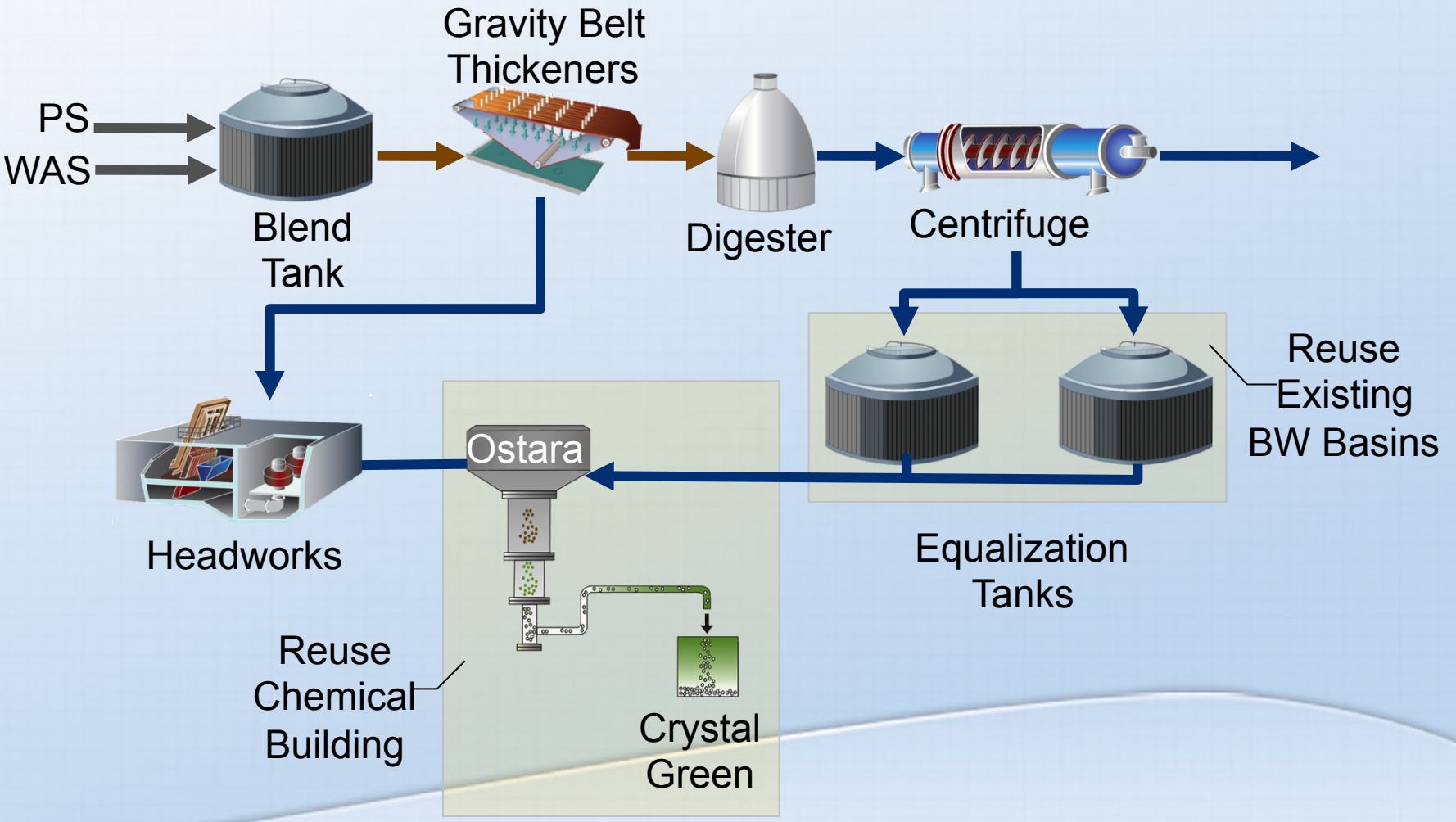
Design/Build Delivery Approach Requires Significant Collaboration

- Ostara responsible for overall coordination and delivery
- Ostara provided design for their equipment package
- Carollo lead design for
  - Structure
  - Connections to plant
  - Mechanical & major EI&C
- Carollo provided SDC support for both Ostara and the District

