



**California Stormwater Quality Association®**

*Dedicated to the Advancement of Stormwater Quality Management, Science and Regulation*

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# A Roadmap for Stormwater and Wastewater Agencies to Collaboratively Reduce Human Fecal Sources of Bacteria in Waterbodies

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Prepared in Partnership with the  
California Association of Sanitation Agencies

**October 2024**



## Preface

### ADVANCING SUSTAINABLE STORMWATER MANAGEMENT

The California Stormwater Quality Association (CASQA) is a nonprofit corporation that advances sustainable stormwater management protective of California water resources. With well over 2,000 members, CASQA's membership is comprised of a diverse range of stormwater quality management organizations and individuals, including cities, counties, special districts, federal agencies, state agencies, ports, universities and school districts, wastewater agencies, water suppliers, industries, and consulting firms throughout the state. Collectively, CASQA represents over 34 million people in California.

CASQA's [\*Vision for Sustainable Stormwater Management\*](#)<sup>1</sup> (Vision) defines the actions needed to manage stormwater as an essential component of the state's water resources, support human and ecological needs, protect water quality, and enhance and restore California's waterways. There are four guiding principles to achieve this Vision. Like the legs of a chair, each Principle is essential and all four must be in place to support the whole.

**Principle #1: Program Implementation:** Projects and programs that use stormwater as a resource, protect water quality and beneficial uses, and efficiently minimize pollution are critical for sustainable stormwater management. Stormwater capture and true source control (identifying and mitigating a pollutant at its source) are the primary drivers of these solutions, with effective Best Management Practices (BMPs) providing an important supportive role.

**Principle #2: Permits, Regulations, and Legislation:** Permits, regulations, and legislation need to focus on effectiveness and desired outcomes to support sustainable stormwater management. Regulatory and legislative actions must align with and support the other components of the Vision – advancing stormwater capture, true source control, and effective BMPs, increasing public education and awareness focused on stormwater as a resource, and securing funding to support these solutions.

**Principle #3: Public Education:** Public awareness, understanding, and support is essential to sustainable stormwater management. The key shift is viewing stormwater as a resource that must be protected and integrated into overall water resource management.

**Principle #4: Funding:** Significant financial investment is required to achieve sustainable stormwater management. Stormwater is the most underfunded portion of the water sector and substantial funding is needed to bring these solutions forward.

### GOALS AND CONTEXT FOR THIS RESOURCE

This resource, *A Roadmap for Stormwater and Wastewater Agencies to Collaboratively Reduce Human Fecal Sources of Bacteria in Waterbodies*, advances Principle 1. CASQA has identified bacteria as a [Water Quality Priority](#), requiring solutions at a statewide scale. In September 2022, the State Water Resources Control Board and CASQA co-hosted a statewide summit on bacteria to create an engaged information sharing and discussion platform. The

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<sup>1</sup> [https://www.casqa.org/wp-content/uploads/2022/10/final\\_-\\_vision\\_for\\_sustainable\\_stormwater\\_management\\_-\\_10-07-2020.pdf](https://www.casqa.org/wp-content/uploads/2022/10/final_-_vision_for_sustainable_stormwater_management_-_10-07-2020.pdf)

California Association of Sanitation Agencies (CASA) and wastewater agency staff were key participants and engaged in active learning and information sharing. During the summit, CASQA and CASA committed to support municipal stormwater agencies and wastewater agencies by identifying potential opportunities for collaboration. This resource was developed to meet that commitment.

## **Acknowledgements**

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## Table of Contents

<b>Introduction</b> .....	<b>1</b>
<b>Collaborative Approaches to Consider When Implementing Permit Requirements</b> .....	<b>3</b>
Development of Required Plans and Programs.....	3
Operations and Maintenance.....	8
Spill Response.....	10
Inspections .....	12
<b>Collaborative Management Practice Opportunities and Examples</b> .....	<b>13</b>
Dry Weather, Low-Flow, and First Flush Diversions .....	13
Potable Reuse with Stormwater as a Water Source.....	14
Public and Private Sewer Laterals.....	15
Human Fecal Waste Source Identification and Abatement Programs .....	16
<b>References</b> .....	<b>17</b>

## Introduction

Working in partnership, the California Stormwater Quality Association (CASQA) and the California Association of Sanitation Agencies (CASA) have developed this resource to identify opportunities for enhancing collaboration and communication between stormwater and wastewater agencies, based upon the mutual goal of protecting recreational waters.

In 2019, CASQA identified bacteria as a statewide water quality priority. In September 2022, the State Water Resources Control Board (State Water Board) and CASQA co-hosted a statewide summit on bacteria to create an engaged information sharing and discussion platform with the following goals:

- Develop a common understanding of the evolution of the standards and science relevant to defining and achieving waters that are safe to swim and shellfish that are safe to eat,
- Review current source reduction and regulatory tools,
- Identify what's working well, what may be falling short, and potential improvements or opportunities to effectively reach our goals,
- Identify needed regulatory actions and research for achieving waters that are safe to swim and shellfish that are safe to eat, and
- Discuss a process for implementing those actions, including immediate next steps.

The summit resulted in the following key takeaways and principles to be considered moving forward, as described in the Day 3 summary<sup>2</sup>:

- Goal remains the same to get to the point where it is safe to swim and shellfish are safe to eat
- Risk-based perspective takes a lot of forms, but is something that came out clearly in the summit
- Fecal contamination source type matters as not every source of indicator bacteria has the same level of risk
- There are some opportunities to use and improve standards
  - Current objectives are most indicative of risk when there are high levels of human and cattle sources and may not be as appropriate when the primary fecal contamination source types are less risky.
  - Risk modeling, such as Quantitative Microbial Risk Assessment (QMRA), could be useful tools and could support site-specific objectives. A framework for how to do the studies and interpret the results would be helpful.
  - Consideration of tribal and subsistence beneficial uses.
- For implementation:
  - Control the controllable sources and prioritize source control for fecal contamination source types with the greater illness risk.
  - Accountability is important.
  - A framework for defining the actions needed would be helpful.

