Septage Management in Vermont

Josh Burns, Vermont DEC
Bill Brower, Brown and Caldwell

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Agenda

1. Project Background and Drivers
2. Survey Review
3. Septage Projection and Receiving Data Analysis Discussion
4. Recommendations

Project Background and Drivers

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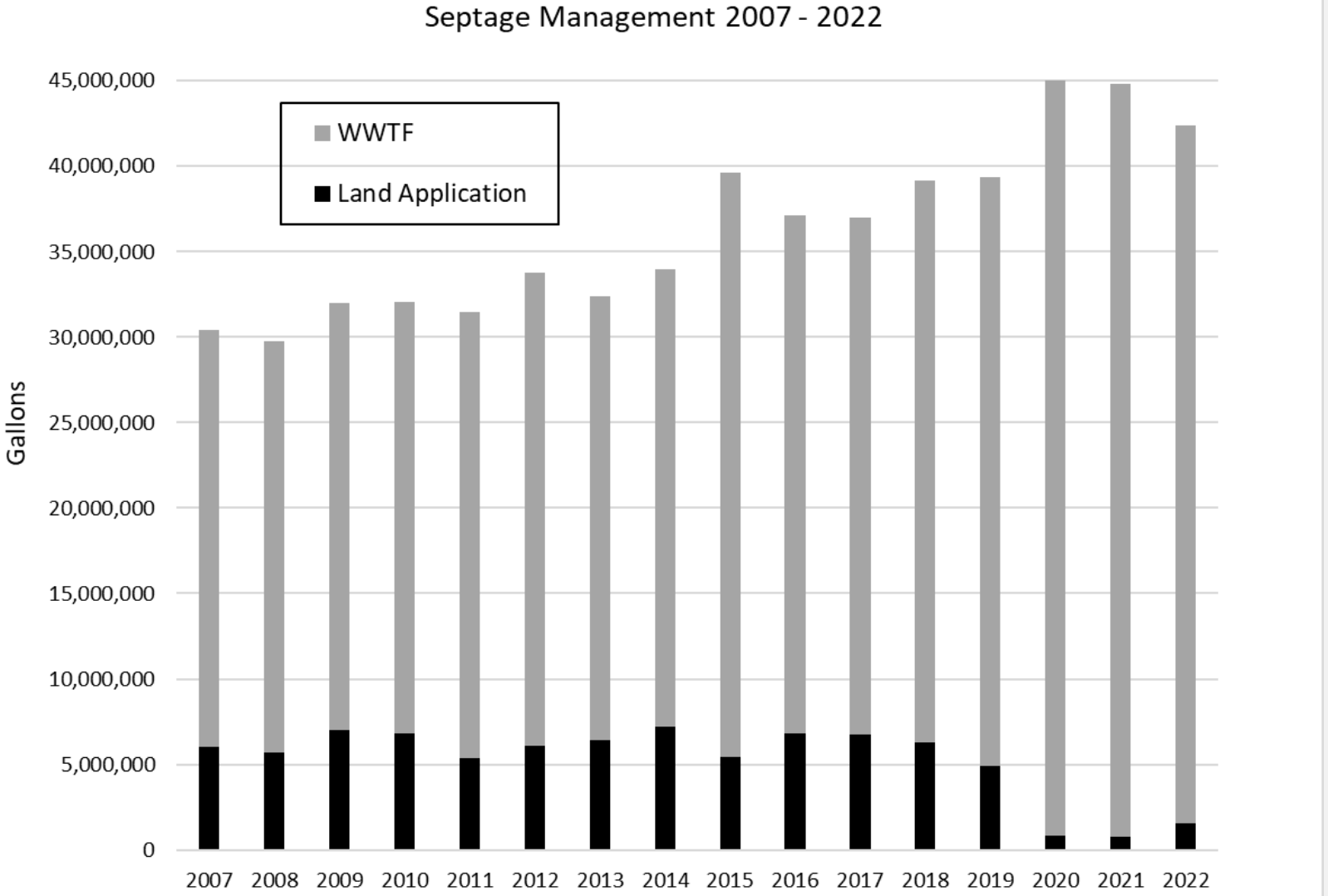
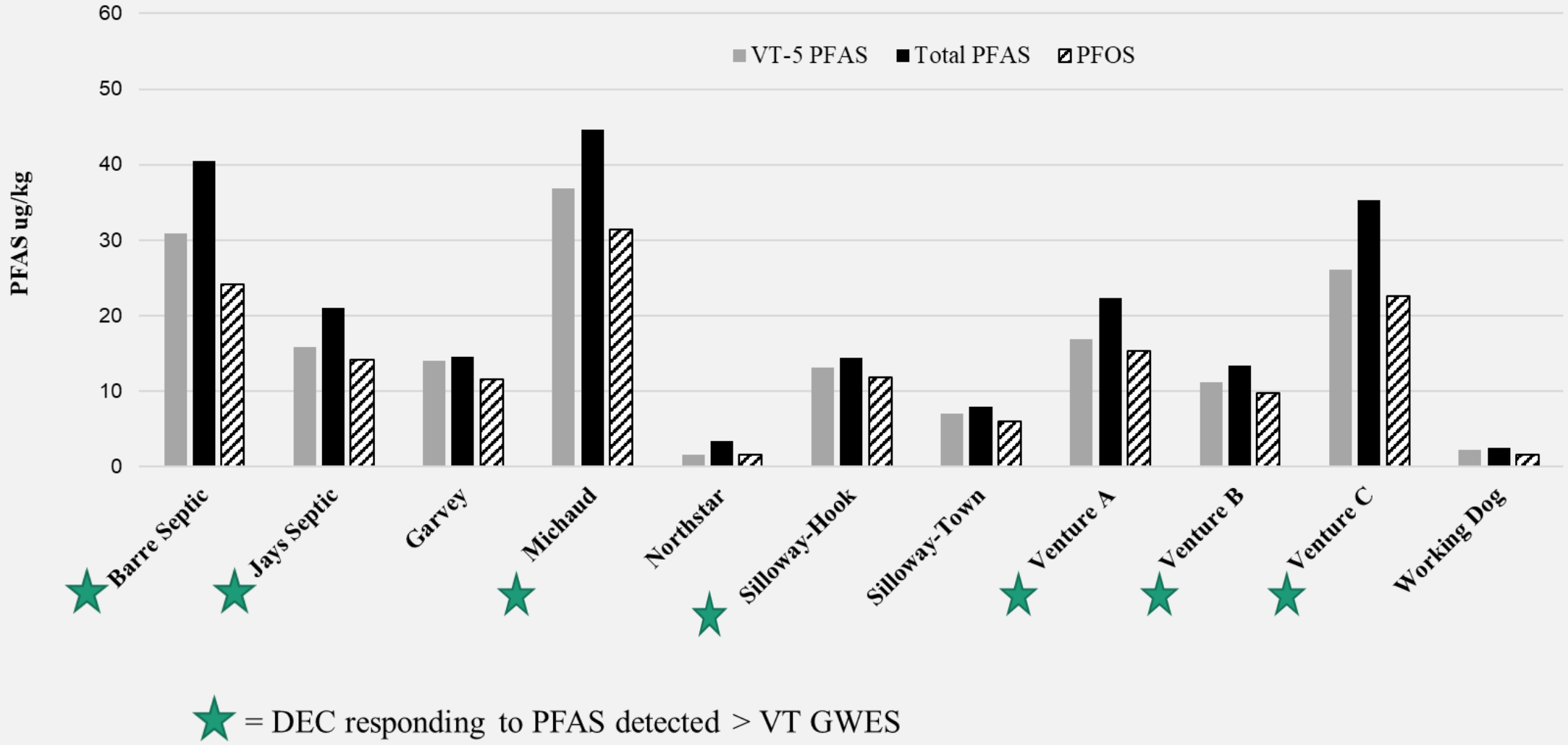
2021 Vermont Septage Management Statistics			
Management Option	**In-State**	**Out-of-State**	**Totals**
Volume (Gallons)			
Land Application	702,484	81,275	783,759
Wastewater Treatment Facility Disposal	39,908,558	3,329,358	43,237,916
Total	40,611,042	3,410,633	44,021,675
Percentages			
Land Application	1.6	0.2	1.8
Wastewater Treatment Facility Disposal	90.7	7.6	98.2
Total	92.3	7.7	100.0

