A Framework to Assess the Affordability of Residential Water and Sewer Rates in Rural Alaska

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Village Safe Water Program
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Information Insights

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List of Acronyms

ADEC	Alaska Department of Environmental Conservation
ADCCED	Alaska Department of Commerce, Community and Economic Development
ARUC	Alaska Rural Utility Collaborative
ANTHC	Alaska Native Tribal Health Consortium
AWRA	American Water Resources Association
CSO	Combined Sewer Overflows
CUAP	Community Utility Assistance Program in the Northwest Arctic Borough
EPA	United States Environmental Protection Agency
FCI	Financial Capability Indicator
HBI	Household Burden Indicator
HM	Hours of Labor at Minimum Wage
HUD	United States Department of Housing and Urban Development
IHS	Indian Health Service
IPF	Infrastructure Protection Funding
IQ	Income Quintile
MHI	Median Household Income
O&M	Operations and Maintenance
PER	Preliminary Engineering Report
PFD	Permanent Fund Dividend
PPI	Poverty Prevalence Indicator
RI	Residential Indicator
RUBA	Rural Utility Business Advisor Program, ADCCED
SNAP	Supplemental Nutrition Assistance Program
SRF	State Revolving Fund, ADEC
VSW	Village Safe Water Program, ADEC
UNICEF	United Nations Children's Fund
USDA	United States Department of Agriculture

Executive Summary

Introduction

Affordable rates for water and sewer utilities are broadly defined as rates that residential users are able to pay. Setting affordable rates is key to ensuring long-term access to water and sewer services. At the same time, rate revenue is the main source of funds utilities use to cover their operating and maintenance costs. Water and sewer rates are roughly set by dividing total utility expenses by the number of customers. However, this formula fails to consider how much households can afford to pay. Households that cannot afford utility rates will be unable to pay their bills. In response, the utility may disconnect service to accounts that have become uncollectible. Consequently, unaffordable rates harm both customers and utilities: households lose access to water and sewer services, while utilities must try to cover their costs with a shrinking revenue base. Considering this, the Alaska Department of Environmental Conservation (ADEC) Village Safe Water (VSW) Program commissioned the development of a framework to assess the affordability of residential rates for water and sewer utilities across rural Alaska.

What is Affordability?

The concept of affordability is based on societal values and varies with situational context. Therefore, affordability can be defined in several ways. In this report, residential water and sewer rates are considered affordable if lower income households within a community can pay them without giving up other essential goods and services, such as rent, food, fuel and electricity. If rates are affordable for lower income households, it follows that they are also affordable for the higher income households within the same community.

What is the Affordability Framework?

The Affordability Framework is a composite indicator in matrix form. The Residential Indicator (RI) produces a score based on the average annual water and sewer utility bill as a percentage of household income at varying income levels within a community. The Financial Capability Indicator (FCI) is the weighted score of socioeconomic indicators for the community published by the U.S. Census Bureau. These include the percentage of households on Supplemental Nutrition Assistance Program, the percentage of households below the federal poverty level and the percentage of working age adults with full-time jobs. Affordability is determined by finding the intersection of the RI and FCI on the matrix. The result is a determination that current rates are either a high, medium or low financial burden for the community. This multidimensional approach helps contextualize the affordability calculations in a way that is specific to each community.

The Affordability Framework

		Residential Indicator		
		Low Burden ≥ 0% to ≤ 2%	Medium Burden > 2% to ≤ 5%	High Burden > 5%
Financial Capability Indicator	Strong > 2.5 to ≤ 3.0	Low Burden	Low Burden	Medium Burden
	Mid-Range > 1.5 to ≤ 2.5	Low Burden	Medium Burden	High Burden
	Weak ≥ 1.0 to ≤ 1.5	Medium Burden	High Burden	High Burden

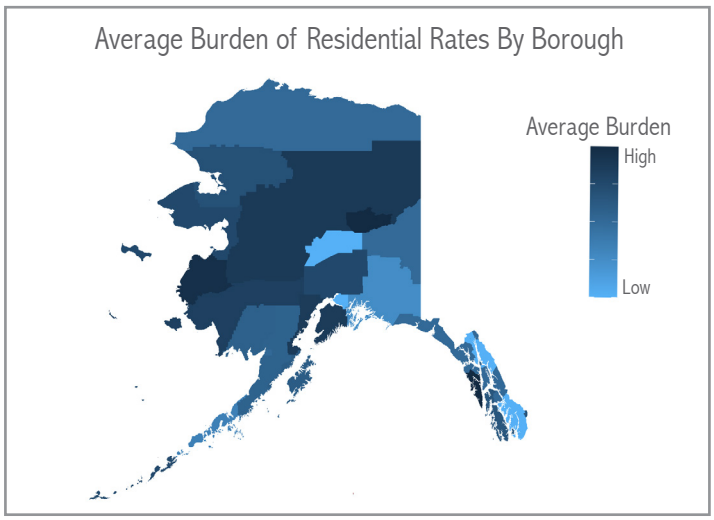
Why Do We Need an Alaska Affordability Framework?

The Alaska Affordability Framework was developed to produce affordability assessments at the community level because existing affordability metrics are impractical or inaccurate for the Alaska context. The framework is specifically designed for rural Alaska; it is intended to be easy to use, interpret and update.

This framework is a guiding tool not without its own limitations. U.S. Census Bureau American Community Survey data for rural Alaska communities are known for wide margins of error. Where necessary, the framework also makes generalized assumptions about rural communities that fail to account for their uniqueness. The measurement of utility rate affordability is an emerging field, especially as applied to water and sewer utilities. As such, best practices are still evolving. Therefore, it is important to annually update the data used in the Affordability Framework and to re-evaluate the framework as new affordability guidance becomes available, including from communities themselves.

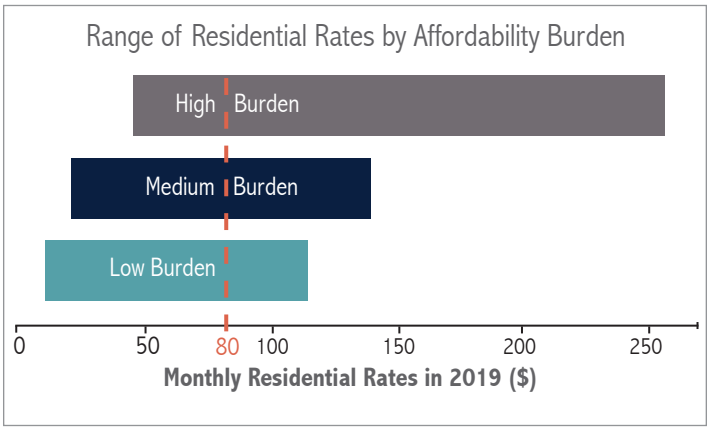
How Affordable Are Water and Sewer Rates in Alaska?

Using the Affordability Framework, this study analyzed rural water and sewer rates in 111 communities with piped water systems, based on 2019 data. Residential rates in 56% of the communities constituted a high burden for residential users, while 30%



were a medium burden, and 14% a low burden. As shown in the map above, affordability varied across Alaska.

What constitutes an affordable rate varies by community. Residential rates among the utilities in the analysis ranged from $10 to $257 per month in 2019 with the majority (109) charging a flat rate. As shown below, while $80 per month was a low burden in one community, the same amount represented a medium burden in another community, and a high burden in a third community. The results of the analysis were validated by interviews and meetings in 13 Alaskan communities.



Whether water and sewer rates are affordable or not has consequences for the ability of utilities to keep their systems in good repair. An Indian Health Service study looked at the 2016 balance sheets of 74 rural Alaska utilities and found that a total of $14.8 million would be needed to adequately fund their operations and maintenance. However, an analysis using the Affordability Framework suggests that only $7.8 million would be collected if affordable rates were set by these same utilities. The funding gap cannot be eliminated solely by increasing user rates, since doing so would require raising rates to an unaffordable level.

How is the Affordability Framework Being Used?

ADEC uses this framework in combination with other criteria to determine eligibility and funding levels for proposed sanitation infrastructure improvement funding for rural communities, including improvement grants from the VSW Infrastructure Protection Funding Program and micro loans through the State Revolving Fund (SRF) Program.

VSW also uses this framework in evaluating utility revenue estimates included in Preliminary Engineering Reports (PER) for proposed water and sewer projects. Specifically, this framework is used to assess whether the residential rates required to support a proposed alternative in the PER would be a high burden to users and if additional sources of O&M funding are needed. However, approval of PERs is not based solely on this framework. In the future, this framework may also be integrated into the process SRF uses to define Disadvantaged Communities and to allocate project subsidies. In time, this framework will also inform VSW's review of business plans required for proposed water and sewer construction projects.

Local governments may find this framework useful as well. One tribal council president planned to use the framework in setting local utility rates. In another case, a city government used the metric to assess the affordability of a rate increase needed to fund utility repairs. By reducing the influence or appearance of local politics in rate setting, the framework can assist communities in making an objective case for higher residential rates. The framework can also help communities determine what level of subsidy is needed to keep residential rates affordable. Since the framework evaluates the affordability of residential rates at various income levels, it can facilitate the development of income-based assistance programs within a community.

Addressing Affordability Concerns

Determining if rates are affordable is only a first step in any action plan to address water and sanitation affordability issues in rural Alaska. Some communities where user rates are known to be a burden for many households are taking steps to decrease rates by expanding the customer base of the utility, reducing O&M costs, or implementing subsidies.

Key Points

1. This report presents a framework for assessing whether rural Alaska households can afford water and sewer utility rates. Historically, rate setting discussions have focused on the ability of utilities to cover costs through revenue collected from users.

2. In this report prepared for the ADEC, rates are defined as affordable if lower income households within the community can pay them without giving up other essential goods and services, such as rent, food, fuel and electricity.

3. While there are several other methods to measure affordability, this framework was designed specifically for use in rural Alaska.

4. This framework is a composite indicator matrix composed of a) the percentage of monthly income that water and sewer bills represent for households of different income levels (Residential Indicator); and b) a weighted score of socioeconomic indicators for the community (Financial Capability Indicator). This composite affordability metric is designed to be easy to use, understand and update.

5. This framework makes community-specific assessments that account for socioeconomic differences among communities.

6. Applying this framework to 2019 data for 111 communities in rural Alaska, residential water and sewer rates were found to be a high burden for households in 56% of the communities analyzed, a medium burden in 30% of communities, and a low burden in 14%. What rate is affordable for lower income households varies among communities.

7. Setting rates that are unaffordable for a community also impacts the utility's ability to cover its own costs. If the utility's revenue is too low, repairs and maintenance will be delayed, and its operations and longevity put at risk. Thus, unaffordable rates not only come at a financial and social cost to lower income households, but also to the utility and the community at large.

8. An Indian Health Service study found that operation and maintenance costs for 74 rural Alaska utilities are underfunded by a total of $14.8 million. However, the funding gap cannot be eliminated solely by increasing user rates, since doing so would require raising rates to an unaffordable level.

9. Determining whether rates are affordable is only a first step in addressing affordability concerns. There are steps communities can take to make rates more affordable, such as by reducing operating costs, implementing subsidies, increasing the utility's customer base, and other solutions.

10. This framework is used by ADEC in combination with other criteria to determine eligibility and funding levels for the Infrastructure Protection Funding Program, the State Revolving Fund Program and the evaluation of Preliminary Engineering Reports.

11. This framework is best viewed as a guiding tool. It should be re-evaluated regularly and updated as new data and best practices become available.

Introduction

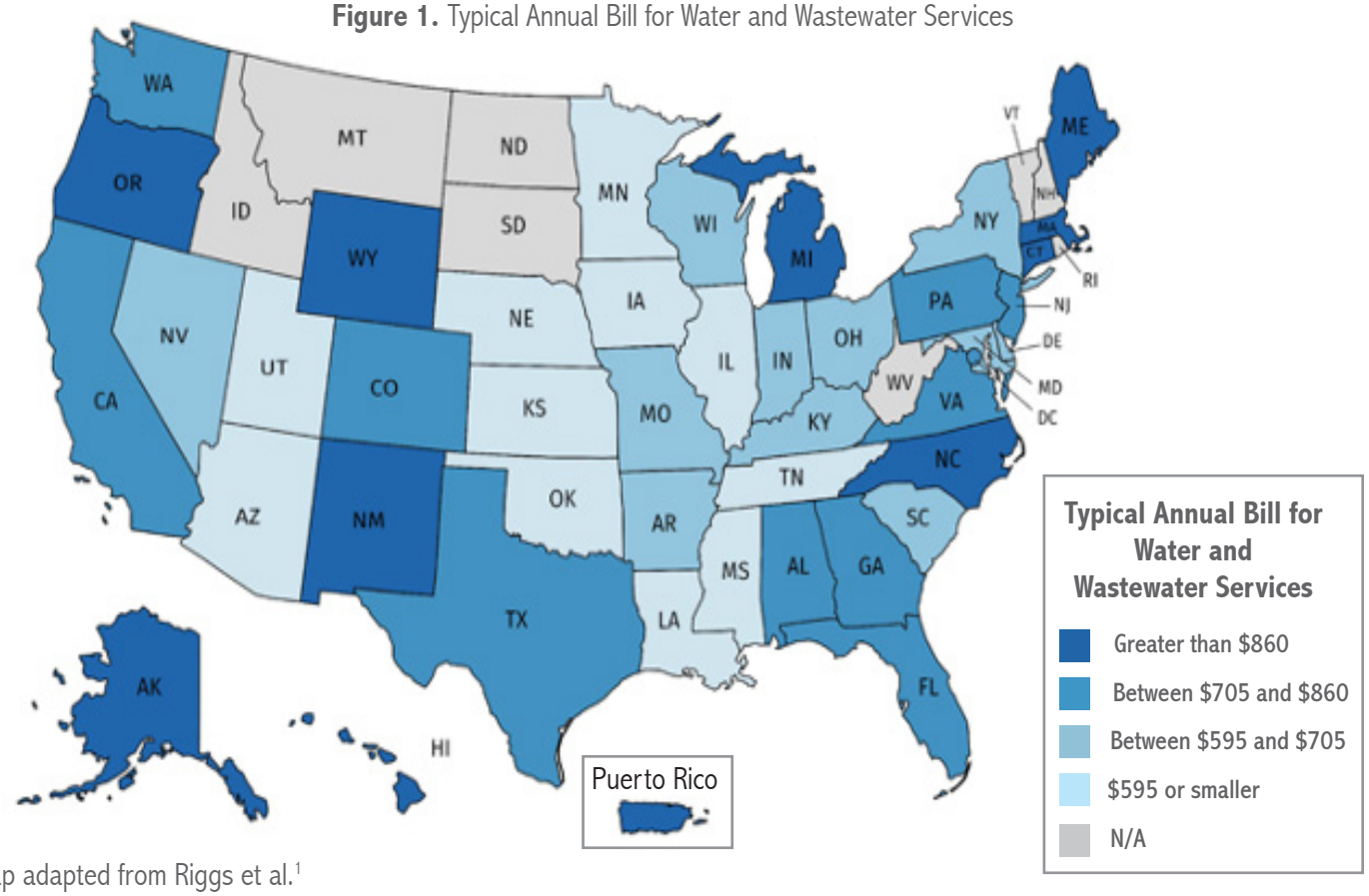
Why Study Affordability?

This report presents a framework for assessing whether residential user rates set by water and sewer utilities are affordable for community households across rural Alaska. Customer sales are the main revenue source for water utilities. The standard formula for setting user rates is to divide a utility's total expenses by the number of customers. However, this calculation fails to consider whether households can afford the resulting rate. Knowing whether households can pay for utility services is important. If households cannot afford local rates, they will eventually be forced to stop paying their bills, and the utility will likely disconnect the service of accounts that become uncollectible. Consequently, unaffordable rates not only impact the ability of households to access water and sewer services but also hinder the ability of utilities to cover their own costs by collecting payments.

Annual bills for water and sewer services in Alaska are among the highest in the nation[1] (Figure 1). Anchorage residents living in single-family homes paid a flat rate of $103.22 per month or about $1,240 annually in 2019.[2] According to data collected by the State of Alaska's Rural Utility Business Advisor Program (RUBA), annual billing rates for rural residential water and sewer services ranged from $120 to over $3,000 in 2019. The average across all rural communities was $1,032 per year, yet compared with Anchorage residents, rural Alaskans have higher living costs, fewer job opportunities and lower household incomes.

Despite having higher rates, many water and sewer utilities in Alaska struggle to cover their costs. Compared with utilities in the contiguous United States, Alaska water and sewer utilities have higher operating costs and significantly smaller customer bases. A 2016 study by the Indian Health Services (IHS) found that operations and maintenance (O&M) costs at 74 tribally owned and operated utilities were underfunded by a total of $14.8 million. Underfunding utilities results in delayed maintenance and repairs, which in turn jeopardizes operations and the longevity of the utility. However, this funding gap cannot be eliminated simply by increasing residential rates, because rates would need to be increased to an unaffordable level to close the gap.

Figure 1. Typical Annual Bill for Water and Wastewater Services



Map adapted from Riggs et al.[1]

Spotlight on Affordability. Affordability is a big concern for utility customers. At a recent meeting in one rural community, four-wheelers and snow machines accumulated in front of the community hall as residents streamed in. Outside, snow settled on the parked machines, while inside people greeted each other. As they sat down, they walked past a sign on the wall which discouraged visitors from filling their water jugs at the building's taps. The sign explained that the city government, which owns the building, is billed by the utility based on the amount of water consumed. "It cost the City a lot of money," the sign warned visitors.

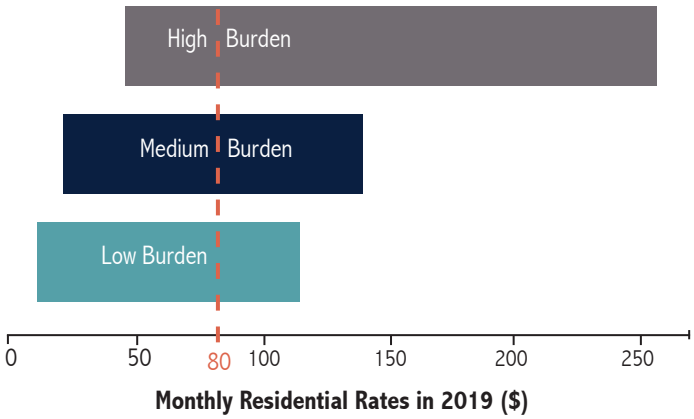
High costs were a recurring theme at the meeting, which was organized to discuss water and sewer rates in the community. The meeting took place in the middle of an unusually long cold snap, which strained both the finances of residents and the community's water pipes. The day had been punctuated by calls to the utility's water operator, as water pipes froze up throughout the community. At the meeting, the operator explained he was trying his best to thaw the lines, but success was unlikely.

Residents in the community were already worried about paying their water and sewer bills. The previous summer's fishing season had been disastrous. Still reeling from the loss of one of their primary cash-making opportunities, residents now faced higher than usual heating costs due to the cold snap, and they worried about the additional energy they would have to consume to keep pipes from freezing. Many residents, including those with full-time jobs, revealed that they often had to juggle their bills: paying the most urgent one and putting off the rest until their next paycheck. The previous week, the utility had sent out letters to residents who were behind on their water bills. Some brought the letters to the meeting and wondered out loud how they would pay the thousands of dollars the letter said they owed. "These bills are unaffordable," a woman at the meeting commented, echoing a sentiment heard across communities in Alaska.

Measuring Affordability in Rural Alaska

What constitutes an affordable rate varies by community. According to a 2019 analysis using the Affordability Framework, 56% of the rural water and sewer rates included in the analysis were found to be a high burden, 30% a medium burden and 14% a low burden for residential customers. The analysis looked at rates from 111 rural water and sewer utilities, which ranged from $10 to $257 per month. What rates are affordable varies among communities. While $80 per month may be a low burden in one community, the same amount constitutes a medium burden in a second community, and even a high burden in a third community (Figure 2).

