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To: Eamon Twohig, Program Manager

From: Tracy Chouinard, PhD

Prepared by:

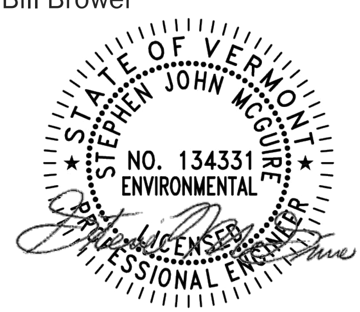
Persephone Ma, PhD

Tracy Chouinard, PhD

Reviewed by:

Natalie Sierra

Bill Brower



Signer Name: Stephen McGuire
Signing Reason: I approved this document.
Signing Time: 2024-04-29 11:19:43(PDT)

Steve McGuire, PE

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AACEI	Association for the Advancement of Cost Engineering International
BC	Brown and Caldwell
BOD	biological oxygen demand
CWSRF	VT's Clean Water State Revolving Fund
Ecology	Washington State Department of Ecology
EGLE	(Michigan Department of) Environment, Great Lakes, and Energy
EJ	environmental justice
EPA	Environmental Protection Agency
mg/L	milligram per liter
MGD	million gallons per day
MPCA	Minnesota Pollution Control Agency
NPC	net present cost
O&M	operational and maintenance
OWTS	onsite wastewater treatment systems
POTW	publicly owned treatment works.
TM	technical memorandum
VT	Vermont
VT DEC	Vermont Department of Environmental Conservation
VTEDI	Vermont Environmental Disparity Index
UVM	University of Vermont
WIFIA	Water Infrastructure Finance and Innovation Act

Executive Summary

With approximately 55 percent of Vermont's (VT) population using onsite wastewater treatment systems (OWTS), or septic systems, proper management of septage is a critical waste management issue for the State with a unique set of challenges (USEPA 2015). These challenges were highlighted during the COVID-19 pandemic when increased demand for septage pumping, hauling and disposal at publicly owned treatment works (POTWs), or wastewater treatment facilities, revealed vulnerabilities in the current system. The Vermont Department of Environmental Conservation (VT DEC) engaged Brown and Caldwell (BC) to conduct a study to assess the State's septage management, considering a 20-year planning period. The goals of the study were to identify opportunities to bolster the existing septage management efficiency and capacity state-wide and to proactively prepare for anticipated changes within the State, such as population increases in rural areas.

To understand current and future septage trends, VT DEC and BC conducted a statewide survey of POTW operators and septage haulers. These surveys were used to ascertain information such as which POTW facilities currently received septage or would like to start to receive septage, what are the POTWs' average annual operating budgets, where haulers prefer to offload, and at what tip fee would they utilize another POTW. Results from the survey indicated a wide range of septage equipment condition, some requests and opportunities for state-level support, and concerns about lack of septage management capacity.

In addition to the survey, the BC team developed alternatives for improving septage management in Vermont. As part of this effort, BC developed a program to model septage transport from its approximate origin to a septage-receiving POTW with the intention of describing and visualizing septage movement throughout the State. Estimates of septage production and POTW septage receiving capacity were used to develop alternatives for improving septage management and produce geographic models of septage hauling and receiving alternatives for Vermont. Figure ES-1 summarizes septage production in the State.

During the analysis, it was found that inefficiencies in septage processing needs and facility receiving capacity had broad regional effects, specifically in the Northwest. Significant amounts of septage are produced around Burlington but the City of Burlington's POTWs either do not have septage receiving infrastructure or access to the facilities is challenging for haulers. These factors redirect septage towards the Town of Richmond POTW, located about 15 miles to the southeast, for processing. Richmond takes significantly more septage than would be expected for a facility its size. Even so, due to Richmond's septage processing capacity being consumed by regions further north, septage from regions east and south of Burlington and nearby Richmond can be displaced to the City of Montpelier POTW, 30 miles east, and potentially as far south as Rutland, 60 miles south of Burlington. Septage was not displaced further south due to both the impracticality of hauling septage that far, as well as Richmond and other regional facilities' abilities to absorb the extra septage. Fundamentally, POTWs that receive septage in the State of Vermont nominally have enough septage receiving and/or processing capacity to manage septage from the entire State. However, geography and physical transportation distances play a significant role in determining septage management, and septage receiving in local areas may not be able to meet the current or future demand for processing.

Three techniques for optimization were identified: (1) optimized septage receiving, which included 24/7 card-reader access, septage storage, and odor control, (2) a pre-processing facility with primary treatment and dewatering, and (3) a septage-only merchant receiving facility. From these data collected and analyzed, along with input from the VT DEC, the team developed alternatives to evaluate potential changes to Vermont's current septage management program. These alternatives were split into three regional areas to address regional challenges and trends: Northwest-Central, Southwest, and East. The alternatives modeled are presented in Table ES-1.

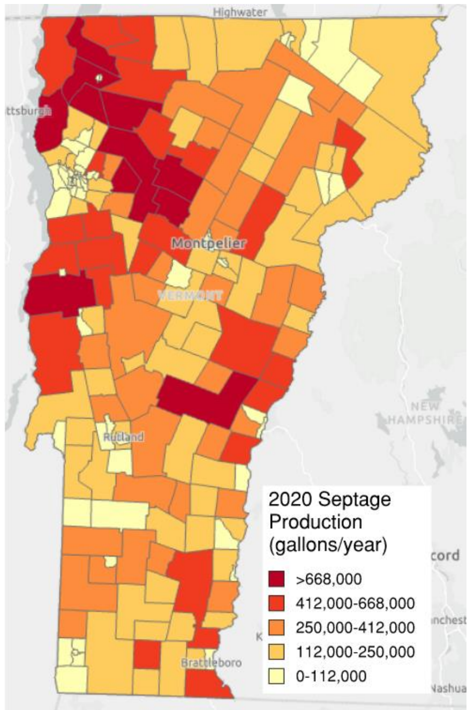

Figure ES-1. 2020 Septage Production Estimates, by US Census Bureau Tract.

Table ES-1. Septage Optimization Alternatives		
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

The approach, discussion, and results of the septage management alternatives were also presented in an ArcGIS Experience Builder dashboard. The dashboard contains geographic models of each of the alternatives and the economic and non-monetary metrics, along with supporting data and project context. The intention for the dashboard is to visually compare the modeled alternatives and their system-wide impacts on septage receiving. Additionally, the dashboard may be used by VT DEC to share the results of the project with other stakeholders and visually demonstrate the impacts of various scenarios.

The three alternatives for optimization were assessed economically assuming the basis for determining cost impacts for POTWs, state government, or other non-private entities. The costs considered in this analysis were only for non-private entities. Economically, treating septage at POTWs is not cost effective at current tip fees. Results from the economic analysis indicated that several POTWs would incur additional capital and operational expenditure, highlighting that implementing one of these solutions would cost the POTWs more money than their current operational budget. In this analysis, the 20-year life cycle net present cost of all septage-receiving POTWs in the State were calculated for each alternative and integrated into the considerations for recommendation.

In addition to the economics, non-monetary factors were calculated to quantify and compare the relative benefits of the alternatives. These factors include total distance traveled, environmental justice score, and remaining septage processing capacity in the system. These factors were chosen to reflect specific considerations of this project and calculated based on septage receiving quantities and changes in transportation described by the geographic models of each alternative. Total distance traveled is a representation of the efficiency of the state-wide septage processing approach, whereas remaining septage processing capacity reflects the system's ability to absorb increases in septage production. All factors were scaled relative to each other from zero to one, with zero being the least beneficial and one being the most beneficial. Figure ES-2 summarizes the compiled economic and non-monetary scores for the alternatives, the larger the bar, the greater the relative benefit for that alternative. For St. Johnsbury and Springfield, these values do not change because the OWTS regions near these POTWs are only served by that POTW and changes in capacity do not have state-level impacts measured by these metrics; therefore, St. Johnsbury and Springfield are not included in the figure below.

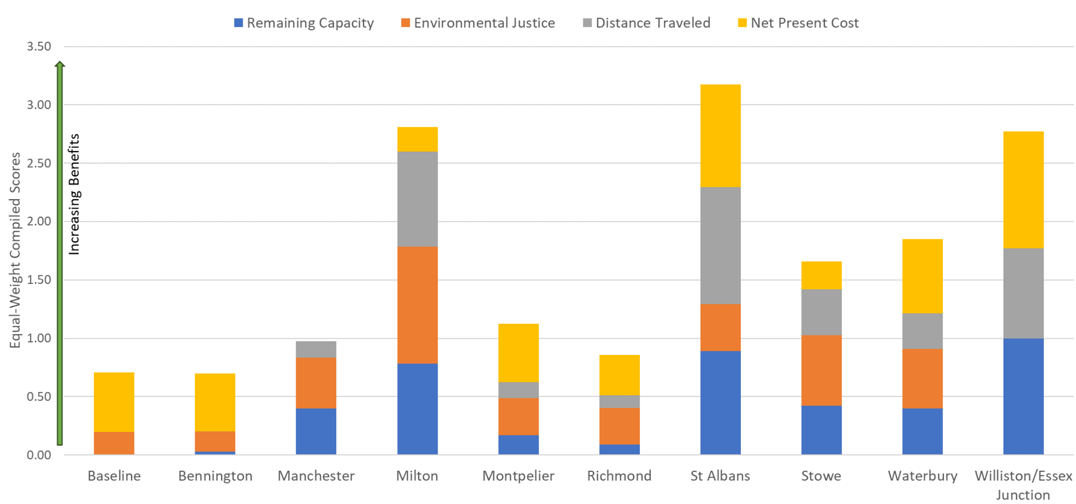

Figure ES-2. Equal-Weight Aggregate Scores for Modeled Alternatives.

To facilitate prioritization for further analysis and potential future funding, BC balanced the geographic analysis and economic and non-monetary considerations discussed above to develop a prioritization list. This list considers the general urgency of addressing the bottleneck in the Northwest-Central as well as the need to bolster overall septage management in the State for potential population and septage production increases. BC recommends further refinement and analysis of the following alternatives, in order:

1. St. Albans – Merchant facility
2. Milton – Pre-processing facility
3. Williston/Essex Junction – Merchant facility
4. Manchester – Pre-processing facility
5. Bennington – Optimized receiving facility

Additionally, BC recommends specific consideration of POTWs who serve specific and isolated geographic areas including St. Johnsbury, Brattleboro, Bellows Falls, and Bennington. Continuing discussions could include timing septage receiving and capacity improvements with upcoming upgrades and 20-year engineering evaluations or refined capacity estimates. Ultimately, this report outlines the data analysis, model logic, and alternatives approach and analysis to identify potential solutions to adjust inefficient hauling in the Northwest-Central, as well as opportunities to build in flexibility for potential stressors and future capacities as Vermont continues to grow.

Key highlights from the Vermont Septage Management Assessment are as follows:

1. Statewide capacity for septage processing meets Vermont's total septage production needs; however geographic and practical restrictions on septage hauling results in localized septage systems where capacity may be limited. For instance, the Northwest region of Vermont produces the most septage and needs additional septage receiving capacity.
2. Septage capacity increases in the St. Albans, Milton, and/or the Williston/Essex Junction areas could significantly bolster septage management and capacity in the Northwest region. Solutions could include expanded septage receiving facilities (storage, card reader, odor control, additional lanes), pre-processing facilities (screening, primary treatment, and dewatering), and/or merchant facilities.
3. The Richmond POTW processes significant amounts of septage for the Northwest region, considering its design capacity, and any substantial changes to the amounts of septage received will broadly impact the region.
4. The Southern and Eastern parts of the state often rely on out-of-state or single POTWs for septage treatment, without additional contingency options, e.g., Bennington. Adding additional capacity or strengthening the existing septage-receiving capabilities at these POTWs will add resiliency to those regions.
5. Septage receiving is not cost-effective at current tipping fees for POTWs because the cost to treat per gallon exceeds tipping fees. Sewer rate payers are currently subsidizing these costs. Increases in septage tipping fees are likely to be borne by OWTS owners.

Section 1: Introduction

Production of wastewater is unavoidable from homes and businesses. In Vermont (VT), approximately 55 percent of the population uses onsite wastewater treatment systems (OWTS), or septic systems. The proper management of septage is a critical waste management issue for VT with a unique set of management challenges for all involved (USEPA 2015). Currently, Vermont septage is predominantly managed by publicly owned treatment works (POTWs), or wastewater treatment facilities (and septage waste haulers. Regional or local haulers collect material from individual addresses and haul it to the most convenient or economical POTW for processing/disposal. While the current septage management approach just meets current needs for septage disposal, stressors during the COVID-19 pandemic when increased demand for septage pumping, hauling, and disposal at POTWs exposed the vulnerabilities and lack of resiliency in the current system. As demand for septage pumping increased, POTWs were not consistently able to accept the volumes of septage produced and haulers struggled to find facilities to offload septage for processing. Projecting forward from now, the continuation of population shifts from urban to rural areas within the State and anticipated influxes of newcomers to rural portions of Vermont will also result in an increase in OWTS users. Several POTW upgrades are expected in the next five to ten years, and the Vermont Department of Environmental Conservation (VT DEC) took the opportunity to engage Brown and Caldwell (BC) to undertake an in-depth septage management planning study with a twenty-year planning period. The goals of the study were to identify opportunities for individual facility improvements and state-directed assistance to bolster the existing septage management program state-wide and proactively prepare for anticipated changes within the State, including projected population increases in rural areas.

1.1 Project Approach

The study was performed in two major parts. First, data regarding septage production, hauling, and management in Vermont were collected and analyzed to understand how septage is currently handled in the State. These included VT DEC data regarding hauling volumes and treatment/disposal locations, POTW design specifications, and current operations, as well as surveys sent to POTW operators and septage haulers throughout the state. Collaborative discussions with the team at the VT DEC underpinned data collection and were used to confirm assumptions used for data analysis. Data related to population and urban/rural demographics were also analyzed for population projections required in part two. Alongside data analysis, BC developed a program to geographically model septage hauling and drop off, given certain parameters. The program took in septage production volumes around Vermont, POTW locations, and estimates of POTW septage receiving capacity and modeled the most likely POTW drop off location based on driving distance. The models produced were used for alternatives identification, testing, and visualization in the second part of the study.

In part two, the BC team identified and assessed various alternatives to improving the septage management system within the State. This began with comparing the modeled baseline to a distance-optimized, theoretical septage hauling model to identify points of discrepancy and opportunities for improvement. In comparing the theoretical model, or "efficient model", to the current baseline or "inefficient model," the BC team was able to identify places where limitations other than capacity and distance may be interfering with efficient septage movement throughout the state. For instance, a particular wastewater treatment plant in the center of town may get significantly less septage in real life than the "efficient" model would dictate due to the inconvenience of driving through town with a septage truck. These "inefficiencies" in the current operation led the BC and VT DEC team to identify the cause as well as potential solutions to increase septage receiving at those locations. In the example above, a septage pre-processing facility outside of town and closer to the highway may improve conditions for many stakeholders – reducing odors from septage receiving in town, reducing truck traffic through populated streets, and enabling easier drop off for septage haulers. This process of comparing the baseline to the theoretical model was used to identify and develop the alternatives for analysis.

Septage receiving capacity was increased at these locations of inefficiency by implementing several types of solutions including a merchant facility, a pre-processing facility, and on-site improvements to septage receiving and storage at POTWs. Nine alternatives were then geographically modeled to understand the implications for septage hauling and impacts to the POTWs. These alternatives were also assessed based on economic and non-monetary metrics. Throughout alternatives development and analysis, regular progress meetings were conducted between the BC and VT DEC teams to guide the project.

This technical memorandum (TM) describes the approach and findings of VT DEC's septage management study. This includes descriptions of the data collection process, data analysis, modeling (found in Section 3) and alternatives development and testing (Section 4), as well as additional research into comparable state-level septage programs (Section 2). The modeled alternatives were ranked and are presented in Section 5. While this project does provide general recommendations for location and solution, additional analysis and refinement will be necessary before full implementation of a given alternative.

1.2 Current Program and History

Vermont is a predominantly rural state with a large percentage of residents who use OWTS to process and dispose of wastewater. State-level jurisdiction of septage was established in 1977 with Chapter 159 Waste Management regulations, which also includes septage oversight. Septage for this project was defined as the "partially treated waste removed from an on-site septic tank or holding tank" (Kelley and Twohig, 2018). Additional regulations in subsequent years established solid waste and septage management plans and outlined acceptable sludge management practices for the state, such as septage land application and treatment at a POTW. Historically, a significant amount of septage was land applied. Today, a very small amount (around 2 percent) is land applied, after lime stabilization, at permitted septage fields within Vermont.

The current state-wide septage management approach consists of local or regional septage haulers who are responsible for coordinating residential and commercial pumping and septage drop off at POTWs with septage receiving infrastructure and capacity. Currently, the state-wide septage disposal and processing network depends on these waste hauling companies and POTWs. Communication between septage haulers and POTWs is important for coordinating septage receiving. To facilitate communication, VT DEC developed a notification system by which POTWs can notify haulers en masse about changes to planned and/or unplanned septage receiving capacity, schedules, etc. Ultimately, the decision to receive septage at a POTW is a municipal level decision. For example, Montpelier takes a proactive approach to septage management within their municipality. Montpelier requires all residents within their domain with an OWTS to pay a septage fee to the Montpelier POTW, similar to a sewer fee. This contracted septage fee covers regular pumping, managed by Montpelier, with a septage hauler contracted by the city. In 2018, VT DEC produced a report on wastewater sludge and septage management in Vermont to understand and quantify the septage program in the state. While this report mainly focused on biosolids management and concerns, it also detailed several issues affecting septage management in the state including POTW capacity and receiving hours, as well as the lack of septage processing capacity in specific regions of the State. This 2024 study provides more detail on the septage capacity and management challenges, likely exacerbated by a population increase in the State during and following the COVID-19 pandemic (Wertlieb and Anderson 2022).

