

Connecting the Dots

good data, good decisions, good results



Connecting the Dots

good data, good decisions, **good** results



Connecting the Dots

- **Goal:** efficiency and effectiveness
 - Best effluent quality at the least operational expense
 - **Largest** margin for error
 - prevent violations
 - **Least** amount of resources
 - staff and money





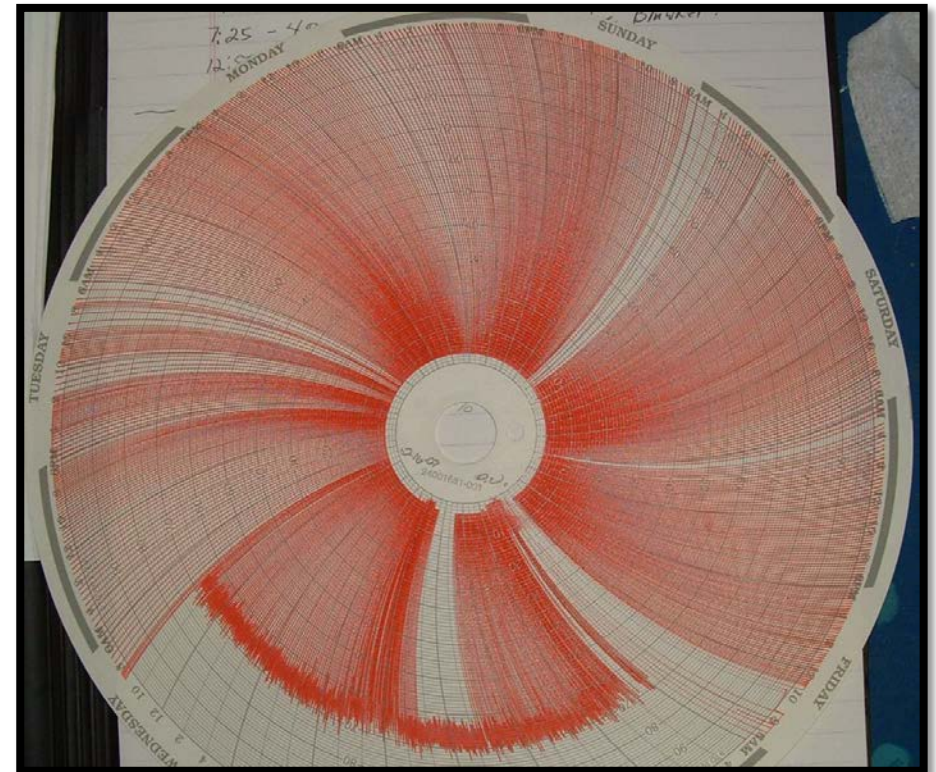
Connecting the Dots

- **Requires:** good data, good decisions, good results
 - Data which is representative of the condition
 - No data, bad data, just guessing
 - Correct analysis of the data
 - Follow the clues, don't solve a fictitious problem
 - A plan which addresses the performance limiting factor
 - Taking an aspirin for a hangover



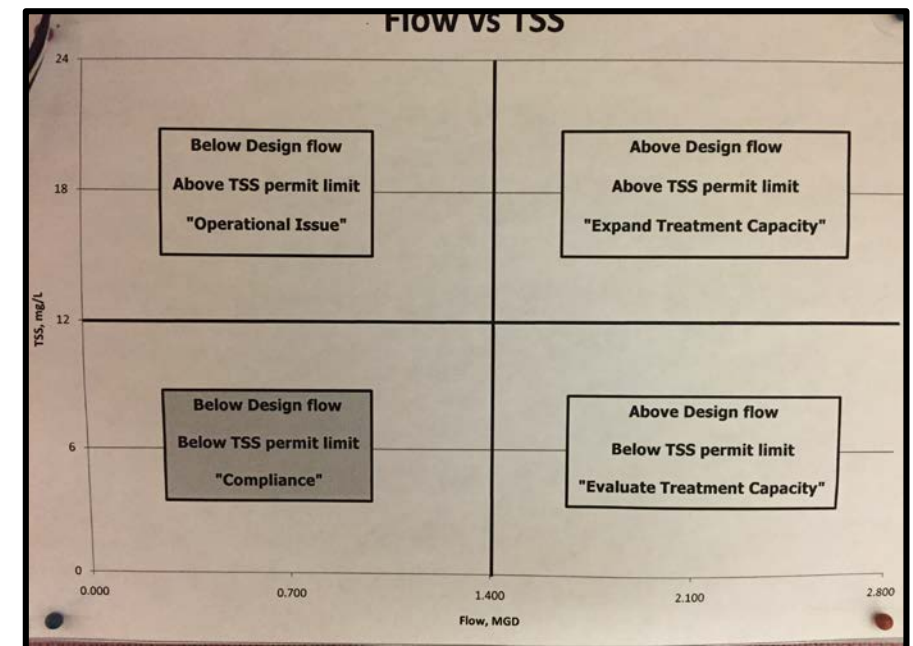
Connecting the Dots

- Good Data: Flow Measurements
 - Tools to Measure:
 - Totalizers, Run Time Meters, Charts
 - Insufficient data to understand the condition.
 - Calibrated?



