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Organic Waste to Fuel Project Screening and Prioritization

North Central Texas Organic Waste to Fuel Feasibility Study

Project Advisory Group
July 12, 2022

AGENDA

- Welcome & Introductions
- Project Status Update
- Feedstock Prioritization Results
- Natural Gas Vehicle (NGV) Fleet Prioritization Results
- Collection Network Evaluation Results
- Pilot Project Location Screening Process
- Next Steps

Virtual Meeting Reminders

1. Please leave your microphone muted unless speaking
2. Use the chat box or raise hand button to ask a question or provide a comment
3. Please state your name prior to asking a question a making a comment
4. Please note that the presentation is being recorded

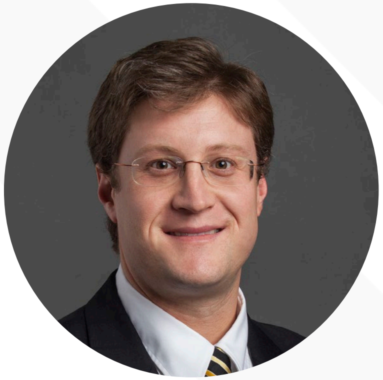
WELCOME & INTRODUCTIONS

Introductions

- **Breanne Johnson**
  Environment & Development Planner
  NCTCOG
- **Lori Clark**
  Air Quality Program Manager
  NCTCOG
- **Soria Adibi**
  Senior Air Quality Planner
  NCTCOG
- **Melanie Sattler**
  Civil Engineering Professor & Researcher
  University of Texas at Arlington

Introductions

Scott Pasternak
Project Manager
Burns & McDonnell



Scott Martin
Deputy Project Manager
Burns & McDonnell

Debra Kantner
Market Assessment & Feasibility
Burns & McDonnell

Drew Mitrisin
Transportation Planning & Policy
Burns & McDonnell

Eric Weiss
Collection Network Assessment
Burns & McDonnell

Matt Tomich
President
Energy Vision

Phil Vos
Program Director
Energy Vision

Project Advisory Group

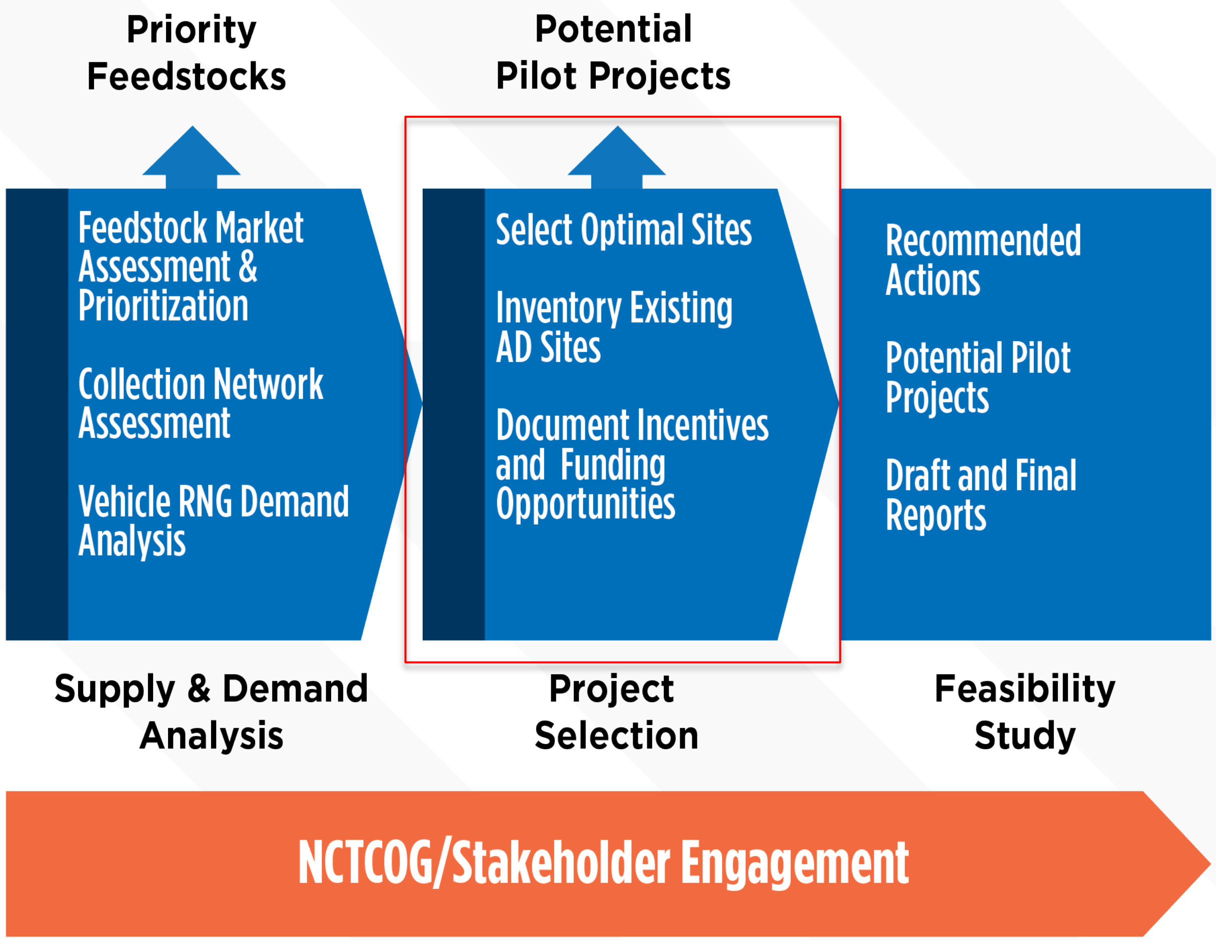
- Joao Pimentel, City of Fort Worth
  This has the potential to benefit the whole Metroplex, and, consequently, Fort Worth.
- Katelyn Hearon, City of Lewisville
  The City of Lewisville is interested in finding sustainable options for sludge disposal.
- Kathy Fonville, City of Mesquite
  Chair of Resource Conservation Council at NCTCOG--interested in how RCC can support this regional initiative.
- Yarcus Lewis, City of Plano
  Achieving greater emissions reductions from the dual benefits of redirecting organic waste emissions to displace fossil fuel usage.
- Jaime Bretzmann, City of Plano
  Interested to learn more about the regional opportunities for waste organics and also about use of the generated fuel gas and digestate.
- Brendan Lavy, Texas Christian University
  Assistant Professor of Sustainability Science at TCU and interested in research that supports sustainability transitions in North Texas.
- Courtney Carroll, Fort Worth ISD
  Would like to better understand the possible uses of all the organic waste produced in school cafeterias.
- Sahana Prabhu, Texan by Nature
  I am interested to learn about anaerobic digestion and renewable energy potentials in North Texas.
- Lynn Lyon, US Gain

