From Rags to Resources: The Movement Towards Resource Recovery at MWRD Chicago

Thomas E. Kunetz, P.E., WEF Fellow
Assistant Director of Monitoring and Research
Metropolitan Water Reclamation District of Greater Chicago

Recovering Resources, Transforming Water
Lesson Learned 1:

“A man’s utility’s got to know its limitations.”

Dirty Harry
• Resource Recovery Bill signed into law in July 2014

• Grants the MWRDGC the authority to:
  ▪ Capture and sell recovered resources and
  ▪ Produce renewable energy resources.
Lesson Learned 2:

“Think of yourself as product manufacturer, not a waste manager.”

Ron Alexander, North Carolina
Biosolids Processing

Centrifuge Cake transport by Rail to Lagoons

Aging Lagoons

Drying cells

Photos: MWRDGC
Class A Biosolids

Commercial Fertilizer | MWRD Biosolids

Corn Roots

Commercial Fertilizer | MWRD Biosolids

Grass
Metropolitan Biosolids Partners Biosolids Pelletizing Facility, Stickney Water Reclamation Plant
EQ Compost

Woodchips and biosolids

Windrow composting

Bag filling operation
Lesson Learned 3:

“Many folks say if it ain’t broke, don’t fix it. Engineers believe that if it ain’t broke, it doesn’t have enough features yet.”

Scott Adams
Using digester gas to produce steam and hot water:
• Offsets 900,000 mmBTU of natural gas
• Equivalent to about 9,000 homes
• Saves $4 million/yr
• Offsets 47,000 MT CO$_2$e/yr
Lesson Learned 4:

“We may be able to substitute nuclear power for coal, and plastics for wood, and yeast for meat, and friendliness for isolation - but for phosphorus there is neither substitute nor replacement.”

Isaac Asimov
N-P-K
5-28-0 + 10% Mg
Annual Stats (approx.)

- 1,200 tons product
- 144 tons phosphorus recovered
- $480,000 revenue
- $1,300,000 chemical costs
Lesson Learned 5:

Money talks and used water walks
A Development Project for Beneficial Reuse of Effluent Water at the Calumet Water Reclamation Plant

Exhibit 1 - CWRP Reuse Concept
Reclaimed Water Lessons

- Industries are hesitant to make long-term deals.
- Reclaimed water is a threat to drinking water utilities’ revenue.
- It’s hard to encourage voluntary use of reclaimed water when you are sitting next to 20% of the world’s supply of fresh water.
Lesson Learned 6:

If you want to go fast, go alone.
If you want to go far, go together.

--African Proverb (maybe)
Algae Technology for Nutrient Recovery
Traditional algae raceway ponds

Earthrise Nutritionals LLC, California
*Revolving Algae Biofilm (RAB) Reactor*

1. Algae picks up water and nutrients
2. CO₂ consumed by algae
3. O₂ generated by algae
4. Algae harvested

- Algae dried for use as raw material
- Algae harvested
3 Ft. and 6 Ft. RAB Reactors in 2015

Photo: Tiffany Tate
10 Ft. RAB Reactor—Commercial Scale

O’Brien Algae Research Facility, Skokie, IL
Harvesting algae biomass
Sustainable products from algae biomass

- Fertilizer pellets
- Bioplastics
- Algae-based EVA foam
- Aquaculture feed
Lesson Learned 7:

“This land is your land, This land is my land...”

Woodie Guthrie
Native Prairie Landscaping

- Lower maintenance costs—no weekly mowing.
- No irrigation or fertilizers
- Mitigates surface runoff from entering collection system
- Cultivates a habitat for wildlife and enhances biodiversity
- Sequesters CO₂ and reduces air pollution
Grissom Elementary School, Hegewisch

Before

After
James Wadsworth Elementary School, Woodlawn

Before

After
One Project, Multiple Benefits

• Reduce runoff to sewers
• Reduced local flooding
• Green space for children to play
• Students, parents, and community take ownership of the outcome
• Opportunity for educational activities
• New playground equipment
• Encourage people to be outdoors—healthier citizens of all ages
Lesson Learned 8:

If you don’t measure it, you can’t manage it.
ReNEW W A T E R P R O J E C T

H₂O Water
E Energy
N Nitrogen
P Phosphorus
Bio Biosolids
BASELINE RECOVERY RATES: 2018

- **Water (H₂O)**: 7%
  - 2.2 billion gallons/day

- **Energy (E)**: 41%
  - 350 megawatts/year

- **Nitrogen (N)**: 11%
  - 172,400 dry metric tons/year

- **Phosphorus (P)**: 21%
  - 68,220 dry metric tons/year

- **Biosolids (Bio)**: 51%
  - 3.4 million dry metric tons/year
“There is no such thing as a waste, only a resource out of place.”

--Raj Bhattarai