Draft White Paper Discussion on Proposed Calculation Recommendations and Thresholds for New Affordability Indicators

November 2022

Table of Contents

I.   Summary

The State Water Resources Control Board (State Water Board) and the Office of Environmental Health Hazard Assessment (OEHHA) are conducting three public workshops on proposed enhancements to the affordability indicators for the 2023 Drinking Water Needs Assessment[1] (Needs Assessment) and for future Needs Assessments. Workshop 1 was held on August 11, 2022, and Workshop 2 was held on September 20, 2022. Workshop 3 is being held on November 1, 2022. Previous Workshop materials can be found on the SAFER Needs Assessment page.[2] The goals of this white paper, which complements Workshop 3, is to:

1) Discuss proposed calculation options for a new affordability indicator that incorporates Housing Burdened Low-Income Households (Housing Burden) and Poverty Prevalence Indicator (PPI).

2) Discuss proposed thresholds and scoring options for the new affordability indicator.

3) Explore options for conducting the Affordability Assessment.

II.   Introduction

The annual Drinking Water Needs Assessment is an analysis conducted by the State Water Board to help inform the implementation of the Safe and Affordable Funding for Equity and Resilience (SAFER) Program. The State Water Board has developed methodologies and indicators to identify At-Risk community water systems (CWSs), K-12 schools, state small water systems (SSWSs) and domestic well (DW) users. The State Water Board's Needs Assessment consists of three core components: the Risk Assessment, Cost Assessment, and Affordability Assessment.

The Needs Assessment is used by the State Water Board and the SAFER Advisory Group[3] to inform prioritization of public water systems, SSWSs, and DWs for funding in

---

[1] 2022 Needs Assessment.
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2022needsassessment.pdf

[2] https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/needs.html

[3] SAFER Advisory Group. https://www.waterboards.ca.gov/safer/advisory_group.html

the SAFER Expenditure Plan[4]; inform direction for State Water Board technical assistance; and to develop strategies for implementing interim and long-term solutions. Although they are included in the Needs Assessment, the State Water Board does not have regulatory authority over SSWSs or DWs. Counties are responsible for permitting and inspections of SSWSs and DWs, and Counties may provide resources to support communities served by them.

The Needs Assessment utilizes measures of drinking water affordability in both the Affordability Assessment and the Risk Assessment. The purpose of the Affordability Assessment is to identify communities that may struggle to pay for drinking water. The Affordability Assessment is conducted for all community water systems. The Risk Assessment uses the affordability indicators, in conjunction with water quality, accessibility, and TMF (technical, managerial, and financial) capacity indicators, to identify small and medium-sized community water systems and K-12 schools that are at risk of failing.

The State Water Board has partnered with the OEHHA to explore previously identified metrics and new metrics and approaches for measuring affordability. The current affordability workshops and discussion on appropriate affordability metrics will help inform future data to be required to be submitted to the State Water Board by community water systems (such as arrearage and/or shut-off data).

III.   Why Measuring Drinking Water Affordability Matters

While there are many existing or emerging programs and efforts to mitigate drinking water affordability challenges, it is important to step back and examine why measuring drinking water affordability is important. Affordability is difficult to measure and discuss. Different terms and metrics have been used to describe affordability in the water sector for decades, and they have been used to influence important decisions. For instance, affordability metrics are used to determine which communities or water systems are eligible for state and federal assistance. Water systems meeting certain affordability thresholds qualify for more grant vs. loan funding for infrastructure projects. These systems and communities are frequently prioritized for state and federal technical assistance as well.

Affordability metrics are often used by water systems when exploring possible rate changes. Systems serving communities with affordability challenges often struggle to raise their rates, thus affecting their long-term financial capacity. Customers unable to

---

[4] SAFER Fund Expenditure Plan.
https://www.waterboards.ca.gov/water_issues/programs/grants_loans/sustainable_water_solutions/safer.html

pay their water bill or unable to maintain their domestic well may then experience challenges in accessing a reliable source of safe drinking water (See Figure 1 below).

Figure 1: Why Measuring Affordability Matters

State & Federal Gov.	Water Systems	Customers
• Funding eligibilities: Grant vs. Loan • Prioritization for & access to technical assistance • Fee waivers	• Impacts rate-setting decisions • Financial capacity of system • Ability to pay for current and future needs	• Quality of life – percent of income spent on drinking water • Access to safe drinking water
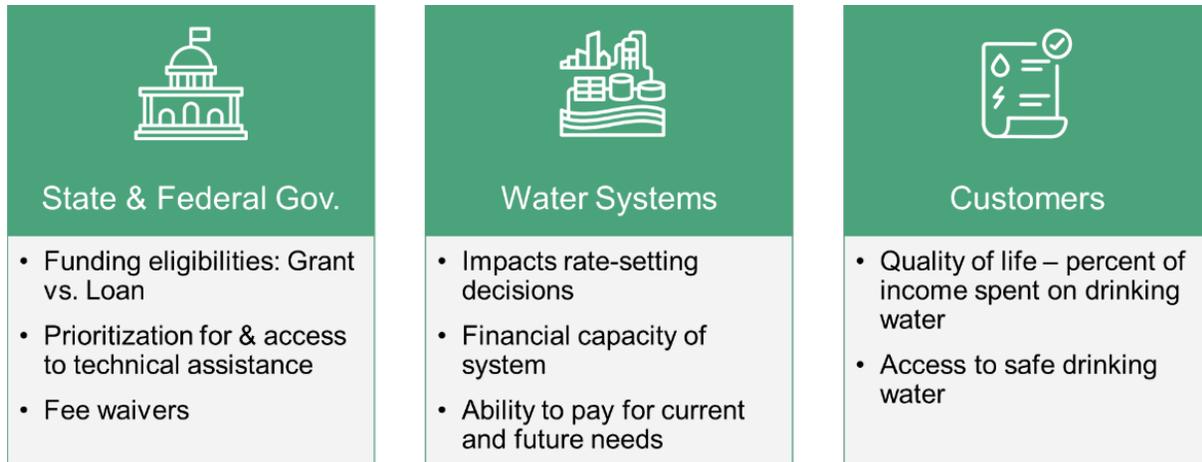
To better navigate the different metrics and approaches used to measure affordability, the State Water Board developed Figure 2 to illustrate the nexus of affordability definitions that exist.

Figure 2: Nexus of Affordability Definitions

Affordability indicators can be categorized into the following three categories which describe affordability burden at the household level, at the community level and for the water system to financially be able to sustain itself and meet safe drinking water standards.

   (1) Household Affordability: The ability of individual households to pay for an adequate supply of water.

(2) **Community Affordability**: The ability of households collectively within a community to pay for water services to financially support a resilient water system.

(3) & (4) **Water System Financial Capacity:** The ability of the water system to financially meet current and future operations and infrastructure needs to deliver safe drinking water. The financial capacity of water systems affects future rate impacts on households.

When exploring potential affordability indicators, it is important to distinguish between indicators that rely on the "price" of water services (rate-based indicators) and those that do not (non-rate-based indicators). California has 691 or 24.1% CWSs that do not charge their customers directly for drinking water services (e.g., mobile home parks that imbed water charges into their rent). Furthermore, SSWSs and DWs also do not charge customers directly for water, but affordability challenges affect the ability of these communities to effectively maintain their systems.

(1) **Rate-Based Affordability Indicators:** rate-based indicators include cost information (water bills for CWSs) in their calculation.

(2) **Non-Rate-Based Affordability Indicators:** non-rate-based indicators are any indicator of affordability that does not use cost information.

IV.   History of Measuring Affordability in the SAFER Needs Assessment

Senate Bill 200 requires that the State Water Board:

STEP 1: Identify DAC water systems that have instituted customer charges.

STEP 2: Of these DAC water systems, the State Water Board must identify those that exceed an "Affordability Threshold" in order to provide drinking water that meets State and Federal standards (Health and Safety Code Section 116769(a)(2)(B)).

In Step 1 of this process, DAC and SDAC communities are currently identified using U.S. Census (Census) MHI data within a system's service area. Currently, a water system is a DAC if the average MHI of the water system service area is below 80% of the statewide MHI and it is considered to be an SDAC if the average MHI is below 60% of the statewide MHI.