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<sup>2</sup> See the Summary for all takeaways at <https://www.casqa.org/wp-content/uploads/2023/04/California-Bacteria-Summit-Short-Summary-03-27-2023.pdf>

- Collective action, partnering and messaging are critical and important to everything that has been discussed. Examples include:
  - Joint fact finding,
  - Partnering with public health experts,
  - Working with expert panels and scientists
  - Highlighting successes and learning from existing studies and monitoring, and
  - Communicating to the public so they can understand the risks more in real time.
- For monitoring, data, and tools, need to ensure that data are consistent and comparable and to support upcoming needs like source tracking and rapid, real-time data.

In the Day 1 and Day 2 summaries, takeaways that provide additional detail that can help inform implementation actions for municipal stormwater agencies include<sup>3</sup>:

- Fecal contamination source type matters as not every source of indicator bacteria has the same level of risk:
  - In waters impacted by human sources, viruses most likely to make people sick.
  - In waters not impacted by human fecal sources, viruses likely not present.
  - Nature and magnitude of source(s) are important in determining the risk of illness.
  - The riskiest sources are human and cattle, but other sources if present in high concentrations can cause illness.
- Distinguishing the sources is important for identifying what actions to take
- Source not only matters for risk, but it also matters for implementation to determine if our actions are removing the risk.

The takeaways from the 2022 Bacteria Summit, regarding the varying levels of risk from different sources of indicator bacteria, align with the conclusions from the United States Environmental Protection Agency's (EPA) 2nd 5-year review of the National Recreational Water Quality Criteria (EPA, 2023c). The review includes a plan to explore new methods to determine whether a waterbody is contaminated with human feces, as this type of contamination poses the greatest risk of illness in recreational waters.

During the 2022 Bacteria Summit, CASA and wastewater agency staff were key participants and engaged in active learning and information sharing. CASQA and CASA committed to support municipal stormwater agencies and wastewater agencies by identifying potential opportunities for collaboration. This resource was developed to meet that commitment. Stormwater and wastewater agencies have a long history of working to prevent pollutant discharges that may affect the beneficial uses of waterways, including collaborating during spills or other events that could impact those uses.

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<sup>3</sup> See the Summary for all takeaways at <https://www.casqa.org/wp-content/uploads/2023/04/California-Bacteria-Summit-Short-Summary-03-27-2023.pdf>

This resource is one of several documents<sup>4</sup> focused on addressing high risk sources that collectively contribute to a goal shared by many organizations – to advance solutions that ensure waters are safe to swim and harvest shellfish. Most of the information presented in this document is based on data and strategies designed to protect recreation (i.e., “safe to swim”). However, actions that address human fecal waste sources are likely to support protection of other beneficial uses, such as harvesting of shellfish and tribal beneficial uses.

## Collaborative Approaches to Consider When Implementing Permit Requirements

While stormwater and wastewater agencies have separate and unique programs, their goals are similar. The tools and methodologies they employ have significant overlaps, suggesting an opportunity for enhancements to existing cooperative efforts and, where appropriate, establishing new relationships between agencies. There are potential opportunities to enhance collaboration and achieve mutual goals through activities already required by their separate regulatory frameworks. These opportunities fall into four categories:

1. Development of Required Plans and Programs
2. Operations and Maintenance (O&M)
3. Spill Response
4. Inspections

### DEVELOPMENT OF REQUIRED PLANS AND PROGRAMS

Both stormwater and wastewater agencies are required to develop planning documents and implement strategies to effectively manage their systems to prevent the discharge of pollutants to waterbodies. Through enhanced training, communication and resource sharing, these planning documents can leverage work from the other agencies to meet requirements and can potentially be modified to provide enhanced protection of waterbodies to meet mutual goals.

#### Sanitary Sewer System Management Plans

On December 6, 2022, the State Water Board adopted Order WQ 2022-0103-DWQ, the Statewide Waste Discharge Requirements General Order for Sanitary Sewer Systems (SSS WDR). Recognizing the importance of unified efforts, the State Water Board has underscored inter-agency collaboration as a pivotal approach to implementing the SSS WDR provisions.

Central to this effort is the Sewer System Management Plan (SSMP). The SSMP serves as a comprehensive blueprint, designed to streamline the management, operation, and maintenance of sanitary sewer systems. It offers a broad perspective on the sewer system’s management activities, methodologies, and decision-making processes, emphasizing the prioritization of system upgrades, repairs and maintenance. With its adaptable structure, the SSMP

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<sup>4</sup> A report on the regulatory and technical challenges associated with the current fecal indicator bacteria (FIB) objectives for recreational waters (CASQA, 2020). This report provides an in-depth discussion of the background of the current FIB objectives and situations in which those objectives may not be directly linked to risk to recreators in California waterbodies. The report also discusses the technical challenges and significant costs associated with implementing actions to meet the FIB objectives. Given the identified uncertainties in applying the FIB objectives in California and the significant costs involved in meeting the FIB objectives, the need to explore alternative ways to assess the actual risk due to contact and/or recreation and strategies to address risk above acceptable levels when present was identified.

CASQA’s *Human Fecal Waste Sources of Bacteria: Abatement Strategies for Municipal Stormwater Agencies*, which outlines actions stormwater agencies can take to address high risk sources of bacteria (CASQA, 2024).

caters to the distinct requirements and challenges of individual sanitary sewer systems. SSMPs aim to seamlessly integrate programs and strategies, ensuring both immediate responsiveness and long-term resilience. This encompasses proactive planning, legislative imperatives, modernized operational procedures, capital enhancements, effective resource allocation, and ongoing training programs for all stakeholders. SSMP's aim to manage, operate, and maintain the sanitary sewer system efficiently, evaluate needs for upgrades, minimize spills, and effectively contain and manage spills that arise. SSMPs must include multiple elements, with the following requirements providing opportunities for collaboration with stormwater agencies:

- Sewer system asset overview
- Chain of communication for reporting spills
- Operation and maintenance (O&M) program, including:
  - Mapping of the sanitary sewer system
  - Preventative O&M activities
  - Training
- Spill Emergency Response Plan
- System evaluation, capacity assurance, and capital improvements
- Communication framework

### Stormwater Quality Management Programs

The 1987 Federal Clean Water Act amendments mandated National Pollutant Discharge Elimination System (NPDES) permits for municipal separate storm sewer system (MS4) dischargers that:

- Effectively prohibit non-stormwater discharges into the MS4s; and
- Require the identification and implementation of controls to reduce the discharge of pollutants in stormwater discharges to the maximum extent practicable.