Figure 2. Range of Residential Rates by Affordability Burden



To validate the quantitative results of this analysis, meetings and interviews were conducted in 13 rural Alaska communities. The meetings revealed that the affordability of water and sewer rates is also a concern of utility owners, which may be the city or tribal government. In fact, after the Affordability Framework was presented, two local governments asked if they could use it to assess the affordability of a recently proposed rate increase.

Scope of Study

The Alaska Affordability Framework presented in this report is the product of a study commissioned by the Village Safe Water (VSW) Program of the Alaska Department of Environmental Conservation (ADEC) in 2016. Existing methodologies for assessing the affordability of water and sewer rates were either impractical to apply or produced inaccurate results for rural Alaska. The state and federal agencies that fund water and sewer infrastructure projects in rural Alaska increasingly needed a better method to define and measure affordability. The lack of such a metric led VSW to fund the development of a framework specifically tailored for rural Alaska. This framework was designed to be easy to understand, easy to use and easy to update in order to produce community-specific affordability assessments.

The study was guided by the following questions:

1. How is affordability defined?
2. How can household affordability be measured?
3. Is the Affordability Framework accurate?
4. What rates are affordable for Alaska's rural households?

At the request of water plant operators and local government officials, the report also suggests several approaches for addressing affordability issues.

Background

What is Affordability?

Broadly defined, affordability is the ability to pay. Until recently, the definition of affordability when applied to residential water and sewer rates was centered on the utility. The rates were set to generate enough revenue to cover the costs of the utility. In recent years, the concept of affordability has evolved. Increasingly, it focuses on the ability of households to pay the assessed rates. It is necessary to clearly define what affordability means for households as well as utilities.

This study defines residential water and sewer rates as affordable if lower income households within a community can pay them without giving up other essential goods and services. If rates are affordable for lower income households, they are arguably affordable for higher income households in the same community. Essential goods and services are those needed to sustain health or life. Examples of essential goods and services vary between communities, but generally include rent, food, fuel and electricity. In rural Alaska, they may also include items used in subsistence activities, such as snowmachines, guns and ammunition.

From a utility perspective, rates are affordable if they generate enough revenue to cover O&M costs while providing their customers with safe and sanitary water and sewer services that meet Safe Drinking Water Act and Clean Water Act standards.[3] Rate revenue from utility customers is the primary funding source for water utilities. Currently, utilities are encouraged to set rates that recover their full costs by dividing total utility expenses by the number of customers served.[4] For more information on how utilities set their rate for full cost recovery in Alaska, see The Water Rate Calculator Guidebook available for download from the Alaska Department of Commerce, Community and Economic Development (ADCCED).[5] For information on the full cost recovery principle, see Principles of Water Rates, Fees, and Charges: M1 published by the American Water Works Association.[4]

Sometimes there is a mismatch between what households can afford to pay and what a utility needs to charge. In Figure 3, the utility charges a flat residential rate of $100 per month to fully cover its costs. In the first scenario at top, households can only afford to pay up to $50 per month. In this situation, setting affordable rates requires the utility to secure other sources

Affordable water and sewer rates are rates that lower income households can pay without giving up other essential goods and services. Essentials include equipment like four-wheelers and boats used for subsistence, such as these seen outside a village in Southwest Alaska.

of funding, such as subsidies, to cover its costs. It might also choose to defer needed maintenance and repairs. In the middle scenario, households can afford the current residential rate but may not be able to afford a rate increase if the number of customers falls or the utility's costs rise. In the last scenario, households can afford more than the established residential rate of $100 per month. In this scenario, the utility has room to increase the rate to finance repairs and invest in improvements.

Figure 3. Perspectives in Affordability: Utilities and Households

Overview of Rural Alaska

Rural Alaska is comprised of over 225 small communities spread throughout the state's 663,300 square miles, an area one-fifth the size of the continental United States.[6] Most of these rural communities are also remote; they are not connected to the rest of the state by road and are only accessible by small plane and, depending on the season, by boat, snowmachine or four-wheeler. Rural Alaska can be divided into multiple regions, each with a regional hub. People and freight generally travel through the hubs to reach smaller communities. Communities within each region have extensive social, economic and cultural ties with each other and their regional hub.[7]

Communities in rural Alaska are quite small and are often referred to as villages. According to the 2018 American Community Survey, their populations range in size from under 10 to 1,600 people, with an average population of 300. Rural communities that function as regional hubs have larger populations ranging from 2,250 to 6,500 residents. Alaska Natives, the indigenous peoples of Alaska, make up the majority of the rural population,[8] while representing just under 20% of the state's overall population. Alaska Native peoples belong to over 20 distinct cultural groups, each with different languages, belief systems and traditions. In Alaska, there are over 200 self-governing tribes; many villages have both a tribal and a municipal government, each with different jurisdictions.[9]

Rural Alaska communities have a mixed economy composed of public and private sector jobs, subsistence activities, and transfer payments.[7,10] Business development in rural Alaska is limited by high transportation and energy costs, distance from larger markets, unreliable communication systems, lack of banks and other business services, and lack of educational and training facilities. More diversified economies exist in communities close to national parks or commercial fisheries and in communities with comparatively low transportation costs.[11]

Rural Alaskans have met these challenges with some innovative business ideas. For example, in one community visited for this study, an entrepreneur described his ice-hauling business. Many elders in his community prefer drinking melted ice water, so he established a business delivering ice blocks. He has a set fee schedule allowing customers to choose the frequency for fresh ice delivery and the desired size of the block. More typical year-round wage-earning activities include working for the school, post office, tribe, city, or local store. Seasonal work includes short-term construction jobs on capital improvement projects, firefighting, fishing and cannery work. Trapping is a common cash-generating activity too. Nonresidents typically fill teaching jobs, health professional positions,[7] and jobs in the resource extraction industry.[12]

Subsistence is integral to community life and cultural well-being. It also has economic value. The Alaska Department of Fish and Game estimates that rural subsistence users harvest 36.9 million pounds of wild foods annually.[13] While subsistence foods decrease the cash needs of rural households for purchasing food,[7] subsistence users must pay for supplies and transportation to engage in hunting, fishing and food gathering activities. These activities are also seasonal and weather dependent, and wage-earning jobs can conflict with the ability to engage in subsistence. Yet, subsistence and market economies co-exist well in many communities.[14]

Transfer payments include income-based welfare programs such as the Supplemental Nutrition Assistance Program (SNAP), as well as unemployment benefits, Social Security payments, Alaska's annual Permanent Fund Dividend (PFD), and Alaska Native Corporation dividends. PFD payments can be a significant source of income. While transfer payments increase the income of households in areas with high poverty levels and few employment options, public assistance participation rates are comparable between urban and rural Alaska. In fact, eligible Alaska Natives are four times less likely to enroll than eligible non-Natives.[15,16]

In rural Alaska, seasonal work opportunites include commercial fishing and working at canneries like this one, located in a village in Southwest Alaska.

Access to Water and Sewer Utilities

Access to water and sewer utilities varies significantly between and within rural Alaska communities. In almost every community with piped water and sewer systems, there are a few households that are not connected to water and sewer lines.[17] In some cases, this is because lines do not extend to those houses or because the households chose to not be connected. In other cases, homes have been disconnected because of past nonpayment.

Water and sewer service access levels include: well and septic systems, piped systems, covered haul and, in unserved communities, self-haul. The VSW Program defines a community as "served" if at least 55% of all homes are connected to pipes or have a well and septic system. Table 1 summarizes rural water system access for 191 communities and over 16,500 homes.[18]

Piped water and sewer systems distribute water to homes and collect sewage that is then delivered to a treatment facility, typically through piped gravity, vacuum or low-pressure systems. The wastewater is treated in a two-cell sewage lagoon or discharged to the ocean.[19]

Table 1. Summary of Access to Water and Sewer Utilities in Rural Alaska in 2017

Household Service Level	Villages	Number of Households
Piped System		
80-100%	97	11,753
10-80%	15	1,163
0-10%	2	6
Unknown	13	-
Total	127	> 12,922
Individual Well and Septic System		
80-100%	13	867
10-80%	5	278
Unknown	3	-
Total	21	> 1,145
Covered Haul System		
80-100%	9	692
10-80%	1	-
Unknown	1	-
Total	11	> 692
Self-Haul/Washeteria	32	> 1,764
Total	191	> 16,523

Homes with piped systems that deliver running water to sinks, a toilet, and shower or bathtub are considered served homes.[20] About 127 communities and almost 13,000 houses were connected to a piped system in 2017.

Approximately 1,150 homes in 21 communities have individual wells and septic tanks. Homes with this type of system also have running water delivered to kitchen and bathroom plumbing fixtures and are considered served homes.[20]

Houses with covered haul systems have water and sewage holding tanks. Water is hauled to homes and the wastewater is hauled away. Small covered haul systems use 100 to165 gallon tanks that can be hauled by snowmachines or four-wheelers. Larger covered haul systems have bigger tanks and use delivery trucks.[19] Almost 700 households in 11 communities have covered haul systems.

Unserved communities are defined as those with fewer than 55% of homes connected to any type of water system. Residents in unserved communities rely on the washeteria as a central watering point providing safe drinking water and access to washing machines, dryers and showers.[19,21-23] In unserved communities, residents must haul water home and haul sewer waste to hoppers throughout the community. Residents are limited in the amount they can haul and store.[20] In these communities, 5-gallon buckets are typically used as indoor toilets called "honey buckets." The buckets are lined with plastic bags that are disposed of in community hoppers or directly in the community lagoon.[24] Approximately 1,800 households in 32 communities still primarily rely on washeterias.

In rural Alaska, unserved homes must haul wastewater to hoppers throughout the community, such as the one pictured above. (Photo credit: VSW)

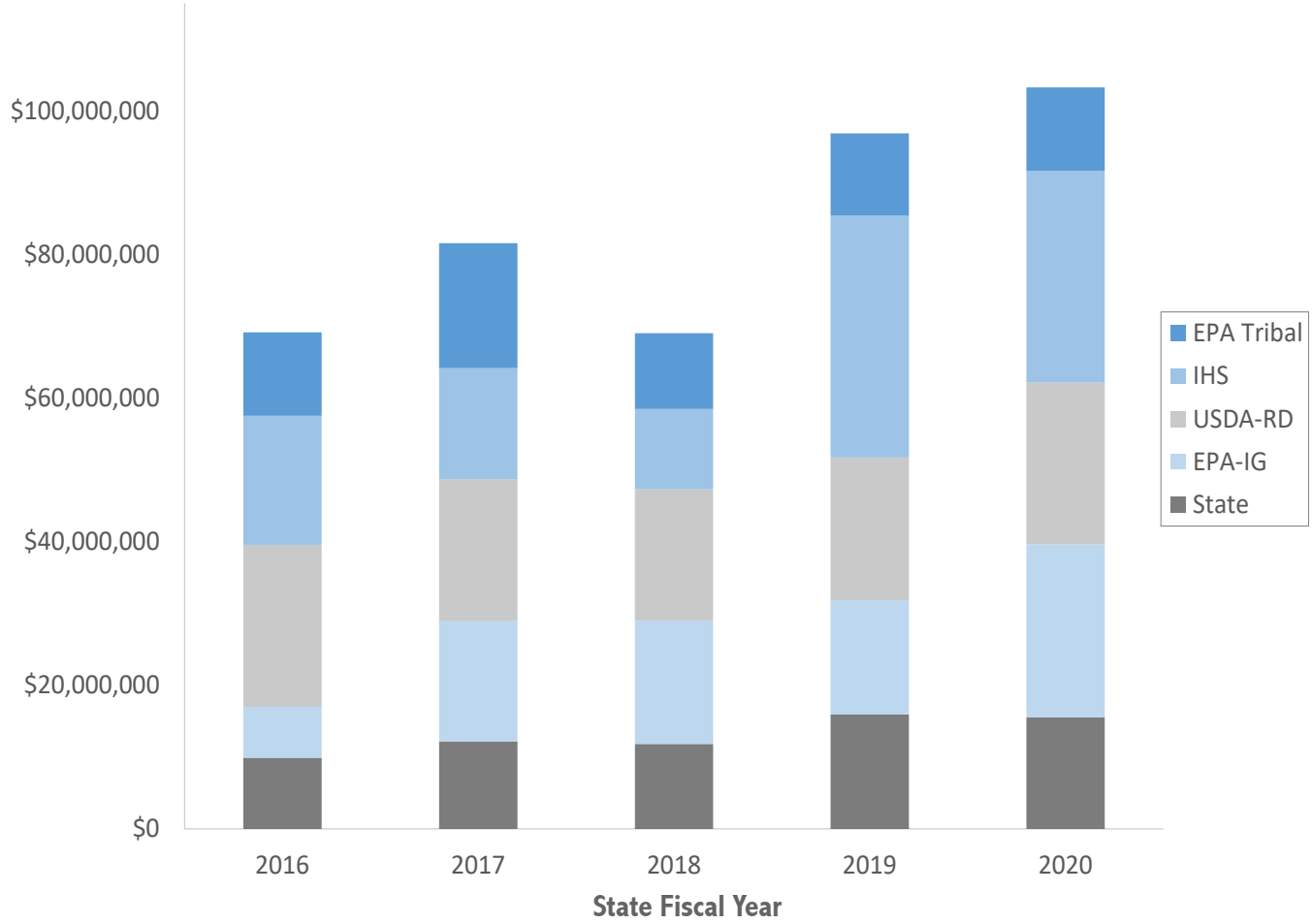
Funding for Rural Water and Sewer Utilities

Rural water and sewer utilities in Alaska have used a mix of funding from federal and state agencies for construction and capital improvements. Federal funding is available through the U.S. Environmental Protection Agency (EPA), U.S. Department of Agriculture (USDA), Indian Health Service (IHS), and U.S. Department of Housing and Urban Development (HUD). The State of Alaska provides the required match contribution for many of these federal funding sources. In fiscal years 2016-2020, approximately $80 million per year was spent on rural water and sewer improvements in Alaska (Figure 4). About 85% of the funding came from federal sources, including the EPA Infrastructure Grant and Tribal programs, IHS and USDA Rural Development, with the State of Alaska providing the remaining 15%.

ADEC estimates that approximately $1.4 billion is needed to fund improvements to rural water and sewer systems in 2020 (Figure 5). Of this, about $900 million is needed to provide first-time service to unserved communities, $250 million for upgrades to address substantial health threats, and $280 million to address minor health threats. However, the State of Alaska is in the midst of a fiscal crisis created by declining oil production and falling world oil prices. The ongoing budget crisis has resulted in significant cuts to Alaska's state operating and capital budgets. Unless state revenues increase substantially over the next few years, the state government's ability to provide the required match for federal funding could be in jeopardy.

There are no federal or state funds available to help water and sewer utilities with their general operating and routine maintenance costs. With the exception of IHS, all federal funding sources are prohibited from paying for operating costs, and Congress has never allocated funding for O&M in IHS's annual appropriation. While the State of Alaska has the authority to provide operating grants under the Village Safe Water Act (AS 46.07.050b), there is no funding to support this.

Figure 4. State of Alaska Funding for Rural Water and Sewer Improvements SFY 2016 - 2020



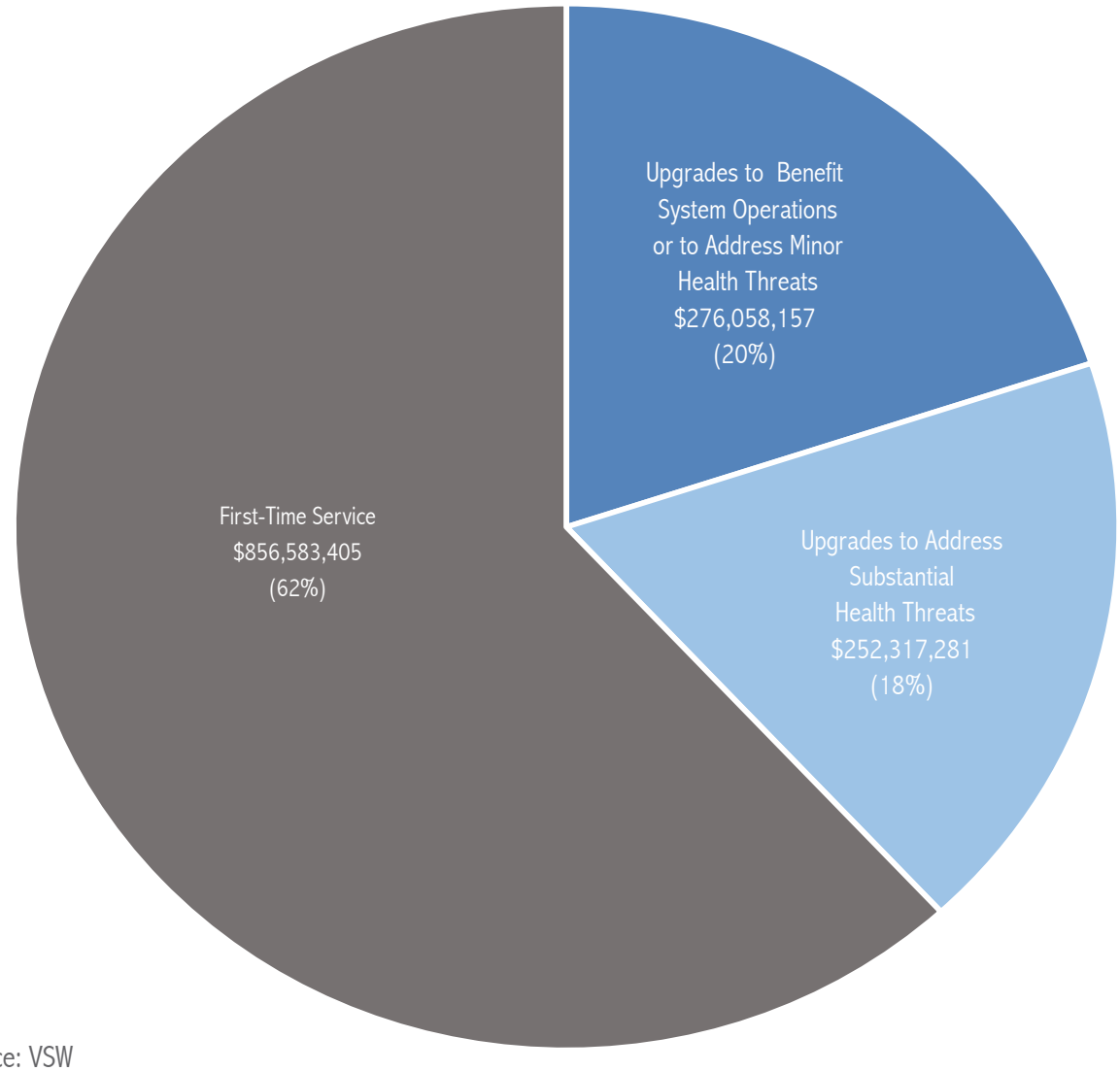
Data source: VSW

In many communities, water and sewer utilities operate as a single entity and charge customers a combined flat rate between $10 and $257 per month for in-home water and sewer services. With a flat rate, households pay the same amount regardless of the volume of water they consume or sewage they dispose of. Fewer than 10 rural water and sewer utilities have installed meters and charge customers based on how much they use.

Water utilities charge their nonresidential customers a different rate than residential customers. The rate may be either flat or metered, though metered rates are more common for non-residential accounts, including commercial customers, than for residential service. In some cases, nonresidential customers pay a significantly higher rate, in effect subsidizing residential users. The rate for large users like schools may be several thousand dollars a month.

