

**CA Wastewater Needs Assessment
Solutions and Cost Assessment
Advisory Group Summary for July 2026 Meeting**

Solutions and Cost Assessment

Overview

Following the Inadequacy and Risk Assessment, the Wastewater Needs Assessment (WWNA) is developing a framework to model high-level solutions and estimate associated solution costs for facilities designated as inadequate. The Solutions and Cost Assessment also considers opportunities for feasible onsite sewage treatment system (OSTS) conversions. The methodology will be used to estimate statewide costs to address inadequate wastewater facilities and OSTS conversion opportunities. As in the Drinking Water Needs Assessment (DWNA), the framework is not designed to be used to determine community- or site-level decisions and does not replace feasibility study or preliminary engineering report processes. This Advisory Group (AG) Summary introduces the types of solutions being considered for inadequate facilities and OSTS conversion. It also discusses proposed approaches for assuming remedial actions for specific inadequacies.

Types of Potential Solutions

Potential solutions will be considered only for facilities determined to be inadequate by the WWNA methodology. A facilities and systems list was developed in previous phases of the WWNA, which contains facilities and systems with National Pollutant Discharge Elimination System (NPDES) permits, Waste Discharge Requirements (WDRs), or enrollment in the Statewide General Waste Discharge Requirements for Sanitary Sewer Systems General Order (SSSGO) that primarily treat or convey domestic wastewater. The WWNA project team examined the inadequacy criteria and the associated California Integrated Water Quality System Project (CIWQS) violations to identify the common causes and corrective actions correlated with each. Generally, each inadequacy criterion can be attributed to one or more operational, infrastructure, or administrative deficiencies.

The Office of Water Programs (OWP) at California State University, Sacramento (Sacramento State) WWNA project team is developing conceptual solutions for the treatment systems (NPDES & WDR permitted facilities) and the collection systems (facilities enrolled in the SSSGO) determined to be inadequate. To inform choices of potential solutions, the OWP WWNA project team has reviewed engineering reports for wastewater projects submitted to the State Water Board's Division of Financial Assistance (DFA) and applied engineering judgment based on team experience. The OWP team is now seeking input on the solutions approach from AG members and State and Regional Water Board staff.

The following types of solutions will be considered:

- Solutions for Inadequate NPDES & WDR Facilities
 - Remedial actions
 - Facility replacements
 - Facility-to-facility connections
 - Administrator assignments or technical assistance
- Solutions for Inadequate SSSGO Collection Systems
 - Pipe replacements
 - Pump replacements
 - Administrator assignments or technical assistance
- Opportunities for OSTS Connections
 - OSTS to sewer connections
 - OSTS to community cluster connections

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The remainder of this Advisory Group Summary will focus on the proposed method for selecting assumed solutions for inadequate WDR facilities. Future AG presentations will focus on solutions for NPDES facilities and SSSGO systems, as well as OSTs connection opportunities and cost assumptions.

Summary of WDR Inadequacies

The WDR inadequacy assessment, detailed in previous Advisory Group summaries, considered criteria related to three violation groups: effluent violations, enforcement actions, and monitoring and reporting violations. Table 1 lists the number of inadequate WDR facilities that met the criteria within each violation group. Solution types proposed for each violation group are also presented. No facilities were deemed inadequate for flow, sanitary sewer overflow, or enforcement action violations.

Fifty-three (53) facilities were deemed inadequate due to effluent or receiving water violations (50 and 3 facilities, respectively; one facility was inadequate due to both). Remedial actions will be assumed for these inadequate facilities. A detailed approach is presented in the following subsection of this AG summary.

Forty-one (41) facilities were also deemed inadequate for violations associated with deficient monitoring, deficient reporting, late reports, and failure to submit a monitoring report. Technical assistance will be included as a solution for these facilities to help assess and improve their administrative practices.

Only two facilities were deemed inadequate due to unauthorized discharge violations. The violations are summarized in Table 1, and were found to be of no current significance. Therefore, no solutions are proposed to address inadequacies in unauthorized discharge.

