Evaluación de Necesidades de Aguas Residuales de California
Evaluación de Soluciones y Costos
Resumen del Grupo Asesor para la Reunión de octubre de 2026

Evaluación de Soluciones y Costos

Descripción General

Después de la Evaluación de Inadecuación y la Evaluación de Riesgo, la Evaluación de Necesidades de Aguas Residuales (WWNA, por sus siglas en inglés) está desarrollando un marco metodológico para modelar soluciones de alto nivel y estimar los costos asociados a dichas soluciones para las instalaciones identificadas como inadecuadas.[1]. La Evaluación de Soluciones y Costos también considera oportunidades para la conversión de sistemas individuales de tratamiento de aguas residuales (OSTS, por sus siglas en inglés). La metodología se utilizará para estimar, a nivel estatal, los costos necesarios para atender las instalaciones de aguas residuales inadecuadas y las oportunidades de conversión de OSTS. Al igual que en la Evaluación de Necesidades de Agua Potable (DWNA, por sus siglas en inglés), este marco metodológico no está diseñado para utilizarse en la toma de decisiones a nivel comunitario ni en sitios específicos, ni sustituye los procesos de elaboración de estudios de factibilidad o informes preliminares de ingeniería. Por lo tanto, a lo largo de la WWNA se utiliza el término "soluciones modeladas" para enfatizar este propósito.

Este Resumen del Grupo Asesor (AG) se enfoca en:

- Los tipos de soluciones modeladas que se están considerando para las instalaciones y sistemas inadecuados, así como para la conversión de OSTS.
- Los métodos para seleccionar soluciones modeladas para las instalaciones inadecuadas con Requisitos de Descarga de Desechos (WDR), las instalaciones con permisos del Sistema Nacional de Eliminación de Descargas de Contaminantes (NPDES) y los sistemas sujetos a la Orden General Estatal para Sistemas de Alcantarillado Sanitario (SSSGO).
- El método para identificar, mediante mapas, las oportunidades de conversión de OSTS.

Las futuras presentaciones al Grupo Asesor (AG) se enfocarán en las metodologías finales de las soluciones modeladas, los supuestos de costos propuestos y el análisis de la brecha de financiamiento.

Tipos de Posibles Soluciones Modeladas

Las posibles soluciones modeladas se considerarán únicamente para las instalaciones que hayan sido determinadas como Inadecuadas de acuerdo con la metodología de la WWNA. En fases anteriores de la WWNA se elaboró una lista de instalaciones y sistemas que incluye aquellos con permisos NPDES, WDR o inscritos en la Orden General Estatal de Requisitos de Descarga de Desechos para Sistemas de Alcantarillado Sanitario (SSSGO, por sus siglas en inglés), cuya función principal es tratar o conducir aguas residuales domésticas. The WWNA project team examined the inadequacy criteria and the associated California Integrated Water Quality System (CIWQS). El equipo del proyecto de la WWNA examinó los criterios de Inadecuación y las infracciones asociadas registradas en el Sistema Integrado de Calidad del Agua de California (CIWQS, por sus siglas en inglés) para identificar las causas comunes y las acciones correctivas asociadas a cada una. En términos generales, se asume que cada criterio de inadecuación puede atribuirse a una o más deficiencias operativas, de infraestructura o administrativas.

Con base en las deficiencias asumidas, el equipo del proyecto de la WWNA está desarrollando soluciones modeladas para los sistemas de tratamiento (instalaciones con permisos NPDES y WDR) y los sistemas de recolección (instalaciones inscritas en la SSSGO) que hayan sido determinados como Inadecuados. Para orientar la selección de las soluciones modeladas, el equipo del proyecto de la WWNA aplicó estrategias comunes de tratamiento de aguas residuales y criterios de ingeniería basados en su experiencia.

[1] Based on list finalized on June 1, 2026.

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Actualmente, el equipo busca recibir comentarios de los miembros del Grupo Asesor (AG) y del personal de la Junta Estatal y de las Juntas Regionales de Control de Recursos de Agua sobre el enfoque para desarrollar las soluciones modeladas.

Se están considerando los siguientes tipos de soluciones modeladas:

- Soluciones Modeladas para Instalaciones NPDES y WDR Identificadas como Inadecuadas
  - Acciones correctivas
  - Reemplazo de instalaciones
  - Conexión de una instalación a un sistema
  - Asistencia técnica
- Soluciones Modeladas para Sistemas de Recolección SSSGO Identificados como Inadecuados
  - Reparación o reemplazo de tuberías
  - Asistencia técnica
- Oportunidades para la conversión de OSTS
  - Conversión de sistemas sépticos a sistemas de alcantarillado sanitario

Los posibles tipos de soluciones modeladas se definen de la siguiente manera:

- Remedial Actions (RA): Representan mejoras comunes de infraestructura relacionadas con las operaciones y los procesos de tratamiento de aguas residuales, aplicables a los respectivos tipos de instalaciones y a las deficiencias identificadas en los parámetros; no consideran otras condiciones específicas del sitio.
- Reemplazo de Instalaciones (FR): Reemplazo de toda la instalación por una nueva planta de tratamiento prefabricada.
- Conexión de una Instalación a un Sistema (F2S): Conexión de una instalación identificada como Inadecuada a un sistema de alcantarillado sanitario existente, con la clausura de la instalación original.
- Asistencia Técnica (TA): Apoyo brindado por una entidad con experiencia, contratada para trabajar en la instalación o en el sistema identificado como Inadecuado, con el fin de mejorar su capacidad técnica, administrativa y financiera. Esto puede incluir la revisión y el asesoramiento sobre prácticas operativas o administrativas, así como la asistencia en la planificación de infraestructura de capital, en el diseño y en la preparación de solicitudes de financiamiento.
- Reparación o Reemplazo de Tuberías (PRR): repair or replacement of sewer pipelines. Reparación o reemplazo de tuberías (PRR): reparación o reemplazo de tuberías de alcantarillado sanitario.
- Conversión de Sistemas Sépticos a Alcantarillado Sanitario (S2S): Conexión de un grupo de parcelas que no cuentan con alcantarillado sanitario (suponiendo que utilizan sistemas sépticos u otros sistemas individuales de tratamiento de aguas residuales [OSTS]) a un sistema de alcantarillado sanitario existente, con la clausura de los sistemas sépticos u OSTS.

Cabe señalar que el enfoque de la WWNA para seleccionar la asistencia técnica como solución modelada difiere del utilizado en la Evaluación de Necesidades de Agua Potable (DWNA). La DWNA selecciona la asistencia técnica como solución modelada para sistemas públicos pequeños (con menos de 3,300 conexiones de servicio) que presentan fallas, así como para sistemas en riesgo que prestan servicio a comunidades desfavorecidas y comunidades severamente desfavorecidas. La WWNA selecciona la asistencia técnica como solución modelada para instalaciones y sistemas que presentan deficiencias en el monitoreo, la presentación de informes o las operaciones generales, independientemente de su tamaño o de si prestan servicio a comunidades desfavorecidas. Nonetheless, a few inadequate WWNA facilities and systems are fairly large, having design flows between 10 and 20 MGD. While the Water Board may consider assessing its enforcement program to better support these facilities in identifying and promptly

addressing violations, technical assistance can be provided in the interim to begin managerial and operational improvements. No obstante, algunas instalaciones y sistemas identificados como Inadecuados por la WWNA son relativamente grandes, con caudales de diseño de entre 10 y 20 millones de galones por día (MGD). Si bien la Junta Estatal de Control de Recursos de Agua puede considerar evaluar su programa de cumplimiento para brindar un mejor apoyo a estas instalaciones en la identificación y atención oportuna de las infracciones, se puede proporcionar asistencia técnica de manera provisional para comenzar a implementar mejoras administrativas y operativas.

Resumen del Enfoque para las Soluciones Modeladas de Instalaciones WDR

El equipo del proyecto presentó las soluciones modeladas propuestas para las instalaciones WDR identificadas como Inadecuadas durante la reunión del Grupo Asesor (AG) de julio de 2026 y solicitó comentarios hasta el 11 de agosto de 2026. No se recibieron comentarios. El Anexo A presenta el enfoque definitivo para seleccionar las soluciones modeladas para las instalaciones WDR identificadas como Inadecuadas.

La Tabla 1 muestra el número de instalaciones correspondientes a cada tipo de solución modelada, junto con las deficiencias asociadas. Para las 139 instalaciones WDR identificadas como Inadecuadas, se seleccionó como solución modelada una acción correctiva, el reemplazo de la instalación, la asistencia técnica o una combinación de estas opciones. Algunas soluciones modeladas de acciones correctivas podrían sustituirse por el reemplazo de la instalación o por conexiones de una instalación a un sistema. El enfoque se presenta en el Anexo A.

Tabla 1. Número de Soluciones por Tipo para Instalaciones WDR Identificadas como Inadecuadas (139 Instalaciones en Total)

Remedial Action Modeled Solutions Only: 35 Facilities
• 35 due to effluent inadequacies
Technical Assistance Modeled Solutions Only: 59 Facilities
• 36 due to deficient monitoring, deficient reporting, late report, or failure to submit monitoring report inadequacies • 4 due to receiving water inadequacies • 15 due to enforcement order inadequacies • 4 due to order condition inadequacies
Remedial Action (or Facility Replacement[1]) & Technical Assistance Modeled Solutions: 45 Facilities
• 21 due to effluent inadequacies & deficient monitoring, deficient reporting, late report, or failure to submit monitoring report inadequacies • 7 due to enforcement order inadequacies • 13 due to effluent inadequacies & enforcement order inadequacies • 4 due to enforcement order inadequacies & deficient monitoring, deficient reporting, late report, or failure to submit monitoring report inadequacies

[1] *Facility replacement was selected for one facility in lieu of remedial actions, as it is classified as a subsurface OSTS.*

Resumen del Enfoque para las Soluciones Modeladas de Instalaciones NPDES

La Evaluación de Inadecuación de las instalaciones NPDES consideró criterios relacionados con dos tipos generales de infracciones: 1) infracciones relacionadas con los efluentes y 2) infracciones relacionadas con los plazos de cumplimiento o con la presentación de informes. Para estas instalaciones, se seleccionó como solución modelada la asistencia técnica por sí sola o una combinación de acciones correctivas y de asistencia técnica. El Anexo B incluye un enfoque detallado para seleccionar las soluciones modeladas. La Tabla 2 presenta el número de instalaciones asociadas a cada solución modelada, junto con las

deficiencias correspondientes. Algunas soluciones modeladas de acciones correctivas podrían sustituirse por el reemplazo de la instalación o por la conexión de una instalación a un sistema.