2022 Vermont Septage Management Statistics			
Management Option	**In-State**	**Out-of-State**	**Totals**
Volume (Gallons)			
Land Application	1,552,100	27,800	1,579,900
Wastewater Treatment Facility Disposal	37,528,504	3,287,511	40,816,015
Total	39,080,604	3,315,311	42,395,915
Percentages			
Land Application	3.7	0.1	3.8
Wastewater Treatment Facility Disposal	88.5	7.8	96.3
Total	92.2	7.8	100.0

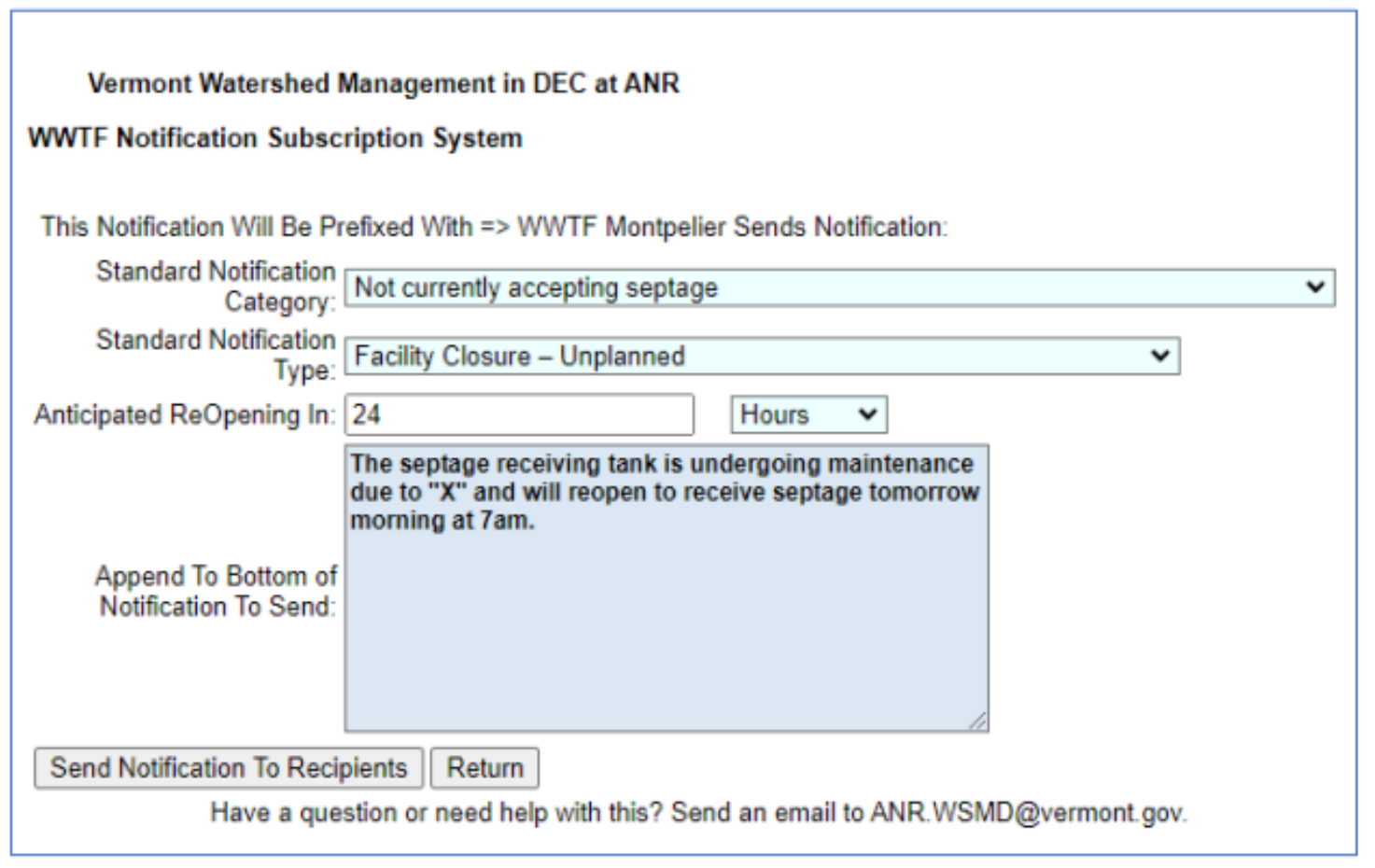

Septage Management 2007 - 2022
45,000,000
40,000,000
35,000,000
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
Gallons
WWTF
Land Application
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022

Total PFAS (ppb) in Shallow Soils at Domestic Septage Land App Sites (2019-2022)



★ = DEC responding to PFAS detected > VT GWES

Vermont Waste Hauler Notification System



Vermont Watershed Management in DEC at ANR

WWTF Notification Subscription System

This Notification Will Be Prefixed With => WWTF Montpelier Sends Notification:

Standard Notification Category: Not currently accepting septage

Standard Notification Type: Facility Closure – Unplanned

Anticipated ReOpening In: 24 Hours

Append To Bottom of Notification To Send:

The septage receiving tank is undergoing maintenance due to "X" and will reopen to receive septage tomorrow morning at 7am.

Send Notification To Recipients | Return

Have a question or need help with this? Send an email to ANR.WSMD@vermont.gov.

Project Overview

- Identified septage management concerns in Vermont
- Project goal: Complete a study with the State of Vermont DEC to meaningfully impact DEC's future decision-making process about septage management in Vermont

