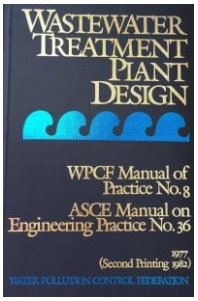
Innovation in Treatment of Food Processing Wastewater

Karen Mancl, PhD
Professor Food, Agricultural & Biological Engineering, OSU

Wastewater Treatment

- Established technologies
- Domestic wastewater



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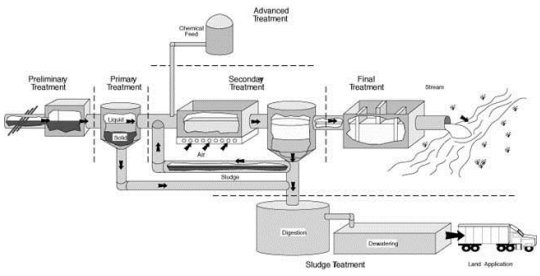
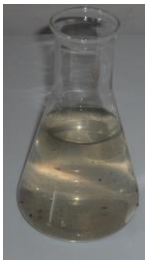


Discharge to City Sewer?

Domestic Sewage



Food Processing Wastewater

Discharge to City Sewer?

Different from sewage

- 5 times stronger
- 100 times more grease

Food Processing Wastewater

Discharge to City Sewer?

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Food Processing Wastewater

Must change the wastewater

- Expensive
- Not very effective

Change treatment technology?

Change the treatment technology

Sand Bioreactor System

- Effective
- Low-cost

Designed to treat food processing wastewater

Whitewater Processing

- Kopp Family Business
  - 4th generation
  - 110 employees
  - 7000 turkeys per day

Whitewater Processing

- Kopp Family Business
  - 4th generation
  - 110 employees
  - 7000 turkeys per day
  - Contacted OSU in 2000

Ohio EPA orders – Abandon old ponds

Options

- Connect to city
- City of Harrison – 10,000 people

Differences

Pollutant	Domestic wastewater	Slaughterhouse wastewater
Organic matter (BOD_5)	200	800
Suspended solids	150	600
Ammonia	20	40
Fat, oil & grease	2	200

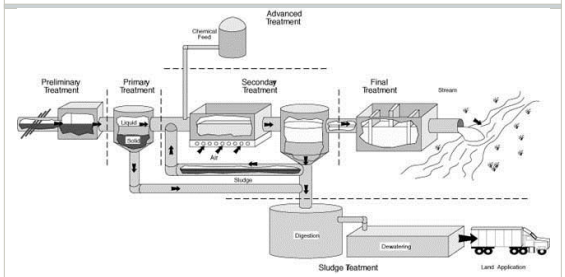
Options

- Connect to city
- City of Harrison – 10,000 people
- 20 year cost $12.5 million

Why so expensive?

- City uses a mechanical, aeration plant
- Wastewater has too much
  - Fat
  - BOD_5

Mechanical Treatment



Why my lab?

- Innovation in wastewater treatment
- Food, Agricultural & Biological Engineering
  - Small flows
  - Agricultural wastewaters

Industry open to new options

Lawsuit	Close
	

Regulators open to new options

Protect environment	Retain Jobs
	

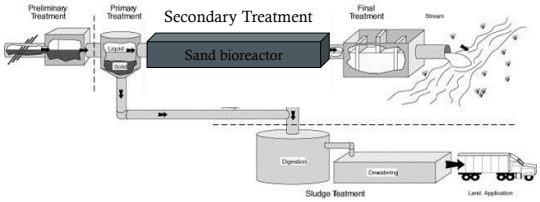
Develop & build full-scale system

Dr. Karen Mancl

Professor Food, Agricultural & Biological Engineering

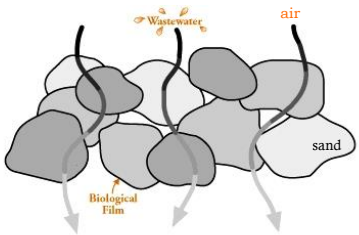
Ryan Kopp

Owner, Turkey Slaughterhouse



Before & After

Microbial Biofilms



Biofilm

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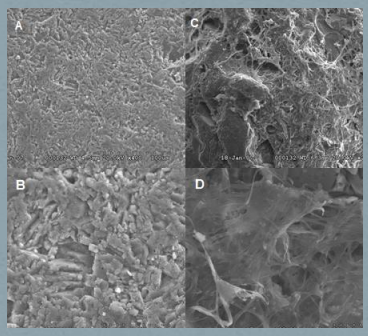

Gaur, Cai, Mancl, and Tuovinen. 2010.

