# Developing Product Blends for Urban Uses

Bloom Branding and Marketing Update

October 27th, 2017

District of Columbia Water and Sewer Authority

## NUTRIENTS and CARBON RECYCLING

FARMING

SILVICULTURE

RECLAMATION

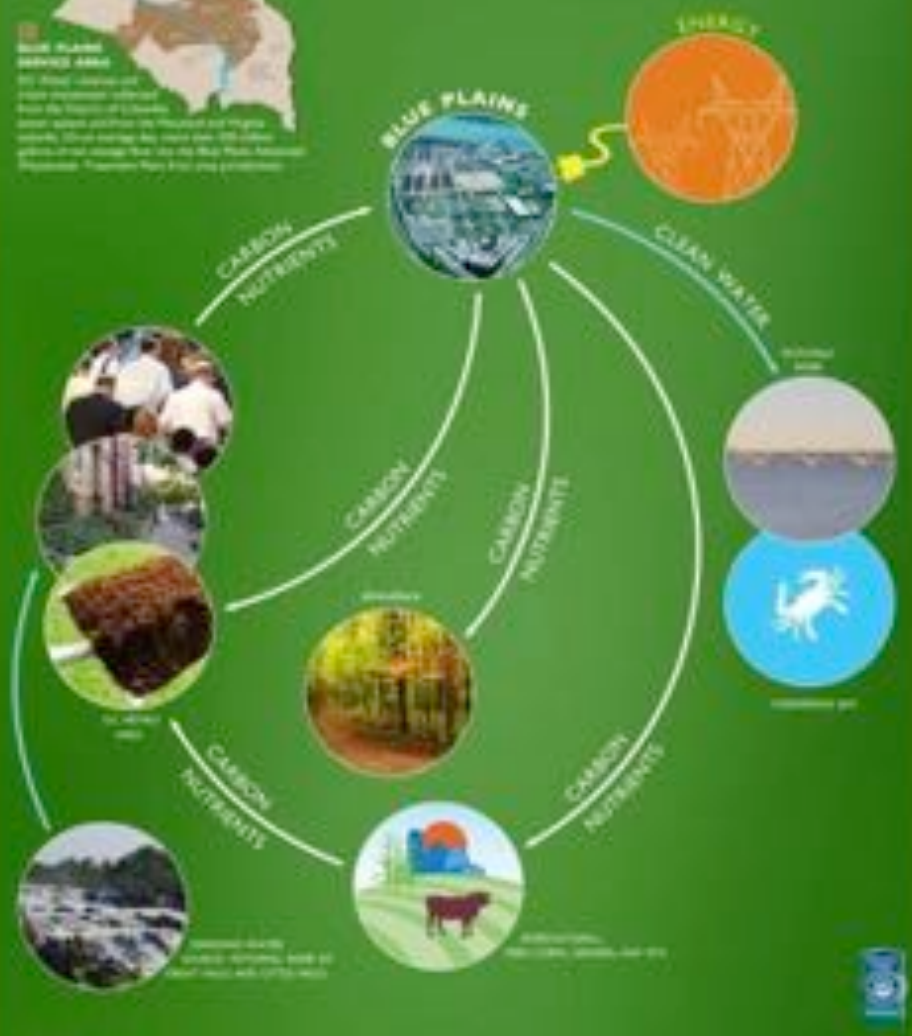
URBAN RESTORATION

dc water is life

BLUE PLAINS ADVANCED WASTEWATER TREATMENT PLANT:

# A RESOURCE RECOVERY FACILITY

water • nutrients • carbon • energy




dcwater.com/biosolids

## GREEN ENERGY BIORENEWABLES

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 $CO_2e$ per year
- Reduce trucking by 1.7 million miles per year
- Save $18 million in biosolids trucking costs
- Produce Class A biosolids to grow trees, sequester carbon and reduce runoff

# 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 did not extract this value

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# New Equipment = Marketing Opportunity

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# Rolling out a Brand – not a passive activity

- Product Research
- Study History
- Elected Official Outreach
  - Prior to roll-out
  - Site visits during demo use
- Public Outreach
  - Addressing concerns
  - Promoting benefits
- Product Demonstration
- Brand and Logo Development

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# Product Quality Research

- A saleable biosolids product must go beyond mere regulatory requirements
  - Consistent
  - Low odor
  - Document positive benefits
    - Drought resistance
    - Crop yield improvement
    - Carbon sequestration
    - Healthy microbial diversity

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Mr. Forbes, MES Inspector demonstrating usage of odor measurement device

# Results: Dilution-to-threshold

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# Change a Local Paradigm

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# Public Outreach Template

- Proactive meetings with community gardens and environmental groups
- Ensure all elected officials are informed and on board
- Donate to gardens and non-profits with a high quality product
- Engage the press and inoculate with facts
- Disseminate success stories

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# Outreach to the Urban Gardening Community

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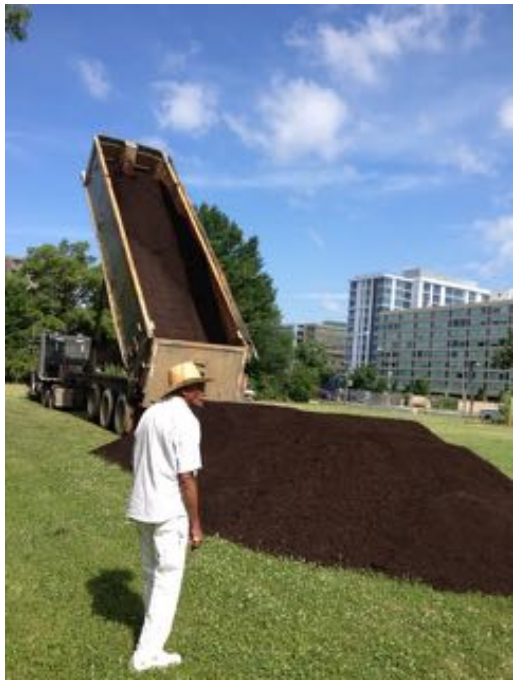
# Community Gardens



