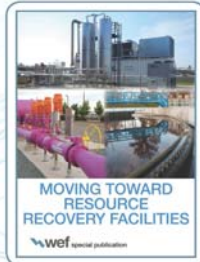


Attendees of the March 2nd The Future of Environmental Sustainability Webcast receive **20% off *Moving Toward Resource Recovery Facilities***.



Order No. P140001
List: ~~\$100.00~~ \$104.00
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Use promo code WEB at checkout

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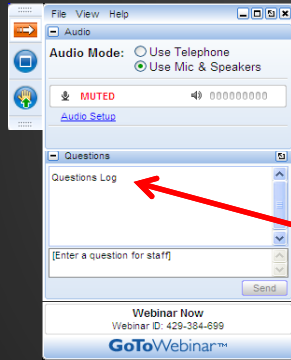


The Future of Environmental Sustainability-Recycling for a Healthier Planet

March 2nd, 2016
1:00 - 3:00 pm Eastern



How to Participate Today



- Audio Modes
 - Listen using Mic & Speakers
 - Or, select "Use Telephone" and dial the conference (please remember long distance phone charges apply).
- Submit your questions using the Questions pane.
- A recording will be available for replay shortly after this webcast.



Today's Speakers

Presenters:

- Chris Peot, DC Water
- Sarah Deslauriers, Carollo Engineers,
- Mike Van Ham, Sylvis Environmental

Moderated by:

- Lynne H. Moss, PE, BCEE, Black & Veatch



Resource Recovery at DC Water



Chris Peot, PE, BCEE
 Director of Resource Recovery
 DC Water



NUTRIENTS and CARBON RECYCLING

FARMING

 Provides carbon and nutrients valued at \$300.00 per acre.

SILVICULTURE

 Increases forest carbon sequestration.

RECLAMATION

 Restores riparian to their natural state and promotes wildlife habitat.

URBAN RESTORATION

 Grow trees and reduce runoff.

water • nutrients • carbon • energy

BLUE PLAINS ADVANCED WASTEWATER TREATMENT PLANT: A RESOURCE RECOVERY FACILITY

GREEN ENERGY BIORENEWABLES

POWER FROM THE PEOPLE

THERMAL HYDROLYSIS PROCESS (THP) AND DIGESTION FACILITY

DC Water will be the first in North America to use thermal hydrolysis for wastewater treatment. When completed, this facility will be the largest plant of its kind in the world.

GREEN BENEFITS:

- Produce combined heat and power, generating 13 MW of electricity.
- Save DC Water \$10 million annually cutting grid demand by a third (DC Water is the largest consumer of electricity in the District).
- Reduce carbon emissions by approximately 30,000 metric tons of CO₂e per year.
- Reduce trucking by 1.7 million miles per year.
- Save \$10 million in biosolids trucking costs.
- Produce Class A biosolids to grow trees, sequester carbon and reduce runoff.

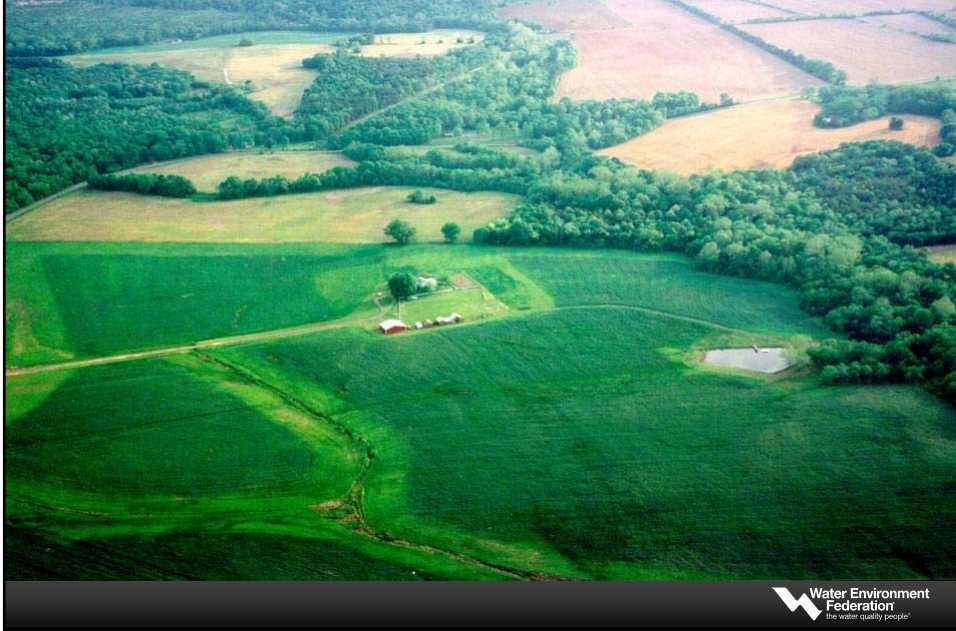
dcwater.com/biosolids

GREEN BENEFITS:

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Agriculture



Water Environment
Federation
the water quality people

Soil Reclamation: Stafford County Airport



Water Environment
Federation
the water quality people



Microbial Production of Auxin in Biosolids

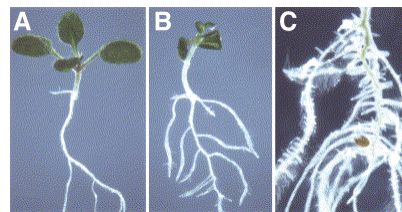
Microbial action

Organic matter → Tryptophan → Auxin



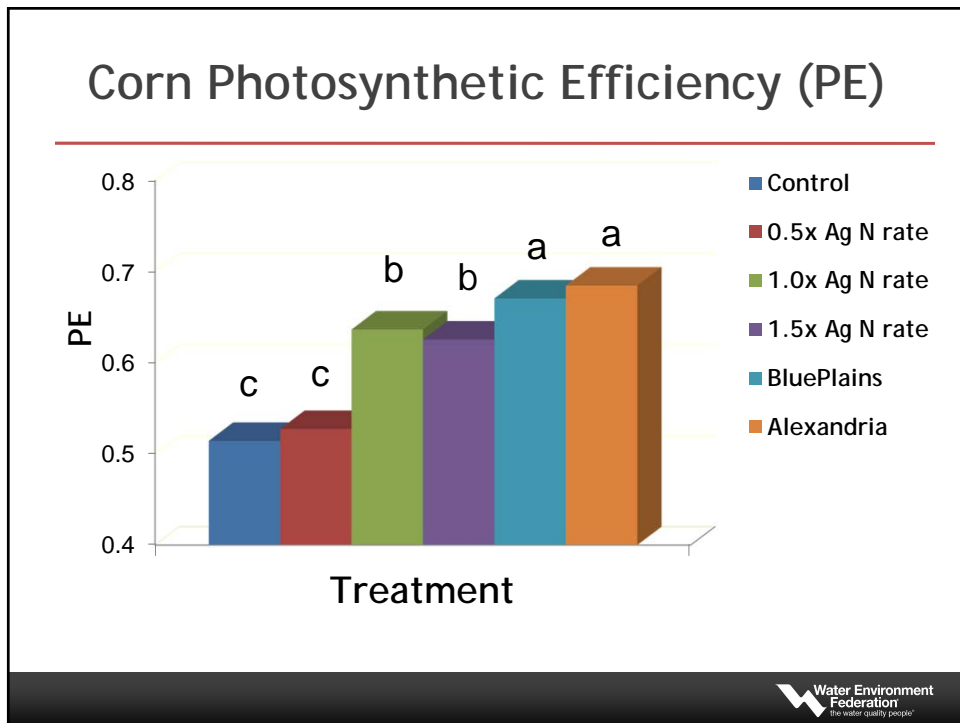
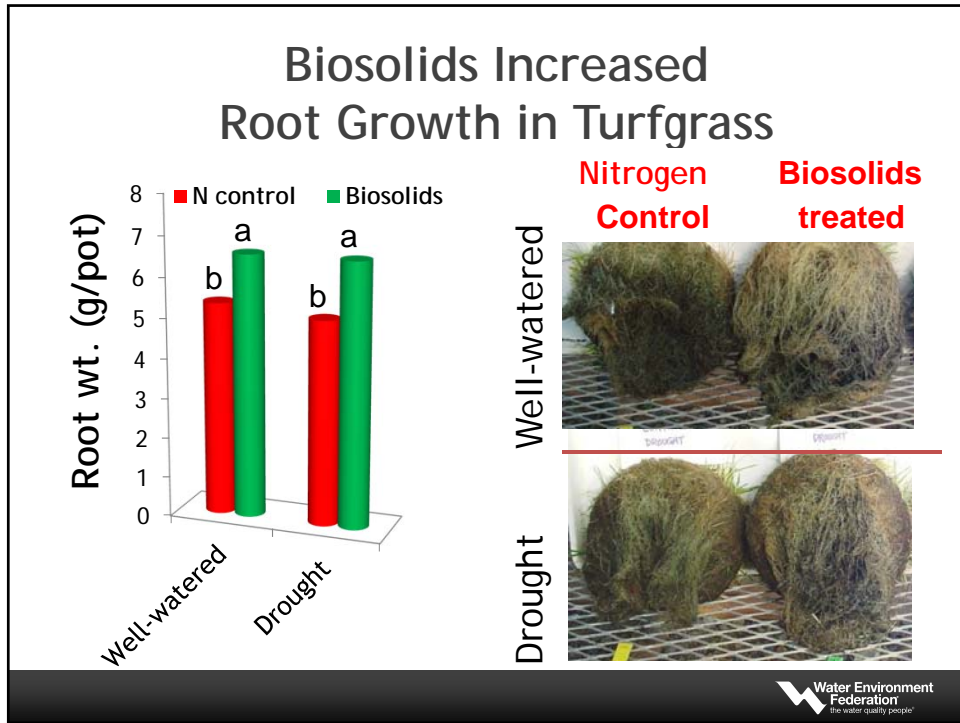
What is Auxin?