Figure 3. Steps for the Affordability Assessment as defined by Senate Bill 200
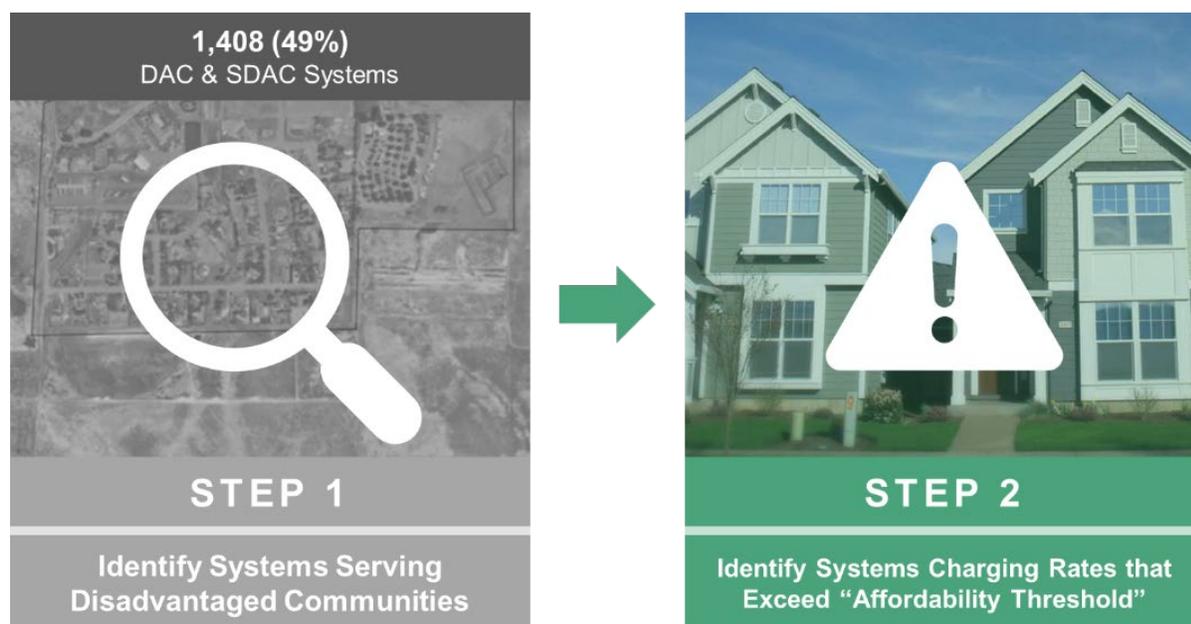
In 2020, for Step 2, the State Water Board conducted an Affordability Assessment for community water systems for the FY 2020-21 Safe and Affordable Drinking Water Fund Expenditure Plan[5]. That analysis relied on one affordability indicator, water charges as a percent of median household income, referred to as %MHI. From April through October 2020, the State Water Board conducted extensive research and public engagement to identify other potential affordability indicators that could be used to identify DAC[6] and SDAC[7] that may be experiencing affordability challenges.[8] This effort identified 23

---

[5] The Fund Expenditure Plan used an affordability threshold of 1.5% MHI to identify DAC water systems that may have customer charges that are unaffordable: FY 2020-21 Fund Expenditure Plan https://www.waterboards.ca.gov/water_issues/programs/grants_loans/sustainable_water_solutions/docs/ sadwfep _2020_07_07.pdf

[6] Disadvantaged Community or DAC mean the entire service area of a community water system, or a community therein, in which the median household income is less than 80 percent of the statewide annual median household income level.

[7] Severely Disadvantaged Community or SDAC means the entire service area of a community water system in which the median household income is less than sixty percent of the statewide median household income.

[8] The identification of additional affordability indicators was undertaken in conjunction with the identification of possible affordability risk indicators for the Risk Assessment. A full list of potential affordability indicators considered can be found in the white paper Evaluation of Potential Indicators &

potential affordability indicators (white paper, Table 10).[9] Due to limitations in data availability, the State Water Board selected two additional affordability indicators from the list of 23 to incorporate into the 2021 Risk Assessment and 2021 Affordability Assessment. These two indicators were: "Extreme Water Bill" and "% Shut-offs."

In 2020, Governor Newsom issued an Executive Order that prohibited water shut-offs beginning March 4, 2020, through December 31, 2021, in response to the COVID-19 pandemic.[10] Therefore, data for '% Shut-offs' was unavailable for the majority of 2020 and all of 2021. Thus, the State Water Board removed this affordability indicator from the 2022 Needs Assessment and will not be able to include it in the 2023 Needs Assessment.

In 2022, the State Water Board replaced "% Shut-offs" with two new affordability indicators: "Percentage of Residential Arrearages" and "Residential Arrearage[11] Burden." These risk indicators were meant to identify water systems in communities that are experiencing household affordability challenges and are a direct measure of household drinking water affordability. Data for these two indicators came from a one-time customer assistance payment program conducted in the fall of 2021. The history of affordability indicators used in the Needs Assessment is shown in Table 1.

---

[9] White Paper: Evaluation of Potential Indicators and Recommendations for Risk Assessment 2.0 for Public Water Systems. 2020.
https://www.waterboards.ca.gov/safer/docs/e_p_i_recommendations_risk_assessment_2_public_water_systems.pdf

[10] Governor Newsom Executive Order. https://www.gov.ca.gov/2020/04/02/governor-newsom-issues-executive-order-protecting-homes-smallbusinesses-from-water-shutoffs/

[11] Arrearage means debt accrued by a water system's customers for failure to pay their water service bill(s) that are at least 60 days or more past due.

Table 1: CWS Affordability Indicators 2020-2022[12]

Indicator	2020	2021	2022
Percent of Median Household Income (%MHI)	X	X	X
Extreme Water Bill		X	X
% Shut-Offs		X	
Percentage of Residential Arrearages			X
Residential Arrearage Burden			X

V. Summary of Affordability Assessment Recommendations from Workshop 2

During Workshop 2, the State Water Board and OEHHA sought stakeholder feedback on the following proposed changes to affordability indicators in the Needs Assessment for 2023 and beyond. These recommendations are being refined as the State Water Board and OEHHA review stakeholder feedback:

Determining Disadvantaged Community (DAC) Status (Step 1)

The current threshold for DAC determination is the statewide MHI. A water system is considered a DAC if its average MHI less than 80% of the statewide MHI and is considered a SDAC if it is less than 60% of the statewide MHI, as determined by Census data. Currently, 80% of the statewide MHI is $62,938[13] and 60% is $47,203. Going forward, the State Water Board and OEHHA recommend that both county and state income thresholds be used to determine DAC and SDAC status for water systems. A water system would be considered a DAC or SDAC if they are either below the county low-income threshold for a family of four[14] (from the Department of Housing and

---

[12] Table 11 Source: 2022 State Water Resources Control Board Drinking Water Risk Assessment for Public Water Systems.
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2022needsassessment.pdf

[13] The most recent MHI from the Census is for 2020 and is $78,672.
https://www.census.gov/quickfacts/fact/table/CA/INC110220#INC110220

[14] Housing and Community Development Income Limits. https://www.hcd.ca.gov/state-and-federal-income

Community Development (HCD)) or if the system is below statewide low-income threshold (80% of statewide median income, as determined by the Census).

Conducting Affordability Assessment for Public Water Systems (Step 2)

For the 2023 Needs Assessment the State Water Board and OEHHA recommend the following:

- Add two new indicators of socio-economic burden: Housing Burden and Poverty. This allows for the inclusion of water systems that do not charge customers directly for water in the assessment.

- Continue to use the rate-based indicators of Water Bill Percent of Median Household Income (%MHI) and Extreme Water Bill.

For future assessments, the State Water Board and OEHHA recommends:

- Begin collecting residential arrearage and shut-off data in the State Water Board's Electronic Annual Report (EAR) survey to enable the incorporation of Percentage of Residential Arrearages, Residential Arrearage Burden, and shut-off metrics into future iterations of the Needs Assessment. The history and future direction of affordability indicators in the Needs Assessment is shown in Table 2.

Table 2 Affordability Indicators in the Needs Assessment over Time

Indicator	Definition	2020	2021	2022	2023	Future
Percent of Median Household Income (%MHI)	Annual system-wide average residential water bill for six hundred cubic feet (HCF) per month relative to the annual MHI within a water system's service area.	X	X	X	X	X
Extreme Water Bill	Drinking water customer charges that meet or exceed 150% of statewide average drinking water customer charges at the six HCF level of consumption.		X	X	X	X
% Shut-Offs	Identifies water systems that have residential customers struggling to pay their water bills due to affordability challenges.		X			X

Indicator	Definition	2020	2021	2022	2023	Future
Percentage of Residential Arrearages	Identifies water systems that have high percentage of their residential customers that have not paid their water bill and are at least 60 days or more past due. The higher the percentage of residential customers, the more vulnerable the community is to affordability challenges.			X		X
Residential Arrearage Burden	Identifies water systems that would have a high residential arrearage burden if they were to distribute their residential arrearages accrued during the COVID-19 pandemic period (March 4, 2020 through June 15, 2021) across their total residential rate base. This indicator measures how large of a burden non-payment is across the water system's residential customers.			X		X
Household Socioeconomic Burden (Combined PPI and Housing Burden)	This indicator is a combination of PPI and Housing Burden components. The PPI measures the percent of the population living below two times the federal poverty level and can be represented reliably at the census block group level and higher. The Housing Burden Indicator measures the percent of households in a census tract that are both low income (making less than 80% of the HUD Area				X	X

Indicator	Definition	2020	2021	2022	2023	Future
	Median Family Income) and severely burdened by housing costs (paying greater than 50% of their income to housing costs).					

VI.   Summary of Feedback Received from Workshop 2

The State Water Board and OEHHA held a virtual workshop to discuss proposed recommendations to the DAC determination and affordability assessment indicators on September 20, 2022. Attendees included representatives from water agencies, non-profit groups, utility organizations, as well as non-affiliated individuals. During the meeting, input on proposed changes to DAC determination methodology and affordability indicators was solicited.

In general, commenters expressed support for accounting for regional variations in incomes and housing costs when identifying DACs. One commenter asked if there was a potential to exclude areas or systems where a large percentage of homes are second homes, because these areas are less likely to experience affordability challenges.

The State Water Board also received one comment letter jointly sent from the Association of California Water Agencies (ACWA) and the California Municipal Utilities Association (CMUA). Additional information on the public feedback received at workshop 2 and a summary of the comment letter can be found in Appendix A.