PROJECT STATUS UPDATE

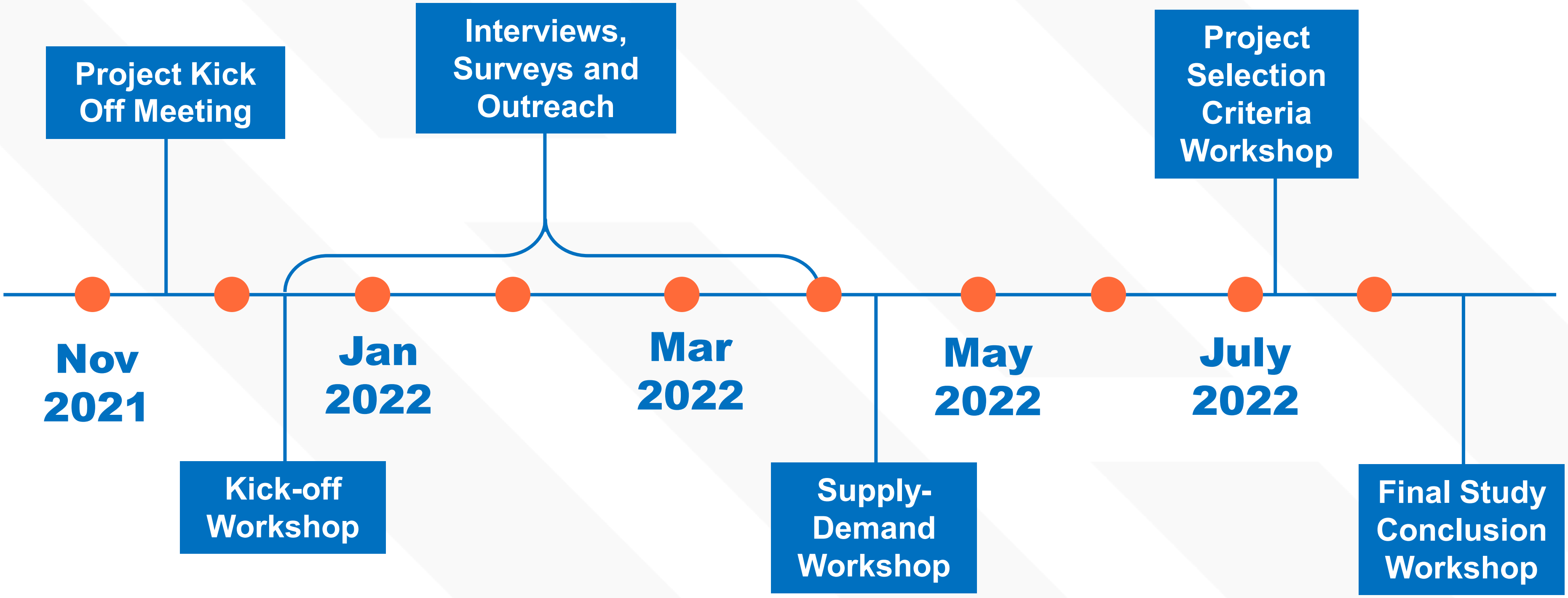
Project Background

- Goal of the study is to assess the feasibility of using of local organic wastes to produce renewable natural gas (RNG) in new or existing digesters within the region and use the RNG as a transportation fuel.
- NCTCOG and UTA partnering on the study which is supported by a grant from the U.S. Environmental Protection Agency (U.S. EPA).
- Prior to the study, NCTCOG hosted a series of virtual roundtables to share existing anaerobic digestion and organic waste collection efforts in the region.
- As North Central Texas continues to grow, waste diversion will become increasingly important to both retain landfill capacity and reduce methane emissions.

Project Approach



Stakeholder Engagement



FEEDSTOCK PRIORITIZATION RESULTS

Regional Annual Feedstock Generation

8.8 Million Tons of Organics Generated Each Year

Landfill Biogas: 17 landfills (open and closed)
Collecting 44,000 scfm of biogas

Wastewater Treatment:
47 WWTPs in NCTCOG
8 utilizing anaerobic digestion

Feedstock Prioritization Considerations

ATTRIBUTE	IMPORTANCE
Existing and Future Volumes of Waste	Consider future supply and long-term fuel production potential.
Diversion Opportunity from Landfill	Materials currently managed at landfills or through other disposal methods should be prioritized first to ensure efforts result in an overall increase in diversion.
Stability and Variability of Materials	Infrastructure requires design and planning considerations specific to the quantities and material types being handled.
Biogas Generation and GHG Reduction Potential	Material type influences biogas production and GHG reduction potential based on properties such as carbon content, lignin, cellulose, etc.
Scalability at the Regional Level	Focus on materials with the potential to provide a solution that is scalable across the 16-county region.
Stakeholder Support	Prioritization includes considerations for stakeholder support based on feedback from the PAG and information obtained by the Project Team.

Feedstock Type	Material Benefits and Prioritization						
	Existing and Future Volumes	Diversion from Landfill	Stability and Variability of Materials	Biogas Production and GHG Reduction Potential	Scalability at the Regional Level	Stakeholder Support	Overall Suitability of Feedstock for RNG Vehicle Fuel
Food Waste	✓	✓	varies	✓	✓	✓	High
Existing Biogas Resources	✓		✓	✓	✓	✓	High
Fats, Oils, and Grease (FOG)	✓		✓	✓	✓		Medium
CAFO Manures	✓		✓	✓			Medium
Yard Trimmings	✓		✓		✓		Low
Crop Residues			✓				Low

Feedstock Prioritization Results

Low

- Yard Trimmings
- Crop Residues

Medium

- Fats, Oils, and Grease (FOG)
- CAFO Manures

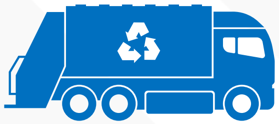
High

- Food Waste
- Existing Biogas Resources

NGV FLEET PRIORITIZATION RESULTS

Opportunities for High-Volume NGV Fleets

Solid Waste Collection



- Highest adoption percentage with demonstrated commercial viability
- Requires fueling at fleet yards and centralized ownership supports capital investments
- Travel fewer road miles compared to tractor trailers or transit busses

Tractor-Trailers

- Lowest adoption percentage but highest number of vehicles in service among all fuel types.
- Off-site fueling in Texas Clean Transportation Zone supports long-hauling routes.

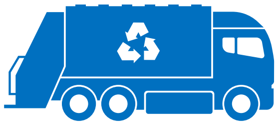
Transit Buses

- Requires fueling at fleet yards and centralized ownership supports capital investments.
- Highest fuel demand on a per vehicle basis.