Section 2: State Septage Program Comparisons

Septage management is an often-overlooked subject nationally. The EPA recently committed to encouraging communities in the proper management of decentralized wastewater systems in a 2023 Memorandum of Understanding (USEPA 2023). As part of this study, BC researched septage management in other states with similarities to Vermont, including climate, rural population, and general geography, to collect lessons learned and potential pitfalls in managing septage at the state level. The findings from regulatory research and conversations with state regulators are below.

2.1 Maine

In Maine, septage is currently managed via land application, direct processing by a POTW, and centralized dewatering facilities. Due to recent legislative changes in Maine, the State suspended new septage land application licenses and restricted existing land application licenses. Based on a recent evaluation completed by BC, if a septage land application ban were enacted, the eleven million gallons of septage hauled to POTWs could lead to a 3 percent increase in sludge production, posing sludge management challenges (Rebodos 2023). Additionally, the POTWs in Maine could incur additional burdens associated with increased costs and regulatory pressures, potentially leading to a refusal to accept septage and further limiting septage management options. Rebodos (2023) found that development of septage “transfer stations” was a potential strategy in areas of the State with limited septage processing capacity at POTWs.

2.2 New Hampshire

In New Hampshire, septage is managed through POTWs, septage lagoons, land application, septage facilities (independent facilities with designated pits for long-term septage storage) or treated out of state. Over the past twenty years, the State has been focused on redirecting septage to POTWs and encouraging treatment facilities to accept it as an additional income stream. Lagoons and septage facilities are being discontinued over the next five years due to concerns with unlined pits, and the eight million gallons of septage that currently go to these facilities will be diverted, likely to POTWs. Additionally, New Hampshire anticipates implementing phosphorus limits for septage land application on legacy fields with high soil phosphorus values. To account for these shifts in septage management, New Hampshire recently increased the permitted amount of septage storage at haulers’ sites from 30,000 gallons to 40,000 gallons, allowing. haulers additional time to locate a site that is able to accept their septage.

Established in 1955, a public health law (RSA 485-A:5-b-1) in New Hampshire requires that each municipality establish a written agreement with a POTW to take its septage, so long as they can handle the volume and characteristics of the septage (“Municipal Responsibility” 2006). Such agreements may include the municipality’s own POTW or a nearby POTW. POTWs do have the “right of refusal,” meaning that even if they have a contract with a town to accept their septage, they have the right to refuse due to operational limitations. New Hampshire has a series of POTWs that will receive septage from any town in the State, which have now become major hubs for septage treatment, including Allenstown, Concord, North Conway, Plymouth, and Lebanon. The State has been engaging larger facilities (i.e., with higher permitted capacity) about receiving septage, as they have the opportunity to accept more septage and better dilute septage to their effluent receiving body.

The State has a hauler program where haulers are permitted for two years and will be inspected once in that time. They permit the septage tank, not the truck, and want to be sure it is leak-proof, properly lettered, has a spill kit nearby, and proper records are being kept. The State recently implemented an educational program to clarify regulatory requirements for domestic versus nondomestic septage. If the septage is not from a home, then it is not domestic and should not be land applied; institutions are not domestic.

2.3 Massachusetts

Land application and POTWs are the approved avenues for septage management, but minimal land application is performed in the Commonwealth. Haulers must be licensed with the department of health in each locale in which they operate (pump or drop off). These permits must include agreements with POTWs for drop-off and are renewed annually. Municipalities will often post the list of approved septage haulers on their town website. POTWs are also required to have existing agreements with haulers and actively manage the haulers and their trucks that drop off at their facilities. In many cases, individual POTWs may have strict rules about the origins of the septage they accept, such as all septage must be domestic or grease can only come from certain locations. As a result, however, septage management is even more decentralized than Vermont as it is managed at the municipal level, with haulers bearing the responsibility for permitting and approvals (sometimes multiples of both). While the Massachusetts Department of Environmental Protection has minimal authority over septage management in the Commonwealth due to the regulatory arrangement, they are currently in the process of gaining additional insight into their state-wide septage management, engaging in similar studies to Maine and Vermont's recent efforts.

2.4 Michigan

In Michigan, residential/domestic and commercial septage is removed by a septage hauler and brought to a treatment facility, either a POTW or a septage receiving facility. There are 79 total facilities that accept septage in Michigan of which roughly 40 percent of are designated septage waste receiving facilities. These facilities have operating guidelines that dictate what type of septage they will accept and the geographic area the septage can come from. The bodies that govern septage management are the Michigan Department of Environment, Great Lakes, and Energy (EGLE) and the local health departments.

Each local health department has their own health code for the installation of home OWTS. The creation of a more universal code is a future goal for EGLE. EGLE staff recognize how confusing it can be for haulers to determine where to bring septage and where facilities' boundaries lie. A piece of advice that EGLE staff has for other programs is to use an efficient back-end program to streamline applications, inspection reports, correspondence, etc. EGLE adopted the Michigan Environmental Health and Drinking Water Information System or "MiEHDWIS," and it allowed them to be much more efficient with correspondence and overall document management.

The State's administrative code allows facilities to claim a radius of up to 25 miles, i.e., facilities may receive septage from up to a 25-mile radius from their site. However, some facilities still limit receiving based on administrative or district boundaries. If the pumping location does not fall within a claimed boundary/radius, haulers have the choice to bring septage to whatever plant will receive them. Michigan also allows for land application of septage, but haulers must receive a separate license and there are site reviews and soil nutrient testing requirements. There are also 28 septage storage facilities including below ground tanks, above ground tanks, and lagoons from 50,000 to 688,000 gallons of storage capacity.

The treatment train for septage facilities in Michigan, which is the same for most states, typically includes screens and grinder units, equalization tanks, and dewatering units. Many transfer the septage solids to a POTW for final treatment. However, there are examples of septage-only receiving facilities that perform a more complete treatment. For example, the Grand Traverse County Septage Waste Receiving Facility transfers septage from haulers to a screen designed to remove large rocks. This septage is then fed to an equalization tank and pumped to an on-site pump station. The pump station pumps the septage material to a bioreactor at a controlled rate. As the concentration of solids accumulates in the bioreactor, a portion is removed, dewatered, and sent to an auto thermophilic aerobic digester for treatment (Slater 2012).

2.5 Minnesota

In Minnesota, haulers have several septage management options. The majority of Minnesota's septage is land applied, with occasional dewatering and landfilling in specific situations, haulers must keep records of every load hauled and where it was delivered. Haulers in Minnesota generally work in a local region and bring septage to the nearest septage-receiving location. The Minnesota Pollution Control Agency (MPCA) provides general guidelines for septage management and land application but direct oversight for septage land application is at the county level. A few counties have incorporated the MPCA guidelines into their local regulations, and the MPCA does require compliance with any applicable local regulation for hauler permit approvals. For haulers and land application site maintainers, this has led to a patchwork of regulations within the state, depending on the local requirements.

One challenge Minnesota's septage management stakeholders have noted is difficult climatic conditions. Recent climatic conditions in the Midwest have brought longer droughts and more extreme rains. Septage receivers often refuse septage during these periods of wet weather, which often coincide with times when fields are flooded. To help alleviate this problem, the State has allowed septage haulers temporary storage on haulers' own sites while they locate different receivers during these periods.

2.6 Washington

In Washington, the Department of Health has oversight on septage and regulates the septage pumping companies, commonly referred to as "pumpers". Pumpers are permitted on a county level and can pump from any septage system within the county for which they receive a permit. It is up to the pumpers where they take septage, and they are only limited by what POTWs or land application sites will accept. Some pumpers have lime stabilization units directly in their trucks and then bring the septage for land application at permitted sites. Others haul to lagoons that may or may not include screens. POTWs that accept septage typically treat the septage alongside their wastewater influent. There are a few septage-specific receiving facilities within the state, for example the Sedron Services Sumner Washington LLC merchant facility, but more often, haulers will go to POTWs. While the Department of Health regulates the pumpers and hauling process, the Washington State Department of Ecology (Ecology) has oversight over treatment and management of septage. Within Ecology, the Water Quality Program has oversight and authority over wastewater influent, treatment, and effluent at POTWs and the Biosolids Program has authority over solids produced in POTW process as well as septage from septic tanks.

One staff member interviewed believes that the program is successful overall but could be improved with increased staffing and financial resources. They also mentioned that there is a state-wide issue regarding asking POTWs to accept septage more regularly when the facilities themselves are not equipped to do so. Because the quality and quantity of septage is inherently more variable than wastewater, POTWs are hesitant to accept septage that could negatively impact their treatment process and/or compliance with Class A or Class B standards. Operators have also reported seeing an increase in nutrient loading entering their POTWs when they accept septage.

2.7 State Comparison Takeaways

The states BC reviewed have significantly different regulatory and functional approaches to managing septage. The states that expressed satisfaction with their current septage management programs appear to have ones in which formal agreements exist between either the haulers and the POTWs or the municipality. This allows for easier coordination during septage drop off as well as for residents or businesses looking for a septage pumping company. Additionally, some states have engaged other techniques to improve operations including allowing for storage at hauler facilities or relying on central septage receiving facilities to create additional buffer and septage processing capacity within the state. Since permitting septage hauler storage in Vermont might be considered onerous on both the haulers and the state due to costs and the type of permit required, only additional POTW storage and centralized septage processing facilities were techniques that BC incorporated into the alternatives analysis portion of this project.

Section 3: Data Collection and Analysis

Reliable and defensible data were required to underpin the basis for the geographic modeling of septage management in the state and establish the septage alternatives analysis. This required understanding state-wide septage data at a granular level to estimate and characterize hauling distances and septage receiving.

3.1 Census Tracts

Because this project incorporated a significant geographic modelling component, it was vital to understand septage production at a reasonably granular level to estimate hauling distances. For instance, if septage production was calculated at the county level, it would be difficult to model the travel distance for septage hauling and to POTWs as there are multiple POTWs per county. BC decided to analyze and model the data at the US Census Bureau tract-level; Census tracts can be seen in Figure 3-1. A census tract is a "small, relatively permanent subdivision of a county" with an average population of 2,500 - 8,000 inhabitants. This granularity allowed BC to model septage movement around the state at a resolution that allowed visualization while still providing valuable details about proximity and preference. During visualization, centroids of the census tracts were used as representations of septage hauled from a given tract (Section 5). Census tracts can be further broken up into blocks, which are the smallest US Census Bureau geographic units. However, this resolution was deemed too high to be useful at a planning level for this project.

3.2 Septage Production (Demand)

For the purposes of this project, septage production is defined as the amount of septage removed, i.e., pumped and hauled, from a given location. Information about OWTS pumping frequency was not collected for this project, and pumping frequency was assumed to remain constant in future projections. While septage production occurs continuously, the "production" used for this project is the amount of septage that must be processed at a given time. Septage production values were used to estimate septage transportation and receiving trends, as well as in the economic analysis to estimate technology sizing. To estimate septage production on the tract level, OWTS permit data, which included general location and volume, were used to quantify the relative production of septage in a tract, compared to the volume of state-wide production. For example, it could be estimated that a given census tract was responsible for a certain percentage of Vermont's total production based on the numbers and capacities of permitted OWTS in that tract. Then, the total state-wide volume of septage hauled and processed in a maximum year (2020), which was based on VT DEC records of reported hauling records, was divided by the relative septage production by tract to estimate gallons of septage produced within that tract.

The number of people within a tract on OWTS was calculated using an estimated gallons of septage per person conversion and the assumption that 55 percent of the state's population uses OWTS, an assumption that was confirmed by VT DEC staff for use on this project. This number came out to around 130 gallons of septage per person per year. The literature values regarding gallons of septage produced per person per year are sparse and poorly researched (USEPA 1980), specifically regarding septage per capita rates at pumping. This overall approach was discussed and confirmed by VT DEC. This approach for estimating septage production does not reflect the true production rates but is an assumption for the purposes of this planning process. In these septage production estimates, land application of 2 percent of the state's septage was incorporated and held constant throughout the twenty-year planning period. Estimated septage production for 2020 by census tract is shown in Figure 3-1.

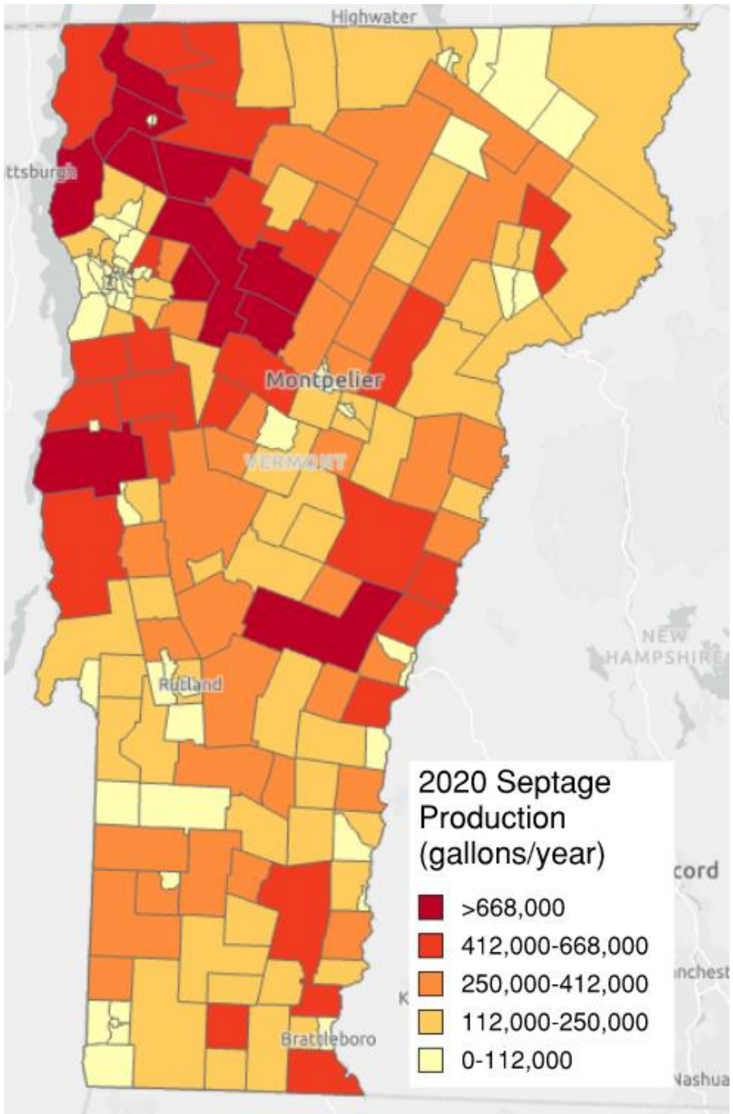

Figure 3-1. 2020 Septage Production Estimates by US Census Bureau Tracts.

3.3 Population and Septage Projections

Future population and subsequent septage production projections are used to ensure accurate facility sizing during the twenty-year planning period. For the septage study, a specific estimate of population changes for Vermont's septage producing population was required. According to results from the 2010 and 2020 census, during this ten-year period Vermont's population increased by 17,500 people, a 2.8 percent increase from the total population of around 626,000 (Table 3-1). During the same time, 17,500 of Vermont's urban population moved out of urban areas, while its rural population increased by 35,000. From these results, BC assumed that the 35,000 increase in the rural population during this period was from existing Vermonters moving from urban settings to rural settings within the State, and the remaining 17,500 were newcomers to rural parts of the State. This would result in an initial estimate of a 0.9 percent increase in the rural population each year (9 percent rural population increase over 10 years). At the planning-level of this study, BC used the simplifying assumptions that the population considered rural by the US Census Bureau would use OWTS instead of sewer, with VT DEC's approval.

During the COVID-19 pandemic and the years following, there was a significant increase in people moving to Vermont, which was reflected both in an increase in septage hauling and OWTS permit requests from 2020-2023. Prior to 2020, around 2,500 permits were requested a year, but from 2020-2023 around 3,000 permits were requested per year, an increase of 20 percent. However, in 2023 the number of permit requests began decreasing back toward normal values. Population values from 2020-2023 were calculated based on the 0.9 percent annual population increase (calculated from the 2010 and 2020 census) multiplied by 20 percent to account for the increased migration during this time. Population projections from 2024-2027 were increased by 0.9 percent only. The approach to accommodate for the temporary increase in population during the COVID-19 pandemic was proposed and confirmed by VT DEC.

Table 3-1. Rural and Urban Populations Shifts from 2010-2020

	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%

3.4 Septage Receiving Capacity (Supply)

Calculations of septage receiving capacity were also required in modelling septage movement within the state and to understand septage receiving limitations and expansion opportunities. Two types of septage receiving capacity were calculated.

The first was the baseline, or a reflection of where septage is being received in recent years and how many gallons. This baseline was established by using historical reported septage hauling data from 2019-2022. Data from 2023 were unavailable at the time of the study. The maximum gallons of septage received in a year was used to set the baseline. While these data were self-reported by haulers and could be an underestimate of total septage moving within the State, VT DEC also corroborated this data using reports of septage received by POTWs. Additionally, these years encompass the COVID-19 pandemic and the subsequent increase in septage within the State, likely providing a slight over-estimate for non-pandemic operations. With these caveats, the production volumes were taken as-is with the understanding that the overall trends of septage receiving were still correct and valuable.