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Sand Treatment

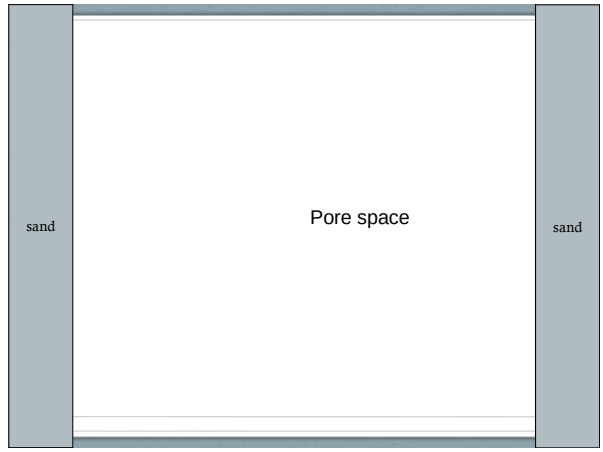
- Microorganisms
  - Organic matter & ammonia is their food

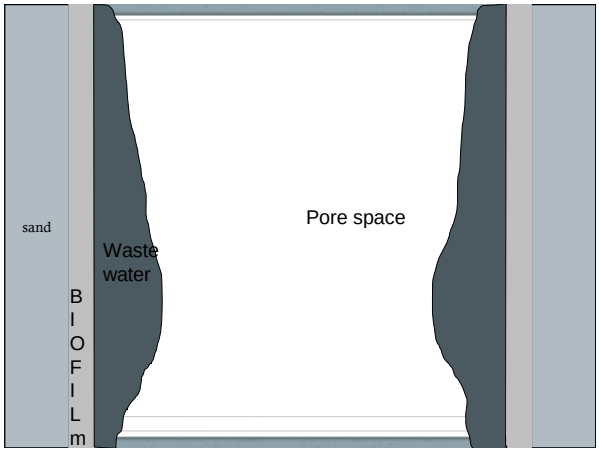
Sand Treatment

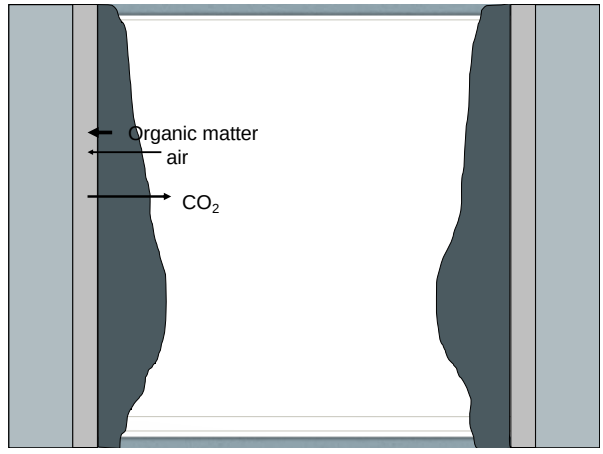
- Create ideal environment for microorganisms