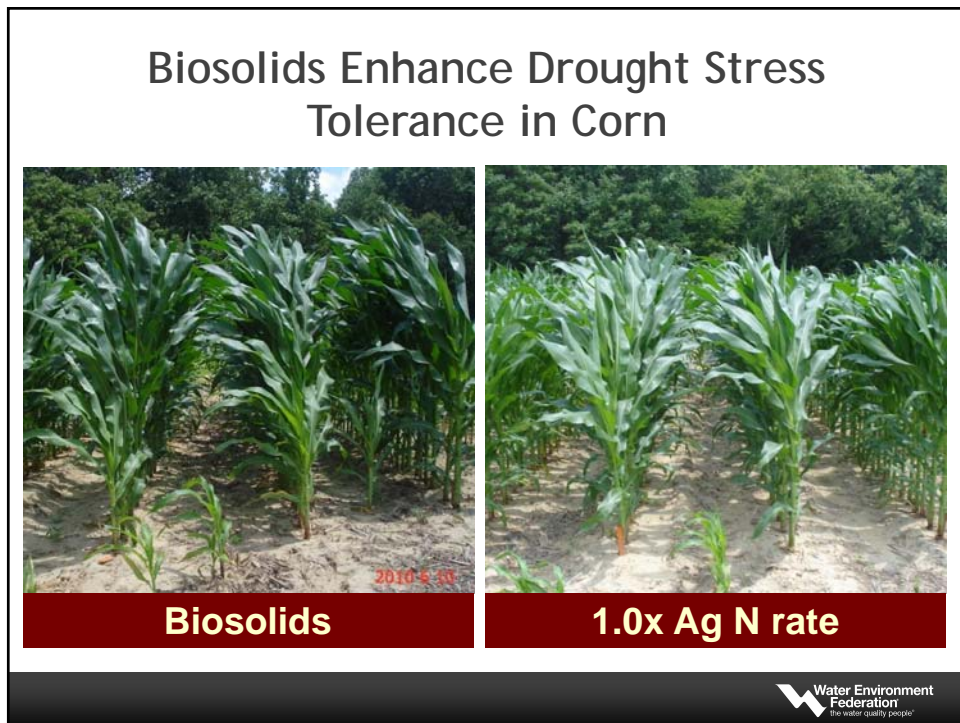
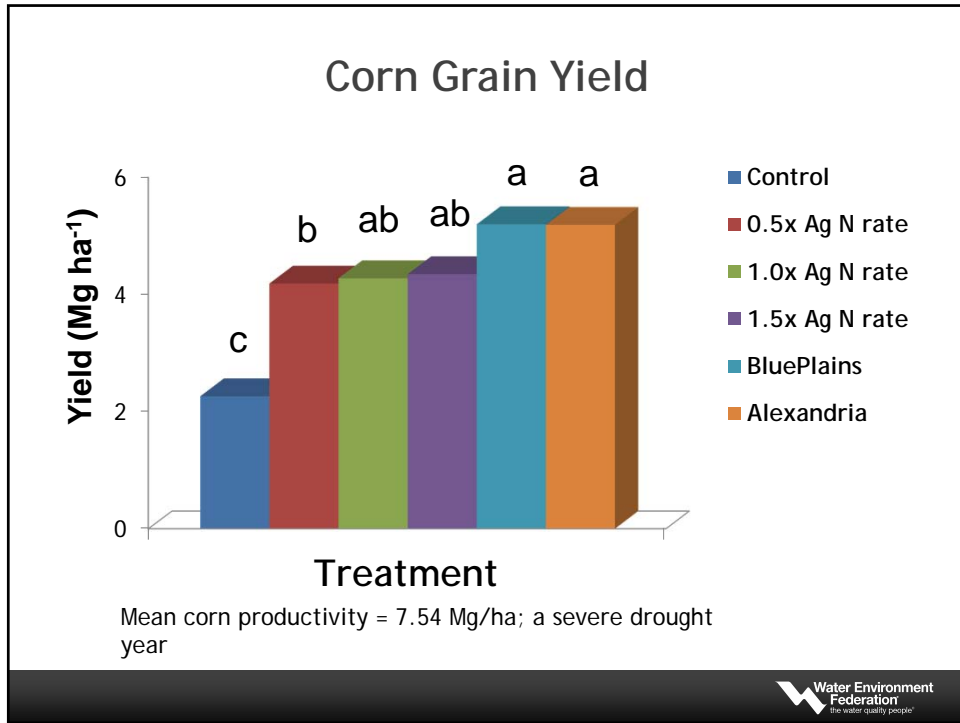
- Auxin (IAA) is a primary plant and bacterial hormone
- Functions of auxin in plants
 - Promotes root growth (could be associated with more root cytokinins)
 - Promotes leaf expansion