The second septage receiving capacity reflected a reasonable but maximized ability for POTWs to receive septage. This "maximum septage receiving capacity" was calculated for every POTW based on a combination of design flow and biological oxygen demand (BOD), current average flow and BOD, and the results of a 2023 Vermont POTW capacity analysis. An assumption of 6,500 milligram per liter (mg/L) BOD to process septage was used for these calculations (EPA 1994). Maximum receiving capacities were calculated using the following logic:

1. From VT DEC-provided monitoring data on average flow and BOD, calculate average daily organics loading.
2. From septage hauling data provided by VT DEC, calculate average daily BOD requirement to process septage.
3. Subtracted (2) from (1) to calculate an estimate of BOD requirement to process wastewater from the sewer system alone.

4. Subtracted (3) from the design BOD to calculate total available BOD for septage receiving (ignoring pre-treatment programs or high strength waste receiving) and converted to gallons of septage for a "maximum septage receiving capacity".
5. Finally, VT DEC provided guidance information about the current operational capacities of POTWs, which was used to assign receiving capacities in the following way:
    a. If a POTW was known to have very limited additional capacity, the average septage received from 2019-2022 was used as their receiving capacity.
    b. If a POTW was known to a small amount of additional capacity, the maximum annual septage received from 2019-2022 was used as their receiving capacity.
    c. If a POTW was known to have plenty of additional capacity, the value calculated in (4) was used as their receiving capacity.

While these maximum septage receiving capacities are optimistic and highly generalized, their usage in creating a geographic model of septage hauling allowed BC to visualize where septage would be hauled to, in a theoretical distance-optimized model. For some POTWs, the responses from the POTW surveys (see below) were also used to corroborate and support these capacities, i.e. if a POTW said that they would like to receive more septage.

3.5 Geographic Python Program

A geographic Python program was developed to predict and calculate "transportation models" for septage within the state. These transportation models described the volumes of septage hauled from a census tract to a given POTW and the distance traveled. Transportation models were developed for a variety of scenarios including a baseline, a theoretical model, potential solutions for septage management, and possible worst-case scenarios. The program was developed in Python 3.11.5, and various Python libraries were used to facilitate development, including Requests, SciPy, Pandas, and NumPy. Resulting models were visualized in Esri's ArcGIS Pro, Web, and Experience Builder. An example of the visualization in Esri's interfaces is shown in Figure 3-2. Additional information about the visualization can be found in Section 5:.

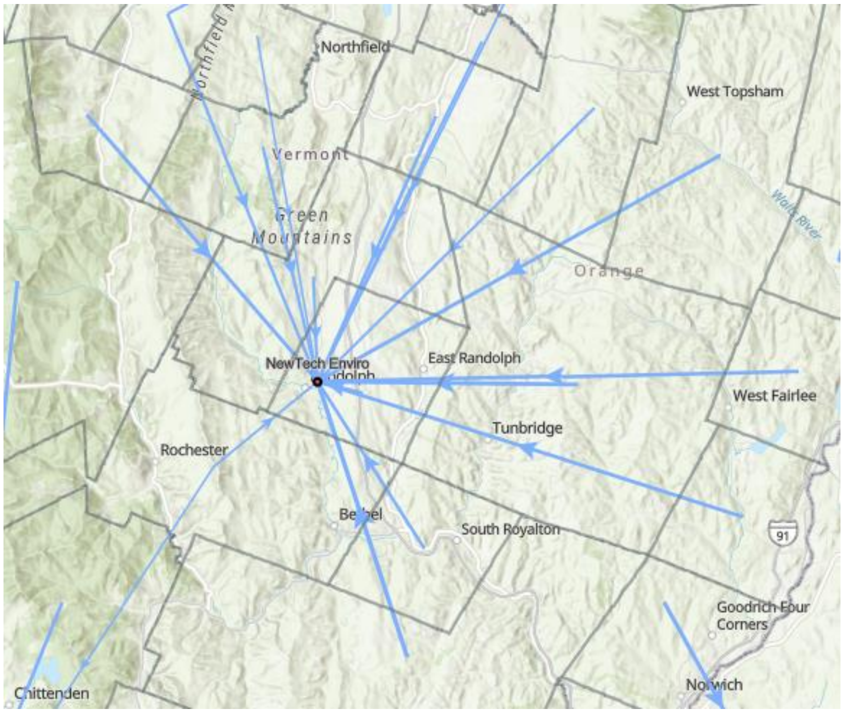

Figure 3-2. Geographic Model Example as Seen in ArcGIS.

Development of the Python program enabled a method to model and analyze multiple alternatives and scenarios within the same assumptions. A key assumption for building this program was that septage would and should be hauled the shortest distance possible, minimizing the total driving distance required to transport the entirety of Vermont's septage from generation source to respective treatment facilities. In other words, when septage is pumped out from the generation source, the census tracts, it would be hauled to the nearest receiving facility, if possible. While driving distance is not the sole consideration for septage hauling, it is an important one. The reduction of overall driving distances was viewed as a proxy for an increase in convenience, as well as a decrease in cost and overall community and environmental impacts. Because of this, initial data requirements included driving distance from each source to each receiving facility, receiving capacity at each facility, and septage generation values for each source. Driving distances were collected within the Python program via the Open Source Routing Machine which connects to OpenStreetMap data to get accurately represented driving constraints and routes instead of geodesic distances. One limitation of this approach is that driving distances were only determined by the shortest route without consideration of other factors such as the grade or width/size of a road.

The program was built within a linear programming framework which takes a function that reflects the project's objectives, in this case reducing driving distance, and various inputs and constraints and attempts to optimize the function within those constraints. The algorithm works by iterating over one variable – the decision variable – subject to the constraints, until the final value of the function is optimized. In this context, the constraints are the septage generation volumes from each census tract and the receiving capacity at each facility. The decision variable is the amount of septage transported from each census tract to each facility. The program transports septage from each community to a facility or several facilities until all of the septage is accounted for. Then it will attempt to redistribute how much septage was sent where until the minimal distance traveled is achieved. This results in a transportation model based on the constraints provided each time.

Once the functionality was developed, the "maximum septage receiving capacity" was input as the receiving capacity constraint to develop the theoretical transportation model. In this theoretical model, because septage receiving was functionally unlimited, the model described where septage would travel if no real-world limitations existed and represented the most "efficient" transportation plan, based on the original assumption that the lowest total driving distance throughout the state was optimal. Next, it was important to set a baseline for comparison and the program was run on historic data from 2019-2022. There were evident variances between how much septage was historically received at multiple treatment plants versus how much septage was received in the theoretical model output. The discrepancies are attributed to the omission of other real-world constraints and inefficiencies, a programming limitation stemming from the absence of supporting data for these constraints. Such constraints include, but are not limited to, tipping fees at receiving facilities, hours of drop off at receiving facilities, operational limitations, and hauler biases and distribution or availability.

Comparing the baseline and the theoretical model, it was possible to identify areas of capacity limitations or stressors. This was explored based on how much septage was sent further in the baseline versus the theoretical model, as well as how much septage was sent further the nearest plants reached their capacity. Once these areas were identified, alternatives were developed; the process for this is described in further detail in Section 4.1. To run these potential solutions through the Python program, the input receiving capacities were modified to reflect that alternative. For example, a new merchant facility was assumed to have an annual receiving capacity of five million gallons, so the capacity input in the model for that facility would be increased to five million gallons. All alternatives were run through the program and compared to the baseline based on various metrics including total annual driving distances, POTW buffer capacity, and impacts to environmental justice regions, which were also calculated through the model. More details on these metrics can be found in Section 4.3.

Data Limitations

The program itself relies upon a significant amount of data to be input, has embedded assumptions and variables, and is limited to consideration of septage receiving facilities locations and capacities, estimates of septage production within Vermont based on current permitted septage tank capacity, and historical septage hauling data. Please note, the data used for and within the program was provided by the VT DEC, other government agencies, and limited responses from a number of septage receiving facilities and septage haulers and has been relied upon as generally accurate without independent verification or validation by BC.

3.6 Outreach Survey Results

The project team circulated separate surveys to Vermont POTWs and septage haulers who work in the State. The intention of these surveys was to gather facility/company specific data from these two sets of stakeholders and add additional context to the data already gathered by the State. For the POTW survey, questions included specifics to septage management and overall wastewater treatment. For the hauler survey, questions included those related to the limitations and economics of hauling septage. VT DEC sent out an email to POTWs and haulers to take the survey, and respondents were given two weeks to respond. After the deadline, VT DEC also reached out to specific POTWs and haulers that they knew to be key players. The results were used to bolster existing data and allowed stakeholders to bring up any other concerns specific to their experiences. Survey questions are included in Attachment A.

3.6.1 Wastewater Treatment Facility Survey

VT DEC sent the survey to seventy-eight municipal contacts, in an attempt to include all Vermont POTWs collectively managed by those contacts. BC received 38 responses from across the state, seen in Figure 3-3. The respondents included every major (over 5 percent of state's septage processing) POTW that receives septage and nearly every POTWs that receive septage in the State. The range of permitted wastewater capacity for the respondents was from 0.055 million gallons per day (MGD) to 8.1 MGD. Half of the responses were from POTWs that currently accept or can accept septage, and the other half were from POTWs that do not currently accept septage. Survey responses from POTWs who do not receive septage were used to understand any past experiences and to assess openness to or capacity for receiving septage in the future. Of these facilities, two POTWs expressed openness to receiving septage again, either after collaboration with VT DEC (Town of Chelsea) or with equipment upgrades to manage the change in waste stream (Town of Fair Haven). A few other plants mentioned past instances of septage and portable toilet waste receiving with some detrimental effects to their processes.

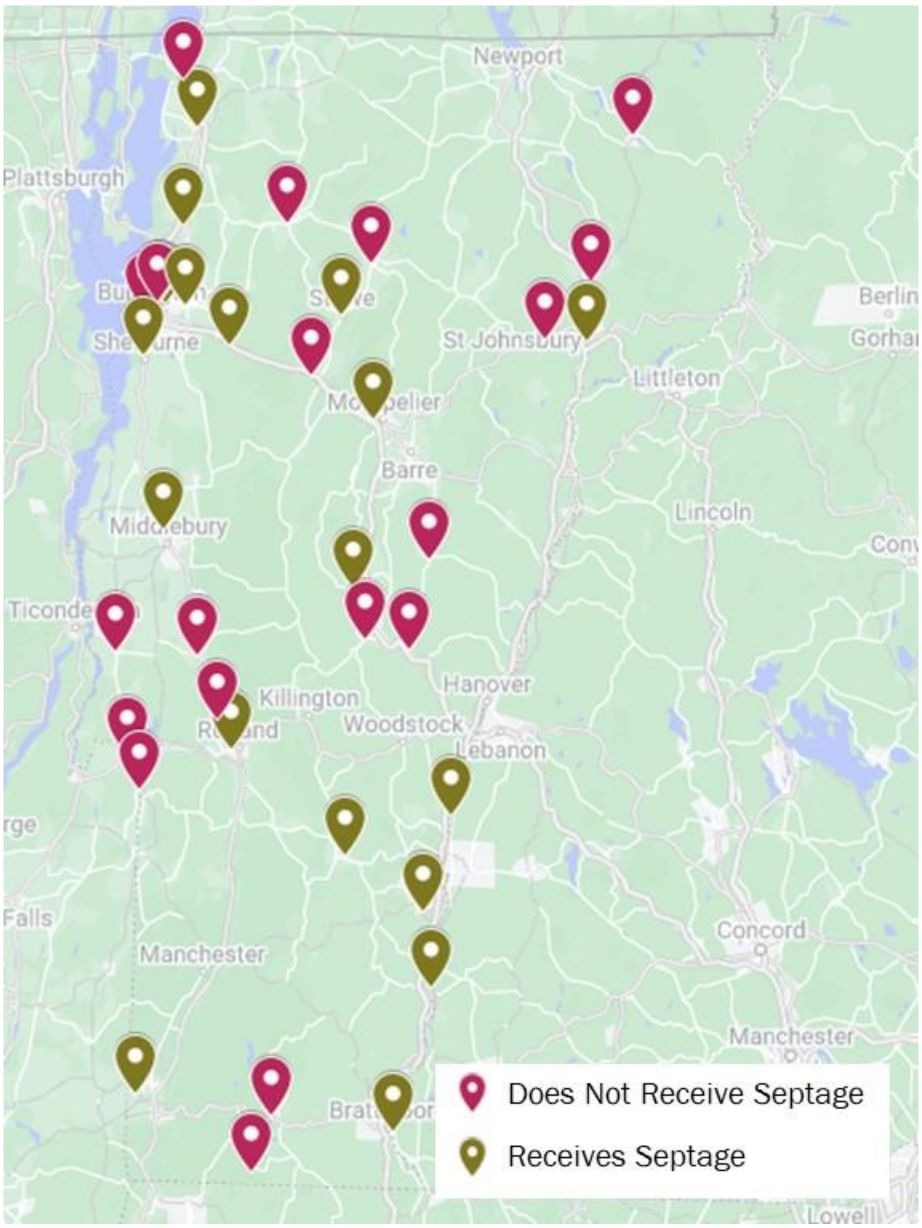

Figure 3-3. Respondents to the POTW Septage Receiving Survey.

The remaining survey response discussion addresses POTWs and one private pretreatment facility (NewTech in Randolph) who can currently receive septage. These nineteen facilities range in size from 0.4 – 8.0 MGD in design flow and broadly covered the whole State of Vermont. Several plants – Montpelier, Richmond, Bellows Falls, NewTech/Randolph, Burlington East, Ludlow, Windsor, and Springfield – report that they have additional capacity for septage processing. Middlebury, St. Albans, Shelburne, St. Johnsbury, Stowe, South Burlington-Airport Parkway, Bennington, and Brattleboro stated that there could be excess capacity dependent on operational limitations including season and sludge removal schedules. Average daily septage receiving volumes ranged from nearly zero to 35,000 gallons per day, with Ludlow receiving practically none to Montpelier receiving the most. While about half of the POTWs experience seasonal trends to septage drop off, with summers being busier than winters, about half the POTWs did not report experiencing seasonality.

Overall reported receiving hours are typically Monday through Friday, starting between 7:00 and 8:00 am and ending between 3:00 and 4:00 pm. One facility reported 24/7 receiving hours (Bellows Falls). Haulers appear to drop off at any time, without clear trends. Tip fees across the respondents average around $0.12 per gallon, with a range of $0.075-0.480 per gallon. Effects from septage receiving were mixed with about half (10) of the facilities reporting nutrient loading impacts. Several POTWs indicated a measured increase in nutrient loading, seen in monitoring data, or an increase in phosphorus precipitating chemicals due to septage receiving.

In terms of septage processing equipment, around 80 percent of facilities receive septage with screening. Essex Junction and Burlington Riverside do not have screening equipment for septage receiving. Generally speaking, septage-receiving equipment is in fair to good condition except for at Richmond, Burlington Riverside, Milton, and Shelburne #2, where the condition was reported as poor. NewTech/Randolph intends to upgrade some equipment, while Middlebury and Richmond anticipate changes to their septage receiving program, as part of their upcoming broader facility upgrades. Some facilities have discussed possible decreases in the amount of septage received and others are considering a price increase. Montpelier is considering transferring an existing leachate holding tank into another septage holding tank to smooth operations for septage receiving as well as dewatering, and St. Johnsbury may route septage directly into their digester after upcoming dewatering upgrades are complete.

In the open-ended call for septage comments, several POTWS requested a state-wide solution to support those POTWs who were serving the septage community. While the comments varied in specificity regarding the type of solution (e.g., regulatory, financial, etc.), the intention for this overall project undertaking is to begin identifying key opportunities for state-level investment and support that serve broader septage management goals within the State.

3.6.2 Septage Hauler Survey

The septage hauler survey was sent to sixty-three septage haulers permitted in Vermont. BC received responses from nineteen unique septage haulers from Vermont and New Hampshire. The respondents service all fourteen counties in Vermont and collect septage from a mixture of residential (36 percent), commercial (27 percent), and institutional sites (20 percent), as well as portable toilet waste (13 percent) and other types of facilities (5 percent, grease traps, farm catch basins, and municipal). Haulers reported traveling an average of 23 miles to dispose of septage with the closest being 1 mile and the furthest being 60 miles.

Nine haulers stated that they would not travel further than 25 miles to offload, whereas nine haulers were willing to go 50 miles. One hauler was willing to go as far as 75 miles to dispose of septage. In terms of cost, nine haulers stated that they would avoid using a facility if the tip fees were 10-15 cents a gallon, six haulers stated that they would avoid usage at 15-20 cents/gallon, and one hauler was willing to pay over 20 cents per gallon of septage. Three haulers gave additional answers, including that they would transfer whatever fee to their customers, would not pay more than 10 cents, or would pay what they needed to if they had no other option.

When haulers were asked about having sufficient outlets, six haulers said yes, while seven haulers said no, and six haulers said no with additional information such as, they would not if they couldn't land apply, they go to New York, or that they often run into plant closures. When asked more specifically about the issues they run into, there were a range of answers, as seen in Figure 3-4. "Other" included price and long waits to offload.