Connecting the Dots

- Good Data: Flow Measurements
- Design Issue vs Operational Issue



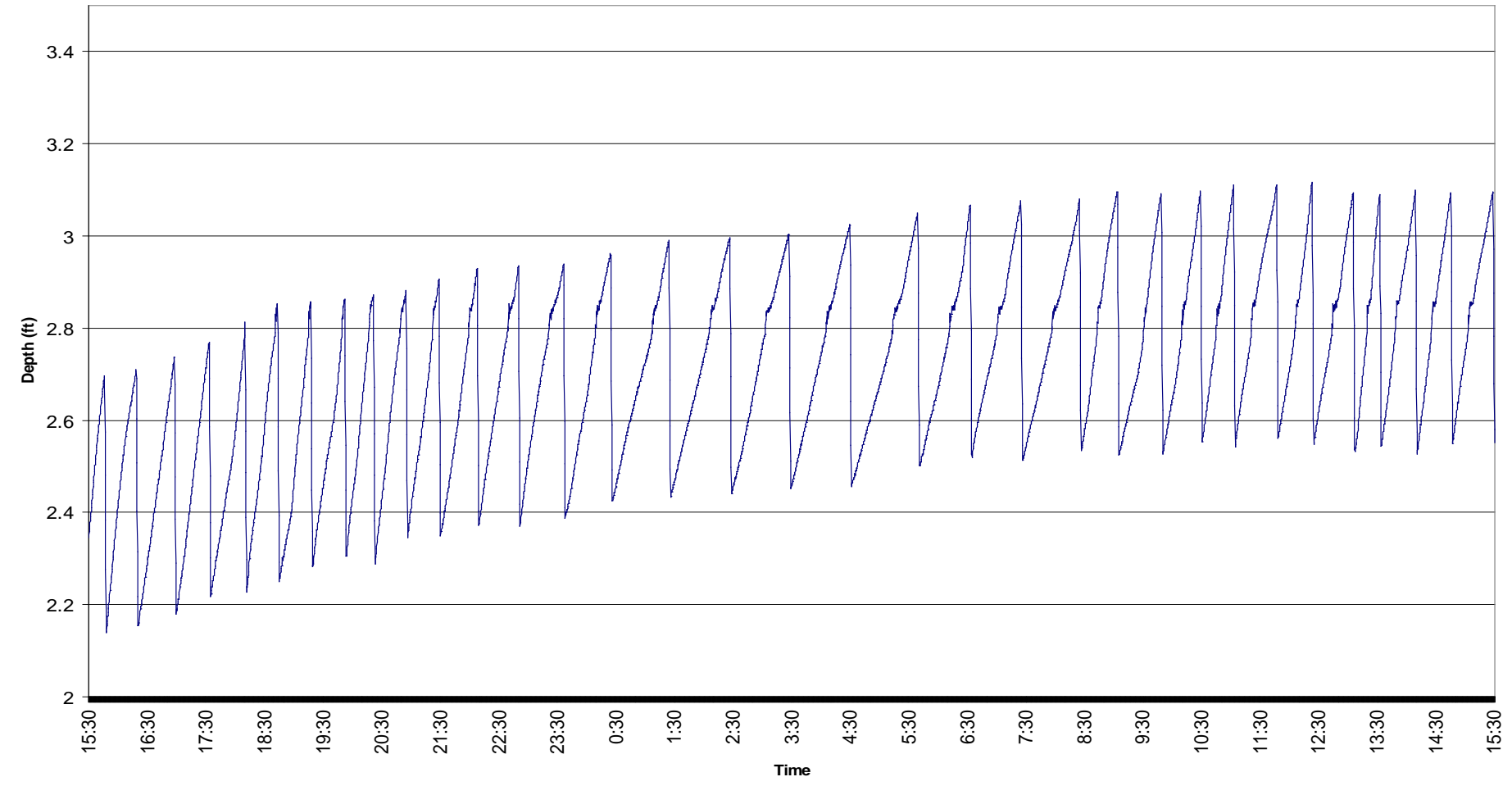
Connecting the Dots

- Internal and Influent Flow Monitoring Study

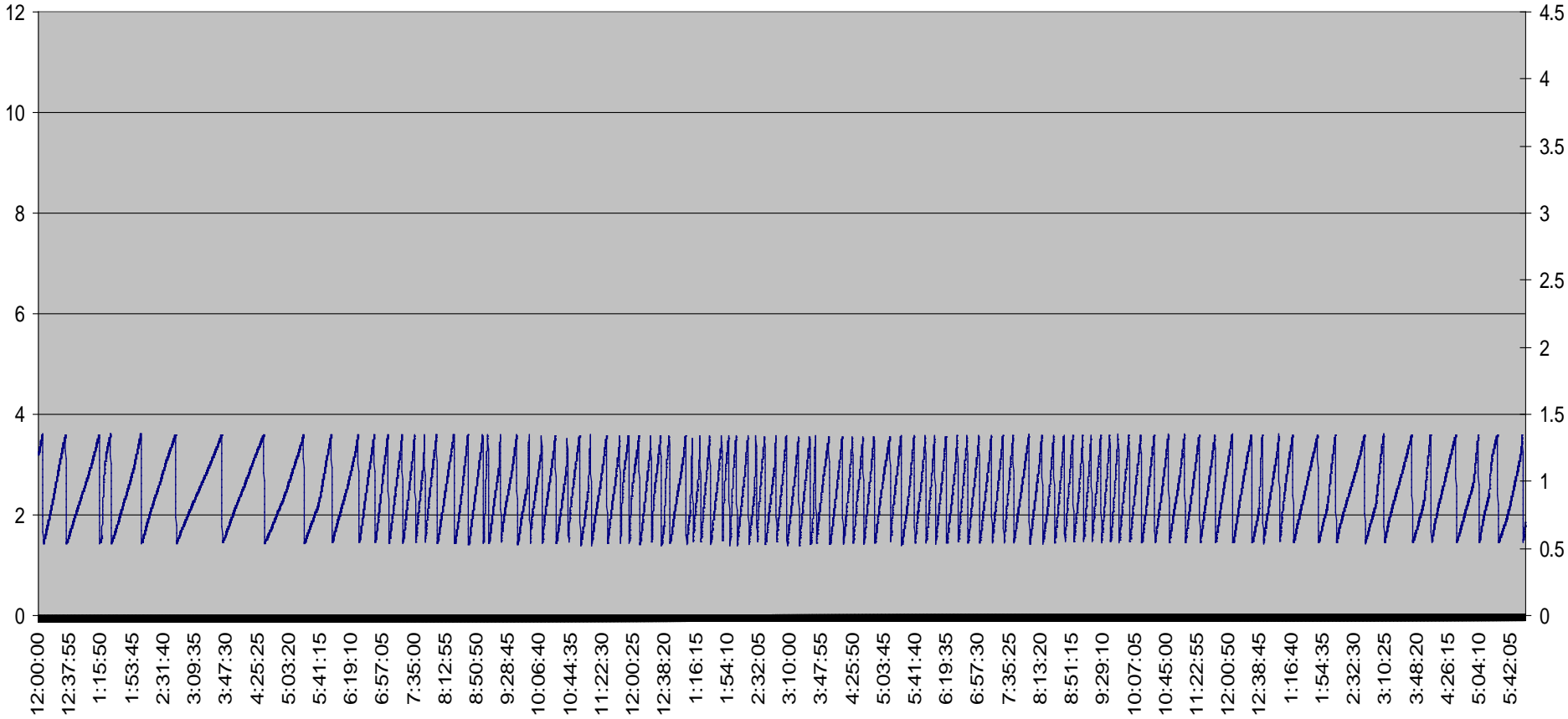




**New Pump Station
Hydraulic Study
March 1, 2005**



Rolling Hills WWTP
Dynamic Hydraulic Profile
August 28-29, 2007



Time

— Influent PS EQ PS Dosing Tank PS





Connecting the Dots

- Good Data: Parameter Measurement

- Sampling Representative
 - Grab

 - Flow Proportion Composite

 - Continuous Grab



Connecting the Dots

- Good Data: Parameter Measurement
- Sampling Representative
 - Grab "snapshot in time"
 - What is happening now.
 - What about in 5 minutes, 5 hours, 5 AM?