Subsequent regulations promulgated by EPA in 1990 and 1999 generally require municipalities over 100,000 in population and municipalities less than 100,000 in population to be regulated by a Phase I NPDES Permit or Phase II NPDES Permit, respectively.

The Phase I and Phase II NPDES municipal stormwater permits require the municipalities to develop, implement, and adaptively manage a comprehensive stormwater program within their jurisdiction that typically addresses the following types of programs and activities:

- Establishment of necessary legal authorities to implement the various components of the stormwater program
- Foster public engagement in the development and implementation of the stormwater program and provide outreach to identified target audiences to prevent the discharge of pollutants on the urban landscape
- Develop and implement an illicit discharge detection and elimination program to proactively identify potential discharges and respond to water pollution complaints conveyed by public agency staff or the public.
- Develop and implement several types of focused management, outreach, and inspection programs targeted at specific types of activities conducted including:
  - Commercial and Industrial Businesses
  - Construction Sites
  - Municipal Operations



- Develop and implement a program to ensure that private and public development projects meet the required design standards.
- Develop and implement a water quality monitoring program to assist in determining the effectiveness of the overall program, specific program elements, and/or to identify potential issues within the receiving waters.
- Develop and implement pollutant-specific programs and/or total maximum daily loads to address high priority water quality concerns.

Each year, municipalities develop and submit an annual report that provides specific data, information, and deliverables required by their respective Permit and addresses the effectiveness of the stormwater program as well as potential modifications.

The development and implementation of stormwater programs provide several opportunities to collaborate with wastewater agencies and others to address specific issues and identify regional, multi-benefit solutions.

In California, most of the recent Phase I permits provide either an option or a requirement to develop a watershed management plan. The plan requirements vary by permit, but generally require evaluating the pollutants of concern for the waterbody, identifying management measures to address the pollutants of concern, a quantitative assessment that the management measures will result in reductions in the pollutants of concern to meet the water quality objectives, a time schedule for implementing the management measures and a monitoring program that will assess whether or not objectives are being met in the receiving water. As part of these plans, stormwater agencies often include a process for investigating potential sources of discharges to the MS4 system, particularly for human fecal waste sources of FIB.

## Opportunities for Collaboration

### Sharing Mapping and Data Resources

Both stormwater and wastewater agencies must map their respective systems. A potential opportunity for collaboration is the sharing of mapping resources and the underlying data supporting those maps. By accurately understanding the geospatial layout of both the sanitary sewer and the storm drain systems, agencies can gain insights into potential overlaps or close proximities that might influence each other. When sanitary sewer systems are situated directly above or in close vicinity to and/or above the storm drain systems, either or both assets have defects, and the soil surrounding the assets are permeable or alluvial, the likelihood of unintended cross-contamination of the stormwater assets is increased. Wastewater agencies can use the stormwater infrastructure maps to help with developing their spill response plans and stormwater agencies can use the mapping resources to assist with source identification, mitigation planning, and implementation of investigative actions.

Additionally, sharing detailed mapping and institutional knowledge of flood-prone areas can inform proactive planning for capital improvements and aid in the prioritization of stormwater infrastructure improvements, especially when in close vicinity to sanitary assets vulnerable to significant inflow and infiltration during rain events. While not required, agencies might consider working together to improve mapping resources to enable improved response for containing, capturing, and disposing captured sewage with the goal of reducing spill volumes to surface waters. This could include progressive improvements from paper maps to Geographical Information System (GIS) systems configured to enable tracing storm drainage systems from the point of entry into the system to the discharge location.

Additional advancements could include identifying strategic containment locations in the storm drain system and potential sampling locations.

### **Prioritizing Management Measures**

SSMPs must include procedures for a condition assessment of their system that prioritizes areas within the vicinity of a receiving water with a bacterial-related impairment on the 303(d) list. Additionally, the SSMP must include a prioritization of maintenance based on the findings of the condition assessment. As wastewater and stormwater infrastructures age or degrade over time, the risk of unintended cross-contamination increases between the two systems, particularly where pipes are in close proximity to each other. If wastewater agencies include procedures in their condition assessment to evaluate the relationship between the sanitary and storm drain systems for areas near 303(d) listed waterbodies, the agencies may be able to further prioritize areas for maintenance by focusing on areas with the highest likelihood of transporting spills to waterbodies.

Additionally, stormwater agencies often have information on areas of high FIB concentrations and may have monitoring data that indicates where human fecal waste sources of FIB may be present. Using this information could help wastewater agencies prioritize investigative actions in their SSMPs. Additionally, wastewater agencies can communicate to stormwater agencies the areas that are at risk due to significant inflow and infiltration. This information will allow stormwater agencies to consider targeting repairs or identifying implementation projects in those areas to help mitigate the inflow and infiltration and the potential for wet weather spills. If specific improvements are then identified and included in the agency's Capital Improvement Plan, it may be possible for stormwater agencies to recognize and account for water quality improvements in their planning and construction efforts.

### **Joint Project Planning**

The SSMPs are required to include a capacity assessment for its infrastructure during wet weather events, identify major sources that contribute to peak flows, and consider the impacts of climate change. While these assessments are specific to the sanitary system, the results of the assessment may identify the need to address capacity limitations in some areas of the collection system. In their watershed management plans, stormwater agencies often evaluate regional projects and low impact development that can reduce flooding and the volume of water moving through the storm drain system. This planning can be strengthened by sharing tools and methods for predicting flooding risks to facilitate project planning, sizing, and implementation. Depending on the locations of the capacity concerns and the sources of the flows to the sanitary system, there may be opportunities for multi-benefit projects that could help reduce stormwater runoff, as well as address some sewer capacity issues.

Additionally, wastewater agencies can provide input on design considerations for stormwater facilities and storm drain improvements in the vicinity of critical wastewater infrastructure. In some cases, stormwater agencies are considering the effects of climate change in their planning efforts, and they may have information that can be useful to the wastewater agencies for completing the required climate change analysis in the capacity assessment. Having similar planning assumptions for climate change across agencies can help with developing multi-benefit projects. Finally, joint project planning provides opportunities to evaluate joint funding opportunities. Opportunities for grant funding are often enhanced by having multi-benefit projects and some funding opportunities may be more easily obtained by either wastewater or stormwater agencies. Collaboratively evaluating all funding opportunities and considering cost-sharing agreements may expand the range of options for funding projects.