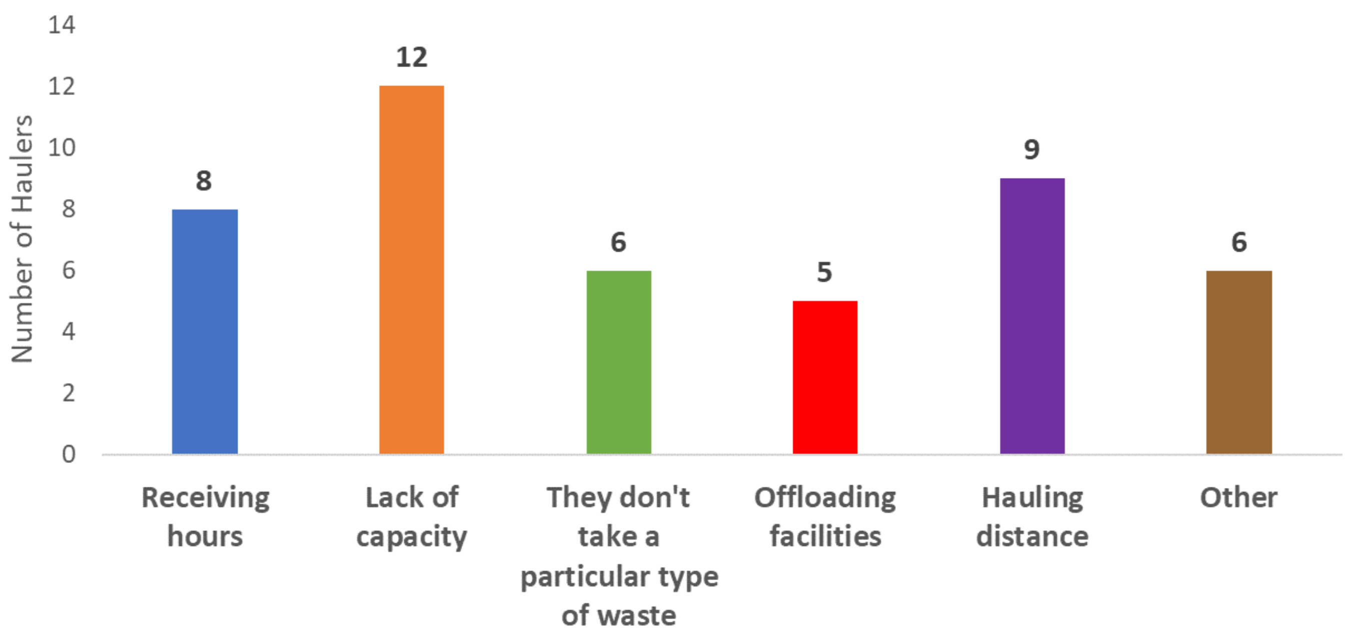

Figure 3-4. Common Hauler Issues During Septage Drop Off.

Around 40 percent of haulers have experienced being turned away from a POTW unexpectedly, mostly for either equipment breakdowns or because the POTW reached capacity for the day. This seems to have occurred consistently throughout the past several years. Ultimately, while the questions were oriented towards understanding the challenges of septage hauling, the sentiment from the respondents indicate opportunities for improvement, specifically with increasing or initiating septage receiving capacity at various POTWs,

Section 4: Alternatives Analysis

VT DEC and BC team used the data collected and analyzed as key inputs in a geographic program that was used to identify regional bottlenecks, develop alternatives for potential solutions, and develop metrics to compare and rank the alternatives.

4.1 Alternatives Development

Alternatives, or possible solutions for addressing specific regional challenges in Vermont's septage management system, were developed using the preliminary geographic models, information from our state septage program review, and the surveys.

4.1.1 Selecting Sites

The septage hauling transportation program developed for this project modeled the driving distances of septage haulers from areas of septage production to the closest available POTW with processing capacity, on a generalized, annual basis. Two main types of data were used – septage production by tract and POTW septage receiving capacity. As discussed in Section 3.4, two separate models were developed – one that reflected the current status quo or baseline model of septage receiving and one that reflected ideal conditions or the theoretical model, i.e. where would septage travel if it always went to the closest POTW. Septage hauling and receiving for these models were plotted against each other, revealing potential areas for improvement.

Septage production was estimated at the tract level. To predict and record hauling distances, the center point or geometric centroid of the tract was used as the starting point, and the program mapped the distance to the POTW. The logic to determine the transportation routes for hauling only incorporated distance and estimated POTW receiving capacity. It did not incorporate tipping fees, size of road, grade of road, distance from highway, or offloading facilities, all of which could impact a hauler's decision to use a particular facility. In comparing the baseline and the theoretical model, any of these factors could be reasons for discrepancies between the models.

Fundamentally, the entire State of Vermont likely has enough septage receiving and/or processing capacity to process septage from the entire state. The theoretical septage receiving capacity calculated in Section 3.4 indicates a state-wide receiving capacity of 194,400,000 gallons per year. If this receiving capacity were further limited and each POTW is capped at either their historical 4-year average or 5 percent of their design BOD, whichever is higher, 59,600,000 gallons of septage receiving would be available to the state per year. This is compared to the state-wide maximum septage management of 45,800,000 gallons in 2020. However, regionality and physical transportation distances play a significant role in determining septage movement, and septage receiving in local areas may not be able to meet the demand for processing.

The alternatives described were grouped into three geographic areas as seen in Figure 4-1. These areas represent regions where there are specific challenges or connected septage ecosystems. Northwest Vermont has significant amounts of septage production which often exceeds processing capacity in the region. The Southwest and the East of Vermont have areas in which the current capacity for septage processing can meet current demand, but the POTWS are isolated and have minimal redundancy or buffer capacity to handle potential septage production increases or management disruptions.

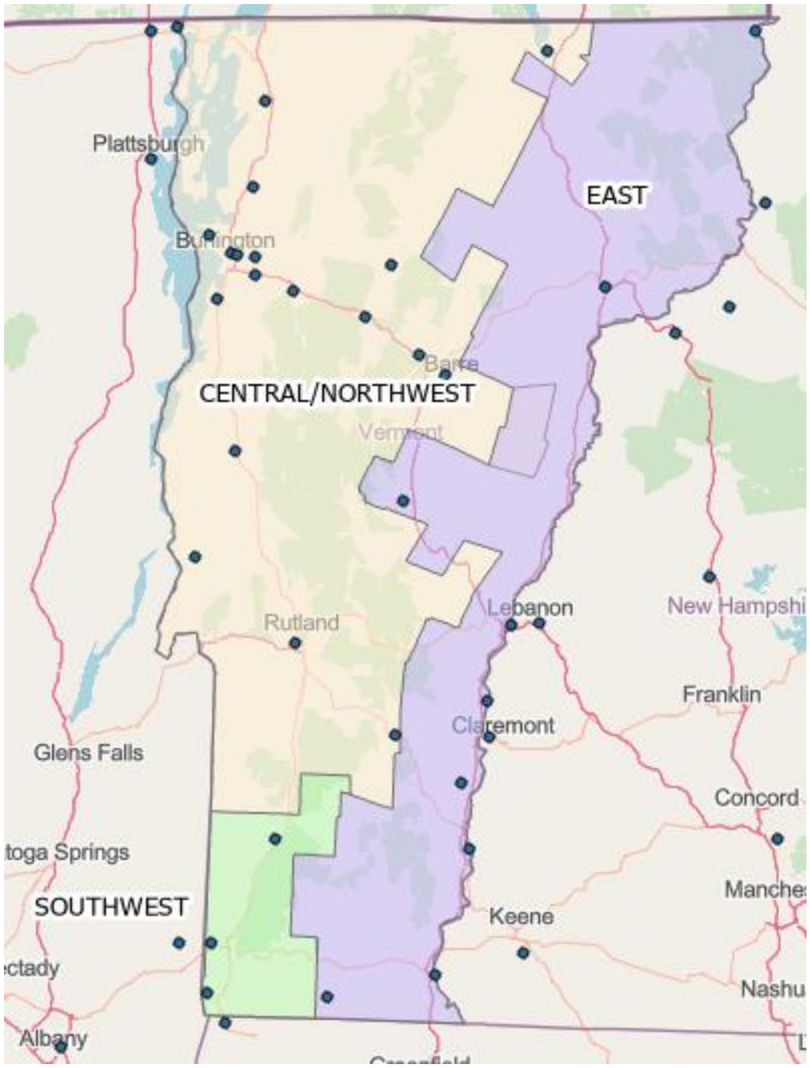

Figure 4-1. Regions of Analysis.

4.1.1.1 Northwest-Central

The region north and east of Burlington produces about 30 percent of the state's septage production and is broadly characterized as having limited POTW receiving capacity in very close range. Anecdotal evidence and experiences during the COVID-19 pandemic indicate that current septage processing capacity cannot easily withstand stressors such as facility outages or short-term or long-term population increases. The region defined here as the Northwest-Central region has an average of 7,700 gallons of septage produced per square mile, and the majority of the alternatives discussed in this report are focused on this region as the one with the most need and opportunity for improvement.

Significant septage production is estimated to occur in the northwest corner of the state, where nearby regional POTWs do not have enough septage processing capacity. St. Albans and Milton POTWs are the most proximate septage processing facilities in this region, but due to operational challenges and overall capacity limitations, significant septage is likely hauled south to the Burlington area. Since the Burlington Main POTW lack septage receiving infrastructure and since the other two POTWS located in Burlington are challenging to access due to travel routes through the city, this shifts septage receiving to plants in the region, namely

Richmond, which is thirteen miles east of Burlington. Richmond serves an outsized role in septage management compared to its overall size, whereas Essex Junction and Shelburne #2, which are also in the area, have not received as significant amounts of septage in recent years. Because septage from north of Burlington is likely treated at Richmond, septage produced east and south of Richmond may be hauled elsewhere for treatment. These cascading pressures likely put significant pressure on other POTWs in the region such as Montpelier and Rutland, which act as the buffers for the Northwest region. Hence, for the purposes of this regional analysis, the Northwest region and the Central (from a North-South perspective) region are combined to reflect this network of septage hauling. Montpelier is a top septage receiver in the state (around 20 percent of the state's production). Having accomplished economies of scale and operational efficiency, they are committed to receiving more septage and are investing in additional equipment to support this approach. While Montpelier likely acts as a general buffer for the region and offsets some of the burden felt in the area north of Burlington, there are likely other opportunities to add capacity to septage generation in that region.

4.1.1.2 Southwest

Compared to the Northwest region, there is less septage produced in the Southwest (approximately 3,700 gallons per square mile), leading to reduced tension between septage processing demand and capacity. However, Bennington serves as the only Vermotn POTW with septage receiving in the Southwest area. Current capacities appear to meet current and future septage processing demand, as modeled. However, in efforts to increase resiliency in the region, additional septage receiving would be highly beneficial and could serve a dual purpose of increasing septage receiving from neighboring states, if planned appropriately.

4.1.1.3 East

Similarly to the Southwest corner of Vermont, the Eastern edge of Vermont generally produces less septage than the Northwest (approximately 4,000 gallons per square mile) and has many POTWs along the border with New Hampshire that can take septage. Brattleboro, St. Johnsbury, and Bellows Falls POTWs process the majority of septage in their respective regions. Notably, the amount of septage that the Brattleboro POTW receives has decreased since the COVID-19 pandemic, and the Keene, NH POTW, across the border, does not seem to have taken on significant amounts of that difference in volumes. The Hartford-White River Junction POTW receives significantly less septage than expected, and the septage haulers in the region likely rely on Lebanon, NH's POTW as Hartford-White River Junction POTW has not received much septage in recent years while Lebanon's receiving volumes have increased. Areas along the Eastern edge of Vermont either rely on out-of-state septage receiving or single POTWs (without contingency options) to manage their septage. If septage production increases due to population increases or out-of-state septage processing becomes unavailable, these areas could be left without septage management options. Like the Southwest, additional septage receiving and processing capacity would be beneficial and increase the overall resiliency of the region.

4.1.2 Developing Alternatives

Once these trends were identified, other information such as tipping fees, survey results, Google Earth images, and conversations with VT DEC were used to identify likely reasons for the hauling inefficiencies identified through the models and to select solutions that may help mitigate limitations and increase septage receiving or processing capacity. The proposed solutions include:

1. Optimized receiving facility: This is a septage receiving facility that is built alongside existing septage receiving infrastructure and has a card-reader enabled septage receiving facility located by the POTW for off-hours receiving, additional septage storage tanks for peak shaving, and odor control. Improving receiving equipment would help increase hauler usage, while storage would allow the POTW to meter out septage processing at appropriate times for their overall operations.

   a. This was assigned if there was sufficient hydraulic or organic capacity to process additional septage, compared to their historic receiving volumes.
   b. In the optimization model, septage receiving capacities were increased 5-20 percent depending on the existing operational conditions and survey results from the POTW.
2. Pre-processing facility: This facility would be located separately from the POTW, though it could either be nearby or farther away. In addition to the optimized receiving facility parameters described above, a pre-processing facility would have primary treatment (initial sedimentation of solids) and dewatering. The dewatered solids would be hauled offsite or could be hauled to a digester if one with capacity and solids receiving was available. The liquid stream would be discharged through the sewer to the POTW for further treatment.
   c. This was assigned if an existing facility had hydraulic or organic capacity to process septage but had limitations at the existing facility to receive or process septage.
   d. In the optimization model, septage receiving capacities were set at 2.5 million gallons of annual septage receiving.
   e. This facility would be owned and operated by the POTW. It would more than likely require a pretreatment permit to discharge to the sewer.
3. Merchant facility: A merchant facility would ideally be located off major roadways along a sewer line. The process within the merchant facility can vary depending on the merchant that decides to build in the area. It could be similar to the pre-processing facility or be more complicated process which includes a drying system such as Sedron. As a market sounding was not completed as part of this evaluation, interested merchants is not provided at this time. The assumption is that the liquid stream is sent to the POTW under an industrial pretreatment permit and solids are managed by the merchant.
   f. This was assigned if an existing facility had either hydraulic or organic capacity limitations.
   g. In the optimization model, septage receiving capacities were set at 5 million gallons of annual septage receiving.
   h. This facility would be privately owned and operated, typically operated for a profit.

4.1.3 Financing Considerations

Section 4.3.1 describes the economic differences among these three facility types. There could be different opportunities for utilities or the State to fund each of these facilities. The VT DEC has undertaken this project to identify the best opportunities for support within the state. State-supported grants or no-interest loans could be opportunities to incentivize either septage receiving broadly or specific equipment or facility upgrades to support septage processing. Ultimately, the details of financing from VT DEC's perspective will depend on the specific location(s) and/or facility(s) selected and will require specific consideration during a later planning process. However, there are a few ownership structure options that could be considered.

Single Utility Ownership of upgraded septage receiving facilities or a pre-processing facility is a model in which a single utility entity owns and operates the waste management facility. The utility would contract with individual facilities or regions to handle their septage. This single utility would have sole responsibility for septage receiving and processing. The benefit of this approach is that collaborative agreements distribute risk among stakeholders. The Single Utility Ownership model also qualifies for Water Infrastructure Finance and Innovation Act (WIFIA) funding, which is designed to accelerate investment in water infrastructure projects.

Another option is VT's Clean Water State Revolving Fund (CWSRF) program. This program provides low interest loans to municipalities for eligible projects. CWSRF eligible projects include septage receiving and handling projects and could be applied to building an optimized septage receiving facility or pre-processing facility. Additionally, the US Department of Agriculture Rural Development provides revolving funds for water and wastewater projects. These funds are available to state and local governments, nonprofits, and Indian Tribes on federal or state reservations.

Finally, Public-Private Partnerships which allow partnerships between public and private entities. The private financing allows higher costs to be offset by performance certainty, efficiency gains, and innovation. This in turn creates a robust financial mechanism that defines clear roles for project company, equity, and debt. Creating a strategic partner engagement depends heavily on early and ongoing collaboration with partners. The public-private partnership allows public partners access to these lower interest loans that they would not have had access to otherwise. Ultimately, it is the responsibility of each POTW to evaluate the pros and cons of each funding source and delivery model to determine the best fit for their situation.

4.2 Septage Management Alternatives

There were nine alternatives geographically evaluated, in addition to the theoretical model and the baseline model. The following are a general description of the different alternatives evaluated.

- Status quo baseline: This baseline represents how septage is currently transported and received in Vermont and is also the basis for the economic model. This is based on the percentage of septage produced in each tract and the percent of septage received at each POTW.
- Theoretical Model: This is the baseline model if septage was hauled to the nearest location, by driving distance, and serves as the basis of comparison for the alternatives and the non-monetary metrics.
- Northwest Alternatives:
    - St. Albans: Because the St. Albans POTW is operating near their BOD design capacity, it was assumed that a merchant facility would be located somewhere in the St Albans sewer district. An annual receiving capacity of 5 million gallons was assumed.
    - Milton: It was assumed that a pre-processing facility would be located at or near the facility. Additionally, while not evaluated as part of this analysis, an optimized receiving station could be assumed as well. The final selection would depend on if the community wanted to reduce the number of trucks going to the Milton POTW or not. The Town of Milton has industrial zones located within its community; this is partly why a pre-processing facility was selected versus a merchant facility, as this pre-processing facility could be placed in an area that is already industrialized and limits the impact to residents. An annual receiving capacity of 18.25 million gallons was assumed, modeled on the current hydraulic permit limits of NewTech.
    - Richmond: Similarly, we assumed that there would be a pre-processing facility at Richmond. After looking at the location of the facility, locating a pre-processing facility off-site, closer to the highway, would reduce the number of trucks that need to travel past the residential houses and recreational fields. Additionally, Richmond currently serves a central role in septage receiving in the Northwest region. Besides improving the location, a pre-processing facility would be able to reduce the operational impacts on this < 1 MGD POTW and support its continued and increased septage receiving. A 5 percent increase in annual receiving capacity was assumed.
    - Williston/Essex Junction: It was assumed that this alternative was a merchant facility that would be located somewhere in the Williston/Essex Junction sewer district. The intention for this alternative would be to site it at a location that reduces the risk of nuisance for the neighboring community. An annual receiving capacity of 5 million gallons was assumed.
- Central Alternatives

  - **Montpelier**: It was assumed that Montpelier would receive an optimized receiving station. This would act as a second train to their current receiving station and would provide more septage storage, increasing their overall septage receiving and processing ability. Additionally, it was assumed that Montpelier would be further increasing its capacity during future upgrades. For the model, a septage receiving increase of 20 percent was assumed in this alternative. The treatment capacity upgrades were not considered as part of the economic analysis of this study as these are required as part of the facilities normal operations and is outside the scope of this project.
  - **Stowe**: While Stowe does receive a small amount of septage throughout the year, in this scenario, it was assumed that they would construct a pre-processing facility. Currently, Stowe is within a hotspot of septage production in the region. However, they receive virtually no septage due to geography, significant odor concerns, and community impacts when they have received septage in the past. However, a pre-processing facility out of town could distance the odor and traffic concerns from the village. An annual receiving capacity of 2 million gallons was assumed.
  - **Waterbury**: Waterbury has lagoon treatment; therefore, it was assumed that a merchant facility could be located near the POTW or somewhere else on the main sewer line. Additionally, while not economically evaluated in this analysis, a pre-processing facility could also be assumed instead of a merchant facility. An annual receiving capacity of 2 million gallons was assumed.
- Southwest Alternatives
  - **Bennington**: At Bennington, the BC team assumed an optimized septage receiving station to increase treatment capacity. As with Montpelier, the treatment capacity upgrades were not included as part of this economic analysis. A 10 percent increase in annual receiving capacity was assumed.
  - **Manchester**: Currently, Manchester does not receive septage; therefore, it was assumed that a pre-processing facility would be located at or near the facility to support additional septage capacity in the Southwest area of the state. An annual receiving capacity of 2 million gallons was assumed.
- East Alternatives

  St. Johnsbury and Springfield: Optimized receiving facilities were economically evaluated for these two locations. The intention for the geographic modeling was to see how a given alternative would change septage hauling and receiving patterns throughout the State. However, these alternatives would not induce any shifts in hauling patterns as they serve specific septage producing regions, and the alternative simply increased the existing capacity. As a result, these alternatives were not geographically modeled or assessed. State-wide economic evaluations were included based on the baseline septage receiving values and future projections.

