CALIFORNIA
Water Boards

APPENDIX:
RISK ASSESSMENT METHODOLOGY FOR PUBLIC WATER SYSTEMS

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CONTENTS

INTRODUCTION

The purpose of the Risk Assessment for public water systems is to identify systems at-risk or potentially at-risk of failing to meet one or more key Human Right to Water goals: (1) providing safe drinking water; (2) accessible drinking water; (3) affordable drinking water; and/or (4) maintaining a sustainable and resilient water system. Data on performance and risk are most readily available for public water systems and thus the Risk Assessment methodology for public water systems allows for a multi-faceted examination across four risk indicator categories: Water Quality, Accessibility, Affordability; and TMF (technical, managerial, and financial) Capacity.

PUBLIC WATER SYSTEMS ASSESSED

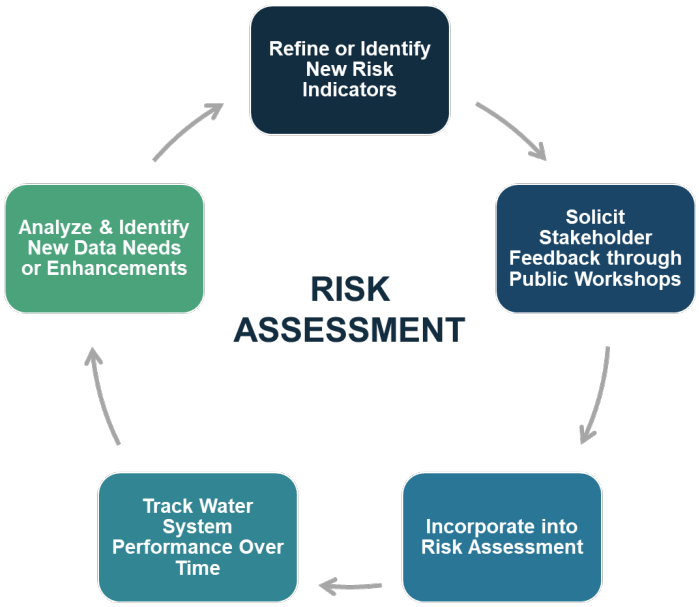
The current Risk Assessment for public water systems is conducted for small- and medium-sized community water systems, those with fewer than 30,000 service connections and serving populations under 100,000, as well as non-transient non-community (NTNC) water systems that serve K-12 schools. Large community water systems are excluded from the assessment. Wholesalers are also excluded, as they do not provide direct service to residential customers.

RISK ASSESSMENT METHODOLOGY DEVELOPMENT PROCESS

The State Water Board, in partnership with UCLA, began developing the initial Risk Assessment in 2019. The State Water Board and UCLA hosted four public webinar workshops in 2020 to solicit feedback and recommendations on the development of the Risk Assessment. Approximately 683 individuals[1] participated in these workshops through either Zoom or CalEPA's live webcast. Since the initial launch of the Risk Assessment in 2021, the methodology has been refined following the development stages summarized in Figure 1. This effort was designed to encourage public and stakeholder participation, providing opportunities for feedback and recommendations throughout the methodology development process. Proposed Risk Assessment methodology updates are detailed in publicly available white papers, presented at public webinars, and public feedback is often incorporated into the final methodology and results. These materials are hosted on the Needs Assessment webpage.[2]

[1] Individuals that participated in more than webinar workshop are double counted in this figure.
[2] State Water Board Needs Assessment Webpage
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/needs.html

Figure 1: Phases of Risk Assessment Development



RISK ASSESSMENT METHODOLOGY

The Risk Assessment methodology relies on three core elements which are utilized to calculate an aggregated risk score for each public water system assessed:

Risk Indicators: quantifiable measurements of key data points that allow the State Water Board to assess the probability of a water system's failure to deliver safe drinking water or other infrastructure and institutional failures. Risk indicators that measure water quality, accessibility, affordability, and TMF capacity are incorporated based on their criticality as it relates to a system's ability to remain in compliance with safe drinking water standards and their data availability and quality across the state.

Risk Indicator Thresholds: the levels, points, or values associated with an individual risk indicator that delineate when a water system is more at-risk of failing.

Scores & Weights: the application of a multiplying value or weight to each risk indicator and risk category, as certain risk indicators and categories may be deemed more critical than others and/or some may be out of control of a water system. The application of weights to risk indicators and risk categories allows the State Water Board multiple ways to assess all risk indicators within each category collectively, resulting in a combined Risk Assessment score.

RISK INDICATORS

The Risk Assessment utilizes risk indicators to assess water system performance and risk. The following section provides a summary of how the indicators used in the Risk Assessment have evolved over time. Sections further below in this Appendix provide details on each

individual risk indicator including definitions, required datapoints, and calculation methodologies.

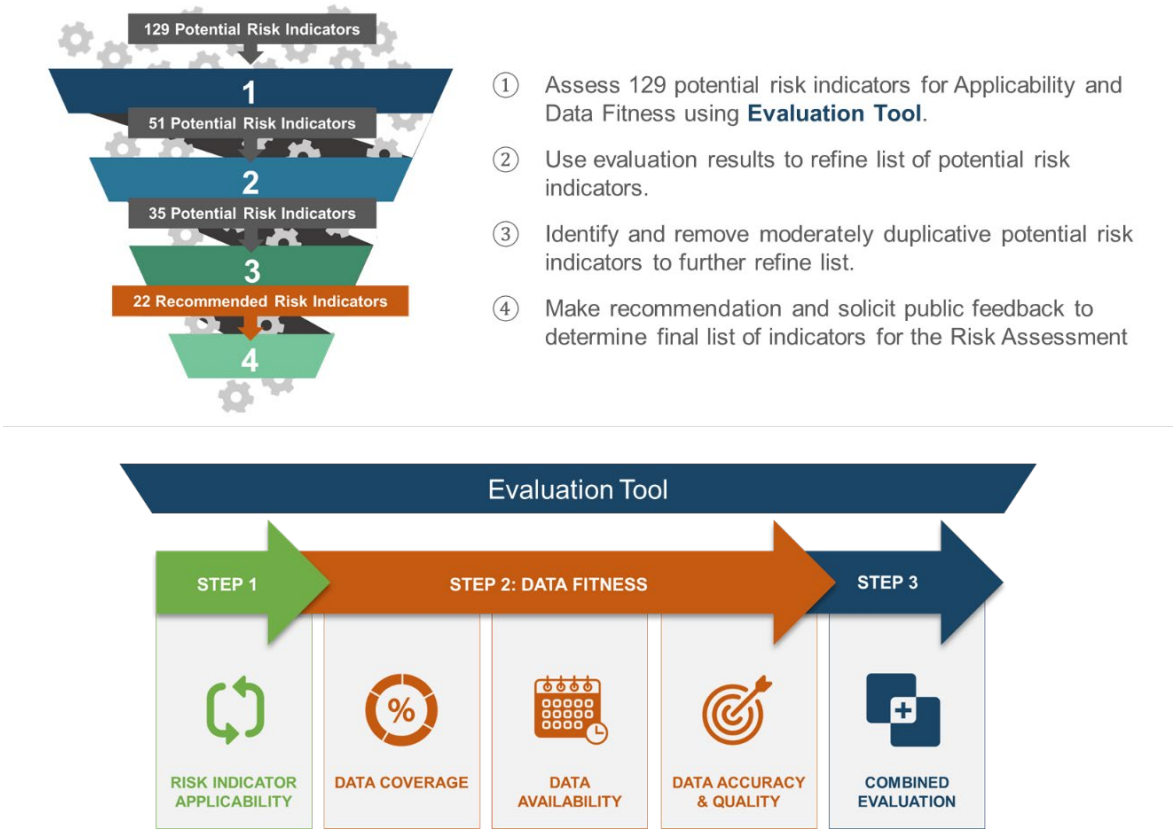
INITIAL 2021 RISK INDICATORS

The State Water Board, in partnership with UCLA, began an effort in April 2020 to identify potential risk indicators to be considered for inclusion in the Risk Assessment for public water systems. The initial version of the draft Risk Assessment utilized 14 risk indicators.[3] In response to public feedback from the April 17, 2020 webinar workshop, the State Water Board and UCLA expanded the scope of the Risk Assessment to evaluate a much broader number of risk indicators. The State Water Board, UCLA, and the public identified 129 potential risk indicators, including several from other complementary state agency efforts, to help predict the probability of a water system's failure to deliver safe drinking water. A concerted effort was made to identify potential risk indicators that measure water quality, accessibility, affordability, and TMF capacity based on their criticality as it relates to a system's ability to remain in compliance with safe drinking water standards. This effort included full consideration of risk indicators identified in efforts conducted by the Office of Environmental Health Hazard Assessment (OEHHA),[4] the Department of Water Resources (DWR),[5] and the California Public Utilities Commission (CPUC).[6]

To facilitate the selection of final indicators for the Risk Assessment, the State Water Board and UCLA conducted an extensive potential risk indicator evaluation process (Figure 2) with both internal and external feedback. This process refined the list of 129 potential risk indicators to a recommended list of 22 risk indicators for the Risk Assessment. Learn more about the risk indicator identification, refinement, and selection process in the October 7, 2020, white paper *Evaluation of Potential Indicators & Recommendations for Risk Assessment 2.0 for Public Water Systems.*[7]

[3] Identification of Risk Assessment 2.0 Indicators for Public Water Systems
https://www.waterboards.ca.gov/drinking_water/programs/safer_drinking_water/docs/draft_white_paper_indicators_for_risk_assessment_07_15_2020_final.pdf
[4] The Human Right to Water in California | OEHHA
https://oehha.ca.gov/water/report/human-right-water-california
[5] Countywide Drought and Water Shortage Contingency Plans | DWR
https://water.ca.gov/Programs/Water-Use-And-Efficiency/2018-Water-Conservation-Legislation/County-Drought-Planning
[6] California Public Utilities Commission
https://www.cpuc.ca.gov/
[7] October 7, 2020 White Paper:
https://www.waterboards.ca.gov/safer/docs/e_p_i_recommendations_risk_assessment_2_public_water_systems.pdf

Figure 2: Potential Risk Indicator Evaluation Process



The 2020-21 potential risk indicator evaluation process yielded a recommended list of 19 risk indicators. Table 1 provides a summary of the risk indicators utilized in the 2021 Risk Assessment.

2022

To respond to stakeholder feedback, the State Water Board added eight new risk indicators and removed five risk indicators for the 2022 Risk Assessment. Additional information about what led to these changes is documented in the 2022 Needs Assessment.[8]

- New risk indicators included: 'Constituents of Emerging Concern', 'Source Capacity Violations', 'Bottled or Hauled Water Reliance', 'Net Annual Income', 'Operating Ratio', 'Days Cash on Hand', 'Percentage of Residential Arrearages', and 'Residential Arrearage Burden'.
- Removed risk indicators included: 'Maximum Duration of High Potential Exposure (HPE)', 'Water Source Types', 'Percent Shut-Offs', 'Number of Service Connections', and 'Extensive Treatment Installed'.

[8] 2022 Needs Assessment https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2022needsassessment.pdf

2023

The State Water Board made minimal changes to the 2023 Risk Assessment indicators:

- Remove two affordability risk indicators: 'Percentage of Residential Arrearages' and 'Residential Arrearage Burden'.
- Add one new affordability risk indicator: 'Household Socioeconomic Burden'.

Removed Risk Indicators

Recent actions have affected the available data used to calculate affordability risk indicators in the 2023 Needs Assessment. Arrearage data was collected once for the 2021 Drinking Water Arrearage Payment Program, which ended in June 2021. For these reasons, 'Percentage of Residential Arrearages' and 'Residential Arrearage Burden' are not included in the 2023 Needs Assessment, since updated data to support these metrics has not been collected. These indicators were advantageous to include in the Needs Assessment because they represent a direct measurement of households struggling to pay their water bills and may be incorporated into future iterations of the Needs Assessment if data becomes available.

Added Risk Indicator

The State Water Board, in partnership with the OEHHA, hosted three webinar workshops in 2022 to solicit stakeholder feedback on new and future affordability indicators for the Needs Assessment. The workshop white papers, presentations, and webinar recording are available on the Needs Assessment website.[9] The State Water Board has incorporated one new affordability risk indicator to the 2023 Risk Assessment, 'Household Socioeconomic Burden', and identified potential new affordability indicators to include once data becomes available. Details on 'Household Socioeconomic Burden' calculation methodology, thresholds, scoring and weight can be found below in this Appendix.

2024 - 2025

The State Water Board made no changes to the risk indicators utilized in the Risk Assessment.

Table 1: Risk Indicators Over Time

Indicators	Category	2021	2022	2023-25
History of *E. coli* Presence	**Water Quality**	✓	✓	✓
Increasing Presence of Water Quality Trends Toward MCL	**Water Quality**	✓	✓	✓
Treatment Technique Violations	**Water Quality**	✓	✓	✓
Past Presence on the Failing List	**Water Quality**	✓	✓	✓
Percentage of Sources Exceeding an MCL	**Water Quality**	✓	✓	✓
Maximum Duration of High Potential Exposure (HPE) (Removed 2022)	**Water Quality**	✓		

[9] State Water Board Needs Assessment Webpage
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/needs.html

Indicators	Category	2021	2022	2023-25
Constituents of Emerging Concern	**Water Quality**		✓	✓
Number of Sources	**Accessibility**	✓	✓	✓
Absence of Interties	**Accessibility**	✓	✓	✓
Water Source Types (Removed 2022)	**Accessibility**	✓		
DWR – Drought & Water Shortage Risk Assessment Results	**Accessibility**	✓	✓	✓
Critically Overdrafted Groundwater Basin	**Accessibility**	✓	✓	✓
Bottled or Hauled Water Reliance	**Accessibility**		✓	✓
Source Capacity Violations	**Accessibility**		✓	✓
Percent of Median Household Income (%MHI)	**Affordability**	✓	✓	✓
Extreme Water Bill	**Affordability**	✓	✓	✓
% Shut-Offs (Removed 2022)	**Affordability**	✓		
Residential Arrearage Burden (Removed 2023)	**Affordability**		✓	
Percentage of Residential Arrearages (Removed 2023)	**Affordability**		✓	
Household Socioeconomic Burden	**Affordability**			✓
Number of Service Connections (Removed 2022)	**TMF Capacity**	✓		
Operator Certification Violations	**TMF Capacity**	✓	✓	✓
Monitoring and Reporting Violations	**TMF Capacity**	✓	✓	✓
Significant Deficiencies	**TMF Capacity**	✓	✓	✓
Extensive Treatment Installed (Removed 2022)	**TMF Capacity**	✓		
Days Cash on Hand	**TMF Capacity**		✓	✓
Operating Ratio	**TMF Capacity**		✓	✓
Net Annual Income	**TMF Capacity**		✓	✓

RISK INDICATOR THRESHOLDS, SCORES, & WEIGHTS

THRESHOLDS

To develop thresholds for the risk indicators in the Risk Assessment, 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. Few exact risk indicator thresholds relating to water system failure were derived from sources beyond California legislative and regulatory definitions, given both the unique definition of water system failure employed in this assessment and the unique access to indicator data which this assessment enabled. However, similar indicators and associated thresholds to inform this process were also identified across other sources.

Based on the research conducted, most risk indicators did not have regulatorily defined thresholds. For binary risk indicators (*e.g.,* operator certification violations), the process of setting thresholds was straightforward because risk is either present or absent. For other risk indicators with continuous or categorical data, thresholds were derived using cut points in the distribution of a given risk indicator, where Failing list systems started to cluster, as well as the professional opinion of external stakeholders, State Water Board staff, and an internal advisory group of District Engineers. Where possible, tiered thresholds were determined to capture more nuanced degrees of risk within indicators. Sections below provide more details about the rationale for the thresholds developed for each indicator.

Moving forward, the State Water Board will continue to refine the risk indicator thresholds as data availability improves and the SAFER Program matures. The process may include refining thresholds by analyzing historical data trends such as looking at the relationship between historical thresholds and the likelihood that systems become out of compliance.

SCORES

To enable the evaluation and comparison of risk indicators, a standardized score between 0 and 1 has been applied to each developed risk indicator threshold. This is important since many of the risk 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 risk indicators. The scores assigned to the risk 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 2).

WEIGHTS

When evaluating the risk indicators, the Risk Assessment methodology can either apply the same "weight" to each risk indicator or apply different weights (Figure 3). Public feedback during four public workshops indicated that the Risk Assessment should weigh some risk 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 risk indicators (Table 2), with a weight of 3 indicating the highest level of criticality. The individual risk indicator weights 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 risk indicator weights impacts the performance of Failing systems was shared with the public for feedback with white paper *Recommendations for Risk Assessment 2.0 Thresholds, Scores, & Weights for Public Water Systems*[10] and a December 14, 2020 webinar,[11] which ultimately supported the final inclusion decision regarding individual risk indicator weights in the Risk Assessment.

[10] December 14, 2020 White Paper:
https://www.waterboards.ca.gov/safer/docs/draft_white_paper.pdf
[11] 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

Table 2: Individual Risk Indicator Thresholds, Scores and Weights

Risk Indicator	Thresholds	Score		Weight	Max Score	Risk Level
History of *E. coli* Presence	**Threshold 0** = **No** history of *E. coli* presence within the last three years.	0		N/A	0	None
	Threshold 1 = **Yes** history of *E. coli* presence (*E. coli* violation and/or Level 2 Assessment) within the last three years.	1		3	3	High
Increasing Presence of Water Quality Trends Toward MCL	**Threshold 0** = **Less than 25%** of sources meet any of the thresholds listed below.	0		N/A	0	None
	Threshold 1 = **Secondary Contaminants** If a source meets the following criteria: 9-year average of running annual averages is at or greater than 80% of MCL and the running annual average has increased by 20% or more.	0.25 per source	If 25% or more of sources meet any of these criteria, average the scores across all contaminated sources. (0 ≤ n* ≤ 1)	2	2	Medium if 0 < n* ≤ 0.5 High if 0.5 < n* ≤ 1
	Threshold 2 = **Primary Non-Acute Contaminants** If a source meets the following criteria: 9-year average of running annual averages is at or greater than 80% of MCL and the running annual average has increased by 5% or more.	0.5 per source				
	Threshold 3 = **Acute Contaminants**: If a source meets one or more of the following criteria: • 9-year average (no running annual average) is at or greater than 80% of MCL; or • Most recent 24-month average is at or greater than 80% of MCL; or	1 per source				

Risk Indicator	Thresholds	Score		Weight	Max Score	Risk Level
	• Any one sample exceeds the MCL.					
Treatment Technique Violations	**Threshold 0** = **0** Treatment technique violations over the last three years.	0		N/A	0	None
	Threshold 1 = **1 or more** Treatment technique violations over the last three years.	1		1	1	High
Past Presence on the Failing List	**Threshold 0** = **0** Failing list occurrences over the last three years.	0		N/A	0	None
	Threshold 1 = **1** Failing list occurrence over the last three years.	0.5		2	1	Medium
	Threshold 2 = **2 or more** Failing list occurrences over the last three years.	1		2	2	High
Percentage of Sources Exceeding an MCL	**Threshold 0** = **less than 50%** of sources exceed an MCL.	0		N/A	0	None
	Threshold 1 = **50% or more** of sources exceed an MCL.	1		3	3	High
Constituents of Emerging Concern	**Threshold 0** = **Less than 25%** of sources meet any of the thresholds listed below.	0		N/A	0	None
	Threshold 1 = If a source meets one or more of the following criteria: • **CrVI: 1 or more** calculated RAA(s) over 5-year period are at or above 80% of the MCL and below the MCL (8 µg/L ≤ RAA < 10 µg/L); or • **PFAS: 2 or more** samples over 5-year period are positive. This criterion applies to all 18 chemicals listed in Table 18.	0.5 per source	If 25% or more of sources meet any of these criteria, average the scores across all contaminated sources.	3	3	Medium if 0 < n* ≤ 0.5 High if 0.5 < n* ≤ 1

Risk Indicator	Thresholds	Score		Weight	Max Score	Risk Level
	Threshold 2 = If a source meets one or more of the following criteria: • **CrVI: 1 or more** calculated RAA(s), over 5-year period, are at or above the MCL (10 µg/L ≤ RAA); or • **PFAS: 2 or more** samples, over 5-year period, are at or above the notification level. This criterion applies only to 4 chemicals with notification level as listed in Table 19; or • **1,4-Dioxane: 1 or more** calculated RAA(s), over 5-year period, are at or above the notification level (1 µg/L ≤ RAA).	1 per source	(0 ≤ n* ≤ 1)			
Number of Sources	**Threshold X** = **0** sources.	Automatically At-Risk		N/A	N/A	Very High
	Threshold 0 = **2 or more** sources.	0		N/A	0	None
	Threshold 1 = **1** source.	1		3	3	High
Absence of Interties	**Threshold 0** = **1 or more** interties.	0		N/A	0	None
	Threshold 1 = **0** interties.[12]	1		1	1	High
DWR – Drought & Water Shortage Risk	**Threshold 0** = **Below top 25%** of systems most at risk of drought and water shortage.	0		N/A	0	None
	Threshold 1 = **Top 25% or above but below top 10%** of systems most at risk of drought and water shortage.	0.25		2	0.5	Medium

[12] Water systems with 10,000 service connections or more that have more than one source are excluded and a risk score of 0 is assigned. If a water system with 10,000 service connections or more has only one source and it is not an intertie, it receives a risk score of 1. Water systems with ten or more water sources are excluded and risk score of 0 is assigned.