Design and Construction Costs Minimized Through Collaborative Design

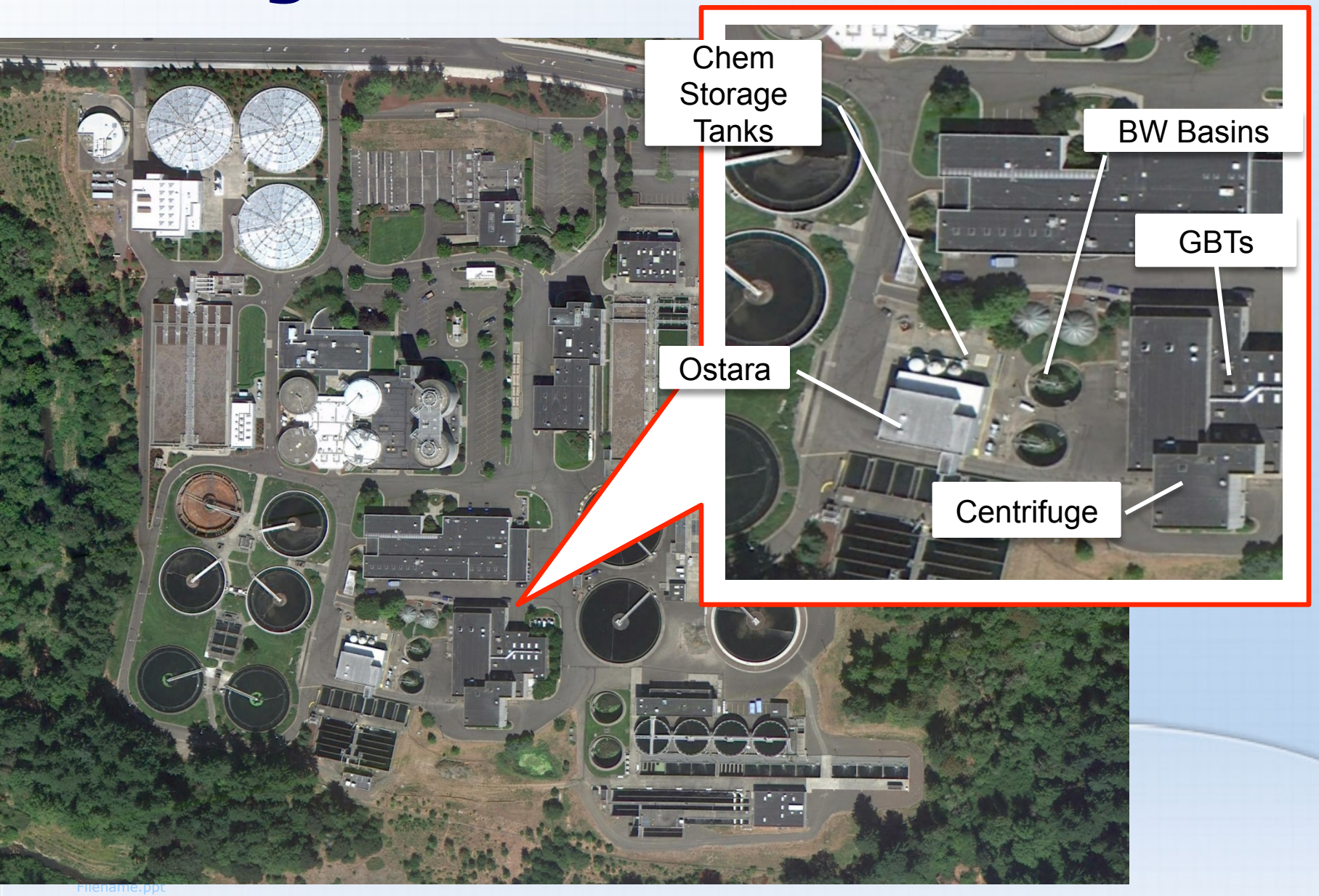
- Optimized use of existing facilities
- Siting
- Efficient layout