Connecting the Dots

- Good Data: Parameter Measurement
- Sampling Representative
 - Grab "snapshot in time"
 - ACCURACY vs TIMELINESS
 - operational staff vs lab staff
 - decision makers vs reporters



Connecting the Dots

- Good Data: Parameter Measurement

- Sampling Representative

- Flow Proportioned Composite

- Flow Proportioned (good)
- Composite (bad)
- What are you missing when combined?

Every 20,000 gals = 100 mls

1 MGD flow rate = 50 samples

CBOD

47 samples 200 mg/L CBOD

3 samples 1,000 mg/L CBOD

50 samples 248 mg/L CBOD

(24% organic load w/in 6% flow)



Connecting the Dots

- Good Data: Parameter Measurement
- Sampling Representative
- Flow Proportioned Composite
- Discrete Sampling
 - 24 individual bottles
 - 24 individual lab analysis. 😞



Connecting the Dots

- Good Data: Parameter Measurement
- Sampling Representative
- Flow Proportioned Composite
- In-Discrete Sampling
 - Hose/strainer condition
 - Sampler location (RAS/Raw, Recycle)



Connecting the Dots

- Good Data: Parameter Measurement
- Sampling Representative
- Continuous Grab
- Most Informative Data
 - Shows current conditions
 - Show trending conditions
 - Labor intensive, not efficient



Connecting the Dots

- Good Data: Parameter Measurement
- Sampling Representative
- Continuous Grab
 - Dataloggers
 - collects discrete samples
 - chemistry done for you
 - data trended for you





Connecting the Dots

- Good Data: Parameter Measurement
- Sampling Representative
- Continuous Grab
 - Dataloggers
 - Not just DO, ORP or pH sensors
 - Now measure for NH_3 , NO_3



Connecting the Dots

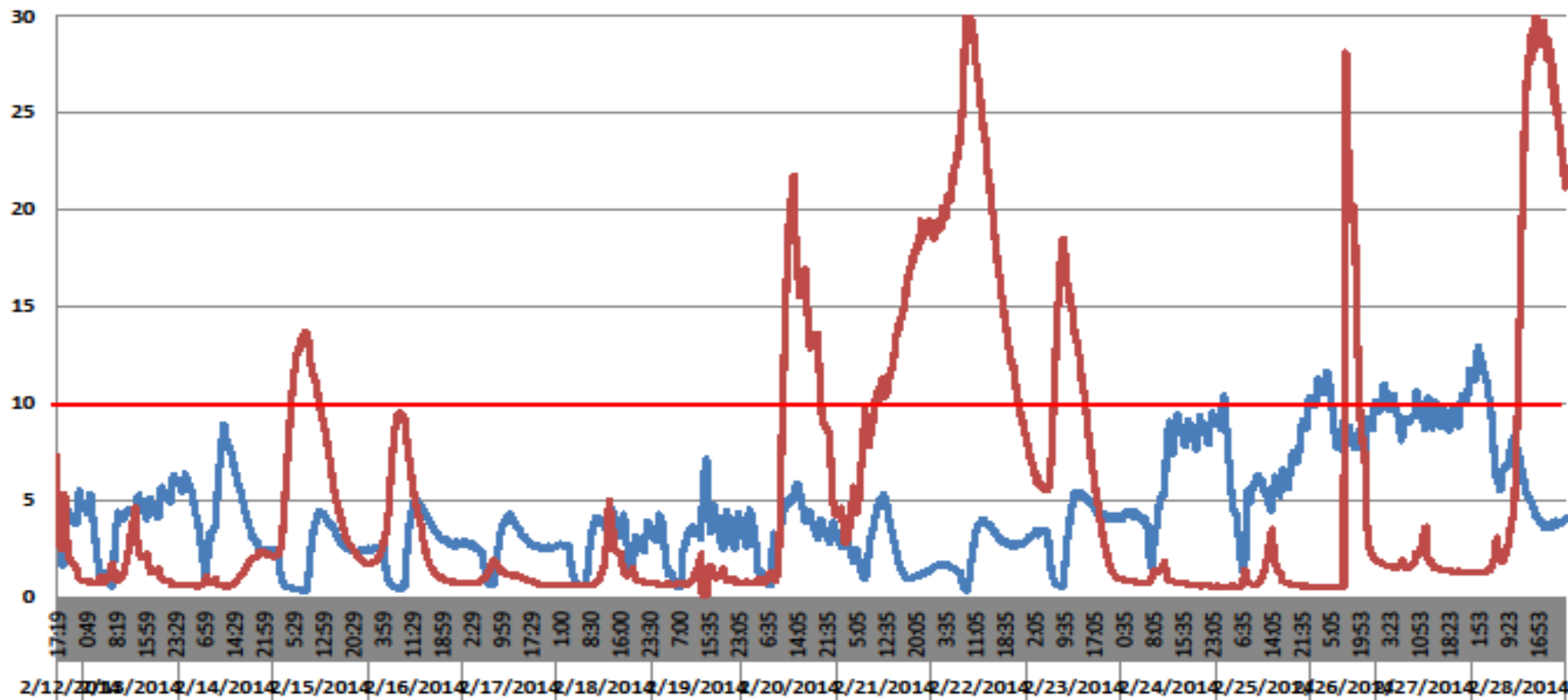
CONTROLLER		18 Sept 2014	15 46	🔒	⚠️	ℹ️
Values: location 010						
01	19 mg/l	K	21.4 °C	AT K		
02	1.1 mg/l	O2	21.4 °C	AT DO		
03	4.9 mg/l	NH4-N	21.4 °C	AT NH3		
04	13.6 mg/l	NO3-N	21.4 °C	AT NO3		
05	6.38	pH	21.3 °C	AT pH		
06	0.2 mg/l	O2	21.3 °C	AX DO		
07	7.8 mg/l	NH4-N	21.3 °C	AX NH3		
08	11.3 mg/l	NO3-N	21.3 °C	AX NO3		
Next sensor ⇄, Display/Options ^{ON}						