Forty-one (41) facilities were also deemed inadequate due to enforcement orders. There does not appear to be a repository that summarizes the details behind the orders. The details on enforcement orders exist within dozens of pdf documents accessed by download through CIWQS. The OWP WWNA team is coordinating with State and Regional Board staff to consider how to summarize these orders so that assumed solutions can be selected.

Finally, 39 facilities were deemed inadequate due to violations of order conditions. Such conditions span causes including:

- Parameter exceedances, including pH, biological oxygen demand (BOD), dissolved oxygen (DO), total suspended solids (TSS), turbidity, electrical conductivity, total dissolved solids, boron, sodium, and total coliform
- Incomplete, missing, or deficient reporting
- Deficient monitoring
- Animal burrows in pond levees/banks
- Non-operative equipment (such as aerators)
- Spills, unauthorized discharges, and free board exceedances

There are approximately 1,100 unique violation-description line items to review across the 39 facilities with order-condition inadequacies. The project team continues to compare order violation types with other violation groups to determine how to account for all inadequacies. Thus, solution types for order condition inadequacies are to be determined.

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Table 1. Count of WDR Facilities Deemed Inadequate for Various Violations and their Proposed Solution Type

Violation Group	Count of Inadequate WDR Facilities Meeting Violation Criteria	Solution Type
Effluent	50	Remedial Actions
Enforcement Order	41	To be determined
Monitoring & Reporting – Failure to submit a monitoring report, Late Report, Deficient Report, or Deficient Monitoring	41	Technical Assistance or Administrator Appointment
Monitoring & Reporting – Order Conditions	39	To be determined
Monitoring & Reporting – Receiving Water (Groundwater)	4	Remedial Action
Monitoring & Reporting – Unauthorized Discharge	2	None – occurred 2 years ago or 1 year occurred and addressed ¹
Monitoring & Reporting – Flow	0	NA
Monitoring & Reporting – Sanitary Sewer Overflow	0	NA
Monitoring & Reporting – Enforcement Action	0	NA

¹ Relevant violations for one of the two facilities occurred prior to February 2021, and it is assumed these issues have since been resolved. For the other facility, although violations occurred more recently (up to March 2025), the violation descriptions indicate that they have ended. Therefore, no solutions are proposed to address inadequacies in unauthorized discharge.

Remedial Actions for Inadequate WDR Facilities

Fifty-three (53) of the one hundred and thirty-nine (139) inadequate WDR facilities met criteria for effluent violations and/or receiving water violations and were thus assumed to be associated with a treatment or infrastructure deficiency. While such violations may have resulted from a wide range of water quality parameters and constituents, the project team developed and categorized remedial actions only for parameters and constituents assessed under the effluent violation inadequacy criteria. Table 2 lists the parameters and indicates whether each parameter resulted in WDR effluent violation inadequacies.

Table 2. Parameters Triggering WDR Effluent Violation Inadequacy Criteria

Parameters Considered in the WDR Effluent Violation Inadequacy Assessment	Was Parameter a Cause of WDR Effluent Violation Inadequacies?
Total Suspended Solids (TSS)	Y
Total Kjeldahl Nitrogen (TKN) as (N)	Y
Settleable Solids	Y
pH	N
Nitrogen, Total (as N); Nitrite plus Nitrate (as N); Nitrate, Total (as NO ₃); Nitrate, Total (as N)	Y
Carbonaceous Biochemical Oxygen Demand (CBOD), Percent Removal; Carbonaceous Biochemical Oxygen Demand (CBOD)	N
Ammonia, Total (as N) violation; Ammonia, Unionized (as N)	N
E. coli; Fecal Coliform, Total Coliform, Enterococcus	Y
Biochemical Oxygen Demand (BOD)	Y
Surface Loading Rate	N
Oil and Grease	N
Dissolved Oxygen	N

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The selected remedial actions will depend on the parameters in violation, the combination of violating parameters, and the facility type. The OWP WWNA project team classified all facilities by their wastewater treatment process in alignment with the State Water Resources Control Board's (State Water Board's) Wastewater Operator Certification Program (WWOCP) classification of treatment plants by treatment level and technology. The facility type classifications are:

- Activated Sludge (AS)
- Biofiltration
- Conventional Treatment Pond (CTP)
- Modified Treatment Pond (MTP)
- Primary
- Tertiary
- Sequencing Batch Reactor (SBR)

The OWP WWNA team then used its engineering experience to infer the underlying conditions that led to violations, which in turn were used to identify potential remedial actions. The remedial actions are intended to represent common engineering solutions applicable to the respective facility types, not to reflect site-specific conditions. Of the 53 facilities with effluent inadequacies, there are 41 distinct scenarios of facility-type-parameter violation combinations. Tables 3 through 9 list the remedial actions for each scenario.