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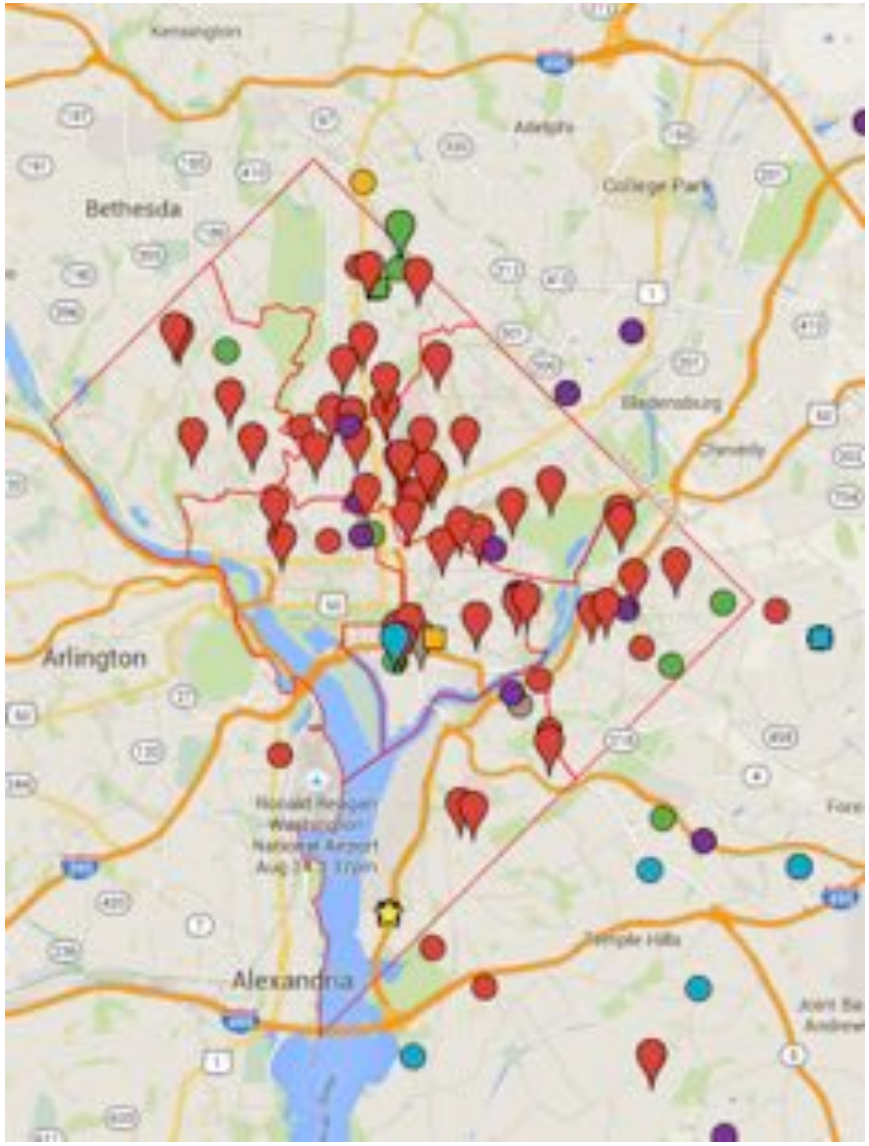
# Map of Compost Use




- 70+ comm. gardens & tree plantings in all 8 wards (430+ tons)
- 765+ tons to employees and on-site

# Class B vs. Class A Product

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# Digester launch event

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# Brand and Logo Development

- Brainstormed internally – came up with a long list of awful ideas
- Brought in a local professional
- Developed a list of 12 names and taglines
- Whittled it down to 4 concepts
- Developed graphics concepts for the chosen 4
- Chose the best one
- Brought it in-house for alignment with the strong DC Water brand and logo

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# Final Logo and Tagline

BLOOM

GOOD SOIL,
BETTER EARTH.

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BLOOM
GOOD SOIL,®
BETTER EARTH.
An exceptional
soil amendment
bloomsoil.com

# Markets for Bloom®

- Tree planting, maintenance, nurseries
- Turfgrass (turf farms, golf courses, home lawns)
- Landscaping
- Soil blending (e.g. bioretention mixes)
- Restoration & remediation projects
- Green roofs
- Urban gardens & farms
- Homeowners