4.3 Alternatives Analysis

While the alternatives listed above are not exhaustive, they do represent specific solutions that could be applied to either increase septage hauling efficiency or increase overall septage receiving capacity in regions that require more or could benefit from reserve septage capacity. To compare the alternatives among each other, four types of metrics were calculated: economic net present cost of the state-wide POTW septage treatment network and three non-monetary metrics.

4.3.1 Economic Analysis

This study was meant to look at the impact to the public entities, and not private entities. Therefore, the basis for determining costs were for POTWs, state government, or other non-private entities. The economic analysis was calculated as the state-wide economic impact of each alternative. However, this analysis did not evaluate cost models for who or how capital costs would be paid, but rather examines what might be the best value option for the State. For each alternative, the total state-wide economic impact was evaluated based on the gallons of septage received at each POTW. First, to account for design and construction time, the BC team assumed that operational and maintenance (O&M) costs did not start until 2027. The 20-year net present cost (NPC) analysis then went through 2047 with the mid-point being 2037. Table 4-1 summarizes the assumptions used for the 20-year NPC analysis.

Second, revenue potential for each facility was determined using either the provided septage tip fee that the POTW currently charges or the weighted average tip fee if one was not provided. Table 4-1 provides the range of septage tip fees and the weighted average tip fee used. Alternatives with a merchant facility assumed a higher tip fee. While this tip fee would be a revenue for a merchant facility, it was treated as a cost for the public (POTWs, state government, or other non-private entities) in this analysis.

Table 4-1. Economic Analysis Assumptions

Parameter	Units	Value	Reference
Escalation rate	%	4.2%	Office of Management and Budget (OMB) Circular No. A-94
Discount rate	%	2.2%	OMB Circular No. A-94
Septage tip fee range	$/gallon	$0.065 to $0.48	Information provided in the survey and by VT DEC
Septage weighted average tip fee	$/gallon	$0.087	Calculated
Merchant tip fee	$/gallon	$0.12	Assumed; this is a cost the public would incur in this analysis

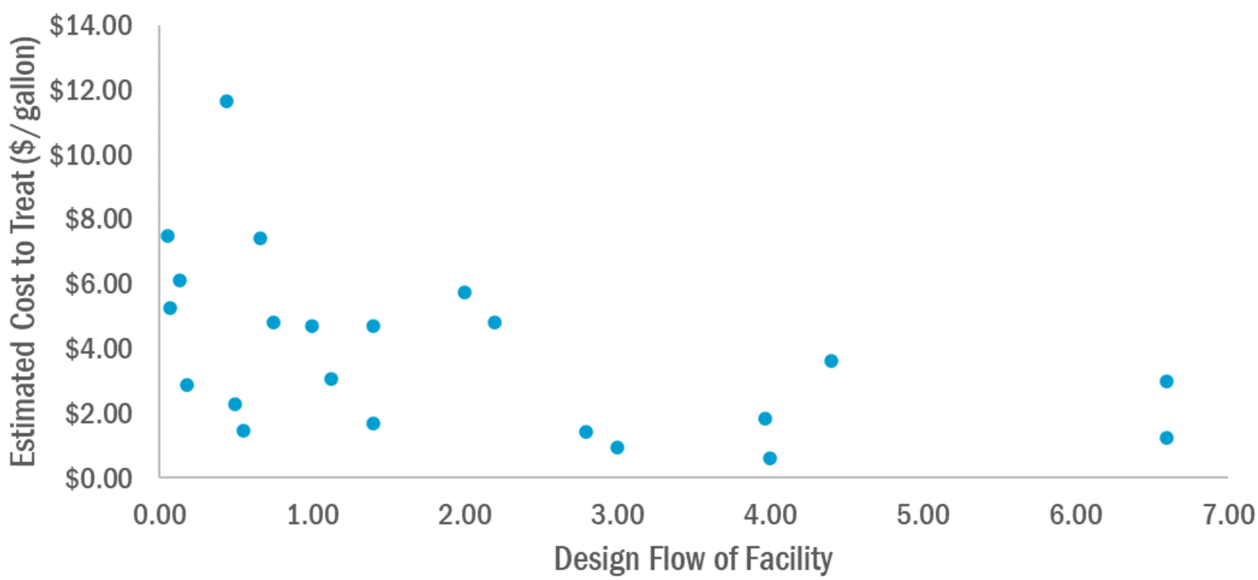

Figure 4-2. Estimated Cost to Treat for POTWs.

Next, the cost to treat a gallon of septage was determined. At this high-level analysis, a simplified approach was used in which it was assumed that each gallon of septage would be treated in the headworks as one gallon of sewered wastewater at the POTW. This is a simplified approach with flaws as there are several factors that determine the costs to treat septage and wastewater such as the level of treatment, size of facility, solids disposition, etc. In the survey, POTWs were asked to provide their average annual operating budget and average annual flow. These two values were used to determine the cost to treat a gallon of influent, including hauled-in septage, at different POTW design flows. Not all POTWs provided this information, therefore using the information provided (summarized in Figure 4-2) a cost-to-treat range based on a POTW's design flow was determined. Table 4-2 lists the ranges and costs-to-treat used as the O&M costs for POTWs that did not provide the data in the survey. For merchant facilities, as POTWs are only managing the liquid stream, the cost-to-treat for the merchant was not considered as part of this analysis. It was assumed that the sewer fees the POTW charged the merchant to discharge to the sewer would cover any cost to treat the POTW incurred. Therefore, no revenue or cost-to-treat was included in the merchant alternatives. The O&M costs associated with the optimized receiving facility and pre-processing facility were based on a percentage of the overall capital costs as noted in Table 4-3. The optimized septage-receiving facility has a lower percent than the pre-processing facility as the pre-processing facility would require additional labor to oversee the process, while the optimized septage-receiving facility would be located onsite at the POTW and would not need an additional staff person onsite. As noted previously, the merchant facility's cost-to-treat was 0 percent as the economic analysis was based on costs included by non-private entities.

Table 4-2. Summary of Design Flow Ranges and Cost to Treat

Design Flow (MG)	Average Cost to Treat
<1	$5.49
≥1 to <2	$3.55
≥2 to <3	$4.00
≥3	$1.88

Finally, the capital costs for the different alternatives were scaled from other projects as summarized in Table 4-3. Capital cost estimates employ a Class 5 conceptual construction cost estimate, following the standards set by the Association for the Advancement of Cost Engineering International (AACEI). These estimates, subject to a margin of +100/-50 percent, are intended for the purpose of comparing different alternatives. They are not intended for construction cost budgeting purposes. These capital costs are presented to facilitate the evaluation of alternatives and should be thoroughly examined as part of a more detailed cost estimate as the project scope progresses. As the type of merchant facility was not determined and technology type and cost would vary, the capital costs for the merchant facility would have too vast of a range, which was another reason why this economic analysis focused on the economic impacts to non-private entities.

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

The overall state-wide NPC for each alternative was higher than the status quo baseline except for St. Albans and Williston/Essex Junction as those alternatives assumed merchant facilities, in which the initial capital investment would be incurred by private entities. Figure 4-3 summarizes the NPCs for each alternative evaluated. Figure 4-4 summarizes the NPC for the POTWs identified in the alternatives as potentially impacted relative to a status quo operation (purple color bar on left). The light blue bars show additional costs relative to their current operational costs, highlighting that implementing one of these solutions would cost the POTWs more money than their current operational budget. Economically, treating septage at POTWs would not be economically favorable at current tip fees. Montpelier and St. Johnsbury do have a small decrease in NPC with the additional septage and changes. At this level of analysis, they would most likely break even. At current rates, sewer rate payers are currently subsidizing the cost to treat septage. Increases in septage tipping fees are likely to be borne by OWTS owners. To determine a more accurate cost to treat septage, a detailed evaluate of each facility accepting septage and its cost to treat septage relative to the cost of sewered wastewater should be conducted.

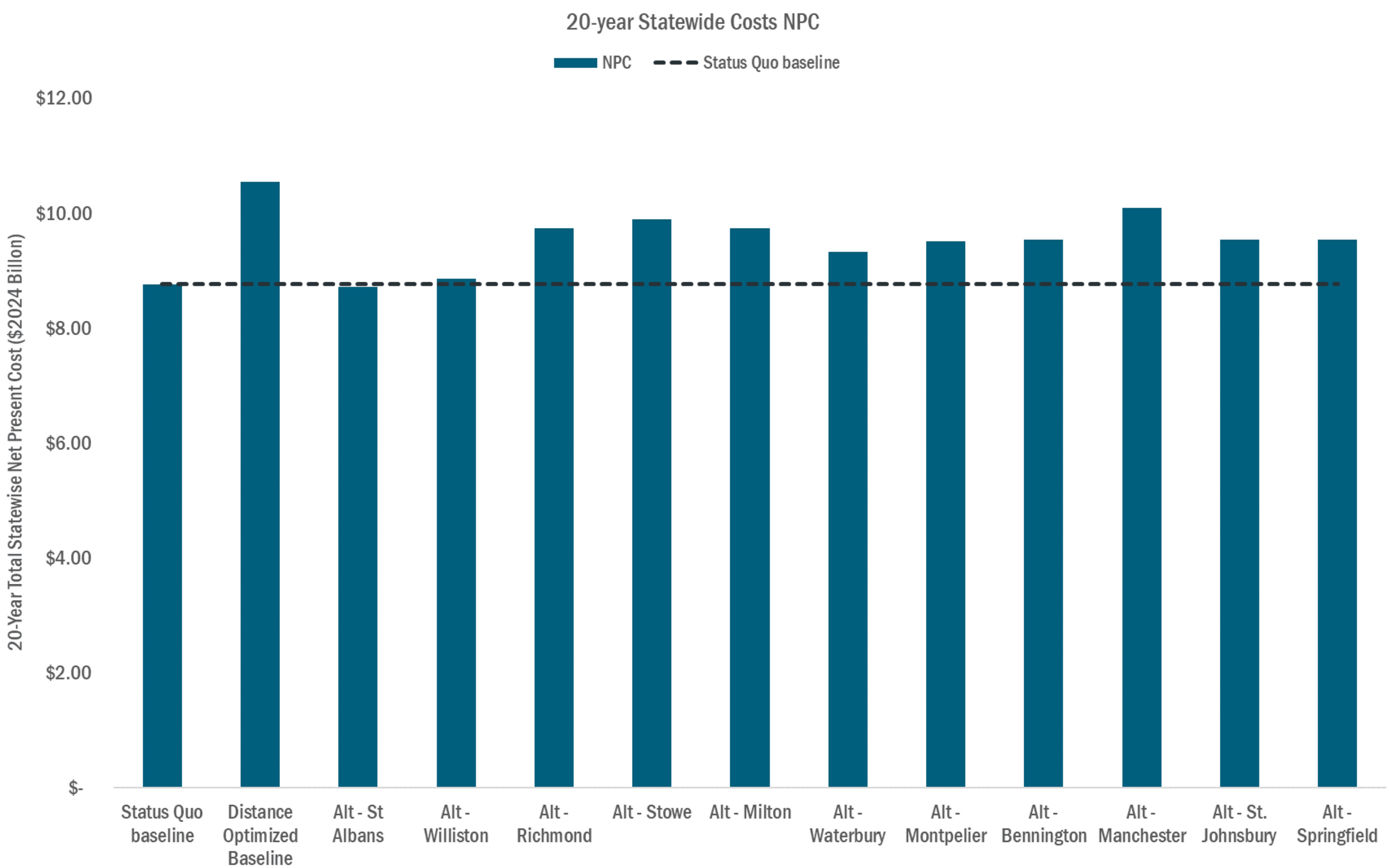

Figure 4-3. Summary of State-Wide Net Present Costs

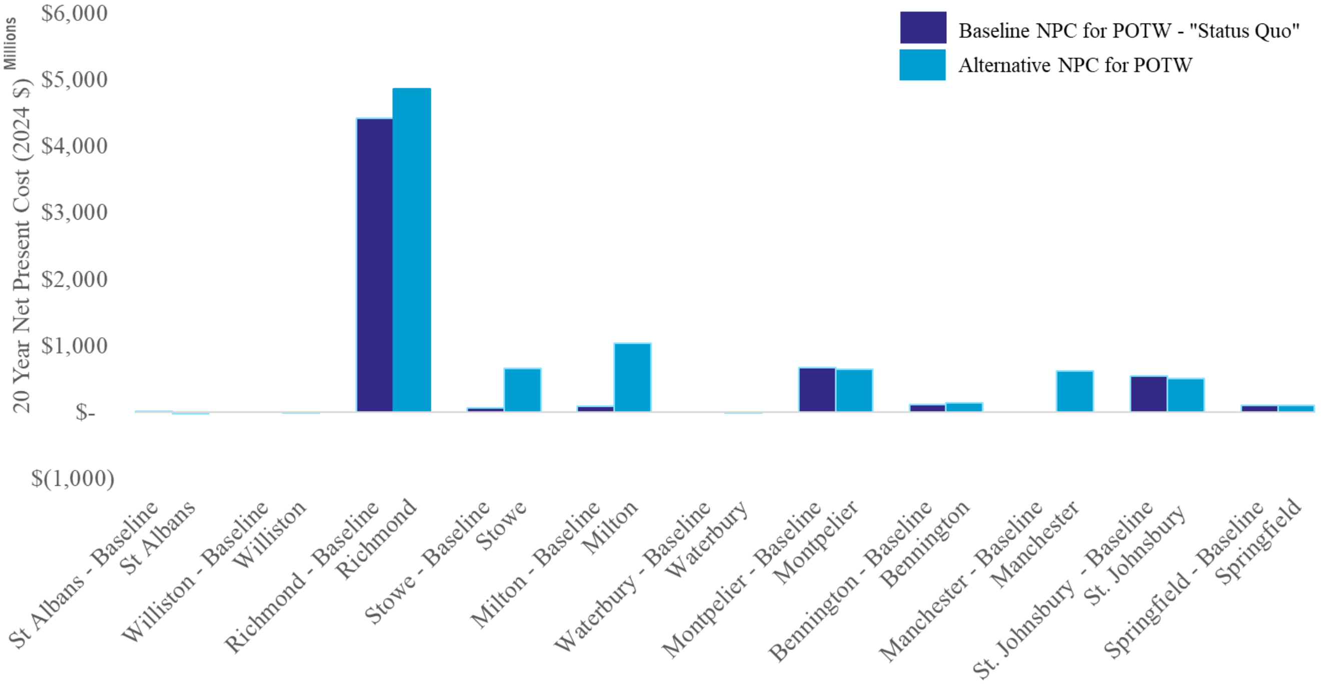

Figure 4-4. A Summary of the 20-Year Net Present Costs for the POTWs.

4.3.2 Non-monetary Metrics

The metrics calculated here aimed to aggregate a comprehensive score based on the impact that each alternative would have on overall septage management in the state. Three non-monetary metrics were explored: total driving distances, total buffer receiving capacity, and environmental justice impact. These metrics were calculated as nominal values (i.e. raw distance) as well as scores scaled to each alternative. The nominal values can be used as a direct comparison to the baseline. The scaled metrics were calculated using standard scaling, which brings every metric to a value between 0 and 1. With each metric scaled between 0 and 1, the four were then summed to represent a total score for each alternative. The higher the sum, the more positive the overall impact is for that alternative. Nominal values for the three metrics are provided in Attachment B.

Total Driving Distance

The total driving distance is represented as the sum of miles required to transport all the septage in the state to the receiving facilities. An alternative with a high nominal total driving distance scores worse than another alternative with a lower nominal total driving distance. This metric captures several considerations; it can be thought of as a proxy for carbon emissions, a stress score for haulers, and a rough representation of septage pumping costs to the consumer. This metric also reflects overall state-wide hauling efficiency. In the calculation of driving distance, average hauler truck capacity was assumed to be 4,500 gallons.