<u>Parameter</u>	<u>Anoxic</u>	<u>Aeration</u>
D.O.	0.2 mg/L	1.1 mg/L
NH ₃	7.8 mg/L	4.9 mg/L
NO ₃	11.3 mg/L	13.6 mg/L
pH		6.38 SU
Temp	21.3 C	21.4 C



Average of Concentration

Scioto Reserve WWTP VARiON Data February 2014



Tank	Parameter
—	ANX - NH4-N
—	ANX - NO3-N

Date	Time
------	------



Connecting the Dots

- **Quality Control Checks**
- Split sampling
 - contract lab or neighboring lab
 - lab analysis vs field test kit
- Primary indicators vs. Secondary indicators
 - PO_4 , NO_3 , NH_3 (chemical) vs. DO, ORP, pH (environment)



Connecting the Dots

- **Good Data:**
 - representative of the condition
 - flow data necessary to confirm hydraulic stress
 - parameter measurement to monitor process
 - continuous grab sample provides complete picture
 - quality control checks for accuracy



Connecting the Dots

good data, good decisions, **good** results

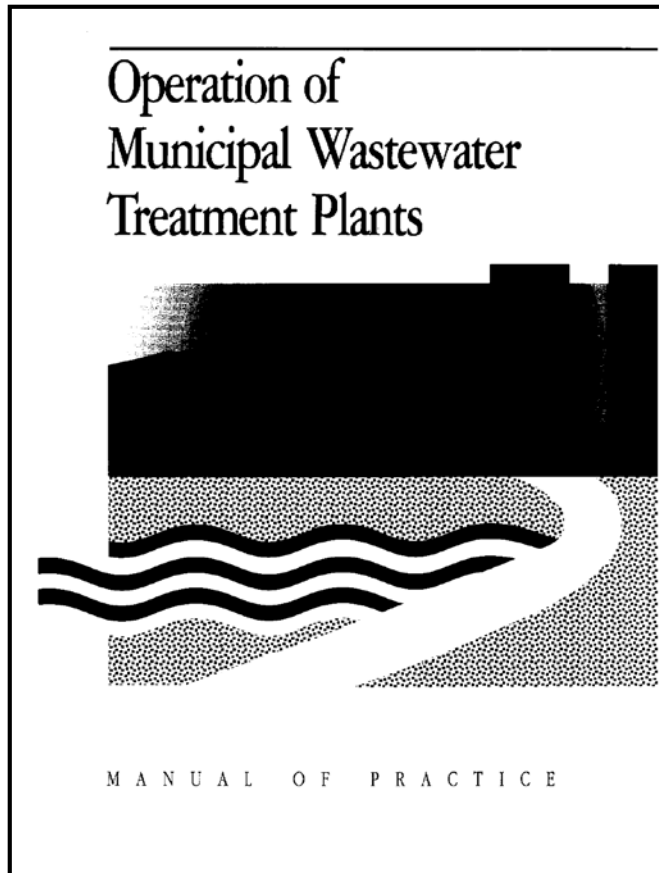


Connecting the Dots

good data, good decisions, good results



Connecting the Dots



WAS CONTROL METHODS.

The most important technique used to control the activated sludge process is controlling the solids inventory in the system with the wasting rate.

The wasting of sludge affects the process more than any other control adjustment.

WAS CONTROL METHODS.

The four most common methods of controlling the amount of sludge wasted are:

Constant F:M ratio

Constant SRT or MCRT

Constant MLSS

Sludge Quality



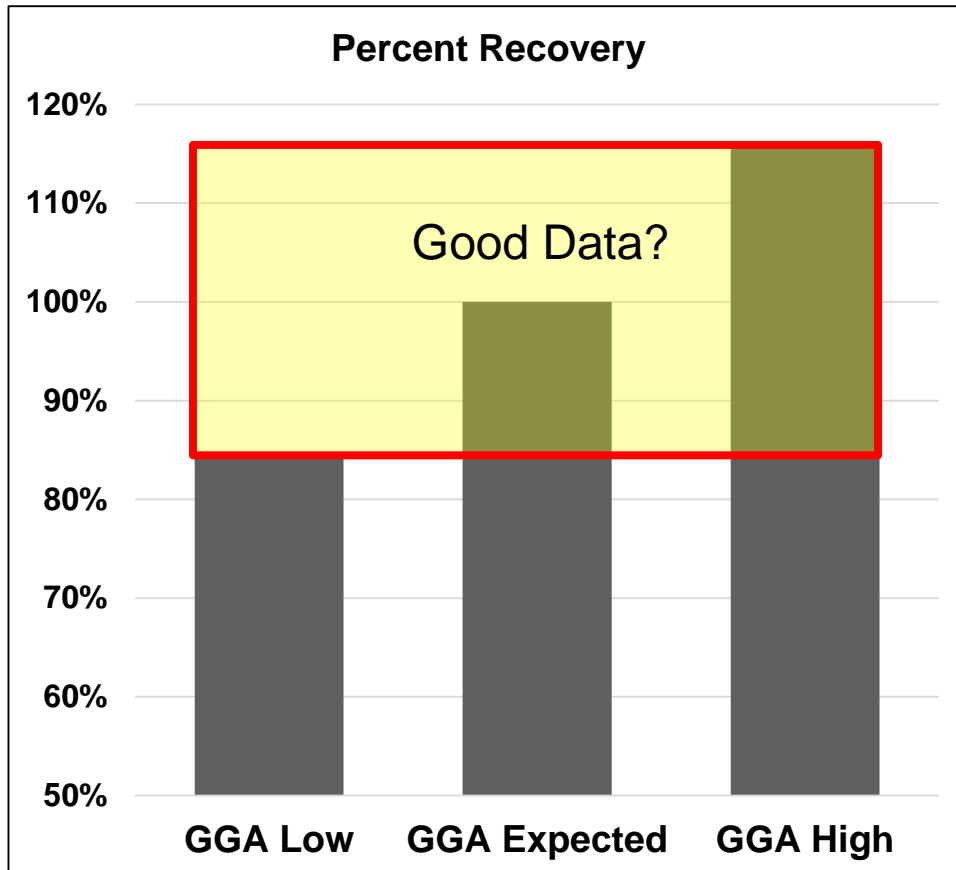


Connecting the Dots

- Good Decision:
 - Goal is effective and efficient operations
- Which method is best for monitoring the process?
 - MLSS, MLVSS, MCRT, F/M, Sludge Quality
 - Which is most effective?
 - Which is most efficient?
 - Which method do you use?