Designed to Maximize Use of Existing Facilities



Conversion of Chemical Building Posed Challenges

Siting Controls Costs



Building Layout

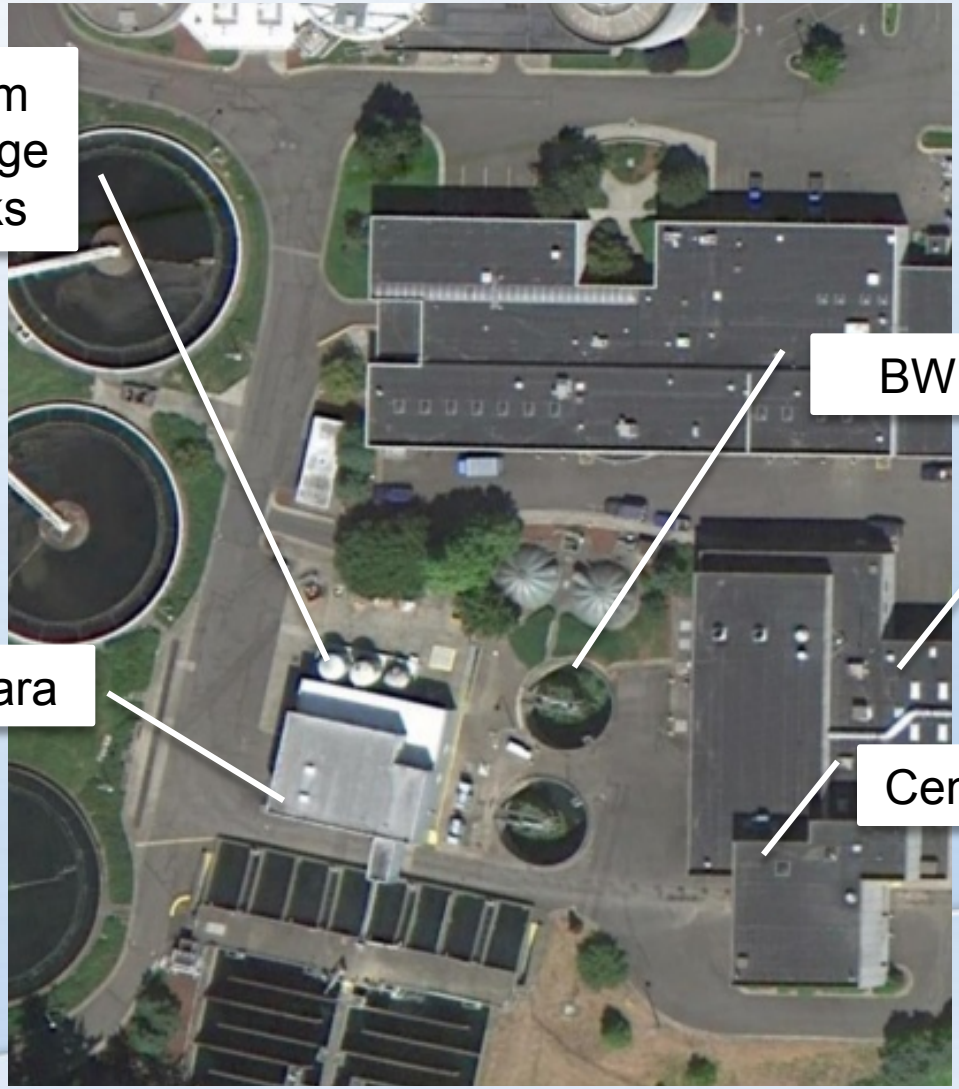
Keys for Successful Implementation of Nutrient Recovery at Rock Creek

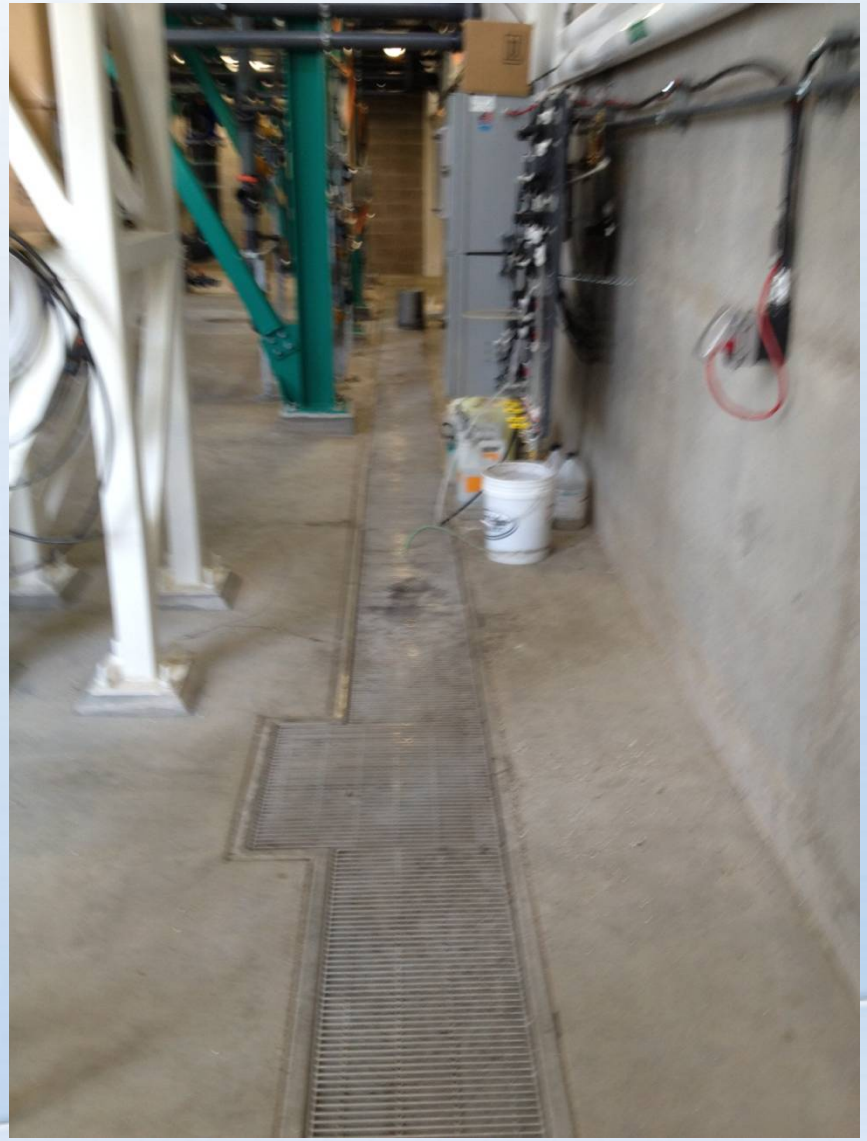
- Integrated and upgraded upstream processes
- Design that maximized use of existing facilities
- Collaborative, efficient project delivery approach