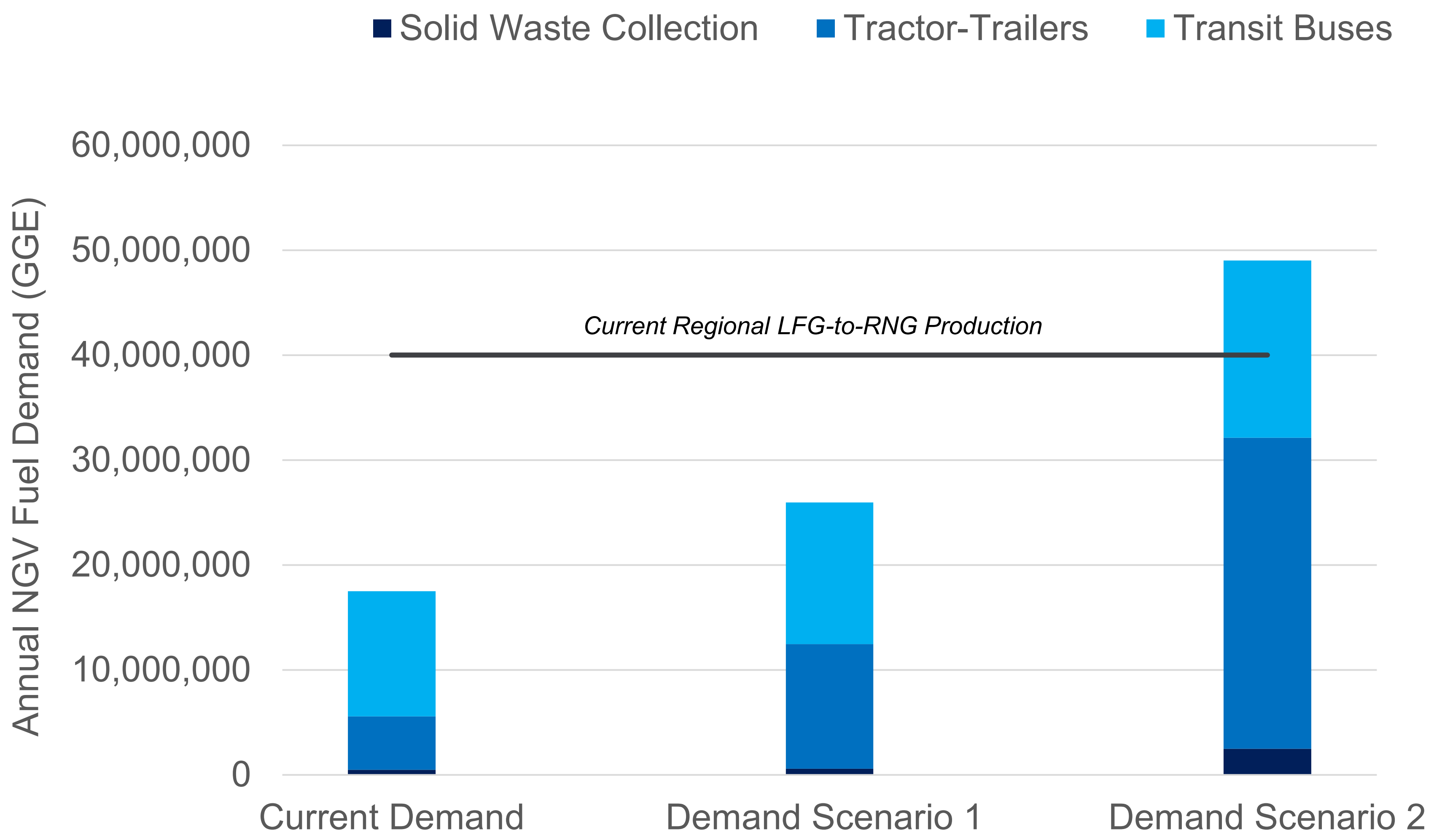
Light-Duty Delivery

- Growing sensitivity to environmental impact among large multi-national fleets (e.g., UPS, Amazon)
- Texas House Bill 963 (2021) supports smaller, less-capitalized fleets to invest in NGVs.

NGV Fuel Demand Scenarios

	Solid Waste Collection	Tractor-Trailers	Transit Buses
			
CURRENT DEMAND			
% Adoption	10.8%	0.9%	7.1%
NGV Fuel Demand (GGE)	497,000	5,089,000	11,916,000
SCENARIO 1 (MINOR)			
% Adoption	13.0%	2.0%	8.0%
NGV Fuel Demand (GGE)	600,000	11,864,000	13,502,000
SCENARIO 2 (AGGRESSIVE)			
% Adoption	50.0%	5.0%	10.0%
NGV Fuel Demand (GGE)	2,480,000	29,660,000	16,878,000

NGV Fuel Demand Scenarios



RNG Supply Scenarios

- Five scenarios of potential supply:

Feedstock Type	Potential RNG Supply Scenarios				
	A	B	C	D	E
Commercial Food	60%	60%	100%	100%	**100%**
Residential Food	-	20%	100%	100%	**100%**
Existing Biogas Resources	-	-	-	*Potential Projects*	*All Sites*
Potential Supply (GGE)	**4,773,989**	**6,495,748**	**16,565,440**	**32,817,023**	**75,232,881**

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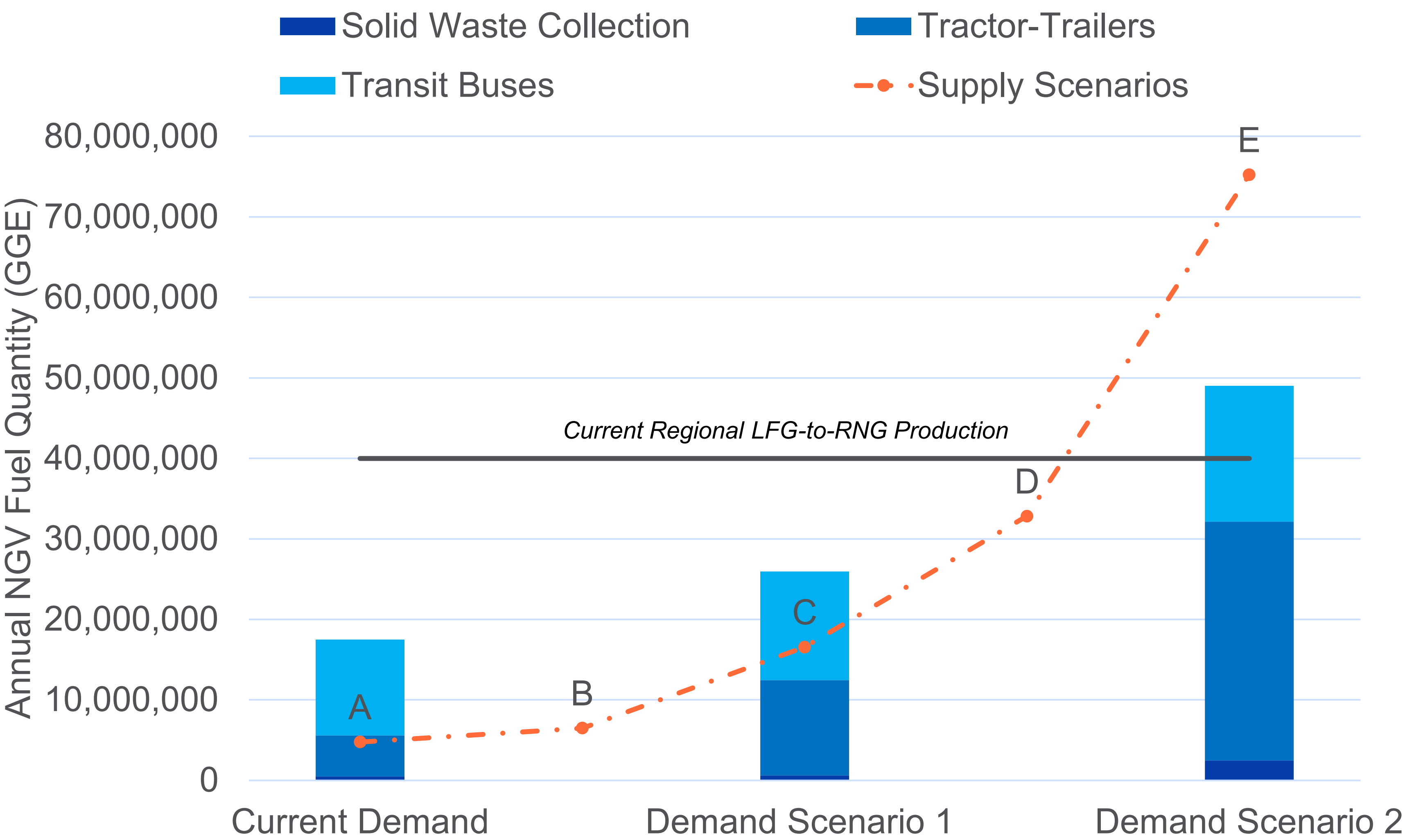
NGV Fuel Supply and Demand Scenarios