Tabla 2. Número de Soluciones Modeladas por Tipo para Instalaciones NPDES Identificadas como Inadecuadas (20 Instalaciones en Total)

Technical Assistance Modeled Solutions Only: 5 Facilities
• 5 due to scheduling/reporting non-compliance
Remedial Action & Technical Assistance Modeled Solutions: 15 Facilities
• 11 due to effluent & scheduling/reporting non-compliance • 4 due to effluent non-compliance associated with particular parameters (see Attachment B, Table B-2)

Soluciones Modeladas para Sistemas SSSGO Identificados como Inadecuados

Los criterios de la Evaluación de Inadecuación de los sistemas SSSGO estaban relacionados con infracciones por derrames o por incumplimiento de los requisitos de presentación de informes. Varios sistemas cumplieron los criterios de Inadecuación debido a un desempeño deficiente en el control de derrames. Se asume que estos derrames se deben a una infraestructura antigua y agrietada, que permite la entrada e infiltración de agua y provoca que los caudales en las tuberías de alcantarillado superen su capacidad. La solución modelada consistirá en la reparación o el reemplazo de las tuberías. El equipo del proyecto de la WWNA desarrolló un enfoque para estimar la longitud de las tuberías que requerían reparación o reemplazo. El enfoque detallado se presenta en el Anexo C de este Resumen del Grupo Asesor (AG, por sus siglas en inglés). La Tabla 3 presenta el número de sistemas asociados a cada tipo de solución modelada, junto con las deficiencias correspondientes.

Tabla 3. Número de Soluciones Modeladas por Tipo para Sistemas SSSGO Identificados como Inadecuados (70 Sistemas en Total)

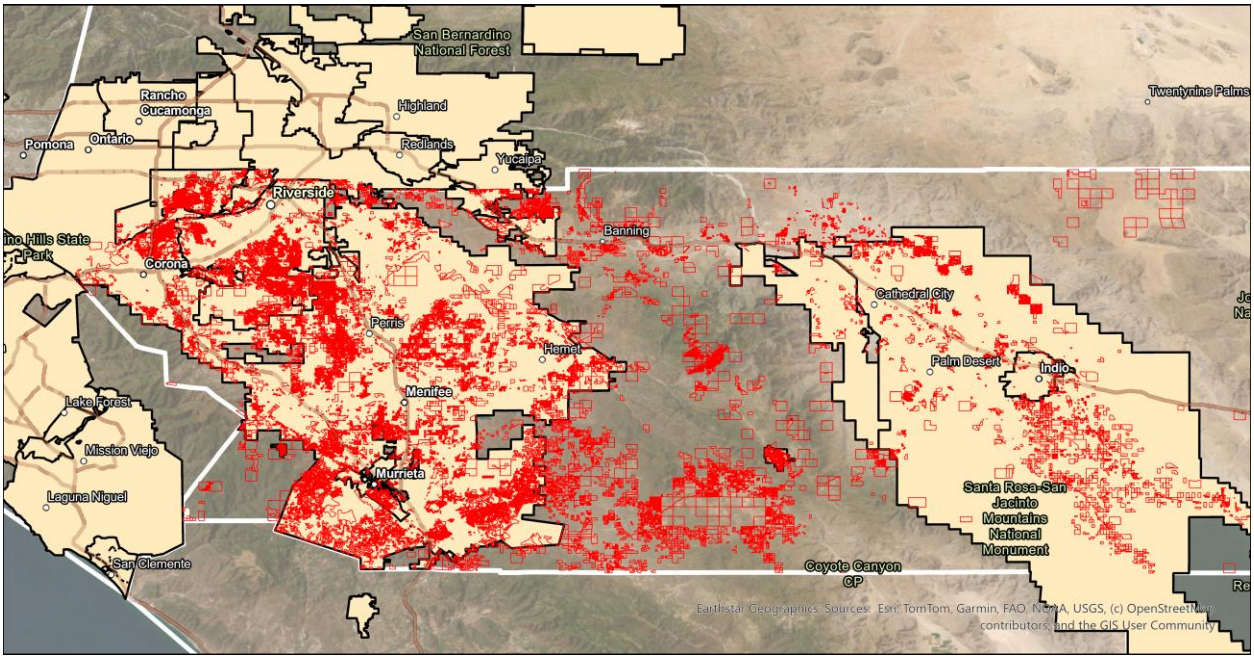
Pipe Repair or Replacement Modeled Solutions: 30 Systems
• 30 due to effluent inadequacies
Technical Assistance Modeled Solutions: 40 Facilities
• 40 due to scheduling/reporting inadequacies

Oportunidades de Conversión de OSTS

La evaluación de las oportunidades de conversión de OSTS será similar a la presentada en el informe de la Fase 1, con algunas excepciones. Debido a consideraciones metodológicas y a limitaciones de tiempo y presupuesto, el alcance de la evaluación se reducirá de una cobertura estatal a aproximadamente seis condados seleccionados para estudios de caso. Se requiere un mayor esfuerzo del previsto inicialmente para perfeccionar las soluciones modeladas y la evaluación de costos de los sistemas identificados como Inadecuados, debido a la complejidad de los criterios de Inadecuación. Asimismo, se reducirá el alcance para excluir la evaluación de la conexión de un grupo de parcelas con sistemas sépticos a un nuevo sistema comunitario de tratamiento de aguas residuales (S2CC), debido al gran número de parcelas sin alcantarillado sanitario que no forman agrupaciones claramente definidas. La Figura 1 ilustra la complejidad de esta situación mediante el ejemplo del condado de Riverside. En la parte occidental del condado, se observa una alta densidad de parcelas sin alcantarillado sanitario (polígonos pequeños de color rojo) entre dos grandes áreas de captación del sistema de alcantarillado (polígonos amarillos).. En la parte oriental, parecen existir algunas agrupaciones de pocas parcelas sin alcantarillado sanitario; sin

embargo, es probable que no sean suficientes para que un sistema comunitario de tratamiento de aguas residuales (planta de tratamiento prefabricada) resulte económicamente viable. También es cuestionable si estas parcelas requieren tratamiento de aguas residuales dentro del alcance de la WWNA, dada la falta de infraestructura visible en las imágenes satelitales. Además, el personal de las Juntas Regionales ha expresado inquietudes sobre la precisión de los resultados modelados de las parcelas sin alcantarillado sanitario, cuya confiabilidad se ve limitada por el reducido número de ubicaciones de OSTS y de parcelas sin alcantarillado sanitario confirmadas mediante trabajo de campo a nivel estatal. Por lo tanto, se decidió suspender este análisis de agrupaciones.

Figura 1. Mapa de las áreas de captación del sistema de alcantarillado (polígonos amarillos grandes) y las parcelas sin alcantarillado sanitario (polígonos rojos pequeños, según el modelado de UMASS) en el condado de Riverside, que ilustra la complejidad de identificar agrupaciones de parcelas sin alcantarillado sanitario para su conversión a plantas de tratamiento prefabricadas.



Aunque se han reducido la escala y el alcance de la evaluación, el objetivo final es proporcionar a las Juntas Estatal y Regionales de Control de Recursos de Agua una metodología para identificar posibles oportunidades de conversión de OSTS, que pueda perfeccionarse a medida que se recopilen más datos sobre la ubicación de estos sistemas. La evaluación de las oportunidades de conversión de OSTS identificará oportunidades para conectar grupos de parcelas con sistemas sépticos a sistemas de alcantarillado sanitario existentes (S2S), utilizando los resultados del mapeo de parcelas sin alcantarillado sanitario realizado por UMASS. Se identificarán las parcelas sin alcantarillado sanitario ubicadas dentro de las áreas de captación de los sistemas de alcantarillado existentes, y se ampliarán los límites de estas áreas en 1 y 3 millas para localizar las parcelas sin alcantarillado sanitario situadas dentro de esas distancias. La evaluación se llevará a cabo en seis condados, seleccionados con base en los amplios aportes del equipo del proyecto de la WWNA y de las Juntas de Control de Recursos de AGua, especialmente los resultados de las investigaciones de campo realizadas por UCANR:

- Condado de Fresno
- Condado de Humbolt

- Condado de Monterey
- Condado de Riverside
- Condado de San Bernadino
- Condado de Tulare

Conclusión y Próximos Pasos

Las soluciones modeladas y la evaluación de costos de la WWNA tienen como objetivo aproximar las soluciones y los costos de las instalaciones y los sistemas identificados como Inadecuados según la Evaluación de Inadecuación del proyecto. También se incluirán mapas que muestren las posibles oportunidades de conexión entre los sistemas OSTS y los sistemas de alcantarillado sanitario existentes (S2S). Los resultados proporcionarán información general de alto nivel para respaldar los esfuerzos de planificación estatal de las Juntas de Control de Recursos de Agua, en particular en lo relativo a las necesidades de financiamiento. Ninguna solución modelada seleccionada para una instalación o sistema en particular debe interpretarse como una determinación definitiva ni como un sustituto de los esfuerzos de planificación específicos del sitio, tales como los estudios de factibilidad de proyectos y los informes de ingeniería que consideran todos los aspectos del sistema, la comunidad a la que presta servicio, la topografía y elevación del terreno, los requisitos de bombeo, las barreras físicas y la infraestructura necesaria para que la conexión sea viable.