Note that several inadequate WDR facilities also had violations for parameters other than those assessed for inadequate effluent violations. Such parameters mostly included salts (Boron, Chloride, Sodium) and electrical conductivity, which is an indicator of salts. No reasonable remedial action could be applied at the treatment facility to address these types of violations. Instead, a source-control effort involving large-scale engineering studies and collaboration with water distribution utilities to identify and remedy the causes would be warranted, as some of the Regional Water Quality Control Boards are already doing (CV-SALTS, Central Valley Regional Water Quality Control Board). However, as these salts/salt indicator parameters were not part of the inadequacy assessment, the project team is not planning to assign costs for these "source control" type solutions. The Water Board may consider doing so in future WWNA iterations. A simple approach in future work might be to assign a standard dollar amount per facility for relevant engineering studies and collaborations.

Conclusion and Next Steps

The WWNA solutions and cost assessment are intended to approximate solutions and costs for inadequate facilities and systems as determined by the project's inadequacy assessment. Cost estimates for feasible opportunities to connect OSTs to existing sewer (S2S) or community cluster systems (S2CC) will also be included. The results will provide high-level insights to support the Water Boards' statewide planning efforts, particularly related to funding needs. No solution assigned to any particular facility or system should be assumed to replace site-specific planning efforts, such as project feasibility studies and engineering reports that consider all aspects of or system and the community it serves.

Tables 3 through 9 of this document present proposed matrices for assigning remedial actions to inadequate WDR facilities, based on facility type and parameters that cause the inadequacy. The project team is seeking feedback on these solution matrices from AG members. **Please send written comments by August 11, 2026 to: OWP-WWNA@owp.csus.edu.** Upon addressing comments and conferring with the State Water Board, the project team will finalize the solution matrices.

Future efforts for the solutions and costs components of the WWNA include continuing previous work on the following:

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- Solutions & Costs for Inadequate NPDES & WDR Facilities
 - Developing solution matrices for NPDES facilities
 - Identifying criteria for considering WDR & NPDES facility replacements or facility-to-facility connections in lieu of remedial actions
 - Identifying criteria for assigning administrators or technical assistance
 - Compiling cost curves
- Solutions for Inadequate SSSGO Collection Systems
 - Identifying criteria for how much pipe length should be replaced
 - Identifying criteria for when pump replacements should be assumed
 - Identifying criteria for assigning administrators or technical assistance
 - Compiling cost curves
- Opportunities for OSTs Connections
 - Finalizing the approach for assessing OSTs connection opportunities (S2S and S2CC)
 - Compiling cost curves

Approaches for these remaining activities will be presented at future AG meetings in October 2026 and January 2027. AG members will be given approximately three weeks (one week prior to quarterly TA meetings and two weeks after) to review executive summaries and presentations on each topic and provide comments. After that, the project team will confer with State Water Board staff and finalize each approach. The final cost estimate results will be presented to the AG members at the April 2027 AG meeting.

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Table 3. Remedial Actions for Activated Sludge Facility Types