There are currently no state or federal subsidies available to help water and sewer customers afford these essential services. This contrasts with electric costs (subsidized in rural communities by the state's Power Cost Equalization fund), telecommunication services (subsidized by the federal Lifeline program), and home heating costs (subsidized by the federal Low-Income Home Energy Assistance Program). Some borough governments in Alaska subsidize local water and sewer systems. The North Slope Borough has the state's longest-standing program, financed largely by oil and gas property taxes. Borough subsidies defray high O&M costs in all eight North Slope communities. More recently, the Northwest Arctic Borough has implemented a subsidy program financed by Payments in Lieu of Taxes (PILT) from a large mine. Some local governments have also implemented subsidy programs to help keep water and sewer rates affordable.

Figure 5. Rural Alaska Sanitation Funding Need in SFY 2020



Data source: VSW

Existing Frameworks for Assessing the Affordability of Water and Sewer Utility Rates

How affordability is defined, and what rates are considered affordable, is highly contextual and dependent on societal values and assumptions. This is reflected in the many different definitions of affordability that exist, and in the different metrics used to measure it. Affordability may be evaluated using a specific methodology, or an assumption that rates are likely to be unaffordable for low-income households may just be made. Often, the affordability of a utility's residential rate is simply not considered.

As shown in Table 2, the U.S. EPA commonly uses median household income (MHI) as a metric to assess affordability, with rates less than or equal to 4.5% of the community's MHI considered affordable.[25] Prior to 2016, ADEC also used MHI as its metric, but defined affordability for combined water and sewer rates as those less than or equal to 5% of a community's MHI. In Western Europe, the affordability of several utility services is evaluated at the household level. In Belgium's Wallonia region, residential utility rates are considered affordable if they are 2% or less of a household's annual income.[26] In Brussels, rates less than 1.1% of a household's annual income are deemed affordable.[26] In Grenoble, France, rates are considered affordable if a household spends 2.5% or less of its annual income on water services.[26]

The Alaska Affordability Framework is based on the financial capability assessment approach proposed by the EPA in the mid-1990s as part of its combined sewer overflows (CSO) control policy.[27] CSOs are a major source of water pollution in communities served by sewer systems that combine wastewater and storm overflow in the same pipe. The EPA's CSO Financial Capability Matrix is a composite indicator composed of a Residential Index (RI) and a Financial Capability Indicator (FCI).[27] The RI is calculated by dividing the cost per household of providing sewage collection and treatment by the community's MHI. Rates less than or equal to 2% of MHI are said to be affordable. The Financial Capability Indicator (FCI) evaluates a variety of financial and socioeconomic factors that influence the financial strength of a utility or municipality, including its bond rating, overall net debt as a percent of full market property value, local unemployment rate, median household income, property tax revenue as percentage of full market property value, and property tax collection rate. Each measure is given a score from 1 (weak) to 3 (strong). The FCI is calculated by averaging the scores to produce an overall value.

By looking at the intersection of the RI and FCI on the CSO matrix, the financial readiness of the utility or municipality to implement CSO controls was assessed. In the case of the Alaska Affordability Framework, the intersection of the RI (renamed to Residential Indicator) and FCI provides a benchmark for assessing the affordability of combined water and sewer rates for households in a community.

Table 2. Applied Methodologies for Assessing Affordability

Location	Methodology	Threshold
USA[25]	Annual rates for water and sewer services as a percentage of MHI	≤ 4.5%
Alaska prior to 2017	Annual rates for water and sewer services as a percentage of MHI.	≤ 5%
USA[27]	A composite indicator composed of: 1. Residential Indicator (RI): Annual cost for sewer services as a percent of MHI 2. Financial Capability Indicator (FCI) based on the scoring of: a) Bond rating; b) overall net debt as a percentage of full market property value; c) local unemployment rate; d) MHI; e) property tax revenues as percent of full market property value; and f) property tax collection rate	RI ≤ 2.0%
Wallonia, Belgium[26]	Survey to estimate percentage of income devoted to water and sewer services bill	≤ 2%
Brussels, Belgium[26]	European Benchmarking Cooperation Methodology (comparison of water and sewer treatment utilities in Europe) used to see if average bills are ≤ 1.1% of annual household income	≤ 1.1%
Grenoble, France[26]	Assess if a household spends ≤ 2.5% of its annual income on water rates	≤ 2.5%

In recent years, alternative affordability metrics have been proposed but have yet to be applied (Table 3). One proposed composite indicator combines a Household Burden Indicator (HBI) with a Poverty Prevalence Indicator (PPI). The HBI is calculated by dividing the cost of providing basic water services by the lowest quintile income. Rates less than or equal to 7% of the lowest quintile income are considered affordable. The PPI is a metric reflecting the community's socioeconomic situation. It is based on the percentage of households at or below 200% of the federal poverty level.[28]

Two metrics that assess affordability for an individual household or group of households have recently been proposed by a researcher and public policy analyst at Texas A&M University. One is an affordability ratio calculated by dividing the combined residential water and sewer rate by the income remaining after a household has paid for its essential needs. For the second metric, the cost of basic household water and sewer service is expressed in terms of hours of labor at minimum wage (HM) a person would have to work to pay their water and sewer bill. Neither of these metrics has a defined affordability threshold.[29]

The California EPA Office of Environmental Health Hazard Assessment proposed a new composite affordability indicator in August 2019, noting that reliable access to safe and affordable water is fundamental to human health and well-being. To calculate a composite affordability ratio for each of the water systems included in the assessment, the system-wide average annual bill for 600 cubic feet of water per month is first divided by three different household income metrics (MHI, county poverty threshold and deep poverty level threshold), and the number of households at each level is estimated. (The deep poverty level threshold is equal to half of the county poverty income.) The result is three separate affordability ratios, each expressed as a percentage.

The average water bill is considered affordable if it does not exceed 2.5% of the relevant income level. Each water system in the assessment is then given a numerical score based on a range of affordability thresholds (a score of **0** if the affordability ratio is $> 2.5\%$; **1** if 1.5% to $\leq 2.5\%$; **2** if 1.0% to $< 1.5\%$; **3** if 0.75% to $< 1.0\%$; and **4** if $< 0.75\%$). The scoring is repeated for each income metric (MHI, county poverty threshold and deep poverty threshold). A composite affordability indicator is created by using the number of households at the three income levels to create a weighted affordability ratio for each water system. In addition to the water affordability indicator, California's newly proposed assessment tool also includes composite indicators for water quality and accessibility.[30]

Table 3. Proposed Methodologies for Assessing Affordability

Proposed by / for	Methodology	Threshold
American Water Works Association (AWWA), the National Association of Clean Water Agencies (NACWA), and the Water Environment Federation (WEF)	A composite indicator composed of: 1. HBI: Total basic water service costs (combined) as a percentage of lowest quintile income, LQI; 2. PPI: The percentage of community households at or below 200% of the Federal Poverty Level[28]	≤ 7% of Lowest Quintile Income
Manuel Teodoro, Assoc. Professor of Political Science, Director of Policy and Politics Program, Texas A&M University	**Affordability Ratio**: The price of water and sewer services divided by the household income minus essential household expenses[29] **Complementary metric**: Hours of Labor at Minimum Wage = price of water and sewer services divided by the labor wage in worker's market[29]	NA
California Environmental Protection Agency, Office of Environmental Health Hazard Assessment	Affordability Ratio calculated by dividing the system-wide average bill for 600 cubic feet of water per month for three income metrics: 1. Median Household Income in the water system service area 2. County Poverty Income threshold 3. Deep Poverty Level (one half the county poverty income) A composite affordability ratio is weighted by the number of households at each income level[19]	≤ 2.5%

Some utilities forego assessing affordability and simply assume that low-income households will struggle to pay their bills. Operating under this assumption, some utilities offer customer assistance programs with eligibility determined by enrollment in other social programs. As shown in Table 4, the Anchorage Water and Wastewater Utility offers Coins Can Count, a customer assistance program funded by donations from other AWWU customers who volunteer to have their monthly bill rounded up to the next dollar or have a designated amount added to it.[31] Eligibility for assistance is determined by the Anchorage Health Department. Several rural Alaska utilities offer a senior discount based on age, typically when the head of household is 65 years of age or older or an Elder.[32,33]

In Oregon, eligibility for the Portland Water Bureau's customer assistance program is based on the state's Median Family Income and family size.[34] In Baltimore and Philadelphia, water utilities set eligibility at 175% and 150% of the Federal Poverty Level respectively.[1,35] California households are eligible for assistance if they qualify for federal low-income assistance programs.[1] In Grenoble, France, the utility provides financial help to households that qualify for social assistance but not housing assistance.[26] In Scotland, students, low-income households and disabled persons are eligible for discounts on their water and sewer bills.[26]

There are places where the affordability of water and sewer services is not considered or addressed for varying reasons. In Switzerland, for example, affordability is not believed to be an issue.[25] Yet, the absence of measurement makes this hard to confirm. In other places, water utilities are concerned about the affordability of their rates, but they have not adopted a way to make affordability assessments.

Why Develop a New Metric?

The MHI Indicator

The Alaska Affordability Framework was developed specifically to replace the use of MHI as an indicator. Prior to 2017, residential water and sewer rates in Alaska were defined as affordable if they equaled 5% or less of the median household income in a community. However, the MHI indicator was found to produce unreliable assessments for rural Alaska.[36]

To understand the shortcoming of MHI as a metric, it is important to understand what the MHI is. Median household income represents the midpoint in household income distribution for a community. Picture the income for every household in a community written down in a list sorted from smallest to largest. The

Table 4. Indicators of Affordability

Location	Eligibility Criteria
Anchorage, Alaska[31]	Determined by the Anchorage Health Department
Ketchikan,[32] Nome,[33] Kasaan, Metlakatla, Emmonak, Alaska	Head of household is 65 years of age or older or an Elder
Grenoble, France[26]	Households eligible for social assistance who do not receive housing assistance
Scotland[25]	Students, low-income households and disabled persons receive discounts
Portland Water Bureau[34]	Eligibility thresholds are set by the Portland Water Bureau based on: 1. Annual Income 2. Family Size
Baltimore City Department of Public Works[1]	Customers with incomes under 175% of the Federal Poverty Level
City of Philadelphia[1,35]	Customers with incomes under 150% of the Federal Poverty Level; seniors and households experiencing special hardship, such as a new child or family member, job loss, serious illness, family loss or domestic violence. Households experiencing other hardships can apply for assistance and their request will be reviewed.
California Water Service[1]	Eligibility for federal low-income assistance programs

median household income is the point at which 50% of all households have an income above it and 50% have incomes below it (Figure 6A). There are at least four problems with the use of MHI as an affordability metric.

Problem 1: The MHI indicator fails to account for the distribution of income within a community. By definition, half of all households in a community will have an income below the MHI. However, the distribution of income among these households makes a difference, as illustrated in Figure 6B where the MHI in both communities is $50,000. In the top panel, three households make $10,000, while one makes $45,000. In the bottom panel, the income level of all households is closer to the median, and even the poorest households make $40,000 per year.

Problem 2: The MHI fails to account for the cost burden experienced by 50% of community households. Figure 6C shows why income distribution is important. In this example, the median household income is $50,000; therefore, residential rates of up to $208 per month are considered affordable. At that rate, a household making $50,000 will spend 5% of its monthly income on water and sewer services, while a more economically disadvantaged household with an annual income of $10,000 would have to spend 25% of its income to pay the bill.

Problem 3: The quality of MHI data for rural Alaska is typically poor. American Community Survey data for rural Alaska has wide margins of error.[37,38] This is largely due to the small population size in rural Alaska communities and the statistical methods used.

Problem 4: The MHI indicator fails to account for socioeconomic differences among communities. Living costs vary significantly across rural Alaska and depend on many factors, such as whether communities are on the road system or can be accessed by barge, whether they are eligible for the Power Cost Equalization Program, and what subsistence opportunities exist.

Why a New Framework?

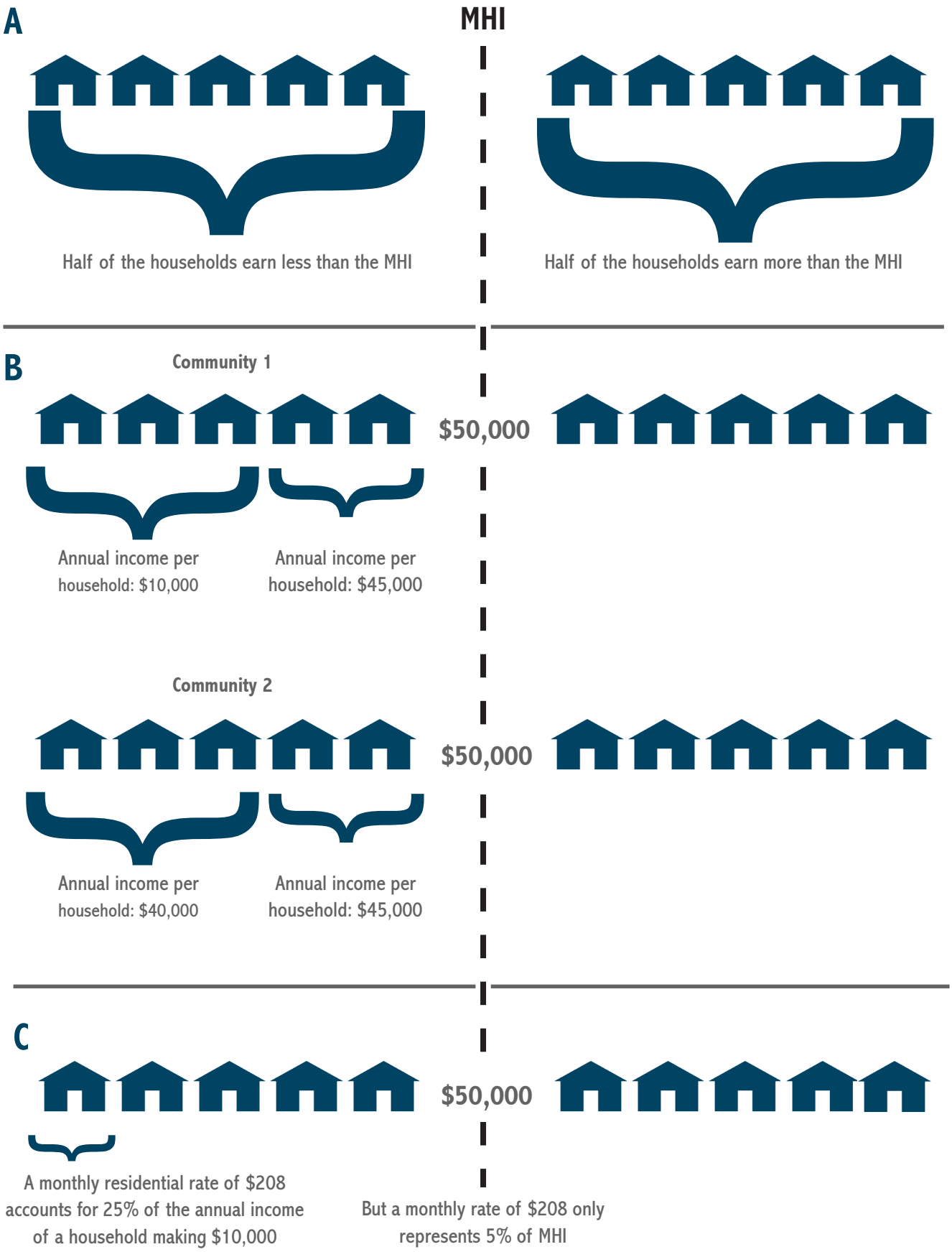
Once the MHI indicator was determined to be unreliable for rural Alaska, VSW made the decision to develop a new framework which would:

1. Use readily available data
2. Be easy to use and understand
3. Contextualize the findings to the community level

None of the frameworks already discussed meet all three of these conditions. The European frameworks and Teodoro's Affordability Ratio and HM metric require collecting data at the household level. This is time-consuming, expensive and unrealistic given the remoteness of Alaska's rural communities. EPA's CSO Financial Capability Indicator uses readily available data but does not account for income distribution within a community. The socioeconomic indicators used in the EPA CSO framework are not a good fit for rural Alaska, since few communities have bond ratings; also, the high number of discouraged workers makes unemployment figures imprecise, and few rural Alaska communities collect taxes. The California EPA Office of Environmental Health Hazard Assessment Tool focuses on low-income households, but lacks context without socioeconomic indicators.

Communities off the road systen, such as this village in Western Alaska, have higher cost of living.

Figure 6. Median Household Income and Income Distribution



Timeline

The Alaska Affordability Framework is the result of a multi-year effort that has included two research studies, 13 community visits, and many meetings with state agencies and other interested parties (Figure 7). In 2015, Camilla Kennedy, an economist for ADEC at the time, initiated a research partnership between ADEC and the Master of Science in Resource and Applied Economics program at the University of Alaska Fairbanks (UAF). The partnership increased ADEC's access to economic analysis and provided UAF graduate students with the opportunity to develop research skills while working on real-world issues.

Under the auspices of this research partnership, the VSW Program requested a review of the use of MHI as an affordability metric. The review was completed by the author, who was a student in the master's program at the time. The study of the MHI indicator found that a more accurate and practical assessment tool for rural Alaska was needed. At the completion of the project, VSW requested the development of a new affordability framework, which the author undertook as a master's thesis project and completed in summer 2016.[36] VSW saw potential in the 2016 version of the framework, but believed it needed further development. In the summer of 2018, the author was hired as a contractor to refine the affordability framework for use in rural Alaska.

From early on, VSW has sought feedback on the framework's development from state and federal agencies and other stakeholders. In April 2016, VSW invited representatives from several organizations to a meeting to learn about the first iteration of the new framework. Attendees included representatives of IHS,

Figure 7. Project Timeline

2015 — Project Start

- Review of use of Median Household Income indicator
- Start developing new affordability framework

2016 – 2017 — Design Phase

- Present the framework
  - Academic conferences
  - Professional associations
  - Consultants
  - Multi-agency meetings
- Publication of framework as a masters of science thesis

2018 – 2020 — Implementation and Testing

- Website launch
- Presentations
  - Consultants
  - Multi-agency meetings
- Trips to 13 communities
  - Community meetings
  - Presentations to Tribal Councils
  - Presentations to City Councils
  - School presentations
  - Informal meetings
- Publication of final report
- Publication of tool to assess affordability

USDA, Alaska Native Tribal Health Consortium (ANTHC), RUBA, U.S. EPA and the Centers for Disease Control and Prevention (CDC). The feedback received was extremely valuable and influenced the development of the framework. For example, attendees suggested simplifying some of the indicators used in the framework and accounting for the effects of income distribution. VSW also arranged for presentations to visiting consultants and shared the framework when attending meetings in Alaska and outside the state, continuously soliciting input.

Presentations on the framework were given at the Western Alaska Interdisciplinary Science Conference in Dillingham in March 2016 and the Alaska Section American Water Resources Association's (AWRA) annual meeting in April 2016 in Anchorage. The AWRA meeting was attended by water operators and utility managers who expressed interest in the project and asked for more information.

In September 2016, the framework was presented at the Water Innovations for Healthy Arctic Homes conference in Anchorage, where an Alaska Native Elder cautioned that it was important to account for differences in living costs between places. Other conference participants suggested that the framework could provide a quantitative assessment of the affordability issues researchers regularly observed. The author also presented the framework at the Arctic Frontiers of Sustainability fellow's conference in Qaqortoq, Greenland, in September 2017.

Community visits played a key role in the framework's development. These trips presented an opportunity to incorporate feedback from utility customers into the framework and to validate its results. Thirteen communities were visited between February 2019 and February 2020. Outreach was done through community meetings, presentations to tribal and city councils, school presentations and meetings with water plant operators. In all, over 200 people attended meetings about the framework, largely thanks to the efforts of tribal administrators, city managers and city clerks to advertise the events and encourage people to attend. Community members frequently asked that the issues raised during the meeting be shared with relevant organizations (generally a tribal health organization or state agency). These requests were satisfied through email and in-person meetings with the organizations.