Septage Receiving Buffer Capacity

The receiving buffer capacity was represented as the total excess volume of treatment capacity in the state. If an alternative increases capacity at one facility, it could encourage more septage to be hauled there leading to newly freed capacity at the other facilities. This metric implies that more capacity to receive at more facilities is better. While the driving distance metric addresses septage hauling efficiency, the buffer capacity specifically addresses improving the state's overall septage management ability by building in a buffer to septage production spikes or projected increases.

Environmental Justice Impact

The environmental justice (EJ) impact score was calculated using the Vermont Environmental Disparity Index (VTEDI), developed at the University of Vermont (Ren et al. 2021). This index provides a value for each census tract based on an aggregated calculation to account for how sensitive areas are to environmental and socioeconomic implications (derived from the Vermont Department of Health's Social Vulnerability Index). To calculate a score for each alternative, the VTEDI was extracted for the census tract that each facility was situated within. Then, the respective value was multiplied by the volume of septage that was sent to that receiving facility, effectively scaling the VTEDI by septage volume. This was done to capture the effects of higher truck traffic, carbon emissions, and community impacts per facility. If more volume was sent to a facility in an environmentally disadvantaged community in an alternative, that alternative would receive a worse EJ score. There may be specific cases in which the EJ scores used in these metrics do not reflect the experiences of specific towns within those tracts. Specific consideration should be directed towards quantifying and evaluating EJ for a given alternative beyond this planning-level project.

4.4 Alternatives Discussion

Metrics for alternatives that were geographically modeled (Northwest-Central and Southwest alternatives) were aggregated with equal weight and are presented in Figure 4-5. In this figure, all metrics have been normalized such that the greater the bar size, the better the score. The equal-weight aggregate scores shown below do indicate significant benefits of certain alternatives over others. Separately, these scores were further evaluated by applying different weights to the metrics on a 1-3 scale with 1 being least important to 3 being most important, to determine if changing the criteria weighting would impact the overall results. Regardless of the weight assigned to the metric, the top five alternatives had the top five scores. The scores below are intended to be used for discussion purposes and to suggest a general framework for future decision-making.

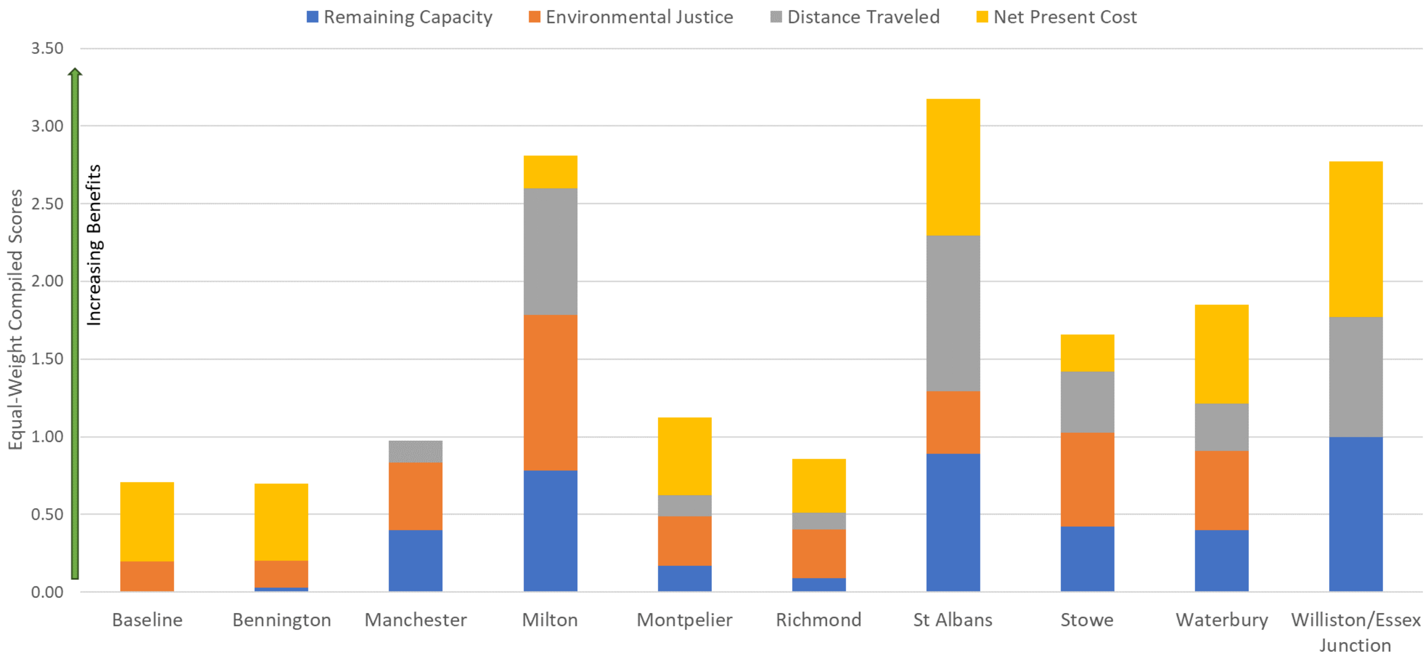

Figure 4-5. Equal-Weight Aggregate Scores for Modeled Alternatives.

Using these metrics to rank alternatives required additional considerations, specific to the current needs of each region. The Distance Traveled metric represents a difference in hauling routes from the status quo. This is a reflection of matching septage processing demand with septage processing capacity and improving overall efficiency. Remaining Capacity represents the ability of an alternative to add resiliency to the state's overall septage processing capability and may not specifically address current regional concerns.

Northwest-Central, The St. Albans alternative provided significant benefits for improving hauling distances and increasing buffer capacity. Especially when relying on a merchant facility, the cost to the state is significantly lower in this analysis, providing a significant cost-benefit. This assumes that the merchant would incur the initial capital investment. However, there could be public-private partnerships or other state grants that could be utilized so that the costs are shared between the municipality and merchant, as municipalities have more access to grants or lower interest loans than a private merchant. Secondarily, Milton offers significant benefits in both economic and non-monetary metrics as well. When considering EJ regions, however, Milton is an example where historic industrialization should be considered in tandem with its prime geographic location for septage receiving. As mentioned above, further development of any alternative past the planning stage in a historically overlooked area should incorporate significant considerations acknowledging and remedying past EJ impacts. Finally, a merchant facility at Williston/Essex Junction provides significant buffer capacity and driving distance improvements. As previously mentioned, this analysis assumes that the merchant would incur the initial capital investment, which results in a favorable NPC, though a public private partnership could also be considered.

Pre-processing facilities at Stowe and Waterbury provide some benefits to the region, though significantly less than the others mentioned. It is worth noting that due to their current standings as the first and second highest septage receivers in the state, any additional capacity or support that can be offered to Montpelier and Richmond would be valuable in supporting the Northwest region's septage management. Additionally, while the geographic program indicated that Stowe may be a potential alternative for mitigating septage processing issues in the region, this alternative highlights limitations in the program's overall algorithm. In this case, elevation and size of the road are significant considerations for septage haulers but are not taken into account in the current program.

Southwest: Given these metrics, it appears that adding a pre-processing facility at Manchester to facilitate septage receiving would be beneficial. However, these metrics may not be quite appropriate to evaluate optimized receiving facilities at Bennington. Because capacity meets demand for now, there are no significant changes in Distance Traveled as the sole POTW serving that region. Additionally, any new capacity is unlikely to free up capacity in other POTWs, reducing the calculated value of the Buffer Capacity metric. It should be noted that Manchester capacity was not considered during the Buffer Capacity calculations as it does not currently receive septage and would not begin if Bennington received upgrades. As with any of these alternatives, if VT DEC is selecting between Manchester and Bennington, it is recommended to perform more specific criteria selection and evaluation for the region, which could include additional factors such as the ease of implementing septage at a new facility or other information available to VT DEC.

East: While not specifically addressed in Figure 4-5, opportunities to improve septage buffer capacity on the eastern border of Vermont through optimized receiving facilities or other upgrades would be beneficial. Economic modeling for optimized receiving facilities at St. Johnsbury and Springfield are presented in Section 4.3.1. This could protect against unexpected regulatory changes in New Hampshire, whose septage receiving POTWs currently acts as the buffer for that region of Vermont. It could also provide additional operational flexibility for these plants who serve a specific and isolated region.

Section 5: Experience Builder Geographic Dashboard

The approach, geographic models, discussion, and results of the septage management alternatives were also presented in an ArcGIS Experience Builder dashboard. The dashboard contains a tutorial for the dashboard, project context and modeling methodology, geographic models of each of the alternatives and accompanying economic and non-monetary metrics, along with supporting data and a summary of findings. The intention for the dashboard is to allow the viewer to visually compare the modeled alternatives and their system-wide impacts on septage receiving. Additionally, the dashboard may be used by VT DEC to share the results of the project with other stakeholders and demonstrate the impacts of various scenarios and alternatives. A representative screenshot of the dashboard is shown in Figure 5-1.

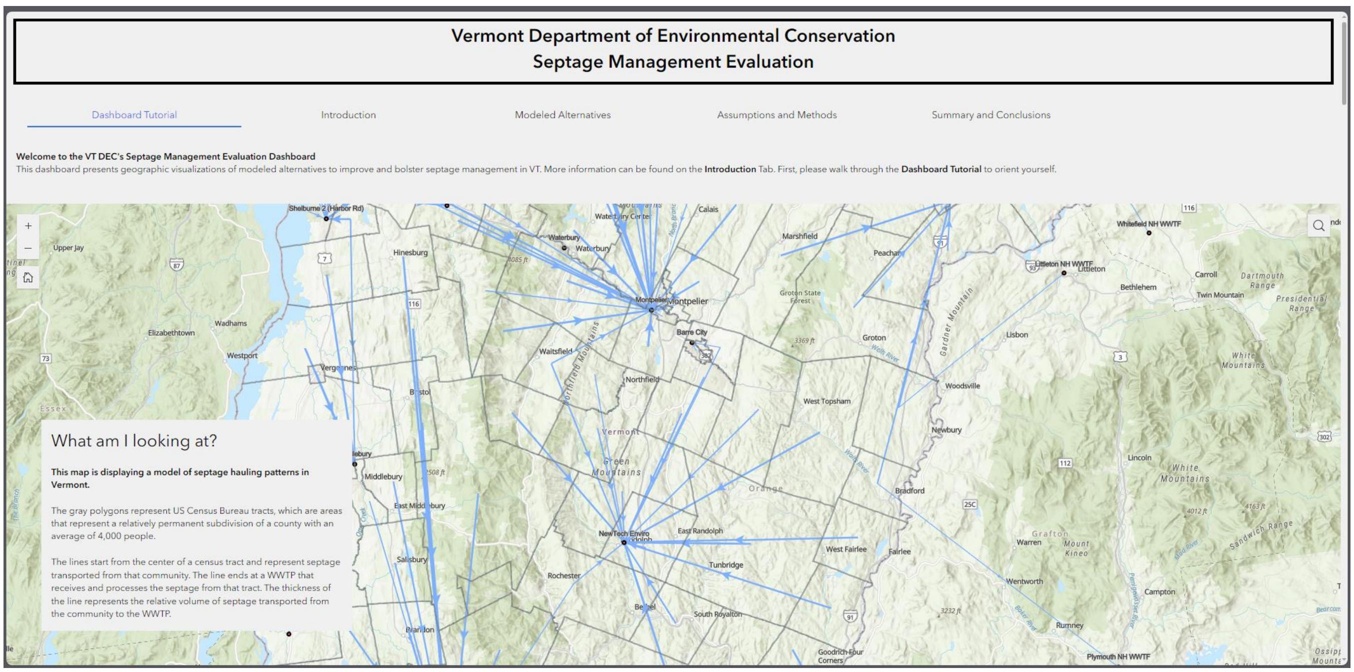

Figure 5-1. Screenshot of VT DEC Septage Management Project Dashboard Tutorial Page.

The maps in the dashboard display movement of septage from a census tract to POTWs that receive the septage. While the geographic models of septage hauling and receiving were developed using actual driving distances, the dashboard visualization simplifies the travel routes to be represented by straight lines that start from the center of a census tract and represent septage produced there and transported from that community. The line ends at a POTW that receives and processes the septage from that tract, and septage can be transported to multiple POTWs, if capacity is limited. Every alternative was geographically rendered to model the changes in hauling patterns, due to new capacity in the alternative. Figure 5-2 displays two geographic models superimposed. Comparing the overlaps and differences in hauling allow the viewer to visualize the changes in efficiency of the overall state-level system. These maps were partnered with figures of the economic and non-monetary metrics discussed in Section 4.3 to be reviewed in tandem, visualizing the state impacts while understanding a quantitative representation of the relative benefits of the alternatives.

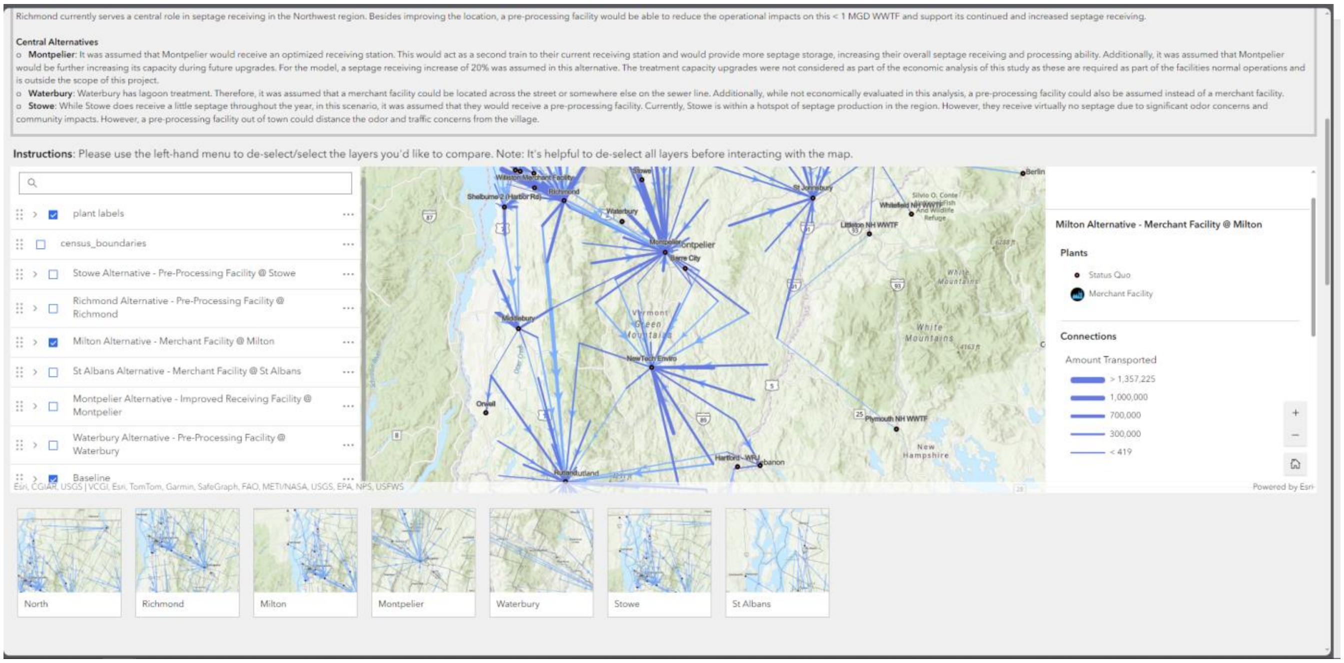

Figure 5-2. Screenshot of VT DEC Septage Management Project Dashboard Alternatives Page.

The dashboard relies on government data that has not been independently verified by the developer of this dashboard and may or may not be representative of all septage receiving station options or may indicate availability that is incorrect. The user should only consider this as a screening tool and independently verify options and availability prior to any reliance on the data for business, financial decisions, or other key decisions.

Section 6: Recommendations

To facilitate prioritization for further analysis and potential future funding, BC balanced the geographic analysis and economic and non-monetary considerations discussed above to develop a prioritization list. This list considers the general urgency of addressing the bottleneck in the Northwest as well as the need to bolster overall septage management in the state for upcoming population and septage production increases.

BC recommends further refinement and analysis of the following alternatives, in order:

1. St. Albans – Merchant facility
2. Milton – Pre-processing facility
3. Williston/Essex Junction – Merchant facility
4. Manchester – Pre-processing facility
5. Bennington – Optimized receiving facility

Additionally, BC recommends specific consideration of Richmond and Montpelier, who are currently the top two septage receiving POTWs in the State, and POTWs that serve specific and isolated geographic areas such as St. Johnsbury, Brattleboro, Bellows Falls, and Bennington. Continuing discussions could include timing considerations with upcoming upgrades and 20-year engineering evaluations or refined capacity estimates. Ultimately, this report outlines the data analysis, model logic, and alternatives approach and analysis to identify potential solutions to adjust inefficient hauling in the Northwest, as well as opportunities to build in flexibility for potential stressors and future capacities as Vermont continues to grow.

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Attachment A: Survey Questions

A.1. Wastewater Facility Survey Questions

A.2. Septage Hauler Survey Questions

State of Vermont Septage Management Survey

Thank you for taking the time to answer this survey from the Department of Environmental Conservation. By completing this survey, you will be helping the State of Vermont and its consultant, Brown and Caldwell, to develop a state-wide strategy for how Vermont manages septage.

The survey should take approximately 25 minutes to complete. Unfortunately, there is not a way to save your answers. If you need to leave and return to the survey later, please leave the window open and you will be able to continue when you return.

If you have any questions, please contact pma@brwncald.com.