Parameter Violation Combination	Install New Earthen Storage Basin (Flow EQ)	Install Flow Recirculation for Biological Nutrient Removal	Install Effluent Filter And/or Dissolved Air Flotation	Install New or Rehab/Replace Existing Clarifier	Install Chemical Feed for Nitrogen Removal	Install UV Disinfection for Pathogen Inactivation	Improve Aeration System	Inadequacies Assumption	Remedial Actions Assumption
Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C)	X						X	Elevated BOD indicates excessive biodegradable organic loading and insufficient aeration or flow equalization capacity through the activated sludge process. Peak loads can deplete dissolved oxygen (DO) and increase oxygen demand, reducing treatment efficiency and causing process instability.	Install flow equalization storage to attenuate peak hydraulic and organic loading. Upgrade the aeration system to target dissolved oxygen (DO) concentrations under peak oxygen demand conditions.
Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C); Nitrate, Total (as N); Total Suspended Solids (TSS)	X		X	X			X	Elevated BOD, nitrate, and TSS indicate incomplete biological nutrient removal and inadequate solids separation. Excess nitrate may result from incomplete denitrification, while solids carryover contributes to elevated particulate BOD.	Install flow equalization to reduce load variability. Optimize denitrification through improved anoxic treatment and internal recycle rates. Upgrade clarification and add tertiary filtration to improve solids removal and effluent quality.
Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C); Nitrogen, Total (as N)	X	X	X				X	Elevated BOD and TN suggest inadequate nitrification and/or denitrification performance. High organic loading can limit oxygen availability for nitrification, resulting in organic nitrogen carryover into the effluent. TN alone does not identify the nitrogen species present, so diagnosis requires consideration of all nitrogen forms (e.g., ammonia, nitrate/nitrite, and organic nitrogen).	Install flow equalization storage to reduce load fluctuations. Upgrade aeration capacity and dissolved oxygen (DO) control to reliably support nitrification and implement/optimize biological nutrient removal (BNR). Add tertiary filtration to control BOD and organic nitrogen carryover in the final effluent.
Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C); Settleable Solids; Total Suspended Solids (TSS)	X		X	X			X	Elevated BOD, settleable solids, and TSS indicate inadequate clarification and solids separation. Poor settleability or solids washout can increase particulate BOD and degrade effluent quality.	Install flow equalization to stabilize loading. Improve secondary clarification capacity and add tertiary filtration to enhance removal of settleable solids, suspended solids, and associated BOD.
Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C); Total Kjeldahl Nitrogen (TKN) (as N)	X						X	Elevated BOD and TKN indicate insufficient biological treatment and incomplete nitrogen conversion. High TKN may result from inadequate nitrification, insufficient aeration capacity, or excessive organic nitrogen carryover.	Install flow equalization to stabilize loading. Increase aeration and biological treatment capacity, optimize solids retention time (SRT), and upgrade nitrification processes to improve BOD and TKN removal.
Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C); Total Suspended Solids (TSS)	X		X	X			X	Elevated TSS is typically caused by clarifier carryover or poor sludge settleability. Suspended solids contribute directly to elevated particulate BOD in the effluent because a significant fraction of BOD is associated with TSS.	Install a flow equalization to reduce load variability. Upgrade clarification and tertiary filtration systems and optimize aeration to improve solids capture and soluble BOD removal.
Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C); Total Suspended Solids (TSS); Nitrogen, Total (as N)	X	X		X			X	Elevated BOD, TSS, and TN indicate inadequate biological nutrient removal and solids separation. Solids carryover reduces effective solids retention time (SRT), impairing nitrification and increasing organic and nitrogen loadings in the effluent.	Install flow equalization to reduce load variability. Upgrade aeration and biological nutrient removal (BNR) processes, optimize internal recycle rates, improve clarification, and add tertiary filtration to enhance solids and nitrogen removal.