## **Proactive Actions**

Many stormwater agencies have identified FIB as a high priority in their watershed management plans and several studies in Southern California have found human fecal waste markers in stormwater discharges. While potential sources of human fecal waste markers are numerous, there can be value in proactively addressing untreated wastewater as a potential source of contamination in receiving waters. Areas where wastewater lines are located in the vicinity of storm drain systems, particularly when located directly above the storm drains, are more at risk of unintended cross-contamination between the systems. There might also be areas where the wastewater systems are located near the receiving water (e.g., running underneath a creek or tributary) or stormwater runoff has a higher potential to contribute to infiltration and inflow challenges in wastewater systems. If the infrastructure is aging or a condition assessment suggests defects are present in these areas, agencies can consider taking proactive steps to mitigate potential cross-contaminations by lining the sewer systems, conducting more frequent maintenance and inspections in these higher-risk areas, or implementing projects to reduce the potential for stormwater infiltration and inflow into the wastewater collection system.

## **Integrated Communication Framework**

Establishing a comprehensive communication framework between wastewater and stormwater agencies carries a multitude of key advantages that collectively contribute to more effective and efficient water management. Such a framework significantly improves operational efficiency by enabling the synchronization of operations, thereby minimizing redundancy and optimizing the use of resources. Such communication greatly enhances emergency responsiveness as agencies can share critical information and resources swiftly, thus effectively mitigating the impact of incidents such as sewer overflows or stormwater flooding.

Furthermore, a robust communication framework with an integrated approach to resource management can help to ensure decisions made within one system consider the potential impacts on the other, promoting sustainable practices across the board. Integrated communication opens channels for shared knowledge and best practices, potentially leading to the adoption of collaborative and innovative solutions for improvement of joint processes. This communication is particularly beneficial for developing the best approaches to achieve respective permit requirements.

Unified communication efforts also extend outward, offering clearer and more impactful community engagement and education on wastewater and stormwater pollution prevention. Financially, a collaborative framework can lead to cost savings by sharing resources such as training materials, data systems, and infrastructure projects, achieving economies of scale. Effective communication frameworks encourage proactive problem-solving, where potential issues can be identified and addressed before they escalate and support the development of resilient infrastructure designed to withstand the growing challenges of climate change and urbanization.

Lastly, such a communication framework is foundational to a watershed-based approach to management, considering all factors affecting a watershed, which can lead to stronger environmental protection and sustainability. In essence, by promoting consistent and collaborative communication, wastewater and stormwater agencies can ensure efficient delivery of better services to the community, enhance the resilience of infrastructure, and engage in a potentially more effective stewardship of natural resources.

## Joint Training Programs

As a part of their permit required training programs, both wastewater and stormwater agencies are encouraged to facilitate training for their direct staff and other key stakeholders. Agencies that embark on additional collaboration for planning can consider training on elements of the plans, such as shared mapping resources, collaborative management measures, water quality monitoring efforts, and proactive maintenance actions. In areas where wastewater and stormwater agencies program planning activities intersect, it may be beneficial for each agency to organize and participate in joint cross training sessions focused on prevention of human fecal waste discharge into waterbodies on a regular basis. These training programs could also include training on joint responses to flooding events and spills. This ensures that every member of the staff, whether longstanding or newly appointed, remains well-versed in the details and nuances of when and how the agencies' programs interconnect.

## OPERATIONS AND MAINTENANCE

Both wastewater and stormwater agencies have permit requirements that specify O&M activities, some of which provide opportunities for collaboration. Wastewater agencies are required to have a schedule of inspection and maintenance activities and a data collection system to document the data from the inspections. Stormwater agencies must maintain their stormwater infrastructure, conduct prioritized inspections of various types of facilities, and have an illicit discharge detection and elimination program in place. Some potential areas of overlap in the two requirements are highlighted below.

### Infrastructure Inspections

Both wastewater and stormwater agencies frequently face the challenge of aging infrastructure. To enhance the longevity of their systems, these agencies engage in consistent maintenance activities, including hydro and mechanical cleaning techniques. Various challenges can afflict these pipes: roots can penetrate, construction activities might disrupt the alignment and joints, crews may unintentionally cross-connect systems, and older pipes are at risk of collapsing. While regular cleaning undeniably extends a pipe's lifespan, a comprehensive assessment of its condition necessitates a detailed internal view.

To conduct assessments, many agencies deploy Closed-Circuit Television (CCTV) inspections, beneficial to both wastewater and stormwater systems. These inspections utilize remotely operated camera robots capable of accessing pipes of varying diameters. The inspection data is often captured using a detailed pipe assessment model, adhering to nationally recognized standards such as NASSCO's Pipeline Assessment Certification Program (PACP) standards. This method yields high-definition videos and images, providing a clear view of the pipe's interior and its condition. Beyond just pointing out structural or functional flaws (potential cross-connections), the CCTV inspection reports also rank the severity of the detected issues, assisting agencies in formulating appropriate corrective measures. CCTV inspections routinely assist stormwater agencies with source tracking and dry weather flows while investigating illicit discharges. To provide a comprehensive spatial perspective, these CCTV inspection findings may be integrated into a GIS overlay to clearly pinpoint problem areas in correlation with above-ground landmarks.

### Proactive Mitigation of Sanitary Sewer Spills, Illicit Connections, and Illicit Discharges

Both agencies have permit requirements to mitigate spills, prevent unintentional cross-connections, or prohibit other illicit discharges and connections to their respective systems. Interagency collaboration can be a mutually beneficial opportunity to address similar regulatory issues and requirements within both the SSS WDR and MS4 NPDES

permits with the emphasis on managing and rectifying spills, cross-connections, illicit connections, and illicit discharges.

*Sanitary Sewer Spill:* This term is used to describe any discharge of untreated sewage from any segment of the sanitary sewer system. This kind of spillage might be attributed to several factors – an overflow of the sanitary sewer, operational failure, or a failure of the underlying infrastructure.