* Required

General POTW Information

1. Name of Wastewater Facility *

2. Contact Name *

3. Phone Number *

4. Email Address *

5. Does your facility currently accept or have the capacity to accept septage? *

- ◯ Yes
- ◯ No

POTWs Currently Receiving Septage

Questions? Email pma@brwncald.com.

6. How much septage (gallons) does your facility receive per day on average? *

7. Is this typical throughout the year? *

- ◯ Yes
- ◯ No

8. If no, please explain.

9. Do you have capacity to receive more septage than you currently/typically do? *

- ◯ Yes
- ◯ No
- ◯ Other

10. What are your typical septage receiving days? *

- ☐ Sundays
- ☐ Mondays
- ☐ Tuesdays
- ☐ Wednesdays
- ☐ Thursdays
- ☐ Fridays
- ☐ Saturdays
- ☐ Other

11. What are your typical septage receiving hours? *

- [ ] Before 8am
- [ ] 8-11am
- [ ] 11am-1pm
- [ ] 1-4pm
- [ ] After 4pm
- [ ] Other

12. When do haulers typically offload?

- [ ] Early morning (6-9am)
- [ ] Morning (9am-noon)
- [ ] Afternoon (noon-5pm)
- [ ] Other

13. Have you seen any impacts to your organics loading due to the acceptance of septage? *

- ○ Yes
- ○ No
- ○ Other

14. If you answered yes to the previous question, please explain.

15. Have you seen any impacts to your nutrient loading due to the acceptance of septage? *

- ○ Yes
- ○ No
- ○ Other

16. If you answered yes to the previous question, please explain.

17. Do you anticipate any changes to your septage receiving program in the near future? *

- ◯ Yes
- ◯ No
- ◯ Maybe

18. If yes or maybe, please explain.

Current Septage Treatment Assets

Questions? Email pma@brwncald.com.

19. How does your facility receive septage? *

- ◯ Septage receiving without screening
- ◯ Septage receiving with screening
- ◯ Manhole/no dedicated receiving
- ◯ Other

20. Please select the processes that your facility uses to treat septage (process flow from receipt to discharge) *

- ☐ Headworks without screening
- ☐ Headworks with screening
- ☐ Digester
- ☐ Dewatering
- ☐ Other

21. What is the age and condition of the septage-receiving equipment? *

E.g. Condition = good, fair, poor

22. Does this equipment need an upgrade in: *

- ◯ ASAP
- ◯ < 5 years
- ◯ 5 - 10 years
- ◯ > 10 years

Cost of Septage Receiving

Questions? Email pma@brwncald.com.

23. What are your septage receiving rates per gallon? (residential/business/portable toilets) *

24. How many gallons of septage do you treat a year? *

25. Please provide any supporting data.

    If you can, enter here, or email documents to pma@brwncald.com.

POTWs Not Currently Accepting Septage

Questions? Email pma@brwncald.com.

26. Why doesn't your facility accept septage? *

- ☐ No receiving options
- ☐ Not enough oversight
- ☐ Staffing limitations
- ☐ Capacity limitations
- ☐ Process limitations (e.g., lagoon)
- ☐ Other

27. Have you accepted septage in the past? *

- ○ Yes
- ○ No
- ○ Other

28. If yes, please explain why you no longer accept septage and any relevant details.

29. Would you be willing to accept septage in the future?

- ○ Yes
- ○ No
- ○ Other

30. If no, please explain why.

31. If yes, what would be your receiving capacity?

POTW Information

Questions? Email pma@brwncald.com.

32. What is your current permitted wastewater capacity? (MGD) *

33. What is your current dry weather flow and average flow? (e.g., ADF 6 MGD; AVG 8 MGD) *

34. How many gallons of wastewater do you treat a year? *

35. What is your average annual operating budget? *

36. Please send the last 3 years of annual operational budgets. *

    If you have annual O&M estimates (e.g., 2022 $4.4 million), hyperlinks to budgets, or contact information for the appropriate person with this information, feel free to provide below. Otherwise, please email any budgetary files to pma@brwncald.com.

37. What is your current organics loading? (Ex. lb/day or mg/L of BOD/COD) *

38. What is your designed organics loading? *

Upgrades and Renovations

Questions? Email pma@brwncald.com.

39. Do you have any current or future planned upgrades? *

- ◯ Yes
- ◯ No
- ◯ Other

40. If so, please outline any major upgrades.

41. Please provide an estimate of capital costs if available.

42. Are any of these upgrades designed to address septage receiving?

- ◯ Yes
- ◯ No
- ◯ Other

43. If so, please elaborate.

Thank you!

Thanks so much for your time and effort in completing this survey.

44. Is there anything else you would like us to know regarding septage in the state of Vermont?

This can include suggestions for improvement. Feedback is welcome.

State of Vermont Septage Management Survey

Thank you for taking the time to answer this short survey from the Department of Environmental Conservation. By completing this survey, you will be helping the State of Vermont and its consultant, Brown and Caldwell, to develop a state-wide strategy for how Vermont manages septage.

The survey should take approximately 10-15 minutes to complete. Your answers will be saved as you go, so you may return to the survey multiple times to complete it. If you have any questions, please contact pma@brwncald.com.

* Required

1. Company Name *

2. First and Last Name *

3. Phone Number *

4. Email Address *

5. What types of facilities do you collect septage from? *

- ☐ Residential
- ☐ Commercial
- ☐ Institutional Sites (e.g., hospitals, schools)
- ☐ Portable Toilet Waste
- ☐ Other

6. What counties do you service? *

- [ ] Addison
- [ ] Bennington
- [ ] Caledonia
- [ ] Chittenden
- [ ] Essex
- [ ] Franklin
- [ ] Grand Isle
- [ ] Lamoille
- [ ] Orange
- [ ] Orleans
- [ ] Rutland
- [ ] Washington
- [ ] Windham
- [ ] Windsor

7. On average, what distances do you travel to dispose of your septage? (miles) *

8. At what cost would you avoid using a septage receiving facility? (ex. WWTP) *

- ○ 10-15 cents/gallon
- ○ 15-20 cents/gallon
- ○ >20 cents/gallon
- ○ Other

9. How far are you willing to drive to dispose of septage? *

- ◯ 1-25 miles
- ◯ 25-50 miles
- ◯ 50-75 miles
- ◯ 75-100 miles
- ◯ >100 miles
- ◯ Other

10. Do you have enough outlets to meet your hauling needs? *

- ◯ Yes
- ◯ No
- ◯ Other

11. What are the most common issues you run into when disposing of septage? (Select all that apply.) *

- ☐ Receiving hours
- ☐ Lack of capacity
- ☐ They don't take a particular type of waste
- ☐ Offloading facilities
- ☐ Hauling distance
- ☐ Other

12. Have you ever been turned away from a tipping site unexpectedly? *

- ◯ Yes
- ◯ No

13. If yes, in what year(s) did this happen?

- ☐ 2023
- ☐ 2022
- ☐ 2021
- ☐ 2020
- ☐ 2019
- ☐ 2018 or prior

14. Please explain what happened and how long you were turned away.

15. Anything else you would like us to know regarding septage in Vermont?

This can include suggestions for improvement. Feedback is welcome.

Attachment B: Summary of Economic Evaluation

Table B-1. Annual Revenue Potential for Each Facility Based on 2037 Septage Received

			Status Quo baseline	Baseline	Distance Optimized Baseline	St Albans	Williston/Essex Junction	Richmond	Stowe	Milton	Waterbury	Montpelier	Bennington	Manchester	St. Johnsbury	Springfield
Tip Fee ($/gal)	POTW Name	State	Tip Fees ($/y)	Tip Fees ($/y)	Tip Fees ($/y)	Tip Fees ($/y)	Tip Fees ($/y)	Tip Fees ($/y)	Tip Fees ($/y)	Tip Fees ($/y)	Tip Fees ($/y)	Tip Fees ($/y)	Tip Fees ($/y)	Tip Fees ($/y)	Tip Fees ($/y)	Tip Fees ($/y)
$ 0.070	Allenstown NH WWTF	NH	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 0.087	Barre City	VT	$ 5,684	$ 6,380	$ 5,166	$ 6,380	$ 6,380	$ 6,380	$ 6,380	$ 6,380	$ 6,380	$ 6,380	$ 6,380	$ 6,380	$ 6,380	$ 6,380
$ 0.130	Bellows Falls	VT	$ 493,506	$ 437,050	$ 248,850	$ 437,050	$ 437,050	$ 437,050	$ 437,050	$ 437,050	$ 437,050	$ 437,050	$ 437,050	$ 498,096	$ 437,050	$ 437,050
$ 0.065	Bennington	VT	$ 165,231	$ 159,087	$ 126,469	$ 159,087	$ 159,087	$ 159,087	$ 159,087	$ 159,087	$ 159,087	$ 159,087	$ 172,513	$ 87,560	$ 159,087	$ 159,087
$ 0.087	Berlin WWTF, Berlin NH	NH	$ 10,280	$ 15,403	$ -	$ -	$ -	$ 15,403	$ 907	$ -	$ 6,995	$ 15,403	$ 15,403	$ 15,403	$ 15,403	$ 15,403
$ 0.080	Brattleboro	VT	$ 510,833	$ 435,159	$ 353,023	$ 435,159	$ 435,159	$ 435,159	$ 435,159	$ 435,159	$ 435,159	$ 435,159	$ 425,120	$ 475,119	$ 435,159	$ 435,159
$ 0.090	Burlington North	VT	$ 8,877	$ 11,706	$ 10,917	$ 11,706	$ 11,706	$ 11,706	$ 11,706	$ 11,706	$ 11,706	$ 11,706	$ 11,706	$ 11,706	$ 11,706	$ 11,706
$ 0.090	Burlington River	VT	$ 34,794	$ 36,568	$ 34,105	$ 36,568	$ 36,568	$ 36,568	$ 36,568	$ 36,568	$ 36,568	$ 36,568	$ 36,568	$ 36,568	$ 36,568	$ 36,568
$ 0.120	Canaan	VT	$ 131,115	$ 133,069	$ 37,424	$ 49,564	$ 53,210	$ 109,595	$ 85,706	$ 49,564	$ 85,706	$ 105,151	$ 133,069	$ 133,069	$ 133,069	$ 133,069
$ 0.087	Champlain NY WWTF	NY	$ 52,448	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 0.087	Claremont NH WWTF	NH	$ 3,076	$ 5,890	$ 2,590	$ 5,890	$ 5,890	$ 5,890	$ 5,890	$ 5,890	$ 5,890	$ 5,890	$ 5,890	$ 5,890	$ 5,890	$ 5,890
$ 0.095	Essex Junction	VT	$ 82,001	$ 96,960	$ 90,429	$ 96,960	$ 96,960	$ 96,960	$ 96,960	$ 96,960	$ 96,960	$ 96,960	$ 96,960	$ 96,960	$ 96,960	$ 96,960
$ 0.087	Glen Falls NY	NY	$ 2,853	$ 4,610	$ 2,402	$ 4,610	$ 4,610	$ 4,610	$ 4,610	$ 4,610	$ 4,610	$ 4,610	$ 4,610	$ 4,610	$ 4,610	$ 4,610
$ 0.129	Hartford - WRJ	VT	$ 3,746	$ 3,074	$ 459,113	$ 3,074	$ 3,074	$ 3,074	$ 3,074	$ 3,074	$ 3,074	$ 3,074	$ 3,074	$ 3,074	$ 3,074	$ 3,074
$ 0.087	Hoosac Water Quality - Williamstown MA	MA	$ 45,442	$ 33,394	$ 32,456	$ 33,394	$ 33,394	$ 33,394	$ 33,394	$ 33,394	$ 33,394	$ 33,394	$ 33,394	$ 40,570	$ 33,394	$ 33,394
$ 0.087	Hoosick Falls NY WWTF	NY	$ 185,482	$ 13,335	$ 16,212	$ 13,335	$ 13,335	$ 13,335	$ 13,335	$ 13,335	$ 13,335	$ 13,335	$ 7,520	$ -	$ 13,335	$ 13,335
$ 0.087	Keene NH WWTF	NH	$ 77,561	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 0.085	Lebanon NH WWTF	NH	$ 69,616	$ 69,487	$ -	$ 69,487	$ 69,487	$ 69,487	$ 69,487	$ 69,487	$ 69,487	$ 69,487	$ 69,487	$ 69,487	$ 69,487	$ 69,487
$ 0.087	Littleton NH WWTF	NH	$ 1,208	$ 1,177	$ 1,017	$ 1,177	$ 1,177	$ 1,177	$ 1,177	$ 1,177	$ 1,177	$ 1,177	$ 1,177	$ 1,177	$ 1,177	$ 1,177
$ 0.480	Ludlow	VT	$ 5,006	$ 4,995	$ 4,658	$ 4,995	$ 4,995	$ 4,995	$ 4,995	$ 4,995	$ 4,995	$ 4,995	$ 4,995	$ 4,995	$ 4,995	$ 4,995
$ 0.087	Manchester	VT	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 359,438	$ -	$ -
$ 0.110	Middlebury	VT	$ 497,428	$ 430,382	$ 900,917	$ 430,382	$ 430,382	$ 430,382	$ 430,382	$ 430,382	$ 430,382	$ 430,382	$ 430,382	$ 430,382	$ 430,382	$ 430,382
$ 0.097	Milton	VT	$ 66,684	$ 176,417	$ 511,537	$ 176,417	$ 176,417	$ 176,417	$ 176,417	$ 813,957	$ 176,417	$ 176,417	$ 176,417	$ 176,417	$ 176,417	$ 176,417
$ 0.090	Montpelier	VT	$ 1,345,344	$ 1,271,996	$ 559,108	$ 1,184,130	$ 1,156,167	$ 1,271,996	$ 1,236,742	$ 1,193,967	$ 1,241,340	$ 1,399,196	$ 1,271,996	$ 1,271,996	$ 1,271,996	$ 1,271,996
$ 0.110	Newport City	VT	$ 370,822	$ 310,422	$ 374,077	$ 309,339	$ 310,422	$ 310,422	$ 310,422	$ 310,422	$ 310,422	$ 310,422	$ 310,422	$ 310,422	$ 310,422	$ 310,422
$ 0.095	NewTech Enviro	VT	$ 255,037	$ 633,114	$ 438,017	$ 633,114	$ 633,114	$ 633,114	$ 633,114	$ 633,114	$ 633,114	$ 633,114	$ 633,114	$ 633,114	$ 633,114	$ 633,114
$ 0.087	Northumberland NH	NH	$ 178	$ 146	$ 150	$ 146	$ 146	$ 146	$ 146	$ 146	$ 146	$ 146	$ 146	$ 146	$ 146	$ 146
$ 0.075	Orwell	VT	$ 15,747	$ 23,686	$ 18,613	$ 23,686	$ 23,686	$ 23,686	$ 23,686	$ 23,686	$ 23,686	$ 23,686	$ 23,686	$ 23,686	$ 23,686	$ 23,686
$ 0.087	Plattsburgh NY WWTF	NY	$ 89,085	$ 83,706	$ 75,005	$ 83,706	$ 83,706	$ 83,706	$ 83,706	$ 83,706	$ 83,706	$ 83,706	$ 83,706	$ 83,706	$ 83,706	$ 83,706
$ 0.087	Plymouth NH WWTF	NH	$ 2,241	$ 4,317	$ -	$ 2,718	$ 2,718	$ 4,317	$ 4,317	$ 2,718	$ 4,317	$ 4,317	$ 4,317	$ 4,317	$ 4,317	$ 4,317
$ 0.087	Pownal	VT	$ 13,623	$ 16,463	$ 20,973	$ 16,463	$ 16,463	$ 16,463	$ 16,463	$ 16,463	$ 16,463	$ 16,463	$ 15,210	$ 13,165	$ 16,463	$ 16,463
$ 0.075	Richmond	VT	$ 1,117,424	$ 1,158,645	$ 1,007,668	$ 1,047,269	$ 1,080,000	$ 1,216,577	$ 1,158,645	$ 1,082,372	$ 1,158,645	$ 1,158,645	$ 1,158,645	$ 1,167,921	$ 1,158,645	$ 1,158,645
$ 0.087	Rouses Point NY WWTF	NY	$ 23,002	$ 53,026	$ 19,367	$ 53,026	$ 53,026	$ 53,026	$ 53,026	$ 53,026	$ 53,026	$ 53,026	$ 53,026	$ 53,026	$ 53,026	$ 53,026
$ 0.095	Rutland	VT	$ 1,142,156	$ 1,211,674	$ 553,038	$ 826,183	$ 826,805	$ 1,156,877	$ 964,574	$ 850,889	$ 971,821	$ 1,099,510	$ 1,211,674	$ 1,109,167	$ 1,211,674	$ 1,211,674
$ 0.090	Shelburne 2 (Harbor Rd)	VT	$ 253,543	$ 273,193	$ 194,064	$ 273,193	$ 273,193	$ 273,193	$ 273,193	$ 273,193	$ 273,193	$ 273,193	$ 273,193	$ 273,193	$ 273,193	$ 273,193
$ 0.090	South Burlington - Airport Parkway	VT	$ 41,603	$ 64,103	$ 59,785	$ 64,103	$ 64,103	$ 64,103	$ 64,103	$ 64,103	$ 64,103	$ 64,103	$ 64,103	$ 64,103	$ 64,103	$ 64,103
$ 0.120	Springfield	VT	$ 95,959	$ 79,993	$ 341,930	$ 79,993	$ 79,993	$ 79,993	$ 79,993	$ 79,993	$ 79,993	$ 79,993	$ 79,993	$ 81,144	$ 79,993	$ 79,993
$ 0.085	St Albans City	VT	$ 90,617	$ 78,466	$ 73,181	$ 1,003,418	$ 78,466	$ 78,466	$ 78,466	$ 78,466	$ 78,466	$ 78,466	$ 78,466	$ 78,466	$ 78,466	$ 78,466
$ 0.120	St Johnsbury	VT	$ 732,919	$ 665,617	$ 534,492	$ 663,354	$ 665,617	$ 665,617	$ 665,617	$ 665,617	$ 665,617	$ 665,617	$ 665,617	$ 665,617	$ 665,617	$ 665,617
$ 0.110	Stowe	VT	$ 44,286	$ 70,613	$ 1,139,745	$ 70,613	$ 70,613	$ 70,613	$ 461,522	$ 70,613	$ 70,613	$ 70,613	$ 70,613	$ 70,613	$ 70,613	$ 70,613
$ 0.087	Waterbury	VT	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 402,783	$ -	$ -	$ -	$ -	$ -
$ 0.087	Whitefield NH WWTF	NH	$ 1,480	$ 1,215	$ 1,246	$ 1,215	$ 1,215	$ 1,215	$ 1,215	$ 1,215	$ 1,215	$ 1,215	$ 1,215	$ 1,215	$ 1,215	$ 1,215
$ 0.180	Whitingham	VT	$ 7,368	$ 7,733	$ 124,952	$ 7,733	$ 7,733	$ 7,733	$ 7,733	$ 7,733	$ 7,733	$ 7,733	$ 7,733	$ 9,737	$ 7,733	$ 7,733
$ 0.120	Williston Merchant Facility	VT	$ -	$ -	$ -	$ -	$ 869,680	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 0.100	Windsor Main	VT	$ 4,397	$ 6,419	$ 214,772	$ 6,419	$ 6,419	$ 6,419	$ 6,419	$ 6,419	$ 6,419	$ 6,419	$ 6,419	$ 6,419	$ 6,419	$ 6,419
	Total Potential Revenue ($/y)	POTWs	$ 8,099,700	$ 8,088,691	$ 8,587,468	$ 8,325,055	$ 8,282,165	$ 8,068,352	$ 8,135,385	$ 8,110,635	$ 8,165,192	$ 8,075,808	$ 8,085,009	$ 8,378,072	$ 8,088,691	$ 8,088,691
	Total Potential Revenue ($/y)	VT only POTWs	$ 7,535,748	$ 7,802,984	$ 8,437,024	$ 8,056,351	$ 8,013,462	$ 7,782,645	$ 7,864,175	$ 7,841,931	$ 7,887,894	$ 7,790,101	$ 7,805,118	$ 8,098,525	$ 7,802,984	$ 7,802,984