Risk Indicator	Thresholds	Score	Weight	Max Score	Risk Level
Assessment Results	**Threshold 2** = **Top 10%** of systems most at risk of drought and water shortage.	1	2	2	High
Critically Overdrafted Groundwater Basin	**Threshold 0** = **Less than 25%** of a system's wells are located within a critically overdrafted basin.	0	N/A	0	None
	Threshold 1 = **25% or more** of a system's wells are located within a critically overdrafted basin.	1	2	2	High
Source Capacity Violations	**Threshold 0 = 0** source capacity violations within the past 3 years; and **0** service connection moratoriums within the past 3 years.	0	N/A	0	None
	Threshold 1 = 1 or more source capacity violations within the past 3 years; or **1 or more** service connection moratoriums within the past 3 years.	1	3	3	High
Bottled or Hauled Water Reliance	**Threshold 0 = 0** occurrences of bottled or hauled water reliance within the past 3 years.	0	N/A	0	None
	Threshold 1 = 1 or more occurrences of bottled or hauled water reliance within the past 3 years.	Automatically At-Risk	N/A	N/A	Very High
Percent of Median Household	**Threshold 0** = **Less than 1.5%** of MHI spent on water.	0	N/A	0	None
	Threshold 1 = **1.5% or greater** but **less than 2.5%** of MHI spent on water.	0.75	3	2.25	Medium

Risk Indicator	Thresholds	Score	Weight	Max Score	Risk Level
Income (%MHI)	**Threshold 2** = **2.5% or more** of MHI spent on water.	1	3	3	High
Extreme Water Bill	**Threshold 0** = **Less than 150%** of the statewide average water charge for 6 HCF.	0	N/A	0	None
	Threshold 1 = **150% or greater** but **less than 200%** of the statewide average water charge for 6 HCF.	0.5	1	0.5	Medium
	Threshold 2 = **200% or greater** of the statewide average water charge for 6 HCF.	1	1	1	High
Household Socio-economic Burden	**Threshold 0** = Combined score **0 – 0.125**.	0	N/A	0	None
	Threshold 1 = Combined score **0.25 – 0.5**.	0.5	2	1	Medium
	Threshold 2 = Combined score **0.625 – 1.0**.	1	2	2	High
Operator Certification Violations	**Threshold 0** = **0** Operator Certification violations over the last three years.	0	N/A	0	None
	Threshold 1 = **1 or more** Operator Certification violations over the last three years.	1	3	3	High
Monitoring & Reporting Violations	**Threshold 0** = **1 or less** Monitoring & Reporting violations over the last three years.	0	N/A	0	None
	Threshold 1 = **2 or more** Monitoring & Reporting violations over the last three years.	1	2	2	High
Significant Deficiencies	**Threshold 0** = **0** Significant Deficiencies over the last three years.	0	N/A	0	None

Risk Indicator	Thresholds	Score	Weight	Max Score	Risk Level
	Threshold 1 = **1 or more** Significant Deficiencies over the last three years.	1	3	3	High
Operating Ratio	**Threshold 0** = **1 or greater**.	0	N/A	0	None
	Threshold 1 = **Less than 1**.	1	1	1	High
Total Annual Income	**Threshold 0** = **More than $0** total annual income.	0	N/A	0	None
	Threshold 1 = $0 total annual income.	0.5	1	0.5	Medium
	Threshold 2 = **Less than $0** total annual income.	1	1	1	High
Days Cash on Hand	**Threshold 0** = **90 days or more** cash on hand.	0	N/A	0	None
	Threshold 1 = **30 or more days** but **less than 90 days** cash on hand.	0.5	1	0.5	Medium
	Threshold 2 = **Less than 30 days** cash on hand.	1	1	1	High

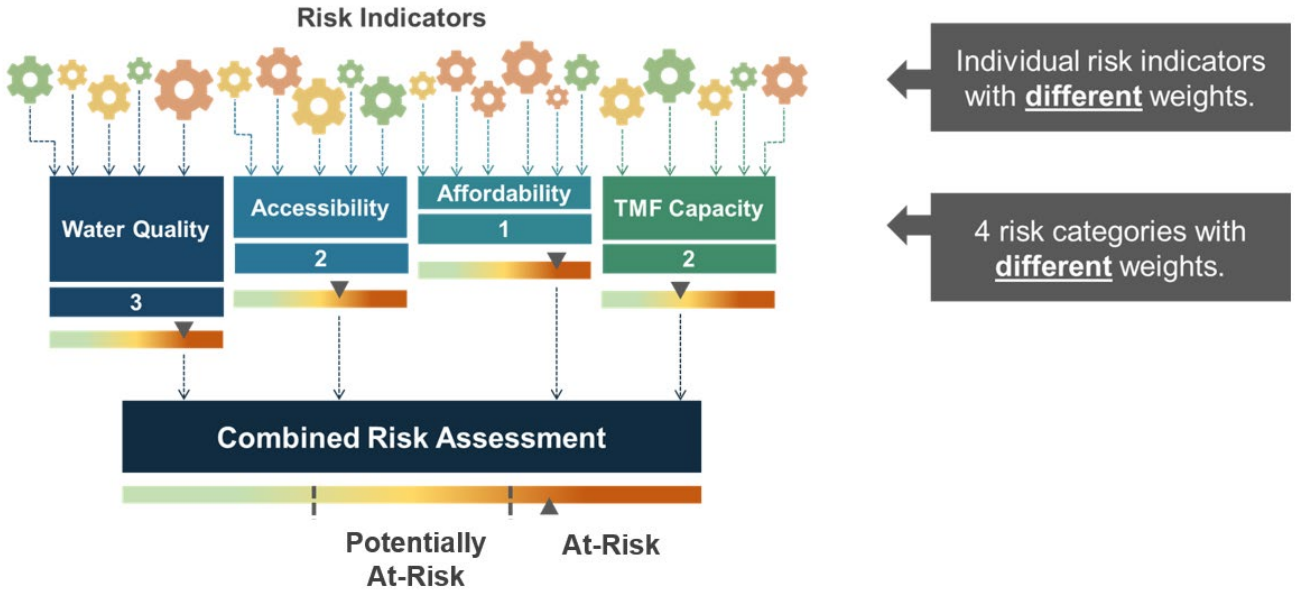
**n = Total score before applying the indicator weight*

RISK INDICATOR CATEGORY WEIGHTS

Public feedback during the initial Risk Assessment methodology development workshops indicated that the Risk Assessment should include risk indicator category weights. An analysis of how the application of risk indicator category weights impacts the performance of Failing 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* [13] and a December 14, 2021 webinar,[14] which ultimately supported the final inclusion of category weights in the Risk Assessment.

Weights between 1 and 3 were applied to each risk indicator category, with a weight of 3 indicating the highest level of criticality (Figure 3). Risk indicator category weights were developed through stakeholder workshops and with the professional opinion of State Water Board staff, including an internal advisory group of District Engineers.

Figure 3: Aggregated Risk Assessment Methodology with Category Weights



[13] December 14, 2020 White Paper: https://www.waterboards.ca.gov/safer/docs/draft_white_paper.pdf

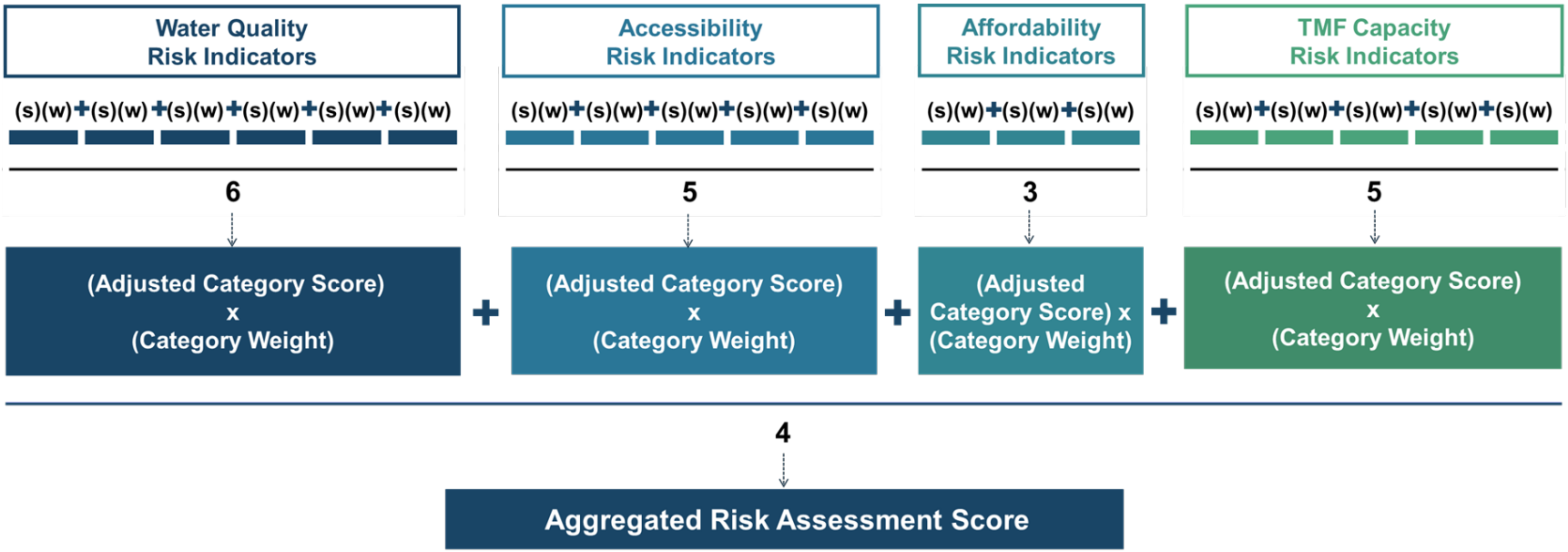
[14] December 14, 2020 Webinar Presentation https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/safer_risk_assessment_webinar_accessible.pdf
December 14, 2020 Webinar Recording https://www.youtube.com/embed/6XDak8R5IDk?cc_load_policy=1&modestbranding=1&rel=0&autoplay=1

AGGREGATED RISK ASSESSMENT CALCULATION METHODOLOGY

The assessment of individual risk indicators within each category and for the aggregated risk assessment relies on: (1) the amount of risk scores or points each system accrues per indicator, (2) the number of indicators that system is assessed for in each category, and (3) the weights applied to individual risk indicators and categories. Figure 4 provides an illustration of the aggregated Risk Assessment calculation method.

The aggregated Risk Assessment methodology takes the standardized score, between 0 and 1, for each risk indicator and applies a criticality weight to each indicator, between 1 and 3. Then a criticality weight is also applied to each risk indicator category (*e.g.,* Water Quality, Accessibility, *etc.*), between 1 and 3. The final score is an average of the weighted category scores.

Figure 4: Illustration of the Risk Assessment Calculation Methodology with Risk Indicator Scores (s) and Risk Indicator Category Weights (w)



ADJUSTING FOR MISSING DATA

It is important that the Risk Assessment methodology adapts for where data may be missing for certain water systems, either because a system failed to report necessary data or because the system may not have data to report. For example, some water systems do not charge for water. Therefore, those systems do not have the necessary data (*i.e.,* customer charges) for two of the three risk indicators in the Affordability category. On the other hand, a system may be missing data because the water system did not report the required data point to the State Water Board. The Risk Assessment methodology treats these two scenarios differently.

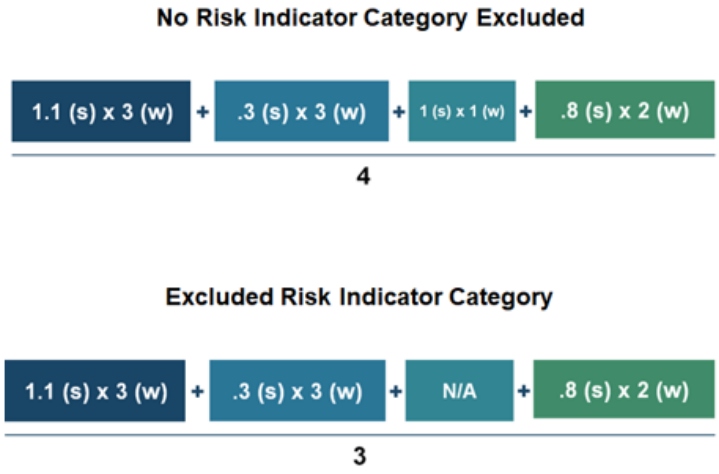
Missing Data – Not Applicable
If a risk indicator is not applicable to a water system and data is unavailable for logical reasons, the water system will be assigned a risk score of 0 for the indicator. No other adjustments are made to the system's aggregated risk score.

Missing Data – Non-Reporting
A water system that is missing necessary data for a risk indicator will have the indicator weights within the risk category redistributed (Figure 5). This increases the calculated impact the other risk indicators have on the category's risk score. This approach allows the analysis to compare systems without complete data to systems with complete data. It also ensures water systems are not assigned lower aggregated risk scores for not reporting data.

Figure 5: Example of How the Aggregated Risk Assessment Adjusts for Missing Risk Indicator Data

Historically, there have been water systems that were missing risk indicator data for a whole category, particularly the Affordability category. Many of these systems were unconventional community water systems in the sense that they had a stable population base, but no ratepayer base (for example, schools, prisons, parks). In the past, these systems (where identifiable) were excluded from the Affordability category of the Risk Assessment altogether and given a risk score of 0 for this category. In these cases, the Risk Assessment redistributed the weights/score of a missing risk indicator category to the other categories, as illustrated in Figure 6. On the 2025 Risk Assessment, there are no occurrences where a system is missing risk indicator data for an entire category.

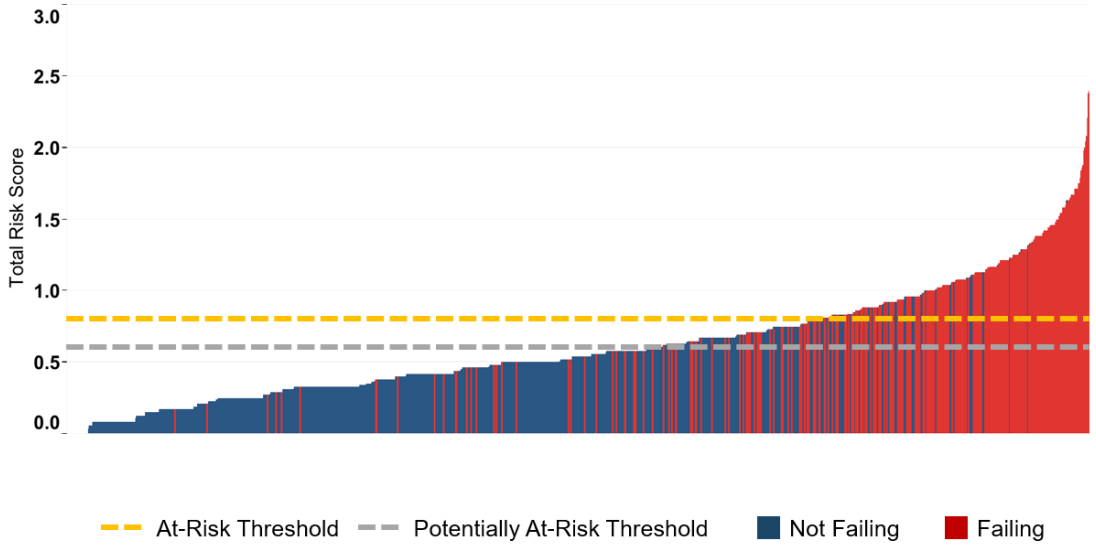
Figure 6: How the Aggregated Risk Assessment Adjusts for a Missing Risk Indicator Category



AGGREGATED RISK ASSESSMENT THRESHOLDS

The Risk Assessment thresholds are 0.8 for At-Risk water systems and 0.6 for Potentially At-Risk water systems. These thresholds remain unchanged from those developed for the 2022 Risk Assessment. The aggregated Risk Assessment thresholds were originally developed based on the distribution of Failing and non-Failing water systems, as shown in Figure 7.

Figure 7: Distribution of Total Risk Scores for Water Systems (illustration only, scores not reflecting current year's result)



RISK INDICATOR DETAILS

IDENTIFICATION OF WATER SYSTEMS ASSESSED

The State Water Board conducts the Risk Assessment for a specific inventory of drinking water systems determined annually. In 2021, the State Water Board conducted a Risk Assessment for K-12 schools and community water systems with 3,300 service connections or less. In 2022, the inventory of systems included in the Assessment expanded to include systems with 30,000 service connections or less and a population served of 100,000 or less.

The following section summarizes the methodology employed to identify which water systems are included in the Risk Assessment using SDWIS data:

- Identify all active[15] water systems with a Federal Water System Type of "Community". Exclude systems with a primary service area of "Wholesaler" but do not exclude systems with multiple service areas if only one of the non-primary service areas are designated as "Wholesaler." Some schools will be included in this category if they are designated as a "Community" Federal Water System Type.
- Identify all active water systems with a Federal Water System Type of "Non-Transient Non-Community" and with a primary service area of "School." Exclude schools that are not K-12 (*i.e.*, colleges and pre-schools).
- Remove water systems that are larger than the determined service connection or population cutoffs for the Risk Assessment.[16]

WATER QUALITY RISK INDICATORS

This section provides full details on each Water Quality risk indicator used in the Risk Assessment. Water Quality risk indicators measure current water quality and trends to identify compliance with regulatory requirements, as well as frequency of exposure to drinking water contaminants.

HISTORY OF E. COLI PRESENCE

The presence of *E. coli* in drinking water suggests that the water supply may be contaminated with human or animal waste, and in turn, that other pathogens could be present. The presence of this contaminant could also suggest that water treatment is inadequate, interrupted, or intermittent. Water systems are required to conduct a Level 1 and/or a Level 2 Assessment if conditions indicate they might be vulnerable to bacteriological contamination.

A Level 1 Assessment is performed by a water system owner or operator when laboratory results indicate that bacteriological threats may exist, and an assessment form must be filled

[15] "Active" means the water system was active at the time the data was pulled.
[16] Currently, systems with more than 30,000 service connections or with a population served of more than 100,000 are excluded.

and submitted to the state within 30 days. A Level 1 Assessment is triggered by any of the following conditions.[17]

- A public water system collecting fewer than 40 samples per month has two or more total coliform positive routine/repeat samples in the same month.
- A public water system collecting at least 40 samples per month has greater than 5.0 percent of the routine/repeat samples in the same month that are total coliform positive.
- A public water system fails to take every required repeat sample after any single total coliform positive sample.

A Level 2 Assessment is performed by the state or state-approved entity, but the water system is responsible for ensuring the completion of the assessment regardless of the entity conducting it. The water system must notify the local regulating agency by the end of the business day to schedule a Level 2 assessment. A Level 2 Assessment is triggered by the following conditions:[18]

- A water system incurs an *E. coli* MCL violation.
- A water system has a second Level 1 Assessment within a rolling 12-month period.

Water systems must fix any sanitary defects within a required timeframe.

Calculation Methodology
Required Risk Indicator Data Points & Sources:

- *E. coli* violations – Analyte Code 3014: Safe Drinking Water Information System (SDWIS).
  - Query systems that only have *E. coli* related treatment technique and/or MCL violations. See list of violation codes in Table 3.
- Level 2 Assessments
  - Violation Type Code (2B): SDWIS.
  - Level 2 Assessment Activities Spreadsheet: Maintained by State Water Board's Data Support Unit (DSU).

Table 3: Identified Violation Types Related to *E. coli*

Violation Number	Violation Type	Description
1A	**MCL, *E. coli*, Positive *E. coli* (rTCR)**	*E. coli* MCL violation based on a single sample.

[17] Revised Total Coliform Rule
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/rtcr.html
[18] Level 2 Assessment: A Quick Reference Guide
https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100K9MP.txt

Risk Indicator Calculation Methodology:

- Determine which systems have had *E. coli* violations within the last three years with a SOX (State Compliance Achieved) Enforcement Action.
- Determine which systems have had a Level 2 Assessment over the last three years.

Threshold Determination
The State Water Board has adopted a threshold for *E. coli* violations for the expanded Failing list criteria which relies on whether the water system has an open enforcement action for the violation.[19] For the Risk Assessment, a modified version of the expanded Failing list criteria threshold was developed for the "History of *E. coli* Presence" risk indicator. Systems that have had an *E. coli* violation or Level 2 Assessment within the last three years are considered more at risk than systems that have not.

Correlational and regression analysis between the risk indicator as defined by this threshold and water system failure to deliver safe drinking water as defined in the Failing list shows a statistically significant relationship.

Risk Indicator Scoring & Weighting
To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Public feedback during the Risk Assessment methodology development process indicated that some risk indicators should be weighted higher than others because they may be more "critical" as they relate to a water system's ability to stay in compliance. Risk indicator weights between 1 and 3 were applied to individual risk indicators. Based on feedback from the State Water Board's engineers, the maximum weight of 3 is applied to the "History of *E. Coli* Presence" risk indicator. Therefore, the minimum risk score is 0 and the maximum risk score is 3. Table 4 summarizes the thresholds, scores, and weight for this risk indicator.

Table 4: "History of E. coli Presence" Thresholds, Scores & Weights

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
0	**No** history of *E. coli* presence over the last three years.	0	N/A	0	None
1	**Yes**, history of *E. coli* presence (*E. coli* violation and/or Level 2 Assessment) over the last three years.	1	3	3	High

INCREASING PRESENCE OF WATER QUALITY TRENDS TOWARD MCL

This risk indicator identifies sources with an increasing presence of one or more regulated contaminants, especially those attributable to anthropogenic causes, that have been detected at or greater than 80% of the MCL within the past nine years. Water systems with 25% of their

[19] Systems that meet the Failing list criteria will not be included in the Risk Assessment.

sources or more experiencing upwards trends in contaminant concentrations are at-risk of exceeding regulatory water quality requirements and are therefore assigned risk points in the Risk Assessment.

Calculation Methodology

Important Note: *In 2022, the State Water Board adjusted the calculation of this risk indicator from the approach used in the 2021 Needs Assessment to account for the inclusion of medium-size water systems that have many sources. Specifically, the analysis excluded systems from accruing risk points for this indicator if less than 25% of their active sources met the risk criteria detailed below.*

In 2023, the State Water Board adjusted the calculation of this risk indicator from the approach used in the 2022 Needs Assessment. The update adjusted the method for determining impaired source thresholds. Instead of assessing water quality source risk per contaminant group individually (acute, primary, and secondary), the assessment is now done across all groups simultaneously. This change improves the identification of water systems that show trends towards MCL in more than 25% of their sources, regardless of contaminant group.

Required Risk Indicator Data Points & Sources:

- Dataset - SDWIS:
  - Data Point(s) - Water System Inventory
    - Active Source Water Facilities including[20]
      a. Consecutive Connection (CC)
      b. Infiltration Gallery (IG)
      c. Intake (IN)
      d. Roof Catchment (RC)
      e. Spring (SP)
      f. Well (WL)
    - Active Water System Sampling Points for the above Source Water Facilities[21]
  - Data point(s) - Water System Water Quality[22]
    - Water Quality Monitoring Sample Results and Dates for the above sample points.
    - Water Quality Contaminants for Sample Results for the above sample point.
      a. List of eligible contaminants described below in Table 5, Table 6, and Table 7.

- Dataset – Water Quality Inquiry Revised (WQIr):[23]
  - Data point(s) for Contaminant Information
    - Regulatory threshold information including
      a. Maximum Contaminant Levels (MCL)
      b. Maximum Residual Disinfection Level (MRDL)

[20] Source Water Facility Types not included in the list are excluded from the analysis (*e.g.*, hauled water).
[21] Source Water Facility Types with no active sample points are excluded from the analyses.
[22] Water Quality Data flagged as False Positive (FP), Invalid (IV), or Questionable (QQ) are excluded from the analysis. Water Quality Data outside the desired time frame are also excluded.
[23] WQIr is a tool that the State Water Board has utilized for decades to determine whether a sampling location is being tested for constituents at the required frequency as specified by regulation.

c. Detection Limits for purposes of Reporting (DLR)
d. Notification Levels (NL)

Analyte names and codes for the contaminants of interest per contaminant category in SDWIS are listed in Table 5, Table 6, and Table 7.