The Affordability Framework was presented at conferences, including the WIHAH conference in Anchorage in 2016, as part of an effort to solicit feedback on the study.

Community input on the affordability framework was solicited during trips to 13 communities across Alaska.

The Affordability Framework of the Village Safe Water Program

The affordability framework eventually adopted by VSW is a composite indicator in matrix form (Figure 8). Like the EPA's 1997 CSO matrix, it consists of an RI and FCI metric.[27] The RI measures the share of family income that lower income households need to pay their residential water and sewer bill. The FCI is the weighted score of several socioeconomic indicators for the community, including the percentage of households on SNAP, percentage of households below the poverty level and percentage of working-age adults with full-time jobs.

Affordability is assessed by finding the intersection of the RI and FCI values on the matrix. Depending on where they meet, residential rates are classified as being either a high, medium or low burden for lower income households. Rates that are shown to be a high burden are considered unaffordable for the community. Rates that are a medium or low burden are assumed to be affordable. The multidimensional approach helps contextualize the affordability calculations specific to each community.

Calculating the Residential Indicator (RI)

The RI estimates the proportion of annual household income needed to pay for water and sewer services in medium- and lower income households. This is calculated by dividing the current or proposed residential rate by the upper threshold for each of the community's three lowest income quintiles, then averaging those results. Income quintiles are a socioeconomic measure that groups a community's household income data into five equal parts. Each quintile represents 20% of the population. For more on income quintiles, see Appendix A.

Table 5. Example of an RI Calculation

Variable	IQ1	IQ2	IQ3
Threshold	$25,000	$43,000	$64,000
Annual fee	$1,032	$1,032	$1,032
RI	4.13%	2.40%	1.61%
Community RI	= average RI (IQ1:IQ3) = 2.71%		

An example of how to calculate the RI is shown in Table 5. In Community X, each household pays a flat rate equivalent to $1,032 annually for water and sewer services. This rate is divided by $25,000, which is the upper end of quintile 1, the lowest economic quintile. This results in an RI value of 4.13% for the first income quintile (IQ1). The calculation is repeated for the second- and third-lowest income quintiles (IQ2 and IQ3), resulting in RI values of 2.40% and 1.61% respectively. The final RI is obtained by averaging the RI values for these three quintiles. The thresholds to classify rates as low, medium or high burdens are shown in Table 6. Rates between 0% and 2% are considered a low burden, rates from 2% to 5% are a medium burden, and rates over 5% are assumed to be a high burden.

Figure 8. The Affordability Framework Matrix

Financial Capability Indicator	Residential Indicator: Low Burden > 0% to ≤ 2%	Residential Indicator: Medium Burden > 2% to ≤ 5%	Residential Indicator: High Burden > 5%
Strong > 2.5 to ≤ 3.0	Low Burden	Low Burden	Medium Burden
Mid-Range > 1.5 to ≤ 2.5	Low Burden	Medium Burden	High Burden
Weak ≥ 1.0 to ≤ 1.5	Medium Burden	High Burden	High Burden

Table 6. RI Thresholds

% cost to quintile	≤ 2%	> 2% to ≤ 5%	> 5%
Burden Value	Low Burden	Medium Burden	High Burden

Table 7. FCI Thresholds

Indicator	Score 1	2	3
% of SNAP recipients households	> 20%	< 10% to ≤ 20%	≤ 10%
% households under the poverty level	> 20%	< 10% to ≤ 20%	≤ 10%
% over the age of 16 employed full time	≤ 30%	< 30% to ≤ 50%	> 50%

Calculating the Financial Capability Indicator (FCI)

The FCI incorporates select socioeconomic indicators from the U.S. Census Bureau's ACS data. To calculate the FCI, community data from the previous four years are averaged. Scores are then assigned based on the 4-year average for each indicator. The scores range from 1 (weak) to 3 (strong). The socioeconomic indicators used are:

1. Percentage of community households that receive SNAP
2. Percentage of community households living below the federal poverty level
3. Percentage of people in the community over the age of 16 with full-time jobs

There is a subjective aspect to establishing the best thresholds for use in public policy metrics. The FCI thresholds used in the framework are based on average values for the indicators in Anchorage and Fairbanks (Table 7). Values above this average are assigned a score of 3 (strong socioeconomic capacity). Thresholds for scores of 1 (weak socioeconomic capacity) and 2 (medium capacity) were established in consultation with VSW staff. The higher the FCI score, the higher the community's capacity to meet economic challenges and spread the cost of essential services across the community.

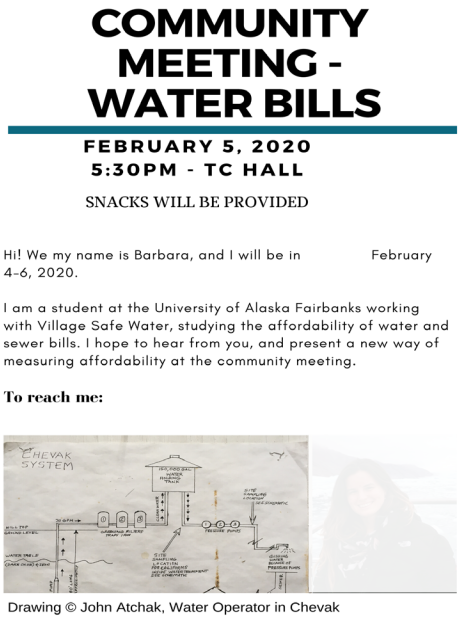
Community Visits

Between February 2019 and February 2020, 13 community visits were conducted to solicit feedback from utility users on the draft framework. The goals of the visits were to:

- Learn about what affordability means to residents;
- Gather community input on affordability issues; and
- Present the Affordability Framework and test to see if the affordability assessment is accurate.

A sample of communities from the Southeast, Southwest, Interior and Northern regions of Alaska was selected (Figure 9). The sample was designed to represent a range of water and sewer

Figure 9. Regions Visited to Evaluate the Affordability Framework



COMMUNITY MEETING - WATER BILLS

FEBRUARY 5, 2020
5:30PM - TC HALL

SNACKS WILL BE PROVIDED

Hi! We my name is Barbara, and I will be in February 4-6, 2020.

I am a student at the University of Alaska Fairbanks working with Village Safe Water, studying the affordability of water and sewer bills. I hope to hear from you, and present a new way of measuring affordability at the community meeting.

To reach me:

Drawing © John Atchak, Water Operator in Chevak

Community meetings were advertised through a variety of means, including flyers like this one.

rates, bill collection rates and affordability scores across rural Alaska. Only communities that wished to be part of the study were visited. Before each trip, city and tribal governments were contacted and asked if they were interested in participating. Communities were promised confidentiality. All communities that were contacted agreed to participate.

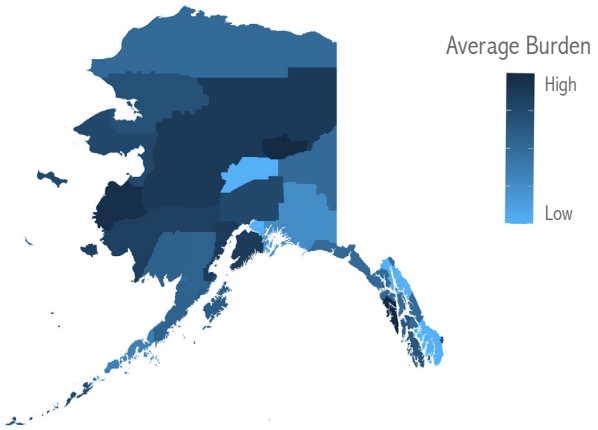
Based on local interest, outreach activities included community meetings and presentations to the city and/or tribal council and additional presentations to school children. Meetings were planned to take place after the researcher had spent at least one night in the community. Community visits were advertised through flyers posted in the community, VHF announcements and Facebook posts on community pages that explained the purpose of the trip and gave the dates the researcher would be in town. The flyer included a picture of the researcher, so people would recognize her. Anyone interested in talking about affordability issues was invited to reach out. In some communities, the researcher was invited to spend the day at the community store or church to meet and talk with people.

Before visits began, a set of questions was developed to help guide conversations (Appendix B). Individual conversations were conducted as semi-structured interviews. Interviews were recorded with the interviewee's consent so the researcher could focus on the conversation. When a community member expressed unease at being recorded, the conversation was documented through written notes. Community meetings were not recorded, but also documented with notes taken during and after the meeting.

Affordability in Served Communities in 2019

The Alaska Affordability Framework was first used to look at 2019 residential rates in 111 rural communities served by piped water and sewer systems. The analysis found that rate affordability varied widely across rural Alaska: rates in 56% of the communities included in the assessment were found to be a high burden, in 30% of communities a medium burden and in 14% a low burden for lower income households (Figure 10).

Figure 10. Average Burden of Residential Rates By Borough



Methodology

Following the steps outlined in *The Affordability Framework of the Village Safe Water Program* (pp. 24-25), the RI and FCI were calculated for 111 rural communities with established utility rates and an affordability determination was made using the framework's matrix. Most of the utilities (109) charge residential customers a flat monthly rate, meaning the size of a household's bill does not change with the amount of water used. For two utilities with metered rates, the analysis was based on the average monthly residential bill, using estimates provided by the local government. The analysis excluded North Slope Borough utilities.

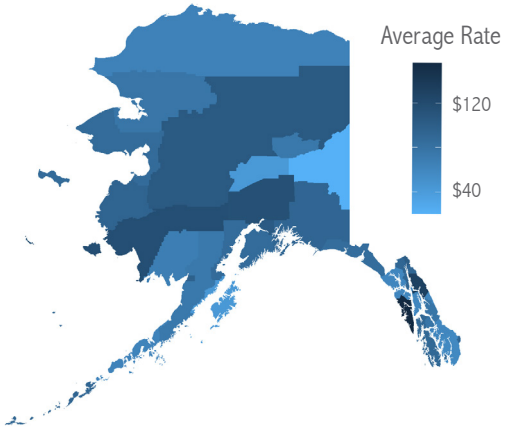
2019 Rates

Residential rates among the utilities assessed in 2019 ranged from $10 to $257 per month (Table 8). The average monthly bill was $85.80 and the median rate was $82.50 per month. The standard deviation was $42, indicating a wide distribution (Figure 11). It follows that the RI values, which are based on water and sewer rates, also have a wide distribution. RI ranged from 0.5% to 9.7%. The average RI value was 3.2% and the median was 2.7%. Thus, the average and median RI values both fall in the medium burden category. The range in FCI values encompassed the spectrum from 1 to 3. The average FCI was 1.5 and the median was 1.33. Both values fall in the "weak" category, indicating that socioeconomic factors significantly impact residential water and sewer affordability in rural Alaska.

Table 8. Summary Statistics of Affordability in 2019

Variable	Min	Max	Average	Median
Monthly Fees	$10	$257	$85.8	$82.5
RI	0.5%	9.7%	3.2%	2.7%
FCI	1.0	3.0	1.5	1.3

Figure 11. Average 2019 Residential Rates By Borough



Affordability

The same utility rates can result in different affordability determinations across communities. For example, the same $80 per month residential rate represented a low burden in one community we assessed, but was determined to be a medium burden in another community and a high burden in a third community. The difference is only partially due to income levels. Income distribution and other socioeconomic factors also play a role in determining which communities experience medium- or high-burdens from the same utility rates found in low-burden communities.

To understand how, it helps to look at income quintiles. In the community where $80 per month creates only a low burden, the lowest income households (IQ1) make at least twice as much as the lowest income households in the medium- and high-burden communities. But there is less of a difference when looking at households

in the second income quintile (IQ2). In the low-burden community, these second quintile households make only about 1.7 times more than their counterparts in the medium- and high-burden communities. Socioeconomic factors are also important. In this example, incomes in the medium-burden community were actually lower than incomes in the high-burden community, but the FCI of the high-burden community was weak (a score of 1), revealing a community with less economic resilience or capacity to absorb higher costs. The FCI score of the community where $80 per month represented a medium burden was a 2, neither strong nor weak.

High-Burden Rates

In 2019, 62 utilities (56% of the sample) had residential rates that represented a high burden for lower income households in the communities they served. These high-burden rates (Table 9) ranged from $45 to $257 per month, with an average monthly rate of $101. RI values in these communities ranged from 2.0% to 9.7%, with an average RI of 4.1% and a median of 3.7%. Both average and median values fall in the medium-burden range for RI, even though the residential rates were determined to be a high-burden. This highlights how the affordability determination is strongly influenced by socioeconomic factors in these communities. Looking at FCI scores, we see that the maximum FCI for a high-burden community is only 2.3, and the median FCI is 1.3. In fact, over 50% of the communities with high-burden water and sewer rates have an FCI score of 1, indicating weak socioeconomic capacity. This tells us that many households in these communities are struggling financially.

Table 9. Summary Statistics of High-burden Communities

Variable	Min	Max	Average	Median
Monthly Fees	$45	$257	$101.9	$95
RI	2.0%	9.7%	4.1%	3.7%
FCI	1.0	2.3	1.2	1.3

Medium-Burden Rates

Thirty-three utilities (30%) were found to have residential rates that were a medium-burden for lower income households in their communities (Table 10). Monthly water and sewer rates ranged from $20 to $140 in 2019, with an average residential rate of $69.20. RI values ranged from 0.6% to 4.7%, with a mean and median RI of 2.4%. FCI scores ranged from 1.0 to 2.3, with a mean FCI of 1.6 and a median of 1.7, putting them in the low end of the mid-range for FCI. Only 11 of the 33 medium-burden communities had an FCI under 1.5, indicating weak socioeconomic factors, in 2019.

Table 10. Summary Statistics of Medium-burden Communities

Variable	Min	Max	Average	Median
Monthly Fees	$20	$140	$69.2	$72.5
RI	0.6%	4.7%	2.4%	2.4%
FCI	1.0	2.3	1.6	1.7

Low-Burden Rates

Of the 111 rural utilities analyzed, 16 (14%) had residential rates in the low-burden category, meaning basic water and sewer services were considered affordable for all income groups (Table 11). Monthly water and sewer rates for these utilities ranged from $10 to $115, with an average residential rate of $58.50. RI values ranged from 0.5% to 2.4%, with a mean RI of 1.5% and a median of 1.6%. Thus, over half of the low-burden communities also had an RI in the low-burden range. FCI scores ranged from 2.0 to 3.0, with a mean FCI of 2.4 and a median of 2.3 (both at the upper end of the mid-range FCI).

Table 11. Summary Statistics of Low-burden Communities

Variable	Min	Max	Average	Median
Monthly Fees	$10	$115	$58.5	$59.9
RI	0.5%	2.4%	1.5%	1.6%
FCI	2.0	3.0	2.4	2.3

Comparing Communities

The summary data for low-, medium- and high-burden communities underscore the role of household income levels and underlying socioeconomic factors in the assessment of affordability. While the range of utility rates that result in a low burden for some communities overlaps substantially with the rates that present high burdens for others, the mean monthly high-burden residential rate ($101.90 per month) is still 40% higher than the mean low-burden rate ($58.50). In low-burden communities, households not only have lower water bills, they have more income available to pay their bills (Table 12). Interestingly, the maximum income among high-burden communities

Table 12. Summary Statistics of the Lowest Income Quintile

		Village Burden		
		Low	Medium	High
Income Quintile 1	Min	$19,811	$14,810	$7,399
	Max	$52,048	$36,813	$44,137
	Average	$31,093	$23,169	$20,375

is actually higher ($44,137) than in medium-burden communities ($36,813), but both are lower than the highest IQ1 income among low-burden communities ($52,048).

The framework can be used to estimate the maximum affordable utility rate for a community. This is equal to the residential rate that would create a medium burden for lower income households. It can be calculated by reversing the framework calculations (see Appendix C for details). The results are shown in Table 13. The maximum affordable monthly rate for low-burden communities ranges from $104 to $492; for medium-burden communities from $38 to $230; and for high-burden communities from $22 to $248. While these are estimates, they highlight the significant differences between low- and high-burden communities and the similarities between medium- and high-burden communities.

Subsidies

Twelve communities (11%) in the study subsidize their water utilities. Monthly subsidies range from $6.30 to $165. The mean subsidy is $100, and the median is $110. Figure 12 shows the subsidized rates, unsubsidized rates, and the affordability threshold. Rates on or below the affordability threshold line are considered affordable. Without subsidies, 11 communities have rates that represent a high burden for residents; one community's rates represent a medium burden. After a subsidy is applied, the affordability of water and sewer rates changes in only two communities, which move from high- to medium-burden communities. The post-subsidy rates in two other high-burden communities are less than $5 from the threshold for a medium-burden community.

Limitations of Statewide Analysis

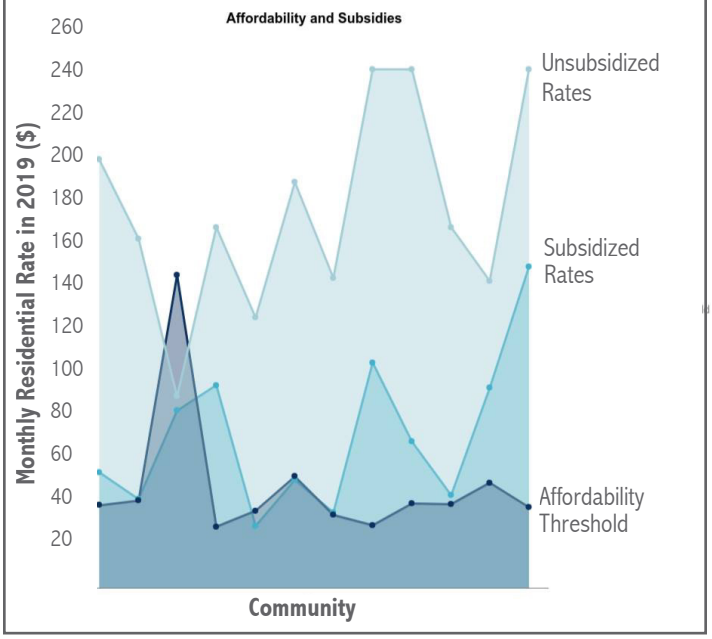
The assessment analyzed established rates in 111 rural communities with piped water systems. The results may not be representative of communities not included in the study. Importantly, the framework is just that. It provides high-level guidance based on a set of generalized assumptions. The framework is only as good as the data available. Its accuracy is limited by that of the ACS, which is known to have wide margins of error for rural Alaska data.[37,38] These are reported in Appendix D. Therefore, while we estimat that 56% of the rural utilities included in the study had unaffordable residential rates that placed a high-burden on lower income households in 2019, we cannot conclude that 56% of all rural Alaska utilities have rates that pose a high-burden for rural households.

Lastly, the data sample used for the statewide analysis may not be representative of all rural Alaska utilities. Rate data used in the study was collected by the ADCCED's Rural Utility Business Advisor Program (RUBA) and ANTHC's Alaska Rural Utility Collaborative (ARUC). To join ARUC, communities must maintain a minimum bill collection rate and satisfy reporting requirements.

Table 13. Summary of Affordability Thresholds in 2019

		Village Burden		
		Low	Medium	High
Medium Burden Threshold	Min	$104	$38	$22
	Max	$492	$230	$248
	Average	$260	$119	$58

Figure 12. Impact of Subsidies on the Affordability of Residential Rates in 2019



Hence, ARUC utilities represent a sample that may be more efficiently managed than utilities in non-ARUC utilities.

Evaluating Funding Gaps

The results of the Alaska Affordability Framework underscore the importance of including a household affordability assessment when evaluating utility funding and rate setting. For example, a currently unpublished IHS study estimated that in 2016 an additional $14.8 million was needed to adequately fund the O&M costs of the 74 Alaskan water utilities included in the study. An affordability analysis of these utilities reveals that, in 2016, 36 already had rates that represented a high burden to their communities. Increasing rates further to fully cover the funding gap would result in an additional six communities with high-burden rates. On the other hand, if all rural residential rates were set at the maximum affordable level, only $7.8 million (52%) could be raised by increasing rates, and only 32 communities could cover the funding gap affordably, according to the framework.