Los anexos A, B y C presentan resúmenes detallados de los enfoques para seleccionar soluciones modeladas para las instalaciones WDR, las instalaciones NPDES y los sistemas SSSGO identificados como Inadecuados, respectivamente. El equipo del proyecto solicita comentarios sobre estos enfoques, así como sobre el enfoque para evaluar las oportunidades de conversión de OSTS**. Se solicita enviar los comentarios por escrito a más tardar el 13 de noviembre de 2026 a: OWP-WWNA@owp.csus.edu.** Una vez que se hayan atendido los comentarios y se haya consultado con la Junta Estatal de Control de Recursos Hídricos, el equipo del proyecto finalizará e implementará los enfoques para las soluciones modeladas de las instalaciones y los sistemas identificados como Inadecuados, así como el enfoque para evaluar las oportunidades de conversión de OSTS.

Los trabajos futuros relacionados con las soluciones modeladas y los componentes de evaluación de costos de la WWNA incluyen continuar los esfuerzos previos para recopilar curvas de costos y vincular los costos con las soluciones correspondientes a los distintos sistemas identificados como Inadecuados. Los enfoques para estas actividades pendientes se presentarán en futuras reuniones del Grupo Asesor (AG) en enero de 2027, junto con una revisión del enfoque para el análisis de la brecha de financiamiento. Se otorgará a los miembros del Grupo Asesor (AG) un plazo aproximado de tres semanas —una semana antes de las reuniones trimestrales del AG y dos semanas después— para revisar los resúmenes y las presentaciones del AG sobre cada tema y enviar sus comentarios. Posteriormente, el equipo del proyecto consultará con el personal de la Junta Estatal de Control de Recursos de Agua y finalizará cada enfoque. Los resultados de las estimaciones de costos se presentarán a los miembros del AG durante la reunión de abril de 2027.

Attachment A – Modeled Solutions Approach for Inadequate WDR Facilities

Inadequacy Results and Modeled Solution Types

The WDR inadequacy assessment considered criteria related to three violation groups: effluent violations, enforcement actions, and monitoring and reporting violations. Table A-1 lists the number of inadequate WDR facilities that met the criteria within each violation group, along with the potential modeled solution types.

Table A-1. Count of WDR Facilities Deemed Inadequate each Inadequacy Type and their Potential Modeled Solution Type

Violation Group (Inadequacy Type)	Count of Inadequate WDR Facilities Meeting Violation Criteria	Potential Modeled Solution Type
Effluent	69	Remedial Action (RA) or Facility Replacement (FR)
Monitoring & Reporting – Failure to submit a monitoring report, Late Report, Deficient Report, or Deficient Monitoring	61	Technical Assistance (TA)
Monitoring & Reporting – Receiving Water (Groundwater)	8	RA or TA
Enforcement Order	41	RA or TA
Monitoring & Reporting – Order Conditions	50	TA or FR
Monitoring & Reporting – Unauthorized Discharge	5	TA
Monitoring & Reporting – Sanitary Sewer Overflow	1	TA
Monitoring & Reporting – Flow	0	TA
Monitoring & Reporting – Enforcement Action	0	TA

Process for Selecting Modeled Solutions

The WWNA project team developed the following steps to select modeled solutions for inadequate WDR facilities:

1. If effluent inadequacy, select remedial actions as a solution, unless facility type is on-site wastewater treatment system (OWTS[2]), for which facility replacement is the selected solution.
2. If failure to submit a monitoring report, late report, deficient report, or deficient monitoring inadequacy, select technical assistance as a solution.
3. If receiving water inadequacy, review CIWQS flat file violation descriptions

[2] *On-site wastewater treatment system (OWTS) is a type of on-site sewage treatment system (OSTS). California defines OWST as "… individual disposal systems, community collection and disposal systems, and alternative collection and disposal systems that use subsurface disposal. The short form of the term may be singular or plural. OWTS do not include "graywater" systems pursuant to Health and Safety Code Section 17922.12." (State Water Board 2023)*

   a. If fairly old or infrequent (one or two occurrences), assume already addressed (no remedial action needed).
   b. If receiving water inadequacy associated with parameter for which no effluent inadequacy occurred, assume no remedial action needed. TA will be a selected solution to look into possible causes.
4. If enforcement order inadequacy, review Regional Board-provided summary
   a. If associated with monitoring, reporting, or operational issues or effluent violation for "source control parameters[3]", select technical assistance as a solution (if not previously selected)
   b. If associated with effluent inadequacy parameter for which no effluent inadequacy occurred, select technical assistance as a solution, if not previously addressed.
   c. If associated with parameter that can be addressed through infrastructure improvements, select remedial action as a solution.
5. If order condition inadequacy, review CIWQS flat file violation descriptions
   a. If system has many operational and effluent violations, as well as effluent inadequacies, replace remedial actions with facility replacement and technical assistance as selected solutions.
   b. Otherwise select technical assistance as a solution, if not already selected.
6. If unauthorized discharge inadequacy, select technical assistance as a solution, if not already selected.
7. If sanitary sewer overflow inadequacy, select technical assistance as a solution, if not already selected.
8. If flow inadequacy, select technical assistance as a solution, if not already selected.
9. If enforcement action inadequacy, select technical assistance as a solution, if not already selected.

The above process results in the following solution counts. Table 1 (main body of this AG summary) provides a detailed list of the inadequacy causes.

- Remedial Actions Only: 35 Facilities
- Technical Assistance Only: 59 Facilities
- Remedial Action (or Facility Replacement) & Technical Assistance: 45 Facilities

[3] *No reasonable remedial action could be applied at the treatment facility to address violations for some parameter types (e.g., salts, salt indicators, and metals. 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). The WWNA selects technical assistance as the modeled solution to serve as an interim/starting point solutions for these types of violations/inadequacies, if not previously selected.*

Remedial actions may be replaced with facility-to-system connections or facility replacements as a selected solution. These alternatives will be considered for facilities with design flows equal to or less than 1 million gallons per day (MGD). To evaluate these alternatives, the WWNA project team will first assess the feasibility of connecting the inadequate facility to another facility based on a 3-mile road distance threshold. No cost comparison for assessing facility-to-facility connections will be made[4]. If facility connections are deemed feasible using this distance criterion, facility connections will be the selected modeled solution in lieu of remedial actions. If the facility connection is deemed infeasible based on the distance threshold, facility replacement will be considered. If the cost of implementing remedial actions exceeds 60% percent of the facility replacement cost, facility replacement will be selected as the modeled solution in lieu of remedial actions.

Effluent Inadequacies

Sixty-nine (69) facilities met effluent violation inadequacy criteria. The WWNA Project Team developed and categorized remedial actions for parameters assessed under the effluent violation inadequacy criteria. Table A-3 lists the parameters and indicates whether each parameter resulted in WDR effluent violation inadequacies.

Table A-3. 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?
Biochemical Oxygen Demand (BOD)	Y
Nitrate, Total (as N)	Y
Nitrite plus Nitrate (as N)	Y
Nitrogen, Total (as N)	Y
Settleable Solids	Y
Total Coliform	Y
Total Kjeldahl Nitrogen (TKN) as (N)	Y
Total Suspended Solids (TSS)	Y
Ammonia, Total (as N) violation; Ammonia, Unionized (as N)	N
Carbonaceous Biochemical Oxygen Demand (CBOD), Percent Removal; Carbonaceous Biochemical Oxygen Demand (CBOD)	N
Dissolved Oxygen	N
E. coli; Fecal Coliform; Enterococcus	N
Nitrate, Total (as NO3)	N
Oil and Grease	N
pH	N
Surface Loading Rate	N

The selected remedial actions will depend on the parameters in violation, the combination of violating parameters, and the facility type. The 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)

[4] The WWNA team conferred with the State Water Board's Division of Financial Assistance (DFA) and concluded that data to assess cost feasibility is not readily available. In addition, DFA noted that current cost thresholds used for facility-to-facility projects in the Clean Water State Revolving Fund Intended Use Plan (CWSRF IUP) are based solely on funding availability for recent years, and not a proper costs assessment feasibility study.

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 WWNA project 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 69 facilities with effluent inadequacies, 68 fall into one of the facility classifications above, with about 36 distinct scenarios of facility-type-parameter violation combinations. Tables A-4 through A-10 contain the remedial actions for each scenario. The 69th facility is classified as OWTS, and a full facility replacement (package plant) is the selected solution.

Receiving Water Inadequacies

Eight (8) facilities met the receiving water inadequacy criteria. Four (4) of these facilities had fairly old or infrequent violations (one or two occurrences), and it is assumed these issues have since been addressed. Some of the remaining four (4) facilities either had violations related to parameters for which there were no effluent inadequacies (nitrate, total nitrogen, total coliform, TKN, and pH) or violations related to salts. Technical assistance is selected as a solution for these facilities

Deficient Monitoring, Deficient Reporting, Late Reports, Failure to Submit a Monitoring Report Inadequacies

Sixty-one (61) WDR facilities met inadequacy criteria for deficient monitoring, deficient reporting, late reports, or failure to submit a monitoring report. Technical assistance is selected as a solution for these facilities to help assess and improve their administrative practices.

Enforcement Order Inadequacies

Forty-one (41) WDR facilities met inadequacy criteria for 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 WWNA project team, therefore, obtained summary information from Regional Board staff. Enforcement orders were generally issued due to effluent violations, monitoring or reporting issues, or operational issues such as non-descript discharges, animal burrowing, or odor complaints.