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| Characteristics | Units of Measure | TS Hardwood | TS Sawdust | PS Hardwood | PS Pine Bark | AC | AC Topsoil | enhanced soil | enhanced soil 2 | enhanced soil 3 | money mix 1 | money mix 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FORMULA | V:V Blend Ratios | 2 biosolids : 1 hardwood bark fines : 1 sand (topsoil mix) | 2 biosolids : 1 sawdust : 1 sand (topsoil mix) | 1 biosolids : 1 sawdust : 3 hardwood bark fines (potting soil) | 1 biosolids : 1 sawdust : 3 pine bark fines (potting soil) | 1 biosolids : 1.5 sand : 1 hardwood bark fines (garden mix) | 1 biosolids : 1.5 soil : 1 hardwood bark fines (topsoil 2) | 3 soil : 1 biosolids | 2 soil : 1 biosolids | 2 soil : 1 sawdust : 1 biosolids | 1 biosolids : 1 soil : 1 money | 2 biosolids : 1 sand : 1 money : 1 hardwood bark |
| **PHYSICAL** | | | | | | | | | | | | |
| Moisture | % | 40.7 | 43.4 | 50 | 51.3 | 29.4 | 35.7 | 27.5 | 33.1 | 33.2 | 31.4 | 40.3 |
| pH Value | Units | 7.09 | 7.77 | 7.04 | 6.37 | 6.83 | 7.45 | 7.64 | 7.59 | 7.64 | 7.17 | 7.43 |
| Electrical Conductivity (ECe) | umhos/cm | 1670 | 1929 | 847 | 494 | 974 | 1326 | 752 | 882 | 673 | 1360 | 1251 |
| Organic Matter | % as received | 7.8 | 14.9 | 30.2 | 43.5 | 10.8 | 8.8 | 3.3 | 4.6 | 6.6 | 16 | 16.6 |
| Organic Matter | % dry weight | 13.2 | 26.3 | 60.3 | 89.2 | 15.3 | 13.6 | 4.5 | 6.9 | 9.9 | 23.4 | 27.9 |
| Ash | % as received | 51.5 | 73.7 | 19.9 | 5.3 | 59.8 | 86.4 | 69.3 | 62.3 | 60.2 | 52.5 | 43.1 |
| Bulk Density - as received | lbs/cu-ft | 69.5 | 62.5 | 39 | 33 | 78.3 | 92.3 | 115.1 | 109.7 | 100.9 | 58 | 54.9 |
| | g/cc | 1.11 | 1 | 0.63 | 0.53 | 1.26 | 1.48 | 1.84 | 1.76 | 1.62 | 0.93 | 0.88 |
| Porosity - at saturation | % by volume | 76.6 | 76 | 87.3 | 81.6 | 66.9 | 59.9 | 52.4 | 56.5 | 52.6 | 79.4 | 76 |
| Air filled - at saturation | % by volume | 5.3 | 18.7 | 33.6 | 30.2 | 62.2 | 0.5 | 1.3 | 1 | 1.9 | 26.4 | 7.1 |
| Water filled - at saturation | % by volume | 71.3 | 57.3 | 53.7 | 51.4 | 4.7 | 59.4 | 51.1 | 55.5 | 50.6 | 53 | 69 |
| Solid - at saturation | % by volume | 23.4 | 24 | 12.7 | 18.4 | 33.1 | 40.1 | 47.6 | 43.5 | 47.4 | 20.6 | 24 |
| | | | | | | | | | | | | |
| Particle Size Distribution | | | | | | | | | | | | |
| Over 2 mm | Fraction | 15.4 | 18.8 | 35.7 | 46.7 | 14 | 18.7 | 20 | 4.6 | 14.6 | 26.5 | 26.8 |
| 0.063 to 2 mm (Sand) | Fraction | 60.8 | 77.4 | 59.1 | 51.8 | 81.6 | 67.7 | 67.1 | 81 | 65.3 | 61.7 | 71.5 |
| 0.002 to 0.063 (Silt) | Fraction | 15.6 | 3.5 | 4.3 | 0.5 | 3.7 | 13.6 | 12.8 | 12.2 | 18.8 | 7.9 | 1.6 |
| < 0.002 (clay) | Fraction | 8.2 | 0.4 | 0.8 | 0.9 | 0.7 | 0 | 0.1 | 2.2 | 1.2 | 4 | 0.1 |
| Sum | | 100 | 100.1 | 99.9 | 99.9 | 100 | 100 | 100 | 100 | 99.9 | 100.1 | 100 |
| | | | | | | | | | | | | |
| **CHEMICAL** | | | | | | | | | | | | |
| Total Nitrogen | % on wet wt basis | 0.26 | 0.5 | 0.43 | 0.36 | 0.14 | 0.13 | 0.23 | 0.19 | 0.2 | 0.28 | 0.3 |
| Ammoniac nitrogen | % on wet wt basis | 0.24 | 0.016 | 0.014 | 0.72 | 0.013 | 0.023 | 0.011 | 0.019 | 0.019 | 0.022 | 0.014 |