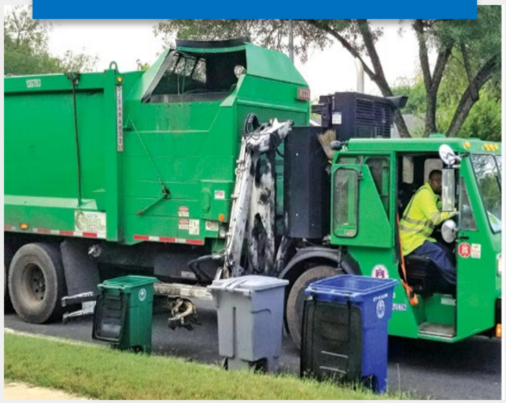
COLLECTION NETWORK EVALUATION RESULTS

SSO Collection Network Analysis Overview

- Routing model compares technical and financial elements of potential collection networks
  - Operational requirements (e.g., staffing, vehicles, other direct costs)
  - Route densities (e.g., households per acre)
  - Collection efficiency (e.g., customers serviced per hour)
- Assumes collection programs are fully implemented and fully optimized (intended to compare financial feasibility)
  - Assumes carts already in place (purchase of new carts approximately $0.50 per household per month)
  - Enclosures installed and dumpsters purchased
  - Slurry tanks and macerators installed
  - Access to processing infrastructure with available capacity
- Calculates required routes and direct costs to collect food waste currently disposed from commercial and residential generators
  - Cost per ton collected
  - Cost per household per month
  - Cost per cubic yard

Collection Networks Evaluated

Residential Single-Family



- Estimates costs of low density, high density and rural areas
- All tons currently disposed are collected
- Organics processing infrastructure operating with available capacity

Commercial Front-Load

- 3x per week per week collection
- 2 CY food waste dumpsters
- Included 90 percent of food retail and 70 percent of food service locations (remaining customers unable to fit additional dumpster/enclosure)

Commercial Slurry

- Every other week collection on a routed basis (consistent with FEL collection)
- Service provided by 5,500-gallon vacuum trucks
- Each pump out takes 45 minutes to complete

Residential Collection Network Cost Comparison

	High Density	Low Density	Rural
Annual Tons Collected	342,377	205,661	72,938
Total Households Serviced	997,601	599,245	212,523
Cost per Ton Collected	$156.42	$187.70	$246.98
Cost per Household per Month	$4.47	$5.37	$7.06

- Cost per household per month in addition to existing costs for refuse and recycling collection (excluding cost of purchasing carts and organics processing)
- Cost per household per month lowest in high density regions and highest in low density regions
- Recent benchmarking indicates costs range between $4.00 to $6.00 per household per month for refuse collection in the North Central Texas region

Commercial Collection Network Cost Comparison

	Front-Load	Slurry
Annual Tons Collected	384,000	174,000
Total Customers Serviced	14,629	5,797
Cost per Ton Collected	$87.43	$72.30
Cost per CY Serviced	$7.36	$6.08

- Lower costs for slurry collection due to more efficient storage (via tanks) and fewer required collections per customer
- Converted gallons of food waste processed into slurry to CY to compare between collection networks
- Recent benchmarking indicates front-load refuse collection programs in the North Central Texas region, collection costs range from $2.00 to $6.00 per CY (excluding disposal costs)

Overall Comparison

	Commercial		Residential		
	Front-Load	Slurry	High Density	Low Density	Rural
Annual Tons Collected	384,000	174,000	342,377	205,661	72,938
Total Customers Serviced	14,629	5,797	997,601	599,245	212,523
Cost per Ton Collected	$87.43	$72.30	$156.42	$187.70	$246.98

- Highest tonnage of material available from commercial front-load and high-density residential areas of the North Central Texas region
- Priority collection networks include commercial front-load, slurry based on cost effectiveness and high density residential based on significant available tonnage

PILOT PROJECT LOCATION SCREENING PROCESS

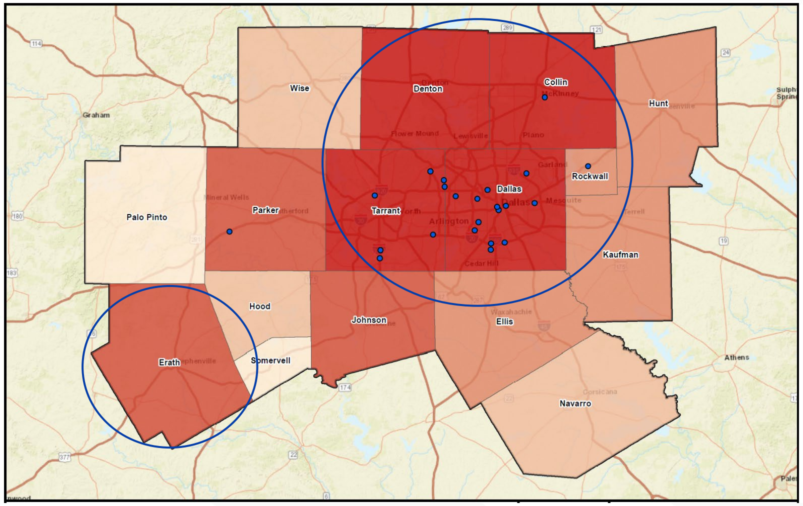
Inventory Regional Sites to Determine Scenarios