Twenty-six (26) facilities were inadequate due to enforcement orders for effluent violations, although fifteen (15) of these also met effluent inadequacy criteria. In a few cases, the enforcement orders were associated with additional constituents that did not meet effluent inadequacy criteria. Regardless, additional remedial actions were not included as solutions for these facilities. For the eleven (11) facilities that did not meet effluent inadequacy criteria but did meet enforcement order inadequacy criteria, and the orders were associated with effluent violations, remedial actions are the selected solution following the solution matrices provided in Tables A-4 through A-10.

All forty-one (41) facilities were inadequate due to enforcement orders for monitoring, reporting, or operational issues or for effluent violations associated with "source control[5]" parameters. Six (6) of these also met the inadequacy criteria for deficient monitoring, deficient reporting, late reports, or failure to submit a monitoring report; therefore, technical assistance was selected as the solution for these facilities. Technical assistance will be a selected solution for the additional thirty-five (35) WDRs facilities with enforcement orders due to monitoring, reporting, or operational issues.

Order Condition Inadequacies

Fifty (50) facilities met order condition inadequacies. Such conditions span causes including:

- Parameter exceedances for pH, biological oxygen demand, dissolved oxygen, total suspended solids, 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 800 unique violation-description line items to review across the fifty (50) facilities with order condition inadequacies. Only four (4) of these facilities did not have remedial actions, technical assistance, or facility replacement (or some combination) as selected solutions based on other inadequacy criteria. Technical assistance is the selected solution for these four (4) facilities, as all order conditions relate to operational issues. While the project team did not review all 800 violation description line items in detail, a value-added approach was used to simplify the solution selection approach, assuming the most concerning issues faced by a facility would already have been addressed following solutions selected for other inadequacies.

Unauthorized Discharge Inadequacies

Five (5) facilities were deemed inadequate due to unauthorized discharge violations. However, all facilities already had technical assistance selected as a solution for other inadequacies, and it is assumed that technical assistance will support the facilities in addressing their unauthorized discharge inadequacies. Therefore, no solutions are proposed.

Sanitary Sewer Overflow Inadequacies

One (1) facility met sanitary sewer overflow inadequacy criteria. Technical assistance is already a selected solution for this facility due to meeting inadequacy criteria for deficient monitoring, deficient reporting, late reports, or failure to submit a monitoring report. It is assumed that technical assistance will also support issues associated with this inadequacy.

Flow and Enforcement Action Inadequacies

No facilities met flow or enforcement action inadequacy criteria.

[5] No reasonable remedial action can be applied at the treatment facility to address violations for some parameter types (e.g., salt indicators, and metals). 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). The WWNA selects technical assistance as the modeled solution to serve as an interim/starting point solutions for these types of violations/inadequacies, if not previously selected.

Table A-4. Remedial Actions for Activated Sludge Facility Types

Combination of Specific Parameter Violations	Install New Earthen Storage Basin (Flow EQ)	Install/Upgrade for BNR	Install Effluent Filter or Flotation	Install New or Rehab/Replace Existing Clarifier	Install UV Disinfection for Pathogen Inactivation	Improve Aeration System	Inadequacies Assumption	Remedial Actions Assumption
BOD (5-day @ 20 Deg. C)	X					X	Elevated BOD indicates insufficient BOD removal. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading and inadequate aeration.	Install new earthen storage basin to provide flow equalization, reduce peak hydraulic and organic loading, and improve treatment stability. Improve aeration system to increase dissolved oxygen and support BOD removal.
BOD (5-day @ 20 Deg. C) Nitrogen, Total (as N)	X	X	X			X	Elevated BOD and total nitrogen indicate insufficient BOD removal and insufficient nitrogen removal/denitrification. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading, insufficient nitrification, limited anoxic treatment capacity, and particulate organic nitrogen carryover.	Install new earthen storage basin to provide flow equalization, reduce peak hydraulic and organic loading, and improve treatment stability. Install/upgrade for BNR to improve nitrogen removal through nitrification and denitrification. Install effluent filter or flotation to improve solids separation and reduce particulate BOD and organic nitrogen carryover. Improve aeration system to increase dissolved oxygen and support BOD removal and nitrification.
BOD (5-day @ 20 Deg. C) Total Kjeldahl Nitrogen (TKN) (as N)	X					X	Elevated BOD and TKN indicate insufficient BOD removal and insufficient nitrification. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading, inadequate aeration, and excessive organic or nitrogen loading.	Install new earthen storage basin to provide flow equalization, reduce peak hydraulic and organic loading, and improve treatment stability. Improve aeration system to increase dissolved oxygen and support BOD removal and nitrification.
BOD (5-day @ 20 Deg. C) TSS	X		X	X		X	Elevated BOD and TSS indicate insufficient BOD removal and insufficient clarification and solids separation. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading, solids carryover, and inadequate aeration.	Install new earthen storage basin to provide flow equalization, reduce peak hydraulic and organic loading, and improve treatment stability. Install effluent filter or flotation to improve solids separation and reduce TSS and associated particulate BOD. Install new or rehab/replace existing clarifier to improve clarification and reduce solids carryover. Improve aeration system to increase dissolved oxygen and support BOD removal.
BOD (5-day @ 20 Deg. C) Nitrate, Total (as N) TSS	X	X	X	X		X	Elevated BOD, nitrate, and TSS indicate insufficient BOD removal, insufficient nitrogen removal/denitrification, and insufficient clarification and solids separation. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading, limited anoxic treatment capacity, and solids carryover.	Install new earthen storage basin to provide flow equalization, reduce peak hydraulic and organic loading, and improve treatment stability. Install/upgrade for BNR to improve denitrification and nitrogen removal. Install effluent filter or flotation to improve solids separation and reduce TSS and associated particulate BOD. Install new or rehab/replace existing clarifier to improve clarification and reduce solids carryover. Improve aeration system to support BOD removal and upstream nitrification.

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BOD (5-day @ 20 Deg. C) Nitrogen, Total (as N) TSS	X	X	X	X		X	Elevated BOD, total nitrogen, and TSS indicate insufficient BOD removal, insufficient nitrogen removal/denitrification, and insufficient clarification and solids separation. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading, insufficient nitrification, limited anoxic treatment capacity, and solids carryover.	Install new earthen storage basin to provide flow equalization, reduce peak hydraulic and organic loading, and improve treatment stability. Install/upgrade for BNR to improve nitrogen removal through nitrification and denitrification. Install effluent filter or flotation to improve solids separation and reduce TSS, particulate BOD, and particulate organic nitrogen. Install new or rehab/replace existing clarifier to improve clarification and reduce solids carryover. Improve aeration system to support BOD removal and nitrification.
Nitrogen, Total (as N)	X	X	X			X	Elevated total nitrogen indicates insufficient nitrogen removal/denitrification. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading, limited anoxic treatment capacity, and particulate organic nitrogen carryover.	Install new earthen storage basin to provide flow equalization and improve treatment stability. Install/upgrade for BNR to improve nitrogen removal through nitrification and denitrification. Install effluent filter or flotation to reduce particulate organic nitrogen. Improve aeration system to support nitrification.
Nitrogen, Total (as N) TSS	X	X	X	X			Elevated total nitrogen and TSS indicate insufficient nitrogen removal/denitrification and insufficient clarification and solids separation. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading, limited anoxic treatment capacity, and particulate organic nitrogen carryover.	Install new earthen storage basin to provide flow equalization and improve treatment stability. Install/upgrade for BNR to improve nitrogen removal through nitrification and denitrification. Install effluent filter or flotation to reduce TSS and particulate organic nitrogen. Install new or rehab/replace existing clarifier to improve clarification and reduce solids carryover.
BOD (5-day @ 20 Deg. C) Settleable Solids TSS	X		X	X		X	Elevated BOD, settleable solids, and TSS indicate insufficient BOD removal and insufficient clarification and solids separation. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading, poor solids settleability, and solids carryover.	Install new earthen storage basin to provide flow equalization, reduce peak hydraulic and organic loading, and improve treatment stability. Install effluent filter or flotation to improve solids separation and reduce settleable solids, TSS, and associated particulate BOD. Install new or rehab/replace existing clarifier to improve clarification and reduce solids carryover. Improve aeration system to support BOD removal.
Settleable Solids Total Coliform				X	X		Elevated settleable solids and total coliform indicate insufficient clarification and solids separation and insufficient disinfection. Solids carryover may also interfere with effective disinfection.	Install new or rehab/replace existing clarifier to improve clarification and reduce solids carryover. Install UV disinfection to improve disinfection and reduce coliform concentrations.
TSS	X		X	X			Elevated TSS indicates insufficient clarification and solids separation. Potential contributing conditions include insufficient flow equalization and variable hydraulic loading, poor settleability, and solids carryover.	Install new earthen storage basin to provide flow equalization and reduce hydraulic loading variability. Install effluent filter or flotation to improve solids separation and reduce TSS. Install new or rehab/replace existing clarifier to improve clarification and reduce solids carryover.

Table A-5. Remedial Actions for Biofiltration Facility Types

Combination of Specific Parameter Violations	Install New Earthen Storage Basin (Flow EQ)	Install/Upgrade for BNR	Install Effluent Filter or Flotation	Improve Aeration System	Inadequacies Assumption	Remedial Actions Assumption
BOD (5-day @ 20 Deg. C) TSS	X		X	X	Elevated BOD and TSS indicate insufficient BOD removal and insufficient solids separation. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading, biofilm sloughing, solids carryover, and inadequate aeration.	Install new earthen storage basin to provide flow equalization, reduce peak hydraulic and organic loading, and improve treatment stability. Install effluent filter or flotation to improve solids separation and reduce TSS and associated particulate BOD. Improve aeration system to increase dissolved oxygen and support BOD removal.
Nitrate, Total (as N)	X	X			Elevated nitrate indicates insufficient nitrogen removal/denitrification. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading, limited anoxic treatment capacity, limited recycle capacity, or insufficient available carbon.	Install new earthen storage basin to provide flow equalization and improve treatment stability. Install/upgrade for BNR to increase anoxic treatment capacity and improve denitrification.