A: normal; B: auxin mutant; C: close up of auxin mutant root proliferation

Rogg & Bartel. 2001. Developmental Cell. 1(5):595



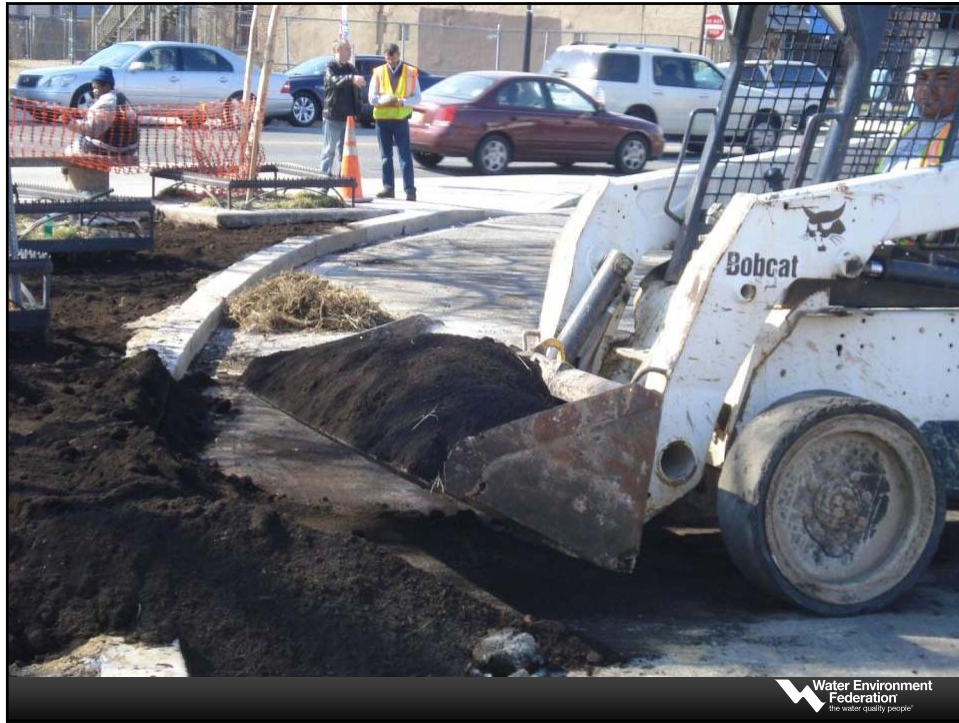


Past Economics of DC Water Biosolids Recycling Program

- Pay a third party ~\$43/wt for full service contract (transport, land app, reporting) of Class B biosolids
- \$19M/yr program cost =21% of the Blue Plains operating budget
- Delivered free to farmers
- Farmers value product at \$300/acre (nutrients, lime, etc.), approximately \$15/wt
- Nutrient rebate back to DC Water (\$2/wt), \$500K/yr designated for research and outreach.
- Value to farmers @ \$15/wt, 1200 wtpd = \$6,570,000/yr
- We do not extract this value

Composted biosolids: material for urban use (Class A)





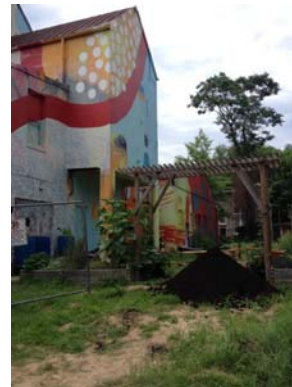
Blue Plains Garden & Compost Giveaway



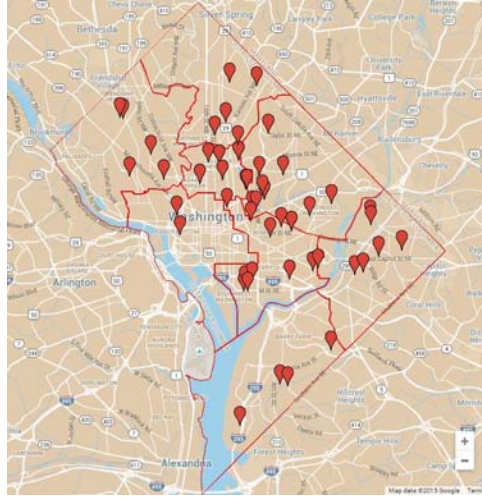
Urban gardening community outreach



Community Gardens



Biosolids Use in DC



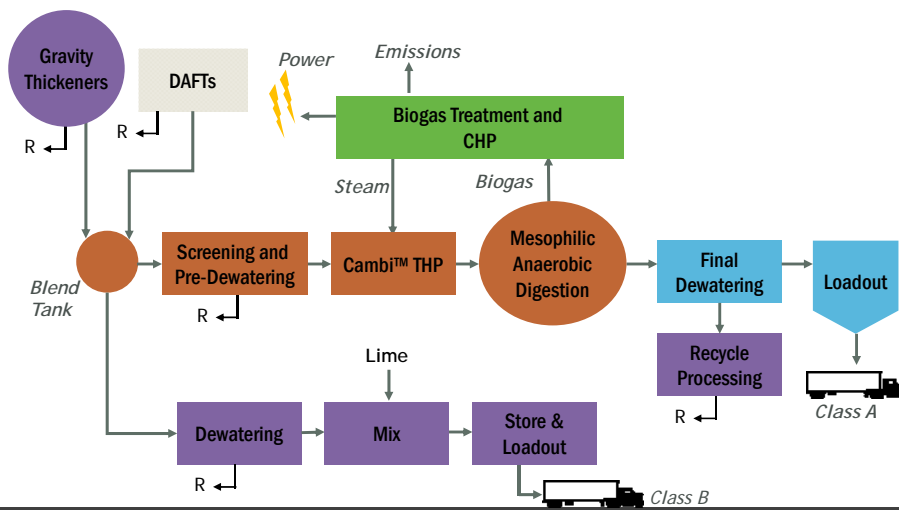
Anaerobic Digestion



Class B vs. Class A Product



Process Schematic of DC Water's New Biosolids Program



Program Benefits

Resource Recovery



Reduce biosolids quantities by more than 50%

Improve product quality (Class A and more)

Generate 10 MW of clean, renewable power

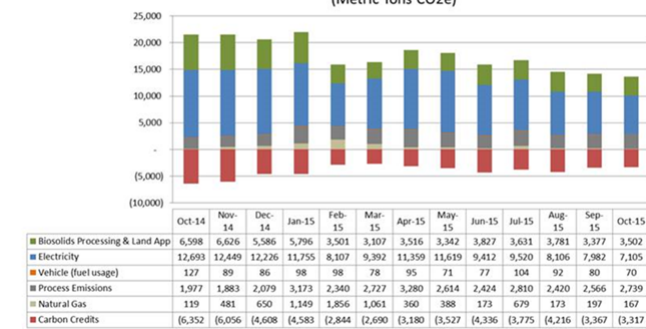
Cut GHG emissions dramatically

Save millions of dollars annually when the facility begins operating in 2014



Carbon footprint before, during, and after digester start-up

DC Water Monthly GHG Emissions Estimates, Oct. 2014-Oct. 2015
(Metric Tons CO₂e)

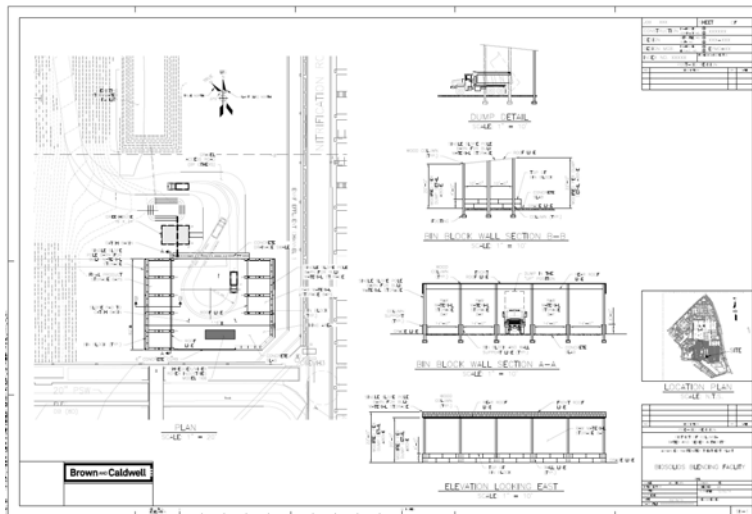


Future Plans for Class A Biosolids

- Continue land application of remaining Class A dewatered biosolids
- Produce a blended soil product (similar to compost)
- Use product in service area for tree planting, restoration, green infrastructure, etc.