Surveys

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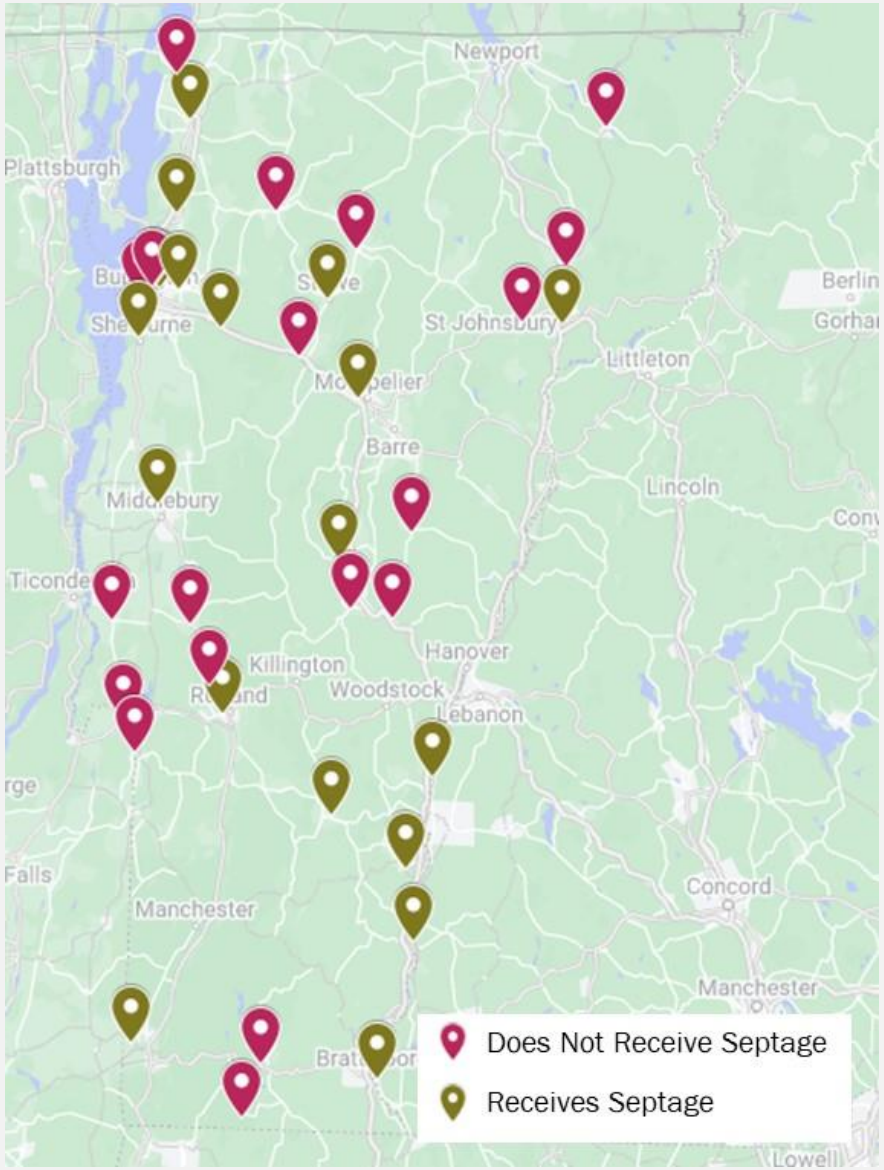
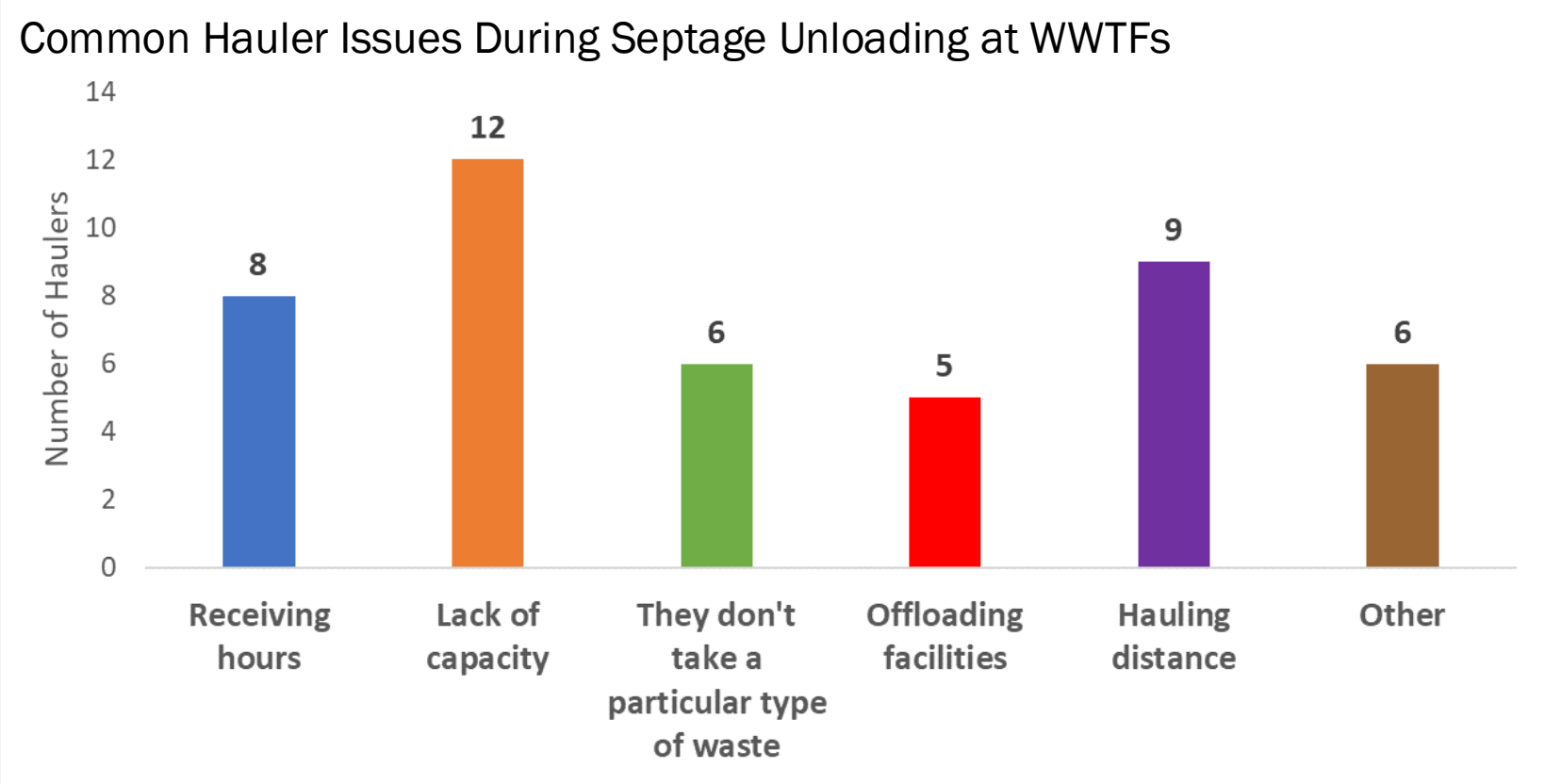
Wastewater Treatment Facility Survey

- 78 POTWs sent survey
- 38 response received (including all 20 that accept septage)
- Some questions asked:
  - If currently accept septage
  - Tip fees
  - Average annual budget
  - Average annual flow
  - Intentions to expand
  - Intentions to change septage program



Septage Hauler Survey

- 36 haulers sent survey
- 19 response received (VT & NH)
- Some questions asked:
  - Common issues during drop off
  - Max tip fees
  - Max hauling distances
  - Types of waste collect
  - Counties they service



Septage Projection and Receiving Data Analysis Discussion

- Geographical Model
- Alternatives Evaluation
  - Economics
  - Non-economic

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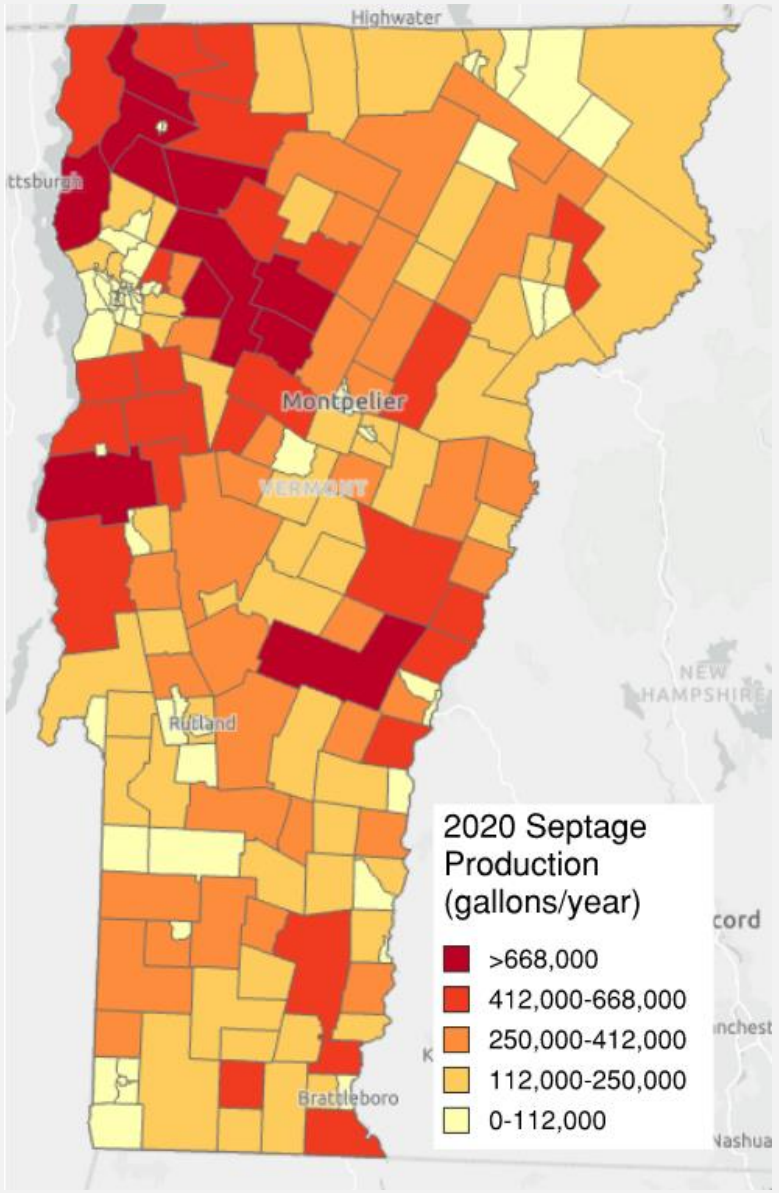
Septage Production Estimates

Estimate septage production and septic-served population at tract level to facilitate geographic modeling.