Acute Contaminants[24]

Table 5: Acute Contaminants with a Primary MCL[25]

Contaminant	SDWIS Analyte Code
Nitrate	1040
Nitrate-Nitrite	1038
Nitrite	1041
Perchlorate	1039
Chlorite	1009
Chlorine Dioxide	1008

Non-Acute Primary Contaminants

Table 6: Non-Acute Contaminants with a Primary MCL

Contaminant	SDWIS Analyte Code
Aluminum	1002
Antimony, Total	1074
Arsenic	1005
Asbestos	1094
Barium	1010
Beryllium	1075
Cadmium	1015
Chromium, Total	1020
Cyanide	1024
Fluoride	1025
Mercury	1035
Nickel	1036
Selenium	1045
Thallium, Total	1085
Benzene	2990

[24] CCR section 64400 Acute Risk means the potential for a contaminant or disinfectant residual to cause acute health effects, *i.e.,* death, damage or illness, as a result of a single period of exposure of a duration measured in seconds, minutes, hours, or days.
[25] Acute contaminants were selected referring to CCR section 64463.1. Tier 1 Public Notice.

Contaminant	SDWIS Analyte Code
Carbon Tetrachloride	2982
O-Dichlorobenzene	2968
P-Dichlorobenzene	2969
1,1-Dichloroethane	2978
1,2-Dichloroethane	2980
1,1-Dichloroethylene	2977
cis-1,2-Dichloroethylene	2380
trans-1,2-Dichloroethylene	2979
Dichloromethane	2964
1,2-Dichloropropane	2983
1,3-Dichloropropene	2413
Ethylbenzene	2992
Methyl-tert-butyl ether	2251
Chlorobenzene	2989
Styrene	2996
1,1,2,2-Tetrachloroethane	2988
Tetrachloroethylene	2987
Toluene	2991
1,2,4-Trichlorobenzene	2378
1,1,1-Trichloroethane	2981
1,1,2-Trichloroethane	2985
Trichloroethylene	2984
Trichlorofluoromethane	2218
Vinyl Chloride	2976
Xylenes, Total	2955
Lasso (Alachlor)	2051
Atrazine	2050
Bentazon	2625
Benzo(a)pyrene	2306
Carbofuran	2046
Chlordane	2959
2,4-D	2105
Dalapon	2031
1,2-dibromo-3-chloropropane	2931
Di(2-ethylhexyl)adipate	2035
Di(2-ethylhexyl)phthalate	2039
Dinoseb	2041

Contaminant	SDWIS Analyte Code
Diquat	2032
Endothall	2033
Endrin	2005
Ethylene Dibromide	2946
Glyphosate	2034
Heptachlor	2065
Heptachlor Epoxide	2067
Hexachlorobenzene	2274
Hexachlorocyclopentadiene	2042
BHC-GAMMA	2010
Methoxychlor	2015
Molinate	2626
Oxamyl	2036
Pentachlorophenol	2326
Picloram	2040
Total Polychlorinated Biphenyls (PCB)	2383
Simazine	2037
Thiobencarb (Bolero)	2727
Toxaphene	2020
1,2,3-Trichloropropane	2414
2,3,7,8-TCDD	2063
2,4,5-TP	2110
Combined Radium (–228 & –226)	4010
Gross Alpha particle Activity	4109
Combined Uranium	4006
Gross Beta particle activity	4100
38-Strontium-90	4174
Tritium	4102

Secondary Contaminants

Table 7: Contaminants that have a Secondary MCL*

Contaminant	SDWIS Analyte Code
Aluminum	1002
Color	1905
Copper, Free	1022
Foaming Agent (Surfactants)	2905

Contaminant	SDWIS Analyte Code
Iron	1028
Manganese	1032
Methyl-tert-butyl ether	2251
Odor	1920
Silver	1050
Thiobencarb (Bolero)	2727
Turbidity	0100
Turbidity, Field	C254
Zinc	1095

**Total Dissolved Solids, Specific Conductance, Chloride, and Sulfate are excluded.*

Prepare Primary and Secondary Data:

Compliance for non-acute contaminants is typically based on calculations of the Running Annual Average (RAA) because they are focused on long-term health risks over time. Therefore, to assess the risk for potential failure of a maximum contaminant level for non-acute primary and secondary contaminants, calculations of the RAAs are needed.

Below is how the Running Annual Average is calculated for the purposes of the Needs Assessment:

- Step 1: Calculate RAA for each sample point.
  - Define a search period that eligible sample results dates must occur in.
  - Calculate all quarters between the start and end date of the search period as shown in the example below.
    - Start Date: 1/1/2012 - End Date: 1/1/2021
    - Number of Years: 9 Years = 36 Quarters

    (2012-Quarter 1, 2012-Quarter 2, 2012-Quarter 3, 2012-Quarter 4, 2013-Quarter 1, *etc.*)
  - For every sample result date, determine what quarter it falls in and assign that sample result value. If there are multiple sample result dates within a quarter, the sample results will be averaged, ensuring that only one sample result value per quarter is used.

- Step 2: Calculate RAA Periods.
  - Average four consecutive quarters of data as shown in the example below:
    (2012-Quarter 2 + 2012-Quarter 3 + 2012-Quarter4 + 2013-Quarter 1) / 4
  - Some water systems may not have four quarters of data in every RAA period. Therefore, the number of quarters used in each RAA calculation is based on the data available during that RAA period. For example, if only three quarters of data are available during a particular RAA period, only those three quarters will be used to calculate the RAA as shown below:

    (2012-Quarter 1 + MISSING + 2012-Quarter 3 + 2012-Quarter 4) / 3

Threshold Determination
The increasing presence of water quality trends toward an MCL, as defined here or a similar measure, has not been assessed in other previous studies as related to water system failure or employed by other regulatory agencies or stakeholders as a threshold of concern. The State Water Board's workgroup of District Engineers determined the draft tiered thresholds for this risk indicator based on their experience working with water systems throughout the state. These draft thresholds were shared with the public through workshops and white papers in 2020 and 2021 and ultimately incorporated into the Risk Assessment.

Contaminant Group Thresholds
The first step in this analysis involves analyzing historical water quality sample results (up to 9 years) for each system's active sources. Water quality data is analyzed by three contaminant groups: secondary contaminants, primary non-acute contaminants, and primary acute contaminants. The analysis uses the thresholds described in Table 8 to determine if any of the system's active sources may be experiencing declining water quality. For each source, the analysis identifies the highest threshold met if the source meets more than one contaminant group threshold.

Table 8: "Increasing Presence of Water Quality Trends Toward MCL" Contaminant Group Thresholds

Threshold Number	Threshold
1	**Secondary Contaminants**: 9-year average of running annual averages is at or greater than 80% of MCL and the running annual average has increased by 20% or more.
2	**Primary Non-Acute Contaminants**: 9-year average of running annual averages is at or greater than 80% of MCL and the running annual average has increased by 5% or more.
3	**Acute Contaminants**: • 9-year average (no running annual average) is at or greater than 80% of MCL; or • Most recent 24-month average is at or greater than 80% of MCL; or • Any one sample exceeds the MCL.

Percentage of Source Impairment Threshold
The analysis then determines if 25% or more of the water system's sources meet the contaminant group thresholds. If less than 25% of the system's sources meet the contaminant group thresholds, the water system will receive zero risk points for this risk indicator. If 25% or more of the system's sources exceed any of the contaminant group thresholds, it will receive risk points. Table 9 provides an example of how this determination is made.

Table 9: Example of 25% or Greater Source Impairment Threshold Determination for a System with 6 Sources

Source	Threshold Exceedance	Contaminant Group	Impaired (Y/N)	Impaired Count
Well 01	9-year Average ≥ 80% MCL	Acute	Yes	1
Well 02	24-month Average ≥ 80% MCL	Acute	Yes	1
Well 03	24-month Average ≥ 80% MCL	Acute	Yes	1
Well 04	9-year Average ≥ 80% MCL	Secondary	Yes	1
Well 05	9-year Average ≥ 80% MCL	Non-Acute	Yes	1
Well 06	Below thresholds	N/A	No	0

Determining if the 25% threshold is met across the system's 6 active sources:

- # of impaired Source Water Facilities = 5
- Total Number of Source Water Facilities = 6
- (5/6) x 100 = 83.33%
- 83.33% > 25% = system will accrue risk points

Risk Indicator Scoring & Weighting

To determine the risk score for this indicator, each active source that meets one or more of the contaminant group thresholds will be assigned a risk score (Table 10). If a source meets more than one contaminant group threshold, the highest applicable risk score will be used. See the example in Table 11.

Table 10: "Increasing Presence of Water Quality Trends Toward MCL" Scores Per Source

Threshold Number	Contaminant Group	Score per Source
1	**Secondary Contaminants**	0.25
2	**Primary Non-Acute Contaminants**	0.5
3	**Acute Contaminants**	1

Table 11: Example of Selection of Max Score per Source

	Source #1	Source #2	Source #3	Source #4	Source #5	Source #6
Acute Risk Score	1.0	1.0	1.0	0	0	0
Non-Acute Risk Score	0.5	0.5	0.5	0.5	0	0
Secondary Risk Score	0	0	0.25	0.25	0.25	0
Max Score Per Source	**1**	**1**	**1**	**0.5**	**0.25**	**0**

After selecting the maximum score for each source, an average of all the non-zero risk scores is calculated. See Equation 1 for an example of this calculation.

Equation 1: Example Calculation of Average Risk Score for Increasing Presence of Water Quality Trends Toward MCL Risk Indicator

$$\text{Average Risk Score} = \frac{\text{Max Risk Score Source 1} + \text{Max Risk Score Source 2} + \text{Max Risk Score Source 3} + \text{Max Risk Score Source 4} + \text{Max Risk Score Source 5}}{\text{Number of Sources with Non-Zero Risk Score}}$$

$$\text{Average Risk Score} = \frac{1 + 1 + 1 + 0.5 + 0.25}{5} = \frac{3.75}{5} = \mathbf{0.75}$$

Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on feedback from the State Water Board's internal stakeholder group, a weight of 2 is applied to the "Increasing Presence of Water Quality Trends Toward MCL" risk indicator. Therefore, the minimum risk score for this indicator is 0 and the maximum risk score is 2. Table 12 summarizes the total risk score ranges and weights applied to this risk indicator.

Table 12: "Increasing Presence of Water Quality Trends Toward MCL" Total Risk Score Ranges & Weights

Total Score Range	Weight	Max Risk Score	Risk Level
0	0	0	None
$0 < n \leq 0.5$	2	1	Medium
$0.5 < n \leq 1$	2	2	High

TREATMENT TECHNIQUE VIOLATIONS

According to federal and state regulations, systems must carry out specified treatment when there is no reliable or feasible method to measure the concentration of a contaminant to determine if there is a public health concern. A treatment technique is an enforceable procedure or level of technological performance standard, which public water systems must follow to ensure control of a contaminant. The treatment technique rules also specify the best available technology for meeting the standard, and the compliance technologies available for small systems. Some examples of treatment technique rules include the following:

- Surface Water Treatment Rule[26] (disinfection and filtration)

[26] Title 22 CCR, Division. 4, Chapter 17 Surface Water Treatment https://govt.westlaw.com/calregs/Browse/Home/California/CaliforniaCodeofRegulations?guid=I7CCE68605B6111EC9451000D3A7C4BC3&originationContext=documenttoc&transitionType=Default&contextData=(sc.Default)

- Ground Water Rule[27]
- Lead and Copper Rule (optimized corrosion control)
- Acrylamide and Epichlorohydrin Rules (purity of treatment chemicals)

This type of violation (which is distinct from more commonly known MCL or monitoring and reporting violations) is incurred when a water system does not follow required treatment techniques to reduce the risk from contaminants, *e.g.,* exceeding the maximum allowable turbidity or flow rate of a surface water treatment plant.

Calculation Methodology
Required Risk Indicator Data Points & Sources:

- Treatment Technique violations: SDWIS

Table 13: Treatment Technique Violation Codes

Violation Type Code	SDWIS Violation Name
07	Treatment Techniques (Other)
33	Failure to Submit Treatment Requirement Report
37	Treatment Tech. No Prior State Approval
40	Treatment Technique (FBRR)
41	Failure to Maintain Microbial Treatment
42	Failure to Provide Treatment
43	Single Turbidity Exceed (Enhanced SWTR)
44	Monthly Turbidity Exceed (Enhanced SWTR)
45	Failure to Address a Deficiency
46	Treatment Technique Precursor Removal
47	Treatment Technique Uncovered Reservoir
48	Failure to Address Contamination
57	OCCT/SOWT Recommendation
58	OCCT/SOWT Install Demonstration
59	WQP Level Non-Compliance
63	MPL Level Non-Compliance
64	Lead Service Line Replacement (LSLR)
65	Public Education
2A	Level 1 Assessment Treatment Technique
2B	Level 2 Assessment Treatment Technique
2C	Corrective Actions/Expedited Actions TT

[27] Title 22 CCR, Division 4, Chapter 15, Article 3.5 Groundwater Rule
https://govt.westlaw.com/calregs/Browse/Home/California/CaliforniaCodeofRegulations?guid=I78BB03005B6111EC9451000D3A7C4BC3&originationContext=documenttoc&transitionType=Default&contextData=(sc.Default)

Violation Type Code	SDWIS Violation Name
2D	Start-up Procedures Treatment Technique
T1	State Violation-Treatment Technique

Risk Indicator Calculation Methodology:

- Determine which systems have had one or more Treatment Technique violations within the last three years, using the Treatment Technique violation codes listed in Table 13, while excluding the following scenarios:
  - Systems with an open Enforcement Action are excluded from the Risk Assessment because they meet the criteria for the expanded Failing list.
  - Systems that have had three or more Treatment Technique violations within the last three years are also excluded from the Risk Assessment because they meet the criteria for the Failing list.

Threshold Determination

The State Water Board has developed a threshold for Treatment Technique violations (in lieu of an MCL) for the expanded Failing list criteria that relies on: (1) whether the water system has an open enforcement action for the violation or (2) the system has had three or more Treatment Technique violations in the past three years.[28] For the Risk Assessment, a modified version of the expanded Failing list criteria threshold was developed for the "Treatment Technique Violations" risk indicator. Systems that have one or more treatment technique violations within the last three years are considered more at risk than systems that have not.

Correlational and regression analysis between the risk indicator as defined by this threshold and water system failure to deliver safe drinking water as defined in the Failing list shows a statistically significant relationship.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Public feedback during the Risk Assessment methodology development process indicated that some risk indicators should be weighted higher than others because they may be more "critical" as they relate to a water system's ability to stay in compliance. Risk indicator weights between 1 and 3 were applied to individual risk indicators. Based on feedback from the State Water Board's engineers, the minimum weight of 1 is applied to the "Treatment Technique Violations" risk indicator. Therefore, the minimum risk score is 0 and the maximum risk score is 1. Table 14 summarizes the thresholds, scores, and weight for this risk indicator.

Table 14: "Treatment Technique Violations" Thresholds, Scores & Weights

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
0	**0** Treatment Technique violations over the last three years.	0	N/A	0	None

[28] Systems that meet the Failing criteria will not be included in the Risk Assessment.

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
1	**1 or more** Treatment Technique violations over the last three years.	1	1	1	High

PAST PRESENCE ON THE FAILING LIST

This indicator reflects past presence on the Failing list within the last three years. The expanded Failing list includes systems that have an open enforcement action for a primary MCL violation, secondary MCL violation, *E. coli* violation, source capacity violation, and monitoring and reporting violation (15 months or more), a current treatment technique violation, and/or systems that have had three or more treatment technique violations in the past 3 years. A system is removed from the Failing list after it has come back into compliance and a return to compliance enforcement action has been issued and/or the system has less than three treatment technique violations or monitoring and reporting violations over the last three years.

Calculation Methodology

Required Risk Indicator Data Point & Source:

- Violation Data: SDWIS
- Enforcement Action Data: SDWIS

Refer to the State Water Board's Failing water system website[29] for detailed criteria and methodology for the Failing list.

Important Note: In 2021, the State Water Board corrected the historical Failing list using a new and improved query methodology to analyze historical violation and enforcement data. This allowed for a better identification of the start and end dates for Failing list occurrences.

Threshold Determination

Peer-reviewed studies suggest that past presence of drinking water quality violations is associated with subsequent present-day violations.[30] Therefore, tiered thresholds were developed, with more occurrences on the Failing list resulting in a higher risk score.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Public feedback during the Risk Assessment methodology development process indicated that some risk indicators should be

[29] Human Right to Water | California State Water Resources Control Board https://www.waterboards.ca.gov/water_issues/programs/hr2w/

[30] See McDonald, Yolanda J., and Nicole E. Jones. "Drinking water violations and environmental justice in the United States, 2011–2015." *American journal of public health* 108.10 (2018): 1401-1407. https://pubmed.ncbi.nlm.nih.gov/30138072/

weighted higher than others because they may be more "critical" as they relate to a water system's ability to stay in compliance. Risk indicator weights between 1 and 3 were applied to individual risk indicators. Based on feedback from the State Water Board's District Engineers, a weight of 2 is applied to the "Past Presence on the Failing List" risk indicator. Therefore, the minimum risk score is 0 and the maximum risk score is 2. Table 15 summarizes the thresholds, scores, and weight for this risk indicator.

Table 15: "Past Presence on the Failing List" Thresholds, Scores & Weights

Threshold Number	Threshold	Score	Weight	Max Score	Risk Level
0	**0** Failing list occurrence over the last three years.	0	N/A	0	None
1	**1** Failing list occurrence over the last three years.	0.5	2	1	Medium
2	**2 or more** Failing list occurrences over the last three years.	1	2	2	High

PERCENTAGE OF SOURCES EXCEEDING AN MCL

This indicator reflects the percentage of sources that exceeded any primary drinking water MCL within the past three years. Water systems with impaired water sources make it more difficult to provide safe drinking water, particularly in the event of a drought or treatment failure.

Calculation Methodology

Required Risk Indicator Data Points & Sources:

- Dataset - SDWIS:
  - Data Point(s) - Water System Inventory
    - Active Source Water Facilities including[31]
      a. Consecutive Connection (CC)
      b. Infiltration Gallery (IG)
      c. Intake (IN)
      d. Roof Catchment (RC)
      e. Spring (SP)
      f. Well (WL)
    - Active Water System Sampling Points for the above Source Water Facilities[32]
  - Data point(s) - Water System Water Quality[33]
    - Water Quality Monitoring Sample Results and Dates for the above sample points.
    - Water Quality Contaminants for Sample Results for the above sample points.

[31] Source Water Facility Types not included in the list is excluded from analysis (ex. hauled water).
[32] Source Water Facility types with no active sample points are excluded from analyses.
[33] Water Quality Data that is flagged as False Positive (FP), Invalid (IV), or Questionable (QQ) are excluded from the analysis. Water Quality Data that was also outside of the desired time frame are excluded.

a. List of eligible contaminants described below in Table 16.

- Dataset – Water Quality Inquiry Revised (WQIr):
  - Data point(s) for Contaminant Information:
    - Regulatory threshold information including:
      a. Maximum Contaminant Levels (MCL)
      b. Detection Limits for purposes of Reporting (DLR)
      c. Notification Levels (NL)

Table 16: Analytes in WQIR Chemical Table

Analyte Name	SDWIS Analyte Code
1,1,1-Trichloroethane	2981
1,1,2,2-Tetrachloroethane	2988
Trichlorofluoromethane	2218
1,1,2-Trichloroethane	2985
1,1-Dichloroethane	2978
1,1-Dichloroethylene	2977
1,2,3-Trichloropropane	2414
1,2,4-Trichlorobenzene	2378
O-Dichlorobenzene	2968
1,2-Dichloroethane	2980
1,2-Dichloropropane	2983
1,3-Dichloropropene	2413
P-Dichlorobenzene	2969
2,3,7,8-TCDD	2063
2,4,5-TP	2110
2,4-D	2105
Lasso (Alachlor)	2051
Aluminum	1002
Antimony, Total	1074
Arsenic	1005
Asbestos	1094
Atrazine	2050
Barium	1010
Bentazon	2625
Benzene	2990
Benzo(a)pyrene	2306
Beryllium, Total	1075
Bromate	1011
Cadmium	1015
Carbofuran	2046
Carbon Tetrachloride	2982
Chlordane	2959
Chlorite	1009

Analyte Name	SDWIS Analyte Code
Chromium (Total)	1020
CIS-1,2-Dichloroethylene	2380
CIS-1,3-Dichloropropene	2228
Combined Radium (-226 & -228)	4010
Cyanide	1024
Dalapon	2031
Di(2-Ethylhexyl) Phthalate	2039
1,2-Dibromo-3-Chloropropane	2931
Dichloromethane	2964
Dinoseb	2041
Diquat	2032
Endothall	2033
Endrin	2005
Ethylbenzene	2992
Ethylene Dibromide	2946
Fluoride	1025
Glyphosate	2034
Gross Alpha Particle Activity	4109
Gross Beta Particle Activity	4100
Total Haloacetic Acids (HAA5)	2456
Heptachlor	2065
Heptachlor Epoxide	2067
Hexachlororobenzene	2274
Hexachlorocyclopentadiene	2042
BHC-Gamma	2010
Manganese, Dissolved	1034
Mercury	1035
Methoxychlor	2015
Methyl-tert-butyl ether	2251
Molinate	2626
Chlorobenzene	2989
Nickel	1036
Nitrate	1040
Nitrate-Nitrite	1038
Nitrite	1041
Oxamyl	2036
Pentachlorophenol	2326
Perchlorate	1039
Picloram	2040
Total Polychlorinated Biphenyls (PCB)	2383
Selenium	1045
Simazine	2037

Analyte Name	SDWIS Analyte Code
38-Strontium-90	4174
Styrene	2996
Tetrachloroethylene	2987
Thallium, Total	1085
Thiobencarb (Bolero)	2727
Toluene	2991
Trihalomethanes (TTHM)	2950
Toxaphene	2020
Trans-1,2-Dichloroethylene	2979
Trans-1,3-Dicholropropene	2224
Tricholoroethylene	2984
Trichlorofluoromethane	2218
Tritium	4102
Combined Uranium	4006
Vinyl Chloride	2976
Xylenes, Total	2955

Risk Indicator Calculation Methodology:

- Determine the number of impaired sources. Impaired sources are sources with any sample results above their respective MCL for the chemicals listed above.
- Determine the total number of sources based on the source types listed above.
- Calculate the percentage of impaired sources by dividing the total number of sources with MCL exceedances by the total number of sources and then multiply that number by 100.