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Parameter Violation Combination	Install New Earthen Storage Basin (Flow EQ)	Install Flow Recirculation for Biological Nutrient Removal	Install Effluent Filter And/or Dissolved Air Flotation	Install New or Rehab/Replace Existing Clarifier	Install Chemical Feed for Nitrogen Removal	Install UV Disinfection for Pathogen Inactivation	Improve Aeration System	Inadequacies Assumption	Remedial Actions Assumption
Nitrogen, Total (as N)	X	X	X		X		X	Elevated TN indicates incomplete nitrification and/or denitrification. Causes may include insufficient aeration, inadequate anoxic volume, low solids retention time (SRT), or poor process control.	Increase aeration and nitrification capacity, provide adequate anoxic treatment volume, optimize internal mixed liquor recycle (IMLR), and supplement carbon if required to improve nitrogen removal.
Nitrogen, Total (as N); Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C)	X	X	X				X	Elevated BOD and TN suggest excessive organic loading and inadequate biological nutrient removal. High oxygen demand can limit nitrification, resulting in nitrogen and organic matter carryover. TN alone does not identify the nitrogen species present, so diagnosis requires consideration of all nitrogen forms (e.g., ammonia, nitrate/nitrite, and organic nitrogen).	Install flow equalization to stabilize loading. Increase aeration and treatment capacity, optimize BNR performance and recycle flows, and provide supplemental carbon where needed to improve denitrification.
Settleable Solids; Total Coliform				X		X		Elevated settleable solids and total coliform indicate inadequate solids removal and disinfection performance. Solids can shield microorganisms from disinfectants, reducing pathogen removal efficiency.	Improve clarification and solids removal processes, reduce solids carryover, and upgrade disinfection systems to achieve reliable coliform reduction.
Total Suspended Solids (TSS)	X		X	X				Elevated total suspended solids (TSS) indicates inadequate solids–liquid separation caused by poor settleability, clarifier limitations, or solids carryover.	Improve clarification performance through process optimization or capacity upgrades and add tertiary filtration where needed to achieve consistent solids removal.
Total Suspended Solids (TSS); Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C)	X		X	X			X	Elevated TSS and BOD indicate solids carryover and insufficient removal of particulate organic matter. A significant portion of BOD is associated with suspended solids.	Provide flow equalization to reduce hydraulic and organic load variability. Improve clarification capacity and process control to enhance solids removal and effluent stability. Add tertiary filtration for improved TSS and BOD removal, and upgrade aeration systems to maintain adequate DO during peak loading.
Total Suspended Solids (TSS); Nitrogen, Total (as N)	X	X	X	X				Elevated TSS and TN indicate solids carryover with particulate organic nitrogen, and may reflect unstable nitrification/denitrification performance.	Improve flow equalization storage to reduce hydraulic and organic load variability. Improve solids capture through enhanced clarification capacity and process control. Expand biological nutrient removal (BNR) with adequate anoxic volume and internal mixed liquor recycle (IMLR) to improve denitrification.

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Table 4. Remedial Actions for Biofiltration Facility Types

Parameter Violation Combination	Install New Earthen Storage Basin (Flow EQ)	Install Flow Recirculation for Biological Nutrient Removal	Install Effluent Filter And/or Dissolved Air Flotation	Install Chemical Feed for Nitrogen Removal	Improve Aeration System	Inadequacies Assumption	Remedial Actions Assumption
Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C); Total Suspended Solids (TSS)	X		X		X	Elevated TSS indicates inadequate solids capture or biofilm sloughing. Associated solids carryover contributes to elevated particulate BOD.	Provide flow equalization to stabilize loading. Upgrade upstream solids removal processes and improve clarification to reduce solids carryover. Enhance aeration capacity and process controls to maintain adequate dissolved oxygen and improve BOD removal.
Nitrate, Total (as N)	X	X		X		Elevated nitrate indicates effective nitrification but insufficient denitrification due to limited anoxic volume, recycle capacity, or available carbon.	Provide flow equalization to stabilize loading. Implement/expand biological nutrient removal (BNR) by adding sufficient anoxic volume and internal mixed liquor recycle (IMLR) to support effective denitrification.