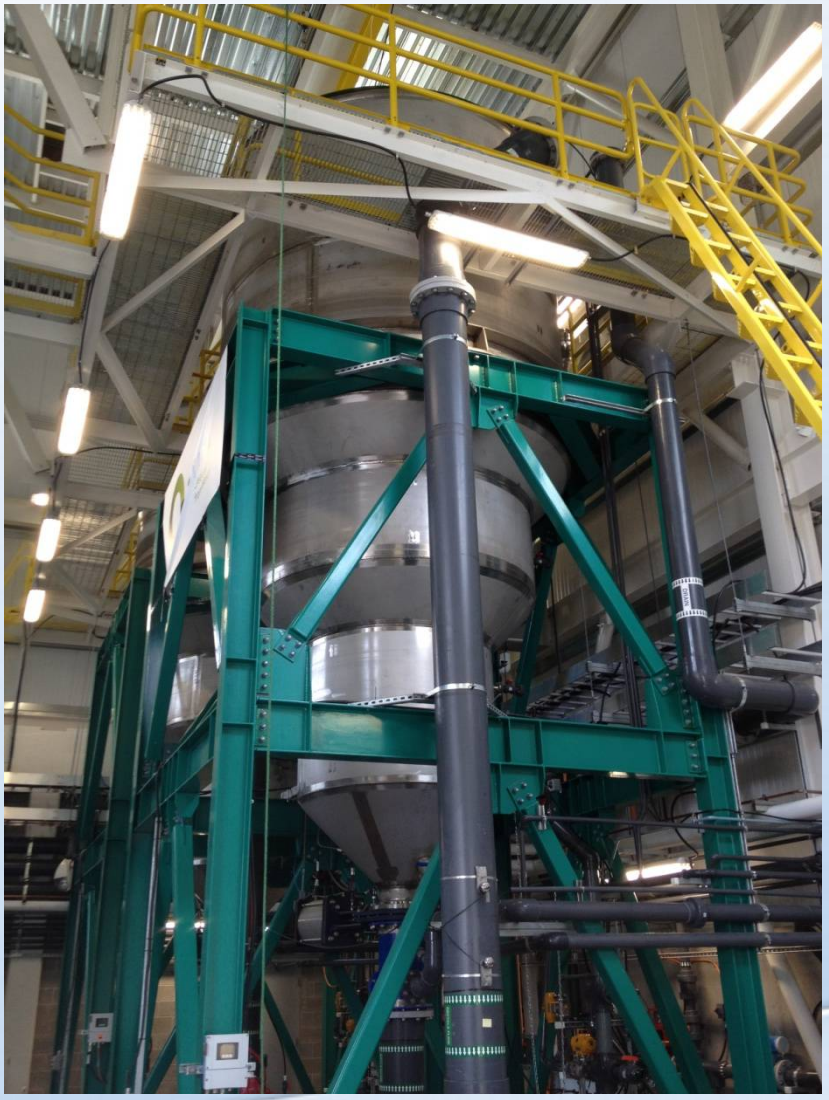
QUESTIONS?