Threshold Determination

The percentage of sources exceeding an MCL, as defined here or a similar measure, has not been assessed in other previous studies as related to water system failure or employed by other regulatory agencies or stakeholders as a threshold of concern. However, this lack of precedent likely reflects that this indicator threshold is hard to obtain and analyze without significant expertise and experience with source water quality data and data processing capability. The State Water Board's workgroup of District Engineers determined the draft tiered thresholds for this risk indicator based on their experience working with water systems throughout the state. These draft thresholds were shared with the public in 2020 and ultimately incorporated into the Risk Assessment.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Public feedback during the Risk Assessment methodology development process indicated that some risk indicators should be weighted higher than others because they may be more "critical" as they relate to a water

system's ability to stay in compliance. Risk indicator weights between 1 and 3 were applied to individual risk indicators. Based on feedback from the State Water Board's engineers, the maximum weight of 3 is applied to the "Percentage of Sources Exceeding MCL" risk indicator. Therefore, the minimum risk score is 0 and the maximum risk score is 3. Table 17 summarizes the thresholds, scores, and weight for this risk indicator.

Table 17: "Percentage of Sources Exceeding an MCL" Thresholds, Scores & Weights

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
0	**Less than 50%** of sources exceed an MCL.	0	N/A	0	None
1	**50% or greater** of sources exceed an MCL.	1	3	3	High

CONSTITUENTS OF EMERGING CONCERN

Constituents of emerging concern (CEC) are unregulated chemicals[34] that are potentially imposing adverse health effects and are likely present (*i.e.*, known or anticipated to occur) at public water systems or in groundwater sources. The purpose of this risk indicator is to identify water systems that could potentially come out of compliance if certain constituents of emerging concern (CECs) were to be regulated by a primary and/or secondary maximum contaminant level (MCL).

While there are many CECs, the State Water Board is proposing a limited list of CECs for inclusion in the calculation of this risk indicator based on the likelihood that a MCL will be developed. This risk indicator would only assess water systems that have water quality sample results associated with hexavalent chromium (CrVI), 1,4-dioxane, and/or the 18 chemicals pertaining to per- and polyfluoroalkyl substances (PFAS) chemical group. The selection of these chemicals was influenced by monitoring data coverage and current regulatory priorities. More chemicals may be included in future iterations of the Risk Assessment.

Hexavalent chromium (CrVI): Chromium is a heavy metal that occurs throughout the environment. The trivalent form is a required nutrient and has very low toxicity. The hexavalent form, also commonly known as Chromium-6, is more toxic and has been known to cause cancer when inhaled. In recent scientific studies in laboratory animals, CrVI has also been linked to cancer when ingested. Much of the low level CrVI found in drinking water is naturally occurring, reflecting its presence in geological formations throughout the state. However, there are areas of contamination in California from historic industrial use, such as the manufacturing of textile dyes, wood preservation, leather tanning, and anti-corrosion coatings, where CrVI contaminated waste has migrated into the underlying groundwater.

1,4-Dioxane: 1,4-dioxane has been used as a solvent and stabilizer for other solvents in a number of industrial and commercial applications. In 1988, 1,4-dioxane was added

[34] Chemicals that are not regulated by the National/State Primary & Secondary Drinking Water Regulations.

to the list of chemicals known to the state to cause cancer[35] and is also considered to pose a cancer risk by U.S. EPA. Over the past decade, 1,4-dioxane has been found in a number of wells, mostly in southern California. The drinking water notification level for 1,4-dioxane is 1 microgram per liter (µg/L). More information can be found on the State Water Board webpage.[36]

Per- and polyfluoroalkyl substances (PFAS): PFAS are a large group of synthetic fluorinated chemicals widely used in industrial processes and consumer products. These synthetic compounds are very persistent in the environment. People are exposed to these compounds through food, food packaging, textiles, electronics, personal hygiene products, consumer products, air, soil, and drinking water. PFAS contamination is typically localized and associated with an industrial facility that manufactured these chemicals or an airfield at which they were used. Studies indicate that continued exposure to low levels of PFAS may result in adverse health effects.

Calculation Methodology

Important Note: *In 2023 the State Water Board adjusted the calculation of this risk indicator from the approach used in the 2022 Needs Assessment. The update adjusted the accounting of how impaired source thresholds are determined. Rather than assessing water quality source risk per* emerging contaminant *individually (*CrVI, 1,4-Dioxane, or PFAS*), it is now done across all contaminants simultaneously. This improves the identification of water systems that are experiencing trends towards MCL in more than 25% of their sources regardless of which contaminant is exceeding a threshold.*

Required Risk Indicator Data Points & Sources:

- Dataset - SDWIS:
  - Data Point(s) - Water System Inventory
    - Active Source Water Facilities Including[37]
      a. Consecutive Connection (CC)
      b. Infiltration Gallery (IG)
      c. Intake (IN)
      d. Roof Catchment (RC)
      e. Spring (SP)
      f. Well (WL)
    - Active Water System Sampling Points for the above Source Water Facilities[38]
  - Data Point(s) - Water System Water Quality[39]
    - Water Quality Monitoring Sample Results and Dates for the above sample points.
    - Water Quality Contaminants for Sample Results for the above sample points.
      a. Eligible contaminants listed in Table 18

[35] Office of Environmental Health Hazard Assessment - Proposition 65: https://oehha.ca.gov/proposition-65
[36] California State Water Resources Control Board - 1,4-Dioxane https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/14-Dioxane.html
[37] Source Water Facility Types not included in the list are excluded from analysis (*e.g.*, hauled water)
[38] Source Water Facility Types with no active sample points are excluded from analyses.
[39] Water Quality Data that is flagged as False Positive (FP), Invalid (IV), or Questionable (QQ) are excluded from the analysis. Water Quality Data that was also outside of the desired time frame are excluded.

- Dataset – Water Quality Inquiry Revised (WQIr):
  - Data point(s) for Contaminant Information
    - Regulatory thresholds information including
      a. Maximum Contaminant Levels (MCL)
      b. Detection Limits for purposes of Reporting (DLR)
      c. Notification Levels (NL)

Analyte names and codes for the contaminants of interest in SDWIS are listed in Table 18: Analyte Names and Codes for CrVI, 1,4-Dioxane & PFAS.

Table 18: Analyte Names and Codes for CrVI, 1,4-Dioxane & PFAS

Analyte Name	SDWIS Analyte Code
Hexavalent Chromium (CrVI)	1080
1,4-Dioxane	2049
Per- and polyfluoroalkyl substances (PFAS)	
Perfluorobutanesulfonic Acid (PFBS)	2801
Perfluoroheptanoic Acid (PFHpA)	2802
Perfluorohexane Sulfonic Acid (PFHxS)	2803
Perfluorononanoic Acid (PFNA)	2804
Perfluoroctane Sulfonic Acid (PFOS)	2805
Perfluoroctanoic Acid (PFOA)	2806
Perfluorodecanoic Acid (PFDA)	2807
Perfluorododecanoic Acid (PFDoA)	2808
Perfluorohexanoic Acid (PFHxA)	2809
Perfluorotetradecanoic Acid (PFTA)	2810
Perfluorotridecanoic Acid (PFTrDA)	2811
Perfluoroundecanoic Acid (PFUnA)	2812
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	2813
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	2814
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	2815
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	2816
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	2817
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	2818

Risk Indicator Calculation Methodology:

Compliance for non-acute contaminants is typically based on calculations of the Running Annual Average (RAA) because they are focused on long-term health risks over time. Therefore, to assess risk for potential failure of a maximum contaminant for non-acute primary and secondary contaminants, RAAs are needed.

Below is how the Running Annual Average is calculated for the purposes of the Needs Assessment:

Prepare CrVI Data:

- Step 1: Calculate RAA for each sample point.
  - Define a search period that eligible sample results dates must occur in.
  - Calculate all quarters between the start and end date of the search period as shown in the example below:
    - Start Date: 1/1/2012 - End Date: 1/1/2021
    - Number of Years: 9 Years = 36 Quarters

    (2012-Quarter 1, 2012-Quarter 2, 2012-Quarter 3, 2012-Quarter 4, 2013-Quarter 1, *etc.*)
  - For every sample result date, determine what quarter it falls in and assign that sample result value. If there are multiple sample result dates within a quarter, the sample results will be averaged, ensuring that only one sample result value per quarter is used.

- Step 2: Calculate RAA Periods.
  - Average four consecutive quarters of data as shown in the example below:
    (2012-Quarter 2 + 2012-Quarter 3 + 2012-Quarter 4 + 2013-Quarter 1) / 4
  - Some water systems may not have four quarters of data in every RAA period. Therefore, the number of quarters used in each RAA calculation is based on the data available during that RAA period. For example, if only three quarters of data are available during a particular RAA period, only those three quarters will be used to calculate the RAA as shown below.
    (2012- Quarter 1 + MISSING + 2012- Quarter 3 + 2012- Quarter 4) / 3

Prepare PFAS Data:

- Define a search period that eligible sample results dates must occur in.
- Count the number of positive sample results (*i.e.,* greater than detection limit) per PFAS chemical results during the search period for each water system.
- Count sample results above the Notification Level (NL) for chemicals that have an NL during the search period for each water system.
- Count the total number of positive sample results (greater than detection limit) over the search period for each water.

Table 19: PFAS Notification Levels

Analyte Name	Notification Level (NL)
PFOS	0.0065 µg/L
PFOA	0.0051 µg/L
PFBS	0.5 µg/L
PFHxS	3 ng/L

Prepare 1,4-Dioxane Data:

- Step 1: Calculate RAA for each sample point.
  - Define a search period that eligible sample results dates must occur in.
  - Calculate all quarters between the start and end date of the search period as shown in the example below:
    - Start Date: 1/1/2012 - End Date: 1/1/2021
    - Number of Years: 9 Years = 36 Quarters

    (2012-Quarter 1, 2012-Quarter 2, 2012-Quarter 3, 2012-Quarter 4, 2013-Quarter 1, *etc.*)
  - For every sample result date, determine what quarter it falls in and assign that sample result value. If there are multiple sample result dates within a quarter, the sample results will be averaged, ensuring that only one sample result value per quarter is used.

- Step 2: Calculate RAA Periods.
  - Average four consecutive quarters of data as shown in the example below:
    (2012-Quarter 2 + 2012-Quarter 3 + 2012-Quarter 4 + 2013-Quarter 1) / 4
  - Some water systems may not have four quarters of data in every RAA period. Therefore, the number of quarters used in each RAA calculation is based on the data available during that RAA period. For example, if only three quarters of data are available during a particular RAA period, only those three quarters will be used to calculate the RAA as shown below.
    (2012-Quarter 1 + MISSING + 2012-Quarter 3 + 2012-Quarter 4) / 3

Threshold Determination

CrVI: On July 1, 2014, an MCL of 10 µg/L CrVI was approved by the Office of Administrative Law. On May 31, 2017, the Superior Court of Sacramento County issued a judgment invalidating the MCL, stating that the state had not properly considered the economic feasibility of complying with the regulation. Until the rulemaking to establish a new MCL[40] becomes effective, the previous MCL was used as part of a tiered threshold for CrVI . A new MCL became effective on October 1, 2024; however, the new MCL value remains the same as the previous one, Therefore, 10 µg/L CrVI MCL continues to be used for this indicator. Water systems with one or more RAA over 5-year period are

[40] Hexavalent Chromium Drinking Water MCL
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Chromium6.html

at or above 80% of the MCL are considered medium risk, and any RAA over a 5-year at or above the MCL is considered high risk.

PFAS: Due to the ubiquitous nature of these contaminants, two positive samples are suggested as part of the tiered threshold to ensure that the water quality sample was not compromised. Since the risk related to each of the PFAS chemicals is not fully known, water quality is noted as a medium risk for any two positive samples of any PFAS contaminant. Three of the 18 PFAS chemicals have a notification level.[41] When two or more samples for these three PFAS chemicals are at or above their notification levels, they are considered to be at high risk for this indicator threshold.

1,4-Dioxane: The State Water Board is recommending a binary threshold for 1,4-Dioxane. The drinking water notification level for 1,4-dioxane is 1 microgram per liter (µg/L).[42] In January 2019, the State Water Board requested OEHHA to establish a public health goal for 1,4-dioxane.[43] When one or more samples are detected at or above their notification level, they are considered to be at high risk for this indicator threshold.

Contaminants Thresholds

The first step in this analysis involves analyzing historical water quality sample results (up to 5 years) for each system's active sources. Currently, water quality data for this indicator is analyzed across three emerging contaminants: CrVI, PFAS, and 1,4-Dioxane. The analysis utilizes the thresholds described in Table 20 to determine if any of the system's active sources have elevated levels of these CECs. For each source, the analysis identifies the highest threshold met across all contaminants and if the source is meeting more than one threshold (example: a source that has met the threshold 1 for CrVI and threshold 3 for PFAS; the analysis will assign Threshold 3 to the source).

Table 20: "Constituents of Emerging Concern" Thresholds

Threshold Number	Threshold
0	**CrVI: All** calculated RAA(s), over 5-year period, are below 80% of the MCL (RAA < 8 µg/L); and **PFAS: Less than 2** samples, over 5-year period, are positive; and **1,4-Dioxane: 0** calculated RAA(s), over 5-year period, are at or above the notification level.

[41] The State Water Board recognizes that more work is being done in this area and that the presence of any PFAS in drinking water may pose a public health risk. Notification levels are non-regulatory, health-based advisory levels established for contaminants in drinking water for which MCL have not been established. A notification level may be considered a candidate for the establishment of an MCL in the future, but it has not completed going through the regulatory standard setting process.

[42] California State Water Resources Control Board - 1,4-Dioxane
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/14-Dioxane.html

[43] Public Health Goals (PHGs) - OEHHA
https://oehha.ca.gov/water/public-health-goals-phgs

Threshold Number	Threshold
1	**CrVI: 1 or more** calculated RAA(s), over 5-year period, are at or above 80% of the MCL and below the MCL (8 µg/L ≤ RAA < 10 µg/L); or **PFAS: 2 or more** samples, over 5-year period, are positive. This criterion applies to all 18 chemicals.
2	**CrVI: 1 or more** calculated RAA(s), over 5-year period, are at or above the MCL (10 µg/L ≤ RAA); or **PFAS: 2 or more** samples, over 5-year period, are at or above the notification level. This criterion only applies to 3 chemicals that have notification level; or **1,4-Dioxane: 1 or more** calculated RAA(s), over 5-year period, are at or above the notification level (1 µg/L ≤ RAA).

Percentage of Source Impairment Threshold

The analysis determines if 25% or more of the water system's sources meet the contaminant thresholds across all contaminants. If less than 25% of the system's sources meet the contaminant thresholds, the water system will receive zero risk points for this risk indicator. If 25% or more of the system's sources exceed any of the contaminant thresholds across all contaminants, the system will receive risk points. Table 21 provides an example of how this determination is made.

Table 21: Example of 25% or Greater Source Impairment Threshold Determination for a System with 5 Sources

Source	Threshold Exceedance	Contaminant	Impaired	Impaired Count
Well 01	Below thresholds	CrVI, 1,4-Dioxane, PFAS	No	0
Well 02	5-year RAA > 80% MCL	CrVI	Yes	1
Well 03	Below thresholds	CrVI, 1,4-Dioxane, PFAS	No	0
Well 04	Below thresholds	CrVI, 1,4-Dioxane, PFAS	No	0
Well 05	Below thresholds	CrVI, 1,4-Dioxane, PFAS	No	0

In this example, less than 25% of the system's active sources meet the thresholds summarized in Table 20. Therefore, this system would receive no (zero) risk points for this indicator. This occurs because of the following calculation:

- # of impaired Source Water Facilities = 1
- Total Number of Source Water Facilities = 5
- (1/5) x 100 = 20%

To meet the source impairment threshold, a water system must have 25% or more of its sources considered to be impaired.

Risk Indicator Scoring & Weighting

If a water system has more than 25% of its active sources meeting the thresholds in Table 22, the system's risk score for this indicator will be the average of the maximum risk score per source. If a source meets more than one contaminant threshold (example: a source has met threshold 2 for CrVI and threshold 3 for 1,4-Dioxane; the analysis will assign Threshold 3 risk score to the source). See example in Table 23.

Table 22: "Constituents of Emerging Concern" Thresholds & Scores Per Source

Threshold Number	Contaminant Threshold	Score per Source
0	**CrVI: All** calculated RAA(s), over 5-year period, are below 80% of the MCL (RAA < 8 µg/L); and **PFAS: Less than 2** samples, over 5-year period, are positive; and **1,4-Dioxane: 0** calculated RAA(s), over 5-year period, are at or above the notification level.	0
1	**CrVI:** 1 or more calculated RAA(s), over 5-year period, are at or above 80% of the MCL and below the MCL (8 µg/L ≤ RAA < 10 µg/L); or **PFAS:** 2 or more samples, over 5-year period, are positive; this criterion applies to all 18 chemicals.	0.5
2	**CrVI:** 1 or more calculated RAA(s), over 5-year period, are at or above the MCL (10 µg/L ≤ RAA); or **PFAS:** 2 or more samples, over 5-year period, are at or above the notification level; this criterion only applies to 4 chemicals that have notification level; or **1,4-**Dioxane: 1 or more calculated RAA(s), over 5-year period, are at or above the notification level (1 µg/L ≤ RAA).	1

Table 23: Example of Selection of Max Score Per Source

	Well 01	Well 02	Well 03	Well 04	Well 05
CrVI Risk Score	0.5	1	0.5	0	0
PFAS Risk Score	0.5	0.5	1	0.5	0
1,4-Dioxane Risk Score	1	1	1	0	0
Max Score per Source:	**1**	**1**	**1**	**0.5**	**0**

After selecting the maximum score for each source, an average of all the non-zero risk scores is calculated. See Equation 2 for an example of this calculation.

Equation 2: Example Calculation of Average Risk Score for Constituents of Emerging Concern Risk Indicator

$$\text{Average Risk Score} = \frac{\text{Max Risk Score Source 1} + \text{Max Risk Score Source 2} + \text{Max Risk Score Source 3} + \text{Max Risk Score Source 4}}{\text{Number of Sources with Non-Zero Risk Score}}$$

$$\text{Average Risk Score} = \frac{1 + 1 + 1 + 0.5}{4} = \frac{3.5}{4} = \mathbf{0.875}$$

Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on feedback from the State Water Board's engineers, the maximum weight of 3 is applied to the "Constituents of Emerging Concern" risk indicator. Therefore, the minimum risk score for this indicator is 0 and the maximum risk score is 3. Table 24 summarizes the total risk score ranges and weights applied to this risk indicator.

Table 24: "Constituents of Emerging Concern" Total Risk Score Ranges & Weights

Total Score Range	Weight	Max Risk Score	Risk Level
0	0	0	None
$0 < n \leq 0.5$	3	1.5	Medium
$0.5 < n \leq 1$	3	3	High

ACCESSIBILITY RISK INDICATORS

This section provides full details on each Accessibility risk indicator used in the Risk Assessment. Accessibility risk indicators measure a system's ability to deliver safe, sufficient, and continuous drinking water to meet public health needs.

NUMBER OF SOURCES

Total number of available water sources including surface water, wells, and imported or purchased water.

Calculation Methodology
Required Risk Indicator Data Point & Source:

- Water Source Facility Type: SDWIS
  - Consecutive Connection (CC)
  - Infiltration Gallery (IG)
  - Intake (IN)
  - Roof Catchment (RC)
  - Spring (SP)
  - Well (WL)

Risk Indicator Calculation Methodology:

- Prepare data:
  - Combine two SDWIS tables (the Water System table and Water System Facility table).
- Apply filters to prepared data and get counts of the total number of Water System Facilities for each Water System.
  - Filters applied:
    - Active Water Systems Only
    - Active Water System Facilities Only
    - Water System Facilities with a facility type of CC, IG, IN, RC, SP, and WL

Threshold Determination

The threshold developed for the number of sources risk indicator mostly aligns with the thresholds used by DWR's Drought & Water Shortage Risk Assessment. Peer-reviewed studies also suggest that single source reliance is associated with water system failure.[44] Moreover, Section 64554(c) of the California Code of Regulations (CCR) requires new community water systems that use only groundwater sources to have a minimum of two approved sources capable of meeting the maximum day demand of the water system.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Public feedback during the Risk Assessment methodology development process indicated that some risk indicators should be weighted higher than others because they may be more "critical" as they relate to a water system's ability to stay in compliance. Risk indicator weights between 1 and 3 were applied to individual risk indicators. Based on feedback from the State Water Board's engineers, the maximum weight of 3 is applied to the "Number of Sources" risk indicator. Therefore, the minimum risk score is 0 and the maximum risk score is 3. Table 25 summarizes the thresholds, scores, and weight for this risk indicator.

Table 25: "Number of Sources" Thresholds, Scores & Weights

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
X	**0** sources.	Automatically At-Risk	N/A	N/A	Very High
0	**2 or more** sources.	0	N/A	0	None
1	**1** source.	1	3	3	High

ABSENCE OF INTERTIES

An intertie or interconnection is a connection between one or more water systems where systems can either supply or receive water from each other. The presence of interties is

[44] See Mullin, M. (2020). The effects of drinking water service fragmentation on drought-related water security. *Science, 368*(6488), 274-277. https://www.science.org/doi/10.1126/science.aba7353

assumed to reduce the risk of a water outage by allowing water systems to switch sources and even governance structure support, if needed.

Calculation Methodology

Important Note: *In 2022 the State Water Board adjusted the calculation of this risk indicator from the approach used in the 2021 Needs Assessment to account for the inclusion of medium-size water systems that have many sources.*

Required Risk Indicator Data Points & Source:

In SDWIS, this type of data is stored as a water system facility with a consecutive connection designation. Additionally, these types of water system facilities can be described in terms of their availability of use. According to internal SDWIS procedure documents, only the receiving facility should have a consecutive connection (CC) water system facility represented in SDWIS. The procedure document does not indicate whether emergency or seasonal CCs should be entered. The purpose of this metric is to capture the number of interties per water system entered in SDWIS, regardless of availability.

- Water source facility type and availability: SDWIS
  - Consecutive Connection (CC)
    - Availability:
      a. Interim (I)
      b. Emergency (E)
      c. Other (O)
      d. Permanent (P)
      e. Seasonal (S)

Risk Indicator Calculation Methodology:

- Prepare data:
  - Combine two SDWIS tables (the Water System table and Water System Facility table).
- Apply filters to prepared data and get counts for each Water Source Type per Water System.
  - Filters applied:
    - Active Water Systems Only
    - Active Water System Facilities Only
    - Water System Facilities with a facility type of CC

Threshold Determination

Interties can be a critical lifeline for water systems, especially when faced with an emergency. A water system is at a higher risk of failure if their sources were to become contaminated, dry, collapse, or be taken out of service (*e.g.*, for maintenance *etc*.), without an intertie to a nearby system for back-up supply. The State Water Board has adopted a binary threshold for "Absence of Intertie." Water systems without an intertie are assigned risk scores and those

with an intertie receive a risk score of zero. The developed threshold aligns with DWR's Drought & Water Shortage Vulnerability Assessment.[45] All water systems with 10,000 service connections or more and that have more than one source are excluded and risk scores of 0 are assigned. If a water system with 10,000 service connections or more has only one source and it is not an intertie, it receives a risk score of 1. Water systems with 10 or more water sources are also excluded and risk scores of 0 are assigned.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Public feedback during the Risk Assessment methodology development process indicated that some risk indicators should be weighted higher than others because they may be more "critical" as they relate to a water system's ability to stay in compliance. Risk indicator weights between 1 and 3 were applied to individual risk indicators. Based on feedback from the State Water Board's engineers, the minimum weight of 1 is applied to the "Absence of Interties" risk indicator. Therefore, the minimum risk score is 0 and the maximum risk score is 1. Table 26 summarizes the thresholds, scores, and weights for this risk indicator.