Table 5. Remedial Actions for Conventional Treatment Pond Facility Types

Parameter Violation Combination	Add New Treatment Pond Capacity (New Ponds)	Desludge Pond and Install New Liner	Install New Earthen Storage Basin (Flow EQ)	Install Effluent Filter And/or Dissolved Air Flotation	Install UV Disinfection for Pathogen Inactivation	Improve Aeration System	Inadequacies Assumption	Remedial Actions Assumption
Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C)	X	X	X			X	Elevated BOD indicates insufficient hydraulic retention time (HRT), short-circuiting, sludge accumulation, or reduced biological treatment efficiency.	Provide flow equalization to stabilize loading and organic load fluctuations. Restore effective treatment volume through sludge removal and seepage reduction. Increase hydraulic retention time (HRT) where feasible and improve aeration to enhance biological treatment performance.
Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C); Settleable Solids	X	X	X	X		X	Elevated BOD and settleable solids indicate solids accumulation, poor settling conditions, and insufficient effluent polishing.	Provide flow equalization to stabilize loading. Restore pond capacity through sludge removal and installation of a new liner, and improve hydraulic retention. Enhance aeration and add tertiary filtration, where needed, to improve removal of settleable solids and associated BOD.
Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C); Settleable Solids; Total Suspended Solids (TSS)	X	X	X	X		X	Elevated BOD, settleable solids, and TSS indicate solids and algae carryover, short-circuiting, and reduced effective treatment volume.	Provide flow equalization to stabilize loading. Restore treatment volume through sludge removal and installation of a new liner, and increase effective retention time. Upgrade aeration and install tertiary filtration to improve removal of TSS, settleable solids, algae, and associated BOD.
Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C); Total Suspended Solids (TSS)	X	X	X	X		X	Elevated TSS and BOD are typically caused by algal or particulate solids carryover and inadequate solids settling.	Provide flow equalization to stabilize loading. Restore effective treatment volume through sludge removal and improve pond hydraulics to minimize short-circuiting. Enhance aeration and add tertiary filtration to improve TSS capture and reduce associated BOD.

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Parameter Violation Combination	Add New Treatment Pond Capacity (New Ponds)	Desludge Pond and Install New Liner	Install New Earthen Storage Basin (Flow EQ)	Install Effluent Filter And/or Dissolved Air Flotation	Install UV Disinfection for Pathogen Inactivation	Improve Aeration System	Inadequacies Assumption	Remedial Actions Assumption
Nitrogen, Total (as N)		X	X	X		X	Elevated TN indicates incomplete nitrogen removal due to limited nitrification and denitrification, often compounded by algae and organic nitrogen carryover. TN reduction cannot be assumed without a controlled biological nutrient removal (BNR) step and/or effective downstream solids removal.	Provide flow equalization to reduce load variability. Restore treatment volume through sludge removal, improve aeration, and add anoxic treatment capacity or BNR processes where feasible. Improve solids removal through tertiary filtration to reduce particulate nitrogen carryover.
Total Coliform		X	X	X	X		Elevated total coliform indicates inadequate pathogen removal due to insufficient detention time, short-circuiting, or reduced disinfection effectiveness from algae and suspended solids.	Provide flow equalization and restore effective treatment volume. Upgrade disinfection capacity, improve solids and algae removal through filtration or polishing, and optimize hydraulic performance to improve pathogen reduction.
Total Suspended Solids (TSS)		X	X	X			Elevated TSS is typically caused by algae and biomass carryover, poor settling, hydraulic surges, or inadequate solids retention.	Provide flow equalization to stabilize loading. Restore treatment volume through sludge removal, improve pond hydraulics, and add tertiary filtration (e.g., cloth disk or sand filters) or polishing to improve effluent solids removal.

Table 6. Remedial Actions for Modified Treatment Pond Facility Types

Parameter Violation Combination	Install New Earthen Storage Basin (Flow EQ)	Install Effluent Filter And/or Dissolved Air Flotation	Install UV Disinfection for Pathogen Inactivation	Improve Aeration System	Inadequacies Assumption	Remedial Actions Assumption
Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C)	X			X	Elevated BOD indicates inadequate biological treatment caused by insufficient hydraulic retention time (HRT), short-circuiting, excessive organic loading, or reduced aeration performance.	Provide flow equalization to reduce hydraulic and organic load variability. Increase effective hydraulic retention time (HRT) and reduce short-circuiting to improve treatment performance and BOD removal.
Settleable Solids; Total Suspended Solids (TSS); Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C)	X	X			Elevated settleable solids, TSS, and BOD indicate inadequate solids settling and effluent polishing, resulting in solids carryover and elevated particulate BOD.	Provide flow equalization to stabilize loading. Restore treatment volume through sludge removal and increase effective HRT. Add tertiary filtration and improve solids management to reduce TSS, settleable solids, and associated BOD.
Total Coliform	X	X	X		Elevated total coliform indicates inadequate pathogen removal due to insufficient detention time, hydraulic short-circuiting, or reduced disinfection effectiveness caused by elevated algae and suspended solids.	Provide flow equalization to reduce hydraulic variability. Restore effective treatment volume through sludge removal and seepage reduction. Upgrade disinfection systems (e.g., UV) and improve solids and algae removal through filtration or polishing to improve pathogen reduction.
Total Suspended Solids (TSS)	X	X			Elevated TSS is typically caused by algae and biomass carryover, poor settling conditions, hydraulic surges, or inadequate solids retention.	Provide flow equalization to stabilize loading. Restore treatment volume through sludge removal and improved hydraulics. Add tertiary filtration or polishing processes to improve solids capture and effluent quality.