Approach:

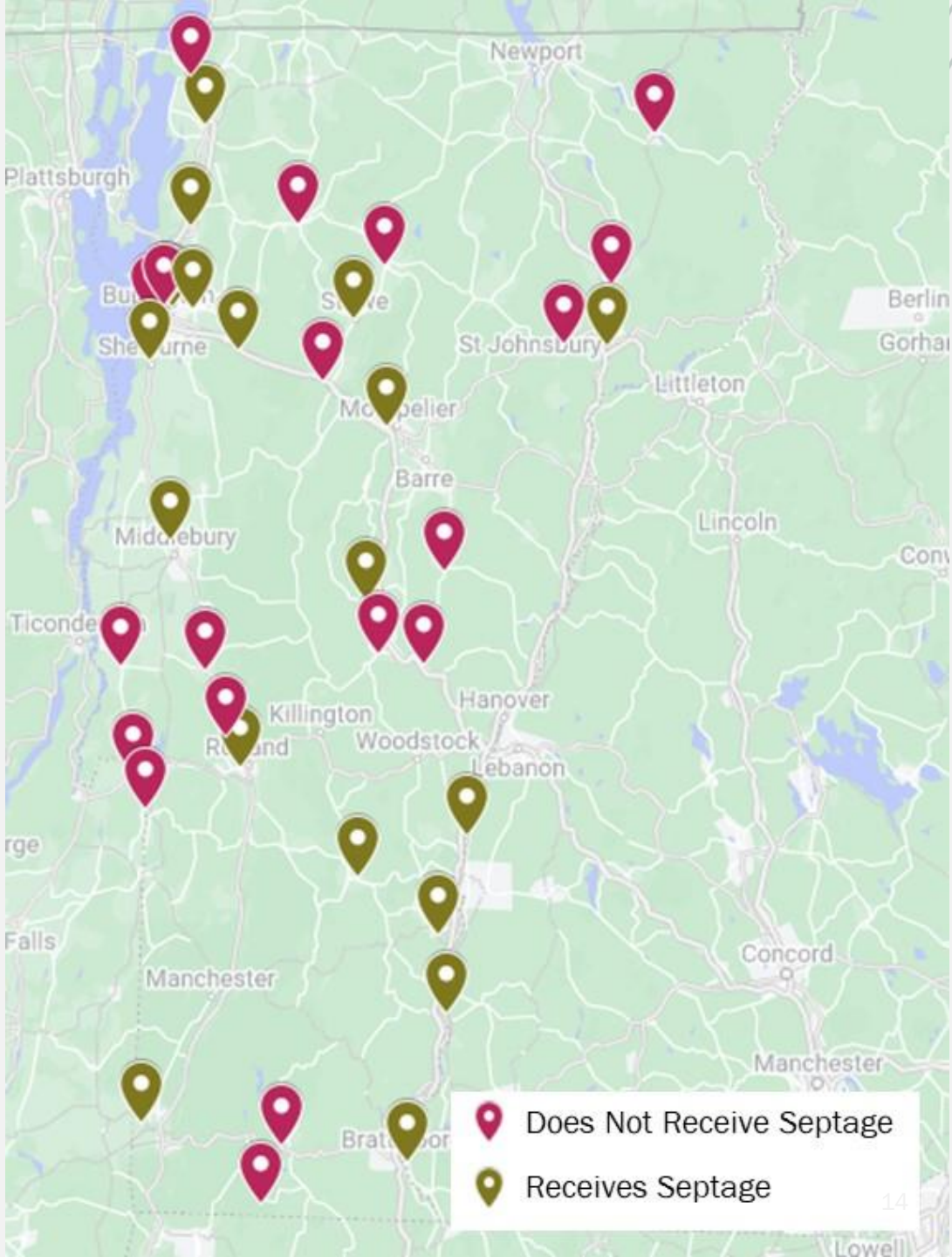
- Used installed, permitted septic systems to calculate relative distribution/septage contribution by tract across the state
- Applied distributions (%) to the max total septage produced to get septage produced per tract
- Used a conversion factor to estimate septic-served people by tract



WWTF Receiving Capacity Estimates

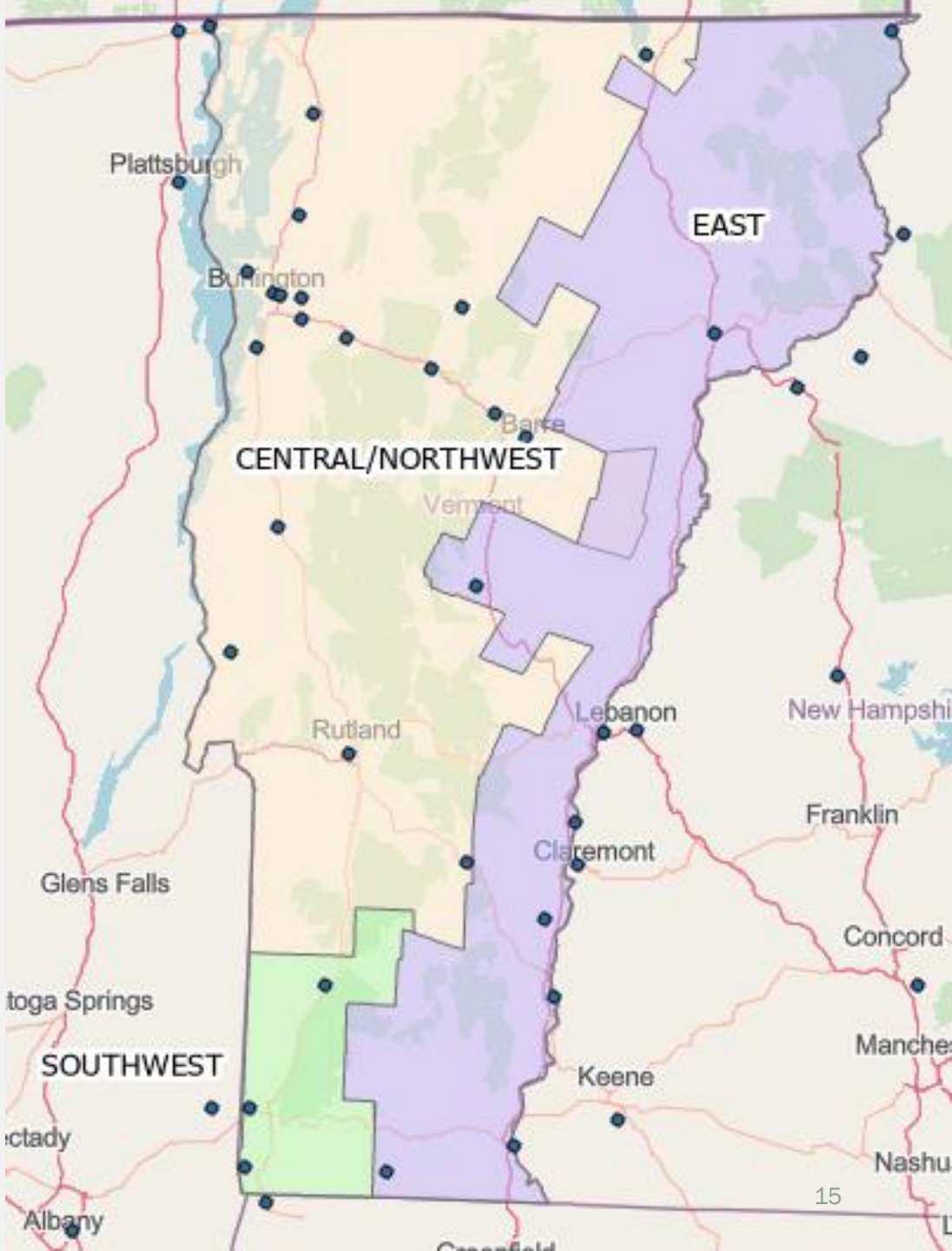
Estimate maximum septage receiving capacity by WWTF to facilitate geographic modeling and economic analysis