Designing a small onsite mixing facility





There is no such thing as
waste, only wasted resources.

www.bloomsoil.com

Chris Peot PE, BCEE
cpeot@dcwater.com



The Value of Biosolids from a Carbon Perspective



- Sarah Deslauriers, P.E.
sdeslauriers@carollo.com
- Chair, WEF Residuals & Biosolids Carbon Resource & Recovery Subcommittee
- Program Manager, California Wastewater Climate Change Group



www.carollo.com



We live in a world of limited resources
and changing environmental conditions...

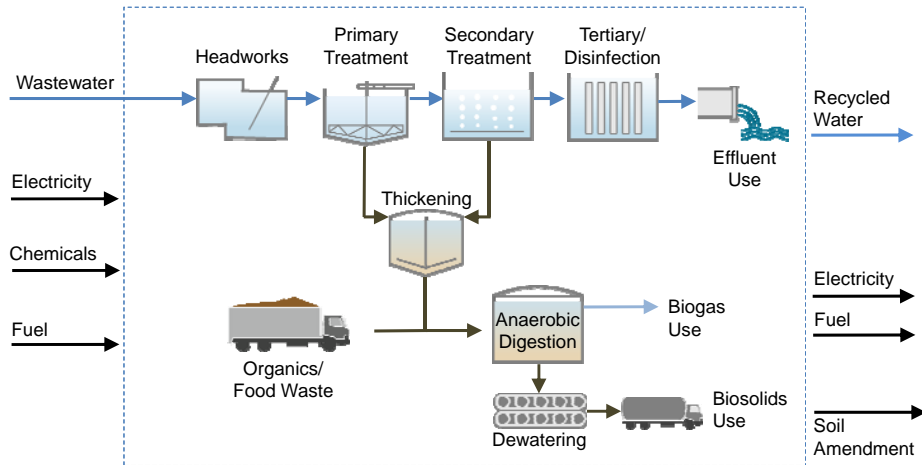


Wastewater treatment plants recover
resources and generate renewable resources

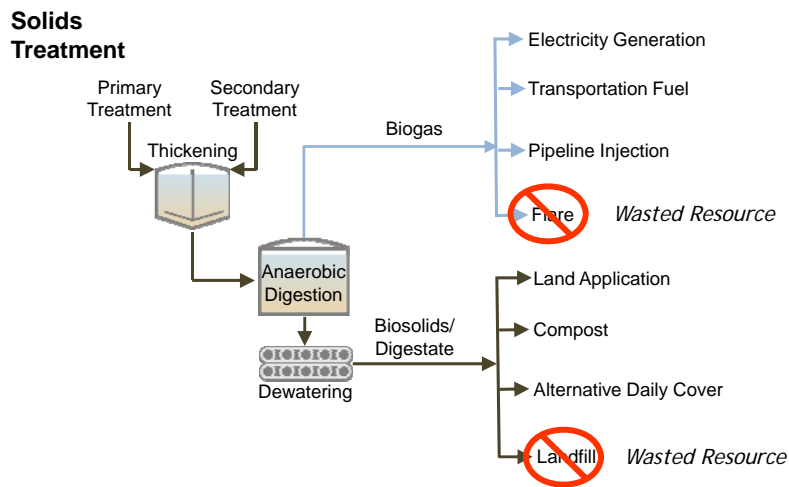
- Renewable biogas replaces fossil fuel based electricity/fuel
- Recovered biosolids replace synthetic fertilizer
- Recycled water replaces potable water use



To account for the carbon value of solids, the system boundary is critical...

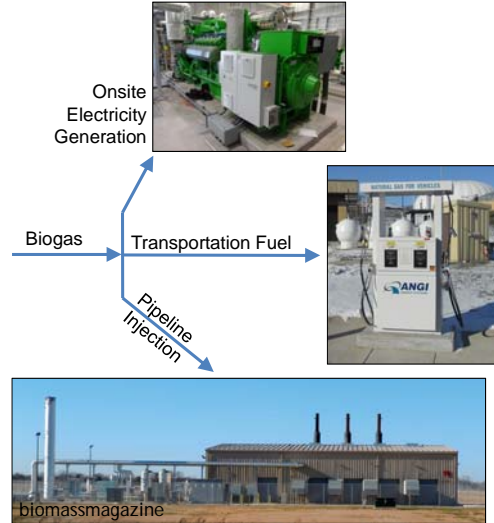


Effective use of each product depends on the plant's operations & community's needs



Biogas is a renewable byproduct that provides multiple uses and benefits

- Offsets purchase of fossil fuel based electricity and transportation fuel
- Reliable, renewable energy/fuel source
- Biogenic source of greenhouse gas (GHG) emissions (i.e., reduces fossil based GHGs)



Land application of biosolids provides multiple benefits as well...

- Offsets inorganic fertilizer production/use
- Increases soil carbon content and stability
- Increases water retention capacity
- Increases nutrient use efficiency
- Sequesters carbon in the soil below
- Increase crop yield

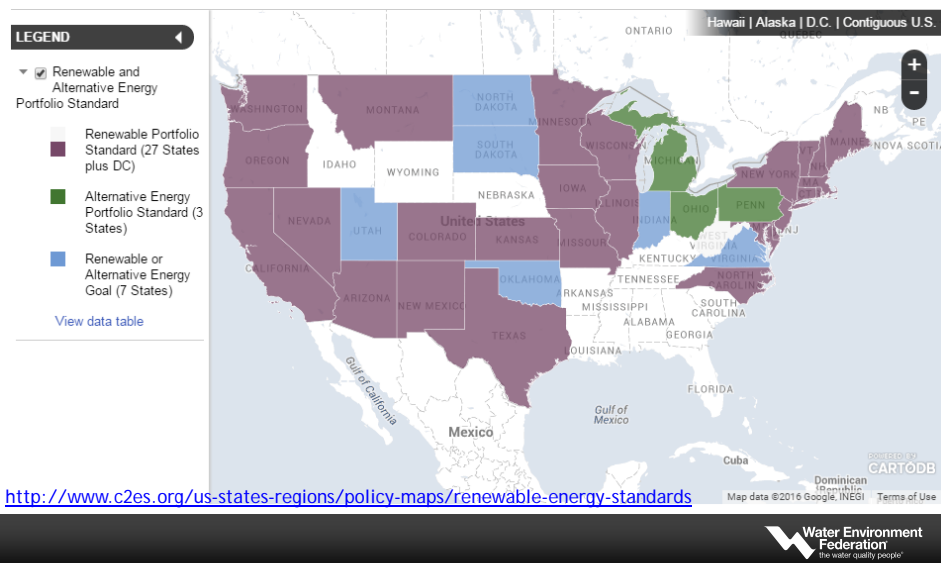


Use of these resources supports goals to increase a community's resilience

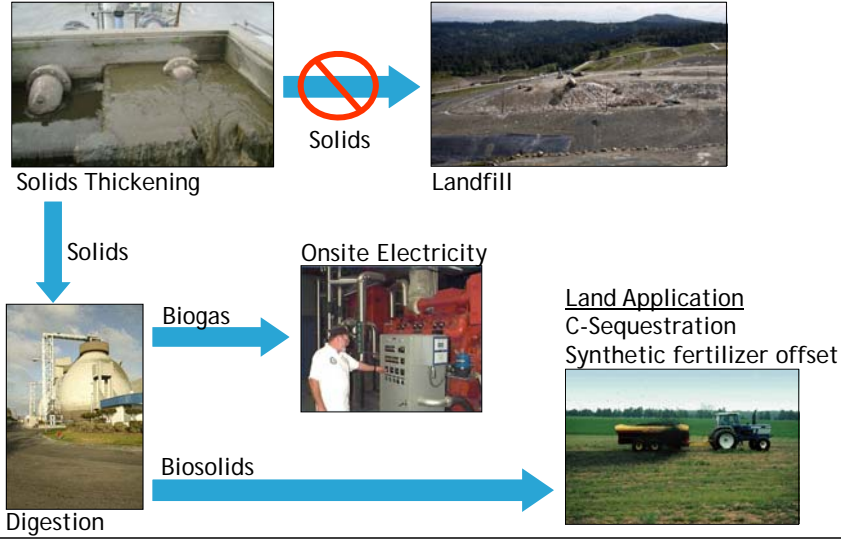
- National
 - Renewable Fuel Standard
 - Clean Power Plan (on hold)
- State
 - Renewable Portfolio Standards
 - Low Carbon Fuel Standards
- Local/City
 - Climate Action Plans
 - Mayor's Climate Protection Agreement
 - 100 Resilient Cities