| Nitrate | % on wet wt basis | 0.013 | 0.0011 | 0.0008 | 0.0006 | 0.0006 | 0.00045 | 0.0003 | 0.00043 | 0.00041 | 0.00034 | 0.00026 |
| Soluble Organic Nitrogen | % on wet wt basis | 0.00001 | 0.00001 | 0.00001 | 0.00001 | 0.00001 | 0.00001 | 0.00001 | 0.00001 | 0.00001 | 0.00001 | 0.00001 |
| non-Soluble Organic Nitrogen | % on wet wt basis | 0.24 | 0.48 | 0.42 | 0.35 | 0.13 | 0.11 | 0.22 | 0.17 | 0.18 | 0.26 | 0.28 |
| Soluble Phosphorus ($P_2O_5$) | % on wet wt basis | 0.0029 | 0.001 | 0.001 | 0.0015 | 0.00057 | 0.0013 | 0.0022 | 0.0021 | 0.0012 | 0.00104 | 0.00099 |
| Available Phosphorus ($P_2O_5$) | % on wet wt basis | 0.0032 | 0.0015 | 0.0019 | 0.0047 | 0.00113 | 0.0016 | 0.0028 | 0.0027 | 0.0015 | 0.00099 | 0.0017 |
| Total Potassium ($K_2O$) | % on wet wt basis | 0.45 | 0.056 | 0.01 | 0.045 | 0.067 | 0.069 | 0.16 | 0.083 | 0.078 | 0.081 | 0.069 |
| Soluble Potash ($K_2O$) | % on wet wt basis | 0.19 | 0.0089 | 0.019 | 0.014 | 0.0082 | 0.0101 | 0.0063 | 0.0063 | 0.0078 | 0.0097 | 0.0087 |
| Calcium (Ca) | % on wet wt basis | 2.7 | 0.6 | 0.36 | 0.21 | 0.18 | 0.6 | 0.29 | 0.65 | 0.54 | 0.79 | 1.6 |
| Magnesium (Mg) | % on wet wt basis | 0.24 | 0.089 | 0.076 | 0.037 | 0.074 | 0.11 | 0.13 | 0.14 | 0.12 | 0.13 | 0.11 |
| Sulfur (S) | % on wet wt basis | 0.18 | 0.022 | 0.014 | 0.0076 | 0.024 | 0.021 | 0.0057 | 0.0064 | 0.012 | 0.012 | 0.016 |
| Boron (B) | % on wet wt basis | 0.0056 | 0.00064 | 0.00073 | 0.0011 | 0.00053 | 0.00018 | 0.00109 | 0.00039 | 0.0004 | 0.0006 | 0.0023 |
| Chlorine (Cl) | % on wet wt basis | 0.56 | 0.021 | 0.01 | 0.0063 | 0.0063 | 0.0048 | 0.0034 | 0.0053 | 0.0043 | 0.0074 | 0.0087 |
| Sodium (Na) | % on wet wt basis | 0.65 | 0.01 | 0.009 | 0.0053 | 0.0049 | 0.0072 | 0.98 | 0.013 | 0.0054 | 0.015 | 0.02 |
| Iron (Fe) | % on wet wt basis | 1.4 | 1.2 | 0.54 | 0.47 | 0.82 | 0.61 | 0.62 | 0.93 | 0.71 | 0.86 | 1.6 |
| Manganese (Mn) | % on wet wt basis | 0.012 | 0.009 | 0.01 | 0.0041 | 0.0104 | 0.0064 | 0.0065 | 0.007 | 0.0061 | 0.0074 | 0.015 |
| | | | | | | | | | | | | |
| **METALS** | | | | | | | | | | | | |
| Arsenic (As) | mg/kg | 3.2 | 2 | 1.3 | 0.8 | 1.8 | 1.4 | 1.4 | 1.7 | 1.4 | 1.7 | 2.3 |
| Cadmium (Cd) | mg/kg | 0.25 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| Copper (Cu) | % on wet wt basis | 0.046 | 0.0036 | 0.0022 | 0.002 | 0.0015 | 0.002 | 0.0033 | 0.003 | 0.0025 | 0.0028 | 0.0067 |
| Cobalt (Co) | mg/kg | 2 | 1.2 | 0.77 | 0.33 | 1.7 | 1.6 | 2 | 2.2 | 2 | 2.4 | 2.7 |
| Mercury (Hg) | mg/kg | ND | 0.054 | 0.00064 | 0.032 | 0.05 | 0.091 | 0.062 | 0.12 | 0.047 | 0.068 | 0.081 |
| Molybdenum (Mo) | % on wet wt basis | 0.00031 | 0.0002 | 0.00009 | 0.00008 | 0.00013 | 0.000071 | 0.000074 | 0.00011 | 0.00009 | 0.00015 | 0.00027 |
| Nickel (Ni) | mg/kg | 9.1 | 3 | 2.4 | 1.5 | 2.6 | 2.4 | 2.9 | 3.6 | 2.8 | 3.9 | 5.1 |
| Lead (Pb) | mg/kg | 48 | 5.9 | 4.4 | 3.4 | 3.4 | 4.2 | 4.2 | 5.6 | 4.5 | 5.4 | 8.6 |
| Selenium (Se) | mg/kg | 0.65 | 5.3 | 0.58 | 3.8 | 0.29 | 1.5 | 172 | 1.9 | 0.22 | 3.3 | 0.95 |
| Zinc (Zn) | % on wet wt basis | 0.021 | 0.0074 | 0.0037 | 0.004 | 0.0025 | 0.0039 | 0.0044 | 0.0052 | 0.0039 | 0.0048 | 0.01 |