VII. Method for Calculating the New Affordability Indicator: Household Socioeconomic Burden

Creating a Combined Indicator Using Poverty and Housing Burden

PPI measures the percent of the population living below two times the federal poverty level and can be represented reliably at the census block group, tract, and county level. The Housing Burden Indicator measures the percent of households in a census tract that are both low income (making less than 80% of the Housing and Urban Development (HUD) Area Median Family Income) and severely burdened by housing costs (paying greater than 50% of their income to housing costs). PPI accounts for poorer, low-income communities while Housing Burden accounts for both low-income communities and factors in their housing and utility cost burden. The combination of these two variables creates a more comprehensive picture of socioeconomic vulnerability while accounting for the varying levels of income and cost burdens throughout California.

The State Water Board and OEHHA explored various methodologies to include PPI and Housing Burden in the set of affordability indicators for PWSs. In Workshop 2, the State Water Board and OEHHA recommend combining Housing Burden and PPI, into a combined indicator called "Household Socioeconomic Burden". This combined indicator will be analyzed in conjunction with two previously used rate-based indicators (%MHI and Extreme Water Bill) as shown in Table 2 above. Here, we refer to the individual PPI and Housing Burden indicators as the components of the "Household Socioeconomic Burden" indicator. Two methods were explored to combine the two components—a relative ranking approach and a matrix approach, which are described in more detail below.

Figure 4. PPI and Housing Burden components combined make up the Household Socioeconomic Burden affordability indicator at the water system level.
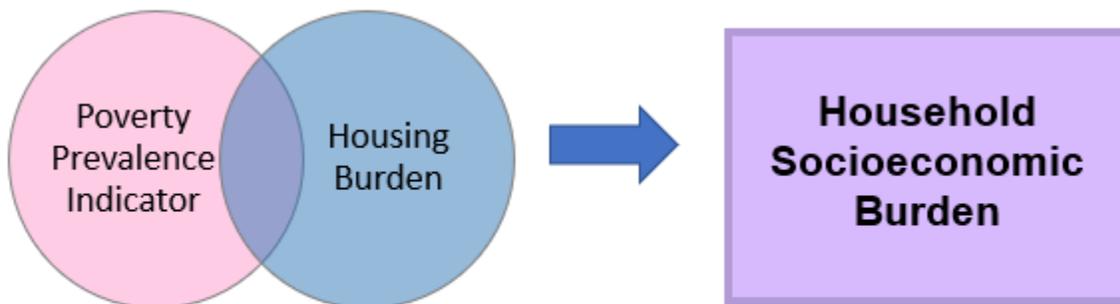
Individual Component Calculation Method

PPI: From the 2015-2019 American Community Survey[15], a dataset containing the number of individuals above 200 percent of the federal poverty level (FPL) was downloaded by block groups for the state of California (23,212 in the state). The number of individuals below 200 percent of the FPL was calculated by subtracting the reported estimate of individuals in poverty (2x FPL) by the total estimate. The number of individuals below 200% of the poverty level was divided by the total population for whom poverty status was determined.

Housing Burden: From the 2014-2018 U.S. Department of Housing and Urban Development (HUD) Comprehensive Housing Affordability Strategy (CHAS)[16], a dataset containing cost burdens for households by HUD-adjusted median family income (HAMFI) category was downloaded by census tract for the state of California (8,057 in the state). CHAS— a special analysis of census data specific to housing— is only available at the census tract and other larger geographies. For each census tract, the data were analyzed to estimate the number of households with household incomes less than 80% of the county median and renter or homeowner costs that exceed 50% of household income. The percentage of the total households in each tract that are both low-income and housing-burdened was then calculated. Each census tract was associated with the block groups within it to maintain consistency with the PPI indicator, which is at the block group level.

The ACS and CHAS estimates come from a sample of the population and suppression criteria were applied to remove estimates considered statistically unreliable. The suppression criteria applied to both components can be found in Appendix B.

PPI and Housing Burden at the block group level were area-weighted to CWS boundaries. These boundaries were downloaded from the System Area Boundary Layer (SABL)[17]. Using the Intersect Tool in ArcPro, the area was determined for each portion of a water system boundary that intersected with a block group boundary. A weighted average, using area as the weight, was calculated for both PPI and Housing Burden for all water systems in the assessment.

---

[15] https://data.census.gov/cedsci/

[16] HUD CHAS Data. https://www.huduser.gov/portal/datasets/cp.html

[17] California Drinking Water System Boundaries.
https://gispublic.waterboards.ca.gov/portal/home/item.html?id=fbba842bf134497c9d611ad506ec48cc

Options for Creating a Combined Indicator

Relative Ranking Approach

In a relative ranking approach, PPI and Housing Burden indicators are individually ranked from lowest to highest and assigned percentile scores. These percentile scores are averaged together and then re-ranked into a combined percentile score. Using this approach, a threshold to identify at risk systems would need to be selected, such as the top 25% of systems. This methodology allows water systems that rank high in one or the other component to rank high overall as shown in area "B" in Figure 5. For example, if a water system had a high PPI percentile score, but Housing Burden had a medium percentile score, the overall score could still be high enough to be identified as passing the threshold. However, while this method is used in other programs such as in identifying Disadvantaged Communities for climate investments using the top 25% of CalEnviroScreen scoring census tracts,[18] it is a comparison methodology which does not use absolute thresholds and an additional threshold to identify systems "at-risk" of failing would still need to be identified.

Matrix Approach

A matrix approach assigns a score to vulnerability bins (a low score, a medium score, a high score) of PPI and Housing Burden data. Rather than comparing systems to other systems, this approach uses thresholds to categorize the individual component data into the bins. This methodology will tend to identify water systems that score high in both components over those that score high in one component and have a medium score in another component, which may be more relevant in identifying at-risk water systems. Additionally, the matrix approach proposed here was modelled off the methodology used in the 2022 Needs Assessment for SSWSs and DWs[19].

Figure 5 shows an example of Housing Burden and PPI results and comparing potential high scores when using the matrix approach versus a relative ranking approach. Any system above the red diagonal line would get a high score using a relative ranking methodology and any system within the blue square lines would get a high score using a matrix approach. Systems in the area marked with an "A" would only score high using the matrix methodology and systems in the area marked with a "B" would only score high using the relative ranking approach.

[18] California Climate Investments to Benefit Disadvantaged Communities.
https://calepa.ca.gov/envjustice/ghginvest/

[19] 2022 Drinking Water Needs Assessment.
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2022needsassessment.pdf

Figure 5. A scatterplot of Percent Housing Burden and Percent PPI indicators for water systems in California.
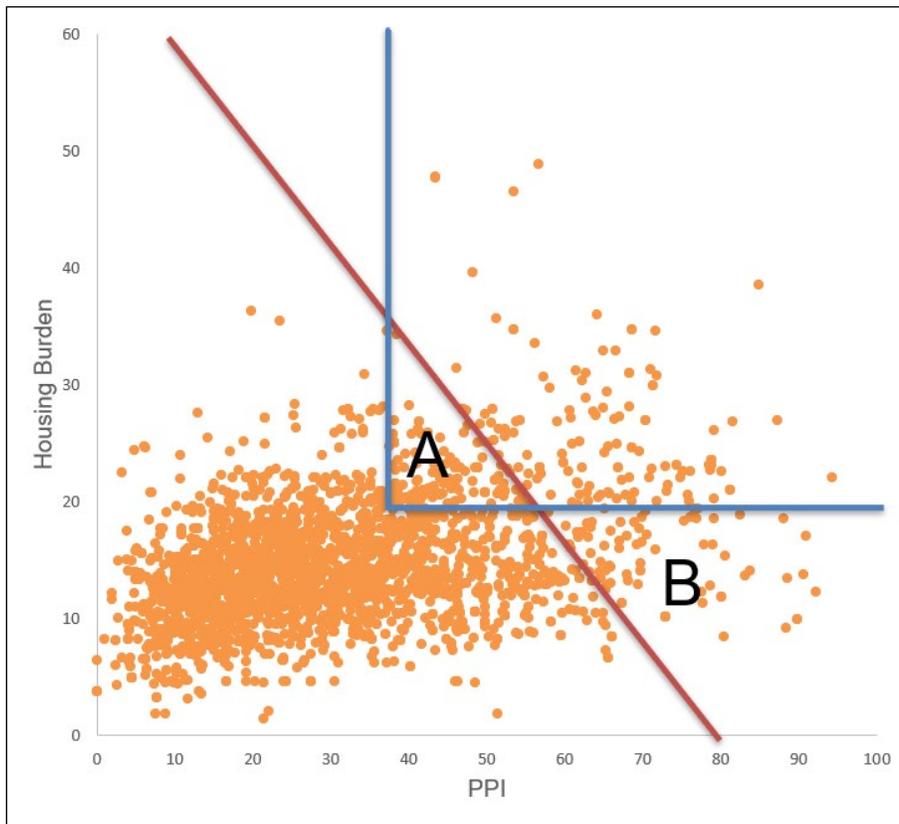
As depicted in Figure 5, the relative ranking method would use the red line as a cutoff point (threshold) and those systems in A would not pass the threshold. In a matrix approach, the blue square line would be the threshold and systems in B would not pass the threshold

The matrix methodology allows for more consistency across versions of the Needs Assessment, since it can utilize recommended thresholds rather than assigning a certain percentage of systems as "vulnerable." Since there are established thresholds for PPI, the State Water Board and OEHHA recommend using this method to combine PPI and Housing Burden. As described earlier, this method would allow systems that score high (worse) in both PPI and Housing Burden to be seen as most vulnerable. The combined indicator will be included alongside **%MHI** and **Extreme Water Bill** in the affordability indicators for the 2023 Needs Assessment.