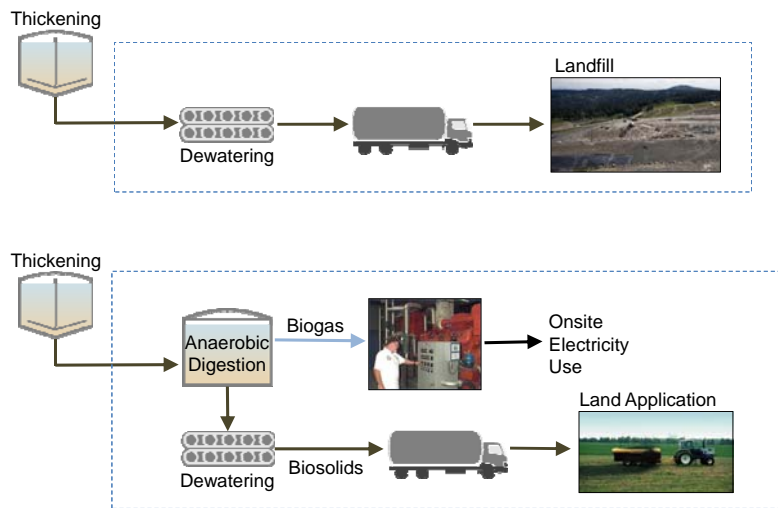
Most states have renewable/alternative energy goals & 34 have climate plans



So what is the carbon (C) value of land applying solids vs landfilling solids?



Example comparison: Landfill vs Anaerobic Digestion/Land Application



Assumptions to estimate C-value: Landfill vs Anaerobic Digestion/Land Application

Landfill

- Dewatering (add polymer)
- Transport to landfill (25 miles)
- Landfill - methane capture & destruction (no beneficial use)

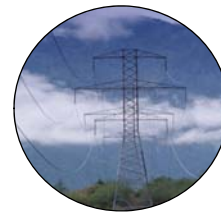
Anaerobic Digestion to Land Application

- Anaerobic digestion
- Biogas - Onsite electricity generation
- Biosolids
 - Dewatering (add polymer)
 - Transport to land application site (25 miles)
 - Land application



GHG emissions estimating terminology

- Scope 1 - direct emissions (onsite stationary combustion)
- Scope 2 - purchased electricity, heat, or steam
- Scope 3 - production of purchased materials and uses of end products

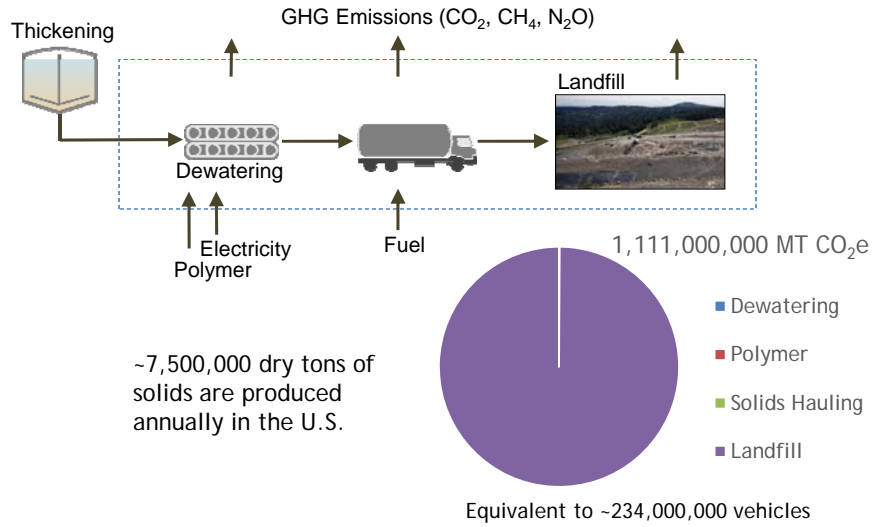


Comparison of 100-Year GWP Estimates	
Gas	CO ₂ equivalents (CO ₂ e)
Carbon Dioxide (CO ₂)	1
Methane (CH ₄)	25
Nitrous Oxide (N ₂ O)	298

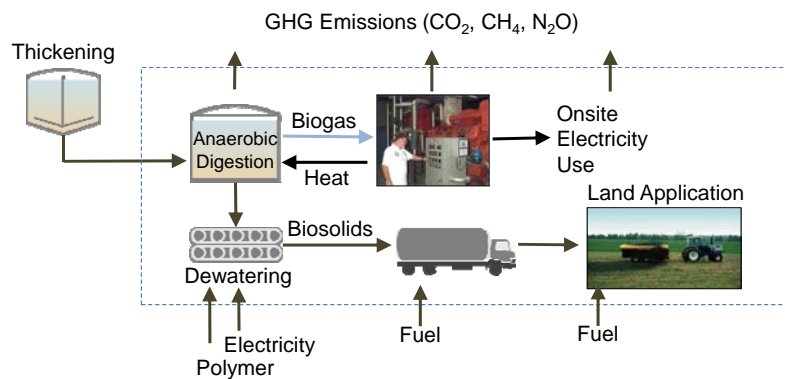
Intergovernmental Panel for Climate Change (IPCC)
Fourth Assessment Report



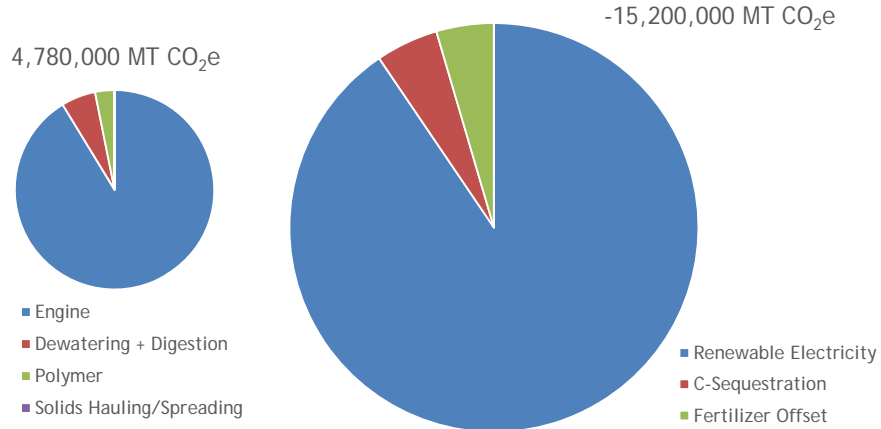
Example C-value estimate: Landfill



Example C-value estimate: Anaerobic Digestion/Land Application



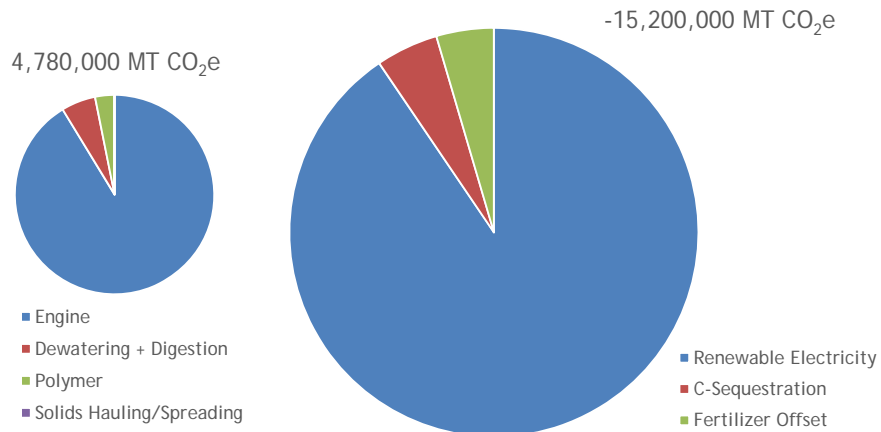
Anaerobic Digestion/Land Application of biosolids is a net sink for carbon!



