NAVIGATING THE NPDES PERMITTING PROCESS FOR WATER REUSE PROJECTS

STRATEGIES TO ENABLE RECYCLING AND PROTECT WATER QUALITY

MARCH 2022

This paper was developed by the action team for WRAP action 2.6 – "Develop Informational Materials to Address How CWA NPDES Permits Can Facilitate Water Reuse" – with representatives from the WaterReuse Association, National Association of Clean Water Agencies (NACWA), Association of Clean Water Administrators (ACWA), National Municipal Stormwater Alliance (NMSA), the Water Environment Federation (WEF) and the United States Environmental Protection Agency (EPA). This paper does not necessarily represent the policies or positions of the US EPA or any group participating in the development of this WRAP action. This paper is not legally binding on any party and does not constitute a statute or regulation, nor does it modify any statute or regulation. If there is any conflict with any statute or regulation or other law, the statute or regulation or other law governs.

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INTRODUCTION

Water reuse can be a valuable tool to augment scarce water supplies, strengthen the resilience of water systems, improve water quality, and yield other environmental and community benefits. Water reuse (also known as water recycling or water reclamation) involves taking water from a variety of sources, treating it as necessary, and reusing it for beneficial purposes such as agriculture and irrigation, potable water supplies, ground water replenishment, industrial processes, and environmental restoration. Water reuse refers to both reuse of treated wastewater and capture and use of stormwater. Sources of water for potential reuse can include municipal wastewater, industry process and cooling water, stormwater (including captured rainwater), agricultural runoff and return flows, and oil- and gas-produced wastewater.

States, municipalities, and other practitioners across the country have demonstrated increasing interest in implementing water reuse projects to more effectively and sustainably use water resources. These actors have implemented thousands of projects, ranging from large, catchment-scale efforts to small, building-scale projects to collect, treat, and distribute water for potable and non-potable uses. The National Water Reuse Action Plan (WRAP) has identified over 50 actions to advance water reuse progress and address local and national barriers to implementing water reuse projects. One of these actions, 2.6, aims to inform National Pollutant Discharge Elimination System (NPDES) permit writers of possible approaches for permitting discharges from water reuse activities and provide real world examples.

To understand how NPDES permitting intersects with water reuse, the U.S. Environmental Protection Agency (EPA) assembled a diverse group of permittees, permitting authorities, reuse experts, and other stakeholders. Together they explored NPDES permitting opportunities and concerns, identified approaches for effective water reuse permitting, and developed case studies that demonstrate where reuse practitioners have successfully worked with permitting authorities to expedite the NPDES permitting process. This paper summarizes the key items to consider when permitting water reuse projects. It also presents strategies to effectively permit water reuse projects and draws upon specific case studies that illustrate these strategies. The intent of this paper is to help permitting authorities and permittees better understand the broad range of NPDES permitting approaches, explain how NPDES permits accommodate and/or incentivize water reuse, and help permitting authorities and permittees to work cooperatively when permitting water reuse projects.

It is important to note that NPDES permitting is not a “one size fits all” endeavor. While NPDES permits implement a common underpinning of the Clean Water Act (CWA) and associated federal regulatory provisions, many of these provisions enable permitting authorities to address individual discharge and receiving water situations. NPDES permits issued by authorized states may incorporate additional requirements based on state authorities. Over the last 50 years, states have established different implementation rules and procedures to meet NPDES regulations and CWA requirements, resulting in diverse state approaches to NPDES permitting.

The specific facts of individual facilities and their discharge circumstances can vary widely. For these reasons, we caution readers that: (1) discussion of situations where states incorporate state-based provisions that go beyond minimum NPDES requirements does not imply EPA’s or other organizations’ endorsement of these approaches; (2) this paper does not create new interpretations of permitting requirements; and (3) this paper is not intended to establish, replace, or supplement existing permitting rules or guidance developed by EPA,

states, or other permitting authorities. Additionally, the examples identified throughout the paper are intended to illustrate the range of methods permitting authorities have used to address reuse challenges in the context of NPDES permits, and do not endorse any specific approach.

Background

EPA, states, tribes, and local governments implement programs under the Safe Drinking Water Act (SDWA) and the CWA to protect the quality of drinking water source waters, community drinking water, and surface water bodies. Under the CWA, NPDES permits regulate point source pollutant discharges to United States waters, including those from water reuse activities.

Currently, 47 states are authorized by EPA to administer the NPDES permit program, consistent with the federal requirements. In some authorized states, in addition to requirements necessary to comply with the federal NPDES program, the permitting authorities incorporate reuse-related provisions in permits under state-based authorities. EPA neither encourages nor discourages this practice because authorized states have discretion to determine the structure and content of their permits, provided they meet federal NPDES requirements.

The NPDES permitting process involves (1) permitting rules, along with information and analysis supporting permit development; (2) the relationships between regulators and the regulated community; and (3) broader regulatory context under the CWA and other federal, state, and local laws (Sherman, et al., 2020). WRAP action 2.6 focuses on the first element of this process by discussing the application of NPDES permitting rules, so that permitting authorities, permittees, and stakeholders can work better together during permit development. Occasionally, NPDES permitting requirements have raised novel questions in the context of water reuse projects. In response to these questions, NPDES authorities and water reuse practitioners have developed NPDES permitting approaches to authorize the discharges and facilitate successful water reuse projects. The case studies in the Appendix provide examples of the permit processes that enabled cooperation between permitting authorities and permittees that helped these reuse projects succeed.

Framing the Broader Regulatory Context of Water Reuse

This section explores how NPDES permitting intersects with other regulatory programs, including where states elect to include non-NPDES requirements under state law within their NPDES permits. Efforts by some regulatory authorities to streamline regulatory processes show that there is potential to make permitting processes more efficient.

Some types of water reuse projects may affect multiple NPDES permits. For example, the West Basin Municipal Water District's Edward C. Little Water Recycling Facility receives treated effluent from the City of Los Angeles' Hyperion Water Reclamation Plant to be further treated for reuse. The West Basin recycling facility and the Hyperion plant are regulated under separate NPDES permits (NPDES Permits No. CA0063401 and CA0109991).