# Va Tech blend testing – pots and field

Blue Plains Biosolids+Mulch (BM),

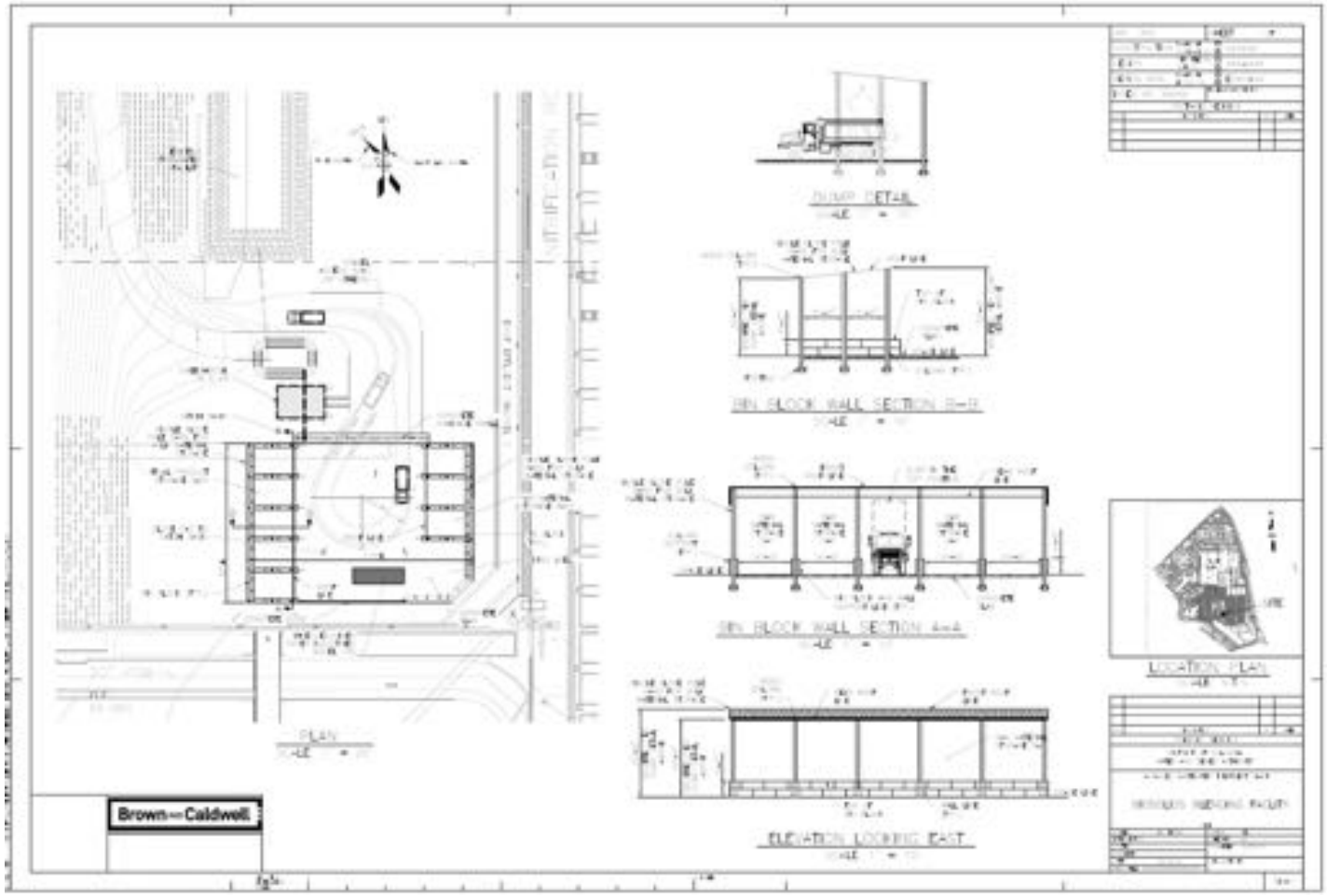
Blue Plains+Sand+Sawdust (BSS),

2 biosolids:4 mulch

0.5 biosolids:1 sand:1.0-1.25 sawdust/currency

| | BM | BSS |
|---|---|---|
| pH | 6.52 | 6.07 |
| Total Solids (g/kg) | 666 | 699 |
| Moisture (g/kg) | 334 | 301 |
| TKN (g/kg) | 26.9 | 22.3 |
| $NH_4$-N (g/kg) | 3.6 | 2.8 |
| Organic N (g/kg) | 23.3 | 19.5 |
| $NO_3$-N (mg/kg) | 5.96 | 3.39 |
| C (g/kg) | 388 | 247 |
| C:N | 14.4 | 11.1 |
| TP (g/kg) | 17.0 | 14.5 |
| K (g/kg) | 2.0 | 0.9 |
| S (g/kg) | 14.1 | 10.5 |
| Ca (g/kg) | 29.3 | 14.1 |
| Mg (g/kg) | 3.5 | 1.8 |
| Na (g/kg) | 0.4 | 0.4 |
| Fe (mg/kg) | 58300 | 52500 |
| Al (mg/kg) | 5400 | 3600 |
| Mn (mg/kg) | 431 | 248 |
| Cu (mg/kg) | 241 | 208 |
| Zn (mg/kg) | 535 | 468 |

# Designing a small onsite mixing facility



# Working with commercial blenders

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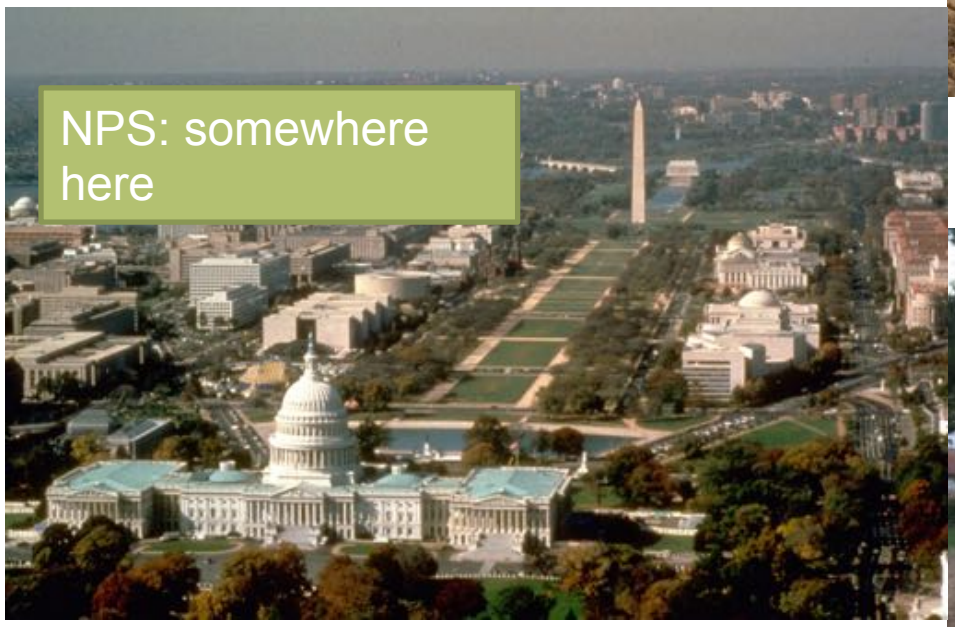
# Users of blends



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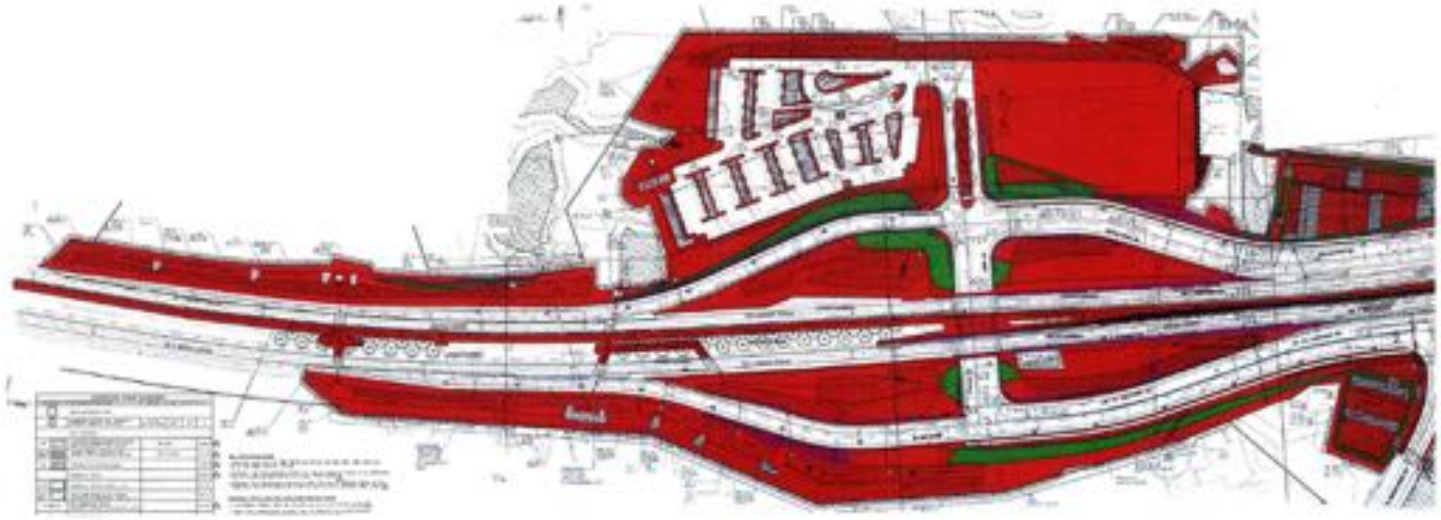
# Maryland State Highway Administration: Topsoil Blend