Equivalent to removing over 2,100,000 passenger vehicles from the roads for a year or ~1,171,000,000 gallons of gasoline



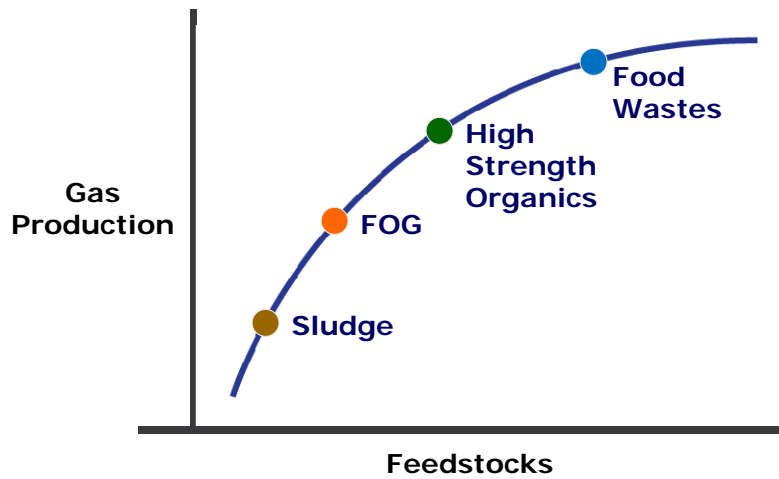
Anaerobic Digestion/Land Application of biosolids is a net sink for carbon!



Increase in carbon content of the soil, 10-30% increase in water holding capacity, and increase in crop yields...



Co-digesting additional organic feedstock increases the net C sink



The additional biogas can be conditioned for pipeline injection or vehicle use

- Avoids combustion onsite
- Extremely low carbon intensity fuel
- Eligible for funding incentives



Resources you can use to start estimating the C-value of your solids!

- Biosolids Emissions Assessment Model (BEAM)
<http://www.ccme.ca/en/resources/waste/biosolids.html>
- EPA Waste Reduction Model (WARM)
http://www3.epa.gov/warm/Warm_Form.html
- WERF Combined Heat Energy Assessment and Plant Emissions Tool (CHEApet)
<http://cheapet.werf.org/documentation/OWSO4R07c%20web.pdf>
- Research at different Institutions/Agencies:
 - Dr. Sally Brown, University of WA
 - Guanglong Tian, MWRD of Greater Chicago
 - Others...



Questions?

Residuals & Biosolids Specialty Conference
“Biosolids as a Resource”

April 3-6 - Milwaukee, WI
<http://www.wef.org/residualsbiosolids/>

Sarah Deslauriers, P.E.
(925) 977-3148
sdeslauriers@carollo.com



Biosolids Haute Couture: See the Potential and Realize the Value



Mike Van Ham, RPF, RPBio, PAg
President and Principal Environmental
Scientist



Biosolids Haute Couture?

Haute Couture

- Made to order
- High quality materials
- Extreme attention to detail
- Exclusive

- Create awareness
- Increase recognition
- Delineate a brand
- Create market demand
- Increase garment value



Biosolids Fertilization



Biosolids Soil Amendment



Haute Couture: Realizing Biosolids Value

It Just Makes "Carbon" Sense...

1. Can't Pass that Gas!
2. Growing Soil Carbon

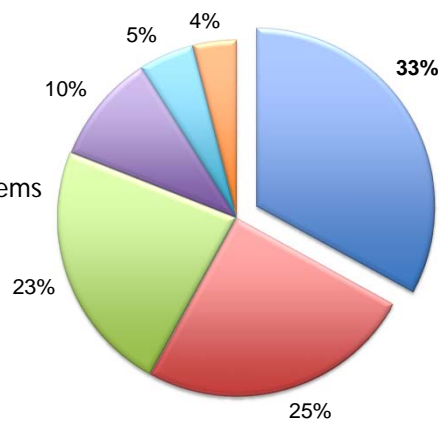


Residuals Treating Residuals?

1. Intertidal Adsorption: A Salmon Safe Place
2. For the Love of Landfill Leachate

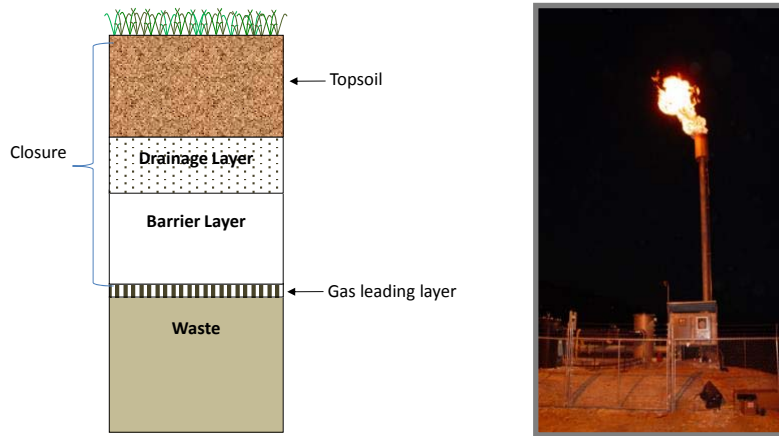
Can't Pass that Gas!

- Landfills
- Livestock
- Natural Gas and Petroleum Systems
- Coal Mining
- Wastewater Treatment
- Other



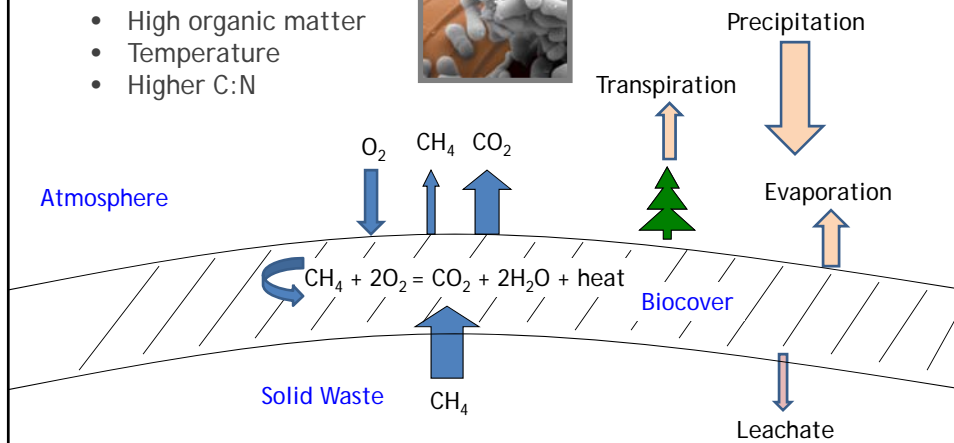
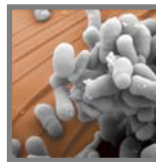
Anthropogenic Methane Sources