Watershed permits that address different types of discharges within a watershed can improve coordination in wastewater and stormwater management, assist water reuse project development, align permit application and reporting requirements, and enable innovative facility design and operation. The NPDES permit for Clean Water Services, issued by the Oregon Department of Environmental Quality, is an example of a watershed

permit that regulates discharges from four wastewater treatment plants and the municipal stormwater system, and enables more coordinated water management (including water reuse) within the watershed.

The St. George, Utah Water Reclamation Facility permit incorporates effluent limitations and other provisions addressing two discharge points, one associated with the discharge to the Virgin River, and the other a discharge of recycled water used to irrigate public parks and golf courses (NPDES Permit No. DWQ-2020-016712).

Water reuse projects may need to obtain permits and/or regulatory approvals from multiple federal, state, and/or local agencies (Ulibarri, et al, 2017). In situations where multiple regulatory mechanisms work independently, projects generally address regulatory requirements through an uncoordinated approach that can add time, complexity, and information burdens to the project development process. Early identification and engagement with all relevant regulatory agencies can increase opportunities for permitting agencies to coordinate and streamline their permit processes. Project proponents, wanting to reduce the difficulty of obtaining permits to comply with multiple regulatory requirements, have streamlined permitting by coordinating permit processes (Ulibarri, et al 2017). Some state regulatory agencies are working to proactively align and coordinate regulatory processes to streamline project authorizations and permitting. (ECOS, 2017; Greiner et al., 2021). For example, the Minnesota Department of Health and the Minnesota Pollution Control Agency released a guide to interagency coordination for planning and permitting projects potentially subject to both CWA and SDWA requirements (MDH and MPCA, 2020). Additionally, the federal regulations, at 40 CFR 124.1(d), explicitly allow several different federal environmental permits, including NPDES permits, to be processed together for a given facility when appropriate.

San Francisco Bay Restoration Regulatory Integration Team

The San Francisco Bay Restoration Regulatory Integration Team (BRRIT) provides coordinated permitting services for restoration and water quality improvement projects through a dedicated team of permitting specialists from the Army Corps of Engineers, the Regional Water Quality Control Board, the Regional coastal agency, and federal and state fish and wildlife agencies. Two wastewater management utilities are currently working with San Francisco BRRIT to clarify and streamline the regulatory process for proposed projects to discharge wastewater in ways that support wetlands augmentation and increase climate resiliency along the margins of San Francisco Bay (BRRIT, n.d.).

Some regulators, outside the NPDES context, have sought to streamline other permitting processes affecting water reuse projects. Examples include the following:

- The California State Water Resources Control Board (CA SWRCB) implemented streamlined procedures for obtaining water rights authorization to divert high flows for ground water augmentation (CA SWRCB, 2019).
- In 2021, the Army Corps of Engineers finalized a new nationwide CWA section 404 dredge and fill permit, 59, designed to expedite permitting of water reuse projects with relatively small impacts to jurisdictional waters.
- The state of California issued a General Order for Water Reclamation Requirements for Recycled Water Use that substantially streamlined non-potable reuse permitting in the state (CA SWRCB, 2016).

Water reuse projects may require additional permits associated with facility siting that involve interactions with the Army Corps of Engineers, federal and state fish and wildlife agencies, coastal and local land use regulatory bodies, and historical resource preservation offices. Table 1 summarizes some of the different types of permitting and regulatory processes that may affect water reuse projects (NRC, 2012).

Table 1: Regulatory Processes Potentially Applicable to Recycling Projects

Type of Regulation	Basis	Effects on Reuse Projects	Application Patterns
Water rights	State water rights laws	May constrain ability to reuse wastewater or harvest stormwater; often require obtaining a water right determination.	State water rights laws and applications vary widely; there are no national standards or guidelines.
Water reuse regulations	State laws and rules	Regulate design and operation of water reuse projects to ensure protection of human health and the environment; often specify treatment requirements and operational procedures.	State reuse rules vary widely. Some specify use-specific treatment and operational requirements; others require case-by-case determinations. States vary in establishing acceptable risk levels for human health protection, provisions to protect ground water quality, and provisions to require minimum environmental flows.
Water Quality Standards	Clean Water Act 303(a) and 303(b)	Baseline state/federal provisions that describe the desired condition of a water body, including its designated use, which are used to establish TMDLs leading to NPDES requirements.	WQS vary by designated use, criteria, and antidegradation analysis. WQS are reviewed by states every three years. States may determine a permanent WQS change is necessary via a use attainability analysis or temporary change is appropriate using a variance.
Impaired waters and total maximum daily load (TMDL) rules	Clean Water Act section 303(d)	Identification of waters as impaired and creation of pollutant loading allocations under TMDLs can affect NPDES permitting and state law-based regulatory programs.	States regularly update lists of impaired waters and develop TMDLs (pollutant budgets) to help develop necessary controls to restore waters to applicable water quality standards.
Drinking water system regulations	SDWA, associated state laws, and rules	For potable reuse projects, these regulations establish treatment and operational requirements. There may be different requirements for public water supply systems and smaller scale potable reuse projects in nonpublic water systems.	Basic SDWA framework is nationally consistent, but implementation of SDWA requirements is conducted by state primacy agencies (except for the District of Columbia and Wyoming).