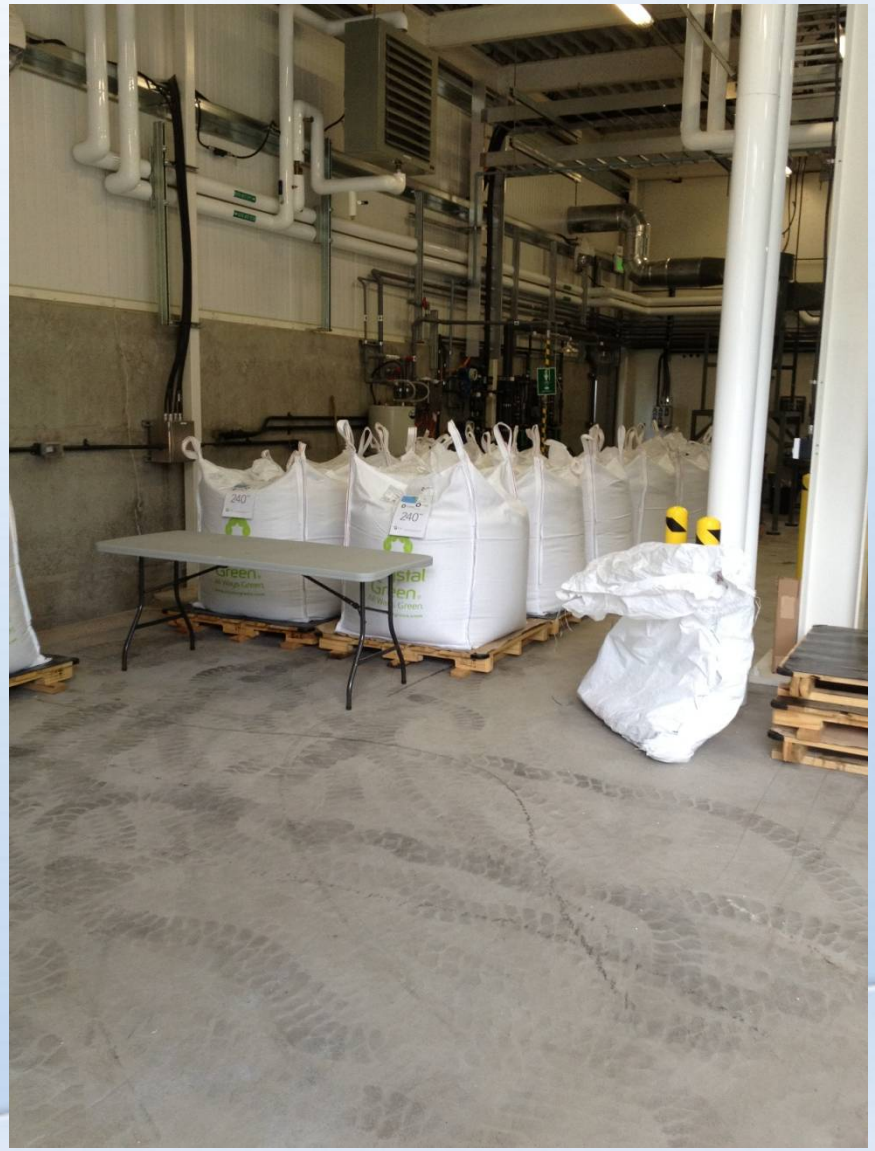
BACK-UP SLIDES

Siting Controls Costs

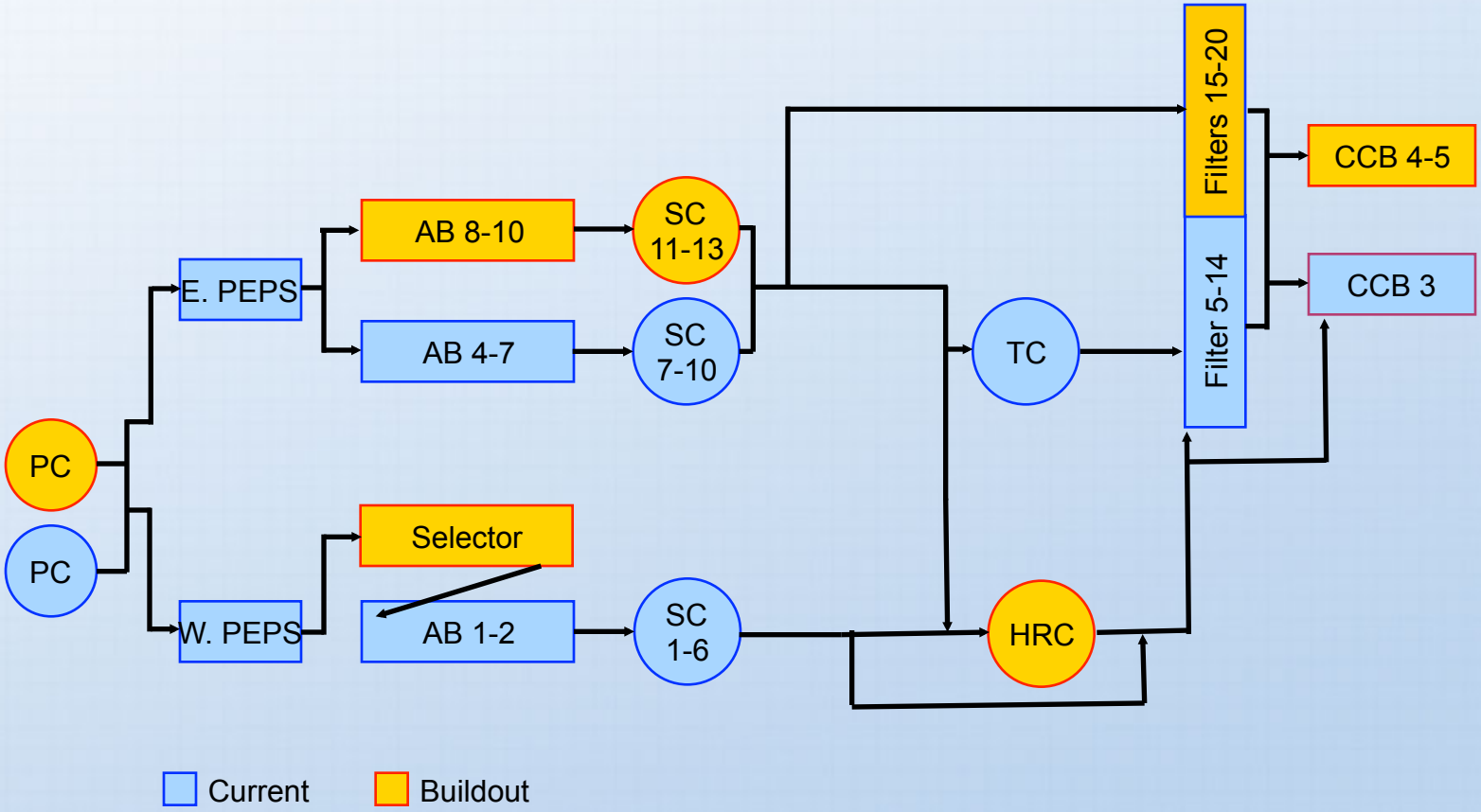




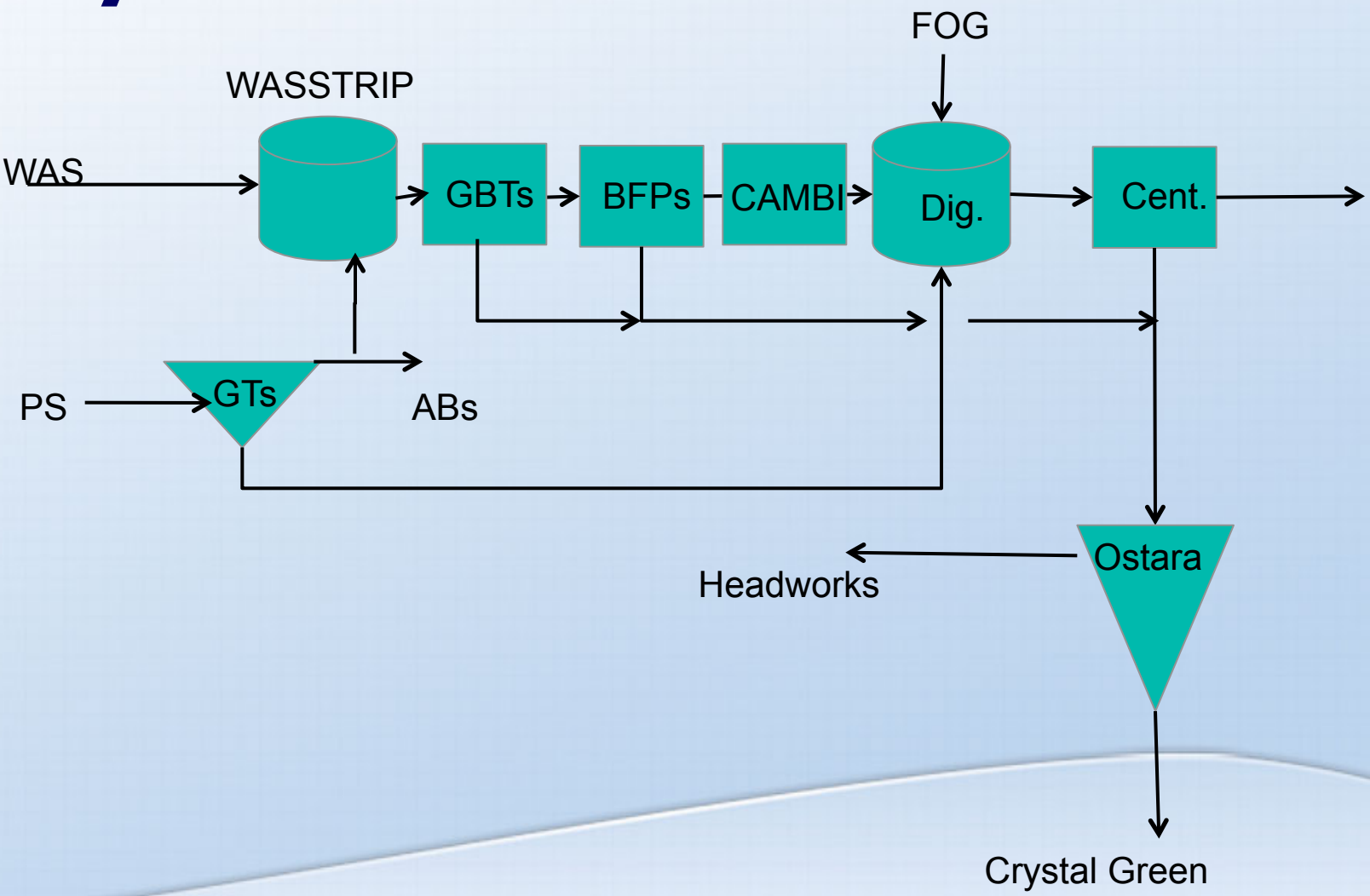