Methodology

Water and sewer rates for 2016 rates were analyzed for 74 rural utilities using data from the IHS study, 2016 ACS, and the methods detailed in the section, *The Affordability Framework of the Village Safe Water Program* (pp. 24-25). An affordability threshold was calculated by reversing the equations used to assess affordability (Appendix E). To estimate how much of the 2016 utility funding was from unaffordable rates, the maximum affordable residential rate was subtracted from the residential rate for each utility. The results were then aggregated by utility type.

Affordability and 2016 Funding Levels

In 2016, 36 of the 74 utilities (49%) in the IHS study had residential rates that constituted a high-burden. These included 18 utilities with circulating and gravity systems, eight with pressure and gravity systems, six circulating and vacuum systems, and four community haul systems (Table 14). Altogether, these 36 utilities collected an estimated $2.7 million more than they would have if their rates had been set at an affordable medium-burden level. It was largely unaffordable rates that were funding the utilities' O&M costs; this is not sustainable over the long term. If all utility rates were at or below the utility's maximum affordable medium-burden threshold, the funding gap identified in 2016 would be $17.5 million instead of $14.8 million.

The affordability of individual haul system rates is difficult to assess using the framework. Individual haul costs are dependent on quantity; therefore, users unable to pay their bills will stop buying water or decrease the quantity of water purchased. In order to evaluate the affordability of individual haul systems, it is necessary to determine if users have modified their behavior and reduced their consumption to what they can afford. According to the United Nations Children's Fund (UNICEF), the health benefits of water services derive from both quality and quantity.[39] UNICEF defines water security for survival as 5.4 gallons of water per person per day. However, Eichelberger (2010) found that households in Northwest Alaska on individual haul systems who were surveyed consumed only 2.4 gallons per person per day.[40] This suggests extreme conservation behavior, which may be happening in other communities too.

Affordability and the Funding Gap

If rate revenue is the only funding source these utilities have to close their O&M funding gap, 42 utilities would have to set their rates at a high-burden level. The rates for the 36 high-burden utilities would have to increase further, and six additional utilities would need to set high-burden rates (Table 15). In this scenario, high-burden rates would fund an additional $4.3 million in O&M costs, bringing the total funding from high-burden rates to $7 million. High-burden rates would fund circulating/gravity systems by $3.3 million, pressure/gravity systems by $109,300, circulating/vacuum systems by $817,000, and community haul systems by $58,186. In other words, if every utility set their residential rates at or below the maximum affordability threshold, only an additional $7.8 million could be raised from residential users to close the funding gap identified by IHS.

Sustainably Funding Utilities

While utilities need an additional $14.8 million to be adequately funded, only $7.8 million can be funded through affordable residential rates. Closing the gap requires finding additional funding sources for utilities, such as subsidies.

Subsidies

Alaska lacks state and federally funded subsidies for water and sewer systems that help defray the high cost of other rural utilities, including electrical and telecommunication services. Some Alaska water systems are subsidized by regional and not-for-profit entities. The North Slope Borough operates Alaska's

Table 14. Funding of Water and Sewer Utilities in in 2016 IHS Study

Category	Water Systems	Utilities with High-burden Rates in 2016	Funding from Rate Revenue = High-burden Rates - Affordable Threshold
1	Pressure/Gravity	8	$ 435,584
2	Circulating/Gravity	18	$ 1,248,726
3	Circulating/Vacuum	6	$ 648,705
4	Circulating/Pressure	0	-
5	Individual Haul/Honey Bucket/ Washeteria	0	-
6	Community Haul/ Water or Wastewater Only	4	$ 366,305
Total		36	$ 2,699,320

Table 15. Funding From High-burden Rates if Utilities Increased Rates to Adequately Fund O&M in 2016

Category	Water Systems	New Utilities with High-burden Rates After Increasing Rates to Adequately Fund O&M	Total Utilities with High-Burden Rates	Additional Revenue Generated from High-burden Rates	Total Revenue from High-burden Rates
1	Pressure/Gravity	1	9	$ 109,266	$ 544,850
2	Circulating/Gravity	2	20	$ 3,307,372	$ 4,556,098
3	Circulating/Vacuum	1	7	$ 817,204	$ 1,465,909
4	Circulating/Pressure	0	0	-	-
5	Individual Haul/Honey Bucket/Washeteria	0	0	-	-
6	Community Haul/Water or Wastewater Only	2	6	$ 58,186	$ 424,491
Total		6	42	$ 4,292,027	$ 6,991,347

longest-running water and sewer subsidy program, which is primarily financed by oil and gas property taxes. Starting in 2018, the Northwest Arctic Borough, in partnership with ANTHC and Maniilaq Association, piloted a new subsidy program, the Community Utility Assistance Program (CUAP). The initial results are promising with monthly bills decreasing from $200 to $60-$80. The CUAP has also increased training opportunities for operators and helped increase collection rates, a common eligibility criterion for grants.[41] Many individual communities that participate in ARUC, which is housed at ANTHC, also choose to subsidize their water and sewer rates.

Voices From the Communities

The feedback obtained during 13 community visits shaped the development of the framework and this report. The primary questions guiding the visits were, "Is the framework relevant and is it accurate?" The objective was to present the framework to people who would be impacted by its use and solicit their input. Interviews and surveys conducted in communities supported the quantitative results of the affordability assessment and underscored the importance of affordable utility rates. Many interviewees also expressed that water and sewer services, while important, are just one of the many concerns of rural residents.

Affordability

The issue of affordability resonated in all the communities. Many residents value having in-home piped services, but they worry about the financial sustainability of the water utilities—a statement supported by previous studies.[42] An Interior resident said, "They [bills] are manageable, but we make it so because it is worth it to have water." In low-, medium- and high-burden communities, people reported knowing someone who struggled to pay their water bills. People identified the utility rates, lack of jobs, and high living costs as factors impacting their ability to pay their bills. In low- and medium-burden communities, the lack of cash-paying jobs impacts what rates many households can afford. As one resident of a medium-burden community in Interior Alaska explained, "If you have a full-time job, it's OK; but most people don't." This contrasts with observations from high-burden communities in Southwest Alaska, where even people with cash jobs described needing to juggle to pay their bills—paying what they could until their next paycheck to avoid being cut off. In these communities, people identified monthly residential rates of over $150 combined with the overall high cost of living (which reduces disposable income) as factors affecting their ability to pay.

> **"Bills are manageable but we make it so because it is worth it to have water"**
>
> **-Interior Alaska resident**

The community visits revealed many instances of unaffordable rates. At the meeting described in the introduction, several residents of a high-burden community in Southwest Alaska brought their recent bills and other correspondence with the water and sewer utility to the meeting. Many bills showed past-due amounts in four figures. People raised their voices and asked for an explanation of the bills. The city accountant, who volunteers her time two days each week because the city cannot afford a full-time accountant, had posted a sign asking people not to fill

their water jugs in the building to help save the city money on its water bill. In Southeast Alaska, managers of two utilities with very good collection rates explained that their customer base was almost exclusively composed of higher income homes. However, at community meetings in the region, several residents who haul their water also said that residential utility rates were too high. They preferred to haul their water than worry about how to pay the bill every month.

These conversations highlighted the differences between the study's definition of affordability and how residents perceive it. Households struggle to pay their utility bills for a variety of reasons, and discussions of affordability quickly moved on to suggestions for tackling the issue. Making residential water and sewer rates affordable means addressing the socioeconomic factors that impact the finances of households and utilities. Ideas suggested by rural residents included the need for more jobs in the community, finding ways to decrease food costs which contribute to the high cost of living, providing local training for utility operators, providing full-time jobs for operators, and repairing infrastructure to fix leaks. In one community, people suggested offering operator training classes to high school students. It is clear that the affordability of residential water and sewer rates and the financial health of utilities go hand in hand.

Household income in rural Alaska changes in predictable and unpredictable ways with the seasons and the year. These fluctuations can significantly impact residents' ability to pay bills. Winter 2019-2020 was colder than usual, requiring people to increase the money spent on home heating. Some residents mitigate their heating expenses by heating with wood, but not everyone has that option. One Southwest Alaska resident explained that, a housing agency recently removed wood stoves when retrofitting homes in the community, requiring residents to heat their homes solely with electricity or heating oil, both of which require cash income. With few cash-generating opportunities in the village, this placed a new burden on many households. Another meeting attendee shared that the elders were right when they "warned us that we would go back to the old way." He then listed his monthly bills, which exceeded his income.

A discussion in a low-burden community emphasized the impact of timing on affordability assessments. "We had a good fishing season, so this year is good," the interviewee explained. The

Cold weather also impacts water and sewer utilities, :Pipes like these ones in a village in Northern Alaska, freeze up. Frozen pipes increase utilities costs, and decrease their revenue.

last three fishing seasons had been disastrous, wrecking the community's economy. By the third year, residents had been forced to give up on their local fishery and work in other fisheries for a season. Had the affordability assessment been done the previous year, the results would have been different; local utility rates would have been found to be unaffordable. The exchange underscored the limitations of the framework's income data, which failed to account for the significant variation in annual income and was based on surveys performed the year prior to the bad fishing seasons.

Most of the utilities interviewed for this study reported struggling to cover their O&M costs. In the Interior, a utility manager explained that she also juggles bills from vendors, paying off the most immediate while waiting for customers to pay their bills. Receiving a payment even from one household can make the difference. Only one utility interviewed—one with rates found to be a high-burden for local households—reported having an emergency fund available for making repairs. Utility and city employees in the community agreed with the high-burden assessment, saying many people are routinely "playing catchup" on their bills. The utility enforces a strict disconnect policy: households are disconnected after two months of nonpayment (equal to $150). The utility does not charge a disconnection or reconnection fee. To be reconnected, households must pay off their past-due bills, for a possible maximum of $150.

Utility clerks in almost all communities reported seasonal variations in payments. Fall is reported to be a tough time, although utilities collect more payments right after residents receive Permanent Fund Dividend (PFD) checks in October and tax refunds in the spring. Utilities reported a dip in payments both before and after the Christmas holiday period. While summer generally means an increase in payments, some utilities must contend with significant population changes, as seasonal workers move in for summer employment. The temporary population boost is problematic for utilities; it is hard to accommodate the increased demand and, when fishermen leave, some inevitably do so without paying their bills.

Unusually cold weather also impacts utilities. This past winter, water and sewer lines froze in communities across Alaska. One freeze-up occurred during a community visit in Northern Alaska. As lines started freezing, sewage was mopped from the floors of the community building, the heat was cranked up, and heat tape applied to warm the pipes. Even as these efforts were undertaken, the city manager worried about the next month's energy bill. Freeze ups severely impact the finances of utilities, since they result in higher O&M costs as operators try to thaw pipes or prevent them from freezing at the same time that revenue often decreases. Customers of some Southwest and Southeast Alaska utilities are not charged if lines are frozen. Other utilities in Southwest Alaska continue to charge users, unable to forfeit the monthly revenue that covers the utilities' costs of providing service.

Communication

Many people shared stories or expressed opinions during community meetings and interviews that highlighted the importance of good communication. In some communities, the trust residents have in their utility is apparent. This was noteworthy in one high-burden community where households had to haul drinking water due to a problem with the piped water. Community members said they trusted the utility since the operator always made sure everyone knew when there was a problem. The operator also helped fix leaking plumbing in local homes.

In Southwest, Interior and Northern Alaska villages, there is a perception that some families and residents receive preferential treatment when it comes to disconnecting users for nonpayment. Similarly, in a high-burden community in Northern Alaska, a woman asked whether it was true that "bills are so high because some people aren't paying." The woman, who works two jobs, suggested that she might stop paying her bills if other people continue to receive service without paying for it. Rather than increase rates, the utility should garnish PFD checks in her opinion. It is important to take note of these perceptions, as they impact users' trust in utility managers and their willingness to pay their bills.

> **"Bills are so high because some people aren't paying"**
> **– Northern Alaska resident**

In one Southwest Alaska village, community residents were asked to attend a training on how to operate the utility. One resident expressed losing trust in the utility after that, since he had learned enough to know when something was going wrong, but not enough to be able to evaluate how serious the situation was. Other examples emphasizing the importance of communication came from a community where the utility clerk sent out bills, but few residents received them, resulting in unpaid bills and a lot of frustration for which the clerk was blamed. In another community, a new subsidy lowered bills, but there was confusion as to what the new bill amount was, or when the subsidy took effect.

Using the Affordability Framework

Current Uses for the Alaska Affordability Framework

Affordability is a complex issue. It is dependent on numerous factors, making it difficult to assess or discuss in objective terms. For example, while it is easy to predict that a rate of $1,000 per month for rural water and sewer services would be unaffordable, it is much harder to assess whether $100, $150 or $200 per month would be affordable to most households. Without more information, the answer will be, "it depends." The Alaska Affordability Framework provides a tool for examining affordability in a localized context and providing a quantitative assessment. The framework is essentially a guide for discussion about affordable water and sewer rates in rural Alaska.

ADEC currently uses this framework in combination with other criteria to determine funding eligibility for grants from the Infrastructure Protection Funding program (IPF) administered by VSW.[43] IPF is funded through legislative appropriations, so its availability may vary. ADEC's State Revolving Fund (SRF) also uses this framework to establish micro loan subsidy levels.[44]

VSW uses this framework in evaluating utility revenue estimates in the Preliminary Engineering Reports (PER) submitted for proposed water and sewer projects. Specifically, this framework is used to assess whether the residential rates required to support a proposed alternative in the PER would be a high burden to users and if additional sources of O&M funding will be needed. Approval of PERs is not based solely on this framework. VSW is also in the process of incorporating the framework into the review process for the business plans required for water and sewer construction projects.[45]

Proposed Uses for the Alaska Affordability Framework

In future, the Alaska Affordability Framework could be employed as an additional decision-making criterion for other purposes. Local governments may also find uses for the Affordability Framework. One city government has used this tool to assess the affordability of a rate increase that was needed to fund utility repairs. In another case, the president of a tribal council planned to use the framework to assist in setting utility rates. The framework can help communities determine the level of subsidy needed to keep local residential rates affordable. By reducing the influence or appearance of local politics in rate setting, this framework can also help build local support for higher residential rates needed to keep utilities solvent.

Since the framework evaluates the affordability of residential rates for households in different income quintiles, it can be used in the development of income-based assistance programs in a community. This might be especially useful in communities where residential rates only constitute a high burden for the lowest income quintile (lowest 20% of all households). In this case, the utility could set the rate at a level that is affordable for the other 80% of households and implement a subsidy or financial assistance program available to households in the lowest quintile. In other cases, income-based assistance may be unsustainable, and other sources of funding will be needed to reduce utility rates.

The Limitations of the Alaska Affordability Framework

It is important to remember the limitations of the Affordability Framework. The framework is only as accurate as the assumptions it is based on and the data used in assessments. Making assumptions is necessary in the formulation of most policy prescriptions and tools, yet there will always be outliers missing from the picture and details that get lost in generalization. The main assumptions incorporated in the framework are detailed below.

Water and Sewer Rates

The framework assumes that all households in a community are charged at the same rate. This may not be true if the utility provides income-based assistance.

The framework assumes that households pay only the monthly residential rate to access water and sewer services. This is not the case when utility customers are charged interest on overdue payments, disconnection and reconnection fees, and other administrative charges. These additional fees increase the amount households pay to be connected to water and sewer services, and therefore increase the percentage of monthly household income these services consume. In some communities, the cost of water and sewer services is bundled with other utilities such as electricity. In these cases, households must pay both bills. If payments are overdue, customers may be charged an additional fee every month until the bill is paid off. While this improves utilities' collection rates, the higher bills reduce the household's ability to decide how to spend its money and may result in some households disconnecting from the services.

Willingness to Pay

The framework assumes that households view water services as essential and cannot access substitutes. This implies that households prioritize paying for water services before paying for other essential and nonessential goods and services. While this report has focused on households' ability to pay, willingness to pay is also important. Willingness to pay varies across households and communities. If water and sewer services are considered to be a nonessential service by some households, then they will pay for goods and services they value more before paying for water services.

Affordability Thresholds

The framework assumes that the thresholds used in the RI and FCI metrics represent meaningful affordability cut offs. Establishing thresholds is an art as well as a science and requires judgment calls. The framework's affordability thresholds are based on thresholds used by the U.S. EPA. While the EPA affordability thresholds are commonly used, they were arbitrarily set and were designed to assess community-level financial capability.[2,24] EPA guidelines established affordable water rates at 2.5% of MHI and sewer rates at 2% of MHI, for a total of 4.5% of MHI. In Alaska, the affordability threshold for the combined services was set at 5% of MHI.

The Affordability Framework uses income quintiles rather than median household income to assess affordability. Nonetheless, when establishing the thresholds of affordability for different income levels, it was decided to keep the affordability threshold at 5%. In part, the decision was due to the absence of data showing the threshold is inaccurate, but also because adopting a conventionally used threshold has advantages. Using similar thresholds allows for comparison, both in Alaska and in other places. Importantly, it also means that the Alaska Affordability Framework will benefit from new research on the EPA thresholds, which are the subject of numerous studies.

The framework's RI thresholds are also based on EPA standards. In its CSO guidance report, EPA sets the RI thresholds as follows[26]:

1. Low financial impact is less than 1% of MHI.
2. Mid-range financial impact is 1% to 2% of MHI.
3. High financial impact is greater than 2% of MHI.

RI thresholds for this framework were combined to create the following thresholds:

1. Low-burden rates are less than or equal to 2% of the upper limits of the three lowest income quintiles.
2. Medium-burden rates are between 2% and less than or equal to 5% of the upper limits of the three lowest income quintiles.
3. High-burden rates are greater than 5% of the upper limits of the three lowest income quintiles.

Medium-burden Rates Are Affordable

This framework assumes a residential rate that is a medium burden is affordable. However, when applying the affordability framework, a change in residential rates of as little as $1 can tip the assessment of a medium-burden rate into the high-burden category, which is considered unaffordable. In practice, it is unlikely that a change of $1 would have such a

significant impact. This would only happen if the rate assessed as a medium burden were at the upper limit of that range, which means it may already have been unaffordable for some households. This example highlights the importance of using the framework as a guide, rather than a final determination of affordability for households in a community.

Data Limitations

The availability and accuracy of socioeconomic data for rural Alaska are known to be issues with no clear remedy.

American Community Survey

ACS data for rural Alaska are known to have wide margins of error due to the small population and sample sizes.[37,38] The nationwide ACS conducted by the U.S. Census Bureau is the most readily available source of regularly updated socioeconomic data for American communities, including those in rural Alaska. The ACS covers a broad range of topics about social, economic, demographic and housing characteristics of the U.S. population.

Income data used in the framework is obtained from the ACS and may underestimate or overestimate a household's income. Household income is defined to include: wage or salary income; net self-employment income; interest, dividends, net rental or royalty income; income from estates and trusts; Social Security or Railroad Retirement income; Supplemental Security Income; public assistance or welfare payments; retirement, survivor, and disability pensions; and all other income including PFDs. However, recent evidence suggests that PFD income is rarely accounted for in ACS income data.[46]

Relative Price of Water and Sewer Utilities

The affordability of water and sewer services depends on both the availability of household resources and the relative cost of other essentials household needs. As an example, energy prices impact the affordability of water services both at the utility and household level.[38] An increase in the price of energy will result in increased O&M costs for the water utility, which may force an increase in the rates it charges users. An increase in energy prices will also increase household expenditures on energy (home heating, transportation and electricity), decreasing the disposable income households have available to pay their water bills. Conversely, a decrease in energy prices reduces utility operating costs and increases household disposable income making water and sewer rates more affordable.