Table 26: "Absence of Interties" Thresholds, Scores & Weights

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A	Systems with **10,000** service connections **or greater;** or with **10 or more** water sources	0	N/A	0	None
0	**1 or more** interties.	0	N/A	0	None
1	**0** interties.	1	1	1	High

DWR – DROUGHT & WATER SHORTAGE RISK ASSESSMENT RESULTS

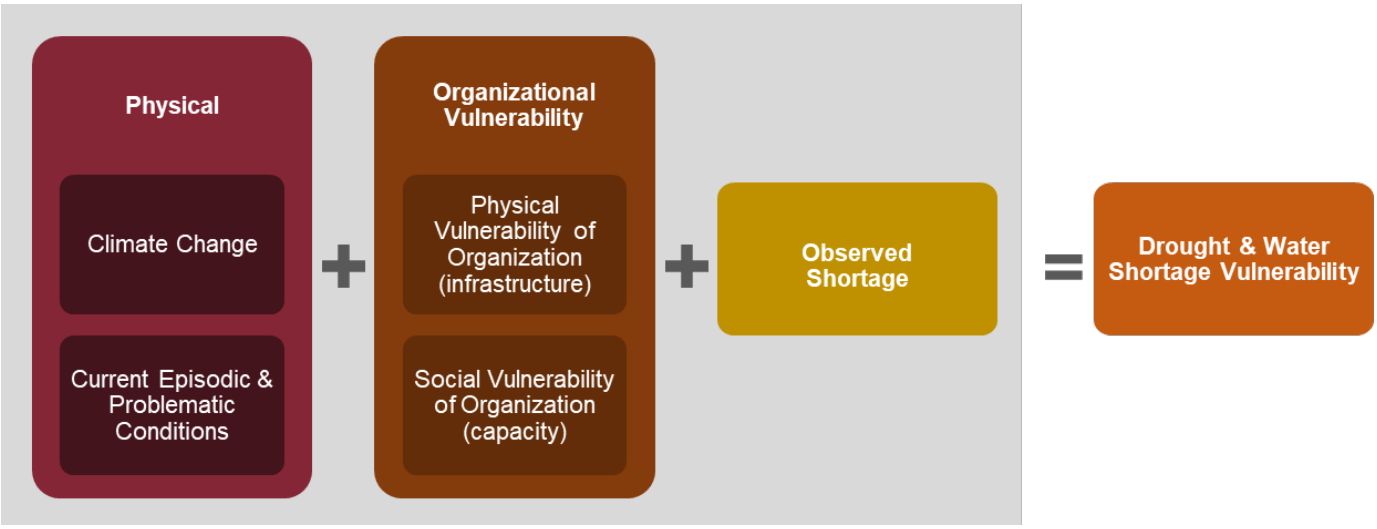
This indicator utilizes DWR's Drought and Water Shortage Risk Scoring Tool[46] results which identify small water suppliers and rural communities (focusing on domestic wells and state small water systems) that are potentially at-risk of drought and vulnerable to water shortages. For this tool, small water suppliers are considered publicly regulated systems with fewer than 3,000 service connections and using fewer than 3,000 acre-feet per year, or otherwise not covered by an urban water management plan. Rural communities are water systems with fewer than 15 service connections, which includes state small water systems (5 to 14 connections), local small water systems (2 to 4 connections), and domestic wells. The output of the analysis is an aggregated, comparable vulnerability score for each water system and separately for each public land survey section (square mile). Both scores of water systems and of rural communities are derived from a set of indicators that capture different dimensions of

[45] 2024 Methods for Small Water System Water Shortage Vulnerability Assessment https://data.cnra.ca.gov/dataset/water-shortage-vulnerability-technical-methods/resource/090baaf3-dc47-4e21-8eba-d9bf499a76a0

[46] DWR Water Shortage Vulnerability Explorer Tool for Small Water Suppliers and Rural Communities: https://experience.arcgis.com/experience/ae1b4e3e41004f07b4901a7a3fa50637/

exposure to projected climate change, episodic and current conditions, including groundwater vulnerabilities, and modelled and observed supply shortages (28 indicators for small water suppliers and 28 indicators for rural communities). For rural communities, a social vulnerability index is provided at the Census Block Group spatial unit level, in addition to the physical vulnerability index.

Figure 8: Grouping of Indicators (Components) Used to Estimate Water Shortage Vulnerability for Small Water Systems



Calculation Methodology

To improve the Water Shortage Vulnerability Assessment, in 2024 DWR updated the 2023 methodology to adjust the scoring to reflect existing knowledge, to align with policy-related research, and to accommodate newer data available. The full overview of changes is available online and summarized below in Table 27.[47]

Table 27: Major Revisions Made to DWR's Water Shortage Vulnerability Assessment for Small Water Systems

Revision Description	2023 Version	2024 Updated Version
Groundwater level indicator improvements (SC2g)	Service area flagged for decreased groundwater level trend from monitoring wells. Did not capture any information about the surrounding areas with monitoring well information in	A new improved indicator developed using 20-year trend information from monitoring wells modelled across nearby area assuming the trend carries over into surround basin area

[47] Technical Methods for the Drought and Water Shortage Vulnerability Assessment Update 2024: California's Small Water Systems
https://data.cnra.ca.gov/dataset/7c8fefef-26fa-44e9-b110-c62c977f2e9a/resource/090baaf3-dc47-4e21-8eba-d9bf499a76a0/download/update-2024-small-water-systems-vulnerability.pdf

Revision Description	2023 Version	2024 Updated Version
	basin areas.	
Replacement of data to represent self-reported shortages (SC5a)	Self-reported through the eAR 2021	Updated to use water system source capacity violations, documented in the SAFER Risk Assessment 2024
Removal of SC5b indicator of past curtailments	Curtailments documented during 2012-2016 drought	Removed indicator
Confidence score created	None	Calculated score of confidence to indicate how many indicators are missing from the water system's vulnerability score.
Total Score Precision	Total Score of the Physical Vulnerability Index reported as number between 0 to 1, with precision of 6 decimal places.	Total Score is reported as a whole number between 0 to 100, to better reflect risk uncertainty.

For the *small water suppliers*, the 28 risk indicators utilized by DWR are weighted and aggregated similar to the approach used in the Risk Assessment. For scoring, the risk indicator variables are rescaled 0-1 numbers (1 is high and 0 is low) and combined with the other variables in their respective component. Individual indicator weights are applied to each variable and then the weighted component scores are aggregated.

Each group of variables is then combined with the other group scores for each component (Exposure, Vulnerability, and Observed Water Shortage). The final score for a water system is calculated with different weights depending on the system's source water composition ("Groundwater Only," "Surface Water Only," or "Both Groundwater and Surface Water"). Finally, the raw risk score from each component is summed and rescaled from 0 to 100 using a min-max scaling technique to calculate the final vulnerability score.

The scoring methods, interactive data explorer tool, and links to the open data downloads for the small water suppliers and rural communities can be found in the DWR Drought and Water Shortage Risk Explorer Tool for Small Water Suppliers and Rural Communities.[48] Additional information is available on the DWR Water Shortage Vulnerability Scoring and Tool website.[49]

Threshold Determination
The State Water Board developed thresholds for this indicator (the top 10% and 25% of

[48] DWR Water Shortage Vulnerability Explorer Tool for Small Water Suppliers and Rural Communities: https://experience.arcgis.com/experience/ae1b4e3e41004f07b4901a7a3fa50637/
[49] Water Shortage Vulnerability Scoring and Tool | DWR https://water.ca.gov/Programs/Water-Use-And-Efficiency/SB-552/SB-552-Tool

systems analyzed) based on the illustrative cutoff provided by DWR in its presentation of Drought & Water Shortage Vulnerability Assessment Results.[50]

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Public feedback during the Risk Assessment methodology development process indicated that some risk indicators should be weighted higher than others because they may be more "critical" as they relate to a water system's ability to stay in compliance. Risk indicator weights between 1 and 3 were applied to individual risk indicators. Based on feedback from the State Water Board's engineers, a weight of 2 is applied to the "DWR Assessment Results" risk indicator. Therefore, the minimum risk score is 0 and the maximum risk score is 2. Table 28 summarizes the thresholds, scores, and weight for this risk indicator.

Table 28: "DWR Assessment Results" Thresholds, Scores & Weights

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A*	**Systems not assessed by DWR**	0	N/A	0	None
0	**Below top 25%** of systems most at risk of drought and water shortage.	0	N/A	0	None
1	**Top 25% or above** but **below top 10%** of systems most at risk of drought and water shortage.	0.25	2	0.5	Low
2	**Top 10%** of systems most at risk of drought and water shortage.	1	2	2	High

**DWR's assessment includes community water systems with fewer than 3,000 service connections and less than 3,000 acre-ft in annual production. Water systems that do not have service area boundaries recorded in the California Drinking Water Systems Area Boundary Layer (SABL)[51] were excluded.*

[50] Small Water Systems and Rural Communities Drought and Water Shortage Contingency Planning and Risk Assessment
https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Water-Use-And-Efficiency/Urban-Water-Use-Efficiency/CDAG/PART-2-CDAG-Report-Final.pdf

[51] California Drinking Water System Area Boundaries
https://gis.data.ca.gov/datasets/fbba842bf134497c9d611ad506ec48cc_0/explore?location=36.912748%2C-119.242341%2C6.67

CRITICALLY OVERDRAFTED GROUNDWATER BASIN

Water systems reliant on groundwater wells in basins considered to be in Critical Overdraft per DWR's California's Groundwater Bulletin 118[52] may be at greater risk of meeting demand, especially during drought conditions. A basin is subject to critical conditions of overdraft when continuation of current water management practices would probably result in significant adverse overdraft-related environmental, social, or economic impacts.

Calculation Methodology

Important Note: *In the 2022 Needs Assessment, the State Water Board adjusted the calculation of this risk indicator from the approach used in the 2021 Needs Assessment to account for the inclusion of medium-size water systems that have many sources.*

Required Risk Indicator Data Points & Sources:

- Sustainable Groundwater Management Act (SGMA) Critically Overdrafted Basins Reference Layer[53]: DWR
- Water System Service Area Boundary Layer (SABL)[54]: State Water Board
- Water Type System Facilities: Safe Drinking Water Information System (SDWIS)[55]

Risk Indicator Methodology:

- Prepare data:
  - **Create System Area Boundary Layer+ (SABL+)**: First water system boundaries from SABL were combined with artificial boundaries for water systems that were included in the Risk Assessment but did not have a known boundary in SABL. Artificial boundaries were generated for the purposes of the Needs Assessment by creating a 0.5-mile buffer around the location of the water system's distribution system facility. The boundaries from SABL joined with the artificial boundaries are referred to as SABL+ and this layer is used in risk indicator calculations that require spatial analysis.
  - **Identify Active Sources**: Filter water system facilities from SDWIS to active source facilities (hereafter known as "active wells" for simplicity) including
    - Consecutive Connection (CC)
    - Infiltration Gallery (IG)
    - Intake (IN)
    - Non-Piped, Purchased (NP)
    - Reservoir (RS)

[52] California's Groundwater (Bulletin 118) https://water.ca.gov/programs/groundwater-management/bulletin-118
[53] SGMA Data Viewer, Critically Overdrafted Basins Reference Layer shapefile, retrieved February 26, 2025 from https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#boundaries
[54] California Drinking Water System Boundaries shapefile available publicly from the State Water Board GIS Portal, retrieved from internal ArcGIS server on February 26, 2025. https://gispublic.waterboards.ca.gov/portal/home/item.html?id=fbba842bf134497c9d611ad506ec48cc
[55] Water system facility information from SDWIS was retrieved via Microsoft SQL Server Management Studio on March 17, 2025.

    - Spring (SP)
    - Well (WL)
  - **Overlay Critically Overdrafted Basins and SABL+**: Intersect water system boundaries from SABL+ with critically overdrafted basin layer from SGMA to identify whether water systems either
    - Fall entirely inside or outside of a critically overdrafted basin, or
    - Overlap a critically overdrafted basin, such that some of the system's wells may fall inside of a critically overdrafted area and others do not.
  - **Find Location of Active Wells**: SDWIS records information about the precise location (latitude and longitude) of most facilities. However, some active wells are missing location information. On the 2025 Risk Assessment, all water systems with missing well locations fell entirely inside or outside of a critically overdrafted basin. Therefore, the coordinates for these wells can be approximated by the location of the water system's distribution system or service address, since all of the system's facilities fall either inside or outside of a critically overdrafted basin.
  - **Overlay Active Groundwater Well Locations and Overdrafted Basins**: Filter active wells to groundwater wells only, having source water type of groundwater (GW) or groundwater under the influence of surface water (GUDI). Intersect active groundwater well locations with the critically overdrafted basin layer from SGMA to identify which groundwater wells fall in areas at risk of critical overdraft.
  - **Calculate Percent of Groundwater Wells in Overdrafted Basins:** Sum up the total number of active groundwater wells for each water system and the number of these wells falling inside of critically overdrafted basins to calculate the percentage of a system's groundwater wells that fall in basins of critical overdraft.

Threshold Determination

In the 2021 Risk Assessment, the State Water Board defined the risk threshold as a water system's service area intersecting at least 75% with a critically overdrafted groundwater basin. However, due to increased data availability of water system well locations and source types, the thresholds for this risk indicator were updated in the 2022 Needs Assessment to reflect the percentage of a water system's groundwater sources within a critically overdrafted groundwater basin. This update was continued for the 2023 Risk Assessment. A binary threshold is still applied: systems with 25% or more of their groundwater sources within a critically overdrafted basin are assigned a risk score of 1, and those with less than 25% of their total sources within a critically overdrafted basin receive a risk score of 0.

Risk Indicator Scoring & Weighting

To evaluate and compare risk indicators, each indicator is assigned a standardized risk score between 0 and 1 based on defined thresholds. During the development of the Risk Assessment methodology, public feedback emphasized that some indicators should carry more weight than others, particularly those considered more "critical" to a water system's ability to maintain compliance. As a result, weighting factors ranging from 1 to 3 were applied to individual indicators. Based on input from State Water Board engineers, the "Critically Overdrafted Groundwater Basin" risk indicator was assigned a weight of 2. This results in a weighted risk score ranging from 0 to 2 for this indicator, where a weighted score of 2 would be given to water systems with more than 25% of groundwater wells within a critically overdrafted

basin (corresponding to an unweighted risk score of 1). Table 29 summarizes the thresholds, scores, and weight for this risk indicator.

Table 29: "Critically Overdrafted Groundwater Basin" Thresholds, Scores & Weights

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A	**Systems with no groundwater sources**	0	N/A	0	None
0	**Less than 25%** of system's groundwater wells are located within a critically overdrafted basin.	0	N/A	0	None
1	**25% or more** of system's groundwater wells are located within a critically overdrafted basin.	1	2	2	High

SOURCE CAPACITY VIOLATIONS

The purpose of this risk indicator is to identify water systems that have violated source capacity standards as required in California Waterworks Standards[56] within the last three years. These violation criteria include:

- Failure to maintain adequate source capacity (may include curtailment order and/or service connection moratorium).
- Failure to maintain adequate pressure leading to a water outage.
- Failure to complete a required source capacity planning study.

The State Water Board developed new source capacity violation codes in 2021 to better track and identify water systems failing to meet source capacity standards. Historically, the State Water Board has responded to source capacity violations with targeted citations, curtailment orders, and service connection moratoriums. Since the new source capacity violations only reflect recent actions, this risk indicator will also include water systems that have had active connection moratoriums within the last three years.

Calculation Methodology

Required Risk Indicator Data Points & Sources:

- Service Connection Moratoriums: SDWIS
- Source Capacity Violations: Violation Type Code in SDWIS (Table 30): WW – Waterworks Standards

[56] California Code of Regulations Title 22 Division 4 Chapter 16 https://govt.westlaw.com/calregs/Browse/Home/California/CaliforniaCodeofRegulations?guid=I7B8064955B6111EC9451000D3A7C4BC3&originationContext=documenttoc&transitionType=Default&contextData=(sc.Default)

Table 30: Source Capacity Violation Analyte Codes

Violation Criteria	Analyte Code	Description
Failure to Maintain Adequate Source Capacity	C277 – CCR section 64554 – SRC CAPACITY	If a water system fails to have adequate source capacity pursuant to CCR section 64554[57]
Failure to Maintain Adequate Source Capacity	C278 – CCR section 64554 – SRC CAPACITY (CURTAILMENT)	If a water system fails to have adequate source capacity pursuant to CCR section 64554 and a curtailment order has been issued (*i.e.*, the failure is directly related to curtailments)
Failure to Maintain Adequate Pressure Leading to a Water Outage[58]	C279 – CCR section 64602 – WATER OUTAGE (DROUGHT)	If a water system fails to maintain the minimum required pressure of 20 pounds per square inch in its distribution system due to inadequate capacity caused by drought
Failure to Maintain Adequate Pressure Leading to a Water Outage[59]	C295 – CCR section 64602 – WATER OUTAGE	If a water system fails to maintain the minimum required pressure of 20 pounds per square inch in its distribution system due to inadequate capacity not caused by drought
Failure to Complete a Source Capacity Planning Study	C280 – CCR section 64558 – SRC CAPACITY STUDY FAILURE	If a water system fails to complete a source capacity planning study required as part of an enforcement action

Risk Indicator Calculation Methodology:

- Source capacity violations: Identify systems that have had one or more source capacity violations within the past three years using the violation type code and analyte codes listed in Table 30.
- Service connection moratoriums (SCM): Identify water systems that have had one or more SCM, based on referrals from State Water Board District staff, within the past three years.

[57] At all times, public water system's water source(s) shall have the capacity to meet the system's maximum day demand (MDD): For ≥ 1,000 service connections, source capacity, storage capacity, and/or emergency source connections must meet 4 hours of peak hourly demand (PHD); For < 1,000 service connections, storage capacity ≥ MDD

[58] This violation criterion is used for repeated, long-term water outages due to a consistent, repeated low-pressure event. This is not for routine main breaks or short-term outages.

[59] This violation criterion is used for repeated, long-term water outages due to a consistent, repeated low-pressure event. This is not for routine main breaks or short-term outages.

- Start Date & End Date
  - Historical SCM – have both the Start Date & End Date
  - Current (Active) SCM – have only Start Date

Threshold Determination

The State Water Board has developed a binary threshold for the Source Capacity Violations risk indicator. Any water systems that have not been able to meet source capacity waterworks standards within the last three years should receive risk points.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on feedback from the State Water Board's engineers, the maximum weight of 3 is suggested for the "Source Capacity Violations" risk indicator. Therefore, the minimum risk score for this indicator is 0 and the maximum risk score is 3. Table 31 summarizes the thresholds, score, and weights for Source Capacity Violations.

Table 31: "Source Capacity Violations" Thresholds, Scores & Weights

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
0	**0** source capacity violations within the past 3 years; and **0** service connection moratoriums within the past 3 years.	0	N/A	0	None
1	**1 or more** source capacity violations within the past 3 years; or **1 or more** service connection moratoriums within the past 3 years.	1	3	3	High

BOTTLED OR HAULED WATER RELIANCE

The purpose of this risk indicator is to identify water systems that have had to supplement or replace their source of supply to meet customer demand with bottled water and/or hauled water at any point within the past three years. A water system that is unable to meet the demand with their available sources due to water quality issues or source capacity challenges is at risk of failing to provide water to the customers.

Calculation Methodology
Required Risk Indicator Data Points & Sources:

The data source used to identify water systems that have relied on bottled water and/or hauled water has changed. In 2024, DFA's spreadsheet for interim solution[60] was used as the primary source, in conjunction with the Drought and Conservation Reports for a one-year duration,[61] along with SDWIS data. In an ongoing effort to enhance data quality, accuracy, and availability, the State Water Board has decided to make the Drought and Conservation Reports the primary data source, as they are fully machine-readable and reported by water systems. The DFA manual spreadsheet has been removed, while SDWIS data continues to be used as a supplementary data source. One caveat is that the data from the Drought and Conservation Reports is currently available for a maximum of two full years, which does not perfectly align with the definition of this indicator. Data for a three-year duration will be available starting with next year's Risk Assessment.

To identify water systems that have had reliance on bottled water and/or hauled water at any point within the past 3 years, the following data points from two sources were used.

- Water Systems Monthly Drought and Conservation Reports[62]: SAFER Clearinghouse
  - Submitted Reports
    - Supply and Demand – Potable Supply: "Bottled Water Reliance" datapoint indicating bottled water supply
    - Source Information: "Total Purchased from Hauler Sources (gallons)" datapoint indicating hauled water supply
- Water Source Facility: SDWIS
  - Water Source Facility Name – any facility names containing "Hauled"; or
  - Water Source Facility Type Code
    - Non-Piped, Non-Purchased (NN)
    - Non-Piped, Purchased (NP)

Risk Indicator Calculation Methodology:

- Prepare Water Systems Drought and Conservation Reports data
  - Export submitted reports with the date range of January 1, 2023 to December 31, 2024.
- Prepare SDWIS data

[60] Internal State Water Board Interim Solution Data Spreadsheet managed by Division of Financial Assistance (DFA)
[61] Water System Monthly Drought and Conservation Reports are collected through the SAFER Clearinghouse. The reporting requirements began in January 2023. Therefore, for the 2024 Risk Assessment, only one year of data was available.
[62] State Water Board Drought & Conservation Reporting Webpage
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/clearinghouse_drought_conservation_reporting.html

- Identify hauled water reliance systems based on the Availability Codes that reflect the availability for NN and NP facilities and whether a water system solely relies on hauled water.
  - Permanent (P) – the source is used all year round
  - Interim (I) – the source is used partly during the year
  - Emergency (E) – the source is used only during emergencies
  - Other

Table 32: Preparation of SDWIS Hauled Water Data

Availability Code	Rely on hauled water only?	Include in the dataset?
P – Permanent	Yes	Include
P – Permanent	No	Include if the system has relied on hauled water within the past 3 years based on Drought and Conservation Reports data*
I – Interim	Yes	Include
I – Interim	No	Include if the system has relied on hauled water within the past 3 years based on Drought and Conservation Reports data*
E – Emergency	Yes or No	Include if the system has relied on hauled water within the past 3 years based on Drought and Conservation Reports data*
Other	Yes or No	Include if the system has relied on hauled water within the past 3 years based on Drought and Conservation Reports data*

**If the Drought and Conservation Reports data doesn't indicate hauled water reliance, data validation must be performed by contacting the water system and/or regulating agency.*

- Combine the two lists of water systems identified from the monthly Drought and Conservation Reports data and SDWIS data.
- Remove any duplicates to identify the unique systems.