Connecting the Dots



F/M control

CBOD₅ determines "F" or food

GGA standard 198 mg/l (+/- 30.5)

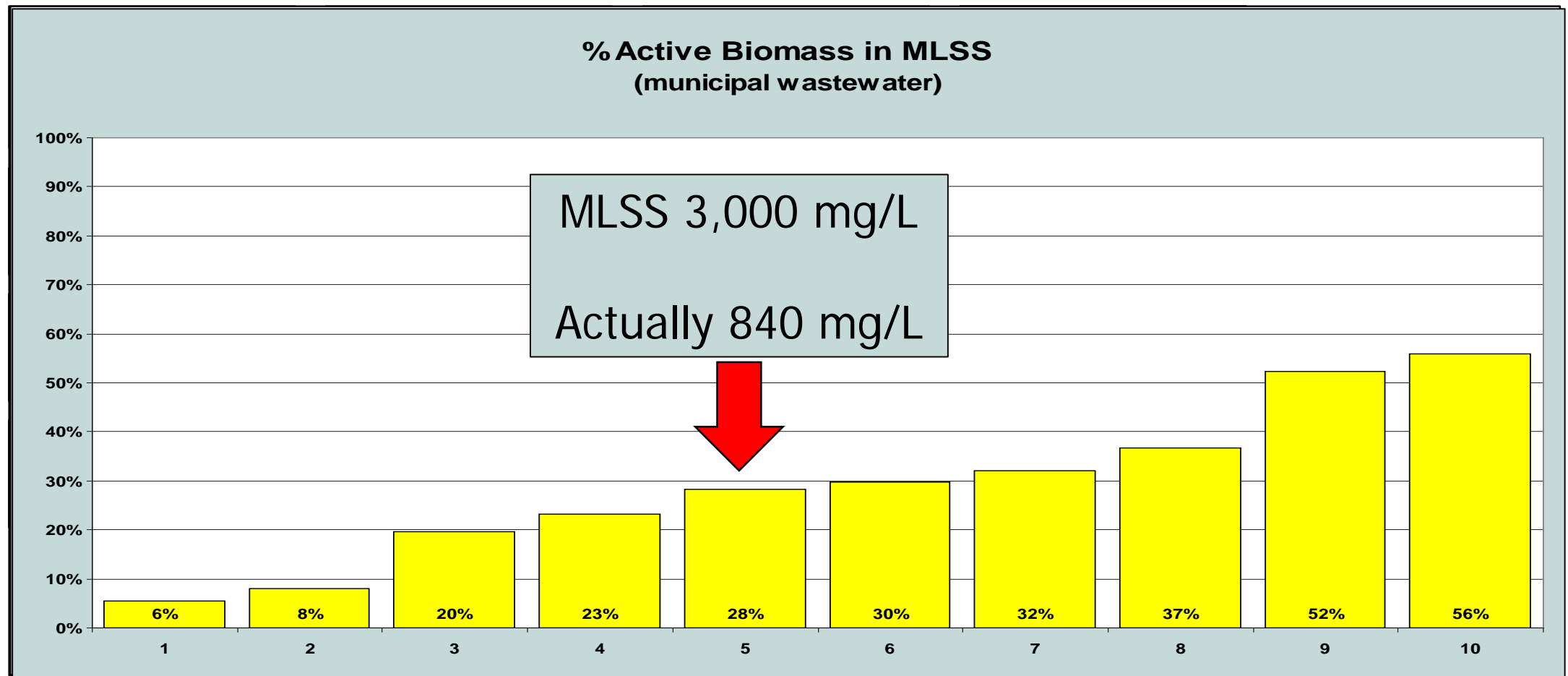
"Standard" 168 mg/L to 229 mg/L

"Standard" recovery is 85 -115%

Five days ago...what about now?



Connecting the Dots



Connecting the Dots

Convert and Separate (CAU)

Goal #1

Convert waste to bacteria

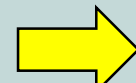
clarifier effluent < 1 mg/L NH₃-N

Goal #2

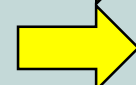
Separate bacteria from water

aeration effluent < 80% in 5 mins

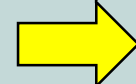
Sludge Quality (MOP 11)



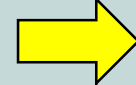
Mixed Liquor D.O.



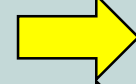
Oxygen Uptake Rates (OUR)



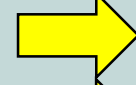
Microscopic Examination (mlss)



Aeration Tank Concentrations (ATC)



Clarifier Solids Concentrations (CSC)



RAS Concentrations (RSC)



30 minute settability (SVI)



Ratio of mlss/ATC (WCR)