The framework is unable to account for the relative price of water services due to a lack of data on other household expenditures, including those on fuel and electricity. Energy expenditures in particular are hard to calculate. They are dependent on both the fluctuating prices of fuel and electricity and the quantity consumed, which often change in inverse relationship. Therefore numerous assumptions about the prices of other goods and services as well as about household behavior must be made to estimate the relative price of water services.

Cost of Living Data

While it is known that the cost of living varies by community, there is no community-level cost of living data available. Data from the Consumer Price Index is only available for Anchorage. The Council for Community and Economic Research Cost of Living Index is only available for Anchorage, Fairbanks, Juneau and Kodiak. Only regional hub cities, such as Bethel and Kotzebue, are included in the University of Alaska Fairbanks quarterly food cost survey. Having more information on living costs in rural Alaska, including expenditures on energy and other essential goods and services, would strengthen affordability assessments. Of particular importance in rural Alaska is the contribution of subsistence to household resources. If a significant share of a household's food is obtained through subsistence harvest or sharing networks, the household will spend less cash on food purchased from the store. At the same time, some of the household's cash resources will necessarily be spent on fuel and other items needed to pursue subsistence activities.

Making Water and Sewer Rates Affordable

This study focused on developing and implementing an affordability framework for rural Alaska as a first step in addressing affordability constraints. In almost every meeting, community members expressed a clear desire for solutions to unaffordable water and sewer rates. There are a variety of ways communities across Alaska are already tackling this issue. While every community is different, knowing what others are doing can be the springboard for developing new and innovative solutions.

The easiest way to make water and sewer rates affordable is to decrease rates. However, to continue to provide services, utilities must be able to cover their O&M costs. Keeping this in mind, there are at least three approaches to making water and sewer rates more affordable:

1. Decrease the O&M costs of the utility.
2. Increase utility revenue through other means.
3. Provide low-income households with financial assistance.

Decrease O&M Costs

There are a variety of ways water utilities can reduce their operations and maintenance costs:

Energy

Energy is among the highest costs for water systems. Energy costs can be reduced through energy efficiency and heat recovery, including adding insulation, upgrading older energy-intensive equipment, and recycling "waste" heat generated by the power plant or other industrial processes.

Insurance

Insurance premiums for water utilities can be expensive, but there may be options for reducing them. In one community, an operator contacted the insurance company to ask what could be done to reduce the system's insurance costs. The company representative said that installing a sprinkler system for fire protection could decrease insurance premiums by 15% per year.

In-kind trades

Some water systems may be able to reduce costs by accepting items they need for operations and maintenance in trade for water and sewer services. For example, a biomass-powered water system could accept a cord of wood in payment for one month of service. Of course, not many water systems can make use of cordwood, but they might accept labor for such maintenance tasks such as painting the water tank, clearing brush on access trails to the water source or storage tank, shoveling snow, or hauling items to the landfill. These do not require the expertise of an operator and are often deferred due to a shortage of staff. It is important that the tasks benefit the utility and not result in additional cost or liability. It is also important that the income of the utility's regular employees is unaffected by the trade. If plant operators' hours or pay are cut, some staff may seek other employment and the utility would lose a skilled employee.

Replacement Parts

Replacing an equipment part or a component can be expensive and time-consuming. In one region of Alaska, neighboring water operators have started coordinating their spare parts inventories. This ensures they have spare parts available when needed and limits how much each utility needs to keep on its shelf. This has worked even though the neighboring communities have different types of systems. Successful coordination requires that operators know which parts their neighbors have and which they themselves need to keep on hand.

Increase Revenue

Another way to reduce rates is to increase the share of utility revenue that comes from other sources than user rates. Below are some ways utilities in Alaska communities are doing just that:

Increase Customer Base

Given the small size of rural Alaska communities, connecting even a few additional households can allow a system to decrease its rates. One utility increased its customer base by reconnecting delinquent households back to the system. Rates were then decreased for everyone. The delinquent households now pay the new lower monthly charge and an extra $10 per month is applied to their past-due account. In this way, everyone benefits from the lower rates.

Subsidies

Subsidies can also be used to decrease residential rates for some or all households. The North Slope Borough has a long-running subsidy program that is primarily financed by oil and gas property tax revenue. These subsidies are the reason no North Slope communities were included in the study. The Northwest Arctic Borough began piloting a subsidy program in 2018. While still in an early stage, the initial results are promising. Many ARUC members also choose to subsidize water utility rates in their communities. Some tribes and cities have a memorandum of agreement to jointly operate water utilities.

While there are no known grants that directly help utilities defray high O&M costs, tribal and city governments may be eligible for grants that provide community members with subsidies for electricity, heat, food or travel. By increasing the disposable income of local residents and reducing the amount they spend on other essential goods and services, these grants serve to indirectly make water and sewer rates more affordable.

Customer Assistance Program

In the United States and Europe, many utilities have implemented customer assistance programs specifically aimed at low-income households (Table 16). In Alaska, several utilities offer senior discount programs. In Anchorage, the Anchorage Water and Wastewater Utility operates the voluntary Coins Can Count program, funded by customers who round up their bills to the nearest dollar.[31] In 2016, the program helped 100 families.[47]

In Baltimore, customers with incomes below 175% of the federal poverty level can receive a $216 credit towards their overdue accounts.[1] In Philadelphia, customers with incomes below 150% of the federal poverty level are eligible for a customer assistance program that will set their bills at a fixed monthly rate based on a sliding scale.[1,35] Collection of past-due amounts is suspended while customers are enrolled in the program.[35] In California, customers eligible for federal assistance programs receive a discount on their water bills.[1] All three American programs are funded through a small fee added to water and sewer bills.

In Europe, utilities in Belgium avoid disconnecting customers, preferring instead to install a flow limiter to ensure households can still use a minimum amount of water to meet their basic needs. The utility also finances a social fund by adding a 0.025-euro charge to each cubic meter of water sold.[26] The fund is used to retrofit plumbing in low-income households to help them reduce their water consumption. Another utility in Belgium offers households the ability to pay their bills more regularly, thereby reducing the amount due at each payment.[26] In Grenoble, France, households who receive social assistance (but not housing assistance) can receive 20 liters (5.3 gallons) per person per day of water for free.[26] In Scotland, students, low-income households and disabled persons receive a discount on their water bills of 25% to 100%.[26]

Table 16. Customer Assistance Programs in Alaska, the United States and Europe

Location		Assistance
Alaska	Anchorage	Coins Can Count program helps eligible households. Program is funded by customers voluntarily rounding their bills up to the nearest dollar.
	Emmonak	Elders receive a $10 monthly discount.
	Kasaan	Senior citizens receive a ~$10 discount.
	Ketchikan[32]	Senior citizens (>65) receive an 11.20% discount.
	Metlakatla	Senior citizens' water services are free.
	Nome[33]	Senior citizen (>65) head of households receive a discount on their bill.
	Thorne Bay	Senior citizens receive a ~ $30 monthly discount.
	Unalakleet	Senior citizens and Elders receive a $30 monthly discount.
USA (outside Alaska)	Baltimore City Department of Public Works[1]	Low-Income Assistance program provides credit of $216 toward delinquent account if customers have an income of less than 175 percent of the federal poverty level.
	City of Philadelphia[1,35]	Households with incomes less than 150% of the federal poverty level who are experiencing hardship can get a fixed monthly bill, based on their income. Past due amounts are suspended and not enforced while customers are enrolled in the customer assistance program.
	California Water Service[1]	Customers eligible for federal assistance programs receive a fixed monthly discount equal to 50% of the 5/8" x 3/4" meter service charge for their district.
Europe	Wallonia, Belgium[26]	Every household contributes 2.5 cents per cubic meter of water used to the social fund. 5% of the fund is used to assist low-income households. The utility avoids disconnections and instead installs flow limiters. Households can opt to pay monthly instead of quarterly bills.
	Grenoble, France[26]	Beneficiaries of social assistance without housing assistance are eligible to receive 20L (5.3 gallons) per person per day for free.
	Scotland[26]	Students, low-income households, disabled persons receive 25% to 100% discount on bills.

Conclusion

This study focused on the affordability of residential water and sewer rates and proposed a new framework to assess their affordability in rural Alaska. The affordability of essential water and sewer services is a concern shared by many throughout Alaska.

The Alaska Affordability Framework was developed specifically for rural Alaska. It was developed to be easy to use and understand, and it was designed to make use of readily available data at the community level. The framework has been constructed as a composite indicator in matrix form. The Residential Indicator (RI) produces a score based on the average annual water and sewer bill in a community as a percentage of household income at varying income levels. The Financial Capability Indicator (FCI) is the weighted score of socioeconomic indicators for the community published by the U.S. Census Bureau.

Communities want to ensure that local households can afford current residential water utility rates and that local utilities can cover their operating costs sustainably and make needed repairs. From a financial and social perspective, unaffordable utility rates are costly for water utilities, households and communities. In a small, tight-knit community, there is a social cost whenever someone must be disconnected from an essential service because of a delinquent account. Even if the person is not a neighbor or relative, the water operator is likely to know the person or family being disconnected. Lack of access to water services also has important public health implications. On the financial side, rural Alaska utilities have small customer bases, so revenue is significantly impacted if just a few households cannot pay their bills.

According to the IHS, 74 of the rural Alaska utilities included in a 2016 study were underfunded by a total of $14.8 million. An analysis using the Affordability Framework estimates that only $8 million in additional revenue can be generated to close the $14.8 million funding gap without making water and sewer rates unaffordable to lower income families in the communities.

Assessing affordability is only the first step in addressing issues that stem from unaffordable utility rates. Rates can be reduced by increasing the customer base of the utility (e.g. by reconnecting previously disconnected households and offering a payment plan), by using subsidies to reduce rates, or by finding ways to decrease operating costs through energy efficiency or other measures.

This framework is a guiding tool with some unavoidable limitations. It relies on ACS data from the U.S. Census Bureau, which is known for wide margins of error due to sampling issues with data from very small communities. Where necessary, the framework also relies on assumptions that do not account for the uniqueness of individual communities. The measurement of affordability at a household level is an emerging field with still evolving best practices. Therefore, it is important to annually update the data and regularly re-evaluate the framework itself with new affordability guidance, including insights from rural communities.

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Appendices

Appendix A: Income Quintiles and Income Distribution

The Residential Indicator (RI) component of the Affordability Framework is based on income quintiles within a community. To calculate the RI, the combined water and sewer rate is divided by the upper limit of each household income quintile and multiplied by 100 to obtain a percentage. Below is an illustration of how income quintiles are derived and how they represent the income distribution within a community. Because water rates are charged at the household level, the Alaska Affordability Framework uses household income quintiles as its basis.

To understand income quintiles, it is useful to know that the word quintile comes from the Latin word quintus, which means five. Income quintiles are five equal-sized groups that all households in a community can be divided into based on annual household income. Each quintile represents 20% of all households, meaning that each has the same number of households in it. The upper and lower income limits for each quintile are based on the actual incomes of the households in the community and so will differ for every community.

To calculate income quintiles for a community:

1. Write down the annual income of every household in the community.
2. Sort the incomes in increasing order, from smallest to largest.
3. Divide the list of incomes into five equal groups, so that each group has the same number of households. Each group is an income quintile.

Figure 13 illustrates the income quintiles in community A, which has just 10 households whose incomes range from $0 to $140,000 per year. Since each income quintile contains one-fifth (20%) of the households, every quintile in community A has two households (10/5=2) in it. The households in Income Quintile 1 make between $0 and $10,000 per year. The households in Income Quintile 2 make between $10,001 and $40,000, and so forth.

Household income quintiles have the following properties:

- Each income quintile contains the same number of households.
- Each income quintile represents one-fifth (20%) of the households in the community.
- The income of every household in an income quintile is between the lower and upper limit of the quintile, but individual household incomes within the same quintile are not necessarily the same.
- Income quintiles show the distribution of income within a community.

Understanding the distribution of income within a community can be extremely helpful. As shown in Figure 14, in both Communities B and C, households in Income Quintile 1 make $10,000 or less per year. However, in Community B the households in Income Quintile 2 make between $10,001 and $15,000 per year, while in Community C they make $10,001 to $35,000. Therefore, 40% of the households in Community B make $15,000 or less per year, while in Community C, 40% of households make $35,000 or less.If both communities have a similar cost of living, a water and sewer rate of $100 per month will be a high burden for more households in Community B than in Community C.

Income distribution can play a role in setting rates. For example, to ensure that rates are affordable for all, Community C may set their residential rate at $100 per month, which should be affordable for most households, and then develop an assistance program to help the 20% of households in Income Quintile 1 pay the their bills. However, if Community B wished to set their rate at $100 per month without putting many households at risk of being disconnected, it might need an assistance program that covers 60% of all households.

Figure 13. Community A Income Quintiles

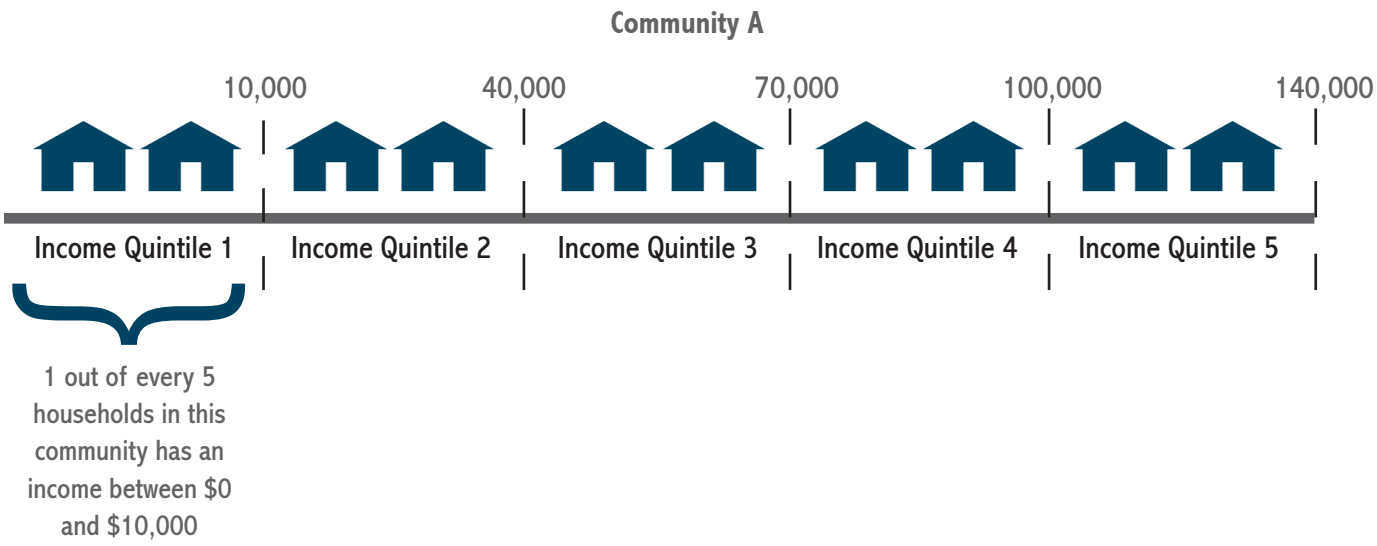
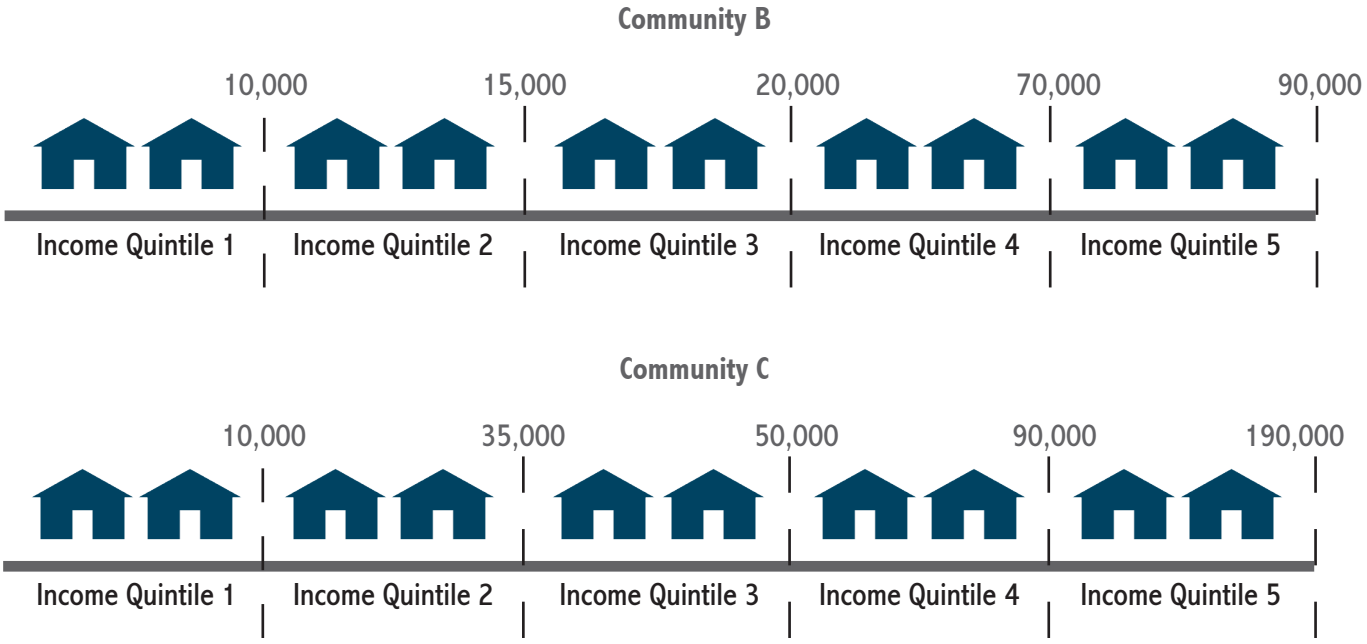


Figure 14. Income Distribution and Income Quintiles in Communities B and C



Appendix B: Survey Questions

Conversations with rural community residents were conducted as semi-structured interviews. The following set of questions was used to guide the conversations. Questions were adapted as appropriate for specific communities. For example, questions related to washeterias were excluded for communities served by other water systems.

1. Category: Access to water services

a. What is the main source of drinking water for your household? How about in your community?
b. What is the main source of water for cooking and washing in your household? And your community?
c. Does your household use the washeteria? How often is the washeteria used? For which services?
d. How long does it take you to collect water and haul water? How often do you do it?
e. Do you treat the drinking water in anyway?
f. Are there problems with the drinking water or treatment plant? Have there been stops in service? How about with the washeteria?

2. Category: What is affordability?

a. What does the word affordable mean to you?
b. What makes water bills affordable?

3. Category: Are systems affordable?

a. Do you get bills from the water utility?
b. Have you had to give up other things to cover your water utility bills? How about other people in the community?
c. Are there times in the year when it is harder to pay water bills?
d. How about the washeteria? What are the prices like?

4. Category: Paying for water services

a. What would make it easier to pay the water utility bills?
b. What are your thoughts on paying for running water and sewage?
c. Do you think paying for electricity is different than paying for water?
d. Do you think [insert name of community] is better or worse off with the utility? How come?

5. Wrap up

a. Did I miss anything?
b. Is there something we have not talked about?

Appendix C: Calculating the Maximum Medium-Burden Rate

The Alaska Affordability Framework can be used to estimate the maximum medium-burden residential rate in a community by reversing the equation used to calculate the RI. It is important to remember that these estimates are dependent on the margins of error listed in Appendix D.

In the Alaska Affordability Framework, a medium-burden rate is determined by both the FCI score and the RI value. Thus, if we know the FCI score of a community (which is based on socioeconomic indicators), then we can find the maximum possible RI value that will result in a medium-burden rate for local households (Table 17). For example, if a community has an FCI score of 1.5 or less, then the highest medium-burden residential rate will be 2% of the average of the upper limit for the community's three lowest income quintiles.