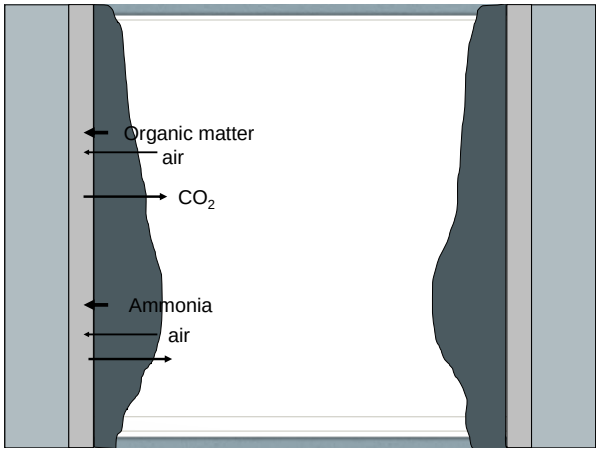
Sand Treatment

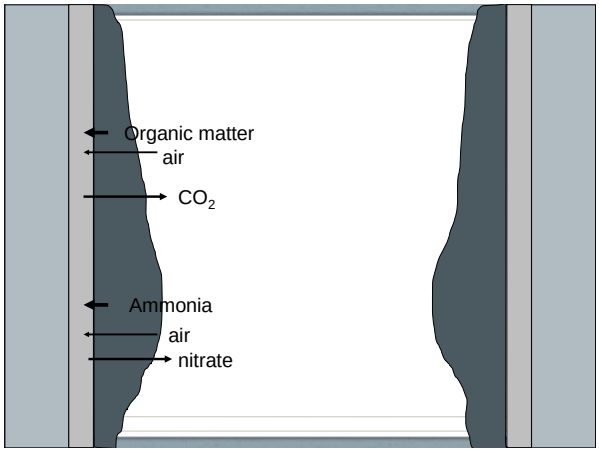
- Create ideal environment for microorganisms
  - Surface to attach to
  - Air
  - Water
  - Food



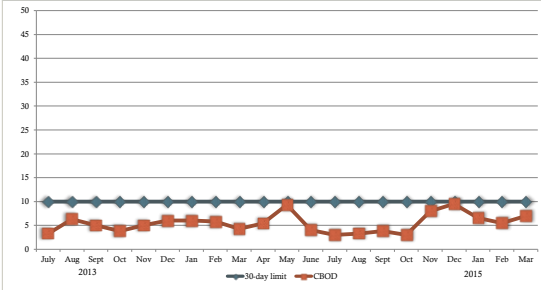




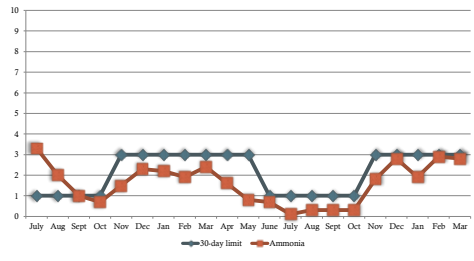




$CBOD_5$



Ammonia



Before & After

Since 2012 – full-scale system meets all regulatory discharge standards

Fat, Oil and Grease Removal

	Influent	Effluent
	FOG	FOG
Sept. 6, 2012	212	Not detected
Oct. 30, 2012	139	Not detected
Nov. 19, 2012	189	Not detected
Dec. 19, 2012	374	Not detected
Jan. 9, 2013	80.8	Not detected
Feb. 13, 2013	168	Not detected
Feb. 27, 2013	273	Not detected
Mar. 27, 2013	42.4	Not detected

Options

- City of Harrison
  - Annex
  - Sewer extension
  - Pretreatment
  - Surcharge

Decentralized
- Sand bioreactor
- Onsite construction
- Discharge permit

Costs

Connect to City

- $12.5 million

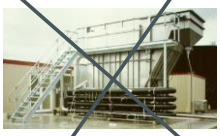
Costs

Connect to City	New System
• $12.5 million	• $2.6 million

Costs

Connect to City	New System
• $10.56/1000 gal • Plus pretreatment	• $3.90/1000 gal • No pretreatment costs

DAF



Why costs so low?

Simple to build	Easy to operate
	• Low electricity • No sludge • 1 full-time operator

Liners with underdrain

Media


Layers of sand, coarse sand & pea gravel


Construction

- Easy
- Local force labor
- Purchased construction equipment
- Local aggregate company

Restaurants

Food processors

Resorts

Conclusions

- Sand Bioreactors
  - Best option for food processing wastewater
  - Local jobs
  - Saved money
  - Protects stream

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