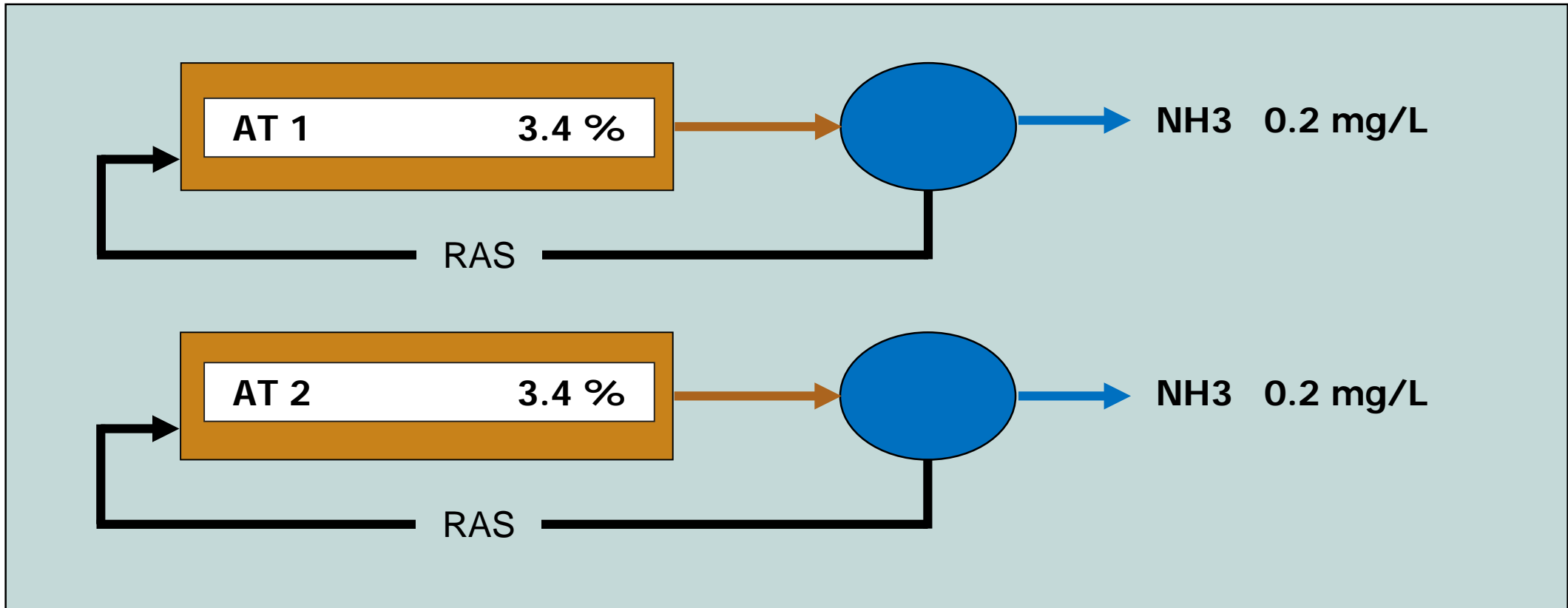


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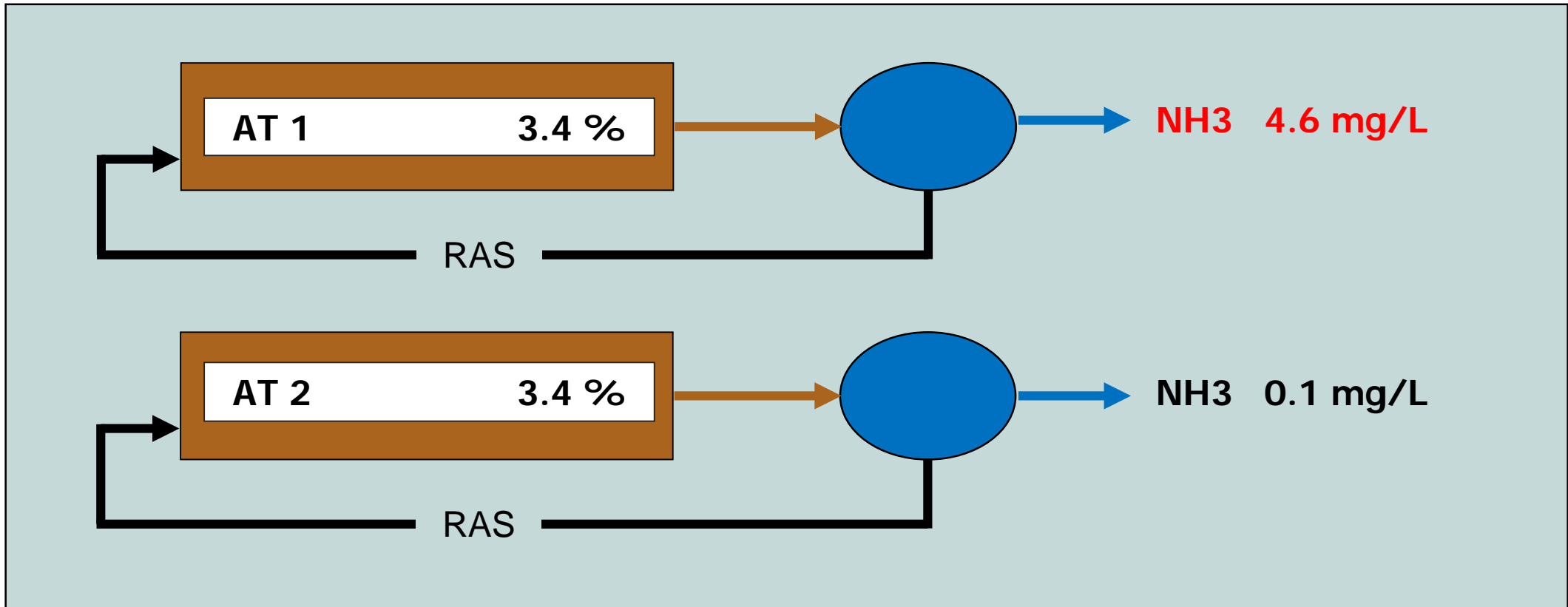
- Good Decision: Correct Analysis
- Goal is effective and efficient operations
- Which method is best for monitoring the process?
- What else can it do?