Table A-6. Remedial Actions for Conventional Treatment Pond Facility Types

Combination of Specific Parameter Violations	Add New Treatment Pond Capacity (New Ponds)	Desludge Pond and Install New Liner	Install New Earthen Storage Basin (Flow EQ)	Install Effluent Filter or Flotation	Install UV Disinfection for Pathogen Inactivation	Improve Aeration System	Inadequacies Assumption	Remedial Actions Assumption
BOD (5-day @ 20 Deg. C)	X	X	X			X	Elevated BOD indicates insufficient BOD removal. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading, insufficient solids management and reduced effective treatment volume, insufficient detention time, and inadequate aeration.	Add new treatment pond capacity (new ponds) to increase treatment capacity and detention time and reduce hydraulic and organic loading rates. Desludge pond and install new liner to restore effective treatment volume, improve solids management, and restore pond integrity. Install new earthen storage basin to provide flow equalization and reduce peak hydraulic and organic loading. Improve aeration system to support BOD removal.
BOD (5-day @ 20 Deg. C) Settleable Solids	X	X	X	X		X	Elevated BOD and settleable solids indicate insufficient BOD removal and insufficient solids separation. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading and insufficient solids management and reduced effective treatment volume.	Add new treatment pond capacity (new ponds) to increase treatment capacity and detention time. Desludge pond and install new liner to restore effective treatment volume, improve solids management, and restore pond integrity. Install new earthen storage basin to provide flow equalization and reduce peak loading. Install effluent filter or flotation to improve solids separation and reduce settleable solids and associated particulate BOD. Improve aeration system to support BOD removal.

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BOD (5-day @ 20 Deg. C) TSS	X	X	X	X		X	Elevated BOD and TSS indicate insufficient BOD removal and insufficient solids separation. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading, insufficient solids management and reduced effective treatment volume, and algae or biomass carryover.	Add new treatment pond capacity (new ponds) to increase treatment capacity and detention time. Desludge pond and install new liner to restore effective treatment volume and improve solids management. Install new earthen storage basin to provide flow equalization and reduce peak loading. Install effluent filter or flotation to reduce TSS, algae, and associated particulate BOD. Improve aeration system to support BOD removal.
BOD (5-day @ 20 Deg. C) Settleable Solids TSS	X	X	X	X		X	Elevated BOD, settleable solids, and TSS indicate insufficient BOD removal and insufficient solids separation. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading, insufficient solids management and reduced effective treatment volume, and algae or biomass carryover.	Add new treatment pond capacity (new ponds) to increase treatment capacity and detention time. Desludge pond and install new liner to restore effective treatment volume and improve solids management. Install new earthen storage basin to provide flow equalization and reduce peak loading. Install effluent filter or flotation to reduce settleable solids, TSS, algae, and associated particulate BOD. Improve aeration system to support BOD removal.
Nitrogen, Total (as N)		X	X	X		X	Elevated total nitrogen indicates insufficient nitrogen removal/denitrification. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading, insufficient solids management and reduced effective treatment volume, insufficient nitrification, algal and other particulate organic nitrogen carryover.	Desludge pond and install new liner to restore effective treatment volume and improve solids management. Install new earthen storage basin to provide flow equalization and improve treatment stability. Install effluent filter or flotation to reduce particulate organic nitrogen carryover. Improve aeration system to support nitrification.
Total Coliform		X	X	X	X		Elevated total coliform indicates insufficient disinfection. Potential contributing conditions include insufficient flow equalization and variable hydraulic loading, insufficient solids management and reduced effective treatment volume, short-circuiting, and algae or suspended solids that interfere with disinfection.	Desludge pond and install new liner to restore effective treatment volume and improve solids management. Install new earthen storage basin to provide flow equalization and reduce hydraulic loading variability. Install effluent filter or flotation to reduce algae and suspended solids that can interfere with disinfection. Install UV disinfection to improve disinfection and reduce coliform concentrations.
TSS		X	X	X			Elevated TSS indicates insufficient solids separation. Potential contributing conditions include insufficient flow equalization and variable hydraulic loading, insufficient solids management and reduced effective treatment volume, and algae or biomass carryover.	Desludge pond and install new liner to restore effective treatment volume and improve solids management. Install new earthen storage basin to provide flow equalization and reduce hydraulic loading variability. Install effluent filter or flotation to improve solids separation and reduce TSS and algae carryover.

Table A-7. Remedial Actions for Modified Treatment Pond Facility Types

Combination of Specific Parameter Violations	Install New Earthen Storage Basin (Flow EQ)	Desludge Pond and Install New Liner	Install Effluent Filter or Flotation	Install UV Disinfection for Pathogen Inactivation	Improve Aeration System	Inadequacies Assumption	Remedial Actions Assumption
BOD (5-day @ 20 Deg. C)	X	X			X	Elevated BOD indicates insufficient BOD removal. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading, insufficient solids management and reduced effective treatment volume, inadequate aeration, and seepage or liner deficiencies that reduce effective pond performance.	Install new earthen storage basin to provide flow equalization, reduce peak hydraulic and organic loading, and improve treatment stability. Remove accumulated sludge to restore effective treatment volume and improve solids management. Repair or replace deficient pond liner areas to reduce seepage and restore pond integrity. Improve aeration system to increase dissolved oxygen and support BOD removal.
BOD (5-day @ 20 Deg. C) Settleable Solids TSS	X	X	X			Elevated BOD, settleable solids, and TSS indicate insufficient BOD removal and insufficient solids separation. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading, insufficient solids management and reduced effective treatment volume, algae or biomass carryover, and seepage or liner deficiencies.	Install new earthen storage basin to provide flow equalization, reduce peak hydraulic and organic loading, and improve treatment stability. Remove accumulated sludge to restore effective treatment volume and improve solids management. Repair or replace deficient pond liner areas to reduce seepage and restore pond integrity. Install effluent filter or flotation to improve solids separation and reduce settleable solids, TSS, algae, and associated particulate BOD.
Total Coliform	X	X	X	X		Elevated total coliform indicates insufficient disinfection. Potential contributing conditions include insufficient flow equalization and variable hydraulic loading, insufficient solids management and reduced effective treatment volume, short-circuiting, algae or suspended solids that interfere with disinfection, and seepage or liner deficiencies.	Install new earthen storage basin to provide flow equalization and reduce hydraulic loading variability. Remove accumulated sludge to restore effective treatment volume and improve hydraulic performance. Repair or replace deficient pond liner areas to reduce seepage and restore pond integrity. Install effluent filter or flotation to reduce algae and suspended solids that can interfere with disinfection. Install UV disinfection for pathogen inactivation to improve disinfection and reduce coliform concentrations.
TSS	X	X	X			Elevated TSS indicates insufficient solids separation. Potential contributing conditions include insufficient flow equalization and variable hydraulic loading, insufficient solids management and reduced effective treatment volume, algae or biomass carryover, and seepage or liner deficiencies.	Install new earthen storage basin to provide flow equalization and reduce hydraulic loading variability. Remove accumulated sludge to restore effective treatment volume and improve solids management. Repair or replace deficient pond liner areas to reduce seepage and restore pond integrity. Install effluent filter or flotation to improve solids separation and reduce TSS and algae carryover.

Table A-8. Remedial Actions for Primary Facility Types

Combination of Specific Parameter Violations	Add New Treatment Capacity	Desludge Pond and Install New Liner	Inadequacies Assumption	Remedial Actions Assumption
BOD (5-day @ 20 Deg. C)	X	X	Elevated BOD indicates insufficient BOD removal in the conventional pond system. Potential contributing conditions include insufficient treatment capacity or detention time, insufficient solids management and reduced effective treatment volume, excessive organic loading, and seepage or liner deficiencies.	Add new treatment pond capacity (new ponds) to increase treatment capacity and detention time and reduce organic loading rates. Desludge pond and install new liner to restore effective treatment volume, improve solids management, reduce seepage, and restore pond integrity.

Table A-9. Remedial Actions for Sequencing Batch Reactor Facility Types

Combination of Specific Parameter Violations	Install New Earthen Storage Basin (Flow EQ)	Install Polymer Feed System to Improve Flotation and Filtration (w/Filter Upgrade)	Improve Aeration System	Modify SBR System	Inadequacies Assumption	Remedial Actions Assumption
BOD (5-day @ 20 Deg. C) Nitrogen, Total (as N) TSS	X	X	X	X	Elevated BOD, total nitrogen, and TSS indicate insufficient BOD removal, insufficient nitrogen removal/denitrification, and insufficient solids separation. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading, insufficient nitrification, inadequate aerobic/anoxic cycle sequencing, inadequate solids retention, poor settling, and limited carbon for denitrification.	Install new earthen storage basin to provide flow equalization, reduce peak hydraulic and organic loading, and improve treatment stability. Install polymer feed system to improve flotation/filtration (w/filter upgrade) to improve solids separation and reduce TSS and associated particulate BOD and nitrogen. Improve aeration system to increase dissolved oxygen and support BOD removal and nitrification. Modify SBR system to optimize BOD and nitrogen removal, including supplemental carbon addition where needed to support denitrification.