*Illicit Connection:* This term typically refers to any drain or conveyance, whether on the surface or subsurface, that allows illegal discharges to enter the storm drain system. This includes, but is not limited to, conveyances that allow non-stormwater discharges such as sewage (from sewer connections, either intentionally or unintentionally connected to the storm drain system, commonly known as cross-connections), process wastewater, or wash water. It also applies to any connections from indoor drains or sinks to the storm drain system, regardless of whether the connection was previously allowed, permitted, or approved by an authorized enforcement agency. Additionally, it includes any drain or conveyance from a commercial or industrial land use to the storm drain system that has not been documented in plans, maps, or equivalent records and approved by an authorized enforcement agency.

*Illicit Discharge:* This term typically means any discharge to a storm drain that is prohibited under local, state, or federal statutes, ordinances, codes, or regulations. The term illicit discharge includes all non-stormwater discharges not composed entirely of stormwater except discharges exempt or conditionally allowed by an NPDES permit and/or local ordinances.

## Opportunities for Collaboration

### Data Sharing

As both agencies are collecting information on the status of their infrastructure, sharing information will aid in managing both systems. For example, information about the status of the sewer system infrastructure from inspections (particularly in predetermined high priority areas where the two systems overlap or are in close proximity to each other) could be a resource for stormwater agencies conducting a source investigation in an area of concern. If a part of the sewer system is experiencing high rates of infiltration, records about the stormwater infrastructure in the area may provide insights that could help prevent spills. Additionally, sharing information collected through the illicit discharge detection and elimination program on a regular basis could help identify potential problem areas for the sanitary sewer system that can be prioritized and addressed.

### Joint Inspections and Investigations

Both agencies use CCTV inspections as a tool for inspecting their infrastructure. Coordinating inspections or sharing information about their timing may offer benefits, as it allows the other agency to highlight any potential problems or issues they have identified in the area, helping to guide the inspection process. Moreover, many stormwater agencies do not own CCTV inspection assets or have the in-house capacity or training to manage such operations. In these cases, agencies might consider the possibility of co-funding the necessary equipment or sharing resources with local wastewater agencies. Such a cooperative approach may not only alleviate the financial strain but also foster a synergy in resource utilization and expertise sharing, potentially leading to more efficient and cost-effective infrastructure maintenance and management for each agency.

## **Identifying and Addressing Cross-Connections**

Pooling resources can streamline the process for wastewater and stormwater agencies when it comes to pinpointing cross-connections that may not be immediately apparent. Cross-connections can introduce significant challenges for both agencies. An unmarked, unknown, or unmapped sanitary connection to the stormwater system can result in untreated sewage inadvertently entering downstream waterbodies and contribute to unidentified dry weather flows. Conversely, stormwater mistakenly directed into the sanitary system can create excessive flow in the wastewater collection system and to the wastewater treatment plant, especially during periods of wet weather when the facilities are already handling increased volumes from inflows and infiltration.

Wastewater and stormwater agencies, through regular monitoring and investigative efforts, often encounter difficulties in isolating the exact source when inadvertent cross-connections exist. Shared tools such as CCTV for pipeline inspection, observations of flow during dry weather, or unusually high monitoring results can aid with identifying these problematic connections. Additionally, dye testing of sanitary sewers represents another practical method often employed by wastewater and stormwater agencies to track and pinpoint the origins of contamination, especially in complex networks where tracing connections can be challenging. Open and proactive communication between the two agencies upon the detection of potential cross-connections, complemented by coordinated inspections and collaborative investigations, can enhance both programs and lead to successful outcomes.

The development of guidance for identifying sewer-to-storm drain connectivity (plumbed or otherwise), led by CASQA, State Water Board, and CASA, may increase and facilitate standardization across both water sectors.

## **O&M Training for Wastewater and Stormwater Agencies**

Both wastewater and stormwater agencies are required through their respective permits to create and deliver training programs specifically tailored to the needs of their personnel and key stakeholders. Joint training opportunities include, but are not limited to, data sharing, infrastructure inspections, spill prevention, spill response/recovery, illicit discharge detection and elimination (IDDE) programs, and the nuanced management of cross-connections.

Where an intersection exists between O&M duties for wastewater and stormwater agencies, it may be particularly beneficial to organize and conduct regular joint training sessions. The goal of these sessions would be to foster a comprehensive understanding of both the unique and shared aspects of O&M activities. The training could be designed to ensure that all staff members, from seasoned employees to newcomers, have a clear understanding of how the operational programs of both agencies intersect and how the agencies collaborate. Training initiatives serve to not only solidify existing program elements but also to cultivate a collaborative discussion dedicated to the enhancement of infrastructure O&M functions.

## **SPILL RESPONSE**

The permits for both stormwater and wastewater agencies include requirements for spill response, training and communication with other agencies. Working together to implement these requirements provides a significant opportunity to increase the effectiveness of both programs.

### **Spill Emergency Response Plans**

The SSS WDR mandates all sewer agencies to either revamp their existing Spill Emergency Response Plan (SERP) or formulate a new one. The SERP is expected to clearly delineate protocols for timely notification of first responders,

pertinent local authorities, and regulatory agencies in the event of a spill. There may be requirements to notify other potentially affected organizations, like health departments or water distributors, especially when a spill might jeopardize public health or impact water quality. A key tenet of the SERP is fostering collaboration with stormwater agencies, ensuring that spills that could affect stormwater systems are managed effectively to minimize impact on water quality.

### Illicit Discharge Detection and Elimination Programs

Stormwater permits mandate that permittees implement controls and measures to prevent, detect and eliminate illicit discharges and seepage of untreated sewage from sanitary sewer systems or other sources from entering the storm drain system. Such measures require source identification, appropriate enforcement measures, and follow-up when an event occurs. A key requirement in the event of an untreated sewage spill is the immediate reporting and coordinated communication with wastewater agencies. This requirement ensures a timely stoppage of the spill and its source, prevents discharge into the storm drain system, and facilitates adequate mitigation, if feasible.

### Opportunities for Collaboration

#### **Integrating Spill Response Plans and IDDE Programs or Integrated Spill Response Management**

Integrating wastewater's SERP with stormwater's IDDE programs presents an opportunity to manage spills more effectively. This integration would ensure that responses to spills are comprehensive, coordinated and collaborative, thus reducing the chances for management gaps between the systems. For instance, stormwater agencies can provide support to wastewater agencies regarding methods and opportunities to capture spills before they reach receiving waters and assist with identifying methods of cleaning the impacted storm drain system after a spill. Wastewater agencies should immediately report any spills reaching storm drains or receiving waters to stormwater agencies. Having a unified and prompt response program will help avoid unnecessary delays or inefficiencies.