Threshold Determination

The State Water Board developed a threshold in 2022 based on how water systems performed for this risk indicator by 2021 SAFER status: Failing, At-Risk, Potentially At-Risk, and Not At-Risk. This analysis concluded that the majority of water systems that have relied on bottled water or hauled water within a three-year time period were either Failing or at risk of Failing (Table 33). Since there is a strong correlation between this risk indicator and Failing, the State Water Board developed a binary threshold of at least one or more occurrences.

Table 33: 2021 SAFER Status of Systems that Have Bottled Water or Hauled Water Reliance

TOTAL	Failing List[63]	At-Risk	Potentially At-Risk	Not At-Risk
88	57 (65%)	18 (20%)	9 (10%)	4 (5%)

Risk Indicator Scoring & Weighting

Due to the strong correlation between this risk indicator and Failing, the State Water Board has determined that any water systems that have relied on bottled or hauled water over the last three years to supplement their sources should **automatically be classified as At-Risk** if they are not currently on the Failing list.

Table 34: "Bottled or Hauled Water Reliance" Thresholds, Scores & Weights

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
0	**0** occurrences of bottled water or hauled water reliance within the last three years.	0	N/A	0	None
1	**1 or more** occurrences of bottled water or hauled water reliance within the last three years.	Automatically At-Risk	N/A	N/A	Very High

AFFORDABILITY RISK INDICATORS

This section provides full details on each Affordability risk indicator used in the Risk Assessment. Affordability risk indicators measure the capacity of individual households and the overall customer base to supply the revenue necessary for a water system to pay for necessary capital, operations, and maintenance expenses.

PERCENT OF MEDIAN HOUSEHOLD INCOME (%MHI)

This indicator measures the annual system-level average residential water bill for 6 hundred cubic feet (HCF) of water usage per month relative to the annual median household income (MHI) of a water system's service area.

Calculation Methodology

Important Note: *In the 2025 Needs Assessment, the State Water Board adjusted the calculation of MHI from the approach used in previous Needs Assessments to improve data coverage and more accurately identify water systems serving disadvantaged communities (DAC). The full methodology is detailed in the* Appendix: Median Household Income (MHI)

[63] Failing list retrieved from the State Water Board SAFER Clearinghouse database on January 3, 2022

and Economic Status Determination Methodology.[64]

Required Risk Indicator Data Points & Sources:

- Water system Service Area Boundary Layer: SABL[65]
- Water system median household income in the past 12 months[66]
- Census Geography Boundaries for Block Groups, Census Tracts, and Places: 2023 TIGER/Line Shapefiles[67]
- Average Monthly Drinking Water Customer Charges: 2023 electronic Annual Report (eAR)[68]

Average monthly drinking water customer charges are collected through the electronic Annual Report (eAR). Historically, this information was not required reporting, resulting in limited data coverage and inconsistent data quality. In 2020, extensive changes were made to the eAR to require reporting of customer charges and implement data validation checks. Since then, continued improvements to the eAR have led to a substantial reduction in reporting errors.

Risk Indicator Calculation Methodology:
To calculate %MHI, two key data products are required: (1) water system median household income; and (2) average monthly residential customer drinking water charges for 6 hundred cubic feet of water usage.

Water System Median Household Income
Water system-level median household income (MHI) is calculated using data from 5-Year ACS Estimates and spatial data on water system service area boundaries.[69] For each water system, an area-weighted average MHI was calculated based on the portions of geographic areas that fall within the system's service area boundary. When available, income surveys conducted within the last five years by the State Water Board's Division of Financial Assistance (DFA) were used to determine a water system's MHI rather than the area-weighted approach. A

[64] Appendix: Median Household Income (MHI) and Economic Status Determination Methodology https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2025/2025mhi-calculation.pdf
[65] California Drinking Water System Boundaries https://gispublic.waterboards.ca.gov/portal/home/item.html?id=fbba842bf134497c9d611ad506ec48cc
[66] American Community Survey Data Tables https://data.census.gov/table
[67] 2023 TIGER/Line shapefiles (U.S. Census Bureau): https://www.census.gov/cgi-bin/geo/shapefiles/
[68] Electronic Annual Report (eAR) | State Water Board https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/ear.html
[69] The procedure for this indicator was based on the Division of Financial Assistance (DFA) MHI methodology, which is used to guide the Fund Expenditure Plan for the Safe and Affordable Drinking Water Fund. While the MHI calculation for the Needs Assessment generally aligns with DFA's approach, the systematic analysis conducted for the Needs Assessment should be considered separately from the case-by-case MHI determinations made by DFA and is not used by DFA to make funding decisions.

detailed explanation on how MHI was calculated can be found in Appendix: Median Household Income (MHI) and Economic Status Determination Methodology.[70]

Average Monthly Drinking Water Customer Charges

To capture the average affordability of water for systems across the state, the Needs Assessment utilizes the average monthly drinking water customer charges for 6 hundred cubic feet (HCF) of water usage per month. 6 HCF (4,488 gallons) of indoor water usage per month is roughly equivalent to 50 gallons per person per day for a three-person household for 30 days. This level of consumption is in line with statewide conservation goals of 55 gallons per capita daily.[71] This customer charge data is reported by public water systems through the electronic Annual Report (eAR), an annual survey administered by the State Water Board that collects information on system operations, finances, and capacity.[72] The 2025 Needs Assessment utilized data from the most recently available eAR from Reporting Year 2023.[73] The 6 HCF charge is calculated based on rate structure information provided by each water system in Section 8 of the eAR; because systems bill customers in different ways (*e.g.* different unit of measurement, billing frequency, or rate structure), converting the rate to 6 HCF allows for a standardized, comparable measure of average monthly customer charges.

- Prepare data:
  - **Determine Systems the Charge for Water**: The first was to determine whether a water system charged customers for water service. If a system reported that it did not charge for water, the 6 HCF charge was marked as "Not Applicable". Non-transient non-community K-12 schools did not charge customers directly for water and therefore their water rate charge was also designated as “Not Applicable”.
  - **Calculate the Monthly Charge for 6 HCF**: For systems that did charge for water, the standard approach was to calculate the monthly charge for 6 HCF of water based on the rate structure provided in the eAR. This calculation occurs automatically within the eAR survey, so the water system was not required to convert their own rate structure to a standardized charge for 6 HCF of monthly water usage. However, there are two situations in which the customer charges for 6 HCF calculated from the rate structure would not be used.
    - **Invalid or Missing Charge**: If the calculated charge falls outside a reasonable range – either less than $5 or more than $500 – it is flagged for review. In some instances, water systems indicated that they charge for water but did not report their rate structure information and therefore were missing an auto-calculated charge for 6 HCF. In cases where the data was invalid or missing, the system-

[70] Appendix: Median Household Income (MHI) and Economic Status Determination Methodology https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2025/2025mhi-calculation.pdf

[71] California Water Code, § 10609.4, subd. (a) https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=WAT&division=6.&title=&part=2.55.&chapter=9.&article=

[72] Electronic Annual Report I State Water Board https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/ear.html

[73] The State Water Board began requiring the submission of average monthly residential customer charges for 6 HCF of water used in the 2019 electronic Annual Report (eAR).

provided alternative charge was used if available (see below). Otherwise, the 6 HCF charge was designated as “Missing”.

- **Alternative Charge Provided**: Some systems experienced issues converting their rate structure to a standard 6 HCF value, typically due to reporting errors. To address this, the eAR allows systems to report an alternative monthly charge directly if the auto-calculated charge for 6 HCF is incorrect. When the water system indicated that they were providing an alternative charge, and the charge provided was between $5 and $500, this reported charge was used in place of the calculated charge. In the rare case that a water system provided an alternative charge that was invalid or indicated they were providing an alternative, but the charge was missing and the auto-calculated charge was between $5 and $500, the auto-calculated charge was used instead of the alternative amount provided.

- Calculate Percent MHI risk indicator
  - Once the median household income and average monthly customer charges for 6 HCF of water usage were determined for each water system, the %MHI indicator was calculated by multiplying the average customer charges by 12 to find the average drinking water customer charges per year and dividing by the annual MHI. %MHI is the percentage of annual MHI spent on drinking water and thus captures the relative affordability of drinking water for customers. The formula for %MHI is found in Equation 3.

Equation 3: Percent MHI Risk Indicator Calculation

$$\textbf{\%MHI} = \frac{\text{Average Monthly Drinking Water Charges for 6 HCF} \times 12}{\text{Annual MHI of Water System Service Area}}$$

Threshold Determination

The percentage of MHI spent on water bills has been widely used for decades by state and federal agencies, as well as water industry stakeholders, to assess the affordability of water service at the community level. The State Water Resources Control Board primarily uses a 1.5% MHI threshold, while the U.S. EPA uses a standard of 2.5% of MHI to delineate whether the cost of drinking water service in a community is considered “affordable”.[74] Other states, including Arkansas[75] and North Carolina[76], have used a threshold of 1.5% of MHI spent on water and sewer costs as a threshold for assess affordability and inform funding decisions.

[74] This metric has been criticized by academics, water system associations, and other stakeholders in the water sector for its limitations in accurately capturing affordability for low-income households and for relying on potentially arbitrary %MHI thresholds. These concerns that have also been acknowledged by the U.S. EPA in recent years. However, because the Needs Assessment incorporates additional factors when assessing affordability and risk, the State Water Board considers %MHI a useful metric for enabling consistent and comparable assessments of water system affordability across the state.

[75] Arkansas Natural Resources Commission (2020). Safe Drinking Water Fund Intended Use Plan SFY 2019 https://www.agriculture.arkansas.gov/wp-content/uploads/2020/05/0_-_2019_DWSRF_IUP_-_AMENDED_January_2019_01082019_1156hrs.pdf

[76] North Carolina Department of Environmental Quality. Joint Legislative Economic Development and Global Engagement Oversight Committee (March 17, 2016) https://webservices.ncleg.gov/ViewDocSiteFile/29349

The Office of Environmental Health Hazard Assessment (OEHHA) also incorporated the State Water Board's %MHI affordability threshold as part of its Human Right to Water (HR2W) Tool.[77] The Needs Assessment incorporates both the 1.5% and 2.5% MHI thresholds when considering affordability.

The State Water Resources Control Board uses a 1.5% of MHI threshold to indicate when the cost of drinking water service may no longer be considered affordable. While 1.5% serves as the primary threshold for identifying affordability concerns, the Risk Assessment scoring framework also incorporates the U.S. EPA's 2.5% standard to reflect varying levels of affordability risk. Systems with charges below 1.5% of MHI receive a risk score of 0, those between 1.5% and 2.5% receive a moderate risk score of 0.75, and those above 2.5% receive the maximum risk score of 1.

Risk Indicator Scoring & Weighting

To evaluate and compare risk indicators, each indicator is assigned a standardized risk score between 0 and 1based on defined thresholds. During the development of the Risk Assessment methodology, public feedback emphasized that some indicators should carry more weight than others, particularly those considered more "critical" to a water system's ability to maintain compliance. As a result, weighting factors ranging from 1 to 3 were applied to individual indicators. Based on input from State Water Board engineers, the "%MHI" risk indicator was assigned a weight of 3, the maximum weight an indicator could receive. This results in a weighted risk score ranging from 0 – 3 for this indicator, where a score of 3 would be given to would be given to water systems with customer charges exceeding 2.5% of annual median household income (corresponding to an unweighted risk score of 1). Table 35 summarizes the thresholds, scores, and weight for this risk indicator.

Table 35: "Percent Median Household Income" Thresholds, Scores & Weights

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A	**System does not charge customers directly for water**	0	N/A	0	None
0	**Less than 1.5%** of MHI spent on water	0	N/A	0	None
1	**1.5% or more** but **less than 2.5%** of MHI spent on water	0.75	3	2.25	Medium
2	**More than 2.5%** of MHI spent on water	1	3	3	High
*Missing**	**No data available**	"--"	N/A	"--"	Unknown

**A water system may be missing necessary data for this indicator due to eAR non-reporting or if the data was excluded because it fell outside of the valid range of $5 - $500 for average monthly customer charges for 6 HCF. Refer to the section* Adjusting for Missing Data *for*

[77] The Human Right to Water in California
https://oehha.ca.gov/water/report/human-right-water-california

details on how the Risk Assessment accommodates for missing data in the calculation of a system's aggregated risk score.

EXTREME WATER BILL

This indicator measures how affordable water is for each system relative to the rest of California water systems. Extreme Water Bill assesses whether a water system's average customer charges meet or exceed 150% of statewide average customer charges for 6 hundred cubic feet (HCF) of drinking water consumption ($70.95 for the 2023 eAR Reporting Year). This indicator allows for a relative comparison of customer water costs across systems.

Calculation Methodology
Required Risk Indicator Data Points & Sources:

- Average Monthly Drinking Water Customer Charges: 2023 electronic Annual Report (eAR)[78]

Risk Indicator Calculation Methodology:

To capture the average affordability of water for systems across the state, the Needs Assessment utilizes the average monthly drinking water customer charges for 6 hundred cubic feet (HCF) of water usage per month. 6 HCF (4,488 gallons) of indoor water usage per month is roughly equivalent to 50 gallons per person per day for a three-person household for 30 days. This level of consumption is in line with statewide conservation goals of 55 gallons per capita daily.[79] This customer charge data is reported by public water systems through the electronic Annual Report (eAR), an annual survey administered by the State Water Board that collects information on system operations, finances, and capacity.[80] The 2025 Needs Assessment utilized data from the most recently available eAR from Reporting Year 2023.[81] The 6 HCF charge is calculated based on rate structure information provided by each water system in Section 8 of the eAR; because systems bill customers in different ways (*e.g.* different unit of measurement, billing frequency, or rate structure), converting the rate to 6 HCF allows for a standardized, comparable measure of average monthly customer charges.

[78] Average monthly drinking water customer charges are collected through the electronic Annual Report (eAR). Historically, this information was not required reporting, resulting in limited data coverage and inconsistent data quality. In 2020, extensive changes were made to the eAR to require reporting of customer charges and implement data validation checks. Since then, continued improvements to the eAR have led to a substantial reduction in reporting errors. Electronic Annual Report (eAR) | State Water Board https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/ear.html
[79] California Water Code, § 10609.4, subd. (a) https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=WAT&division=6.&title=&part=2.55.&chapter=9.&article=
[80] Electronic Annual Report I State Water Board https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/ear.html
[81] The State Water Board began requiring the submission of average monthly residential customer charges for 6 HCF of water used in the 2019 electronic Annual Report (eAR).

- Prepare Data:
  - **Determine Systems the Charge for Water**: The first step was to determine whether a water system charged customers for water service. If a system reported that it did not charge for water, the 6 HCF charge was marked as "Not Applicable". Non-transient non-community K-12 schools also did not charge customers directly for water and therefore also had a water rate charge of “Not Applicable”.
  - **Calculate the Monthly Charge for 6 HCF**: For systems that did charge for water, the monthly charge for 6 HCF of water was calculated based on the rate structure provided in the eAR. This calculation occurs automatically within the eAR survey, so the water system is not required to convert their own rate structure to a standardized charge for 6 HCF of monthly water usage. However, there are two situations in which the customer charges for 6 HCF calculated from the rate structure were not used.
    - **Invalid or Missing Charge**: If the calculated charge fell outside a reasonable range – either less than $5 or more than $500 – it was flagged for review. In some instances, water systems indicated that they charged for water but did not report their rate structure information and therefore were missing an auto-calculated charge for 6 HCF. In cases where the data was invalid or missing, the system-provided alternative charge was used if available (see below). Otherwise, the 6 HCF charge was marked as “Missing”.
    - **Alternative Charge Provided**: Some systems experienced issues converting their rate structure to a standard 6 HCF value, typically due to reporting errors. To address this, the eAR allows systems to report an alternative monthly charge directly if the auto-calculated charge for 6 HCF is incorrect. When the water system indicated that they were providing an alternative charge, and the charge provided was between $5 and $500, this reported charge was used in place of the calculated charge. In the rare case that a water system provided an alternative charge that was invalid or indicated they were providing an alternative amount, but the charge was missing AND the auto-calculated charge was between $5 and $500, the auto-calculated charge was used instead of the alternative amount provided.
    - **Calculate the Statewide Average Monthly Charge for 6 HCF**: Using the valid monthly charges calculated above, the average charge for 6 HCF of water usage for all community water systems was found. The Risk Assessment is applied to small and medium community water systems (serving 30,000 or less service connections and populations up to 100,000) as well as non-transient non-community K–12 schools. However, the statewide average used in the Extreme Water Bill calculation included all community water systems, regardless of size, to better reflect water affordability for all of California’s residents. K–12 schools are excluded from the statewide average because they did not charge customers for water service (customer charge for 6HCF is “Not Applicable”).
- Calculate Extreme Water Bill risk indicator
  - The Extreme Water Bill risk indicator is calculated by dividing each water systems average monthly drinking water customer charge for 6 HCF by the statewide average charge for customers of community water systems. This allows for a relative comparison of customer water costs across systems. Extreme Water Bill captures

the relative affordability of drinking water for customers *compared to customers across the state*. The formula for Extreme Water Bill is found in Equation 4.

Equation 4: Extreme Water Bill Risk Indicator Calculation

$$\textbf{Extreme Water Bill} = \frac{\text{Average Monthly Drinking Water Charges for 6 HCF}}{\text{Statewide Average Monthly Drinking Water Charges for 6 HCF}}$$

Threshold Determination

The State Water Board's AB 401 report[82] recommended using a two-tiered indicator threshold for identifying systems where customers are paying relatively more for water to determine eligibility for a statewide low-income rate assistance program. In alignment with this recommendation, the Needs Assessment methodology incorporates thresholds of 150% and 200% of the statewide average monthly charge for 6 HCF in the calculation of the Extreme Water Bill risk indicator.

Risk Indicator Scoring & Weighting

To evaluate and compare risk indicators, each indicator is assigned a standardized risk score between 0 and 1 based on defined thresholds. During the development of the Risk Assessment methodology, public feedback emphasized that some indicators should carry more weight than others, particularly those considered more "critical" to a water system's ability to maintain compliance. As a result, weighting factors ranging from 1 to 3 were applied to individual indicators. Based on input from State Water Board engineers, the "Extreme Water Bill" risk indicator was assigned a weight of 1, the minimum weight an indicator could receive. This results in a weighted risk score ranging from 0 to 1 for this indicator, where a weighted score of 1 would be given to water systems with average customer charges for 6 HCF of water greater than 200% of the statewide average (corresponding to an unweighted risk score of 1). Table 36 summarizes the thresholds, scores, and weight for this risk indicator.

Table 36: "Extreme Water Bill" Thresholds, Scores & Weights

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A	**System does not charge customers directly for water**	0	N/A	0	None
0	Charges are **less than 150%** of statewide average 6 HCF charge.	0	N/A	0	None
1	Charges are **150% or more** but **less than 200%** of statewide average 6 HCF charge.	0.5	1	0.5	Medium
2	Charges are **200% or more** of the statewide average 6 HCF charge.	1	1	1	High

[82] AB 401 Final Report: https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/assistance/docs/ab401_report.pdf

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
*Missing**	**No data available due to non-reporting**	"--"	N/A	"--"	Unknown

**A water system may be missing the necessary data for this indicator due to non-reporting or because the data was excluded because it fell outside of the valid range of $5 - $500 for average monthly customer charges for 6 HCF. Refer to the section* Adjusting for Missing Data *for details on how the Risk Assessment accommodates missing data in the calculation of a system's aggregated risk score.*

HOUSEHOLD SOCIOECONOMIC BURDEN

This indicator is intended to identify water systems that serve communities experiencing both high poverty rates and high housing costs for low-income households. These communities may already struggle to afford their current water bills with limited disposable income constrained by high housing costs and could face additional hardship if customer charges increase in the future. This indicator combines two metrics – Poverty Prevalence and Housing Burden – to capture the compounded financial strain on a water system's customers.

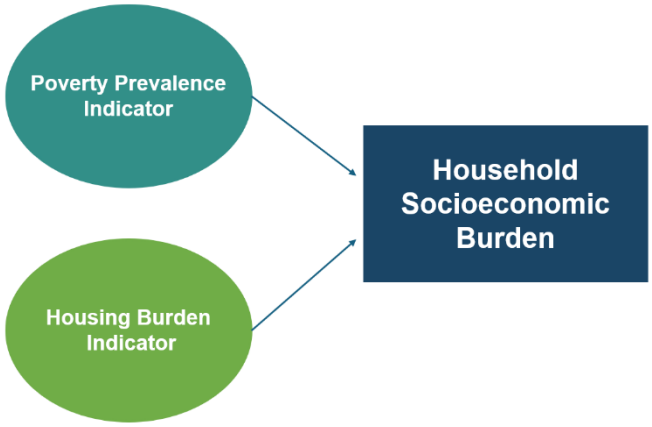
- **Poverty Prevalence Indicator (PPI)** measures the percentage of the population with incomes less than two times the federal poverty level.[83]

- **Housing Burden Indicator (HBI)** captures the percentage of households in a census tract that are both
  - Low-income, defined as making less than or equal to 80% of the Housing and Urban Development (HUD) Area Median Family Income (HAMFI), and
  - Severely burdened by housing costs, paying greater than 50% of their income to housing.

Together, these two indicators provide a more comprehensive picture of socioeconomic vulnerability by accounting for the varying levels of income and cost burdens across California.

[83] The federal poverty level used to assess poverty varies by family size and composition, and in some cases age. How the Census Bureau Measures Poverty: https://www.census.gov/topics/income-poverty/poverty/guidance/poverty-measures.html.

Figure 9: Poverty Prevalence and Housing Burden Components Combined to Create Household Socioeconomic Burden Indicator



Calculation Methodology

Required Risk Indicator Data Points & Sources:

- Water system Service Area Boundary Layer: SABL[84]
- Ratio of Income to Poverty Level in the Past 12 Months: 2019-2023 5-Year Block Group-Level Estimates from U.S. Census Bureau's American Community Survey[85]
- Table 8 – Tenure by Household Income, Housing Cost Burden and Substandard Housing: 2017-2021 5-Year Census Tract-Level Estimates from Comprehensive Housing Affordability Strategy data, U.S. Department of Housing and Urban Development (HUD)[86]
- Census Geography Boundaries for Block Groups and Census Tracts: 2023 TIGER/Line Shapefiles[87]

Risk Indicator Calculation Methodology:

To calculate Household Socioeconomic Burden, two key data products are required: (1) percentage of the population with incomes less than 200% of the federal poverty level served by a water system, to capture overall economic vulnerability (Poverty Prevalence Indicator); and (2) percentage of households (both owner- and renter-occupied) served by a water system with incomes less than or equal to 80% of the HUD Area Median Family Income (HAMFI) and paying more than 50% of household income for housing, to capture particularly vulnerable

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

[85] Census Bureau data table C17002 (Block Group-level): Ratio of Income to Poverty Level in the Past 12 Months, retrieved March 11, 2025, from 2019-2023 American Community Survey 5-Year Estimates https://data.census.gov/table/ACSDT5Y2023.C17002?t=Income+and+Poverty&g=040XX00US06$1500000&y=2023

[86] HUD Office of Policy Development and Research Comprehensive Housing Affordability Strategy (CHAS) data (Census Tract-level), based on 2017-2021 ACS 5-year estimates, retrieved January 27, 2025 from https://www.huduser.gov/portal/datasets/cp.html#data_2006-2021

[87] 2023 TIGER/Line shapefiles (U.S. Census Bureau): https://www.census.gov/cgi-bin/geo/shapefiles/

populations that are both low-income and experiencing severe housing burden (Housing Burden Indicator). The calculations for the Poverty Prevalence Indicator and the Housing Burden Indicator can be found in Equation 5.