Liquids Operation

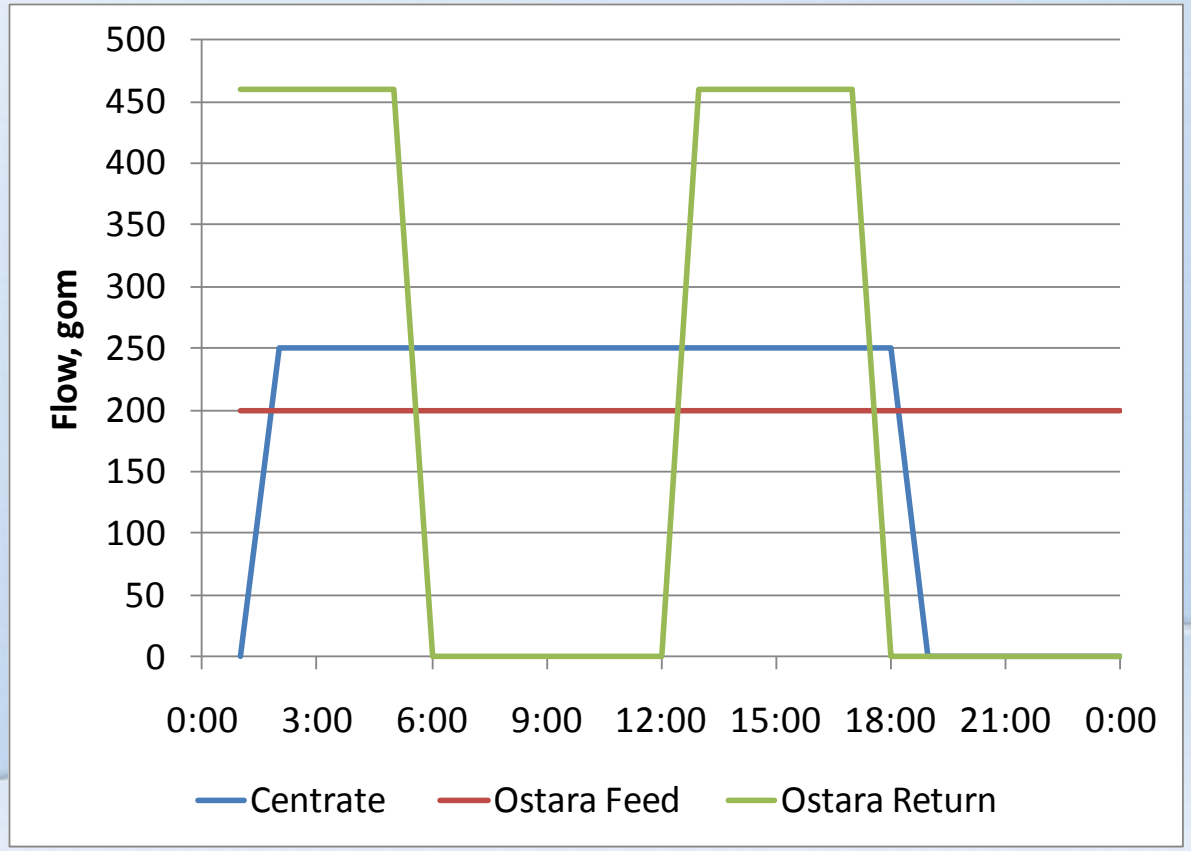


Future Operation – 2015 and beyond



Current Flows

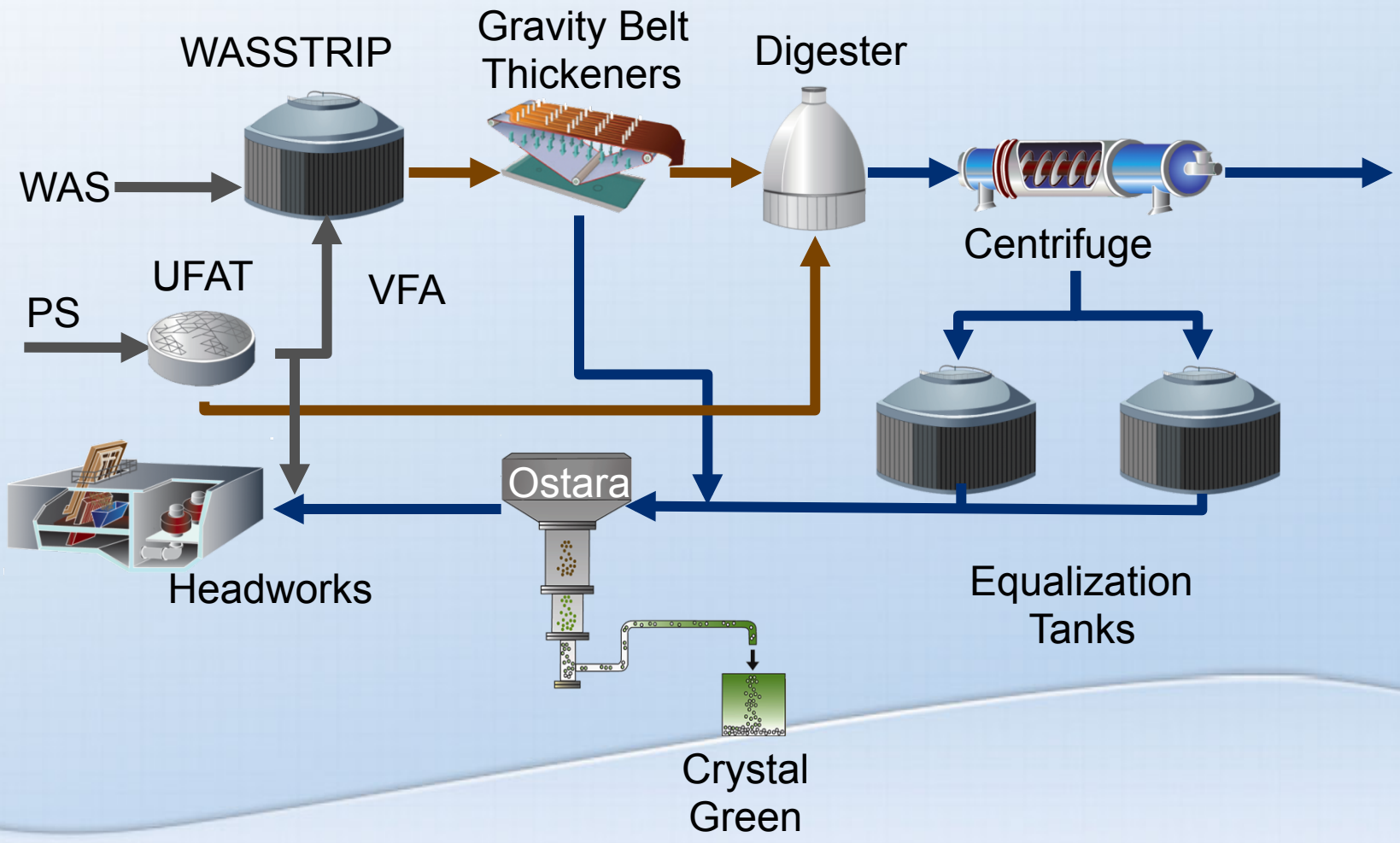
	Centrate	Ostara Feed	Ostara Return
	(gpd)	(gpm)	(gpm)
Average	167,000	115	275
Max Day	278,000	200	460



Minimized Construction Costs Resulted in Fast Payback

- Estimated construction cost = $4.5 million
- Approximate payback 5 years

Future Projects Will Optimize Nutrient Recovery



CAMP Increases Collaboration and Reduces Delivery Time