- Approach: Use weekly influent BOD data to evaluate current BOD usage and estimate additional receiving capacity
- Validated data: Use hauling data and survey results



Regions With Different Strategies & Priorities

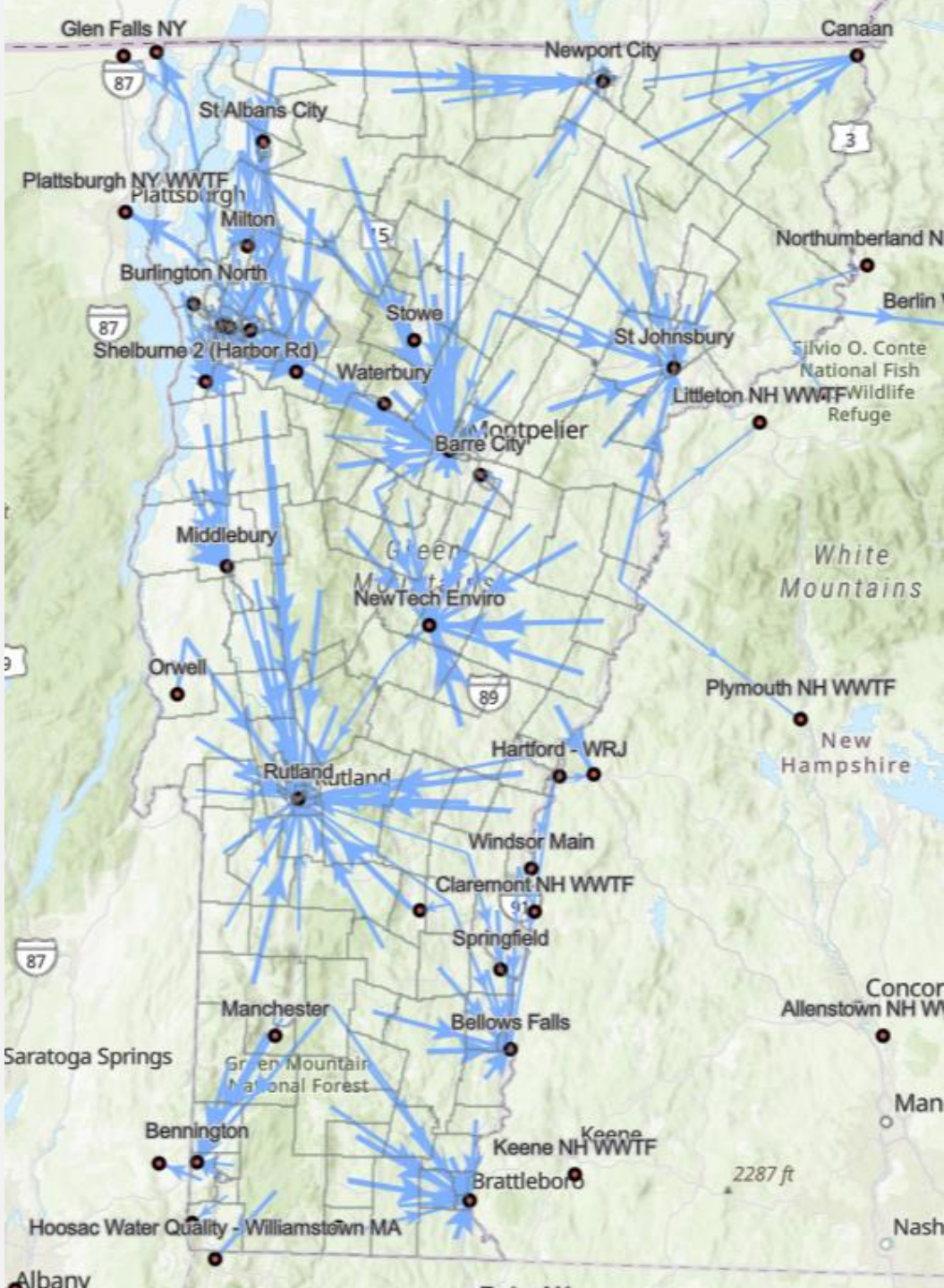
- Central/Northwest: Fairly connected; pressing needs
- Southwest: Primarily Bennington
- East: Very little redundancy in-state