Since Poverty Prevalence and Housing Burden estimates are only available at the block group and census tract-level, respectively, it was necessary to combine these data with spatial data on water system service area boundaries to produce water system-level estimates. For each water system, area-weighted average Poverty Prevalence and Housing Burden were calculated based on the portions of either the block group or census tract that fell within the system's service area boundary. A detailed explanation on how these area-weighted estimates were calculated can be found in *Appendix: GIS Methodology for Calculating Data.*[88]

Equation 5: Poverty Prevalence and Housing Burden Indicator Calculation

$$\textbf{Poverty Prevalence} = \frac{\text{Sum of population with incomes below 200\% of federal poverty line}}{\text{Total population for whom poverty status is determined}}$$

$$\textbf{Housing Burden} = \frac{\text{Sum of households with income } \leq \text{ 80\% of HAMFI \& housing costs > 50\% of income}}{\text{Total occupied housing units}}$$

Component Thresholds

Poverty Prevalence Indicator (PPI):
Various thresholds have been used by organizations and researchers to assess poverty prevalence, including fixed cutoffs such as 30%[89] and tiered categories (*e.g.*, less than 10%, 10-30%, 30-50%, and greater than 50%).[90] However, the most widely adopted thresholds were first proposed by Raucher et al. in their report for the American Water Works Association, 'Developing a New Framework for Household Affordability and Financial Capability

[88] Appendix: GIS Methodology for Calculating Data
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/2025-needs/general-gis-methodology.pdf
[89] Lauren Patterson (2023): Affordability of household water services across the United States | PLOS Water
https://journals.plos.org/water/article?id=10.1371/journal.pwat.0000123
[90] David Mitchell, and Elizabeth Stryjewski (2020): Technical Memorandum on Water/Sewer Service Affordability Analysis
https://www.cityofsantacruz.com/home/showpublisheddocument/83950/637553072866376248

Assessment in the Water Sector'.[91,92,93,94] In that report, the authors recommend the following PPI thresholds:

- No risk: less than 20%
- Medium risk: 20% to 35%
- High risk: more than 35%

The State Water Board and the Office of Environmental Health Hazard Assessment (OEHHA) evaluated these thresholds in the context of California data and proposed to adopt them for the Poverty Prevalence Indicator component of the Household Socioeconomic Burden risk indicator.

Table 37: Poverty Prevalence Indicator Component Thresholds & Scores

Component	Threshold	Score	Risk Level
Poverty Prevalence Indicator	**Threshold N/A** = Missing Poverty Prevalence data	**N/A**[95]	Unknown
	Threshold 0 = < 20%	**0**	None
	Threshold 1 = 20% - 35%	**0.25**	Medium
	Threshold 2 = > 35%	**1**	High

Housing Burden Indicator (HBI):

Based on a nationwide literature review, consistent thresholds for housing burden have not yet been established by researchers or adopted by other organizations. One report by the University of North Carolina on housing conditions in North Carolina identified census tracts in the top 20% of state as severely housing burdened.[96] Similarly, a recent University of Southern California Master's thesis categorized census tracts in the top 75% of California as the "most

[91] Developing a New Framework for Household Affordability and Financial Capability Assessment in the Water Sector (2019)
https://www.acwa-us.org/wp-content/uploads/2019/05/Developing-New-Framework-for-Affordability-Report-Final.pdf

[92] American Water Works Association: Measuring Water Affordability and the Financial Capability of Utilities
https://awwa.onlinelibrary.wiley.com/doi/full/10.1002/aws2.1260

[93] Alliance for Water Efficiency (2020): An Assessment of Water Affordability and Conservation Potential in Detroit, Michigan
https://www.allianceforwaterefficiency.org/impact/our-work/assessment-water-affordability-and-conservation-potential-detroit-michigan

[94] Duke University, Nicholas Institute: Exploring the Affordability of Water Services within and across Utilities
https://nicholasinstitute.duke.edu/water-affordability/affordability/Affordability_Preprint.pdf

[95] A small number of water systems did not have available poverty prevalence data, typically in places where it is not statistically appropriate or meaningful to publish estimates – such as systems that serve detention centers or military installations with non-household populations. A risk score of "Not Applicable" is thus more appropriate than "Missing", because the data are unavailable for logical reasons (it is not appropriate to make inferences about socioeconomic conditions for these systems using Census data).

[96] William Rohe, Todd Owen, and Sarah Kerns; The University of North Carolina at Chapel Hill, Center for Urban and Regional Studies (2017): Extreme Housing Conditions in North Carolina
https://nchousing.org/wp-content/uploads/2017/02/Extreme-Housing-Conditions-in-North-Carolina-1.pdf

impacted".[97] Another study found that 16% of children in Los Angeles County live in severely housing cost-burdened households, though this was based on survey data.[98] Given the lack of consistency, peer-reviewed evidence, and broad relevance across these sources, the Needs Assessment used the distribution of 2019 statewide housing burden data to define thresholds. Census tracts were divided into three categories (terciles), with thresholds rounded to the nearest whole number:

- No risk: fewer than 14% of households are housing cost burdened.
- Medium risk: 14% to 21% of households are housing cost burdened.
- High risk: more than 21% of households are housing cost burdened.

A matrix scoring approach was used to assign vulnerability values to each category, 0 for "no vulnerability," 0.25 for "medium vulnerability," and 1 for "high vulnerability."

The State Water Board will continue to assess affordability indicators – such as arrearages and water shutoffs – over time to evaluate whether these housing burden thresholds should be adjusted in the future.

Table 38: Housing Burden Indicator Component Thresholds & Scores

Component	Threshold	Score	Risk Level
Housing Burden Indicator	**Threshold N/A =** Missing Housing Burden data	**N/A**[99]	**Unknown**
	Threshold 0 = <14%	**0**	**None**
	Threshold 1 = 14% - 21%	**0.25**	**Medium**
	Threshold 2 = >21%	**1**	**High**

Threshold Determination

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.[100] The normalized scores for the Poverty Prevalence and Housing Burden Indicator components were added together and divided by the number of components (two) to produce a Household Socioeconomic Burden score for each water system (Equation

[97] Lucresia Graham (2021): A Cartographic Exploration of Census Data on Select Housing Challenges Among California Residents (Master's thesis in Geographic Information Science and Technology, University of Southern California)
https://spatial.usc.edu/wp-content/uploads/formidable/12/Lucresia-Graham-thesis-compressed.pdf

[98] Tabashir Z. Nobari, Shannon E. Whaley, Evelyn Blumenberg, Michael L. Prelip, and May C. Wanga (2018): Severe Housing-Cost Burden and Obesity Among Preschools-aged Low-Income Children in Lost Angeles County.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6305808/

[99] A small number of water systems did not have available housing burden data, typically in places where it is not statistically appropriate or meaningful to publish estimates – such as systems that serve detention centers or military installations with non-household populations. A risk score of "Not Applicable" is thus more appropriate than "Missing", because the data are unavailable for logical reasons (it is not appropriate to make inferences about socioeconomic conditions for these systems using Census data).

[100] 2022 Needs Assessment.
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/needs/2022needsassessment.pdf

6). Figure 10 shows how much each calculated score represents a degree of Poverty Prevalence and Housing Burden within the matrix.

Equation 6: Calculating Household Socioeconomic Burden Score

$$\text{Household Socioeconomic Burden} = \frac{\text{Poverty Prevalence Indicator Score} + \text{Housing Burden Indicator Score}}{2}$$

Figure 10: Household Socioeconomic Burden Scores from Poverty Prevalence and Housing Burden Indicator Scores

Poverty Prevalence	**High Risk** > 35%	Score = 1	*N/A*	**0.5**	**0.625**	**1**
	Med Risk 20 - 35%	Score = 0.25	*N/A*	**0.125**	**0.25**	**0.625**
	No Risk < 20%	Score = 0	*N/A*	**0**	**0.125**	**0.5**
	Unknown	Score = N/A	*N/A*	*N/A*	*N/A*	*N/A*
			Score = N/A	Score = 0	Score = 0.25	Score = 1
			Unknown	**No Risk** < 14%	**Med Risk** 14% - 21%	**High Risk** > 21%
			Housing Burden			

These combined scores are converted into threshold risk designations, as shown in Table 39.

Table 39: Thresholds for Household Socioeconomic Burden

Threshold Number	Threshold	Risk Level
0	Combined score of **0 – 0.125**	**None**
1	Combined score of **0.25 – 0.5**	**Medium**
2	Combined score of **0.625 – 1.0**	**High**

Risk Indicator Scoring & Weighting

To evaluate and compare risk indicators, each indicator is assigned a standardized risk score between 0 and 1 based on defined thresholds. During the development of the Risk Assessment methodology, public feedback emphasized that some indicators should carry more weight than others, particularly those considered more “critical” to a water system’s ability to maintain compliance. As a result, weighting factors ranging from 1 to 3 were applied

to individual indicators. Based on input from State Water Board engineers, the "Household Socioeconomic Burden" risk indicator was assigned a weight of 2. This results in a weighted risk score ranging from 0 – 2 for this indicator, where a weighted score of 2 would be given to water systems with a combined Household Socioeconomic Burden risk score of 0.625 or higher (at least one of the component poverty prevalence or housing burden indicator thresholds were considered high risk). Table 40 summarizes the thresholds, score, and weights for Household Socioeconomic Burden.

Table 40: "Household Socioeconomic Burden" Thresholds, Scores & Weights

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A*	**Socioeconomic data not collected**	0	N/A	0	Unknown
0	**Combined score of 0 – 0.125**	0	N/A	0	None
1	**Combined score of 0.25 – 0.5**	0.5	2	1	Medium
2	**Combined score of 0.625 – 1.0**	1	2	2	High

** The Household Socioeconomic Burden indicator is given a threshold of "Not Applicable" when Census data were not available, typically in places where it is not statistically appropriate or meaningful to publish estimates – e.g., in the case of systems that serve detention centers or military installations with non-household populations.*

TMF CAPACITY RISK INDICATORS

This section provides full details on each TMF Capacity risk indicator used in the Risk Assessment. TMF Capacity risk indicators measure a system's technical, managerial and financial (TMF) capacity to plan for, achieve, and maintain long term compliance with drinking water standards, thereby ensuring the quality and adequacy of the water supply.

OPERATOR CERTIFICATION VIOLATIONS

Operator certification violations are issued to water systems that do not have an appropriately certified water treatment or distribution operator. A lack of adequately trained water treatment or distribution operators may be indicative of larger technical and managerial risks borne by the system. Research shows that poorly trained staff and managers working on water systems can result in avoidable waterborne disease outbreaks. Chief and shift operators must possess valid operator certificates pursuant to CCR sections 63765 and 63770.

Calculation Methodology
Required Risk Indicator Data Point & Source:

- Operator Certification Violations: SDWIS Violation Codes:
  - 12
  - OP

Risk Indicator Methodology:

- Determine which systems have had an Operator Certification Violation within the last three years.
  - Systems that are currently out of compliance or have returned to compliance are included.

Threshold Determination
Peer-reviewed studies suggest that the absence of a certified operator is associated with water system failure.[101] Moreover, operator certification violations are an established threshold for additional regulatory oversight by states, such as Illinois.[102] Therefore, a threshold of 1 or more operator certification violations over the last three years was determined.

Risk Indicator Scoring & Weighting
To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Public feedback during the Risk Assessment methodology development process indicated that some risk indicators should be weighted higher than others because they may be more "critical" as they relate to a water system's ability to stay in compliance. Risk indicator weights between 1 and 3 were applied to individual risk indicators. Based on feedback from the State Water Board's engineers, the maximum weight of 3 is applied to the "Operator Certification Violations" risk indicator. Therefore, the minimum risk score is 0 and the maximum risk score is 3. Table 41 summarizes the thresholds, scores, and weight for this risk indicator.

Table 41: "Operator Certification Violations" Thresholds, Scores & Weights

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
0	**0** Operator Certification violations over the last three years.	0	N/A	0	None
1	**1 or more** Operator Certification violations over the last three years.	1	3	3	High

MONITORING & REPORTING VIOLATIONS

A water system is required to monitor and verify that the levels of contaminants present in the drinking water supplies do not exceed an MCL. A monitoring violation occurs when a water system fails to have its water tested as required within the legally prescribed time frame. A water system that fails to perform required monitoring for a group of chemicals (such as

[101] See Oxenford, J. L., & Barrett, J. M. (2016). Understanding small water system violations and deficiencies. *Journal-American Water Works Association, 108*(3), 31-37. Retrieved from https://awwa.onlinelibrary.wiley.com/doi/abs/10.5942/jawwa.2016.108.0040
[102] Office of the Illinois State Fire Marshal (2012): Notification of New NOV for Operator Certification Violations https://www2.illinois.gov/sites/sfm/SFMDocuments/Documents/NoticeRedTagOperators.pdf

synthetic organic chemicals or volatile organic chemicals) would incur a monitoring violation for each of the individual chemicals within the group.

A reporting violation occurs when a water system fails to report test results in a timely manner to the regulatory agency or fails to provide certification that mandated information was provided to the public, such as through the issuance of a public notice or the annual Consumer Confidence Report. A system may also receive a reporting violation for not submitting an Annual Report to the State Water Board.

This indicator measures the total number of monitoring and reporting violations during a 3-year compliance cycle.

Calculation Methodology
Required Risk Indicator Data Point & Source:

- Monitoring and Reporting violations: SDWIS

Table 42: Monitoring & Reporting Violation Codes

Violation Type Code	SDWIS Violation Name
03	Monitoring, Regular
04	Monitoring, check, repeat, or confirmation
19	Failure to Conduct Assessment Monitoring
23	Monitoring, Routine Major (TCR)
24	Monitoring, Routine Minor (TCR)
25	Monitoring, Repeat Major (TCR)
26	Monitoring, Repeat Minor (TCR)
27	Monitoring, Routine (DBP)
29	Failure Submit Filter Profile/CPE Report
30	Monitoring, Routine (IDSE)
31	Monitoring of Treatment (SWTR-Unfilt/GWR)
32	Monitoring, Source Water (LT2)
34	Monitoring, Source Water (GWR)
35	Failure Submit IDSE/Subpart V Plan Rpt
36	Monitoring of Treatment (SWTR-Filter)
38	Monitoring, Turbidity (Enhanced SWTR)
39	Monitoring and Reporting (FBRR)
51	Initial Tap Sampling for Pb and CU
52	Follow-Up or Routine LCR Tap M/R
53	Water Quality Parameter M/R
56	Initial, Follow-Up, or Routine SOWT M/R

Violation Type Code	SDWIS Violation Name
66	Lead Consumer Notification
3A	Routine Monitoring
3B	Additional Routine Monitoring
3C	TC Samples (triggered by turbidity exceedance) Monitoring
3D	Monitoring, Lab Cert/Method Errors
4A	Assessment Forms Reporting
4B	Sample Result/Fail to Monitor Reporting
4C	Start-up Procedures Certification Form Reporting
4D	EC+ Notification Reporting
4E	*E. coli* MCL Reporting
4F	L1/L2 TT Vio or Correct Action Reporting
S1	State Violation-M&R (Major)
AR	Failure to Complete an Annual Report
RR	State Reporting Requirement Violation

Risk Indicator Methodology:

- Determine which systems have had Monitoring & Reporting violations over the last 3-year compliance period using the Monitoring & Reporting violation codes in Table 42. This excludes MCL and TT related Monitoring & Reporting violations described below that are included in the expanded Failing list criteria:
  - Systems that have three or more Monitoring and Reporting violations within the last three years where at least one violation has an Enforcement Action that has been open for 15 months or greater.

Threshold Determination

The State Water Board has developed a threshold for Monitoring & Reporting violations (related to an MCL or Treatment Technique) as criteria for the Failing list. The Failing list criteria threshold is three or more MCL/TT-related Monitoring & Reporting violations within the last three years where at least one violation has an open enforcement action greater than 15 months. For the Risk Assessment, the State Water Board developed a slightly modified version of the Failing list criteria threshold. Systems that have had two or more Monitoring & Reporting violations over the last three years are more at-risk.[103]

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Public feedback during the Risk Assessment methodology development process indicated that some risk indicators should be weighted higher than others because they may be more "critical" as they relate to a water system's ability to stay in compliance. Risk indicator weights between 1 and 3 were applied to

[103] Systems that meet the Failing list criteria are not included in the Risk Assessment results.

individual risk indicators. Based on feedback from the State Water Board's engineers, a weight of 2 is applied to the "Monitoring and Reporting Violations" risk indicator. Therefore, the minimum risk score is 0 and the maximum risk score is 2. Table 43 summarizes the thresholds, scores, and weight for this risk indicator.

Table 43: "Monitoring and Reporting Violations" Thresholds, Scores & Weights

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
0	**1 or less** Monitoring & Reporting violations over the last three years.	0	N/A	0	None
1	**2 or more** Monitoring & Reporting violations over the last three years.	1	2	2	High

SIGNIFICANT DEFICIENCIES

Significant Deficiencies are identified by State Water Board staff or a Local Primacy Agency (LPA) during a Sanitary Survey and other water system inspections. Significant Deficiencies include, but are not limited to, defects in the design, operation, or maintenance, or a failure or malfunction of the sources, treatment, storage, or distribution system that U.S. EPA determines to be causing or have the potential for causing the introduction of contamination into the water delivered to consumers. Significant Deficiencies can be identified for both groundwater and surface water systems, although the compliance deadlines and requirements differ depending on the applicable rule (Groundwater Rule vs. Long Term 2 Enhanced Surface Water Treatment [LT2] Rule).

The State Water Board and LPA staff must enter these deficiencies into SDWIS and must follow-up on the addressing actions taken by the water system to correct the deficiencies. The State Water Board and LPA must provide written notification of Significant Deficiency within 30 days and require the water system to respond within 30 days with a corrective action plan. Scheduled return to compliance dates should be noted in the plan and approved by the State Water Board or LPA. The water system must implement the appropriate corrective action within 120 days of notification or be in compliance with a State-approved plan for correcting the deficiency at the end of the same 120-day period. The State Water Board and LPAs must then confirm that the deficiency has been addressed within 30 days after the scheduled date of correction.

A water system can incur a violation for failing to respond to or correct a Significant Deficiency (Title 22 CCR § 64430 and 40 CFR § 141.404 (s) for systems subject to the Groundwater Rule, or Title 22 CCR § 64650(f) and 40 CFR § 141.723 having for systems subject to LT2 Rule). The State Water Board and LPAs may take additional enforcement action as necessary to correct the deficiency.

Calculation Methodology
Required Risk Indicator Data Point & Source:

- Significant Deficiencies: Table in SDWIS with a SIG (Significant) severity designation.

Risk Indicator Calculation Methodology:

- Determine which systems have had a Significant Deficiency **within the last three years** using the visit date in SDWIS (date the State Water Board became aware of the Significant Deficiency).
  - Systems that are currently out of compliance or have returned to compliance are included.

Threshold Determination
As described above, the presence of Significant Deficiencies has already been defined as a threshold for State Water Board action. Moreover, peer-reviewed studies suggest that the presence of Significant Deficiencies is associated with water system failure.[104] Finally, similar measures of significant deficiencies are used as an established threshold of concern by states such as Alaska and Nevada,[105] Connecticut,[106] and New Mexico,[107] among others. Therefore, the threshold of one or more Significant Deficiencies within the last three years has been determined to be an appropriate threshold for risk.

Risk Indicator Scoring & Weighting
To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Public feedback during the Risk Assessment methodology development process indicated that some risk indicators should be weighted higher than others because they may be more "critical" as they relate to a water system's ability to stay in compliance. Risk indicator weights between 1 and 3 were applied to individual risk indicators. Based on feedback from the State Water Board's engineers, the maximum weight of 3 is applied to the "Significant Deficiencies" risk indicator. Therefore, the minimum risk score is 0 and the maximum risk score is 3. Table 44 summarizes the thresholds, scores, and weight for this risk indicator.

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[104] See Oxenford, J. L., & Barrett, J. M. (2016). Understanding small water system violations and deficiencies. Journal-American Water Works Association, 108(3), 31-37.
[105] State Strategies to Assist Public Water Systems in Acquiring and Maintaining Technical, Managerial, and Financial Capacity. Retrieved from https://books.google.com/books?id=MK64VtYz-SsC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
[106] Systems that meet the Failing list criteria will not be included in the Risk Assessment. McPhee, Eric (n.d.). "Significant Deficiencies" Connecticut Department of Public Health: Drinking Water Division. Retrieved from: https://portal.ct.gov/-/media/Departments-and-Agencies/DPH/dph/drinking_water/pdf/CTAWWAGWRTraining2009SigDefpdf.pdf?la=en
[107] New Mexico Environment Department: Drinking Water Bureau (2016). "Surface Water Rule and Interim Enhanced Surface Water Treatment Rule: Significant Deficiency Policy" Retrieved from https://www.env.nm.gov/wp-content/uploads/sites/5/2018/11/RE_Surface-Water-Rule-Significant-Deficiency_Policy_020816.pdf

Table 44: "Significant Deficiencies" Thresholds, Scores & Weights

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
0	**0** Significant Deficiencies over the last three years.	0	N/A	0	None
1	**1 or more** Significant Deficiencies over the last three years.	1	3	3	High

OPERATING RATIO

Operating Ratio is a measure of whether a water system's revenues are sufficient to cover the costs of operating the water system. Specifically, "Operating Ratio" is a ratio of the water system's annual revenues compared to annual operating expenses. To be self-supporting, a water system should have at least as much annual revenue as it has operating expenses, *e.g.*, an operating ratio equal to or greater than 1.0. The operating ratio does not include planned investments in future years. Therefore, a water system should collect revenues greater than expenses to accommodate for future investments by building up their financial reserves.

Annual Revenue: includes total annual revenues generated from customer charges and fees (meter fees, base service charges, fixed charges, late fees, penalties, shutoff fees, reconnection fees, *etc.*); intergovernmental fund transfers (*i.e.*, city or county tax revenues *etc.*); revenues generated through rent, land lease, or other revenue-generating activities.