Type of Regulation	Basis	Effects on Reuse Projects	Application Patterns
Ground water discharge/aquifer recharge	SDWA Underground Injection Control (UIC) program, state ground water protection rules	EPA's UIC program regulates the construction, operation, permitting, and closure of injection wells used to place fluids underground for storage or disposal. State programs may establish treatment and operational requirements for different types of ground water recharge but may not clearly address all forms of aquifer recharge (e.g., stormwater best management practices).	SDWA UIC framework is nationally consistent, but states vary widely in whether and how they regulate other types of aquifer recharge and infiltration.
Produce safety regulations	U.S. Food and Drug Administration Produce Safety Rule	Working under federal requirements, and states implement; states vary in whether and how they authorize use of recycled water on food crops.	The Produce Safety Rule outlines minimum, science-based standards on the microbial safe handling practices for produce production. The Produce Safety Rule is one of the foundational rules within FSMA (Food Safety Modernization Act).
Onsite water reuse rules	Mostly local, some state-level onsite recycling rules, local plumbing codes	Local and some state onsite water reuse rules authorize different types of reuse and establish treatment and operational requirements. These requirements are often codified in local plumbing and building codes.	Communities are increasingly codifying onsite reuse regulations, often informed by the regulatory frameworks and guidance developed by the National Blue Ribbon Commission for Onsite Non-potable Water Systems.
Facility land use and siting regulations	Local land use regulations, CWA section 404 permits for discharges of fill to surface waters, state coastal zone rules	Planning and construction of many recycling projects, especially adjacent to water bodies, may require a variety of permits and clearances from land use regulatory bodies, including the Army Corps of Engineers (CWA section 404 permits), local planning bodies, and coastal zone agencies. Clearances from federal and state fish and wildlife protection and historic preservation agencies may also be required.	While the CWA section 404 permitting process follows national rules and procedures, state and local land use and siting rules vary widely across the U.S. Consultation approaches of fish and wildlife agencies and historic preservation offices can also vary substantially.

Type of Regulation	Basis	Effects on Reuse Projects	Application Patterns
Environmental impact rules	National Environmental Policy Act (NEPA) project reviews, state environmental impact assessment rules	Many states require environmental impact assessments of large-scale public and private projects. Some projects require preparation of NEPA documents, depending upon their funding sources.	While the NEPA process follows nationally applicable rules and procedures, state environmental impact assessment requirements can vary substantially.

How Do NPDES Permitting and Water Reuse Intersect?

This paper discusses NPDES permit requirements for discharges associated with water reuse activities from three classes of facilities:

1. Industrial and municipal wastewater treatment facilities.
2. Stormwater management systems.
3. Water reuse facilities (e.g., industrial and municipal plants producing potable or non-potable water from recycled wastewater or captured stormwater).

This paper also addresses generally applicable and crosscutting topics.

The following sections review how specific reuse situations present different NPDES permitting challenges and opportunities and permitting strategies to address these situations.

Municipal and Industrial Wastewater Treatment Facilities: Permitting Strategies

How Does Water Reuse Affect Wastewater Permitting?

Effluent limitations serve as the primary mechanism in NPDES permits for controlling discharges of pollutants to receiving waters. When developing effluent limitations for an NPDES permit, a permit writer must consider limits based on both the technology available to control the pollutants (i.e., technology-based effluent limits or TBELs) and limits that are protective of the water quality standards of the receiving water (i.e., water quality-based effluent limits or WQBELs). TBELs are developed independently of the potential impact of a discharge on the receiving water. WQBELs depend upon the nature of the discharge, the applicable receiving water body characteristics, and the water body's water quality goals. More information on different types of NPDES permit limitations can be found in the EPA's NPDES Permit Writer's Manual (EPA, 2010).

Initiating water reuse practices may change the volume, character, and/or variability of a discharge regulated by an NPDES permit. Municipal and industrial wastewater treatment facilities may divert a portion of their treated water for reuse from effluent that would otherwise be discharged. This can result in a lower volume of effluent where pollutants are more concentrated. Such effluents may have higher concentrations of salts, nutrients, biochemical oxygen demand, dissolved solids, and other pollutants. Seasonal variations in recycled water demand may also increase variability in effluent characteristics. Reducing the volume of effluent discharged could limit the ability of receiving waters to maintain their designated uses, particularly where

receiving waters depend upon effluent discharges to maintain their ecosystem functions. NPDES permits must require permittees to notify the NPDES authority as soon as possible of any planned physical alterations or additions to the permitted facility that could significantly change the nature of or increase the quantity of pollutants discharged (see 40 CFR 122.41(l)). Changes to the volume of a discharge or changes in pollutant concentrations in a discharge may not be authorized under the existing permit and result in changes to the water quality-based requirements of the permit when it is modified or reissued. Some facilities must provide additional treatment to support water reuse processes that create new waste streams (e.g., highly saline concentrated brines or filtrate from reverse osmosis filtration).

Some pollutants are of particular concern because they create human health risks and are difficult to treat through conventional wastewater treatment methods (e.g., low molecular weight solvents, some pesticides, and some other organic compounds). Source control through the proper application of pretreatment standards can reduce difficult-to-treat contaminants (NWRI, 2020).

How Can Permits Address Water Reuse-Related Discharges?

More Concentrated Effluents

The NPDES regulations provide that all pollutants limited in permits are to have effluent limitations expressed in terms of mass with limited exceptions. Permits may also provide supplemental limits expressed as concentration-based permit limits. In situations where water reuse practices result in higher or more variable concentrations of pollutants in the permitted effluent, permit writers can consider whether it is appropriate to express limits solely in terms of mass. For example, it may be appropriate to only express a WQBEL in terms of mass for pollutants where the underlying concern is long-term bioaccumulation through the food chain in a receiving water with long residence times, and the pollutant concentration within a particular time period may be less of a determinant of bioaccumulation potential than long-term mass loading.

WQBELs may be based on applicable wasteload allocations established by a total maximum daily load (TMDL). Wasteload allocations in a TMDL reflect consideration of other pollutant sources in the watershed. For example, the San Francisco Bay Regional Water Quality Control Board established mass-based effluent limitations for polychlorinated biphenyls (PCBs) and mercury based on TMDL wasteload allocations for multiple co-permittees (San Francisco Bay Mercury and PCBs Group Permit No. CA0038849). The watershed permit provides that compliance with mass-based limits for mercury and PCBs is attained if the sum of all individual permittees' mass emissions is not greater than the aggregate mass limit. This watershed permitting approach provides permittees greater flexibility than if the state issued a separate permit with individual mass-based limits for each facility.