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Table 7. Remedial Actions for Primary Facility Types

Parameter Violation Combination	Add New Treatment Pond Capacity (New Ponds)	Desludge Pond and Install New Liner	Inadequacies Assumption	Remedial Actions Assumption
Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C)	X	X	Elevated BOD following primary treatment indicates insufficient removal of soluble and particulate organic matter due to inadequate retention time, short-circuiting, or accumulated sludge.	Provide flow equalization to reduce hydraulic and organic load variability. Restore effective treatment volume through sludge removal and seepage reduction through installation of a new liner, increase hydraulic retention time where feasible, and improve aeration to enhance biological treatment performance.

Table 8. Remedial Actions for Sequencing Batch Reactor Facility Types

Parameter Violation Combination	Install New Earthen Storage Basin (Flow EQ)	Install Chemical Feed for Nitrogen Removal	Install Polymer Feed System to Improve Flotation and	Improve Aeration System	Modify SBR System	Inadequacies Assumption	Remedial Actions Assumption
Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C); Total Suspended Solids (TSS); Nitrogen, Total (as N)	X	X	X	X	X	Elevated BOD, TSS, and TN suggest that SBR operating conditions are not adequately matched to treatment demands. Potential causes include insufficient aeration, limited anoxic treatment, inadequate solids retention, and poor settling, resulting in reduced removal of organic matter, solids, and nitrogen.	Implement flow equalization to stabilize influent loading. Upgrade aeration and dissolved oxygen control systems, optimize cycle sequencing and wasting practices, and expand biological nutrient removal processes by adding anoxic treatment capacity and internal recycle. Install tertiary filtration and supplemental carbon addition, where required, to improve effluent quality and nitrogen removal.

Table 9. Remedial Actions for Tertiary Facility Types

Parameter Violation Combination	Install New Earthen Storage Basin (Flow EQ)	Install Flow Recirculation for Biological Nutrient Removal	Install Effluent Filter And/or Dissolved Air Flotation	Install New or Rehab/Replace Existing Clarifier	Install Chemical Feed for Nitrogen Removal	Install Polymer Feed System to Improve Flotation and	Install UV Disinfection for Pathogen Inactivation	Improve Aeration System	Inadequacies Assumption	Remedial Actions Assumption
Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C)	X					X		X	Elevated BOD at the tertiary stage indicates inadequate upstream biological treatment and/or tertiary filtration performance, allowing soluble and particulate organic matter to remain in the effluent.	Provide flow equalization to reduce hydraulic and organic load variability. Improve upstream biological treatment and aeration performance, and enhance tertiary filtration through filter upgrades or polymer addition.