1. Inventory of Regional Sites
2. Optimization Tool Screening to Create Long List
3. Short List of Pilot Projects
4. POWER Tool Screening
5. Prioritization Evaluation
6. Analysis of Selected Pilot Projects

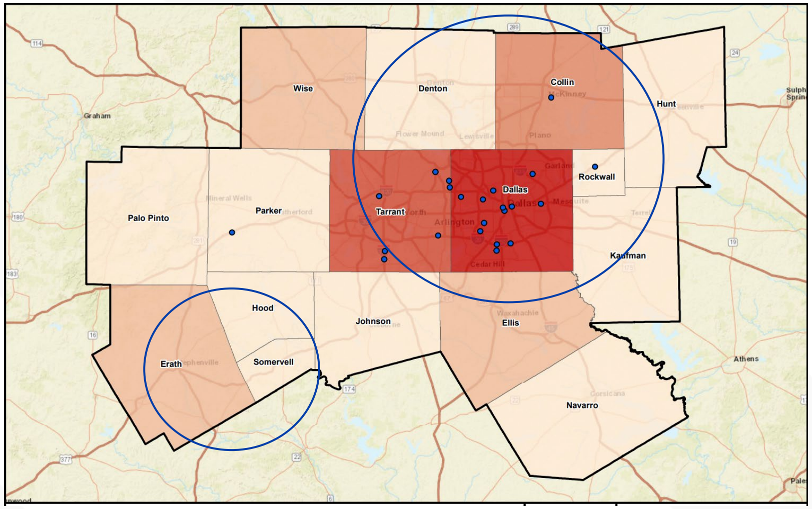
- Inventory of existing infrastructure sites provides baseline for screening for potential project sites.
- Potential project sites considered for four project types:
  - Co-locate with WRRF and/or existing digester
  - Co-locate with LFGTE project
  - Co-locate with transfer station
  - Greenfield development
- Focus scenarios in targeted areas of North Central Texas region