Methane Capture and Oxidation

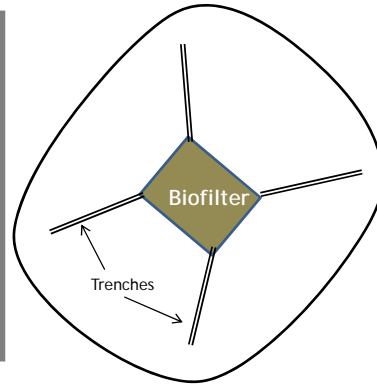


Biosolids-based Biocover/Biofilters

- Good porosity
- Moderate pH (6.5-8.0)
- 20-30% soil moisture
- High organic matter
- Temperature
- Higher C:N

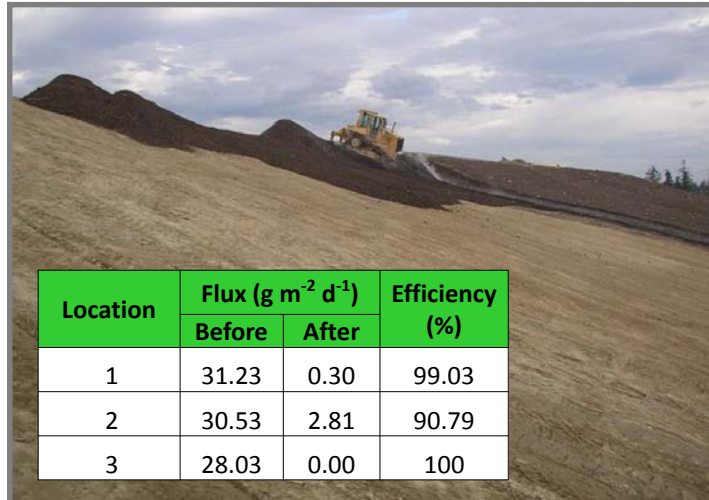


Methane Oxidation Biofilters



(from Zeiss, 2006)

Biosolids Biocover Efficacy



Location	Flux (g m ⁻² d ⁻¹)		Efficiency (%)
	Before	After	
1	31.23	0.30	99.03
2	30.53	2.81	90.79
3	28.03	0.00	100

Growing Soil Carbon

“Using a carbon and nutrient feedstock, we will accelerate the production and sequestration of biogenic carbon within degraded environments sixty-fold.”










A Big Biosolids Amended Stool Bed



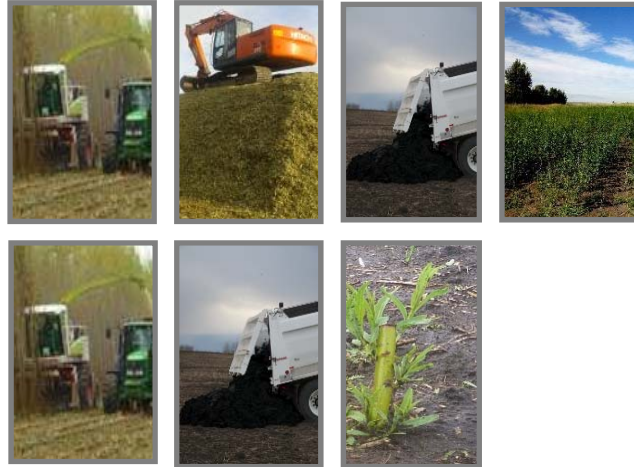
Growing Soil Carbon



	Year 1	Year 2	Year 3
Area 1			
Area 2			
Area 3		Three Years to Steady State!	

Harvest, Chip, Apply, Repeat...

Years 4+

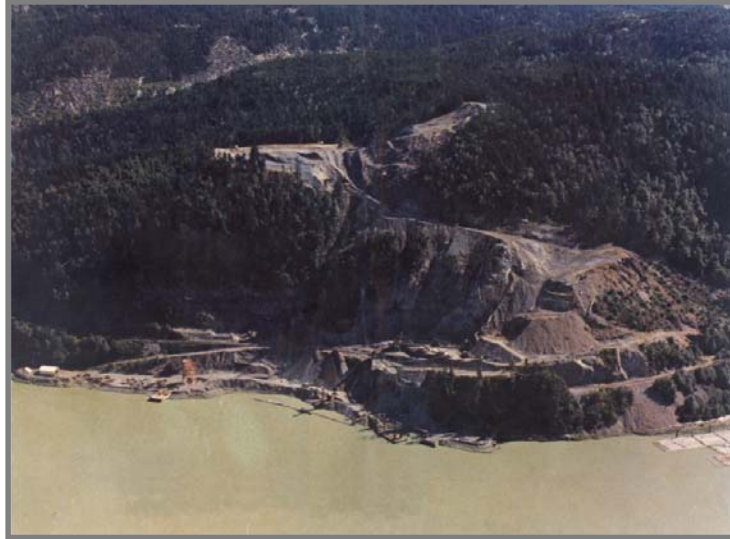


+29.13 tCO₂eq ha⁻¹ yr⁻¹

- Parkland agriculture no-till baseline:
0.25 tCO₂eq ha⁻¹ yr⁻¹
- Additionality through land application of biosolids (Years 1-3/Years 4-36):
7.53 / 3.77 tCO₂eq ha⁻¹ yr⁻¹
- Additionality through willow biomass management:
21.60 tCO₂eq ha⁻¹ yr⁻¹



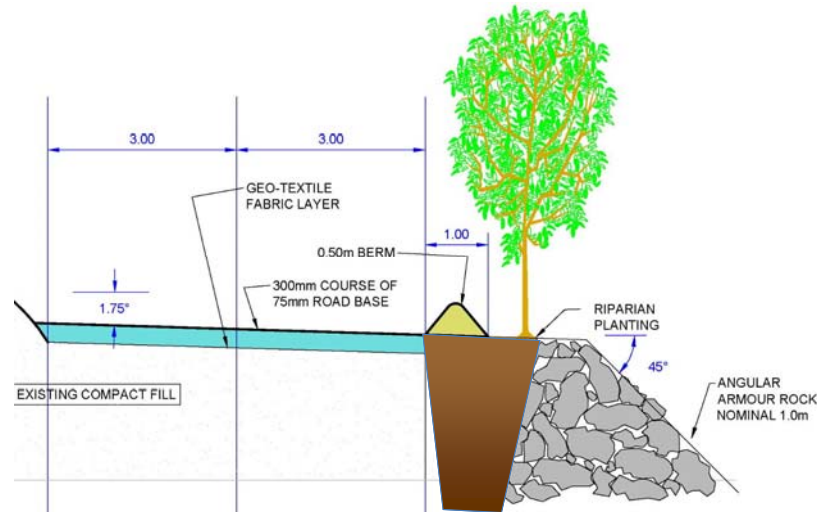
Intertidal Adsorption: A Salmon Safe Place