8000 yds of fresh Bloom ordered

6 parts topsoil : 3 parts sand: 2 parts Bloom



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# Blending opportunity*: Bioretention

*where nutrient leaching not an issue

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# Cured Bloom meets USCC standards

Date Received: 31 Mar. 16
Sample Identification: Bloom windrow +30d, post flip
Sample ID #: 6030946 - 1/3

| Nutrients | Dry wt. | As Rcvd. | units |
|---|---|---|---|
| Total Nitrogen: | 4.2 | 1.8 | % |
| Ammonia ($NH_4$-N): | 1600 | 690 | mg/kg |
| Nitrate ($NO_3$-N): | 6.8 | 2.9 | mg/kg |
| Org. Nitrogen (Org.-N): | 4.0 | 1.7 | % |
| Phosphorus (as $P_2O_5$): | 7.7 | 3.3 | % |
| Phosphorus (P): | 34000 | 14000 | mg/kg |
| Potassium (as $K_2O$): | 0.11 | 0.048 | % |
| Potassium (K): | 950 | 400 | mg/kg |
| Calcium (Ca): | 2.8 | 1.2 | % |
| Magnesium (Mg): | 0.40 | 0.17 | % |
| Sulfate ($SO_4$-S): | 2800 | 1200 | mg/kg |
| Boron (Total B): | <1.0 | <1.0 | mg/kg |
| Moisture: | 0 | 57.9 | % |
| Sodium (Na): | 0.094 | 0.040 | % |
| Chloride (Cl): | 0.07 | 0.029 | % |
| pH Value: | NA | 6.78 | unit |
| Bulk Density : | 20 | 46 | lb/cu ft |
| Carbonates ($CaCO_3$): | 23 | 9.5 | lb/ton |
| Conductivity (EC5): | 5.4 | NA | mmhos/cm |
| Organic Matter: | 52.2 | 22.0 | % |
| Organic Carbon: | 29.0 | 12.0 | % |
| Ash: | 47.8 | 20.1 | % |
| C/N Ratio | 6.9 | 6.9 | ratio |
| AgIndex | > 10 | > 10 | ratio |

| Stability Indicator: | | Biologically |
|---|---|---|
| **CO2 Evolution** | Respirometery | Available C |
| mg $CO_2$-C/g OM/day | 2.8 | 2.9 |
| mg $CO_2$-C/g TS/day | 1.5 | 1.5 |
| *Stability Rating* | *stable* | *stable* |

| Maturity Indicator: Cucumber Bioassay | |
|---|---|
| Compost:Vermiculite(v:v) | 1:2 |
| Emergence (%) | 100 |
| Seedling Vigor (%) | 111 |
| *Description of Plants* | *healthy* |

| Pathogens | Results | Units | Rating |
|---|---|---|---|
| Fecal Coliform | 11 | MPN/g | *pass* |
| Salmonella | < 3 | MPN/4g | *pass* |

Date Tested: 31 Mar. 16

| Inerts | % by weight |
|---|---|
| Plastic | < 0.5 |
| Glass | < 0.5 |
| Metal | < 0.5 |
| Sharps | ND |

| Metals | Dry wt. | EPA Limit | units |
|---|---|---|---|
| Aluminum (Al): | 6700 | - | mg/kg |
| Arsenic (As): | 11 | 41 | mg/kg |
| Cadmium (Cd): | 3.5 | 39 | mg/kg |
| Chromium (Cr): | 46 | 1200 | mg/kg |
| Cobalt (Co) | 7.1 | - | mg/kg |
| Copper (Cu): | 430 | 1500 | mg/kg |
| Iron (Fe): | 86000 | - | mg/kg |
| Lead (Pb): | 49 | 300 | mg/kg |
| Manganese (Mn): | 360 | - | mg/kg |
| Mercury (Hg): | < 1.0 | 17 | mg/kg |
| Molybdenum (Mo): | 11 | 75 | mg/kg |
| Nickel (Ni): | 26 | 420 | mg/kg |
| Selenium (Se): | 3.9 | 36 | mg/kg |
| Zinc (Zn): | 720 | 2800 | mg/kg |

| Size Distribution | |
|---|---|
| MM | % by weight |
| > 50 | 0.0 |
| 25 to 50 | 0.0 |
| 16 to 25 | 0.0 |
| 9.5 to 16 | 0.0 |
| 6.3 to 9.5 | 0.0 |
| 4.0 to 6.3 | 1.8 |
| 2.0 to 4.0 | 1.6 |
| < 2.0 | 96.6 |

Analyst: Assaf Sadeh

*Sample was received and handled in accordance with TMECC procedures.