Operations and Maintenance Expenses: expenses incurred during the system's normal operation during the reporting year. It may include salaries, benefits for employees, utility bills, system repair and maintenance, supplies (*e.g.*, treatment chemicals), insurance, water purchased for resale, *etc.*

Calculation Methodology

Required Risk Indicator Data Points & Sources:

- Electronic Annual Report, Total Annual Revenue – Section 8B1.8
- Total Annual Revenue for the Reporting Year = Residential Water Rate Revenue (B1.1) + Non-Residential Water Rate Revenue (B1.2) + Residential Fees and Charges Revenue (B1.3) + Non-Residential Fees and Charges Revenue (B1.4) + Interfund or Governmental Revenue (B1.5.2) – Interfund or Government Revenue Lost (B1.6) + Other Revenue (B1.7)
- Electronic Annual Report, Total Annual Operating Costs – Section 8B2.1

Risk Indicator Calculation Methodology:

Equation 7: Operating Ratio Calculation

$$\textbf{Operating Ratio} = \frac{\text{Annual Revenue (\$)}}{\text{Annual Operating Expenses (\$)}}$$

Threshold Determination

The threshold for this risk indicator was developed through an analysis of industry, academic, and state publications (Table 45). Feedback was also solicited from the Division of Drinking Water's internal stakeholder group. Many have suggested that a viable water system should have a current ratio of at least 1 or greater. An operating ratio of 1 is the lowest level for a self-supporting water system. A ratio below one means expenses are higher than revenues. If a water system has outstanding debt, an operating ratio above one is required. Usually, the higher the debt/equity ratio, the higher the operating ratio required.

Table 45: Industry Recommended Operating Ratio

Organization	Recommended Operating Ratio	Resources
Community Resource Group, Inc.	1	Small System Guide: Understanding Utility Financial Statements[108]
University of North Carolina Environmental Finance Center	≥ 1.2	California Small Water Systems Rates Dashboard[109]
Rural Community Assistance Partnership (RCAP)	≥ 1	Financial Management Guide[110]
University of Georgia	≥ 1.2	Evaluating Water System Financial Performance and Financing Options[111]
Brookings	> 1	Appendix B: Investing in water: Comparing utility finances and economic concerns across U.S. cities[112]

[108] See Small System Guide: Understanding Utility Financial Statements (2011). Community Resource Group, Inc. https://www.in.gov/iurc/files/small_system_guide_to_understanding_financial_statments.pdf
[109] See California Small Water Systems Rates Dashboard (2021). Environmental Finance Center at the University of North Carolina, Chapel Hill. https://dashboards.efc.sog.unc.edu/ca
[110] The Basics of Financial Management for Small-community Utilities http://www.rcapsolutions.org/wp-content/uploads/2013/06/RCAP-Financial-Management-Guide.pdf
[111] See Jeffrey L. Jordan. Issue 3: Evaluating Water System Financial Performance and Financing Options. University of Georgia Department of Agricultural & Applied Economics. https://ageconsearch.umn.edu/record/16712/files/fs9815.pdf
[112] See Joseph W. Kane (2016). Investing in water: Comparing utility finances and economic concerns across U.S. cities. Brookings. https://www.brookings.edu/research/investing-in-water-comparing-utility-finances-and-economic-concerns-across-u-s-cities/

Organization	Recommended Operating Ratio	Resources
Arizona Department of Environmental Quality	≥ 1	Capacity Development Application for a New Public Water System[113]
State of Florida Public Service Commission	≥ 1.25	Docket No. 20 180141-WS - Proposed adoption of Rule 25-30.4575, F.A.C., Operating Ratio Methodology[114]

Based on the industry standards summarized above, the State Water Board adopted a binary threshold for "Operating Ratio" as summarized in Table 46.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on feedback from the State Water Board's engineers, the minimum weight of 1 is suggested for the "Operating Ratio" risk indicator due to data quality concerns. Therefore, the minimum risk score for this indicator is 0 and the maximum risk score is 1. Table 46 summarizes the thresholds, score, and weights for Operating Ratio.

Table 46: "Operating Ratio" Thresholds, Scores & Weights

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A*	**Systems serving military bases; non-transient non-community systems that are K-12 schools**	0	N/A	0	None
0	**1 or greater**	0	N/A	0	None
1	**Less than 1**	1	1	1	High
*Missing***	**No data available due to non-reporting**	"--"	N/A	"--"	Unknown

**Water systems serving military bases were excluded from the Risk Assessment's financial indicators. Non-transient non-community systems that are K-12 schools were excluded because they were not required to report the necessary data for this indicator.*

***A water system may be missing the necessary data for this indicator due to eAR non-reporting.*

[113] See Capacity Development Application For A New Public Water System (Elementary Business Plan). Arizona Department of Environmental Quality. https://static.azdeq.gov/forms/capacitydevelopmentapp.pdf

[114] See Office of the General Counsel (Harper), Division of Accounting and Finance (Galloway), Division of Economics (Guffey) (2018). Docket No. 20 180141-WS - Proposed adoption of Rule 25-30.4575, F.A.C., Operating Ratio Methodology. State of Florida Public Service Commission http://www.psc.state.fl.us/library/filings/2018/06300-2018/06300-2018.pdf

TOTAL ANNUAL INCOME

The purpose of this risk indicator is to identify water systems whose total annual revenue is unable to cover their total annual expenses. A water system should generate enough revenue to cover all incurred expenses (including operational expenses) throughout the year. Total Net Annual Income of a water system should be a positive (+) value. If more money is spent than is brought in, then the water system will have to make adjustments in order to maintain operations. If the expenditures are outpacing revenue too quickly, then the water system may have to cut costs or decrease its level of service. Reserves or available cash savings allow for a financial cushion in times when expenses are greater than revenues.

A water system may generate enough revenue to cover their annual operating and maintenance costs (operating ratio = 1 or greater), but in some cases revenues may fall short in covering a water system's total annual expenses. These additional expenses that fall outside of general operating and maintenance costs typically include debt/loan repayments, new/upgraded infrastructure investments, unforeseen emergency costs, *etc*.

Calculation Methodology

Required Risk Indicator Data Points & Sources:

- Electronic Annual Report, Total Annual Revenue - 8B1.8
- Electronic Annual Report, Total Annual Expenses - 8B2.5

Risk Indicator Calculation Methodology:

Equation 8: Total Annual Income Calculation

$$\textbf{Total Annual Income} = \text{Total Annual Revenue (\$)} - \text{Total Annual Expenses (\$)}$$

Threshold Determination

Water systems may have emergencies they must respond to, or a large capital investment that occurs within a year which may lead to negative total annual income. Based on industry standards and recommendations by State Water Board engineers, the tiered thresholds in Table 47 were developed for Total Annual Income.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on feedback from the State Water Board's engineers, the minimum weight of 1 is suggested for the "Total Annual Income" risk indicator due to data quality concerns. Therefore, the minimum risk score for this indicator is 0 and the maximum risk score is 1. Table 47 summarizes the thresholds, score, and weights for Total Annual Income.

Table 47: "Total Annual Income" Thresholds, Scores & Weights

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A*	**Systems serving military bases; non-transient non-community systems that are K-12 schools**	0	N/A	0	None
0	**Greater than $0** total annual income	0	N/A	0	None
1	**$0** total annual income	0.5	1	0.5	Medium
2	**Less than $0** total annual income	1	1	1	High
*Missing***	**No data available due to nonreporting**	"--"	N/A	"--"	Unknown

**Water systems serving military bases were excluded from the Risk Assessment's financial indicators. Non-transient non-community systems that are K-12 schools were excluded because they were not required to report the necessary data for this indicator.*

***A water system may be missing the necessary data for this indicator due to eAR non-reporting.*

DAYS CASH ON HAND

Days cash on hand is the estimated number of days a water system can cover its daily operations and maintenance costs, relying only on their current cash or liquid reserves, before running out of money. This metric measures a system's financial capacity and is an estimate of how long a system can operate *without* new revenues or additional funding. It is a helpful measure of how long a system can operate if it has a sudden and dramatic reduction in operating income, perhaps from a large customer leaving or an environmental emergency (fire, drought restrictions, *etc.*).[115]

According to Moody's definition, "Cash is the most important resource utilities have to meet expenses, deal with emergencies, and survive temporary disruptions to cash flow without missing required payments."[116] Days cash on hand is a ratio that is calculated by dividing a water system's unrestricted cash by the system's estimated daily expenses. This calculation approach allows for the comparison of water systems of different sizes by accounting for differences in operational expenses (Figure 11). The higher the number, the more days an organization can sustain its operations without any additional cash inflows.

[115] See Glenn Barnes (2015). Key Financial Indicators for Water and Wastewater Systems: Days of Cash on Hand. Environmental Finance Center at the University of North Carolina. https://efc.web.unc.edu/2015/06/24/days-cash-on-hand/

[116] See Edward Damutz, Leonard Jones, (2017). Moody's Utility Revenue Bond Rating Methodology. Moody's Investors Services. https://www.moodys.com/research/Moodys-updates-its-methodology-for-rating-US-municipal-utility-revenue--PR_373942

Figure 11: Comparison of Days Cash on Hand for Large and Small Water SystemsTable

Large Water System	Small Water System
$\frac{Unrestricted\ Cash: \$\mathbf{5,000,000}}{Average\ Daily\ Operation\ Expenses: \$\mathbf{100,000}}$	$\frac{Unrestricted\ Cash: \$\mathbf{20,000}}{Average\ Daily\ Operation\ Expenses: \$\mathbf{400}}$
Days Cash on Hand = **50 Days**	Days Cash on Hand = **50 Days**

Calculation Methodology
Required Risk Indicator Data Points & Sources:

- Electronic Annual Report, Section 8B.10

Risk Indicator Calculation Methodology:

- Risk indicator calculation formula (water system calculated and reported in the electronic Annual Report):
  - Calculate water system's **daily operating expenses**: [Annual Operating Expenses] / [365]
  - Calculate **days cash on hand**: [Total Unrestricted Cash] / [Daily Operating Expenses]

Equation 9: Days Cash on Hand Calculation

$$\textbf{Days Cash on Hand} = \frac{\text{Unrestricted Cash (\$)}}{\text{Daily Operating Expenses (\$)}}$$

Threshold Determination
The thresholds for the "Days Cash on Hand" risk indicator were developed by assessing peer-reviewed publications and soliciting feedback from the State Water Board's Division of Drinking Water internal stakeholder group. Table 48 and Table 49 summarize recommendations made by industry groups and rating agencies for minimum days cash on hand.

Table 48: Industry Recommended Days Cash on Hand

Organization	Recommended Days Cash on Hand	Resources
University of North Carolina Environmental Finance Center	90+ days	California Small Water Systems Rates Dashboard[117]

[117] See California Small Water Systems Rates Dashboard (2021). Environmental Finance Center at the University of North Carolina, Chapel Hill. https://dashboards.efc.sog.unc.edu/ca

Organization	Recommended Days Cash on Hand	Resources
Utility Financial Solutions, LLC	90+ days; Higher bond rating 200+ days	Managing Your Community's Stimulus Money[118]
International City/County Management Association (ICMA)	30 - 60 days	Capital Budgeting and Finance: A Guide for Local Governments[119]
Government Finance Officers Association	45+ days	Overview of GFOA's Best Practices in Budgeting[120]
American Water Works Association	270 - 365 days	Developing a New Framework for Household Affordability and Financial Capability Assessment in the Water Sector[121]

Table 49: Financial Scoring Criteria for Major Rating Agencies

Moody's[122]					
Aaa	Aa	A	Baa	Ba	B & Below
> 250 days	250 ≥ n > 150 days	250 ≥ n > 150 days	150 ≥ n > 35 days	35 ≥ n > 15 days	≤ 7 days
S&P Global[123]					
1: Extremely Strong	2: Very Strong	3: Strong	4: Adequate	5: Vulnerable	6: Highly Vulnerable
> 150 days	150 ≥ n > 90 days	90 ≥ n > 60 days	60 ≥ n > 30 days	15 ≥ n > 30 days	≤ 15 days

[118] See Sally Duffy, P.E., Ian Robinson, Dawn Lund (2021). Managing Your Community's Stimulus Money. MI - AWWA, MWEA, and MRWA. https://cdn.ymaws.com/www.mi-water.org/resource/resmgr/docs/Managing_Stimulus_webinar_07.pdf

[119] See Robert L. (Bob) Bland, Michael R. Overton, (2019). A Budgeting Guide for Local Government, Fourth Edition. ICMA. https://icma.org/publications/budgeting-guide-local-government-fourth-edition

[120] See John Fishbein (2019). Overview of GFOA's Best Practices in Budgeting. Technical Services Center, Government Finance Officers Association (GFOA). https://nesgfoa.com/wp-content/uploads/2019/05/overview_of_gfoas_best_practices_in_budgeting_april_4_2019.pdf

[121] See R. Raucher, E. Rothstein, J. Mastracchio (2019): Developing a New Framework for Household Affordability and Financial Capability Assessment in the Water Sector. The American Water Works Association (AWWA). https://www.acwa-us.org/wp-content/uploads/2019/05/Developing-New-Framework-for-Affordability-Report-Final.pdf

[122] See Moody's Investors Service, US Municipal Utility Revenue Debt. October 19, 2017. https://www.moodys.com/researchdocumentcontentpage.aspx?docid=PBM_1095545

[123] S&P Global, Criteria | Governments | U.S. Public Finance: U.S. Public Finance Waterworks, Sanitary Sewer, And Drainage Utility Systems: Rating Methodology and Assumptions. January 19, 2016; last update October 11, 2021; Accessed December 30, 2021 at https://www.spglobal.com/ratings/en/research/articles/220414-criteria-governments-u-s-public-finance-u-s-municipal-water-sewer-and-solid-waste-utilities-methodology-12272141

Fitch[124] Liquidity Cushion		
Stronger	**Neutral**	**Weaker**
> 120 days	120 ≥ n > 90 days	< 90 days

Based on the industry standards summarized above, the State Water Board developed a tiered threshold for "Days Cash on Hand" as summarized in Table 50.

Risk Indicator Scoring & Weighting

To enable the evaluation and comparison of risk indicators, a standardized scale between 0 and 1 for risk scores has been applied to each threshold. Risk indicator weights between 1 and 3 are also applied to individual risk indicators. Based on feedback from the State Water Board's Division of Drinking Water internal stakeholder group, the minimum weight of 1 is suggested for the "Days Cash on Hand" risk indicator. Table 50 summarizes the thresholds, score, and weights for Days Cash on Hand.

Table 50: "Days Cash on Hand" Thresholds, Scores & Weights

Threshold Number	Threshold	Score	Weight	Max Risk Score	Risk Level
N/A*	**Systems serving military bases; non-transient non-community systems that are K-12 schools**	0	N/A	0	None
0	**90 days or more** cash on hand.	0	N/A	0	None
1	**30 days or more but less than 90 days** cash on hand.	0.5	1	0.5	Medium
2	**Less than 30 days** cash on hand.	1	1	1	High
*Missing***	**No data available due to non-reporting**	"--"	N/A	"--"	Unknown

**Water systems serving military bases were excluded from the Risk Assessment's financial indicators. Non-transient non-community systems that are K-12 schools were excluded because they were not required to report the necessary data for this indicator.*

***A water system may be missing the necessary data for this indicator due to eAR non-reporting.*

[124] Fitch Ratings, U.S. Water and Sewer Rating Criteria, March 18, 2021. https://www.fitchratings.com/research/us-public-finance/us-water-sewer-rating-criteria-18-03-2021

LIMITATIONS OF THE RISK ASSESSMENT FOR PUBLIC WATER SYSTEMS

The Risk Assessment for public water systems is an important endeavor in assessing water system performance and risk. While the State Water Board has worked to advance the methodology since the first iteration of the Risk Assessment in 2021, the following limitations exist in the current methodology and approach:

Water Systems Not Assessed
Three types of systems have not been incorporated in the Risk Assessment. First, federally recognized tribal systems were originally envisioned to be included in the same risk assessment as public water systems and attempts were made to gather data to this end, but ultimately tribal systems had to be excluded from the assessment due to missing data. Instead, State Water Board is working with U.S. EPA and Indian Health Service to merge and compare existing risk/need assessments for tribal water systems. Second, public water systems with greater than 30,000 service connections or more than 100,000 population served were not included, but these larger systems may be included in future iterations of the Risk Assessment. Finally, wholesalers have been excluded from the Risk Assessment. To evaluate the performance risk of wholesalers, the State Water Board may need to develop an alternative approach to assessing these systems than the methodology developed for other public water systems as there are not always direct correlations between their respective risk indicators.

Data Quality
In 2021, the State Water Board expanded the electronical Annual Report (eAR) to require the submission of income data for the first time. Many water systems struggled to provide this information. Many water systems may have provided inaccurate data which may explain why three of the top five risk indicators with thresholds exceeded are the new financial risk indicators utilizing this data in the TMF Capacity category. The State Water Board has provided additional guidance to assist water systems in completing the eAR and ensuring the accuracy of information provided. Updates to the eAR, including enhanced data validation checks and warning messages, will also improve data quality in future years.

Database and Data Collection Limitations
The State Water Board's primary violation, enforcement and regulatory tracking database, the Safe Drinking Water Information Systems (SDWIS), was designed for reporting compliance to the U.S. EPA for national tracking purposes. The database was not designed for the type of complex risk assessments being done in California or tailored to California's specific water quality regulations or drought-monitoring needs. SDWIS is limited in its ability to store technical, managerial and financial data and currently does not separate out other key system-level data components, such as boil water notices, how water system connections are utilized, water quality trends, *etc*. Several efforts to augment this data collection and management have been made by the State Water Board through project-specific efforts, such as the Drinking

Water Watch,[125] the eAR[126] and the SAFER Clearinghouse. We are in the process of creating a comprehensive data management system to fully support the Risk Assessment.

RISK ASSESSMENT REFINEMENT OPPORTUNITIES

The Risk Assessment methodology will evolve over time to incorporate additional and better-quality data; evidence from targeted research to support existing and new risk indicators and thresholds; experience from implementing the SAFER Program; and further input from the State Water Board and public. The following highlights are near-term opportunities for Risk Assessment refinement:

Outreach to Tribal Water Systems
Concerted outreach to tribal water systems was conducted in 2021 by the State Water Board and the Department of Water Resources (DWR). These outreach efforts were centered on informing tribal governments and their representatives about the purpose of the SAFER Program and informing them on the benefits of sharing information so that they may be included in future Risk Assessments. In the interim, SAFER Program staff will implement the SAFER Tribal Drinking Water Outreach Plan[127] and work with individual tribes, as requested by tribal governments or in response to drinking water needs identified through coordination with the U.S. EPA and DWR.

Mid-Sized Urban Disadvantaged Water Systems
Mid-sized urban disadvantaged water systems, like those in Los Angeles County, in some cases appear to be ranking lower on the At-Risk list than expected. This may be attributed to the fact that many of the risk indicators in the Water Quality category do not score issues related to secondary standards as high compared to primary standards. Regulations for compliance with secondary standards typically require sampling at the source, rather than the distribution system. Furthermore, many of these systems have interties and multiple sources, which means they do not score as many risk points in the Accessibility category. The limitations of the TMF Capacity category discussed above also contribute to the lower risk scores for some of these systems.

Expanded Data Collection Efforts
The State Water Board is actively working to improve data coverage and accuracy for the Risk Assessment.

[125] Public Drinking Water Watch
https://sdwis.waterboards.ca.gov/PDWW/
[126] Electronic Annual Report (EAR) | State Water Board
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/ear.html
[127] SAFER 2022 Tribal Outreach Plan
https://www.waterboards.ca.gov/safer/docs/2022/SAFER-Tribal-Outreach-Plan-ENG-03242022.pdf

The State Water Board maintains a geospatial dataset of water service area boundaries for California public water systems, known as the System Area Boundary Layer (SABL).[128] To provide an accurate dataset of these boundaries, the State Water Board has undertaken a project to review, add, and correct public water system boundaries that were collected under previous efforts.[129] All missing community water system boundaries have been added to the SABL layer as of 2024. Efforts to verify and correct boundaries are ongoing and are expected to be completed by 2026. In 2024, the State Water Board verified 447 existing boundaries that were either pending or not verified, for a total of 4,807. SABL is an essential dataset utilized in the Needs Assessment to calculate risk indicator datapoints for water and is also used to determine potential consolidation or intertie projects. Accurate system boundaries improve the findings of the Risk Assessment and allow for more accurate calculation of risk indicators that rely on geospatial analysis (Critically Overdrafted Groundwater Basin, %MHI, and Household Socioeconomic Burden).

For the 2025 Needs Assessment, the State Water Board enhanced its socioeconomic data collection to provide a more accurate and complete picture of community-level vulnerability. Water system median household income (MHI) and the determination of disadvantaged communities (DAC) used American Community Survey data from multiple census geographies and years. Additionally, the State Water Board's Needs Analysis Unit assumed responsibility for calculating the household socioeconomic burden indicator – previously developed and calculated by OEHHA – and enhanced methodology documentation to increase transparency and reproducibility.

Enhancement of Risk Indicators and Thresholds
In partnership with the OEHHA, the State Water Board will focus on refining the Risk Assessment methodologies to enhance their accuracy and integrity. This will potentially include the following:

- Develop a new water quality risk indicator quantifying the potential synergistic health impacts associated with the co-occurrence of multiple contaminants for public water systems.
- Reintroduce a risk indicator to identify water systems that experience an ongoing contamination problem, which was previously referred to as "Maximum Duration of High Potential Exposure (HPE)." HPE was first implemented in 2021, and the State Water Board removed this indicator in 2022, due to the complicated nature of how it was calculated and determined.
- Evaluate the performance of current individual risk indicators and thresholds in predicting failure (*i.e.*, the predictive power of each indicator in identifying Failing systems) to identify opportunities to refine the Risk Assessment methodologies.

As data on water system risk indicators and failures are consistently tracked over time, future versions of the Risk Assessment will be able to more fully evaluate data-driven weighting and

[128] California Drinking Water System Boundaries
https://gispublic.waterboards.ca.gov/portal/home/item.html?id=fbba842bf134497c9d611ad506ec48cc
[129] System Area Boundary Layer (SABL) Look-up Tool
https://gispublic.waterboards.ca.gov/portal/apps/webappviewer/index.html?id=272351aa7db14435989647a86e6d3ad8

scoring approaches for characterizing water system risk. This may lead to the removal of risk indicators from the assessment if they are less associated with risk than expected, and the addition of others that reflect new or previously underestimated dimensions of risk.

The intent of the State Water Board going forward is to update the Risk Assessment annually, and in so doing, enhance the accuracy and inclusiveness of the assessment through an iterative and engaged process. Accordingly, future versions will continue to incorporate new data and improve the quality of existing data.