From a practical standpoint, integrated programs can facilitate the sharing of resources and information to develop plans and programs, potentially leading to more effective plans for communication and programmatic elements. This approach can prevent unnecessary duplication of efforts, where both programs might otherwise carry out similar tasks independently. Data sharing can be enhanced, improving the ability to proactively plan for spill response, enabling early detection of potential discharges. Combining knowledge and expertise can lead to better-informed decisions and programs, as well as more innovative solutions to common challenges.

Moreover, the integration of these programs can be instrumental in ensuring compliance with each program's spill management requirements, which often necessitate measures that span both wastewater and stormwater management, particularly related to coordinated communication plans. This integration can also simplify training processes, as personnel need only be trained in one comprehensive set of procedures, rather than navigating through potentially conflicting or overlapping sets of rules.

The SSS WDR requires enrollees that have a sewage spill of 50,000 gallons or greater to conduct receiving water monitoring and a location in the storm drain conveyance system before it discharges into the receiving water. In many cases, the stormwater agency already has applicable data and relevant sampling locations that can be used to benefit the water quality monitoring program. These data and sampling locations can be accessed for key areas such as sewer pump stations and waterbodies in advance of a large sewer spill to streamline creation of event specific monitoring plans.

An example of an integrated spill response program is the Countywide Area Spill Control (CASC) program developed by the County of Orange and Orange County Sanitation District. Full-scale implementation of CASC throughout Orange County began in 2010. This coordinated response to sanitary sewer overflows that threaten the MS4 is a key strategy of the Water Quality Improvement Plan for South Orange County to address the highest priority water quality condition identified as a pathogen health risk.

### **Coordinating Spill Response and IDDE Training**

Integrating training programs for SERP and stormwater IDDE programs offers intrinsic synergies, stemming from the interconnected nature of sanitary and stormwater infrastructures and the overlapping regulatory requirements. Such integration fosters unified methodologies for managing spill events and detecting illicit discharges, which may often be linked or, in some instances, represent the same incident. Having coordinated training programs and agreements for mutual assistance during spill events allows both wastewater and stormwater agency staff to operate cohesively, ensuring swift and effective response measures. This unified training ensures that personnel are adept in understanding and addressing issues pertinent to both systems, thereby enhancing the efficiency and effectiveness of their response.

The integration allows staff to adopt a consistent set of practices to address various types of incidents. A unified approach is especially beneficial in emergencies, where swift and coordinated responses are paramount to mitigate spill impacts. Clearer and more precise communication, fostered by unified training, enhances cooperation among different departments, which leads to more effective identification, reporting, and resolution of spills. Moreover, by consolidating resources and eliminating duplicative training efforts, integrated programs can yield cost savings. Ultimately, this holistic training strategy is in line with the primary objective of adhering to permit requirements, ensuring that all involved personnel possess the requisite knowledge and skills to manage and minimize the impact of spill events.

### **INSPECTIONS**

Both stormwater and wastewater agencies are mandated by their specific regulatory frameworks to perform inspections, each with its unique set of requirements. Wastewater agencies primarily focus on industrial pre-treatment and fats, oils, and grease (FOG) inspections, while stormwater agencies are responsible for a broader range of stormwater inspections at construction sites, MS4 facilities, industrial and commercial businesses, and in response to illicit discharge reports. The frequency of these inspections is not uniform. It varies based on the specific regulatory requirements, inspection type, and hinges on the agency's objectives and/or the inspected facility's capacity to consistently demonstrate compliance.

It is noteworthy that there is a significant overlap in the facilities inspected by both types of agencies. Facilities subject to sanitary industrial pre-treatment and FOG inspections are often also inspected by the Phase I MS4 agencies for industrial and commercial stormwater inspections. This intersection can lead to confusion among regulated entities, especially when they encounter similar requirements from two different agencies. Moreover, the financial aspect of these inspections is relevant. Many agencies levy fees to offset the costs of these inspections, a financial burden that can be particularly taxing for smaller entities with limited resources.



## Opportunities for Collaboration

### Inspection Inventory

Identifying and tracking facilities requiring inspections can be a difficult task, often requiring communication between different internal databases (e.g. business licensing, water/wastewater billing, etc.). Through sharing inventories and collaborating on methods for updating those inventories, wastewater and stormwater agencies can alleviate some of the burden of maintaining up-to-date facility databases. Additionally, if joint inspection inventories are established, it can facilitate creating a more coordinated inspection approach between the agencies.

### Inspection Results

Establishing methods to share information on inspection results, particularly areas of non-compliance, provides opportunities to facilitate corrective action. If both stormwater and wastewater agencies are aware of all inspection results from a facility, the agencies can collaborate on future inspections, evaluate corrective actions, and identify any additional problems that could potentially impact wastewater and stormwater. Facilities would also benefit from integrated direction and information sharing, potentially increasing effectiveness and reducing confusion.

### Inspection Coordination

The intersection of inspection responsibilities between wastewater and stormwater agencies presents an opportunity for improved coordination, which can lead to benefits for both the agencies and the inspected facilities. Agencies can investigate opportunities for collaborative inspections by coordinating inspection schedules, harmonizing inspection criteria, developing joint inspector training programs, and adopting a unified approach to communicating with inspected facilities. Agencies can also consider creating a unified inspection process that can be implemented through cost sharing or service agreements to reduce redundancies and streamline inspection processes. This not only mitigates the financial burden on the agencies themselves by optimizing resource utilization but also alleviates the regulatory load on the inspected entities. A coordinated approach can minimize confusion, reduce the frequency of inspections for compliant entities, and enhance customer service.

## Collaborative Management Practice Opportunities and Examples

In addition to collaborating on permit requirements, opportunities exist for stormwater and wastewater agencies to reduce human fecal sources of bacteria in waterbodies by coordinating management practices.