Targeted Organics Collection Areas

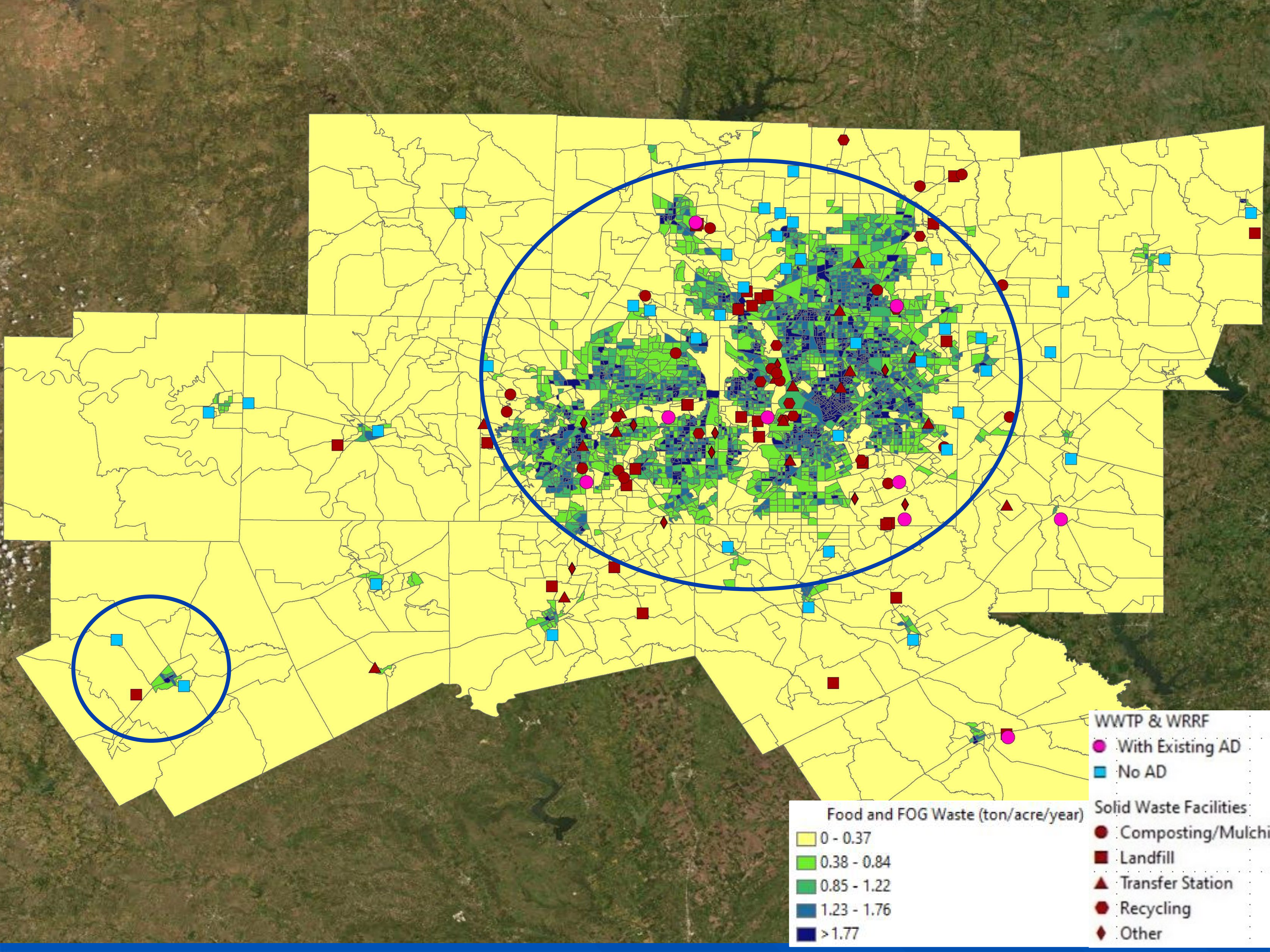
POTENTIAL RNG SUPPLY



NGV FUEL DEMAND

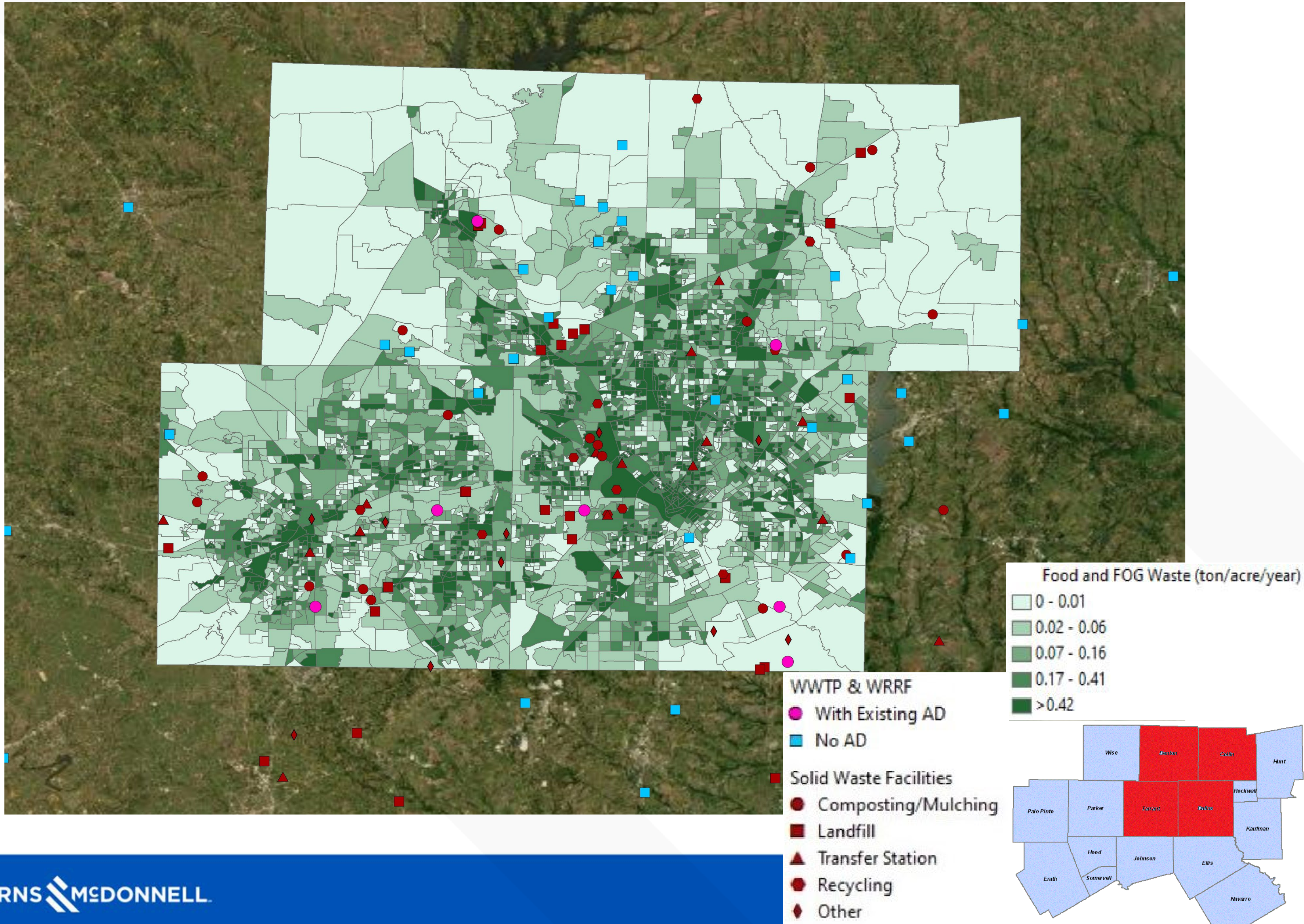


- Location of supply of high priority feedstocks (commercial and residential food waste) and demand from NGVs indicate Collin, Dallas, Denton, and Tarrant Counties as focus areas for further evaluation
- Location of supply of medium priority feedstocks (CAFO manure) indicates Earth County as a focus area for further evaluation

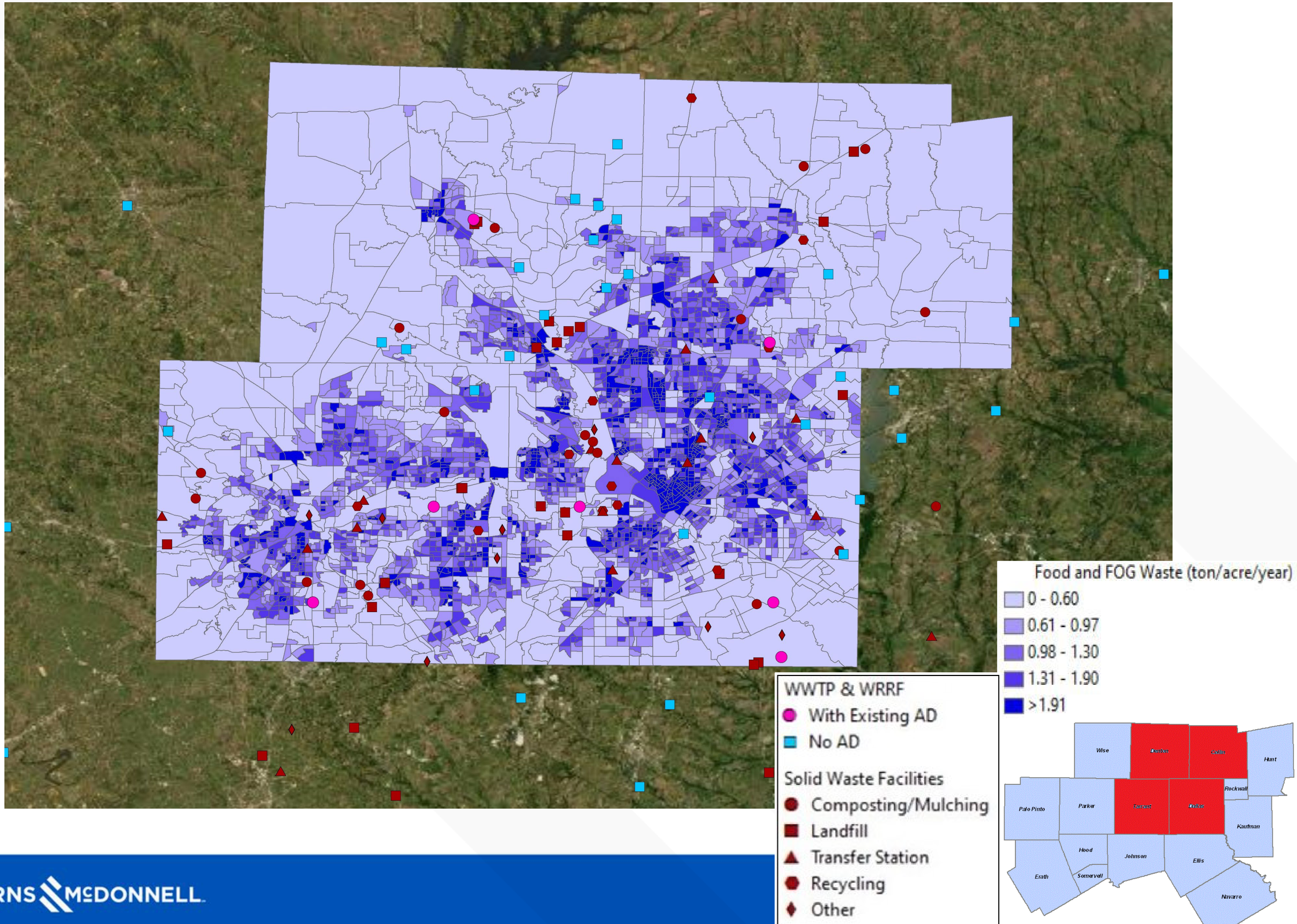


WWTP & WRRF
With Existing AD
No AD
Solid Waste Facilities
Composting/Mulchi
Landfill
Transfer Station
Recycling
Other
Food and FOG Waste (ton/acre/year)
0 - 0.37
0.38 - 0.84
0.85 - 1.22
1.23 - 1.76
> 1.77