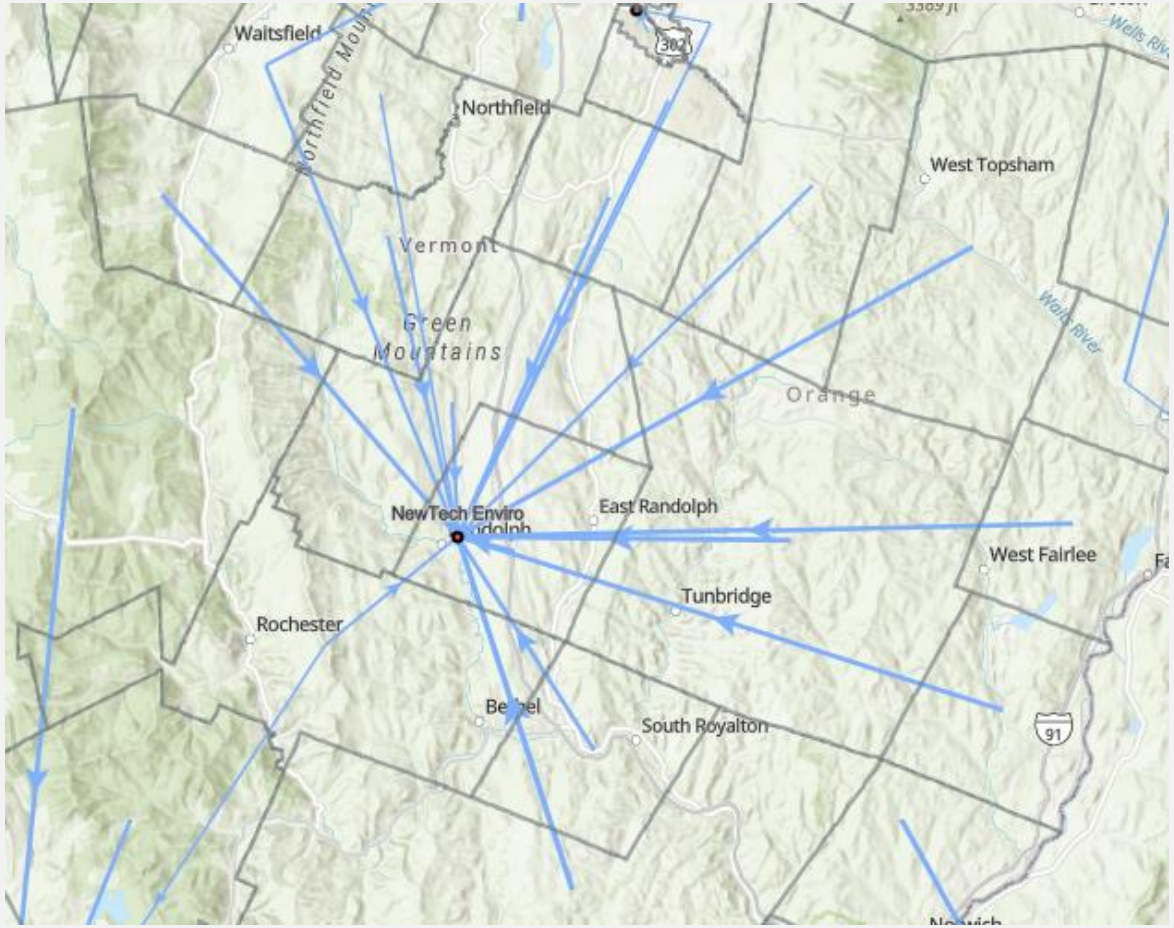
Alternatives Development

Region	Location	Optimization Type
Northwest-Central	St. Albans	Merchant facility
Northwest-Central	Milton	Pre-processing facility
Northwest-Central	Richmond	Pre-processing facility
Northwest-Central	Williston/Essex Junction	Merchant facility
Northwest-Central	Montpelier	Optimized septage receiving
Northwest-Central	Stowe	Pre-processing facility
Northwest-Central	Waterbury	Merchant facility
Southwest	Bennington	Optimized septage receiving
Southwest	Manchester	Pre-processing facility
Northeast	St. Johnsbury	Optimized septage receiving
Southeast	Springfield	Optimized septage receiving