### DRY WEATHER, LOW-FLOW, AND FIRST FLUSH DIVERSIONS

In California, the sanitary sewer system and storm drain system are typically separate systems, with the storm drain system generally flowing without treatment to downstream receiving waters. Diversions are a tool that can be used to divert water from the storm drain system in a controlled manner to a wastewater treatment plant for treatment. Diversions have primarily been implemented for dry weather, typically low flows, to avoid the possibility of sending too much flow to the wastewater treatment plant. Some agencies are exploring the use of “first flush diversions” to direct runoff from the initial portion of a storm event when sufficient controls are in place to limit the volumes entering the wastewater collection system and treatment facility from the storm drain system. When collection, treatment, and storage capacity are all available, diversions can offer wastewater agencies additional flows to be used for water recycling and to increase flows in the collection system where stagnation may be problematic. Additionally,

opportunities may exist to jointly obtain funding for low flow diversions with the goal of having systems in place to divert spills at strategic locations during dry weather.

While some areas have implemented numerous low flow diversions, typical concerns include questions about the management and maintenance of the diversion infrastructure, volume of flow, ability to manage the additional flows, and quality of the water. Additionally, some agencies may have ordinances or other regulatory constraints that can limit the use of diversions and some waterways may have environmental concerns where the flows are necessary for a threatened species. While these concerns are valid, the key to successful implementation seems to be transparency, role clarity, community support, and maximizing mutual benefits.

Las Virgenes Municipal Water District's (LVMWD) Phase 2 White Paper entitled *Tapping into Available Capacity in Existing Infrastructure to Create Water Supply and Water Quality Solutions* (LVMWD, 2021) provides a proposed roadmap and numerous case studies from Southern California for stormwater agencies that would like to implement diversions. Additional resources are included below.

### Links to Publicly Accessible Resources on Diversions

Los Angeles County's Low Flow Diversions

[https://pw.lacounty.gov/LACFCD/SWQ/diversions.aspx#:~:text=A%20Low%20Flow%20Diversion%20\(LFD,outlets%20to%20the%20Santa%20Monica](https://pw.lacounty.gov/LACFCD/SWQ/diversions.aspx#:~:text=A%20Low%20Flow%20Diversion%20(LFD,outlets%20to%20the%20Santa%20Monica)

Orange County Sanitation District's Dry Weather Urban Runoff Diversion Program

<https://www.ocsan.gov/services/urban-runoff>

Southern California Water Coalition's Phase 2 White Paper: Tapping into Available Capacity in Existing Infrastructure to Create Water Supply and Water Quality Solutions

<https://socalwater.org/stormwater/>

Moulton Niguel Water District/OC Public Works: Smart Watershed Network

[https://www.mwdh2o.com/media/ln2dprpn/smartwatershedsnetwork\\_final\\_report.pdf](https://www.mwdh2o.com/media/ln2dprpn/smartwatershedsnetwork_final_report.pdf)

<https://www.smartwatershednetwork.org/>

### POTABLE REUSE WITH STORMWATER AS A WATER SOURCE

California is facing critical water challenges exacerbated by severe drought and climate change. However, communities are actively redefining water management approaches, emphasizing conservation, efficiency, reuse, and stormwater capture. As a part of this redefinition, some wastewater agencies are evaluating potable water reuse as an option for increasing available water supplies and resiliency. Agencies considering potable water projects may benefit from evaluating the addition of stormwater capture projects to increase the available water supply for the reuse project. Research indicates that urban stormwater capture presents an opportunity to secure 580,000 acre-feet per year (AFY) in dry years and up to 3.0 million AFY in wetter periods (Pacific Institute, 2022).

Greater investment in urban stormwater capture will also yield significant socioeconomic benefits. A recent study (CASQA, 2024) utilized an extensive literature review to estimate monetary values for five socioeconomic benefits – Community Health, Water Quality, Green Space, Recreation, and Wetlands – for four stormwater capture projects. The annual dollar value of the benefits estimated exceeded the total cost of each project studied. In other words, all of the study projects had a one-year payoff.

While the addition of stormwater capture to potable reuse projects is an emerging area, some agencies have begun to explore options and implement projects. Links to resources that can help with exploring these opportunities are included below.

### [Links to Guidance and Projects Utilizing Urban Stormwater as a Water Source](#)

CASQA's The Socioeconomic Value of Urban Stormwater Capture, February 2024

<https://www.casqa.org/wp-content/uploads/2024/02/FINAL-The-Socioeconomic-Value-of-Urban-Stormwater-Capture-02-03-2024.pdf>

Los Angeles Department of Water and Power (LADWP) Stormwater Capture Program

[https://www.ladwp.com/ladwp/faces/wcnav\\_externalId/a-w-storm-capture?\\_adf.ctrl-state=50142811r\\_4&\\_afLoop=1687304648601754](https://www.ladwp.com/ladwp/faces/wcnav_externalId/a-w-storm-capture?_adf.ctrl-state=50142811r_4&_afLoop=1687304648601754)

Pacific Institute's The Untapped Potential of California Urban Water Supply: Water Efficiency, Water Reuse, and Stormwater Capture

<https://pacinst.org/publication/california-urban-water-supply-potential-2022/>

Pure Water Monterey's One Water Program

<https://purewatermonterey.org/>

### **PUBLIC AND PRIVATE SEWER LATERALS**

Sewer laterals are pipes that connect a property's plumbing to the public sewer system. In most cases, private sewer laterals are the responsibility of property owners to maintain and manage. However, these pipes can encounter issues such as blockages, erosion, and tree root intrusion that can result in sewage leaks and spills that may enter the storm drain system. Additionally, the longevity of these pipes varies based on the material, for example:

- Vitrified clay pipes and polyvinyl chloride (PVC) are prevalent, and both are long lasting materials if not damaged by construction activity or tree roots
- Cast iron typically offers 30-50 years of service or longer depending on soil conditions
- High-density polyethylene (HDPE) has a life expectancy of over a century, but often no processes exist to regularly examine and maintain private laterals

Wastewater agencies can also be impacted by failures in private sewer laterals as roots can travel through cracked laterals to wastewater main pipes. Additionally, wastewater agencies may be called upon to support cleanup of spills and repairs caused by backups in damaged laterals.

Addressing leaks and spills from private sewer laterals is challenging for both wastewater and stormwater agencies and benefits can be gained by considering cooperative programs. Opportunities include joint outreach and education programs to encourage homeowner maintenance of laterals, incentive programs for homeowners to inspect and repair laterals, and adopting ordinances to require inspection at the time of home sale or construction. Examples of private sewer lateral programs that have been implemented by municipalities are provided in the links below for agencies that may want to consider developing a local program.