Industrial dischargers instituting water reuse practices can face unique questions when working to meet the technology-based requirements of some effluent limitations guidelines (ELGs). Many ELGs are based on mass per unit of production (e.g., parts 409, 419, and 430 of Title 40 of the Code of Federal Regulations [40 CFR]). In these cases, reduced process flow due to water reuse is not likely to change a TBEL because production does not change. Other ELGs establish different methods for developing TBELs. For example, the ELG for Organic Chemicals, Plastics and Synthetic Fibers (OCPSF) leads to mass-based TBELs based on a concentration value and a process flow (40 CFR part 414). If an OCPSF facility were to propose to reuse process flow, the process flow used in the TBEL calculation could be lower and result in more stringent mass-based permit limits. This could create a disincentive to reuse process water. If the portion of process water reused is counted as

process flow in the TBEL calculation, the potential penalty for reuse could be mitigated. In calculating effluent limits for municipal discharges, permit writers may apply the facility design flow, even if actual flow is lower due to recycling activity.

Permit Averaging Periods and Seasonal Limits

Water reuse practices may result in seasonal variability in the volume and concentration of pollutants in a treatment plant effluent. Seasonal permit limits have been used in the NPDES program where consistent with applicable water quality standards. Seasonal WQBELs have been developed for wastewater and stormwater permits that account for seasonal changes in receiving water flows or quality, or in the case of bacteria indicators, as specified in applicable water quality standards. For example, the Cottage Grove, Oregon, publicly owned treatment work (POTW) NPDES permit incorporates seasonal WQBELs (Permit No. 101300). The Denver municipal separate storm sewer system (MS4) permit includes seasonal and flow-based requirements for bacteria control that account for variability in bacteria loadings (City and County of Denver Permit No. COS000001). In areas where receiving water dilution capacity varies seasonally, it may be feasible to schedule the timing of discharges to take full advantage of available dilution capacity of receiving waters to better assimilate discharges of higher strength effluents.

The NPDES regulations provide that permit limits for continuous discharges from POTWs are to be stated as average weekly and average monthly unless impracticable. Permit limits for continuous discharges from non-POTW facilities are to be stated as average daily and average monthly unless impracticable (40 CFR 122.45(d)). EPA has explained that setting permit limits for nitrogen and phosphorus is different from setting limits for other parameters such as toxic pollutants, where the exposure period of concern for nutrient loadings to receiving waters is very long; the area of concern is far-field (not in immediate vicinity of the discharge); and the average pollutant load, rather than the maximum pollutant load, is of concern. In some situations, it may be reasonable to conclude that it is "impracticable" to express permit effluent limitations as daily maximum, weekly average, or monthly average effluent limitations, and to use a longer averaging period for the limitation. In such cases, the permitting authority should document the basis for finding that daily, weekly, or monthly limits are impracticable and for establishing an alternative averaging period. The Colton/San Bernardino Regional Tertiary Rapid Infiltration and Exfiltration (RIX) Facility NPDES permit in San Bernardino County, CA includes a 12-month averaging period for total dissolved solids and total inorganic nitrogen limitations based on a finding that it is not practicable to express these limits as average weekly and average monthly limitations (RIX Facility Permit No. CA8000304). (See also, EPA Chesapeake Bay memo, https://www3.epa.gov/npdes/pubs/memo_chesapeakebay.pdf) The factors listed in 40 CFR 122.45(e) provide permitting authorities with greater flexibility to determine appropriate averaging periods for limits for non-continuous discharges.

Difficult-To-Treat Pollutants and Source Control

Source control methods can be used to avoid introducing difficult-to-treat pollutants into wastewater or stormwater collection systems. For example, the state of Washington's water reclamation regulations include a section focused on source control through pretreatment (Wash. Admin. Code Section 173-219-300) for situations where POTWs receive wastewater from non-domestic sources (the latter which are called "industrial users"). These regulations also reference federal pretreatment regulations. In addition, Colorado, as part of its process to develop regulations for direct potable reuse, is considering creating "enhanced" pretreatment requirements that would require additional sampling and analysis of industrial users and

broader pollutant monitoring within the collection and treatment system. This enhanced monitoring approach could enable more effective source control of difficult-to-treat industrial pollutants discharged to collection systems (Carollo Engineers, 2018).

POTW pretreatment requirements are designed to ensure that the POTW receives a consistent and treatable quality of influent wastewater from its industrial users. As a result, the POTW's NPDES permit pretreatment requirement can be adapted, if necessary, to protect the operation of treatment processes, which may enhance the quality and reliability of recycled effluents. Separate WRAP actions, 2.4 and 8.7, explore how to enhance wastewater source control through local pretreatment programs to support water reuse opportunities for municipal wastewater. Additionally, reports by the National Water Research Institute and the Water Environment & Reuse Foundation discuss in detail pretreatment program mechanisms that could be used to achieve improved source control (NWRI, 2020; Rimer et al., 2017).

Effects of Industrial Water Reuse on Industrial Pretreatment

When industrial facilities reuse their process wastewater, the volume of wastewater discharged may be reduced and the concentration of pollutants in the discharged wastewater may increase. Many categorical pretreatment standards were designed with the assumption that onsite water recycling would occur (e.g., 40 CFR part 433, Metal Finishing Point Source Category). Categorical pretreatment standards may not change in these circumstances or where the standard was developed based on production levels. With respect to noncategorical industrial users, local pretreatment programs have flexibility in allocating local limits and could potentially re-allocate according to individual industrial users' recycling operations (as long as the influent at the downstream wastewater treatment plant is maintained at a consistently treatable quality). For example, it may be feasible to set mass-based local limits to address concerns about increasing pollutant concentrations of industrial discharge loadings due to onsite water reuse.