VIII. Recommend Affordability Indicator Thresholds

Current Affordability Indicator Thresholds

To develop current thresholds for the affordability indicators **%MHI** and **Extreme Water Bill**, in 2020 the State Water Board reviewed multiple available types of evidence, looking both within California, across other state agencies nation-wide, and at the U.S. EPA's standards. Where possible, tiered thresholds were determined to capture more nuanced degrees of risk within indicators. The State Water Board does not propose modifying the current thresholds for %MHI and Extreme Water Bill.

Table 3: Current Affordability Indicator Thresholds

Affordability Indicator	Thresholds	Risk Level = Affordability Burden
Percent of Median Household Income (%MHI)	**Threshold 0 = Less than 1.49%**	None
	Threshold 1 = 1.5% - 2.49%	Medium
	Threshold 2 = 2.5% or greater	High

Extreme Water Bill	**Threshold 0 = Below 149.99%** of the statewide average.	None
	Threshold 1 = 150% - 199.99% of the statewide average.	Medium
	Threshold 2 = 200% or greater of the statewide average.	High

Recommended PPI and Housing Burden Component Thresholds

Options for possible thresholds for PPI and Household Burden components were researched to develop the following recommendations.

PPI Component Thresholds: For PPI, various thresholds have been explored by other organizations and researchers including the use of 30%[20] or multiple categories such as less than 10%, 10% to 30%, 30% to 50%, and greater than 50%[21]. However, the most widely used PPI thresholds by organizations and researchers was first suggested by

---

[20] https://internetofwater.org/wp-content/uploads/2021/12/Blog010_WaterAffordability_Patterson.pdf

[21] https://www.cityofsantacruz.com/home/showpublisheddocument/83950/637553072866376248

Raucher et al. in a report prepared for the American Water Works[22,23,24,25]. In the Raucher et al. report entitled 'Developing a New Framework for Household Affordability and Financial Capability Assessment in the Water Sector,' the following PPI thresholds are recommended: low risk less than 20%, medium risk between 20% to 35%, and high risk greater than 35%. The State Water Board and OEHHA evaluated these thresholds as it relates to California data and propose to use these thresholds for the PPI component of the Household Socioeconomic Burden indicator.

Table 4. Recommended PPI Component Thresholds

Component	Thresholds	Risk Level = Affordability Burden
PPI	Threshold N/A = Missing or not reliable PPI data	Unknown
	Threshold 0 = < 20% Indicates relatively low amounts of poverty	Low
	Threshold 1 = 20% ≥ n < 35% Indicates moderate amounts of poverty	Medium
	Threshold 2 = ≥ 35% Indicates high amounts of poverty	High

Housing Burden Component Thresholds: Consistent thresholds for Housing Burden have not yet been established, to our knowledge, by other organizations or identified in the scientific literature. A report by the University of North Carolina on housing conditions in North Carolina identified census tracts in the top 20% of state as severely burdened[26]. Additionally, a recently published Master's Thesis about housing

---

22

https://www.awwa.org/Portals/0/AWWA/ETS/Resources/DevelopingNewFrameworkForAffordability.pdf?ver=2020-02-03-090519-813

23 https://awwa.onlinelibrary.wiley.com/doi/full/10.1002/aws2.1260

24

https://www.allianceforwaterefficiency.org/sites/www.allianceforwaterefficiency.org/files/highlight_documents/AWE_Water_Affordability_Detroit_Final_2020_0.pdf

25 https://nicholasinstitute.duke.edu/water-affordability/affordability/Affordability_Preprint.pdf

26 https://curs.unc.edu/wp-content/uploads/sites/400/2017/02/Extreme-Housing-Conditions-in-North-Carolina.pdf

challenges in California identified census tracts in the top quartile of the state as being the "most impacted.[27]" Lastly, one study showed that 16% of children in Los Angeles County live in severe housing-cost burdened households, but this was based on survey data.[28] Given the lack of peer-reviewed literature, consistency and relevance among these limited examples, the census tracts were grouped into three categories (or tertiles), based on the overall distribution of housing burden in the state to identify three levels of risk.

Based on this statewide data, low risk corresponds with fewer than 10.86% of total households experiencing housing burden as defined above. Medium risk is between 10.86% and 14.71%, and high risk is greater than 14.71%, respectively. Using a matrix scoring approach, first each bin was assigned a score of 0 for "low vulnerability," 0.25 for "medium vulnerability" and 1 for "high vulnerability." Based on selected thresholds for PPI or Housing Burden, each bin gets assigned these scores (see Table 4 and 5). See the map showing the results of PPI (Figure 6) and the map showing results of Housing Burden (Figure 7), both categorized by low, medium, and high vulnerability.

Table 5. Recommended Housing Burden Component Thresholds[29]

Component	Thresholds	Risk Level = Affordability Burden
Housing Burden	Threshold N/A = Missing or not reliable Housing Burden data	Unknown
	Threshold 0 = < 10.86% Indicates relatively low amounts of housing burden	Low
	Threshold 1 = 10.86% ≥ n < 14.71% Indicates relatively moderate amounts of housing burden	Medium
	Threshold 2 = ≥ 14.72% Indicates relatively high amounts of housing burden	High

---

[27] https://spatial.usc.edu/wp-content/uploads/formidable/12/Lucresia-Graham-thesis-compressed.pdf

[28] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6305808/

[29] https://www.awwa.org/Portals/0/AWWA/ETS/Resources/DevelopingNewFrameworkForAffordability.pdf?ver=2020-02-03-090519-813

Figure 6. Map of PPI for water system boundaries, the percent of the population below two times the FPL, categorized by low, medium, and high vulnerability.[30]

---
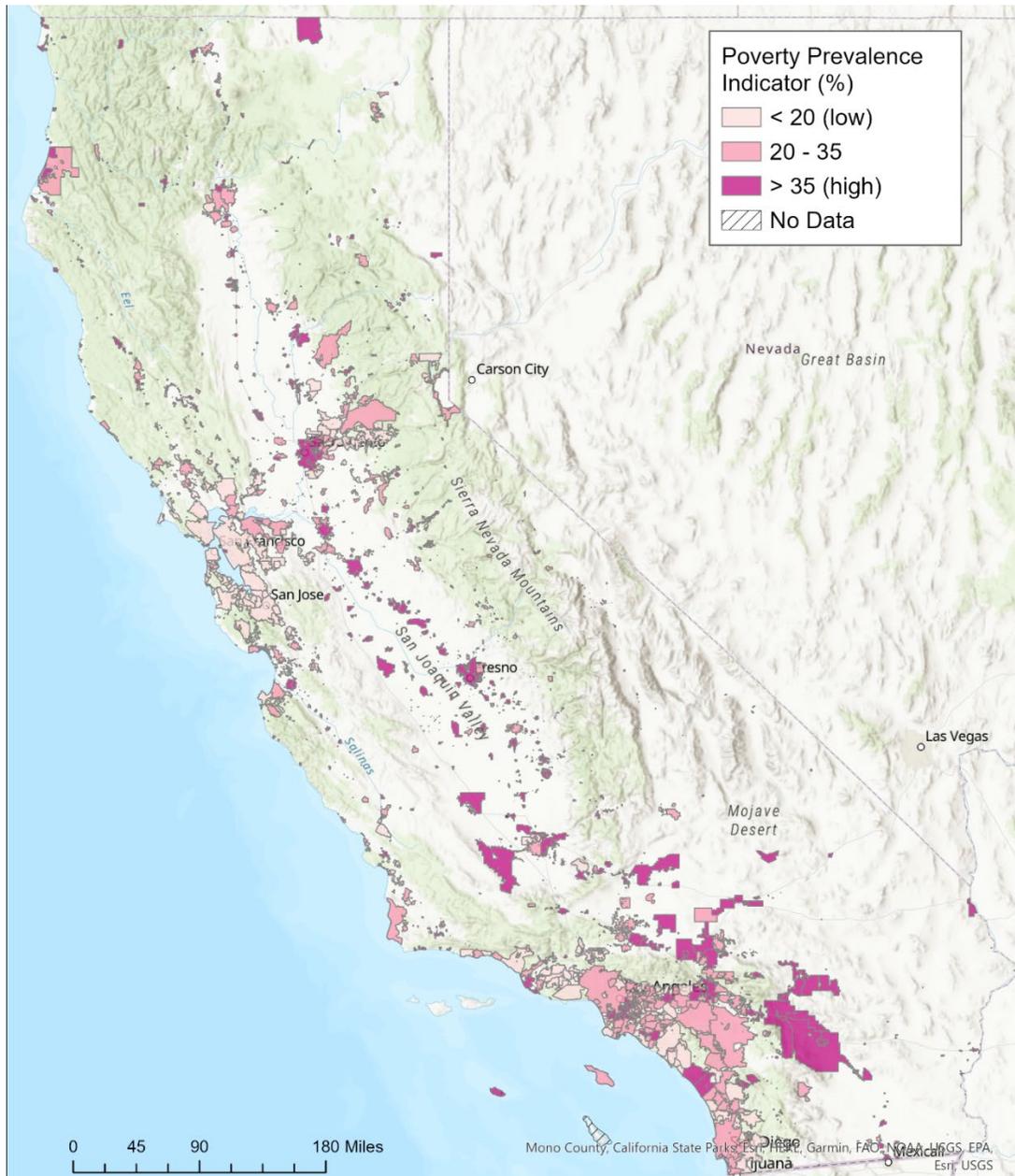
[30] Based on preliminary analysis of census data, there are 12 water systems where there is not enough or accurate census boundaries or low population where there was not a poverty score for that service area.