Select Subsectors of Commercial Food Waste; FOG



Residential & Commercial Food Waste; FOG



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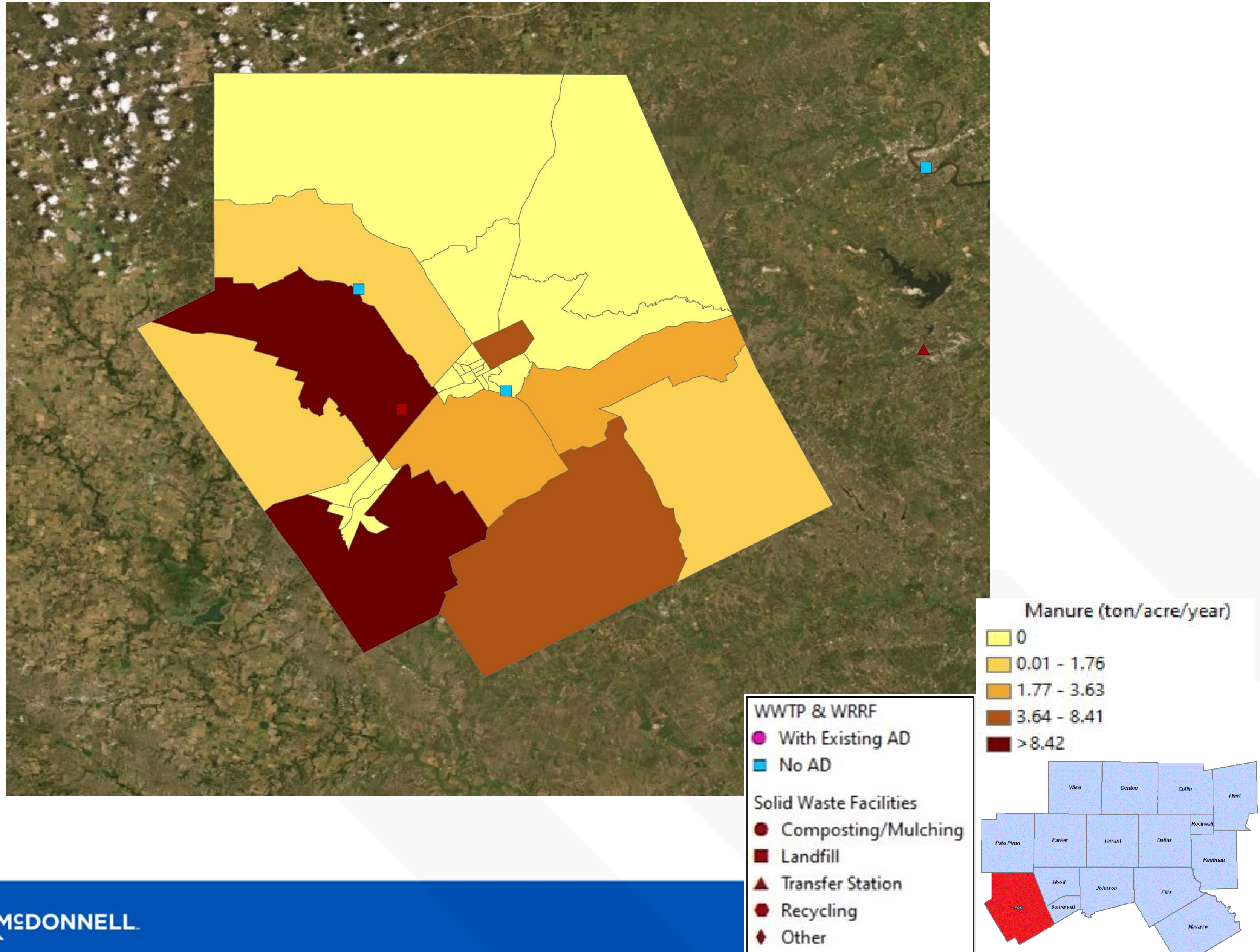
Erath County CAFO Manure

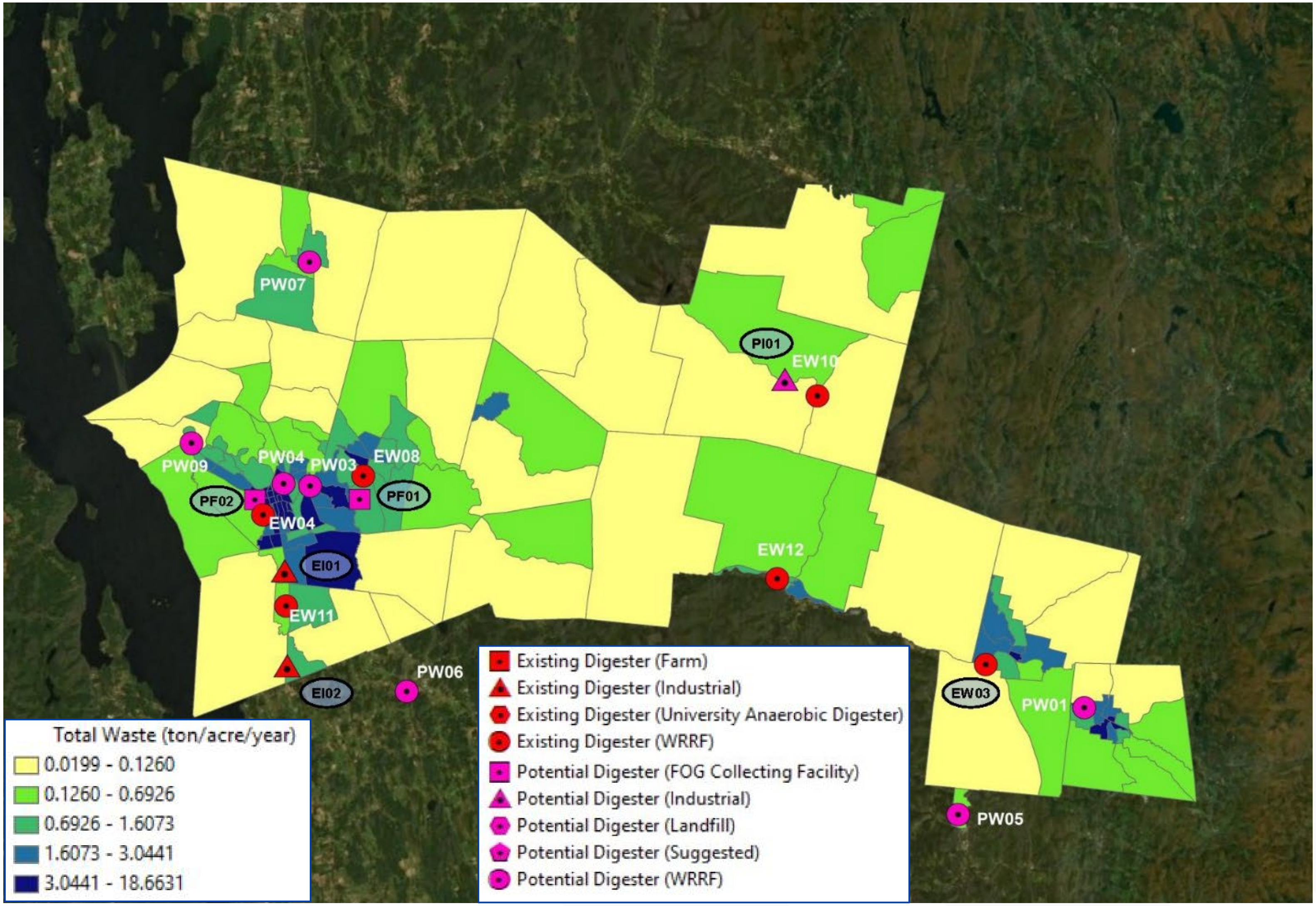


Optimization Tool Generates “Long List”