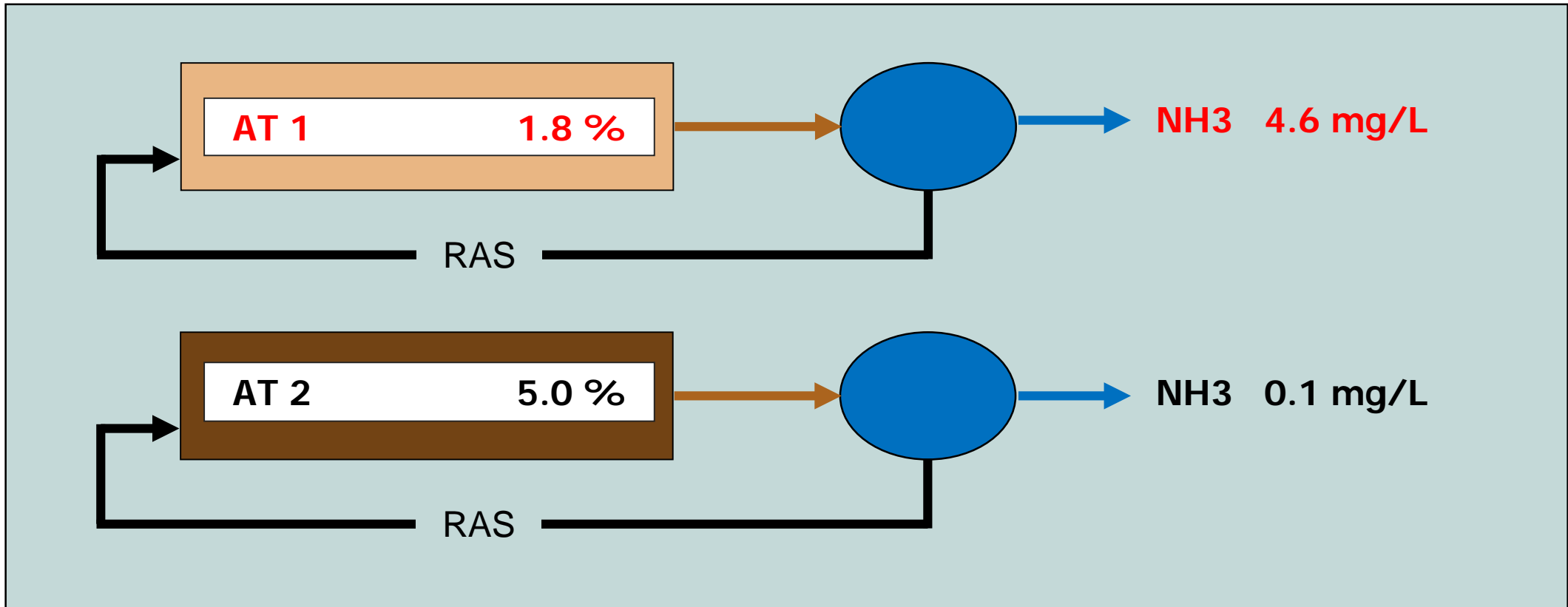
Connecting the Dots



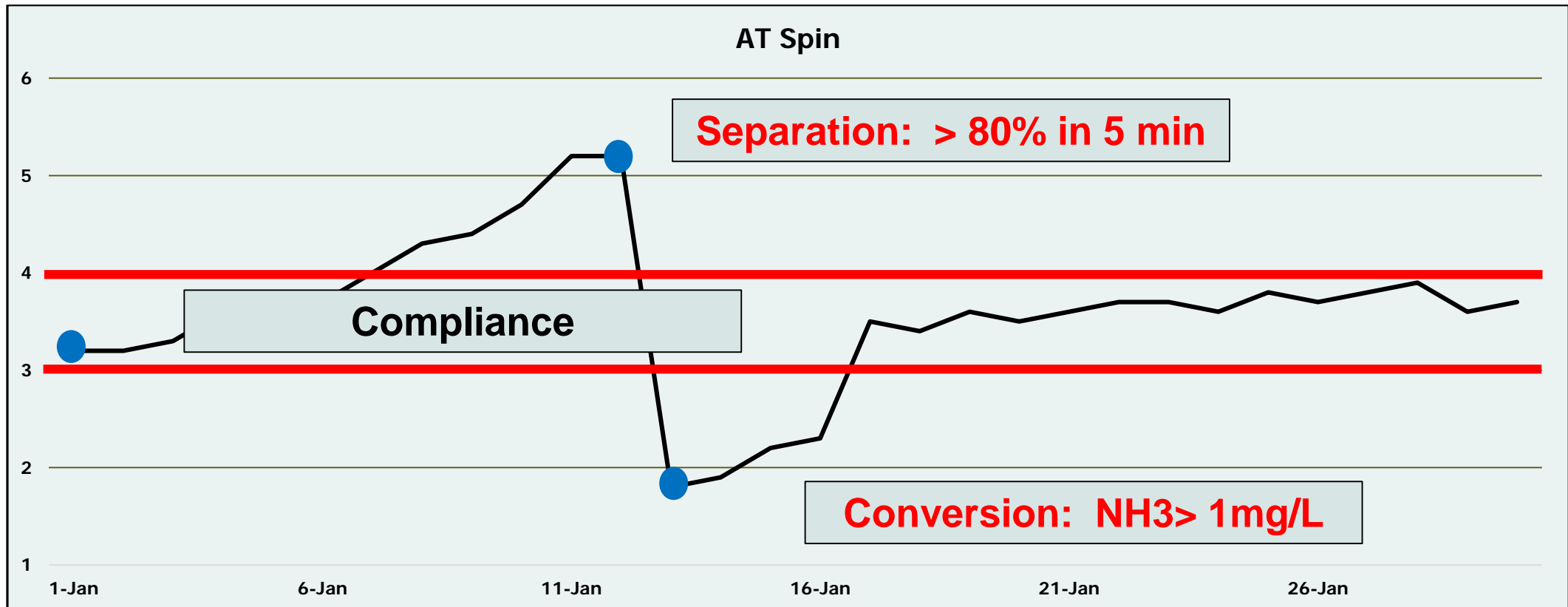
Connecting the Dots



Connecting the Dots



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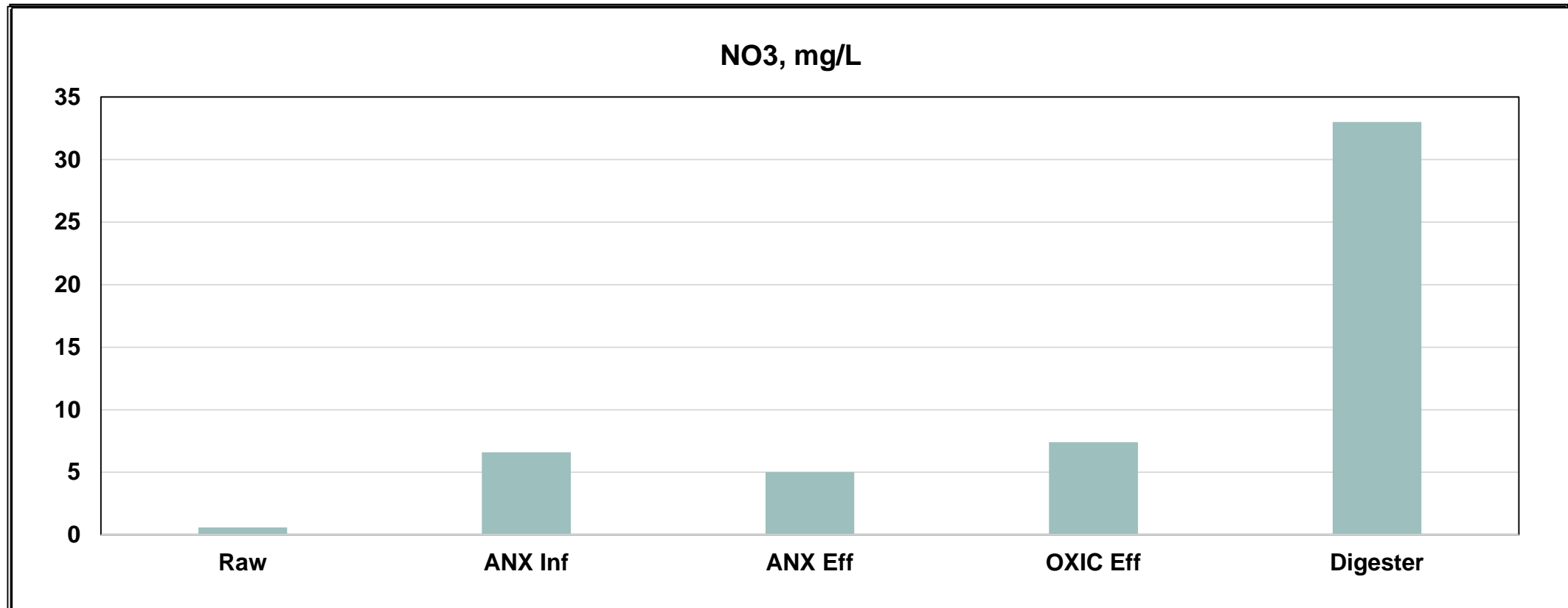
Reduce energy costs