Figure 7. Map of Housing Burden for water system boundaries, the percentage of the total households that are both low-income and housing-burdened, categorized by low, medium, and high vulnerability.[31]
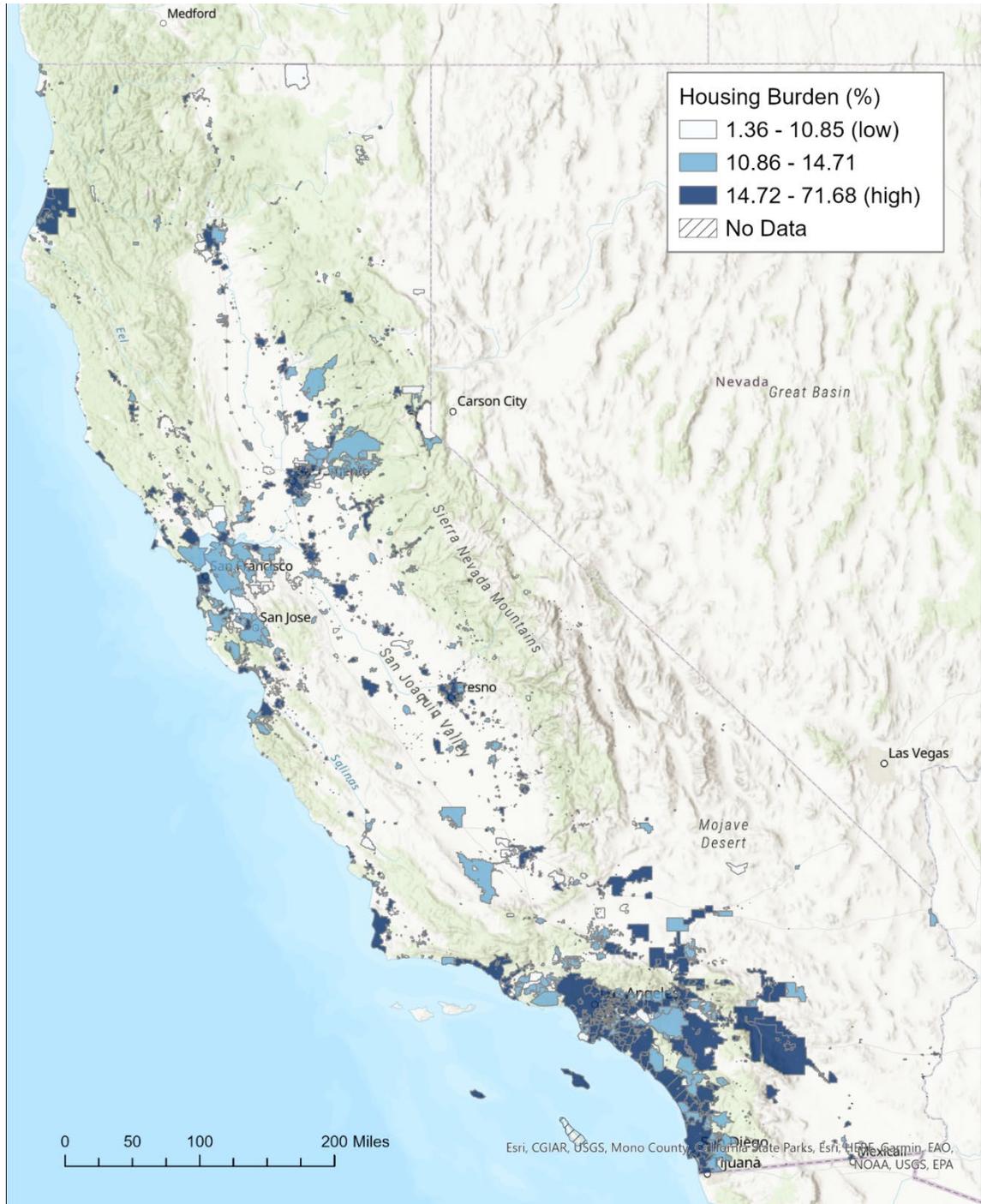
Household Socioeconomic Burden Indicator Threshold Matrix

Combining PPI and Housing Burden using the designated thresholds for each component in a matrix methodology, results in bins of high-high, high-med, high-low, etc., depending on how each system performs for each component. See Figure 8 for the breakdown of categories resulting from combining PPI and Housing Burden components.

Figure 8. Household Socioeconomic Burden with Component Thresholds

IX. Recommended Household Socioeconomic Burden Threshold Scoring

To incorporate the new affordability indicator into the Risk Assessment the proposed thresholds discussed above must be associated with normalized scores and assigned an indicator weight.

---

[31] Based on preliminary analysis of census data, there are 53 water systems where there is not enough or accurate census boundaries or low population where there was not a housing burden score for that service area.

Figure 9: Aggregated Risk Assessment Methodology with Category Weights
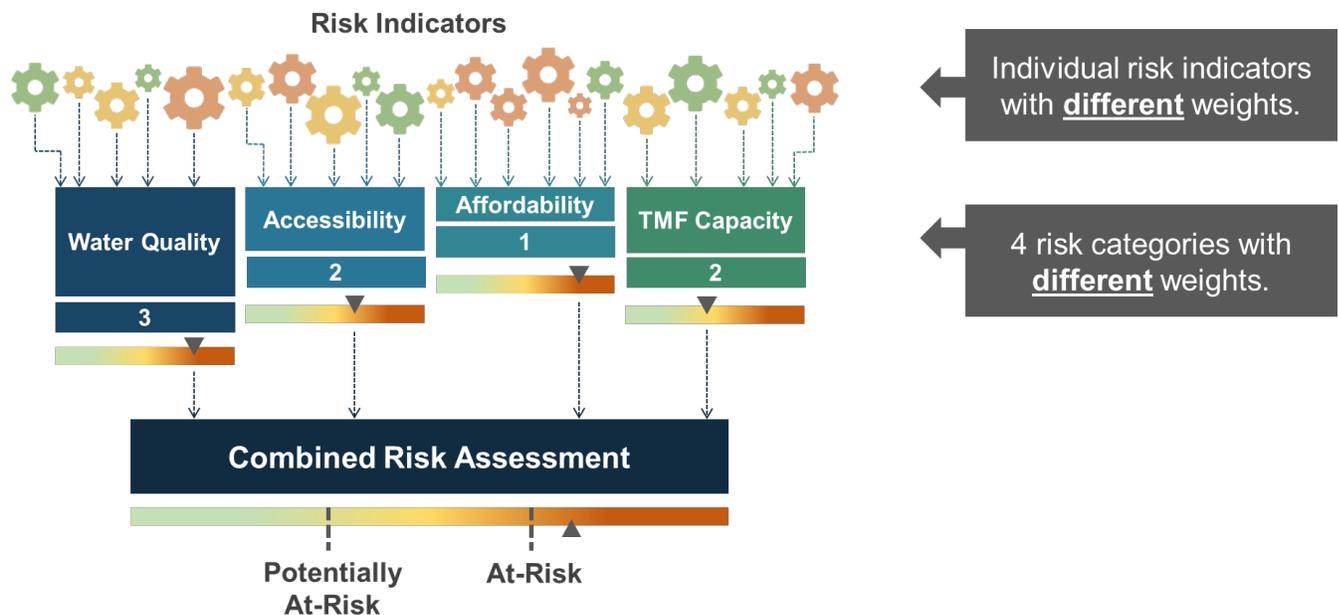
Scores

To enable the evaluation and comparison of affordability indicators within the Risk Assessment, a standardized score between 0 and 1 is applied to each indicator threshold. This is important since many of the indicators are measured in different units and scales. The score normalizes the thresholds and allows the Risk Assessment to assess water system performance across all indicators. The scores assigned to the indicator thresholds were developed with the professional opinion of external stakeholders, State Water Board staff, as well as an internal advisory group of District Engineers (Table 6).

Weights

When evaluating the affordability indicators, the Risk Assessment methodology can either apply the same "weight" to each indicator or apply different weights (Table 6). Public feedback during four public workshops in 2020-21 indicated that the Risk Assessment should weight some indicators higher than others because they may be more "critical" as they relate to a water system's ability to stay in compliance. Weights between 1 and 3 were applied to individual indicators (see affordability indicator weights in Table 6), with a weight of 3 indicating the highest level of criticality. The individual indicator weights for **%MHI** and **Extreme Water Bill** were developed with the professional opinion of external stakeholders, State Water Board staff, as well as an internal advisory group of District Engineers. In 2020, an analysis of how the application

of indicator weights impacts the performance of Failing: HR2W list systems was shared with the public for feedback with white paper *Recommendations for Risk Assessment 2.0 Thresholds, Scores, & Weights for Public Water Systems*[32] and a December 14, 2020 webinar,[33] which ultimately supported the final inclusion decision regarding individual indicator weights in the Risk Assessment.