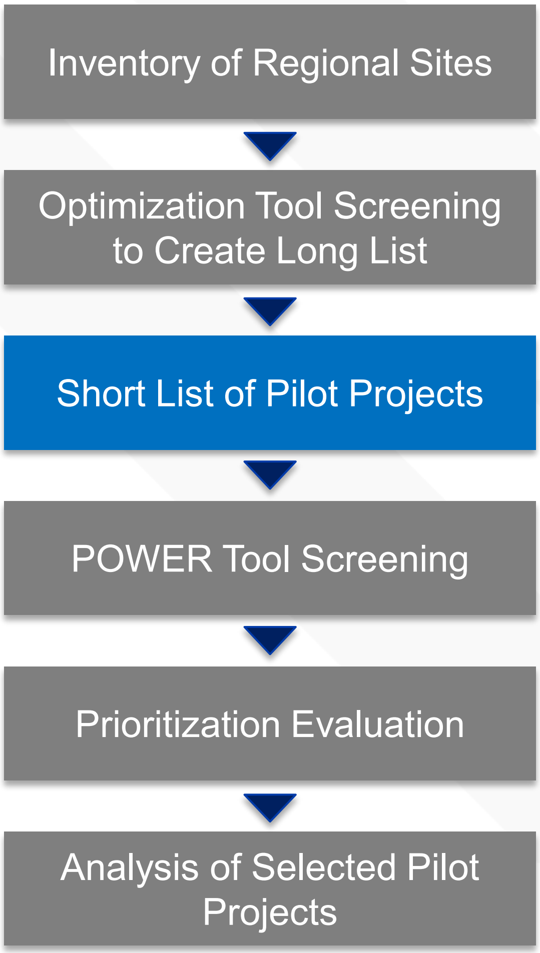
- Inventory of Regional Sites
- **Optimization Tool Screening to Create Long List**
- Short List of Pilot Projects
- POWER Tool Screening
- Prioritization Evaluation
- Analysis of Selected Pilot Projects

- Determine optimal facility locations for each scenario
  - Based on facility type and distance to critical mass of feedstock generation
- Optimization tool creates “Long List” of locations for each scenario
  - Commercial food waste and FOG
  - Residential & commercial food waste and FOG
  - CAFO Manure
- Each potential location/project type further screened

Example Optimization Results from State of Vermont

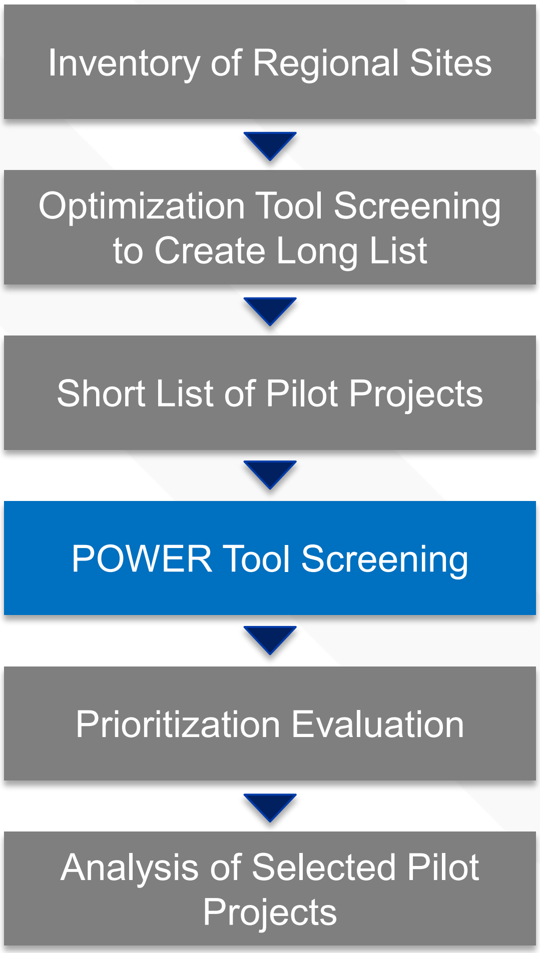


Generate “Short List” of Potential Pilot Projects



- Additional high-level engineering, operational, and economic screening to identify locations:
  - Access to feedstock
  - Land use/zoning
  - Proximity to floodplains
  - Roadway and pipeline infrastructure
  - Supporting solid waste infrastructure
  - Distance to NGV fuel demand
- Identify 3-4 locations that meet needs of a viable AD pilot project

POWER Tool Provides Initial Evaluation



- POWER Tool evaluates key project criteria
  - Facility capacity
  - Biogas output and electricity/fuel generation
  - GHG emissions
  - Capital expenses
  - Operating expenses
  - Air pollutant emissions
- Project Team will run POWER Tool for each identified pilot project

Prioritization Builds on POWER Tool Results

Inventory of Regional Sites

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Optimization Tool Screening to Create Long List

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Short List of Pilot Projects

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POWER Tool Screening

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Prioritization Evaluation

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Analysis of Selected Pilot Projects

- Prioritization evaluation criteria include
  - Distance to existing collection networks
  - Proximity to NGV fleets
  - Availability of utility interconnections
  - Distance to solid waste infrastructure
- Environmental Justice considerations including
  - Income
  - Race
  - English proficiency

Project Assessments Describe Projects

- Inventory of Regional Sites
- Optimization Tool Screening to Create Long List
- Short List of Pilot Projects
- POWER Tool Screening
- Prioritization Evaluation
- **Analysis of Selected Pilot Projects**

- Project assessments provide comprehensive development considerations of each project Funding/financing considerations
  - Estimated costs and revenues
  - Infrastructure requirements
  - Local biogas utilization opportunities

Next Steps

- Complete optimization evaluation and advance screening process
- Hold additional workshop to review results of the optimization and initial screening
- Complete evaluation of identified pilot projects assessments including financial and contracting considerations
- Hold workshop #4 – Feasibility Study conclusion in mid-August time-frame

THANK YOU!

CREATE AMAZING.