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Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C); Total Suspended Solids (TSS)	X					X		X	Elevated BOD and TSS indicate solids carryover from upstream processes and/or inadequate tertiary filtration performance.	Provide flow equalization to stabilize loading. Improve upstream clarification and solids removal. Add polymer feed systems to enhance solids capture and improve tertiary filtration efficiency.
Nitrate, Total (as N); Total Coliform	X		X		X		X		Elevated nitrate indicates inadequate denitrification, while elevated coliform indicates insufficient disinfection performance often due to elevated solids/turbidity that inhibit effectiveness and/or insufficient disinfectant dose or contact time (CT).	Expand biological nutrient removal by increasing anoxic treatment capacity, optimizing internal recycle rates, and adding supplemental carbon if needed. Upgrade UV disinfection systems and improve solids removal to enhance pathogen reduction.
Nitrite Plus Nitrate (as N)	X		X		X				Elevated nitrite and nitrate indicate incomplete nitrogen removal due to inadequate denitrification, insufficient anoxic conditions, or limited carbon availability.	Improve biological nutrient removal through additional anoxic treatment capacity, optimized recycle rates, and supplemental carbon addition where needed to improve denitrification. Upgrade to UV disinfection to meet effluent pathogen reduction requirements.
Nitrogen, Total (as N)	X	X	X					X	Elevated TN indicates incomplete nitrification and/or denitrification and may also reflect carryover of particulate organic nitrogen.	Provide flow equalization storage to attenuate hydraulic and organic load variability. Improve biological nutrient removal by optimizing aeration, solids retention time (SRT), anoxic treatment capacity, and internal mixed liquor recycle (IMLR). Add supplemental carbon if denitrification is carbon limited.
Nitrogen, Total (as N); Total Coliform	X	X	X				X	X	Elevated TN and total coliform indicate deficiencies in both nutrient removal and pathogen reduction. Contributing factors may include inadequate nitrification/denitrification, poor solids removal, and insufficient disinfection performance.	Improve biological nutrient removal through enhanced aeration, anoxic treatment capacity, and internal recycle. Upgrade disinfection systems and improve solids removal through filtration or polishing to support both nitrogen and pathogen reduction objectives.
Settleable Solids	X			X		X			Settleable solids in tertiary effluent indicate inadequate upstream clarification and/or ineffective tertiary filtration.	Provide flow equalization to stabilize loading. Increase secondary clarification capacity to improve solids settleability and overall solids capture. Rehabilitate upstream clarification and filtration processes, and add a polymer feed system to enhance tertiary filtration performance and effluent quality.

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Advisory Group Summary for July 2026 Meeting**

Parameter Violation Combination	Install New Earthen Storage Basin (Flow EQ)	Install Flow Recirculation for Biological Nutrient Removal	Install Effluent Filter And/or Dissolved Air Flotation	Install New or Rehab/Replace Existing Clarifier	Install Chemical Feed for Nitrogen Removal	Install Polymer Feed System to Improve Flotation and	Install UV Disinfection for Pathogen Inactivation	Improve Aeration System	Inadequacies Assumption	Remedial Actions Assumption
Total Coliform	X						X		Elevated coliform concentrations following tertiary treatment indicate insufficient disinfection dose or contact time (CT) (or inadequate UV intensity), short-circuiting, and/or interference from suspended solids or turbidity.	Provide flow equalization to stabilize loading. Upgrade UV disinfection and improve upstream solids removal to achieve reliable pathogen reduction.
Total Coliform; Total Suspended Solids (TSS)	X		X			X			Elevated TSS and coliform indicate inadequate filtration and disinfection performance. Suspended solids can shield microorganisms and reduce disinfection effectiveness.	Improve filtration and solids removal, add polymer feed if needed, and upgrade UV disinfection to improve pathogen reduction and meet effluent limits.
Total Suspended Solids (TSS)	X					X			TSS in tertiary effluent indicates filter breakthrough, inadequate coagulation, or solids loading that exceeds filtration capacity.	Provide flow equalization to stabilize loading. Rehabilitate filtration processes and add a polymer feed system to enhance tertiary filtration performance and improve effluent quality.
Total Suspended Solids (TSS); Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C)	X					X		X	Elevated TSS and BOD indicate particulate carryover, with suspended solids contributing directly to elevated effluent BOD.	Provide flow equalization to stabilize loading. Implement supplemental aeration upgrades to improve upstream BOD conversion and overall biological treatment performance. Upgrade tertiary filtration and add polymer feed as needed to reduce TSS and associated BOD.
Total Suspended Solids (TSS); Total Coliform	X					X	X		Elevated TSS can reduce disinfection effectiveness by shielding microorganisms, resulting in increased coliform concentrations.	Provide flow equalization to stabilize loading. Rehabilitate filtration processes and add a polymer feed system to enhance tertiary filtration performance and improve effluent quality. Upgrade UV disinfection and maintain adequate dose/contact conditions to improve pathogen reduction.