Geographical Model – Current



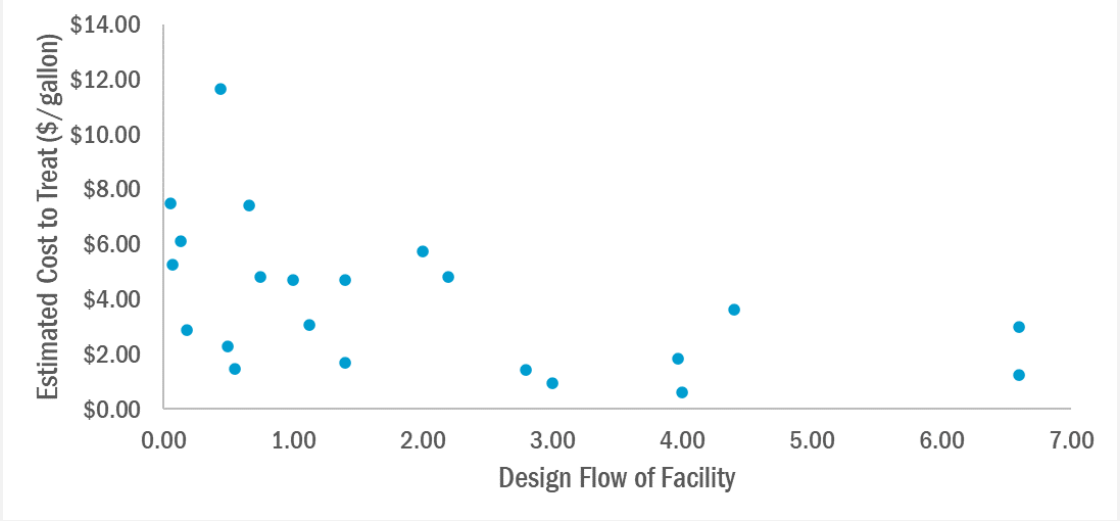
Geographical Model

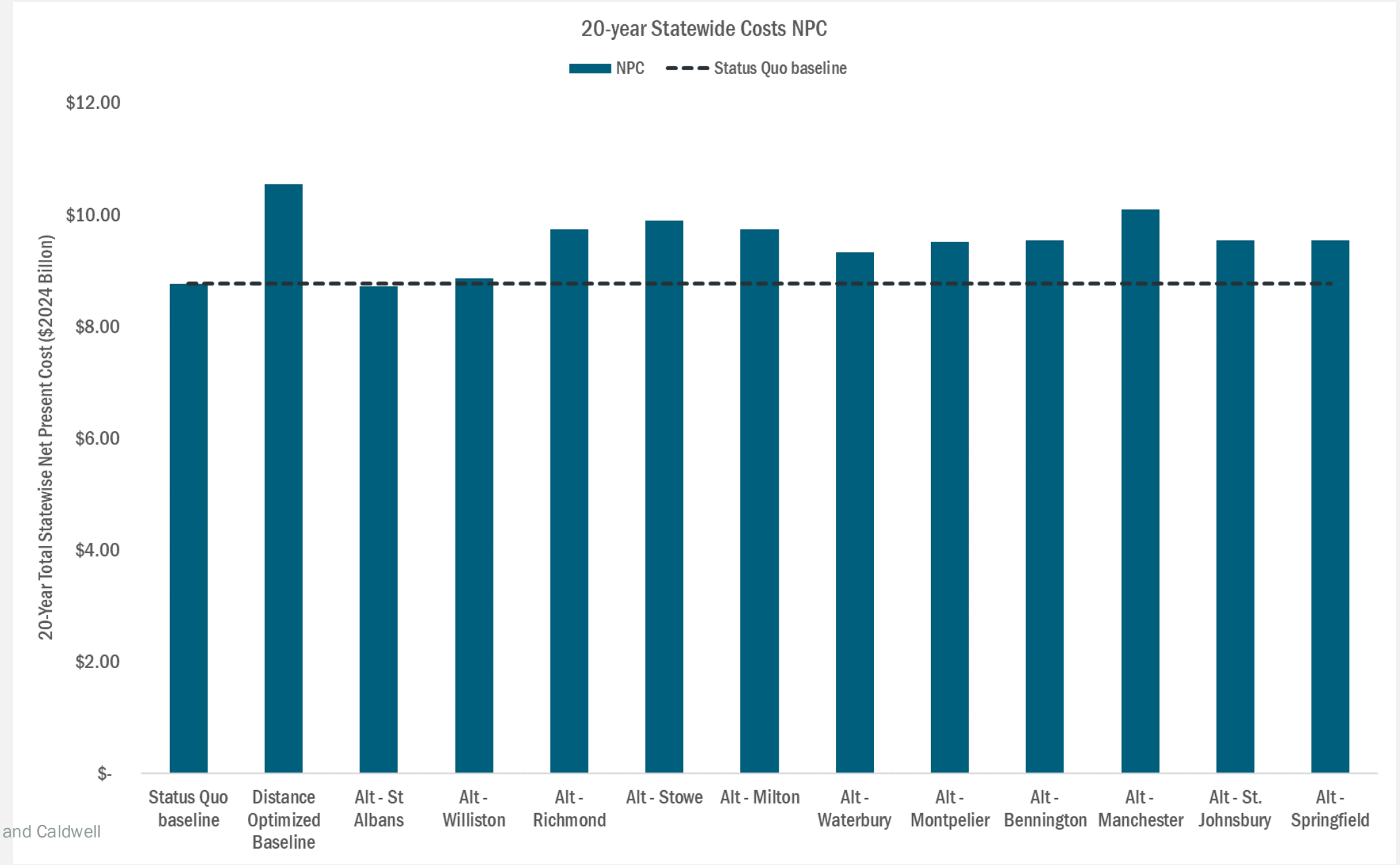


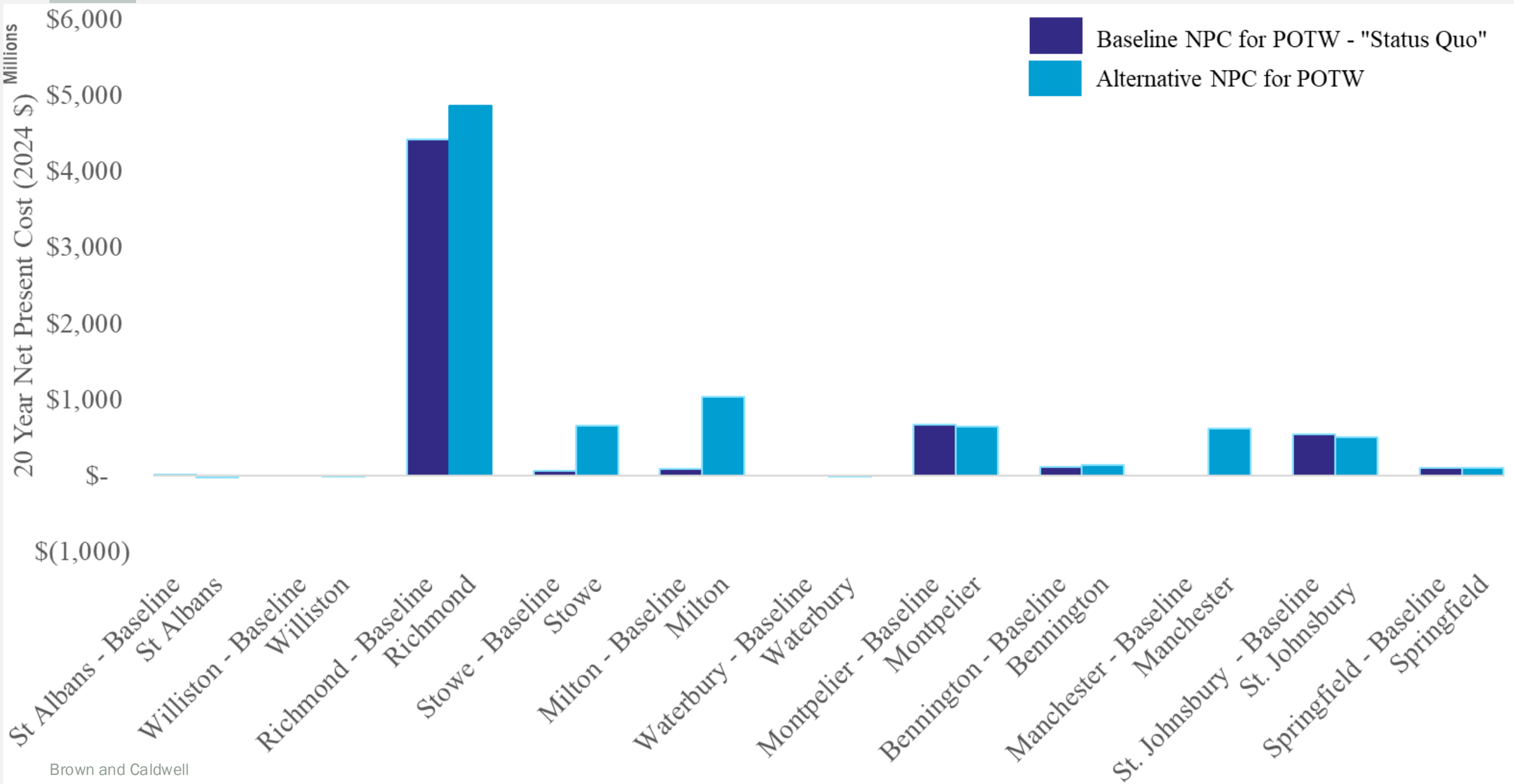
Business Case Evaluation Overview

- 20-year Net Present Cost (NPC)
  - AACE Class 5 capital cost estimates (-50% ± 100%)
  - O&M based on estimated Cost to Treat
  - Tip fee range $0.065 to $0.48 per gallon

- Assumptions
  - 4.2% Escalation Rate (OMB Circular A-94)
  - 2.2% Discount Rate (OMB Circular A-94)
  - Representative technology costs
  - Population projections discussed for capacity sizing

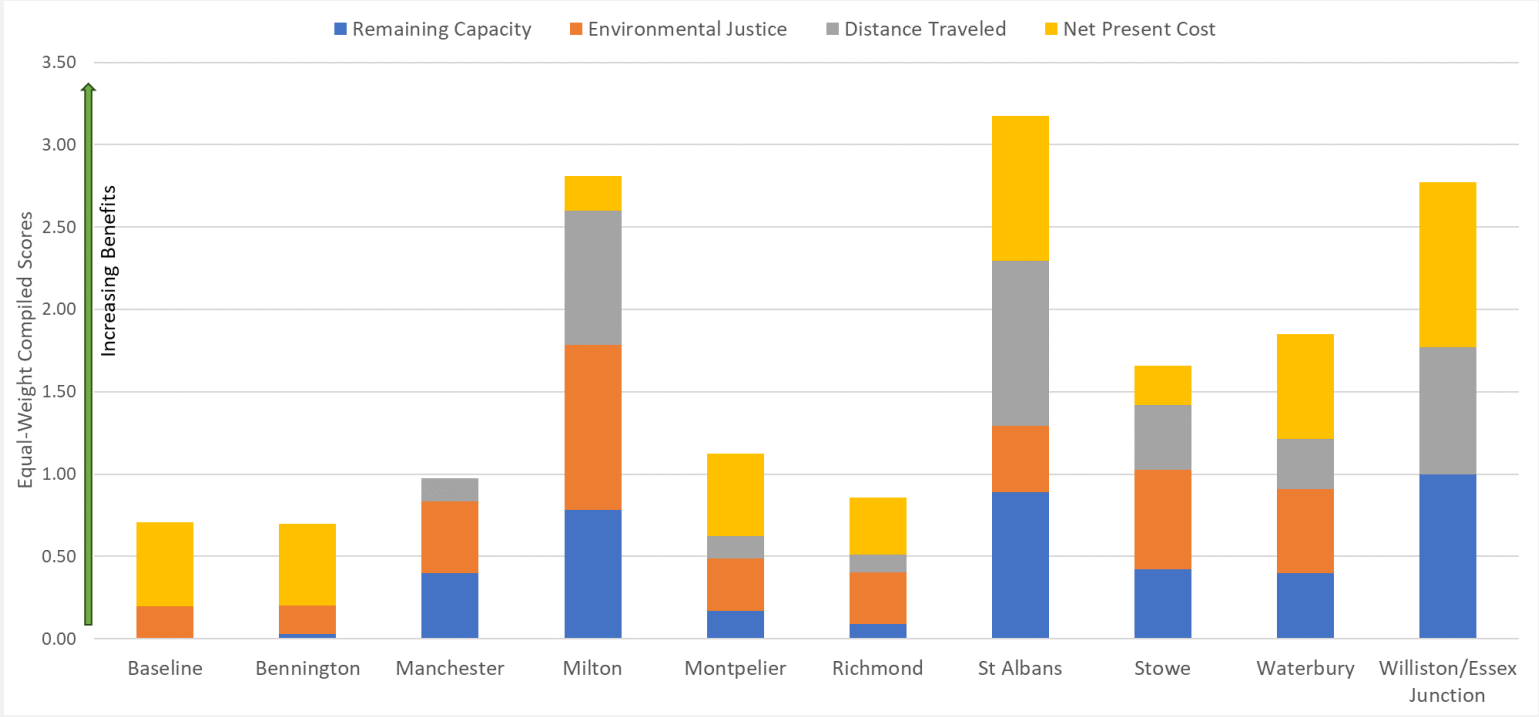



20-year Statewide Costs NPC
NPC
Status Quo baseline
$12.00
$10.00
$8.00
$6.00
$4.00
$2.00
$-
20-Year Total Statewise Net Present Cost ($2024 Billon)
Status Quo baseline
Distance Optimized Baseline
Alt - St Albans
Alt - Williston
Alt - Richmond
Alt - Stowe
Alt - Milton
Alt - Waterbury
Alt - Montpelier
Alt - Bennington
Alt - Manchester
Alt - St. Johnsbury
Alt - Springfield