Table 6: Current Affordability Indicator Thresholds, Scores, & Weights for the Risk Assessment

Affordability Indicator	Thresholds	Score	Weight	Max Score
Percent of Median Household Income (%MHI)	Threshold 0 = Less than 1.49%	0	N/A	0
	Threshold 1 = 1.5% - 2.49%	0.75	3	2.25
	Threshold 2 = 2.5% or greater	1	3	3

Affordability Indicator	Thresholds	Score	Weight	Max Score
Extreme Water Bill	Threshold 0 = Below 149.99% of the statewide average.	0	N/A	0
	Threshold 1 = 150% - 199.99% of the statewide average.	0.5	1	0.5
	Threshold 2 = 200% or greater of the statewide average.	1	1	1

---

[32] December 14, 2020 White Paper:
Recommendations for Risk Assessment 2.0 Thresholds, Scores, & Weights for Public Water Systems
https://www.waterboards.ca.gov/safer/docs/draft_white_paper.pdf

[33] December 14, 2020 Webinar Presentation
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/safer_risk_assessment_webinar_accessible.pdf

December 14, 2020 Webinar Recording
https://www.youtube.com/embed/6XDak8R5IDk?cc_load_policy=1&modestbranding=1&rel=0&autoplay=1

Proposed Threshold Scores and Weights for the New Affordability Indicator for the Risk Assessment

PPI and Household Burden Component Threshold Score Recommendations

Since no regulatory thresholds exist currently for the combined indicator of PPI and Housing Burden, a similar scoring approach was applied from the Risk Assessment for state small water systems and domestic wells. Each component's low category received a 0 score, the medium category received a 0.25 score, and the high category received a 1 score.

Table 7. Recommended PPI Component Threshold Scores

Component	Thresholds	Score	Risk Level = Affordability Burden
PPI	**Threshold N/A =** Missing or not reliable PPI data	N/A	Unknown
	Threshold 0 = < 20%	0	Low
	Threshold 1 = 20% ≥ n < 35%	0.25	Medium
	Threshold 2 = ≥ 35%	1	High

Table 8. Recommended Housing Burden Component Threshold Scores

Component	Thresholds	Score	Risk Level = Affordability Burden
Housing Burden	**Threshold N/A =** Missing or not reliable Housing Burden data	N/A	Unknown
	Threshold 0 = < 10.86%	0	Low
	Threshold 1 = 10.86% ≥ n < 14.71%	0.25	Medium
	Threshold 2 = ≥ 14.72%	1	High

Recommended Combined Household Socioeconomic Burden Threshold Scores

The two components of Household Socioeconomic Burden were combined using a matrix approach and following the same methodology as the Risk Assessment for state small water systems and domestic wells.[34] The normalized scores for PPI and Housing Burden components were added together and divided by the number of components (two). Below is the calculation used for each water system's Household Socioeconomic Burden score and Figure 10 shows how much each calculated score represents a degree of PPI and Housing Burden within the matrix.

Combined Household Socioeconomic Burden Score Calculation Method

$$Household\ Socioeconomic\ Burden\ Score = \frac{PPI\ score\ +\ Housing\ Burden\ score}{2}$$

Figure 10. Household Socioeconomic Burden scores within the matrix represents varying degrees of PPI and Housing Burden.

PPI		Unknown (N/A)	Low (0)	Med (0.25)	High (1)
	High (1)	N/A	0.5	0.625	1
	Med (0.25)	N/A	0.125	0.25	0.625
	Low (0)	N/A	0	0.125	0.5
	Unknown (N/A)	N/A	N/A	N/A	N/A
		Unknown (N/A)	Low (0)	Med (0.25)	High (1)
		Housing Burden			

[34] 2022 Needs Assessment.
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2022needsassessment.pdf

These combined scores are converted into risk designations, as shown in Table 9. The State Water Board and OEHHA recommend an indicator weight of 2 is applied to the new Household Socioeconomic Burden indicator. The number and percentage of systems that fall within each category are in Table 10.

Table 9. Risk designations based on Household Socioeconomic Burden combined score.

Affordability Indicator	Thresholds	Score	Weight	Max Score	Risk Level
Household Socioeconomic Burden	Threshold 0 = 0 – 0.125	0	N/A	0	None
	Threshold 1 = 0.25 – 0.5	0.5	2	1	Medium
	Threshold 2 = 0.625 – 1.0	1	2	2	High

Table 10. Number and percentage of systems in each threshold for the Household Socioeconomic Burden indicator.

Affordability Indicator	Thresholds	Risk Level	Number of Systems	Percent of Systems (%)
Household Socioeconomic Burden	Threshold 0 = 0 – 0.125	None	776	28%
	Threshold 1 = 0.25 – 0.5	Medium	667	24%
	Threshold 2 = 0.625 – 1.0	High	1,248	45%
	N/A	N/A	56	2%

A map showing the results of combined Housing Burden and PPI components—Household Socioeconomic Burden— in a matrix is shown in Figure 11. High risk scores for both components are shown in the darkest color.

Figure 11. Map of Household Socioeconomic Burden (combined PPI and Housing Burden)
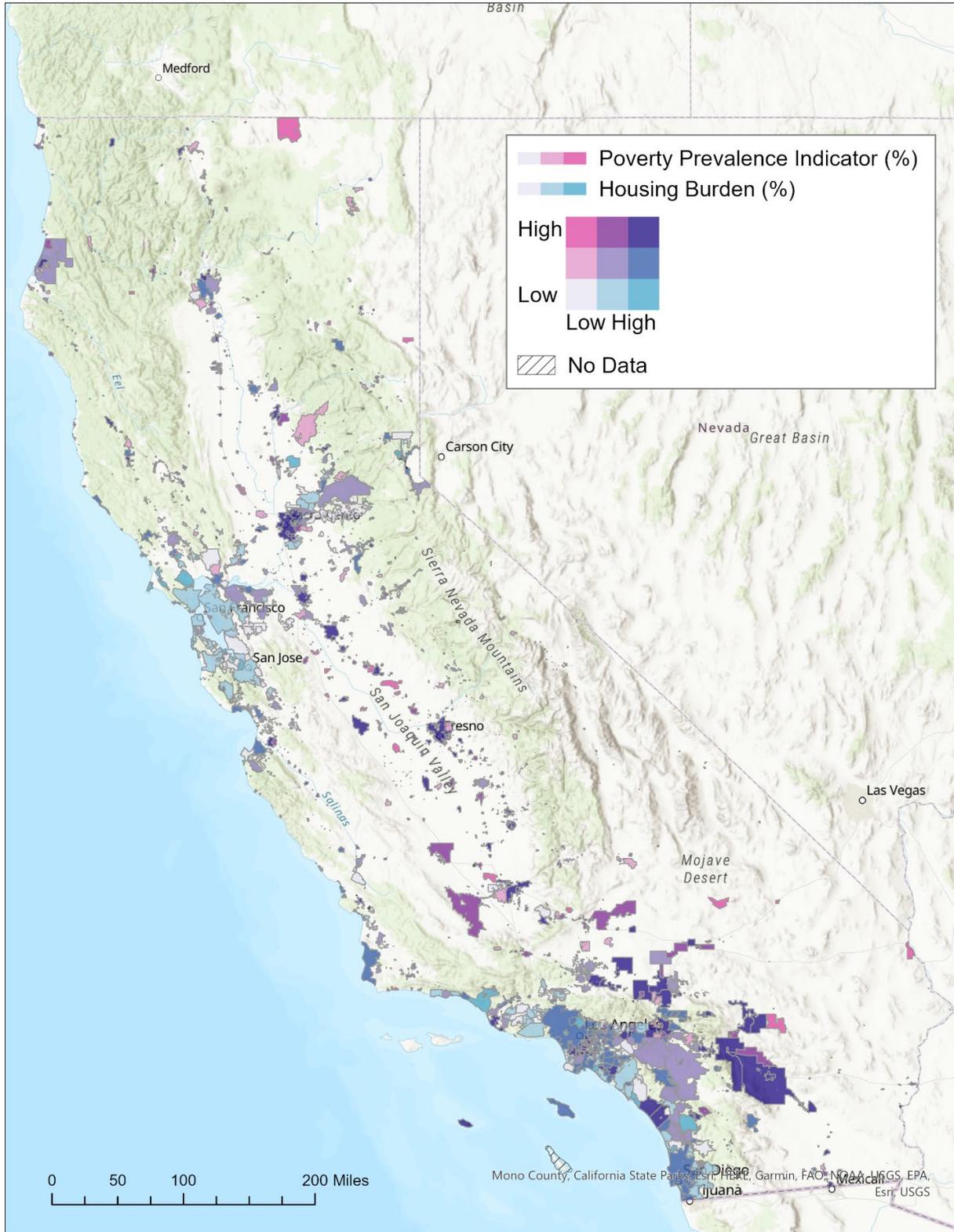
X.   Affordability Assessment Methodology Options

The methodology employed by the current Affordability Assessment utilizes the same affordability indicators used in the Risk Assessment; however, the calculation method differs between the two Assessments.

Current Approach

The current Affordability Assessment utilizes the minimum thresholds (Threshold 1, which corresponds to medium risk) for each affordability indicator only. The aggregated Affordability Assessment Thresholds are based on the sum of minimum affordability indicator thresholds met for each water system. The current approach does not weight the individual affordability indicators, they are all assessed equally in the analysis.