Maintaining or Enhancing Receiving Water Flows

Several states have established minimum flow requirements on rivers, often related to downstream water rights preservation, aquifer protection, and ecosystem protection. Many receiving streams and rivers in drier parts of the country rely on wastewater effluent discharges to maintain flows necessary to support aquatic habitat and other beneficial uses (Luthy, et. al., 2015). One concern is that reducing or ceasing wastewater discharges that are diverted for reuse could lower receiving water flows below levels necessary to protect these uses. There is no explicit federal requirement to incorporate permit provisions designed to ensure that a minimum level of receiving water flow is maintained. However, some state permitting authorities include minimum flow requirements in permits designed to protect receiving waters, ensure the integrity of the permit's reasonable potential analysis calculation, and/or as an operating condition to ensure compliance with permit effluent limits under CWA section 402(a). For example, the Arizona Pollutant Discharge Elimination System permit for the city of Flagstaff to discharge to Rio de Flag (from a facility that recycles much of its effluent) includes a minimum discharge provision designed to maintain instream flows in this effluent-dependent river (Permit No. AZ0023639). Several POTWs discharging to the Upper Santa Ana River in California must meet minimum annual discharge flow requirements (Santa Ana Regional Water Quality Control Board, 1995). Other states are currently evaluating whether and how instream flow needs should inform NPDES permitting and the state of California is currently evaluating minimum flow needs for the Los Angeles River to help determine how much flow would be available for reuse (SCCWRP, 2020).

Some communities are exploring the reuse of treated effluent to provide sufficient flows to create or restore aquatic ecosystem services or offset increased upstream flow diversions for consumptive use. Sequim, Washington uses recycled water from its water reclamation plant to supplement flows and enhance habitat in Bell Creek under the existing terms of its NPDES permit (Permit No. WA0022349). Establishing a new location for discharging effluent to receiving waters for this purpose will require a permit modification or new NPDES permit. For example, a proposed project to discharge treated municipal water reclamation plant effluent to Hillsborough River near Tampa, Florida to offset increases in upstream diversions for potable use was not implemented because it would have been a new discharge of pollutants to an impaired receiving water (Luthy et. al., 2015).

Pursuant to applicable state water rights, some states have limitations on diverting water for recycling purposes that impair downstream water rights. In some cases, these limitations apply to reusing stormwater and wastewater that would, in the absence of a reuse project or practice, be discharged to a receiving water. For example, Colorado water rights law limits some forms of wastewater reuse because effluent is often legally required to be discharged to a specific stream. Washington state water rights law can also restrict some applications of water reuse. For example, in Washington state, with respect to stormwater, a water right is needed to capture and divert any stormwater runoff for consumptive use. While there is a *de minimus* allowance for home-scale rain barrels, larger scale projects may need a water right.

Permitting Strategies to Enable and Incentivize Wastewater Reuse

NPDES permits can include approaches and provisions that incentivize water reuse. Several examples follow:

- Permits can help permittees optimize the design of wastewater treatment and recycling facilities to meet regulatory requirements by establishing effluent limitations that allow for variability in wastewater effluent characteristics and other provisions that clarify water recycling performance objectives. See, for example, King County South Treatment Plant, NPDES No. WA0029581.
- Some states issue NPDES general permits for discharges from facilities that reuse water that ease the process of obtaining permit coverage. For example, the North Carolina Department of Environmental Quality (DEQ) issued a general permit for discharges of water from reclaimed water storage and irrigation operations (NC General Permit NCG580000). Other states issue general permits that authorize short-term discharges that could be associated with recycling facility operations (e.g., filter backwash-related discharges). For example, Arizona DEQ issued an NPDES general permit that applies to small volume discharges associated with water reuse operations (Arizona De Minimis Discharge Permit No. AZG2021-001).
- Permits can be specifically designed to provide operational flexibility or to account for several related facilities. The NPDES permit for the Tapia Water Reclamation Facility incorporates effluent limitations for discharges to Malibu Creek and Los Angeles River. In addition, the permit includes limitations for discharges to a recycled water storage pond to address the rare possibility that the storage pond would discharge after large rainfall events (Tapia WRF Permit No. CA0056014).
- Permitting authorities have issued regional or sector permits that address several facilities within a geographical area, which may help neighboring facilities work together to establish connections and manage discharges in aggregate. For example, the San Francisco Bay Regional Nutrient permit regulates nutrient discharges from 35 municipal wastewater facilities under a general permit. The general permit provides flexibility for participating permittees to pursue discharge trading arrangements and other collaborative approaches (San Francisco Bay Regional Nutrient Permit,

Permit No. CA0038873). This type of approach could enable a municipal wastewater facility and neighboring recycled water treatment facility to cooperate in managing discharges from each facility and reduce their overall compliance challenges.

- Discharges from recycling operations may be diluted when recycled water is transported through canals. For example, the state of California authorizes use of the Delta-Mendota Canal to move treated wastewater downstream to the Del Puerto Water District, where it is used for agricultural irrigation. The state used the dilution potential in the canal to ensure the water quality standards of the receiving water were not exceeded by setting a compliance point where the canal discharges to the San Joaquin River (see Appendix).

Stormwater Management Facilities: Permitting Strategies

How Can Permits Address Water Reuse-Related Discharges?

NPDES permits for discharges from MS4s include provisions to implement measures in new development and redevelopment, including post-construction stormwater management. In addition, permits may contain water quality-based provisions, including urban retrofits, to reduce the pollutants in MS4 discharges. Increasingly, combined sewer system permits include provisions encouraging stormwater capture and diversion prior to entering the combined sewer to reduce the volume of wet weather flows at the treatment plant and combined sewer overflows (CSOs). Many municipalities are finding that implementing green infrastructure designed to infiltrate stormwater or using retained stormwater for consumptive uses, can be effective in reducing both the volume of stormwater discharged and the pollutants discharged. Properly designed green infrastructure projects that consider local conditions can augment aquifer recharge and/or provide treated stormwater for consumptive uses, such as landscape irrigation, reducing the demand for potable water supplies.