Millions
20 Year Net Present Cost (2024 $)
$6,000
$5,000
$4,000
$3,000
$2,000
$1,000
$-
$(1,000)
Baseline NPC for POTW - "Status Quo"
Alternative NPC for POTW
St Albans - Baseline
St Albans
Williston - Baseline
Williston
Richmond - Baseline
Richmond
Stowe - Baseline
Stowe
Milton - Baseline
Milton
Waterbury - Baseline
Waterbury
Montpelier - Baseline
Montpelier
Bennington - Baseline
Bennington
Manchester - Baseline
Manchester
St. Johnsbury - Baseline
St. Johnsbury
Springfield - Baseline
Springfield

Alternatives Scoring

- Total Driving Distance
- Septage Receiving Buffer Capacity
- Environmental Justice Impact
- Net Present Cost



Recommendations

- St. Albans – merchant facility
- Milton – pre-processing facility
- Williston/Essex Junction – merchant facility
- Manchester – pre-processing facility
- Bennington – optimized receiving facility

Conclusions

- VT has enough statewide capacity on paper
  - But it is localized and not accessible to all geographies
- Northwest regional capacity can be increased by increasing capacity at St. Albans, Milton, and/or Williston/Essex Junction via pre-processing and/or a merchant facility
- Any reduction to Richmond's capacity to accept septage will significantly impact the Northwest region's septage capacity
- Eastern and Southern regions of State typical rely on single POTW or out of state with no to limited contingencies
- Septage processing does not appear to be cost effective for POTWs at current tip fees*

*a detailed cost analysis would need to be performed for each POTW to confirm

Special Thanks!

VT DEC

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- Gillian Avruskin
- Natalie Sierra
- Matt Davis
- Kevin Torrens
- Colin O’Brien
- Deb Mahoney

Thank you.

Questions?

Joshua Burns

Joshua.Burns@vermont.gov

(802)585-5040

Bill Brower

BBrower@brwncald.com

(585)532-9996

Brown AND Caldwell

Bull pen

Population Projections

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Population Projections

Population Trends:

- From 2010 and 2020, VT population increased by 3% (~17,300 people)
- New 3% settled in rural environments
- 4% of urban Vermonters (~17,500) moved to rural areas
- Since 2020, state population has increased 0.6% (=3% increase in 10 years)

Projection Approach: Septic populations will increase 0.9% per year

	Total Population	Urban Population	Urban (% of state)	Rural Population	Rural (% of state)
2010	625,741	243,385	38.9%	382,356	61.1%
Change	17,336	-17,535 (-7.2%)	-3.8%	34,871 (9.1%)	3.8%
2020	643,077	225,850	35.1%	417,227	64.9%

Septage Characteristics

Typical Septage Characteristics														
Parameters	Units	Reference 1			Reference 2	Reference 3	Reference 4	Reference 5	Reference 6	Reference 7			Average	Range
		Min	Average	Max						Min	Average	Max		
pH	s.u.	6.9	7.3	7.7	6.9 to 7.5	--	--	--	--	1.5	--	12.6	5.5	1.5 to 12.6
BOD	mg/L	--	--	--	165 to 1,107	--	--	--	6,500	440	6,480	78,600	6,490	165 to 78,600
COD	mg/L	20,020	46,255	60,763	181 to 9,315	--	--	--	32,000	1,500	31,900	703,000	36,718	181 to 703,000
Ammonia as N	**mg/L**	**175**	**308**	**441**	**5 to 155**	--	--	--	**100**	**3**	**97**	**116**	**168**	**3 to 441**
TKN	mg/L	--	--	--	9 to 525	--	--		600	66	588	1,060	588	9 to 1,060
Total Phosphorus	mg/L	469	606	810	--	--	--	--	210	20	210	760	210	20 to 810
Phosphate as P	**mg/L**	**36**	**48**	**60**	**5.4 to 24.2**	--	--	--	--	--	--	--	**606**	**5.4 to 60**
TS	mg/L	--	--	--	328 to 23,028	213,000	23,900	18,700		1,132	34,106	130,475	34,100	328 to 130,475
TSS	**mg/L**	**6,704**	**26,955**	**45,020**	**76 to 13,444**	--	--	--	**13,000**	**310**	**12,862**	**93,378**	**12,862**	**76 to 93,378**
VSS	mg/L	--	--	--	212 to 11556	--	--	--		95	9,027	51,500	9,027	95 to 51,500
Oil and Grease	mg/L	--	--	--	264 to 82,320	--	--		5,500	208	5,600	23,368	5,600	208 to 82,320
PFOA	**ng/g**	--	--	--	--	**11.18**	--	--	--	--	--	--	**11.18**	**0.822 to 49.6**
PFOS	**ng/g**					**16.42**							**16.42**	**1.24 to 70.8**
PFAS (sum of 6)	**ng/g**	--	--	--	--	**25.53**	--	--	--	--	--	--	**25.53**	**2.23 to 85.6**

1. Troesch, S., Lienard, A., Molle, P., Merlin, G. and Esser, D., 2009. Treatment of septage in sludge drying reed beds: a case study on pilot-scale beds. Water Science and Technology, 60(3), pp.643-653.
2. Al-Sa'ed, R.M. and Hithnawi, T.M., 2006. Domestic septage characteristics and co-treatment impacts on Albireh wastewater treatment plant efficiency. Dirasat: Engineering Sciences, 33(2), pp.187-198.
3. Regional Facilities in Maine (Maine Department of Environmental Protection, EGAD (Environmental and Geographic Analysis Database), https://www.maine.gov/dep/maps-data/egad/March 3rd, 2023).
4. State of Vermont Report, 2018
5. State of Vermont Report, 2018
6. USEPA, 2018. https://www.epa.gov/sites/default/files/2018-11/documents/guide-septage-treatment-disposal.pdf
7. USEPA, 2018

Assumptions: 6,500 mg/L BOD for septage; only residential WW and septage at WWTF

WWTF On-site Septage Storage

Allow on-site septage storage at WWTFs.

- Increase holding capacity on-site
- Maximize efficiency during high flows
- Decrease hauling to alternative facilities
- Additional storage availability during process or equipment malfunctions
- Potential revenue source for facilities

Upgraded WWTF Receiving Capability

Upgrade WWTF receiving capabilities and capacity via process improvements.

Potential Upgrades to Include:

- Card reader
- Screening
- Storage
- Multiple lanes of receiving

Regional Septage Transfer Station

Build a regional septage transfer station, which would accept, consolidate, and pre-treat septage to reduce hauling costs.

Would Include:

- Screening
- Primary treatment (clarifiers or DAFT)
- Send liquids via sewer to closest WWTF
- Haul concentrated solids to WWTF
  - Feed to digester
  - Dewater and send to landfill

Merchant Facility

Build a merchant facility in a geographically optimized location with third-party septage handoff.

Capital Costs

Table 4-3. Summary of Capital Costs		
Facility	Capital Costs [1]	O&M Estimates [2]
Merchant Facility[3]	0	0%
Optimized Receiving Facility	$4.2M	10%
Pre-processing Facility	$11.0M	12%

[1] Capital cost are planning-level estimates
[2] Annual O&M costs as a percent of the total capital cost estimate
[3] These are costs to non-private entities

Septage Production Estimates, deeper dive

Assumptions:

- Total annual production/disposal = 45 million gallons (2020 hauling data)
- 55% of VT population on septic
- Key Assumption: By tract, distribution of septic systems in the permit program is similar enough to distribution of septic systems pre-permit
  - Distribution means: Tract 1 = 12%, Tract 2 = 51%, Tract 3 = 37%
  - I.e., Distribution of non-permitted systems is the same as permitted systems, across the tracts