### [Links to Publicly Accessible Lateral Programs](#)

East Bay Municipal Utilities District's Private Sewer Lateral Program Details

<https://www.ebmud.com/wastewater/private-sewer-laterals>

City of Ventura Private Sewer Lateral Program  
<https://www.cityofventura.ca.gov/503/Wastewater>

City of Santa Barbara Sewer Lateral Inspection Program  
<https://santabarbaraca.gov/government/departments/public-works/water-resources/sewer-lateral-inspection-program>

City of Modesto's Call Us First Lateral Program  
<https://www.modestogov.com/2614/Programs>

Castro Valley Sanitation District's Private Lateral Program  
[https://www.cvsan.org/wastewater/private\\_sewer\\_lateral\\_program.php](https://www.cvsan.org/wastewater/private_sewer_lateral_program.php)

City of Berkeley's Private Sewer Lateral Program  
<https://berkeleyca.gov/city-services/streets-sidewalks-sewers-and-utilities/private-sewer-lateral>

City of San Luis Obispo's Lateral Program  
<https://www.slocity.org/government/department-directory/utilities-department/wastewater/wastewater-collections/sewer-lateral-program>

City of El Cajon's Private Lateral Inspection Program  
[https://library.gcode.us/lib/el\\_cajon\\_ca/pub/municipal\\_code/item/title\\_13-chapter\\_13\\_37-13\\_37\\_050](https://library.gcode.us/lib/el_cajon_ca/pub/municipal_code/item/title_13-chapter_13_37-13_37_050)

## **HUMAN FECAL WASTE SOURCE IDENTIFICATION AND ABATEMENT PROGRAMS**

Based on the findings highlighted in the 2022 Bacteria Summit (CASQA, 2022) and EPA's 2<sup>nd</sup> 5-year review (EPA, 2023), stormwater agencies are increasingly focusing on finding and eliminating high risk sources of human fecal waste in storm drain discharges. Structured programs of receiving water and outfall monitoring are conducted to identify areas of elevated concentrations of indicator bacteria, human fecal waste markers, chemical wastewater indicators, and/or pathogens. Where elevated concentrations are identified, agencies investigate the storm drain network to locate inputs of human fecal waste and abate sources. Investigations may involve desktop and field reconnaissance, CCTV inspections, smoke testing, dye testing, and/or monitoring upstream in the storm drain network. Once an input is located, stormwater agencies either abate the source or refer the identified issue to the appropriate agency. Confirmed leaks, spills and cross-connections from the sanitary sewer should be referred to the wastewater agency for repair.

Incorporating awareness of the risk from human sources into ongoing programs, such as dry weather outfall screening and monitoring and stormwater inspections, can support the identification of those sources to storm drains. Such cooperative work can be achieved through cross training and informal communications. For example, a stormwater inspection crew may notice visual signs of untreated wastewater, such as toilet paper, wipes, and/or undigested food. Agencies can work together to find inputs using CCTV, smoke, and dye testing (practices that are common to wastewater agencies).

Collaboration also creates a working relationship that can facilitate and accelerate the abatement of sources when identified. Many of the identified collaborative opportunities, such as sharing mapping resources, information about sanitary sewer system maintenance findings, and priorities for maintenance and repair, can help streamline source investigation efforts for stormwater agencies. By supporting these efforts, wastewater agencies can leverage the comprehensive surveillance and monitoring conducted by stormwater agencies to identify and resolve problems in the sanitary system before a spill occurs.

## Links to Publicly Accessible Human Fecal Waste Source Identification and Abatement Programs and Guidance

[CASQA's Human Fecal Waste Sources of Bacteria: Abatement Strategies for Municipal Stormwater Agencies, 2024](https://www.casqa.org/resources/water-quality-priorities/bacteria)  
<https://www.casqa.org/resources/water-quality-priorities/bacteria>

Final Comprehensive Human Waste Source Reduction Strategy Work Plan  
<https://ocerws.ocpublicworks.com/news/final-comprehensive-human-waste-source-reduction-strategy-work-plan-now-available>

City of Santa Barbara. Tools for Tracking Human Fecal Pollution in Urban Storm Drains, Creeks, and Beaches. <https://www.riverkeeper.org/wp-content/uploads/2015/03/TrackingGuide112712.pdf>. The purpose of this guide is to present a brief overview of tools and provide examples where they have been used successfully to track “nonpoint sources” human fecal pollution to its source.

Colorado E. coli Toolbox: A Practical Guide for Colorado MS4s  
<https://mhfd.org/wp-content/uploads/2019/12/Denver-E-coli-Toolbox-08-5-2016.pdf>

Pathogens in Urban Stormwater Systems  
<https://www.asce-pgh.org/Resources/EWRI/Pathogens%20Paper%20August%202014.pdf>

## References

California Stormwater Quality Association (CASQA), 2020. Regulatory and Technical Challenges Associated with Current Bacteria Objectives for Recreational Activities Task 2 Report for Statewide Bacteria Project.

CASQA, 2022. California Bacteria Summit available at <https://www.casqa.org/resources/water-quality-priorities/bacteria> or <https://www.waterboards.ca.gov/bacterialobjectives/#bsummit>.

CASQA, 2024. Human Fecal Waste Sources of Bacteria: Abatement Strategies for Municipal Stormwater Agencies from <https://www.casqa.org/resources/water-quality-priorities/bacteria>.

Las Virgenes Municipal Water District's (LVMWD), 2021. Phase 2 White Paper Tapping into Available Capacity in Existing Infrastructure to Create Water Supply and Water Quality Solutions. Retrieved from [https://www.mwdh2o.com/media/3uyc3rvk/las-virgenes\\_phase-2\\_final-report.pdf](https://www.mwdh2o.com/media/3uyc3rvk/las-virgenes_phase-2_final-report.pdf).

Pacific Institute, 2022. The Untapped Potential of California Urban Water Supply: Water Efficiency, Water Reuse, and Stormwater Capture. Retrieved from <https://pacinst.org/publication/california-urban-water-supply-potential-2022/>.

U.S. Environmental Protection Agency (EPA), 2023. 2nd Five-Year Review of the Recreational Water Quality Criteria Report No. EPA 822-R-23-003, May 25, 2023 available at <https://www.epa.gov/wqc/five-year-reviews-epas-recreational-criteria#second>.