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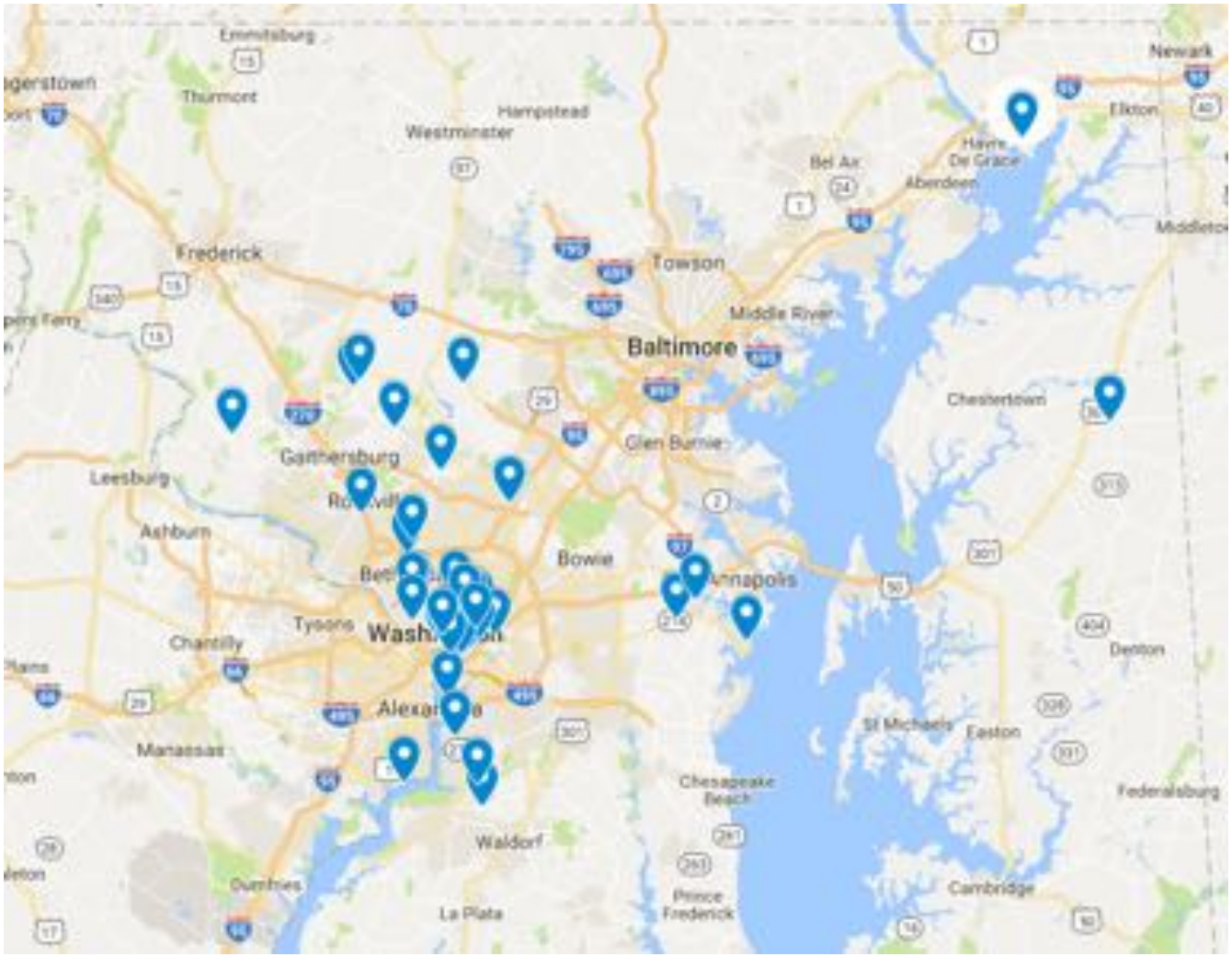
# DDOT Urban Forestry Administration & Casey Trees: Tree plantings w/cured Bloom

# Commercial distribution

**2016**: 1,000 tons
**2017**: 9,000 tons
2018: 20,000 tons
2019: 40,000 tons

**Nurseries, landscapers, soil blenders, gardens, highways**

**$7.50/cy – Cured**
**$3.50/cy -- Fresh**

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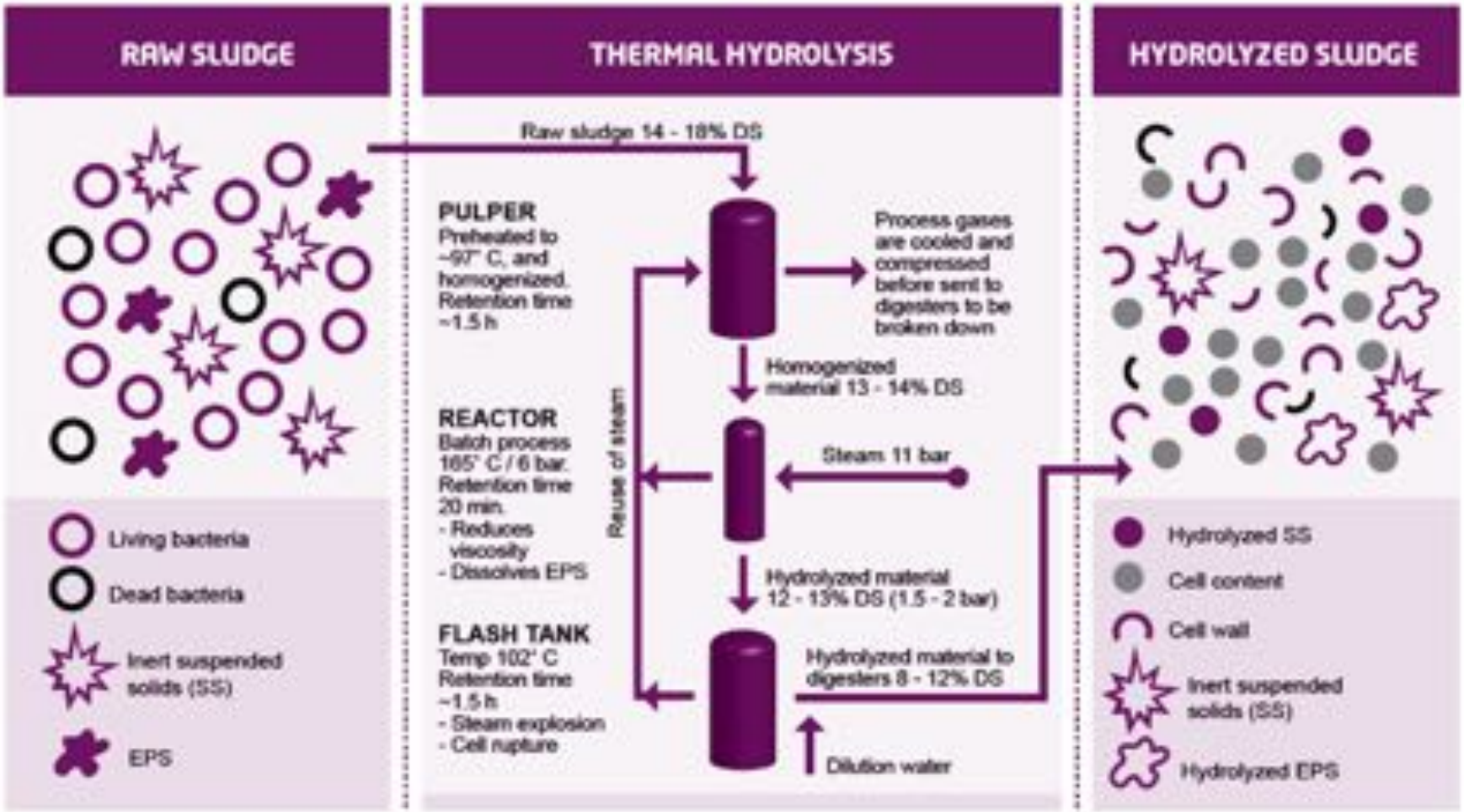
Thank you!