Table A-10. Remedial Actions for Tertiary Facility Types

Combination of Specific Parameter Violations	Install New Earthen Storage Basin (Flow EQ)	Install/Upgrade for BNR	Install New or Rehab/Replace Existing Clarifier	Install Polymer Feed System to Improve Flotation and Filtration (w/Filter Upgrade)	Install UV Disinfection for Pathogen Inactivation	Improve Aeration System	Inadequacies Assumption	Remedial Actions Assumption
BOD (5-day @ 20 Deg. C)	X			X		X	Elevated BOD indicates insufficient BOD removal. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading, upstream BOD carryover, and insufficient tertiary removal of particulate BOD.	Install new earthen storage basin to provide flow equalization and stabilize BOD loading. Install polymer feed system to improve flotation and filtration (w/filter upgrade) to improve removal of particulate BOD. Improve aeration system to improve upstream BOD removal.
BOD (5-day @ 20 Deg. C TSS	X			X		X	Elevated BOD and TSS indicate insufficient BOD removal and insufficient solids separation. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading, upstream solids carryover, and inadequate tertiary filtration performance.	Install new earthen storage basin to provide flow equalization and stabilize BOD and TSS loading. Install polymer feed system to improve flotation and filtration (w/filter upgrade) to improve solids separation and reduce TSS and associated particulate BOD. Improve aeration system to improve upstream BOD removal.
Nitrate, Total (as N) Total Coliform	X	X		X	X		Elevated nitrate and total coliform indicate insufficient nitrogen removal/denitrification and insufficient disinfection. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading, limited anoxic treatment capacity or carbon availability, and solids or turbidity that interfere with disinfection.	Install new earthen storage basin to provide flow equalization and improve treatment stability. Install/upgrade for biological nutrient removal (BNR) to increase anoxic treatment capacity and improve denitrification, including supplemental carbon addition where needed. Install polymer feed system to improve flotation and filtration (w/filter upgrade) to improve solids removal and reduce interference with disinfection. Install UV disinfection for pathogen inactivation to improve disinfection and reduce coliform concentrations.
Nitrite Plus Nitrate (as N)	X	X					Elevated nitrite and nitrate indicate insufficient nitrogen removal/denitrification. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading, inadequate anoxic conditions, limited recycle capacity, or insufficient carbon availability.	Install new earthen storage basin to provide flow equalization and improve treatment stability. Install/upgrade for biological nutrient removal (BNR) to increase anoxic treatment capacity and improve denitrification, including optimization of recycle rates and supplemental carbon addition where needed.

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Nitrogen, Total (as N)	X	X		X		X	Elevated total nitrogen indicates insufficient nitrogen removal/denitrification. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading, insufficient nitrification, limited anoxic treatment capacity or carbon availability, and particulate organic nitrogen carryover.	Install new earthen storage basin to provide flow equalization and improve treatment stability. Install/upgrade for biological nutrient removal (BNR) to improve nitrogen removal through nitrification and denitrification, including supplemental carbon addition where needed. Install polymer feed system to improve flotation and filtration (w/filter upgrade) to reduce particulate organic nitrogen carryover. Improve aeration system to support nitrification.
Nitrogen, Total (as N) Total Coliform	X	X		X	X	X	Elevated total nitrogen and total coliform indicate insufficient nitrogen removal/denitrification and insufficient disinfection. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading, insufficient nitrification, limited anoxic treatment capacity or carbon availability, solids carryover, and insufficient disinfection performance.	Install new earthen storage basin to provide flow equalization and improve treatment stability. Install/upgrade for biological nutrient removal (BNR) to improve nitrogen removal through nitrification and denitrification, including supplemental carbon addition where needed. Install polymer feed system to improve flotation and filtration (w/filter upgrade) to improve solids removal and reduce particulate nitrogen and interference with disinfection. Install UV disinfection for pathogen inactivation to improve disinfection and reduce coliform concentrations. Improve aeration system to support nitrification.
Settleable Solids	X		X	X			Elevated settleable solids indicate insufficient clarification and solids separation. Potential contributing conditions include insufficient flow equalization and variable hydraulic loading, insufficient upstream clarification, and inadequate tertiary filtration performance.	Install new earthen storage basin to provide flow equalization and reduce hydraulic loading variability. Install new or rehab/replace existing clarifier to improve clarification and reduce solids carryover. Install polymer feed system to improve flotation and filtration (w/filter upgrade) to improve tertiary solids separation and reduce settleable solids.
Total Coliform	X				X		Elevated total coliform indicates insufficient disinfection. Potential contributing conditions include insufficient flow equalization and variable hydraulic loading, insufficient UV intensity or disinfectant contact time, and interference from suspended solids or turbidity.	Install new earthen storage basin to provide flow equalization and reduce hydraulic loading variability. Install UV disinfection to improve disinfection and reduce coliform concentrations.

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Total Coliform TSS	X			X	X		Elevated total coliform and TSS indicate insufficient disinfection and insufficient solids separation. Potential contributing conditions include insufficient flow equalization and variable hydraulic loading and suspended solids or turbidity that interfere with disinfection.	Install new earthen storage basin to provide flow equalization and reduce hydraulic loading variability. Install polymer feed system to improve flotation and filtration (w/filter upgrade) to improve solids separation and reduce TSS and interference with disinfection. Install UV disinfection to improve disinfection and reduce coliform concentrations.
TSS	X			X			Elevated TSS indicates insufficient solids separation. Potential contributing conditions include insufficient flow equalization and variable hydraulic loading, filter breakthrough, inadequate coagulation, or solids loading that exceeds tertiary filtration capacity.	Install new earthen storage basin to provide flow equalization and reduce hydraulic loading variability. Install polymer feed system to improve flotation and filtration (w/filter upgrade) to improve tertiary solids separation and reduce TSS.

Attachment B - Proposed Solutions Approach for Inadequate NPDES Facilities

Eleven (11) NPDES facilities met inadequacy criteria associated with a compliance schedule, compliance reporting, or failure to submit a discharge monitoring report. Technical assistance is the selected model solutions for these facilities.

Fifteen (15) inadequate NPDES facilities met criteria for effluent violations and were thus assumed to be associated with a treatment or infrastructure deficiency. While the NPDES effluent violation inadequacy criteria included a large set of parameters, the WWNA project team developed and categorized remedial actions only for parameters that could be addressed through remedial action infrastructure improvements. Table B-1 lists the parameters for which inadequacies occurred.

Table B-1. Parameters Triggering NPDES Effluent Violation Inadequacy with Remedial Actions as a Modeled Solutions

Parameter Violation Category	Specific Parameter Violations
Ammonia/TKN	Ammonia Impact Ratio Ammonia, Total (as N) Ammonia, Unionized (as N)
Bacteria	E.coli Total Coliform UV Transmittance
Chlorine	Chlorine, Free Available Chlorine, Total Residual
Disinfection Byproducts	Dibromochloromethane Dibromodichloromethane Dibromomethane Dichlorobromomethane
Flow	Flow
Nitrogen/Nitrate/Nitrite	Nitrate, Total (as N) Nitrite Plus Nitrate (as N) Nitrogen, Total (as N)
Oil & Grease	Oil & Grease
Organic Matter	Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) BOD5 @ 20 Deg. C, Percent Removal Carbonaceous Biochemical Oxygen Demand (CBOD) (5-day @ 20 Deg. C) Carbonaceous Biochemical Oxygen Demand (CBOD) (5-day @ 20 Deg. C), Percent Removal
pH	pH
Solids	Settleable Solids Total Solids (TS) Total Suspended Solids (TSS) Total Suspended Solids (TSS), Percent Removal Turbidity
Temperature	Temperature
Phosphorous	Phosphorus, Total (as P)

Table B-2 lists the parameters assessed for which no reasonable remedial action could be applied at the treatment facility. 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 (e.g., CV-SALTS, Central Valley Regional Water Quality Control Board). For inadequate facilities with these types of violations, the WWNA selects technical assistance as the modeled solution to serve as an interim/starting point solution, if not previously selected. Note that all 15 facilities with meeting effluent inadequacy criteria had violations associated with such "source control" parameters.

Table B-2. Violation Parameters Assumed to Require Source Control Solutions for Inadequate NPDES Facilities

Parameter Violation Category	Specific Parameter Violations
Metals	Aluminum, Total Recoverable Copper, Total & Total Recoverable Zinc, Total & Total Recoverable
Organic Chemicals & Industrial Pollutants	Bis (2-Ethylhexyl) Phthalate Carbon disulfide Phthalate Esters Plastics TCDD Equivalents
Salts	Chloride Electrical Conductivity @ 25 Deg. C Sodium, Total & Total Recoverable Sulfate, Total (as SO4) Total Dissolved Solids (TDS)
Toxicity	Acute Toxicity, including Fathead Minnow-survival Chronic Toxicity, including Species 3; C.dubia-Reproduction; & Green Alga-Growth Cyanide, Free Available & Total (as CN)
UV Banks in Operation	UV Banks in Operation

To address inadequacies associated with parameters for which remedial action may be applied, the selected remedial actions will depend on the parameters in violation, the combination of violating parameters, and the facility type. The 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 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 15 facilities with effluent inadequacies, there are 14 distinct scenarios of facility-type-parameter violation combinations. Tables B-3 through B-8 lists the remedial actions for each scenario. No NPDES SBR facilities met inadequacy criteria for effluent violations, so no solutions were developed for SBR facilities.

Table B-3. Remedial Actions for Activated Sludge Facility Types

Combination of Parameter Violation Categories	Combination of Specific Parameter Violations	Install New Earthen Storage Basin (Flow EQ)	Install/Upgrade for BNR	Install Effluent Filter or Flotation	Install Alkalinity/Chemical Feed	Install UV Disinfection for Pathogen Inactivation	Improve Aeration System	Inadequacies Assumption	Remedial Actions Assumption
Ammonia/TKN Bacteria Chlorine Disinfection Byproducts pH Nitrogen/Nitrate/Nitrite Organic Matter Solids	Ammonia Impact Ratio E.coli Total Coliform Chlorine (Free Available) Chlorine (Total Residual) Dibromochloromethane, Dibromodichloromethane, Dibromomethane, Dichlorobromomethane pH Nitrate (Total as N) BOD5 @ 20 Deg. C Percent Removal Settleable Solids Total Suspended Solids (TSS) Total Suspended Solids (TSS) Percent Removal	X	X	X	X	X	X	Elevated concentrations of ammonia, bacteria, chlorine residual, nitrate, organic matter, and solids, and abnormal pH indicate multiple activated sludge process deficiencies. Potential contributing conditions include variable hydraulic or organic loading; insufficient nitrification and nitrogen removal; insufficient aeration; insufficient solids separation/polishing; insufficient disinfection; inadequate chlorine residual control; and inadequate pH/alkalinity control.	Install new earthen storage basin to provide flow equalization, reduce peak hydraulic and organic loading, and improve treatment stability. Install/upgrade for BNR to improve nitrogen removal. Install effluent filter/flotation to reduce settleable solids and TSS in the effluent. Install alkalinity/chemical feed to provide pH and alkalinity control and support nitrification. Install UV disinfection to improve coliform removal and reduce chlorine-based disinfection. Improve the aeration system to increase dissolved oxygen and support nitrification and BOD removal.