Table 17. Maximum RI Values Given FCI Score

FCI	RI Max
≤ 1.5	2%
≤ 2.5	5%
> 2.5	8%

Please note that if the FCI score is above a 2.5, the maximum RI is 8%. This threshold was set in consultation with VSW solely for the purpose of calculating the Maximum Medium-burden Rate. In its current form, the Alaska Affordability Framework does not have a maximum RI value for communities with a strong FCI.

To calculate the RI, we calculate the average annual residential rate as a percentage of household income for the three lowest income groups. In these equations, IQx stands for the upper limit of Income Quintile X. The equation to calculate RI is:

$$\mathrm{RI} = \frac{1}{3}\left(\frac{\text{Annual User Rate}}{\mathrm{IQ}_1} + \frac{\text{Annual User Rate}}{\mathrm{IQ}_2} + \frac{\text{Annual User Rate}}{\mathrm{IQ}_3}\right)$$

$$\mathrm{RI} = \frac{\text{Annual User Rate}}{3}\left(\frac{1}{\mathrm{IQ}_1} + \frac{1}{\mathrm{IQ}_2} + \frac{1}{\mathrm{IQ}_3}\right)$$

We can further simplify this by using Y to represent the result of the operations inside the parentheses in the equation above. Therefore,

$$\mathrm{Y} = \left(\frac{1}{\mathrm{IQ}_1} + \frac{1}{\mathrm{IQ}_2} + \frac{1}{\mathrm{IQ}_3}\right), \quad \mathrm{RI} = \left(\frac{\text{Annual User Rate}}{3}\right)\mathrm{Y}$$

To determine the annual user rate, we isolate the "Annual User Rate" variable in the equation:

$$\frac{3\mathrm{RI}}{\mathrm{Y}} = \text{Annual User Rate}$$

We can then calculate the maximum residential rate that would be a medium burden for the community by substituting the RI in the equation with the RI Max value from Table 17, based on that community's FCI score:

$$\frac{3\mathrm{RI}_{\max}}{\mathrm{Y}} = \text{Annual User Rate}$$

Appendix D: Margins of Error in American Community Survey (ACS) Data

Table 18. ACS 2015 - Margins of Error Part 1

Name	Income Quintile 1	Income Quintile 2	Income Quintile 3	Households on SNAP Percentage Points	Households below Poverty Level Percentage Points	Full Time Employment Percentage Points
Adak	#N/A	#N/A	#N/A	10.9	10.5	12.5
Akhiok	#N/A	#N/A	#N/A	31.8	28.5	13
Akiachak	$2,788	$8,657	$15,931	6.7	9.2	5.7
Akiak	$4,098	$9,664	$7,392	8.3	10.2	4.8
Akutan	$3,871	$1,271	$7,074	10	10.2	16.3
Alakanuk	$2,917	$7,230	$4,566	7	7.1	4.1
Aleknagik	$10,624	$4,614	$20,665	10	8.8	9.5
Ambler	$11,498	$5,686	$14,732	11	10.6	11
Anderson	$8,329	$12,014	$10,260	20.6	20.6	8
Angoon	$5,596	$6,675	$10,546	8.5	10.9	23.9
Aniak	$5,844	$15,252	$10,939	5.8	6.7	5.5
Bethel	$6,226	$5,537	$9,897	2.9	3.8	4.3
Brevig Mission	$3,596	$9,122	$5,602	11.8	9.9	7.1
Buckland	$8,227	$10,025	$12,514	7.9	7.5	7.3
Chevak	$4,676	$2,626	$7,868	8.3	6.9	6.8
Chignik	$23,030	$41,118	$39,728	44.4	44.4	18.4
Chignik Lagoon	$23,363	$36,633	$71,584	40.4	40.4	11.4
Chignik Lake	$12,400	$12,280	$6,610	14.2	16.4	11.6
Chuathbaluk	$6,638	$35,203	$8,355	15.9	18.6	12.1
Coffman Cove	$16,659	$12,814	$26,692	13.6	10.3	14.6
Cordova	$22,388	$4,657	$12,849	3.7	1.9	11.1
Craig	$2,131	$5,824	$7,501	3.2	3.1	4.9
Deering	$10,108	$6,111	$6,638	9.2	10.2	11.8
Eek	$3,451	$4,089	$7,945	7.3	8.1	5.5
Egegik	#N/A	#N/A	#N/A	17.8	21.3	22
Ekwok	$9,379	$12,170	$17,234	16.4	17.9	9.5
Elim	$6,651	$5,300	$11,310	12	9.4	12
Emmonak	$2,852	$4,165	$12,652	6	6.5	5.3
Fort Yukon	$6,198	$5,855	$9,770	6.4	6.5	7.1
Gambell	$3,717	$3,839	$10,918	7.1	10.2	20.3
Golovin	$7,814	$6,443	$14,662	15.5	9.8	11.1
Goodnews Bay	$4,831	$10,779	$18,287	11.8	11.8	10
Grayling	$3,915	$8,685	$6,892	14.8	14.7	7.3
Gulkana	#N/A	#N/A	#N/A	36.1	12.6	20.5
Holy Cross	$12,162	$6,882	$12,120	7.9	11.3	8.2
Hoonah	$4,125	$8,512	$4,630	3.9	5.1	5.9
Hooper Bay	$3,632	$11,973	$3,320	6.1	6.8	4.1
Hughes	#N/A	#N/A	#N/A	28	23.3	13.3
Huslia	$6,682	$6,442	$6,937	8	12.4	9.5
Hydaburg	#N/A	#N/A	#N/A	6.1	11.9	9.3
Kake	$5,390	$9,098	$8,968	6.6	8.6	5.3
Kaktovik	$3,239	$14,275	$30,191	9.7	4.5	10.8
Karluk	#N/A	#N/A	#N/A	41.9	42.6	35.1
Kasaan	$20,975	$10,460	$18,358	39.7	16.2	21.8
Kasigluk	$2,495	$8,784	$5,273	8.4	9	4.5
Kiana	$6,669	$11,744	$21,473	9	9.2	6.3
King Cove	$8,528	$5,544	$4,814	4.3	4.8	10
King Salmon	$24,144	$6,587	$12,268	6	5.2	9.1
Klawock	$960	$9,008	$5,888	6.4	5.6	7
Klukwan	$11,090	$17,866	$27,767	9.9	12.6	11.5
Kobuk	#N/A	#N/A	#N/A	29.9	14.8	10.4
Kokhanok	$5,283	$12,310	$8,819	10.4	25	5.5
Koliganek	$3,472	$12,297	$30,654	12.2	16	3.8
Kotlik	$3,329	$13,440	$9,700	8.6	9.7	5.1
Kotzebue	$9,719	$5,388	$8,822	2.4	3.2	3.9
Koyuk	$7,264	$8,333	$6,598	10.4	12.2	7
Kwethluk	$3,982	$4,153	$5,641	6.2	6.9	3.9
Larsen Bay	#N/A	#N/A	#N/A	16.9	10.3	40.4
Lower Kalskag	#N/A	#N/A	#N/A	9.9	13.9	5.3
Manokotak	$2,655	$7,880	$16,470	6.4	7.8	19.2
Marshall	$2,584	$7,276	$7,708	9	14.8	8.3
McGrath	$8,962	$7,500	$15,564	5.6	5.6	6.7

Table 19. ACS 2015 - Margins of Error Part 2

Name	Income Quintile 1	Income Quintile 2	Income Quintile 3	Households on SNAP Percentage Points	Households below Poverty Level Percentage Points	Full Time Employment Percentage Points
Mountain Village	$8,226	$4,193	$4,125	6.3	10.1	4
Nanwalek	$4,096	$7,984	$13,467	15.7	15.1	7.9
Nelson Lagoon	$46,105	$29,869	$37,842	17.9	22.7	18
Nenana	$3,993	$8,332	$18,097	6.6	7.1	6.8
New Stuyahok	$4,954	$16,593	$20,863	7.7	11.3	3.8
Newhalen	$12,623	$12,229	$23,056	11.4	17.5	9.9
Nikolaevsk	#N/A	#N/A	#N/A	13.1	10.8	10.3
Noatak	$3,261	$8,741	$8,514	12.3	12.6	7.2
Nondalton	$4,493	$7,199	$21,448	10.8	13.6	10
Noorvik	$7,036	$7,283	$17,020	8.8	10.8	6.3
Nulato	$2,364	$12,323	$6,644	9.2	9.5	8.1
Nunam Iqua	$12,223	$18,664	$11,861	9.9	15.5	23.3
Old Harbor	$5,692	$9,730	$32,255	12.4	10.1	13.4
Ouzinkie	$11,447	$7,164	$36,467	10.7	14.8	16.7
Pelican	#N/A	#N/A	#N/A	37.3	11.4	22.9
Perryville	$3,987	$8,934	$14,244	23.3	30.3	7.4
Pilot Station	$1,813	$4,245	$8,732	8.1	12	8.3
Pitkas Point	#N/A	#N/A	#N/A	16.5	20.5	6.7
Platinum	#N/A	#N/A	#N/A	28.2	28.2	32.8
Port Graham	$4,774	$8,040	$7,734	11.7	11.4	10.6
Port Lions	$6,864	$11,136	$31,010	9.1	8.2	10.4
Quinhagak	$4,604	$3,633	$8,408	8.2	7.2	3.8
Russian Mission	$14,803	$3,659	$18,215	12.2	13.8	4.9
Sand Point	$2,584	$4,126	$9,194	5	4.8	9.2
Savoonga	$1,445	$11,154	$3,956	6.9	6.9	4.2
Saxman	$5,888	$9,896	$17,707	9.6	12.1	9.9
Scammon Bay	$3,302	$4,837	$7,290	12	8.9	4.6
Selawik	$1,652	$5,496	$7,249	6.5	7.3	5.1
Seldovia	$5,557	$11,445	$10,545	4.6	4.7	13.1
Shaktoolik	$5,745	$5,231	$9,656	12.5	11.1	9
Shungnak	$3,506	$12,801	$11,612	10.7	14.4	8.7
Sleetmute	#N/A	#N/A	#N/A	16.4	18.3	6.7
South Naknek	$5,364	$16,041	$50,824	5.9	14	29.1
St. Mary's	$3,527	$3,997	$11,418	7.8	6.2	5.9
St. Michael	$6,035	$7,780	$4,139	9.8	10.8	8.3
St. Paul	$8,562	$5,822	$13,018	5.3	7.2	7.7
Tanacross	$3,173	$5,203	$10,908	18.9	17.1	9.2
Tanana	$9,582	$5,584	$7,360	6.1	10.2	8.1
Tatitlek	#N/A	#N/A	#N/A	15.6	37.3	15
Thorne Bay	$5,299	$20,533	$18,078	7.3	5.2	7.9
Togiak	$2,188	$5,903	$8,946	6.5	7.8	3.3
Toksook Bay	$6,039	$8,407	$14,920	7.3	9.1	5.4
Twin Hills	$7,661	$9,638	$25,617	13.5	18.7	14.3
Tyonek	$6,518	$12,639	$29,908	15.8	10.9	14.3
Unalakleet	$8,276	$7,103	$7,768	4.7	7.5	10.9
Upper Kalskag	$6,623	$10,085	$7,081	10.4	17.9	8.9
Valdez	$15,699	$22,268	$25,768	5.8	5	8.6
White Mountain	$7,509	$4,584	$22,472	11	15.2	10.8
Yakutat	$6,966	$9,185	$9,213	2.8	4.6	6.3

Table 20. ACS 2016 - Margins of Error Part 1

Name	Income Quintile 1	Income Quintile 2	Income Quintile 3	Households on SNAP Percentage Points	Households below Poverty Level Percentage Points	Full Time Employment Percentage Points
Adak	$11,295	$25,942	$12,977	11.5	6.6	13.8
Akhiok	#N/A	$14,521	$13,046	27.3	27.5	18.4
Akiachak	$2,182	$4,538	$7,320	12.1	10.6	6.8
Akiak	$2,887	$8,452	$9,590	9.1	8.3	6.4
Akutan	$1,824	$969	$12,024	10.5	9.9	19.1
Alakanuk	$7,084	$9,791	$7,574	8.4	9.3	5.6
Aleknagik	$15,300	$4,499	$25,210	10.2	8.2	9.8
Ambler	$5,235	$6,695	$20,265	9.2	9.6	10
Anderson	$7,995	$21,509	$12,816	23.6	23.6	9.1
Angoon	$5,065	$1,490	$12,759	14.6	12.1	22
Aniak	$9,895	$7,001	$7,734	5.4	8.1	7.2
Bethel	$5,999	$7,265	$13,133	3.9	3.6	5.3
Brevig Mission	$3,993	$6,517	$5,828	9.6	9.9	8
Buckland	$6,726	$4,106	$9,332	7	10.7	6
Chevak	$7,137	$4,785	$7,108	6.5	6.2	8.8
Chignik	$18,773	$13,620	$15,811	58.2	16.2	20.4
Chignik Lagoon	$35,718	$33,146	$26,049	7.7	43.5	9.4
Chignik Lake	$6,703	$13,675	$17,452	8.5	15.2	13.5
Chuathbaluk	$4,132	$15,903	$12,240	19.9	22.5	5
Coffman Cove	#N/A	$27,539	$9,305	15.2	9.8	12.2
Cordova	$11,227	$16,242	$27,297	4.6	1.6	7.7
Craig	$3,902	$8,875	$7,645	3.5	3.4	5.4
Deering	$9,850	$5,388	$8,118	8.4	15.2	11.3
Eek	$4,324	$4,346	$7,128	10.7	15.7	6
Egegik	#N/A	$15,355	$28,572	16.2	24	32.1
Ekwok	$10,890	$8,009	$37,764	16.5	18.3	12.8
Elim	$4,955	$5,147	$10,474	6.9	9.7	7.3
Emmonak	$3,441	$5,147	$10,580	6.4	7.1	4.4
Fort Yukon	$4,227	$7,527	$10,869	7.3	7.2	7.3
Gambell	$2,412	$4,579	$6,466	8.8	7.8	23.9
Golovin	$9,240	$3,570	$16,022	12.4	10.7	12.1
Goodnews Bay	$2,982	$13,118	$14,848	10.7	10.8	6.2
Grayling	$2,904	$8,733	$20,466	19.6	13.6	7.2
Gulkana	#N/A	$21,566	#N/A	27.9	27.9	20.9
Holy Cross	#N/A	$6,390	$11,775	11	12.7	8
Hoonah	$3,419	$6,069	$7,340	4.2	5.3	6.4
Hooper Bay	$2,861	$7,012	$5,685	6.6	9.3	5
Hughes	$7,918	$9,002	$27,672	18.4	21.7	12.5
Huslia	$5,885	$5,107	$7,506	5.8	8.9	7.7
Hydaburg	$3,105	$5,349	$7,015	7.4	10.7	10.3
Kake	$3,900	$10,405	$8,197	6.3	6.9	5.8
Kaktovik	$3,940	$19,939	$18,961	5.8	3.9	16
Karluk	#N/A	$13,124	#N/A	35.4	42.9	68.8
Kasaan	$30,173	$15,756	$15,674	36.1	17.8	13.1
Kasigluk	$5,340	$9,319	$9,744	9.1	10.5	4.2
Kiana	$2,995	$17,390	$20,852	9.2	10.4	8.1
King Cove	$8,708	$7,187	$6,109	4	4.5	10.1
King Salmon	$15,076	$15,354	$15,326	5.1	6.2	7.5
Klawock	$2,355	$7,623	$7,431	5.8	4.3	4.7
Klukwan	$3,770	$19,927	$17,842	10.7	14.7	12.1
Kobuk	$16,705	$29,554	$31,361	20	15.6	13.6
Kokhanok	$4,636	$14,548	$9,626	11.8	13.6	4.3
Koliganek	$7,750	$13,550	$18,734	9.2	12.9	12.9
Kotlik	$3,003	$14,661	$9,279	7.9	7.7	6.9
Kotzebue	$6,547	$5,330	$9,363	2.5	3.6	5.3
Koyuk	$6,188	$16,761	$11,536	14.7	18.6	8.4
Kwethluk	$6,182	$5,233	$8,848	6.1	7.4	6.7
Larsen Bay	$13,519	$6,753	#N/A	13.4	47.5	35.4
Lower Kalskag	$2,209	$12,243	$24,527	11.7	10.9	4.2
Manokotak	$2,891	$7,102	$12,307	9.2	10.1	19.2
Marshall	$8,726	$3,284	$20,143	13	13.8	5.8
McGrath	$10,359	$8,690	$6,752	6.5	7.8	7.8
Mountain Village	$5,742	$5,923	$9,688	8	6.8	5.2
Nanwalek	$14,126	$4,850	$12,187	17.3	22.7	12.4
Nelson Lagoon	$7,993	#N/A	$17,196	10.5	14	14.4

Table 21. ACS 2016 - Margins of Error Part 2

Name	Income Quintile 1	Income Quintile 2	Income Quintile 3	Households on SNAP Percentage Points	Households below Poverty Level Percentage Points	Full Time Employment Percentage Points
Nenana	$3,440	$14,916	$15,379	8.2	8.1	7.6
New Stuyahok	$3,371	$5,698	$5,867	9.1	6.4	3.2
Newhalen	$17,608	$10,144	$30,952	15.8	18.6	11.9
Nikolaevsk	$5,747	$11,129	$12,455	13.9	9.4	11.1
Noatak	$3,960	$9,712	$19,186	8.6	9.6	7.8
Nondalton	$2,145	$7,120	$12,142	9.7	13.4	7.4
Noorvik	$5,076	$11,810	$9,721	9.2	8.2	9.2
Nulato	$2,649	$15,204	$11,578	9.8	9.5	9.8
Nunam Iqua	$6,197	$17,621	$22,229	11.3	17.3	26.4
Old Harbor	$3,968	$12,291	$30,437	10.3	7.1	11.1
Ouzinkie	$7,807	$7,056	$39,225	11.4	12	16.8
Pelican	$31,340	$10,087	$27,954	33.7	8.6	16.3
Perryville	$9,540	$10,080	$10,976	14.8	20	4.8
Pilot Station	$3,187	$5,772	$11,913	9.3	8.2	4.3
Pitkas Point	$9,953	$22,865	$13,269	19	17.8	6
Platinum	#N/A	#N/A	$16,429	29.5	29.8	25.1
Port Graham	$8,543	$5,048	$8,313	12.5	10.3	10.2
Port Lions	$7,420	$24,767	$17,646	11.2	6.6	9.6
Quinhagak	$2,740	$4,888	$8,640	9.3	7.2	4.7
Russian Mission	$9,441	$3,889	$22,402	9.8	11	6.5
Sand Point	$3,699	$2,970	$3,565	3	3.2	9.6
Savoonga	$1,660	$6,439	$9,521	7.2	9	4.6
Saxman	$5,454	$11,776	$21,331	8	10.5	9.3
Scammon Bay	$3,003	$5,149	$7,344	9.7	11.1	4.7
Selawik	$11,441	$7,583	$24,871	8.2	7.6	8.2
Seldovia	$3,244	$11,066	$13,358	3.8	4	12.4
Shaktoolik	$12,375	$12,789	$29,711	10.5	11.4	9.2
Shungnak	$4,842	$6,260	$8,261	11.2	12.4	7.9
Sleetmute	#N/A	$4,772	#N/A	19.2	17.6	8.8
South Naknek	$2,887	$9,811	#N/A	8.1	15.3	24.7
St. Mary's	$10,886	$4,232	$8,208	6.9	11.6	7.2
St. Michael	$5,555	$7,630	$9,844	9.7	9.6	8.4
St. Paul	$4,267	$17,343	$6,899	5.5	4.9	6.1
Tanacross	$2,593	$3,962	$31,199	13.6	16.4	15.9
Tanana	$8,059	$5,795	$10,357	7.1	8.5	8.1
Tatitlek	$19,228	$31,971	$39,373	36.7	36.7	21.8
Thorne Bay	$4,842	$13,919	$23,227	5	4.9	7.9
Togiak	$3,038	$6,946	$18,232	7	7.2	4.8
Toksook Bay	$5,294	$10,308	$3,891	6.6	7.5	5.8
Twin Hills	$6,716	$13,555	$18,245	21	18.8	15
Tyonek	#N/A	$15,899	$22,434	11.3	10.2	11.9
Unalakleet	$7,161	$7,351	$9,460	4.7	7	11.9
Upper Kalskag	$9,559	$13,608	$10,760	9.7	10	9
Valdez	$13,532	$12,513	$11,574	6.2	5.6	10.3
White Mountain	$9,693	$7,032	$9,516	9.1	14.6	10.5
Yakutat	$5,907	$7,726	$6,568	4.8	3.6	7.9