Table 11: Current Aggregated Affordability Assessment Thresholds

Current Affordability Assessment Thresholds	Total Affordability Burden
0 Affordability Indicator Min. Thresholds Exceeded	None
1 Affordability Indicator Min. Thresholds Exceeded	Low
2 Affordability Indicator Min. Thresholds Exceeded	Medium
> 2 Affordability Indicator Min. Thresholds Exceeded	High

Table 12: 2022 Affordability Assessment Results[35]

Systems	Total Systems	High Affordability Burden	Medium Affordability Burden	Low Affordability Burden	None
DAC / SDAC Systems	1,366	62 (5%)	176 (13%)	285 (21%)	843 (62%)

---

[35] The results in Table 9 differ slightly from the results published in the 2022 Needs Assessment Report. The results in Table 9 incorporate corrected MHI values updated after the Report's release.

Table 9 results include an analysis of the 2022 Affordability Assessment indicators: %MHI; Extreme Water Bill; % Residential Arrearages; & Residential Arrearage Burden

Systems	Total Systems	High Affordability Burden	Medium Affordability Burden	Low Affordability Burden	None
Non-DAC/SDAC Systems	1,394	21 (2%)	133 (10%)	275 (20%)	965 (69%)
Missing DAC Status	108	0 (0%)	4 (4%)	6 (6%)	98 (91%)
TOTAL	2,868	83 (3%)	313 (11%)	566 (20%)	1,906 (66%)

Table 13: <mark>Preliminary 2023</mark> Affordability Assessment Results[36]

Systems	Total Systems	High Affordability Burden	Medium Affordability Burden	Low Affordability Burden	None
DAC / SDAC Systems	1,714	70 (4%)	276 (16%)	539 (31%)	785 (46%)
Non-DAC/SDAC Systems	1,470	72 (5%)	94 (6%)	583 (40%)	705 (48%)
Missing DAC Status	56	0 (0%)	0 (0%)	7 (13%)	49 (88%)
TOTAL	3,240	142 (4%)	370 (11%)	1,129 (35%)	1,539 (48%)

---

[36] Table 10 results include an analysis of the proposed 2023 Affordability Assessment indicators: %MHI; Extreme Water Bill; & Household Socioeconomic Burden

Chart 1: Current Affordability Assessment Method Distribution for 2023 Preliminary Results

Affordability Assessment Current Method
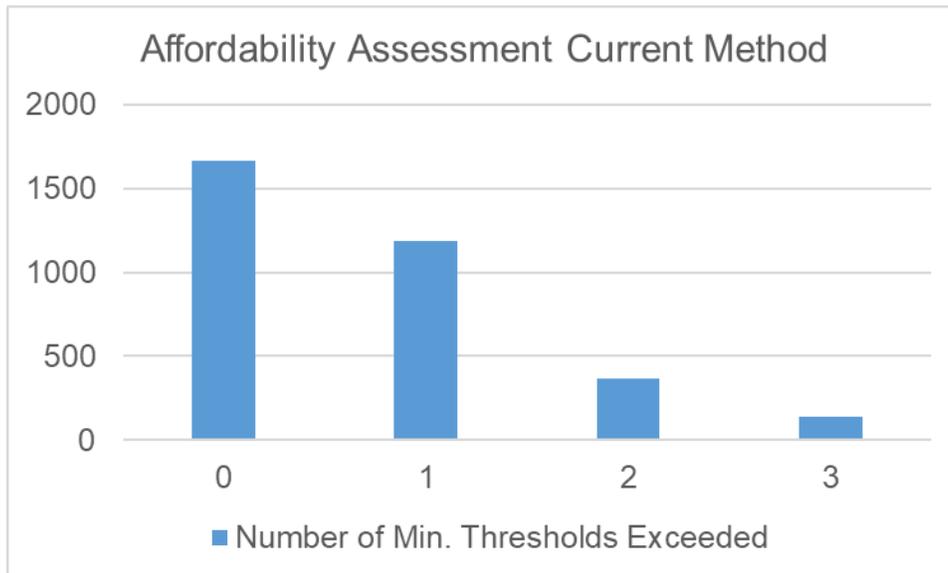
Pros:

- Can accommodate additional affordability indicators in the future without changing the aggregated Affordability Assessment thresholds for determining affordability burden.

- The sole utilization of the minimum threshold ensures communities that are experiencing affordability challenges are fully captured in the results of the Assessment.

Cons:

- Individual affordability indicator tiered thresholds (Thresholds 2) are not used in the Affordability Assessment; therefore, nuanced degrees of affordability burden are not captured in the Assessment's results.

- Some may support the user of weights for each affordability indicator to signal relevant influence on affordability challenges.

Alternative Approaches

Alternative methods for conducting the Affordability Assessment may rely on the tiered thresholds and indicator weights utilized in the Risk Assessment. Utilizing the tiered

thresholds, associated normalized scores, and weights would require numeric thresholds be developed for the aggregated Assessment score:

Chart 2: Alternative Approach 1: Utilize Tiered Threshold Scores; No Indicator Weights

Affordability Assessment Alternative 1
(Unweighted Scores)
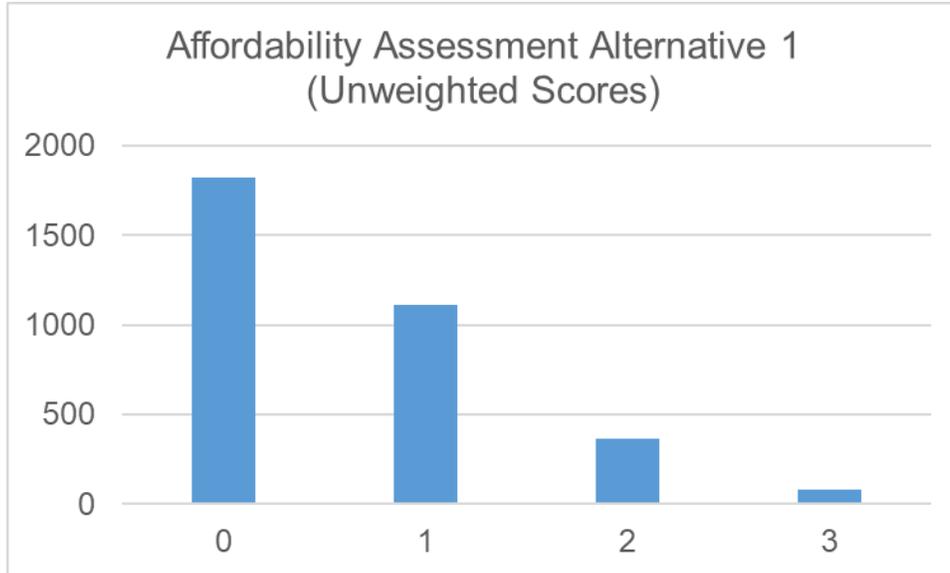
Chart 3: Alternative Approach 2: Utilize Tiered Threshold Scores; Include Indicator Weights

Affordability Assessment Alternative 2
(Weighted Scores)
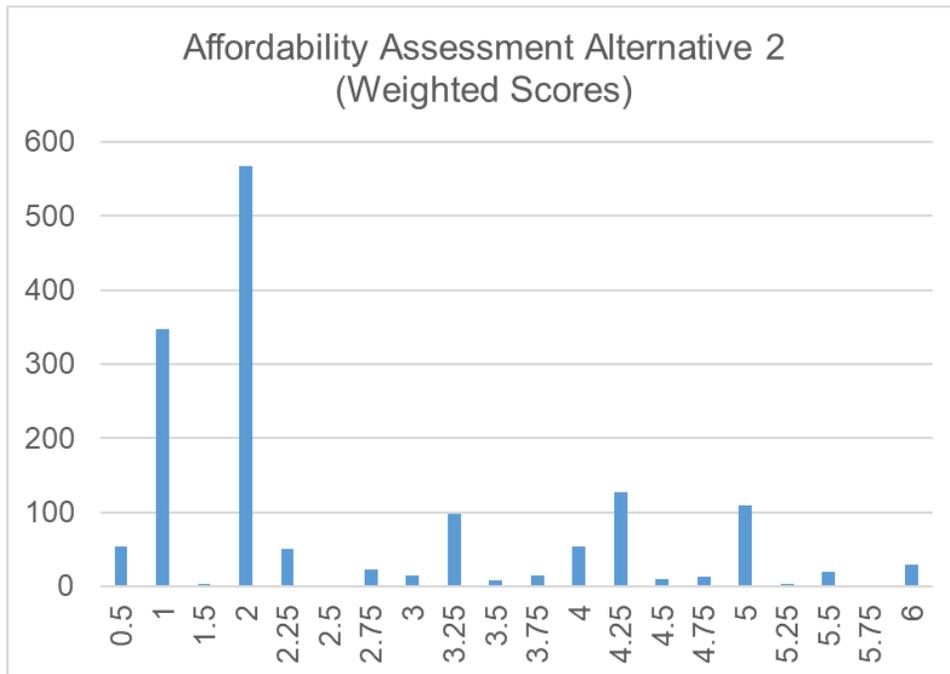
Pros:

- Utilization of individual affordability indicator tiered thresholds and indicator weights (Thresholds 1 & 2) results in nuanced degrees of affordability burden that are not captured in the current Assessment's results.