Practitioners have noted the importance of ensuring that stormwater infiltration practices incorporate effective treatment, where necessary, to protect aquifer water quality (Musik & Job, 2021). Some stormwater infiltration occurs through injection wells, which are regulated by the UIC program. Other stormwater infiltration practices (e.g., infiltration basins, rain gardens) are regulated under state rules that vary substantially among states.

How Can Permits Address Reuse-Related Discharges?

Addressing and Incentivizing Stormwater Capture and Use Through Permits

Permitting authorities have flexibility in establishing effluent limitations and other provisions in MS4 and CSO permits. EPA's MS4 Permit Compendium series provides many examples of existing permit conditions, including examples for post-construction standards and water quality-based provisions in MS4 permits. Some permittees have responded to permit requirements by providing retention and detention practices that enable capture and use of stormwater.

The San Diego Regional MS4 permit provides for the inclusion of stormwater capture and use projects to help meet permit requirements in two ways (San Diego MS4 Permit No.CAS0109266; Order No. R9-2013-0001, as amended). As part of the permit's land development requirements, all projects are required to maximize use of low impact development practices, including but not limited to stormwater and rainwater harvesting and

reuse. The San Diego permit incorporates alternative compliance provisions consistent with the California State Water Resources Control Board's precedential Order WQ 2015-0075, which discusses alternative compliance options for MS4 permits. The order incorporates seven principles to encourage watershed-based management strategies, such as stormwater capture and use, that yield multiple benefits. The San Diego Regional MS4 permit requires co-permittees to include stormwater capture strategies in their watershed Water Quality Improvement Plans (WQIPs). Through these WQIP provisions, co-permittees can implement stormwater capture and reuse projects as a strategy to address high priority pollutants. The flexibility in the permit allows for but does not require including stormwater capture and reuse projects in this way.

A 2018 District of Columbia MS4 permit was structured to implement actions to reduce or prevent stormwater discharges in lieu of including discharge limitations focused on performance outcomes (e.g., concentrations of certain pollutants in stormwater discharges) (District of Columbia MS4 Permit No. DC0000221). This approach enables stormwater managers to implement stormwater capture and use projects to reduce pollutant discharges and capture reusable water.

Some MS4 permits require permittees to demonstrate the effectiveness of stormwater management practices or projects that ensure permit compliance in controlling specific pollutants of concern (e.g., pollutants addressed in TMDLs or for which receiving waters are impaired). Permitting authorities have taken different approaches that demonstrate the effectiveness of stormwater capture practices in controlling pollutants of concern. These approaches include modeling and evaluating data about the effectiveness of specific stormwater management practices, such as onsite stormwater capture (for further information, see Paradigm Environmental, 2017; PG Environmental, 2018).

Los Angeles MS4 Permit Encourages Stormwater Capture

As Southern California faces substantial water supply challenges, there is strong interest in encouraging stormwater harvesting to supplement existing water supplies. The 2012 Los Angeles County MS4 Permit, as modified in 2016, enables dischargers to implement compliance approaches based on watershed management plans (WMPs) that specify long-term stormwater control strategies and projects. WMPs allow dischargers to meet water quality-based requirements in the permit as an alternative to meeting receiving water limitations for individual pollutants (Permit No. CAS004001).

One variation on this alternative compliance approach provides additional flexibilities for "enhanced" WMPs that explicitly commit the permittee to stormwater harvesting projects. The Regional Water Board added this option to help advance its objectives of enabling more stormwater capture for use and encouraging more integrated water management planning.

Setting Stormwater Performance Expectations to Address Capture and Use

Some MS4 permits incorporate provisions that track the implementation of facilities and practices that may result in capture and recharge across the permitted jurisdiction (e.g., Los Angeles County MS4 Permit No. CAS004001). These include large scale detention and infiltration facilities and/or small-scale, distributed practices. Municipal stormwater permits may address activities designed to capture stormwater for several kinds of use. MS4 permits can require that permittees demonstrate that they sufficiently implement specified practices and controls consistent with required minimum measures and applicable water quality-based

requirements (e.g., TMDL-based requirements related to specific pollutants and wasteload allocations). In cases where retention/detention of stormwater is a key element of the stormwater management plan, permits may enable permittees to demonstrate compliance by tracking and reporting projects that accomplish specified amounts of flow detention/retention (and associated capture for use, where appropriate (e.g., Denver MS4 Permit No. COS000001). Some permits do not require monitoring of individual practices once the effectiveness of specified stormwater controls is established and documented.

WATER REUSE FACILITIES: PERMITTING STRATEGIES

Some water reuse operations use reverse osmosis (RO) treatment, which can generate high strength brine residuals. Recycling operators have primarily used four pathways for managing and discharging these residuals:

1. Surface discharge to a receiving water subject to an individual facility or general NPDES permit (through individual or shared outfall).
2. Discharge to a POTW collection system.
3. Underground injection or recharge of residuals subject to UIC or other state ground water protection/land application permit (if applicable).
4. Evaporation of residuals, possibly subject to state permitting requirements.

Discharging Concentrated Residuals to Saline Waters and/or Waters with Dilution Capacity

Developing NPDES permit limits for concentrated residual discharges is generally straightforward in situations where the receiving water is saline and/or subject to substantial dilution with receiving water flows. For example, the Brunswick County Northwest Water Treatment Plant's permit for its RO concentrate discharges to the Cape Fear River uses the dilution capacity of this large, tidally influenced river (Permit No. NC0057533). As state mixing zone policies for NPDES permitting vary, project developers should work closely with permitting authorities in advance to determine whether using a mixing zone is feasible in a particular discharge setting. As discussed in the Orange County reuse case study, the Orange County Sanitation District's NPDES permit explicitly accounts for discharge of RO concentrate to the ocean, so the expansion of RO treatment at the Orange County Water District's Ground Water Replenishment System plant did not require a separate NPDES permit (Appendix A).

Texas has developed a framework for evaluating permitting considerations associated with water reuse facilities using RO. This framework discusses evaluating permitting options for discharges of concentrated residuals associated with recycling projects (Beck, 2004).