Table 22. ACS 2017 - Margins of Error Part 1

Name	Income Quintile 1	Income Quintile 2	Income Quintile 3	Households on SNAP Percentage Points	Households below Poverty Level Percentage Points	Full Time Employment Percentage Points
Adak	$19,365	$40,236	$20,253	21.7	11.1	19.3
Akhiok	$19,069	$14,724	$11,615	21.9	28.3	47.5
Akiachak	$3,747	$6,131	$12,428	7.2	7.7	6.7
Akiak	$5,607	$8,640	$7,629	9.9	9.2	9
Akutan	$3,749	$2,265	$10,691	9.9	10.7	17.8
Alakanuk	$4,069	$7,898	$9,289	7.4	6.1	4.9
Aleknagik	$12,274	$4,048	$34,007	10.1	6.1	10.5
Ambler	$5,457	$9,875	$17,025	8.8	10.5	10
Anderson	$12,663	$13,529	$15,823	4.5	4.5	14
Angoon	$5,075	$6,393	$10,133	11.9	10.5	13.2
Aniak	$4,811	$7,390	$21,698	8.1	7.9	7.1
Bethel	$9,165	$9,638	$7,045	4.1	4.4	5.3
Brevig Mission	$4,174	$6,122	$9,166	9.1	10.5	10.6
Buckland	$5,283	$4,966	$14,137	6.5	10.4	6.4
Chevak	$7,380	$4,589	$6,052	6.7	6	10.5
Chignik	$16,096	$21,085	$24,504	56.2	12.2	25.7
Chignik Lagoon	$77,417	$68,275	$33,677	22	42.7	11.5
Chignik Lake	$10,573	$10,241	$11,351	14.2	19.9	12
Chuathbaluk	$11,382	$17,697	$7,923	15.1	18.5	4.3
Coffman Cove	$11,740	$30,318	$24,564	20.6	7.4	13.7
Cordova	$16,995	$4,921	$7,303	3.1	0.8	8
Craig	$3,247	$6,872	$9,807	3.2	2.7	5.8
Deering	$21,391	$6,706	$11,331	9.5	13.2	11.3
Eek	$8,098	$7,743	$8,271	7.5	8.1	5.1
Egegik	$13,224	$9,903	$29,404	16.9	20	33
Ekwok	$4,174	$5,983	$18,146	15	18.2	8
Elim	$4,590	$5,068	$9,962	7.3	8.3	8.7
Emmonak	$4,607	$2,979	$12,824	6.9	7.2	3.9
Fort Yukon	$3,960	$8,538	$16,296	6.6	11.6	8.2
Gambell	$3,373	$5,282	$6,800	7	11.3	28.6
Golovin	$22,465	$35,373	$23,424	13.3	14.5	11.5
Goodnews Bay	$6,030	$4,011	$20,096	16.2	14.3	7.5
Grayling	$3,820	$9,187	$14,350	17.2	12.5	7.7
Gulkana	$25,403	$33,528	$16,631	47.4	47.4	56.1
Holy Cross	$29,367	$6,963	$13,569	11.7	12.3	10
Hoonah	$5,027	$8,000	$4,671	3.8	5.1	5.4
Hooper Bay	$2,615	$5,031	$8,184	7.2	6.8	6
Hughes	$13,228	$10,266	$9,178	16.7	19.2	16.7
Huslia	$5,748	$4,558	$6,222	8.4	8.4	9.2
Hydaburg	$2,452	$6,170	$7,296	8.5	9	10.5
Kake	$8,160	$15,466	$11,001	6.8	8	9.1
Kaktovik	$6,279	$15,821	$29,223	9.6	5	10.2
Karluk	#N/A	$10,032	$16,376	39.4	27.7	97.3
Kasaan	$20,405	$16,415	$9,621	12.2	14.7	17.3
Kasigluk	$6,510	$10,582	$7,130	14.2	8.6	4.5
Kiana	$3,203	$18,634	$17,005	11.3	14.3	6.8
King Cove	$10,509	$11,141	$5,723	5.8	4.6	7.3
King Salmon	$25,764	$12,322	$17,941	3.5	5.7	6.8
Klawock	$2,183	$7,017	$5,034	6.5	4.2	4.6
Klukwan	$4,394	$27,376	$15,350	9.6	13.6	16
Kobuk	$16,593	$21,223	$30,577	19.1	17.4	14.9
Kokhanok	$12,409	$12,584	$13,085	22	20.1	3.8
Koliganek	$7,148	$21,253	$18,250	8.8	16.3	11.5
Kotlik	$2,438	$8,521	$6,750	7.1	7.9	4.7
Kotzebue	$5,889	$7,097	$15,792	2.7	3.6	4.9
Koyuk	$2,239	$12,561	$11,974	17.9	12.4	9.2
Kwethluk	$3,846	$4,902	$9,278	6	7.7	5.1
Larsen Bay	$12,101	$27,476	$83,543	28.4	20.7	42.2
Lower Kalskag	$1,691	$5,479	$27,206	11	14.4	5.2
Manokotak	$4,546	$6,260	$12,438	6	7.1	16.4
Marshall	$4,051	$2,368	$4,517	9.5	10.7	6.8
McGrath	$10,820	$8,054	$10,085	6.6	8.1	11.1
Mountain Village	$5,584	$5,976	$5,451	11.1	8.1	6.1
Nanwalek	$12,890	$10,029	$12,740	14.7	14.5	9.3
Nelson Lagoon	$28,909	$36,553	$21,003	49.9	15	19.2
Nenana	$3,382	$10,566	$15,502	7.2	7.1	6.5

Table 23. ACS 2017 - Margins of Error Part 2

Name	Income Quintile 1	Income Quintile 2	Income Quintile 3	Households on SNAP Percentage Points	Households below Poverty Level Percentage Points	Full Time Employment Percentage Points
New Stuyahok	$5,968	$13,233	$7,942	8.3	14.3	3.6
Newhalen	$17,616	$11,177	$37,809	12.8	15.2	12.7
Nikolaevsk	$4,787	$18,935	$6,239	11.3	9.8	11.3
Noatak	$2,499	$13,251	$12,254	9.6	10	7
Nondalton	$8,878	$7,483	$48,497	17.7	14.2	12.3
Noorvik	$4,919	$10,276	$11,018	7.1	8.1	10.5
Nulato	$2,628	$16,393	$10,602	10.4	11.3	7.3
Nunam Iqua	$4,637	$9,279	$19,626	17.3	23.6	15.8
Old Harbor	$3,475	$10,503	$34,239	10.1	9.9	11.3
Ouzinkie	$9,275	$12,765	$52,045	11.6	14.5	24.4
Pelican	$19,831	$10,240	$26,534	39.1	39.1	14.4
Perryville	$10,427	$11,458	$5,817	15	17	5.9
Pilot Station	$3,905	$5,049	$11,124	8.3	9.6	4.8
Pitkas Point	$18,018	$25,778	$29,411	30.4	19.2	7.3
Platinum	$29,201	$68,014	$87,726	34.4	33.4	29
Port Graham	$9,708	$7,891	$7,072	13.8	11.3	8.9
Port Lions	$7,046	$10,162	$30,947	9.3	6.1	11.3
Quinhagak	$6,096	$5,541	$10,683	11.2	9.7	6.4
Russian Mission	$2,604	$6,554	$16,483	13.3	12.2	8
Sand Point	$5,236	$3,455	$5,333	4	3.5	6.7
Savoonga	$2,839	$4,813	$5,872	7.4	8.6	5.2
Saxman	$6,406	$4,448	$19,717	9.3	9.7	9.9
Scammon Bay	$3,632	$4,922	$9,869	12.6	9	7
Selawik	$2,261	$6,092	$6,040	7.2	7.5	5.4
Seldovia	$4,525	$12,846	$14,286	4.7	5.4	11.5
Shaktoolik	$6,273	$14,349	$31,796	10.8	11.9	7.5
Shungnak	$4,208	$9,664	$23,693	19.3	21.6	9.9
Sleetmute	$13,455	$12,956	$35,318	32.9	17.4	5.9
South Naknek	$3,111	$10,469	$65,829	13.1	20	16.1
St. Mary's	$12,211	$6,045	$10,718	8.7	7.8	6.1
St. Michael	$7,531	$6,740	$8,777	8.7	9.5	7.2
St. Paul	$5,304	$10,752	$17,593	5.4	5.9	7.6
Tanacross	$4,838	$4,005	$17,916	17.4	18.9	16.1
Tanana	$6,181	$8,464	$7,900	7	8.5	10.8
Tatitlek	$15,630	$52,847	$55,382	44.4	44.4	22.7
Thorne Bay	$2,615	$18,530	$21,746	6	4.9	10.6
Togiak	$4,253	$3,345	$12,293	6.9	9.4	4.4
Toksook Bay	$4,581	$16,332	$7,438	7.8	8.6	4.4
Twin Hills	$10,032	$14,356	$17,817	26.9	23.2	17.3
Tyonek	$11,620	$17,396	$31,812	12.2	11.5	11.4
Unalakleet	$4,692	$9,760	$12,149	5.1	5.5	16.8
Upper Kalskag	$9,317	$14,314	$11,595	10.2	12.4	7.9
Valdez	$23,412	$25,349	$13,704	6.1	1.9	9.2
White Mountain	$15,086	$7,473	$6,836	10.3	11.8	12.3
Yakutat	$8,393	$7,603	$11,922	2.9	4	10.2

Table 24. ACS 2018 - Margins of Error Part 1

Name	Income Quintile 1	Income Quintile 2	Income Quintile 3	Households on SNAP Percentage Points	Households below Poverty Level Percentage Points	Full Time Employment Percentage Points
Adak	16234	26728	29826	12.2	12.4	13.7
Akhiok	9834	28228	30863	22.6	33.9	14.3
Akiachak	3106	4998	10982	8.3	13.4	6.1
Akiak	7248	17197	5992	13	10.6	6.8
Akutan	4027	4541	16453	9.6	5.9	25.1
Alakanuk	3010	5210	12844	8.4	8.5	4.7
Aleknagik	7121	8830	25104	12	9.6	10.5
Ambler	10099	6925	35912	8.9	15.8	25.7
Anderson	15626	20456	16122	3.9	3.9	14.6
Angoon	7188	7212	14715	11.9	9	16.6
Aniak	7266	10013	22724	5.3	9.8	12.7
Bethel	13385	11303	9272	4.1	4.1	5.2
Brevig Mission	4260	6958	18997	16.7	13.5	8.1
Buckland	4785	8521	17548	9.7	9.6	8.1
Chevak	6854	7770	8393	9	8.5	15
Chignik	11194	3988	24682	10	12.5	15.1
Chignik Lagoon	49977	42883	32049	20	45.6	14.2
Chignik Lake	7988	14124	6366	15.6	21	13.6
Chuathbaluk	12037	17574	6436	15.3	14.2	23.9
Coffman Cove	13355	28686	10815	26	5	17
Cordova	20471	16779	18196	4.4	2.5	7.6
Craig	4529	11115	9453	2.9	2.7	5.4
Deering	14267	8058	14396	10.3	14.8	11
Eek	7536	6106	6120	7.2	9	5.4
Egegik	18538	12809	20007	18.6	30.9	33.7
Ekwok	3196	9403	26192	17.8	19.5	13.2
Elim	4708	8641	9493	10.4	9.1	6.6
Emmonak	6409	2596	4401	6.3	7.1	5.1
Fort Yukon	4009	4265	9410	6.9	7.9	8.3
Gambell	3673	6098	8020	7.7	8.4	4.1
Golovin	37388	18460	21547	17.1	13.1	15.8
Goodnews Bay	14735	6830	23195	15.9	14.3	9.7
Grayling	4829	11961	9935	13.3	12.3	8
Gulkana	11911	37463	35835	42.2	42.2	28.5
Holy Cross	7117	4165	9323	12	13	9.7
Hoonah	3916	6363	5476	3.1	5.4	5.4
Hooper Bay	2520	8778	12215	9	9	8.8
Hughes	7014	16357	10844	19.9	17.7	15.6
Huslia	7798	13703	10238	9.1	8.7	7.1
Hydaburg	2939	7214	25106	10	8.3	14.9
Kake	6901	8244	7533	5.1	8	6.6
Kaktovik	7090	17599	28669	9.7	6.7	14.1
Karluk	13221	11900	29819	30.1	35	29.2
Kasaan	8546	27305	21609	14.9	12.6	22.3
Kasigluk	4308	19454	6167	12	9.4	5.1
Kiana	11309	5602	20789	12.5	13.6	10.4
King Cove	8413	8552	8306	5.5	5.2	6.4
King Salmon	14633	12027	26035	3.5	3.2	6.7
Klawock	3178	8629	14992	7	4.6	5.6
Klukwan	6048	31114	9650	11.8	13.3	14.2
Kobuk	30916	24367	23749	16.1	19.2	12.2
Kokhanok	5005	12512	14060	11.7	14.8	4.7
Koliganek	5854	25715	18755	10.1	13.1	15.2
Kotlik	3506	8229	8222	8.9	10.8	4.3
Kotzebue	8097	7896	16530	3.2	4.1	4.3
Koyuk	3590	7939	16260	9.7	13.1	5.2
Kwethluk	8912	9273	10515	9.1	8.8	5.8
Larsen Bay	20188	39494	72194	27.6	21.5	36.6
Lower Kalskag	3090	5031	30217	12.8	14.8	6.5
Manokotak	3191	5244	10512	6.5	6.5	14
Marshall	4987	4820	8001	11.3	9.3	7.4
McGrath	6475	7210	10122	5.8	6.8	8.6
Mountain Village	6632	4296	5137	7.3	6.8	6.4
Nanwalek	7541	22661	8814	14.5	18.3	9.5
Nelson Lagoon	25844	53411	40415	44	11	16.9
Nenana	3348	16001	13888	6.6	9.6	9.4

Table 25. ACS 2018 - Margins of Error Part 2

Name	Income Quintile 1	Income Quintile 2	Income Quintile 3	Households on SNAP Percentage Points	Households below Poverty Level Percentage Points	Full Time Employment Percentage Points
New Stuyahok	3511	4641	4868	11.1	8.9	3
Newhalen	21135	11599	41739	13.8	13.7	18
Nikolaevsk	5158	12315	9581	12.4	9.4	10.6
Noatak	2690	10399	12083	12	10.8	8.2
Nondalton	13835	4163	28761	10.2	14.1	11.8
Noorvik	6491	12392	5896	8.5	9.3	9.8
Nulato	5057	19926	9599	10.4	9.4	10.8
Nunam Iqua	13232	6744	10386	16.9	17.4	10.1
Old Harbor	4777	18527	20203	15.3	10.9	8.8
Ouzinkie	5287	16929	26079	15.7	14.2	12.9
Pelican	12850	23234	51353	10.7	33.6	16.1
Perryville	14744	9882	13168	25.7	22.8	5.5
Pilot Station	4542	6063	9082	11.8	10.7	5
Pitkas Point	13504	21459	20915	15.7	28.3	15.6
Platinum	39860	110394	75875	48.7	41	36.9
Port Graham	10020	6297	15180	10	12.3	8.2
Port Lions	14921	6920	48519	9.5	9	11.1
Quinhagak	2610	6001	8853	6	7.5	7.6
Russian Mission	6850	9993	28287	17.5	19.4	7.9
Sand Point	6594	7125	11126	4.3	3.9	7.6
Savoonga	3982	5306	5557	8.4	7	4.9
Saxman	6263	7022	19008	10.4	12.5	10.8
Scammon Bay	3887	4088	8204	8.8	9.7	4.4
Selawik	2499	9555	15064	8.9	6.8	6.1
Seldovia	3372	13930	15607	4.7	6.1	11
Shaktoolik	3653	9373	17698	12.6	18.9	8.9
Shungnak	10988	16663	34722	12.5	12.8	15.1
Sleetmute	16799	21051	48077	15.2	21.3	5.5
South Naknek	2144	29530	80137	11.6	17.7	13.1
St. Mary's	6600	2745	7811	6.8	9.1	7.2
St. Michael	8829	6625	12045	8.9	10.5	6.6
St. Paul	14340	25259	9867	8.1	7.2	7.1
Tanacross	7379	5178	25704	15.7	17.2	18
Tanana	7124	13694	14473	10.7	9.3	11.4
Tatitlek	33738	42195	22690	52	52	22.9
Thorne Bay	2350	13332	16827	5.6	4.7	11.1
Togiak	3265	4352	15373	8.1	8.2	5.2
Toksook Bay	10326	5282	8485	7.6	8.6	4.8
Twin Hills	19980	10200	13044	19.6	19.2	19
Tyonek	5836	21374	18809	12.7	12.8	10.8
Unalakleet	3064	17110	9287	4.6	5.9	22.6
Upper Kalskag	2748	11260	23487	11.8	11.3	12.1
Valdez	10548	27936	9678	7.3	1.5	10
White Mountain	13468	21776	5667	11.1	9.6	14.3
Yakutat	5179	9727	4582	3	4.3	9.1

Appendix E: Estimating Additional O&M Funding Available with Affordable Rates

A 2016 IHS study of 74 rural Alaska utilities identified $14.8 million in O&M funding gaps. The following methodology was developed to estimate the amount of additional O&M funding that can be obtained from residential customers in these communities while keeping rates affordable by avoiding high-burden rates. The methodology is derived from Appendix C.

In Appendix C, we saw how to calculate the maximum medium-burden residential rate (**Max Medium-burden Rate)**:

1. Max Medium-burden Rate = $3RI_{max}$ /Y

To calculate the maximum revenue for each community that can be obtained from sustainable (low- or medium-burden) rates:

2. Max Revenue from Sustainable Rates = (Number of Residential Customers)*(Max Medium-burden Rate)

To calculate the fraction of O&M funding coming from high-burden rates in 2016, we subtracted Max Medium-burden Rate from high-burden rates for each community and then totaled the results for all high-burden communities:

3. O&M Revenue from High-burden Rates in 2016 = 2016 Revenue – Max Medium-burden Rate

4. Total from High-burden Rates in 2016 = Sum of O&M revenue from High-burden Rates for All Communities

Using the O&M funding gap estimates for each utility from the IHS study, we calculate the revenue needed to adequately fund O&M costs:

5. Needed Revenue = Current Revenue + O&M Funding Gap

If Max Revenue from Sustainable Rates was larger than Needed Revenue, communities could cover their funding gap through affordable customer rates.

If Max Revenue from Sustainable Rates was smaller than Needed Revenue, then more revenue is needed than can be generated from medium-burden utility rates. To estimate the size of the O&M funding gap that cannot be funded from affordable rates, we modified equation two:

6. Funding for Gap from High-burden Rates = Needed Revenue – Max Revenue from Sustainable Rates

Summing the results of equation six for every community whose Max Revenue was lower than its Needed Revenue, we derived the amount of the O&M funding gap that cannot be funded from affordable rates.