BLOOM GOOD SOIL,™ BETTER EARTH.

Chris Peot, PE, BCEE
bloomsoil.com

# Thermal Hydrolysis Process

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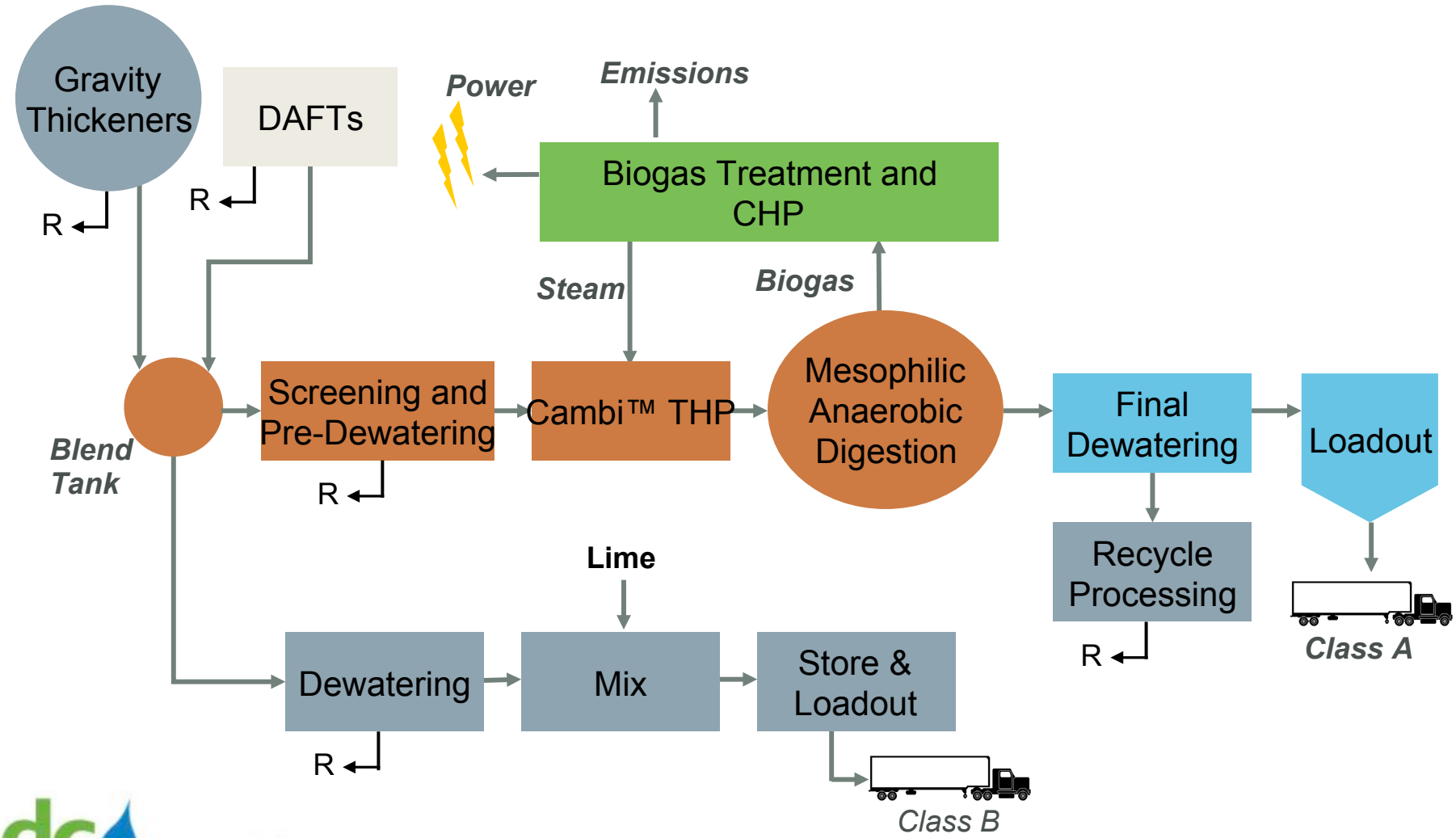
# Process Schematic

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