Deleterious Substances in Water



Biosolids Fabricated Infiltration Barrier



Biosolids Creates a Salmon Safe Place



For the Love of Landfill Leachate



Terrestrial Landfill Leachate System

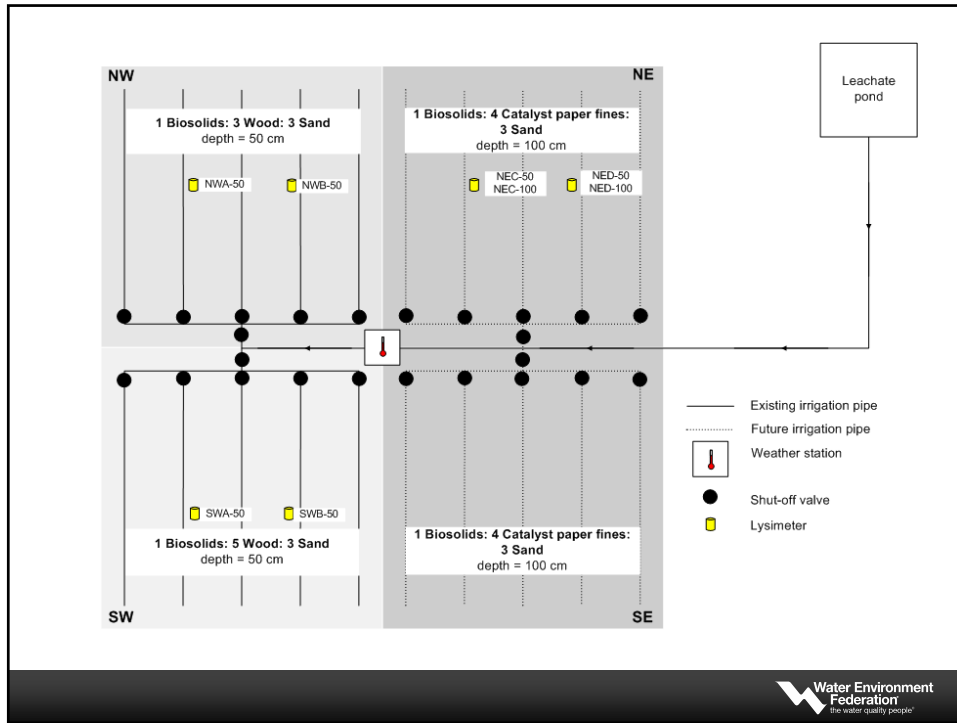
Three soil formulations

1:3:3 - biosolids: wood: sand

1:5:3 - biosolids: wood: sand

1:4:3 - biosolids: wood: sand





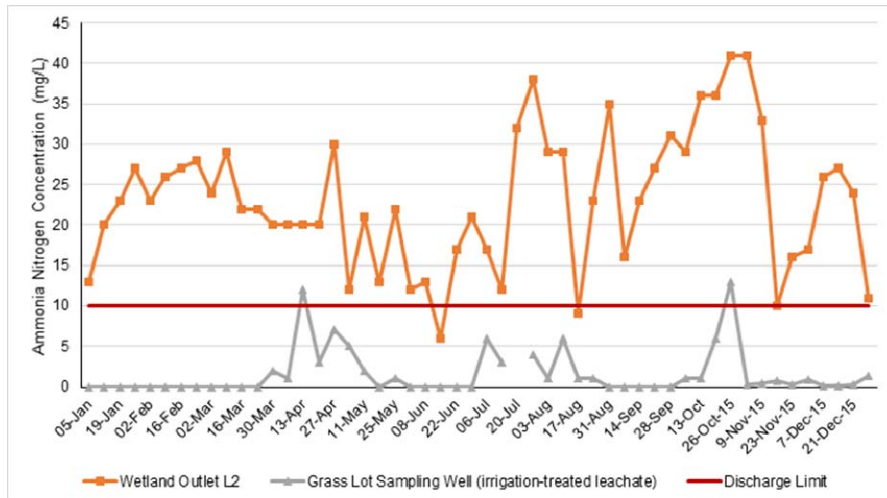
Biosolids Soil Fabrication and Placement



Optimizing Nutrient Removal and Hydraulic Loading by Vegetation Type

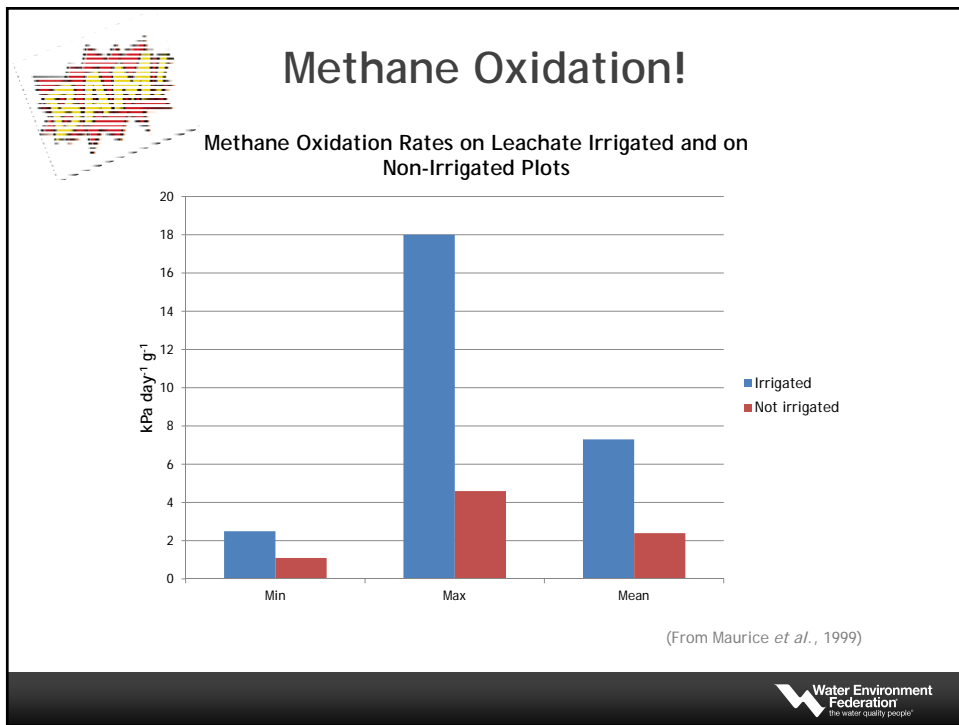
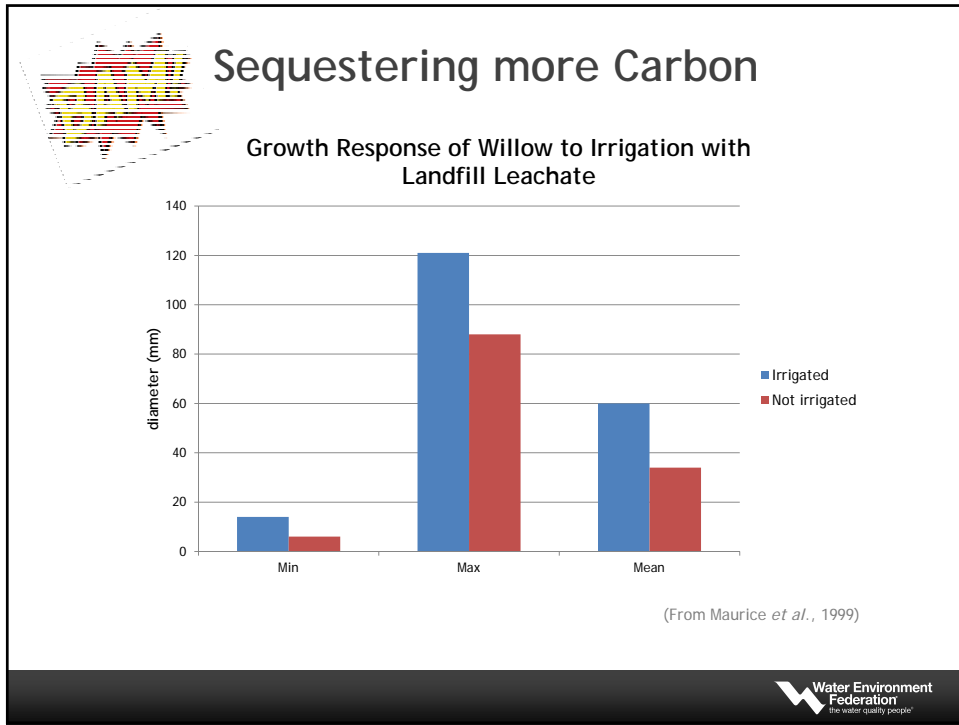



Grass Lot Leachate Treatment Performance 2015



For the Love of Landfill Leachate







Biosolids Haute Couture
Do You See The Value?

Mike Van Ham
1-800-778-1377
mvanham@sylvis.com