Table B-2. Annual O&M for Each Facility Based on 2037 Septage Received

			Status Quo baseline	Baseline	Distance Optimized Baseline	St Albans	Williston/Essex Junction	Richmond	Stowe	Milton	Waterbury	Montpelier	Bennington	Manchester	St. Johnsbury	Springfield
Estimted Cost to Treat ($/gal)	POTW Name	State	Annual Cost to Treat ($/y)	Annual Cost to Treat ($/y)	Annual Cost to Treat ($/y)	Annual Cost to Treat ($/y)	Annual Cost to Treat ($/y)	Annual Cost to Treat ($/y)	Annual Cost to Treat ($/y)	Annual Cost to Treat ($/y)	Annual Cost to Treat ($/y)	Annual Cost to Treat ($/y)	Annual Cost to Treat ($/y)	Annual Cost to Treat ($/y)	Annual Cost to Treat ($/y)	Annual Cost to Treat ($/y)
$ 3.545	Allenstown NH WWTF	NH	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 1.879	Barre City	VT	$ 122,505	$ 137,510	$ 111,335	$ 137,510	$ 137,510	$ 137,510	$ 137,510	$ 137,510	$ 137,510	$ 137,510	$ 137,510	$ 137,510	$ 137,510	$ 137,510
$ 1.700	Bellows Falls	VT	$ 6,453,535	$ 5,715,268	$ 3,254,190	$ 5,715,268	$ 5,715,268	$ 5,715,268	$ 5,715,268	$ 5,715,268	$ 5,715,268	$ 5,715,268	$ 5,715,268	$ 6,513,566	$ 5,715,268	$ 5,715,268
$ 1.879	Bennington	VT	$ 4,777,144	$ 4,599,500	$ 3,656,465	$ 4,599,500	$ 4,599,500	$ 4,599,500	$ 4,599,500	$ 4,599,500	$ 4,599,500	$ 4,599,500	$ 4,987,666	$ 2,531,514	$ 4,599,500	$ 4,599,500
$ 1.879	Berlin WWTF, Berlin NH	NH	$ 221,549	$ 331,973	$ -	$ -	$ -	$ 331,973	$ 19,546	$ -	$ 150,763	$ 331,973	$ 331,973	$ 331,973	$ 331,973	$ 331,973
$ 0.958	Brattleboro	VT	$ 6,119,351	$ 5,212,847	$ 4,228,916	$ 5,212,847	$ 5,212,847	$ 5,212,847	$ 5,212,847	$ 5,212,847	$ 5,212,847	$ 5,212,847	$ 5,092,578	$ 5,691,528	$ 5,212,847	$ 5,212,847
$ 4.000	Burlington North	VT	$ 394,538	$ 520,261	$ 485,217	$ 520,261	$ 520,261	$ 520,261	$ 520,261	$ 520,261	$ 520,261	$ 520,261	$ 520,261	$ 520,261	$ 520,261	$ 520,261
$ 3.545	Burlington River	VT	$ 1,370,582	$ 1,440,460	$ 1,343,434	$ 1,440,460	$ 1,440,460	$ 1,440,460	$ 1,440,460	$ 1,440,460	$ 1,440,460	$ 1,440,460	$ 1,440,460	$ 1,440,460	$ 1,440,460	$ 1,440,460
$ 5.490	Canaan	VT	$ 5,998,557	$ 6,087,948	$ 1,712,184	$ 2,267,583	$ 2,434,392	$ 5,014,019	$ 3,921,071	$ 2,267,583	$ 3,921,071	$ 4,810,702	$ 6,087,948	$ 6,087,948	$ 6,087,948	$ 6,087,948
$ 5.490	Champlain NY WWTF	NY	$ 3,302,192	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 3.545	Claremont NH WWTF	NH	$ 125,060	$ 239,482	$ 105,294	$ 239,482	$ 239,482	$ 239,482	$ 239,482	$ 239,482	$ 239,482	$ 239,482	$ 239,482	$ 239,482	$ 239,482	$ 239,482
$ 1.250	Essex Junction	VT	$ 1,078,964	$ 1,275,793	$ 1,189,859	$ 1,275,793	$ 1,275,793	$ 1,275,793	$ 1,275,793	$ 1,275,793	$ 1,275,793	$ 1,275,793	$ 1,275,793	$ 1,275,793	$ 1,275,793	$ 1,275,793
$ 1.879	Glen Falls NY	NY	$ 61,488	$ 99,348	$ 51,770	$ 99,348	$ 99,348	$ 99,348	$ 99,348	$ 99,348	$ 99,348	$ 99,348	$ 99,348	$ 99,348	$ 99,348	$ 99,348
$ 3.545	Hartford - WRJ	VT	$ 102,948	$ 84,488	$ 12,617,610	$ 84,488	$ 84,488	$ 84,488	$ 84,488	$ 84,488	$ 84,488	$ 84,488	$ 84,488	$ 84,488	$ 84,488	$ 84,488
$ 1.879	Hoosac Water Quality - Williamstown MA	MA	$ 979,358	$ 719,714	$ 699,484	$ 719,714	$ 719,714	$ 719,714	$ 719,714	$ 719,714	$ 719,714	$ 719,714	$ 719,714	$ 874,372	$ 719,714	$ 719,714
$ 5.490	Hoosick Falls NY WWTF	NY	$ 11,678,268	$ 839,604	$ 1,020,753	$ 839,604	$ 839,604	$ 839,604	$ 839,604	$ 839,604	$ 839,604	$ 839,604	$ 473,482	$ -	$ 839,604	$ 839,604
$ 1.879	Keene NH WWTF	NH	$ 1,671,608	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 1.879	Lebanon NH WWTF	NH	$ 1,539,144	$ 1,536,300	$ -	$ 1,536,300	$ 1,536,300	$ 1,536,300	$ 1,536,300	$ 1,536,300	$ 1,536,300	$ 1,536,300	$ 1,536,300	$ 1,536,300	$ 1,536,300	$ 1,536,300
$ 3.545	Littleton NH WWTF	NH	$ 49,096	$ 47,837	$ 41,336	$ 47,837	$ 47,837	$ 47,837	$ 47,837	$ 47,837	$ 47,837	$ 47,837	$ 47,837	$ 47,837	$ 47,837	$ 47,837
$ 3.545	Ludlow	VT	$ 36,974	$ 36,889	$ 34,404	$ 36,889	$ 36,889	$ 36,889	$ 36,889	$ 36,889	$ 36,889	$ 36,889	$ 36,889	$ 36,889	$ 36,889	$ 36,889
$ 5.490	Manchester	VT	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 22,630,769	$ -	$ -
$ 3.638	Middlebury	VT	$ 16,449,715	$ 14,232,512	$ 29,792,895	$ 14,232,512	$ 14,232,512	$ 14,232,512	$ 14,232,512	$ 14,232,512	$ 14,232,512	$ 14,232,512	$ 14,232,512	$ 14,232,512	$ 14,232,512	$ 14,232,512
$ 4.704	Milton	VT	$ 3,233,514	$ 8,554,533	$ 24,804,654	$ 8,554,533	$ 8,554,533	$ 8,554,533	$ 8,554,533	$ 39,469,099	$ 8,554,533	$ 8,554,533	$ 8,554,533	$ 8,554,533	$ 8,554,533	$ 8,554,533
$ 1.824	Montpelier	VT	$ 27,258,594	$ 25,772,469	$ 11,328,323	$ 23,992,176	$ 23,425,596	$ 25,772,469	$ 25,058,166	$ 24,191,479	$ 25,151,324	$ 28,349,716	$ 25,772,469	$ 25,772,469	$ 25,772,469	$ 25,772,469
$ 3.545	Newport City	VT	$ 11,951,423	$ 10,004,766	$ 12,056,323	$ 9,969,857	$ 10,004,766	$ 10,004,766	$ 10,004,766	$ 10,004,766	$ 10,004,766	$ 10,004,766	$ 10,004,766	$ 10,004,766	$ 10,004,766	$ 10,004,766
$ 5.490	NewTech Enviro	VT	$ 14,738,615	$ 36,587,663	$ 25,313,006	$ 36,587,663	$ 36,587,663	$ 36,587,663	$ 36,587,663	$ 36,587,663	$ 36,587,663	$ 36,587,663	$ 36,587,663	$ 36,587,663	$ 36,587,663	$ 36,587,663
$ 5.490	Northumberland NH	NH	$ 11,227	$ 9,214	$ 9,452	$ 9,214	$ 9,214	$ 9,214	$ 9,214	$ 9,214	$ 9,214	$ 9,214	$ 9,214	$ 9,214	$ 9,214	$ 9,214
$ 5.490	Orwell	VT	$ 1,152,684	$ 1,733,851	$ 1,362,496	$ 1,733,851	$ 1,733,851	$ 1,733,851	$ 1,733,851	$ 1,733,851	$ 1,733,851	$ 1,733,851	$ 1,733,851	$ 1,733,851	$ 1,733,851	$ 1,733,851
$ 1.879	Plattsburgh NY WWTF	NY	$ 1,919,966	$ 1,804,035	$ 1,616,513	$ 1,804,035	$ 1,804,035	$ 1,804,035	$ 1,804,035	$ 1,804,035	$ 1,804,035	$ 1,804,035	$ 1,804,035	$ 1,804,035	$ 1,804,035	$ 1,804,035
$ 3.545	Plymouth NH WWTF	NH	$ 91,106	$ 175,521	$ -	$ 110,496	$ 110,496	$ 175,521	$ 175,521	$ 110,496	$ 175,521	$ 175,521	$ 175,521	$ 175,521	$ 175,521	$ 175,521
$ 5.490	Pownal	VT	$ 857,732	$ 1,036,540	$ 1,320,520	$ 1,036,540	$ 1,036,540	$ 1,036,540	$ 1,036,540	$ 1,036,540	$ 1,036,540	$ 1,036,540	$ 957,673	$ 828,862	$ 1,036,540	$ 1,036,540
$ 11.644	Richmond	VT	$173,481,351	$179,880,972	$156,441,649	$162,589,633	$167,671,236	$188,875,020	$179,880,972	$168,039,449	$179,880,972	$179,880,972	$179,880,972	$181,321,067	$179,880,972	$179,880,972
$ 5.490	Rouses Point NY WWTF	NY	$ 1,448,264	$ 3,338,608	$ 1,219,364	$ 3,338,608	$ 3,338,608	$ 3,338,608	$ 3,338,608	$ 3,338,608	$ 3,338,608	$ 3,338,608	$ 3,338,608	$ 3,338,608	$ 3,338,608	$ 3,338,608
$ 1.879	Rutland	VT	$ 22,593,907	$ 23,969,101	$ 10,940,077	$ 16,343,376	$ 16,355,690	$ 22,885,106	$ 19,081,000	$ 16,832,119	$ 19,224,360	$ 21,750,280	$ 23,969,101	$ 21,941,309	$ 23,969,101	$ 23,969,101
$ 7.419	Shelburne 2 (Harbor Rd)	VT	$ 20,901,363	$ 22,521,295	$ 15,998,071	$ 22,521,295	$ 22,521,295	$ 22,521,295	$ 22,521,295	$ 22,521,295	$ 22,521,295	$ 22,521,295	$ 22,521,295	$ 22,521,295	$ 22,521,295	$ 22,521,295
$ 2.985	South Burlington - Airport Parkway	VT	$ 1,379,710	$ 2,125,868	$ 1,982,675	$ 2,125,868	$ 2,125,868	$ 2,125,868	$ 2,125,868	$ 2,125,868	$ 2,125,868	$ 2,125,868	$ 2,125,868	$ 2,125,868	$ 2,125,868	$ 2,125,868
$ 4.800	Springfield	VT	$ 3,838,346	$ 3,199,705	$ 13,677,191	$ 3,199,705	$ 3,199,705	$ 3,199,705	$ 3,199,705	$ 3,199,705	$ 3,199,705	$ 3,199,705	$ 3,199,705	$ 3,245,765	$ 3,199,705	$ 3,199,705
$ 0.621	St Albans City	VT	$ 662,473	$ 573,640	$ 535,001	$ 110,171	$ 573,640	$ 573,640	$ 573,640	$ 573,640	$ 573,640	$ 573,640	$ 573,640	$ 573,640	$ 573,640	$ 573,640
$ 3.545	St Johnsbury	VT	$ 21,653,169	$ 19,664,821	$ 15,790,900	$ 19,597,964	$ 19,664,821	$ 19,664,821	$ 19,664,821	$ 19,664,821	$ 19,664,821	$ 19,664,821	$ 19,664,821	$ 19,664,821	$ 19,664,821	$ 19,664,821
$ 5.750	Stowe	VT	$ 2,314,942	$ 3,691,125	$ 59,577,584	$ 3,691,125	$ 3,691,125	$ 3,691,125	$ 24,125,000	$ 3,691,125	$ 3,691,125	$ 3,691,125	$ 3,691,125	$ 3,691,125	$ 3,691,125	$ 3,691,125
$ 2.899	Waterbury	VT	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 44,224	$ -	$ -	$ -	$ -	$ -
$ 5.490	Whitefield NH WWTF	NH	$ 93,183	$ 76,474	$ 78,455	$ 76,474	$ 76,474	$ 76,474	$ 76,474	$ 76,474	$ 76,474	$ 76,474	$ 76,474	$ 76,474	$ 76,474	$ 76,474
$ 5.490	Whitingham	VT	$ 224,720	$ 235,872	$ 3,811,086	$ 235,872	$ 235,872	$ 235,872	$ 235,872	$ 235,872	$ 235,872	$ 235,872	$ 235,872	$ 296,978	$ 235,872	$ 235,872
$ 0.013	Williston Merchant Facility	VT	$ -	$ -	$ -	$ -	$ 95,487	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 3.077	Windsor Main	VT	$ 135,303	$ 197,551	$ 6,609,469	$ 197,551	$ 197,551	$ 197,551	$ 197,551	$ 197,551	$ 197,551	$ 197,551	$ 197,551	$ 197,551	$ 197,551	$ 197,551
	Cost to Treat ($/y)	POTWs	$372,474,169	$388,311,352	$424,817,954	$356,831,398	$362,186,267	$395,147,477	$400,663,520	$394,449,063	$380,641,605	$387,392,533	$388,134,261	$408,777,960	$388,311,352	$388,311,352
	Cost to Treat ($/y)	VT only POTWs	$349,282,661	$379,093,245	$419,975,532	$348,010,288	$353,365,157	$385,929,370	$391,757,839	$385,627,953	$371,604,708	$378,174,425	$379,282,276	$400,244,799	$379,093,245	$379,093,245

Attachment C: Non-monetary Metrics

Table C-1. Raw Scores for Non-monetary Metrics

Alternatives	Total Distance Traveled (million miles)	Remaining Capacity (gallons)	EJ Score
Baseline	216,538	4,365,417	216.5
Bennington	217,218	4,525,835	217.2
Manchester	210,836	6,565,418	210.8
Milton	197,245	8,673,348	197.3
Montpelier	213,591	5,291,770	213.6
Richmond	213,822	4,871,699	213.8
St Albans	211,577	9,260,362	211.6
Stowe	206,813	6,694,667	206.8
Waterbury	209,100	6,565,417	209.1
Williston/Essex Junction	221,356	9,865,417	221.4