Discharging Concentrated Residuals to Inland Waters

Permitting discharges of concentrated residuals to inland waters with less dilution capacity may be more challenging than permitting discharges to open waters. The Cypress Water Treatment Plant in Wichita Falls, Texas, which has NPDES permits for brackish discharges to Big Wichita River and Lake Arrowhead, obtained permits for these discharges (see case study in Appendix). It may be feasible to develop WQBELs expressed solely in terms of mass loads if it can be demonstrated that the mass-based limits are sufficient to meet applicable water quality standards consistent with permitting requirements. It is important to ensure that the permit fact sheet provides a clear explanation of the basis for such limits. A more detailed discussion of

permitting-related challenges associated with discharge and permitting of high strength brines is found in Irlbeck and Voutchkov, 2013.

Discharging Concentrated Residuals to POTW Collection Systems

Industrial facilities may use RO or other membrane treatment methods to treat water for recycling, thereby creating concentrated residuals for discharge. In some places, it may be feasible to discharge these residuals to the POTW collection system or to the headworks of a treatment plant. However, high volumes of residual discharges to collection systems may increase the risk of POTW treatment facility upsets because high salinity pulses could interfere with biological treatment processes. Facilities considering discharging RO concentrate to collection systems should coordinate closely with local pretreatment program managers to ensure that these discharges meet categorical and local limits and pose no significant threat to treatment system operations.

Some communities use a "scalping" plant that diverts a portion of the flow from a municipal collection system to a small, local treatment facility that produces high-quality reclaimed water. These treatment facilities then discharge concentrated activated sludge back into the collection system for further processing at the main POTW. For example, the LOTT Clean Water Alliance operates this type of recycling operation in Washington State (LOTT Martin Way Reclaimed Water Facility Permit No. ST0006206). This facility uses a membrane bioreactor treatment system that operates as a water reclamation facility producing high-quality water for aquifer recharge. Residuals from this facility flow through the collection system to a separate advanced treatment facility that discharges effluent to Puget Sound (LOTT Wastewater Treatment Plant Permit No. WA0037061).

Generally Applicable and Crosscutting Topics: Permitting Strategies

Anti-Backsliding

Anti-backsliding considerations may apply to water reuse scenarios where an existing permit is reissued to account for a change in the discharge effluent quality that occurs when a significant portion of treated flow is diverted for reuse, potentially resulting in a lower volume of more concentrated effluent. In general, anti-backsliding requirements provide that effluent limits cannot be less stringent in a reissued permit than they were in the previous permit unless certain exceptions listed in sections 402(o) and 303(d)(4) of the CWA and 40 CFR 122.44(l) apply. For example, if a facility's treatment process has undergone material and substantial alternations associated with implementing water reuse, it may be permissible to apply less stringent technology-based effluent limitations. In such cases, the permit fact sheet should clearly explain the rationale for setting less stringent limitations. See EPA, 2010, Section 7.2 for more information.

Ensuring Competent Facility Operations and Maintenance

Effective implementation of water reuse projects depends upon the maintenance of reliable treatment facility operations to ensure recycled water quality is consistent. As discussed above, the regulatory processes for recycling operations vary substantially among different types of water reuse operations.

NPDES permits require permittees to properly operate and maintain all facilities and systems of treatment and control to achieve compliance with the conditions of the permit (40 CFR 122.41(e)). Permitting authorities have discretion in determining how 40 CFR 122.41(e) is expressed in NPDES permits. Some permits

incorporate detailed provisions, specifying how permittees must ensure proper facility operation, maintenance, and data quality. Some states also include permit provisions for operator training and certification. The state of Washington incorporated facility operations and operator training requirements in its water reuse regulations. Other permits incorporate asset management provisions to help ensure facilities are properly maintained, such as the Guam Wastewater Facility permits (NPDES Permit No. GU0020141, GU0020087, GU0020222, GU0020273). These requirements are based on the overarching territory legislative mandate that reclaimed water receive "adequate and reliable treatment" at all times. The federal regulations do not prohibit the inclusion of conditions based on state law in NPDES permits.

Permit Monitoring, Tracking, and Reporting

Water reuse can cause changes in effluent quantity and quality that may necessitate reviewing the monitoring, tracking, and reporting provisions in related permits. Permitting authorities have flexibility in designing monitoring, tracking, and reporting requirements to document changes in discharge characteristics, given federal requirements concerning monitoring and reporting are met, and the provisions are sufficient to evaluate permit compliance. Federal permitting guidance recommends establishing monitoring requirements that address the unique circumstances of the discharge characteristics, including frequency, magnitude, and seasonal distribution (see NPDES Permit Writers' Manual, Section 8.1.3 for more information). If the implementation of a water reuse project changes the discharge characteristics (e.g., a previously continuous discharge becomes intermittent), then it may be appropriate to modify monitoring requirements and methods during permit reissuance or permit modification.

Some potable water reuse projects involve engineered linkages from advanced water treatment facilities that provide purified water to drinking water treatment facilities. Proponents of potable water reuse have noted that monitoring requirements and analytical methods vary between the CWA/NPDES and the SDWA programs, which can create duplicative monitoring and analysis requirements. It may be feasible to coordinate separate permits' state-based recycling rules to align requirements for collection and treatment system operations, monitoring, and reporting to avoid unnecessary duplication with NPDES permit requirements.

Only methods approved under 40 CFR part 136 may be used to meet NPDES testing requirements unless one of the following exceptions applies (see 40 CFR 136.1):

- Alternative methods are specified in an effluent limitation guideline.
- There is no approved method for the pollutant.
- EPA approves an alternative test procedure (ATP). More information about procedures for submittal and review of ATPs can be found at this link.

Where there is an approved method under 40 CFR part 136 for a parameter, drinking water analytical methods cannot replace the wastewater analytical method.