Table B-4. Remedial Actions for Biofiltration Facility Types

Combination of Parameter Violation Categories	Combination of Specific Parameter Violations	Install New Earthen Storage Basin (Flow EQ)	Install/Upgrade for BNR	Install Effluent Filter or Flotation	Install Alkalinity/ Chemical Feed	Install UV Disinfection for Pathogen Inactivation	Improve Aeration System	Inadequacies Assumption	Remedial Actions Assumption
Bacteria Organic Matter Solids	Total Coliform Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) BOD5 @ 20 Deg. C, Percent Removal Total Suspended Solids (TSS) Total Suspended Solids (TSS) Percent Removal Turbidity	X		X		X	X	Elevated concentrations of bacteria, organic matter, and solids indicate multiple treatment deficiencies. Potential contributing conditions include variable hydraulic or organic loading; insufficient BOD removal; insufficient solids separation/polishing; and insufficient disinfection.	Install new earthen storage basin to provide flow equalization, reduce peak hydraulic and organic loading, and improve treatment stability. Install effluent filter flotation to improve solids separation and reduce TSS and turbidity in the effluent. Install UV disinfection to reduce coliform concentrations. Improve aeration system to increase dissolved oxygen and support BOD removal.
Ammonia/TKN Bacteria Chlorine Disinfection Byproducts pH Nitrogen/Nitrate/Nitrite Solids	Ammonia (Total as N) Total Coliform Chlorine (Total Residual) Dichlorobromomethane pH Nitrate (Total as N) Settleable Solids	X	X	X	X	X	X	Elevated concentrations of ammonia, bacteria, chlorine residual, nitrate, and solids, and abnormal pH indicate multiple treatment deficiencies. Potential contributing conditions include variable hydraulic loading; insufficient nitrification and nitrogen removal; insufficient solids separation/polishing; insufficient disinfection; inadequate chlorine residual control; and inadequate pH/alkalinity control.	Install new earthen storage basin to provide flow equalization, reduce peak hydraulic loading, and improve treatment stability. Install/upgrade BNR to improve nitrogen removal. Install effluent filter/flotation to improve solids separation and reduce settleable solids in the effluent. Install alkalinity/chemical feed to provide pH and alkalinity control and support nitrification and ammonia removal. Install UV disinfection to reduce coliform concentrations and reduce chlorine-based disinfection. Improve aeration system to increase dissolved oxygen and support nitrification.

Table B-5. Remedial Actions for Conventional Treatment Pond Facility Types

Combination of Parameter Violation Categories	Combination of Specific Parameter Violations	Desludge Pond and Install New Liner	Install New Earthen Storage Basin (Flow EQ)	Install/Upgrade for BNR	Install Effluent Filter And/or Flotation	Install UV Disinfection for Pathogen Inactivation	Improve Aeration System	Inadequacies Assumption	Remedial Actions Assumption
Bacteria Nitrogen/Nitrate/Nitrite Organic Matter Solids	Total Coliform Nitrate (Total as N) Nitrite Plus Nitrate (as N) Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) Settleable Solids Total Suspended Solids (TSS)	X	X	X	X	X	X	Elevated concentrations of bacteria, nitrate/nitrite, organic matter, and solids indicate multiple treatment pond deficiencies. Potential contributing conditions include variable hydraulic or organic loading; insufficient nitrogen removal; insufficient BOD removal; insufficient algal solids management, separation, and polishing; and insufficient disinfection.	Desludge pond and install new liner to restore effective pond volume, improve solids management, and restore pond integrity. Install new earthen storage basin to provide flow equalization, reduce peak hydraulic and organic loading, and improve treatment stability. Install/upgrade for BNR to improve nitrogen removal. Install effluent filter/flotation to improve algal solids separation and TSS in the effluent. Install UV disinfection to reduce coliform concentrations. Improve aeration system to increase dissolved oxygen and support BOD removal and nitrification.

Table B-6. Remedial Actions for Modified Treatment Pond Facility Types

Combination of Parameter Violation Categories	Combination of Specific Parameter Violations	Add New Treatment Pond Capacity (New Pond)	Desludge Pond and Install New Liner	Install New Earthen Storage Basin (Flow EQ)	Install Effluent Filter or Flotation	Install Alkalinity/ Chemical Feed	Install UV Disinfection for Pathogen Inactivation	Improve Aeration System	Inadequacies Assumption	Remedial Actions Assumption
Ammonia/TKN Bacteria Chlorine pH Organic Matter Solids	Ammonia (Total as N) Total Coliform Chlorine (Total Residual) pH BOD5 @ 20 Deg. Percent Removal Total Suspended Solids (TSS) Total Suspended Solids (TSS) Percent Removal	X	X	X	X	X	X	X	Elevated concentrations of ammonia, bacteria, chlorine residual, organic matter, and solids, and abnormal pH indicate multiple treatment pond deficiencies. Potential contributing conditions include insufficient treatment capacity and detention time; variable hydraulic or organic loading; insufficient nitrification; insufficient BOD removal; insufficient solids management, separation, and polishing; insufficient disinfection; inadequate chlorine residual control; and inadequate pH/alkalinity control.	Add new treatment pond capacity to increase treatment capacity and detention time and reduce hydraulic and organic loading rates. Desludge pond and install new liner to restore effective pond volume, improve solids management, and restore pond integrity. Install new earthen storage basin to provide flow equalization, reduce peak hydraulic and organic loading, and improve treatment stability. Install effluent filter/flotation to improve solids separation and reduce TSS in the effluent. Install alkalinity/chemical feed to provide pH and alkalinity control and support nitrification. Install UV disinfection to improve pathogen inactivation and reduce chlorine-based disinfection. Improve the aeration system to increase dissolved oxygen to support nitrification and BOD removal.

Table B-7. Remedial Actions for Primary Facility Types

Combination of Parameter Violation Categories	Combination of Specific Parameter Violations	Desludge Pond and Install New Liner	Install New Earthen Storage Basin (Flow EQ)	Install Effluent Filter or Flotation	Install UV Disinfection for Pathogen Inactivation	Add/Improve Aeration System	Inadequacies Assumption	remedial actions assumption
Chlorine Organic Matter Solids	Chlorine (Free Available) Chlorine (Total Residual) Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) BOD @ 20 Deg. C (Percent Removal) Settleable Solids Total Suspended Solids (TSS)	X	X	X	X	X	Elevated concentrations of chlorine residuals, organic matter, and solids indicate multiple primary treatment deficiencies. Potential contributing conditions include variable hydraulic or organic loading; insufficient biological organic matter removal; insufficient solids management, separation, and polishing; and inadequate disinfection and chlorine residual control.	Desludge pond and install new liner to restore effective treatment volume, improve solids management, and restore pond integrity. Install new earthen storage basin to provide flow equalization, reduce peak hydraulic and organic loading, and improve treatment stability. Install effluent filter/flotation to reduce settleable solids and TSS in the effluent. Install UV disinfection to reduce chlorine-based disinfection. Add an aeration system to increase dissolved oxygen to support BOD removal.

Table B-8. Remedial Actions for Tertiary Facility Types

Combination of Parameter Violation Categories	Combination of Specific Parameter Violations	Install New Earthen Storage Basin (Flow EQ)	Install/Upgrade for BNR	Install Effluent Filter or Flotation	Install Alkalinity/ Chemical Feed	Install UV Disinfection for Pathogen Inactivation	Improve Aeration System	Inadequacies Assumption	Remedial Actions Assumption
Ammonia/TKN Bacteria Chlorine Organic Matter Solids	Ammonia (Total as N) Total Coliform Chlorine (Total Residual) Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) BOD5 @ 20 Deg. C (Percent Removal) Total Suspended Solids (TSS) Total Suspended Solids (TSS) Percent Removal	X		X	X	X	X	Elevated concentrations of ammonia, bacteria, chlorine residual, organic matter, and solids indicate multiple treatment deficiencies. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading; insufficient nitrification and ammonia removal; insufficient BOD removal; insufficient solids separation/polishing; insufficient disinfection chlorine residual control.	Install new earthen storage basin to provide flow equalization, reduce peak hydraulic and organic loading, and improve treatment stability. install effluent filter/flotation to improve solids separation and reduce TSS in the effluent. Install alkalinity/chemical feed to support nitrification. Install UV disinfection to reduce coliform concentrations and chlorine-based disinfection. Improve aeration system to increase dissolved oxygen to support nitrification and BOD removal.