- Aligns more closely with how the affordability indicators are utilized in the Risk Assessment.

Cons:

- Approach 1: The results with Approach 1 closely mirror the current method's results.

- Approach 2: The distribution of system weighted scores would require grouping of scores to the final Affordability Assessment burden designations. The results would be similar to the current approach.

- This approach makes it more difficult to make future adjustments to the selection of affordability indicators. Removing and/or adding affordability indicators to the Assessment may require adjusting the aggregated Affordability Assessment thresholds for determining affordability burden.

Affordability Assessment Methodology Recommendations

The State Water Board and OEHHA recommend the continued utilization of the current Affordability Assessment methodology and thresholds. This helps to ensure the Assessment's affordability thresholds are more easily maintained over time as affordability indicators are added and removed from the Assessment. Furthermore, as illustrated in the distribution of scores for Alterative Approaches 1 and 2; the distribution of systems does not support the adoption of a new approach. The results with Approach 1 closely mirror the current method's results. The results with Approach 2 would require the grouping of the score distribution which would also result in a similar final analysis to the current approach.

Appendix A

Comments and discussion at the September 20, 2022 workshop along with the comment letter received are summarized here.

I. Workshop Discussion: DAC Determination

Q1: What do you think of identifying water systems serving DACs by applying these additional criteria?

Q2: Are the additional HCD low-income and very-low income thresholds we propose reasonable?

Comment	Response
I like this method of identifying DACs. One thing that happened during COVID that there were funds for water because the incomes were affected by COVID. I requested information on how to receive help with a water bill but was told there was nothing remaining. What happens to funds that are not used?	You are referring to the debt program, which was a one-time program that the Board launched last year with special appropriations from the Governor's office to help with debt that accrued over the pandemic. I believe that the CSD DAC program may still be up and running, that is another program that may be helping with customer debt.
The proposed approach seems reasonable.	Comment acknowledged.
I also agree that the approach seems reasonable, and like that this would better capture pockets of low-income households within certain communities. This is similar to intended use plans, where the same thresholds are used for DACs, but communities are excluded if over 50% of households are second homeowners. Would that same type of exclusion be applied in this affordability assessment.	At this time, we haven't considered excluding systems from the assessment, other than military bases. The State Water Board's Division of Financial Assistance may look at additional criteria, but that was not the goal of the needs assessment at this time.
Are fixed charges and property tax charges for water being counted?	Some of the affordability metrics include rate or customer charge information. When the state collects this data we're looking at the rates as well as trying to

Comment	Response
	estimate how much customers might be paying through the local taxes, which helps illustrate the total cost for water. This is something that the state is pursing, and the Board can share how we're currently doing this through the EAR.

II.   Workshop Discussion Step 2: Affordability Assessment

Q1: Do the proposed community socioeconomic indicators contribute to a better understanding of drinking water for PWSs? For SSWS/DW communities?

Q2: Do you think it is valuable to utilize similar community socioeconomic indicators for both PWSs as well as for SSWS/DW communities?

Q3: How should the community socioeconomic indicators be used in establishing the affordability threshold?

Comment	Response
SB 222 may be signed by Governor to address household level affordability, which will indirectly assist community affordability. Will the SAFER fund be a financing mechanism for SB 222 if it becomes law?	There is no funding tied to the legislation, just the establishment of the program. At this time, we do not know if the Governor intends on signing it. We're also not sure about financing at this time. There would need to be additional appropriations for the program. Hopefully we will have more information in the future.
The combined metric is the best approach, because of the limitations for each metric.	Comment Acknowledged.
For the socioeconomic indicators, are these items that SWQRB and OEHHA would be responsible for? Or would responsibility fall on water companies?	Yes, the data is available through federal sources, and would not be required in the EAR.
Q1: Yes, the approach seems to increase the understanding of households affordability for both PWS's and SSWS/DW. Q2: Yes. Q3: Not sure at this point, specifically for small systems and domestic wells. What are the SWQCB and OEHHA's thoughts?	We do not conduct affordability assessments for SSWSs and DWs, but we do want to better align the risk assessment and affordability information for these communities. When we came out with the first needs assessment, there were questions about why SSWSs and DWs didn't mirror PWSs. Ultimately, it's because they have different data and different needs. Last year, we included new indicators, like drought risk. We are also working with OEHHA to see if there are any additional risk assessments. IF a community is struggling because housing

Comment	Response
	costs are high and/or there is a lot of poverty, there may also be barriers to testing wells, replacing wells, and digging deeper wells.
I think that the real challenge for SSWSs and DWs is the managerial and water quality component, which we don't know much about. There may be some ways to assess these, like looking at area water quality and drought factors. But identifying the correct socioeconomic indicators will be a challenge for those systems.	The supplemental appendix does include a lot of other socioeconomic indicators, which could be combined with those that exist today. For example, we've been trying to identify the resources available at the county level: Are permitting fees high, is there a testing program, etc.? We will be hosting other workshops in the future to explain and assess those indicators.
We would like to work with your team members to provide more comments in the future. We support arrearage removal for 2023 and are glad to have the opportunity to comment and are looking forward to working more with the board in the future.	Comment acknowledged.
I liked the clear PowerPoint presentation and can tell that lots of thought has gone into this. My only concern is that agencies are mostly focused and specialized on water quality. When you explore other areas like household affordability and poverty, it becomes challenging due to the broad scope and complexity of housing costs. I'm glad to hear that we have a source for this information that is well recognized and widely used.	We are hoping to expand data collection for shutoff, debt, and assistance data so that those sources may be used in the future. However, we are also trying to remove reporting requirements. We understand that the CPUC also collects data from its regulated systems, and this can lead to a lot of effort for system operators.
The state of New Jersey will be requiring all public water systems to provide more affordability data on a regular basis, and this data will be collected at a zip code	Comment acknowledged.

Comment	Response
level. They will also collect information about shutoff and assistance data.	
Multiple people also asked about statewide customer assistance programs to help with water bills. We're not sure about the future of SB 222. CSD also has an arrearage burden relief program. We think it's important to remember why we need to measure affordability, because it will help is identify communities that struggle to pay, but also assist in understanding and targeting statewide customer assistance programs.	Comment acknowledged.

III. Summary of Comment Letters Received

The State Water Board received a comment letter jointly sent from the Association of California Water Agencies (ACWA) and the California Municipal Utilities Association (CMUA). Representatives from the State Water Board, OEHHA, ACWA, and CMUA met virtually to preview the comments and provide initial feedback and responses. This summary reflects both the written and verbal comments.

ACWA and CMUA expressed concern about the expansion of the definition of Disadvantaged Community beyond the statutory definition of community water systems where the median household income is less than 80% is less than the statewide annual median household income. The organizations indicated that the current approach for identifying DACs is adequate.

Additionally, ACWA and CMUA do not support the addition of the PPI and Housing Burden indicators to the Affordability Assessment, because these indicators "are not direct indicators of local water affordability." In particular, the organizations suggest the metrics might not properly reflect the ability of customers to afford water in areas with high costs of living. The organizations suggested that the State Water Board "focus its efforts on developing engineering-level solutions for the failing public water systems on the Human Right to Water (HR2W) list."

Finally, ACWA and CMUA asked for additional detail and clarification for how the proposed collection of residential arrearage and shut-off data would be used for small and medium sized public water systems in the Needs Assessment.

Appendix B

Suppression Criteria for PPI

- Unlike the US Census, ACS estimates come from a sample of the population and may be unreliable if they are based on a small sample or population size. The standard error (SE) and relative standard error (RSE) were used to evaluate the reliability of each estimate.

- The SE was calculated for each block group using the formula for approximating the SE of proportions provided by the ACS (American Community Survey Office, 2013, pg. 13, equation 4). When this approximation could not be used, the formula for approximating the SE of ratios (equation 3) was used instead.

- The RSE is calculated by dividing a tract's SE by its estimate of the percentage of the population living below twice the federal poverty level and taking the absolute value of the result.

- Block group estimates that met either of the following criteria were considered reliable and included in the analysis:

    o RSE less than 50 (meaning the SE was less than half of the estimate) OR

    o SE was less than the mean SE of all California block group estimates for poverty.

- Block groups with unreliable estimates received no score for the indicator (null).

- Block groups that met the inclusion criteria were sorted and assigned percentiles based on their position in the distribution.

Suppression Criteria for Housing Burden

- Like ACS estimates, CHAS data come from a sample of the population and may be unreliable if they are based on a small sample or population size. The standard error (SE) and relative standard error (RSE) were used to evaluate the reliability of each estimate.

- The SE was calculated for each census tract using the formula for approximating the SE of proportions provided by the ACS (American Community Survey Office, 2013, pg. 13, equation 4). When this approximation could not be used, the formula for approximating the SE of ratios (equation 3) was used instead.

- The RSE was calculated by dividing a tract's SE by its estimate of the percentage of housing-burdened low-income households and taking the absolute value of the result.

- Census tract estimates that met either of the following criteria were considered reliable and included in the analysis:
    - RSE less than 50 (meaning the SE was less than half of the estimate) OR
    - SE was less than the mean SE of all California census tract estimates for housing-burdened low-income households.
- All census tract level Housing Burden scores were associated with the block groups within them.
- Block groups with unreliable estimates receive no percentile score for the indicator (null).
- Block groups that met the inclusion criteria were sorted and assigned percentiles based on their position in the distribution.