Reduce equipment wear

Prevent low f/m filament growth/foaming



Connecting the Dots



Connecting the Dots

Good Decisions

Don't confuse THE cause for A symptom

Multiple lines of evidence supporting cause

Primary Indicators and Secondary Indicators

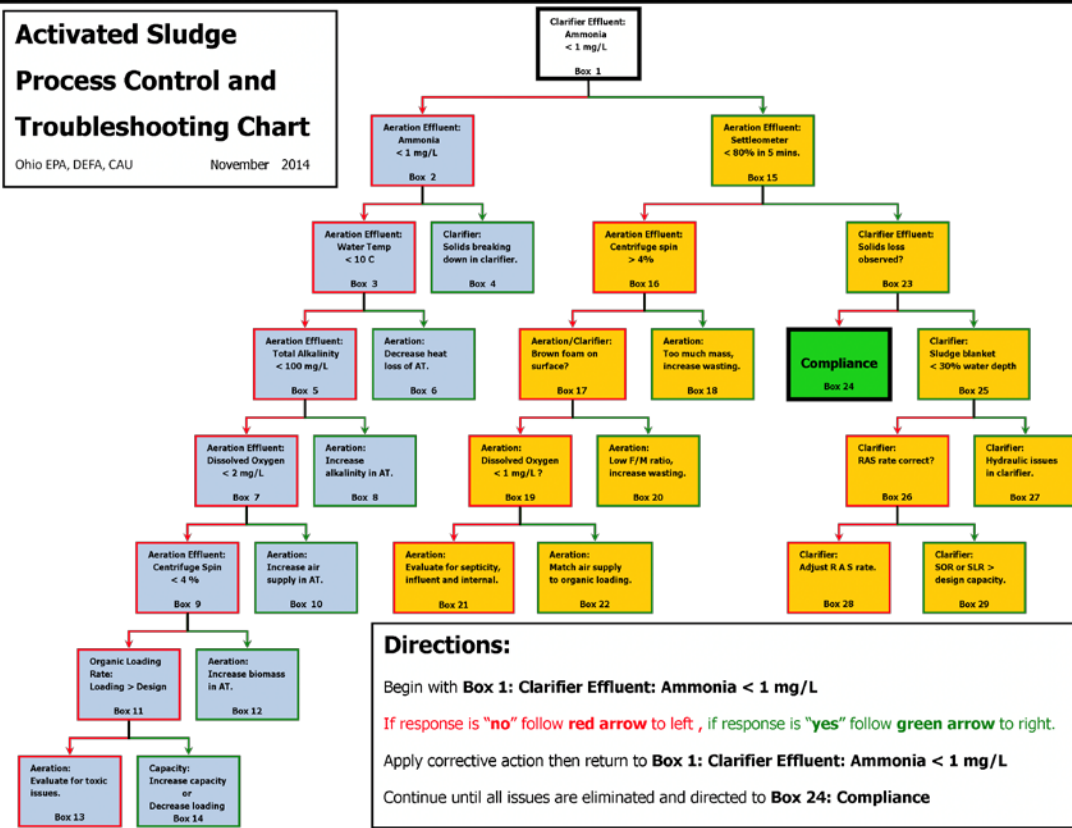
Interconnected, work backwards from the data



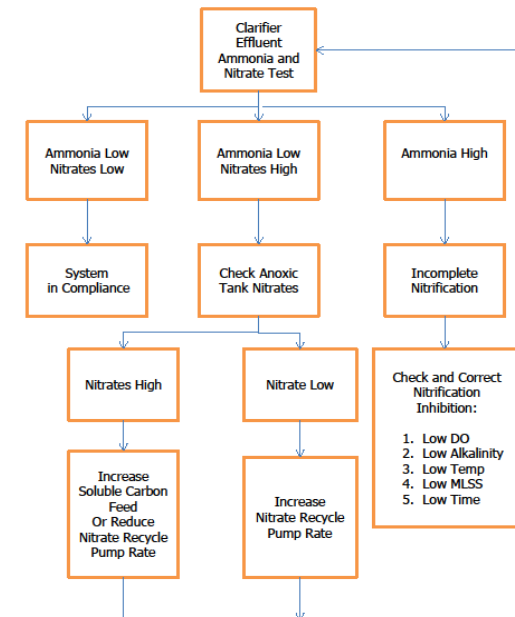
Connecting the Dots

Activated Sludge Process Control and Troubleshooting Chart

Ohio EPA, DEFA, CAU November 2014



Process Control Flow Chart for Denitrification in Anoxic Tank



Connecting the Dots

Issue:

It is not an EPA approved method.



Reality:

There is no EPA approved method for process control, it is your decision.



Connecting the Dots

Issues:

It's not reliable



Reality:

MLSS and cBOD are better?

30 years, primary process control tool

Rapidly identifies area



Connecting the Dots

Issues:

Nobody else uses it.



Reality:

At one time the world was considered flat.

What is surprising is why isn't everyone using this method?



Connecting the Dots

Issues:

It's too complicated,
ATC, CSC, RSC . . .



Reality:

Which is greater three
or six?



Connecting the Dots

Issues:

My system is too big and complex for this simple tool.



Reality:

Is your wrench too simple for car repair?

More tanks, BNR system, more valuable.



Connecting the Dots

Issues:

It's not accurate enough for process control.



Reality:

It's not physics, it's wastewater.

Trending is more valuable.



Connecting the Dots

Issue:

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Reality:

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Connecting the Dots

Issue:

It is not an EPA approved method.



Reality:

There is no EPA approved method for process control, it is your decision.



Connecting the Dots

Is it effective?

Balance solids inventory.

Determine wasting rate.

Determine RAS rate.



Is it efficient?

Results in 15 minutes.

Samples for chemical analysis.

Profile system quickly.



questions

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<https://epa.ohio.gov/defa/CAU>