Evaluación de Necesidades de Aguas Residuales de California
Evaluación de Soluciones y Costos
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Combination of Parameter Violation Categories	Combination of Specific Parameter Violations	Install New Earthen Storage Basin (Flow EQ)	Install/Upgrade for BNR	Install Effluent Filter or Flotation	Install Alkalinity/ Chemical Feed	Install UV Disinfection for Pathogen Inactivation	Improve Aeration System	Inadequacies Assumption	Remedial Actions Assumption
Bacteria Disinfection Byproducts pH Nitrogen/Nitrate/Nitrite Solids	Total Coliform Dichlorobromomethane, Dibromochloromethane pH Nitrogen (Total as N) Settleable Solids Total Suspended Solids (TSS)	X	X	X	X	X	X	Elevated concentrations of bacteria, nitrogen, and solids, and abnormal pH indicate multiple treatment deficiencies. Potential contributing conditions include insufficient flow equalization and variable hydraulic loading; insufficient nitrogen removal; insufficient solids separation; insufficient disinfection; and inadequate pH/alkalinity control.	Install new earthen storage basin to provide flow equalization, reduce peak hydraulic loading, and improve treatment stability. Install/upgrade for BNR to improve nitrogen removal. Install effluent filter/flotation to reduce settleable solids and TSS in the effluent. Install alkalinity/chemical feed to provide pH and alkalinity control and support nitrification. Install UV disinfection to reduce coliform concentrations. Improve aeration system to increase dissolved oxygen for nitrification and nitrogen removal.
Ammonia/TKN Organic Matter Temperature	Ammonia (Unionized as N) Biochemical Oxygen Demand (BOD) (50day @ 20 Deg. C) Temperature	X			X		X	Elevated concentrations of ammonia and organic matter and abnormal effluent temperature indicate multiple treatment deficiencies. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading; insufficient nitrification; insufficient BOD removal; inadequate dissolved oxygen; and elevated influent or process temperatures.	Install new earthen storage basin to provide flow equalization, reduce peak hydraulic and organic loading, improve treatment stability, and dampen short-term temperature fluctuations associated with influent flow variability. Install alkalinity/chemical feed to support nitrification. Improve aeration system to increase dissolved oxygen for nitrification and BOD removal.
Nitrogen/Nitrate/Nitrite	Nitrogen (Total as N)	X	X				X	Elevated total nitrogen indicates insufficient biological nitrogen removal. Potential contributing conditions include insufficient flow equalization and variable hydraulic loading; insufficient nitrification and denitrification; and inadequate dissolved oxygen to support nitrification.	Install new earthen storage basin to provide flow equalization, reduce peak hydraulic loading, and improve treatment stability. Install/upgrade for BNR to improve nitrogen removal through nitrification and denitrification. Improve aeration system to increase dissolved oxygen to support nitrification.

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Combination of Parameter Violation Categories	Combination of Specific Parameter Violations	Install New Earthen Storage Basin (Flow EQ)	Install/Upgrade for BNR	Install Effluent Filter or Flotation	Install Alkalinity/ Chemical Feed	Install UV Disinfection for Pathogen Inactivation	Improve Aeration System	Inadequacies Assumption	Remedial Actions Assumption
Ammonia/TKN Bacteria Flow pH Organic Matter Solids	Ammonia (Unionized as N) Total Coliform Flow pH Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) Total Suspended Solids (TSS)	X		X	X	X	X	Elevated concentrations of ammonia/TKN, bacteria, organic matter, and solids, abnormal pH, and elevated flow indicate multiple tertiary treatment deficiencies. Potential contributing conditions include insufficient flow equalization and excessive hydraulic or organic loading; insufficient nitrification and ammonia removal; insufficient biological organic matter removal; insufficient solids separation and polishing; insufficient disinfection and pathogen inactivation; inadequate dissolved oxygen; and inadequate pH/alkalinity control.	Install new earthen storage basin to provide flow equalization, reduce peak hydraulic and organic loading, and improve treatment stability. Install effluent filter/flotation to reduce TSS in the effluent. Install alkalinity/chemical feed to provide pH and alkalinity control and support nitrification. Install UV disinfection to reduce coliform concentrations. Improve aeration system to increase dissolved oxygen to support nitrification and BOD removal.
Bacteria	Total Coliform	X				X		Elevated concentrations of bacteria indicate insufficient disinfection and pathogen inactivation. Potential contributing conditions include insufficient flow equalization and hydraulic loading variability that may reduce disinfection performance.	Install new earthen storage basin to provide flow equalization, reduce peak hydraulic loading, and improve treatment stability. Install UV disinfection to reduce coliform concentrations.
Flow Organic Matter Solids	Flow Carbonaceous Biochemical Oxygen Demand (CBOD) (5-day @ 20 Deg. C) Carbonaceous Biochemical Oxygen (CBOD) (5-day @ 20 Deg. C) Percent Removal Settleable Solids Total Solids (TS) Total Suspended Solids (TSS) Total Suspended Solids (TSS) Percent Removal Turbidity	X		X			X	Elevated flow and concentrations of organic matter and solids indicate multiple treatment deficiencies. Potential contributing conditions include insufficient flow equalization and excessive hydraulic or organic loading; insufficient BOD removal; and insufficient solids separation.	Install new earthen storage basin to provide flow equalization, reduce peak hydraulic and organic loading, and improve treatment stability. Install effluent filter/flotation to improve solids separation and reduce settleable solids, total solids, TSS, and turbidity in the effluent. Improve aeration system to increase dissolved oxygen to support BOD removal.

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Combination of Parameter Violation Categories	Combination of Specific Parameter Violations	Install New Earthen Storage Basin (Flow EQ)	Install/Upgrade for BNR	Install Effluent Filter or Flotation	Install Alkalinity/ Chemical Feed	Install UV Disinfection for Pathogen Inactivation	Improve Aeration System	Inadequacies Assumption	Remedial Actions Assumption
Ammonia/TKN Bacteria Chlorine Nitrogen/Nitrate/Nitrite Oil & Grease Organic Matter Phosphorous Solids Temperature	Ammonia (Total as N) Total Coliform Chlorine (Total Residual) Nitrate (Total as N) Nitrite Plus Nitrate (as N) Oil & Grease Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) Phosphorous (Total as P) Total Suspended Solids (TSS) Turbidity Temperature	X	X	X	X	X	X	Elevated concentrations of ammonia, bacteria, chlorine residual, nitrate/nitrite, oil & grease, organics, phosphorus, and solids, and abnormal effluent temperature indicate multiple treatment deficiencies. Potential contributing conditions include insufficient flow equalization and variable hydraulic or organic loading; insufficient nitrification and biological nutrient removal; insufficient biological treatment; insufficient solids separation and polishing; insufficient disinfection; inadequate chlorine residual control; inadequate dissolved oxygen; insufficient phosphorus removal; and elevated influent or process temperatures.	Install new earthen storage basin to provide flow equalization, reduce peak hydraulic and organic loading, improve treatment stability, and dampen short-term temperature fluctuations associated with influent flow variability. Install/upgrade BNR to improve nitrogen and phosphorous removal. Install effluent filter/flotation to reduce TSS, turbidity, and oil & grease in the effluent. Install alkalinity/chemical feed to provide alkalinity needed to support nitrification and provide chemical phosphorus removal, as applicable. Install UV disinfection to reduce coliform concentrations and reduce chlorine-based disinfection. Improve aeration system to increase dissolved oxygen to support nitrification and BOD removal.

Attachment C – SSSGO Pipe Repair/Replacement Approach

Several SSSGO systems met inadequacy criteria for poor spill performance. It is assumed that these spills result from aging, cracked infrastructure with subsequent inflow and infiltration, causing flows within the sewer lines to exceed their capacity. Pipe repair or replacement will be the selected solution. The amount of pipe that would need repair or replacement will be based on each system pipe length .

As part of the inadequacy assessment, the WWNA project team sorted SSSGO systems by system length, resulting in four system length size categories: large, medium, small, and micro. The project team calculated the average pipe length for all inadequate facilities in each size category, applied a percentage to each category to determine the length to be repaired/replaced, and developed a correlation across all inadequate SSSGO systems. Table C-1 lists each system length size category, the relevant number of inadequate systems, average pipe length for each category, and the assumed percentage for repair/replacement. Figure C-1 displays the plot of the average pipe length and resulting pipe length to be repaired/replaced for each size category, as well as the estimated regression line. The project team plans to apply this correlation for each inadequate SSSGO system to estimate the length of pipe to be repaired/replaced. The regression equation is:

$$PLRR = 0.1SPL + 6.7$$

Where PLRR is the pipe length to be repaired/replaced and SPL is the system pipe length.

Table C-1. Number of Inadequate Systems, Average Pipe Length, and Assumed Pipe Repair/Replacement for each System Length Size Category

System Length Size Category	# of Inadequate SSSGO Systems	Average Pipe Length (mi)	Assumed Percentage to be Repaired/Replaced	Length of Pipe to be Repaired/Replaced
Large	1	933	10%	93.3
Medium	12	165	15%	24.7
Small	11	44	25%	11.1
Micro	6	10	50%	5.2

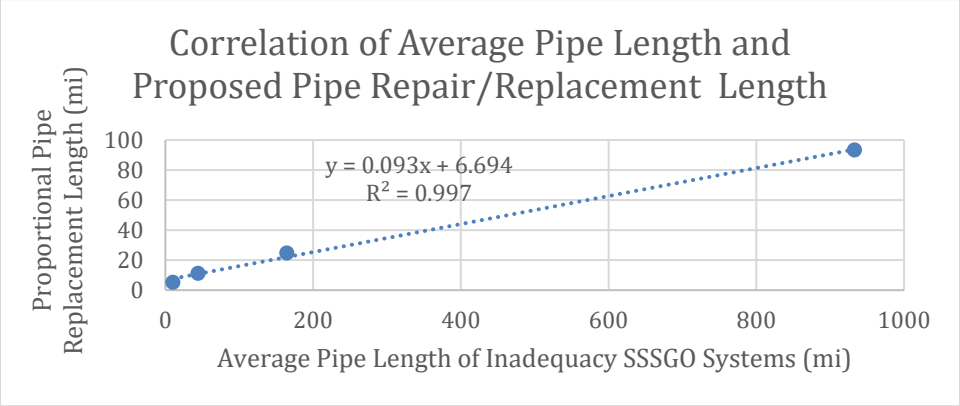


Figure C-1. Plot of Average Pipe Length and Proposed Pipe Repair/Replacement Length for Inadequate SSSGO Systems.