Diverting Urban Runoff/Stormwater into Wastewater Collection Systems

Communities may have dry weather flows in separate storm sewer systems. Some local agencies have implemented projects that divert dry weather and/or first-flush wet weather storm drain flows into POTW collection systems using controlled and engineered diversion infrastructure. This helps reduce water quality impacts associated with dry weather storm sewer system discharges. For example, the city of Los Angeles implemented several dry weather diversions to help reduce dry weather impacts at coastal beaches (LA Sanitation, 2018; LADWP, 2021). This practice is also common in Orange County, California (OCSAN, n.d.).

Controlled diversions from storm sewer systems into wastewater collection systems can increase the flows in the POTW system that could be available for water reuse. Recent improvements in real-time monitoring and control technologies have enabled the safe implementation of projects to divert dry weather and first flush wet-weather flows from storm drains to sanitary sewers. Controlled diversions from storm sewer systems to POTW collection systems may protect a wastewater collection system by reducing sediment build up and/or hydrogen sulfide production in the sewer system. In some communities with water reuse programs, reduced wastewater inflows have made it difficult for these programs to meet their commitments to supply recycled water to customers.

In designing diversion projects, it is important to ensure that diversions are allowable under local sewer use ordinances, that there is sufficient capacity in the wastewater collection system to accept diverted flows, and that these diversions do not result in unanticipated operational or treatment challenges in the POTW collection and treatment system.

Permitting authorities have taken different approaches to address diverting water from storm sewer systems into wastewater collection systems. Some wastewater utilities require locally issued permits for storm drain diversion projects that use real-time operation and monitoring provisions to ensure the diversion can be closed before or during wet weather-related flows to prevent sanitary sewer overflows or treatment plant upsets (LADPW, 2014). The Los Angeles County MS4 Permit generally encourages diversions to wastewater collection systems and requires facilities to map diversion locations and report actions to eliminate illicit discharges. In some cases, wastewater management utilities may create specific requirements before accepting dry weather storm drain diversions to sanitary sewers. For example, the Orange County Sanitation District and Los Angeles County Sanitation Districts developed policies and guidelines for accepting dry-weather flows in sanitary sewers, requiring the stormwater management agency to obtain a specific permit from the utility operating the sanitary sewer (LADPW, 2014). Alternatively, the three water boards with NPDES permitting authority in coastal Southern California have not found it necessary to include more specific permit provisions in wastewater or stormwater permits that control storm drain diversions to wastewater collection systems. They concluded that such provisions are unnecessary to ensure that discharge requirements are met (personal communications with Renee Purdy and Ivar Ridgeway, Los Angeles Regional Water Quality Control Board, Adam Fischer, Santa Ana Regional Water Quality Control Board, and Laurie Walsh, San Diego Regional Water Quality Control Board, 3/19/21). Such provisions could be incorporated in the source control requirements of a POTW permit, which authorize the wastewater agencies to control inflow quality and quantity. Sometimes requirements by the POTW pose challenges to implementing storm drain diversion projects, including the costs of fees that POTWs charge to receive diverted storm drain flow, and the requirements established by the POTW (e.g., for storage and/or telemetry).

Some states prohibit diverting flows from storm drains into sanitary sewer collection systems. For example, Washington State generally prohibits the diversion of stormwater, other direct inflow sources, and non-contact cooling water in significant volumes into sanitary sewer systems (see Wash. Admin. Code 173-216-060).

Conditions in Permits to Address Reuse

Some permitting authorities have incorporated reuse-related provisions in NPDES permits, often pursuant to reuse regulatory provisions of state law. For example, the regional MS4 permit for the Middle Rio Grande

Watershed in New Mexico authorizes capture of stormwater from rooftops for onsite reuse. Other states (e.g., Idaho) issue separate state reuse permits and do not incorporate reuse provisions in NPDES permits.

In jurisdictions where EPA is the permitting authority, the state, tribal, or territory agency with CWA section 401 certification authority may include conditions designed to ensure the permit results in attainment of applicable water quality standards. These conditions are then included in the applicable NPDES permit. This approach has been used to incorporate provisions designed to address water reuse. See the Hopi tribal permit example in the following text box.

Tribal NPDES Permit Addresses Reuse Through CWA Section 401

When the EPA drafted a new permit for the Upper Moenkopi wastewater plant located on the Hopi Indian Reservation, the Hopi Tribe initially requested that provisions be added to the permit to ensure the safe reuse of treated water that was diverted prior to discharge for agricultural irrigation. The situation was addressed through conditions included in the tribal section 401 certification, which were included in the final permit (Permit No. AZ0024619).

Addressing Ground Water Quality Protection

It is important to ensure that ground water quality is protected where wastewater, recycled water, or stormwater are infiltrated or injected to ground water, often with the goal of later using that ground water for consumptive use. Questions have arisen about how to ensure that projects that recharge recycled wastewater or captured stormwater adequately protect aquifer quality (NRC, 2008; GWPC, 2007; Musik & Job, 2021). Aquifer recharge via injection wells is regulated under the SDWA UIC program. WRAP action 7.4 discusses challenges and corresponding efforts to ensure the protection and sustainability of ground water resources related to aquifer recharge and aquifer storage and recovery activities (see the WRAP Online Platform for more information).

Some states have issued NPDES permits containing provisions that implement both NPDES- and state law-based requirements. Infiltration activities employing UIC Class V wells are regulated by EPA or any state with an approved UIC primacy program. The UIC Class V regulations are designed to prevent endangerment of underground sources of drinking water.

Most states incorporate provisions in municipal MS4 permits concerning implementation of retention and infiltration practices, usually in the permit section addressing implementation of stormwater controls in new and redevelopment projects. Many such permits reference stormwater management design handbooks that provide detailed guidance to inform practice design and maintenance and ensure selected practices protect water quality over time. While most manuals focus on protecting surface water quality, some design manuals also include design considerations to protect ground water quality. For example, the 2016 Georgia Stormwater Management Manual includes provisions addressing aquifer protection in the chapter on infiltration practices.

Many states have state authorities to ensure protection of aquifer quality in discharge permitting through separate permitting mechanisms. Arizona regulates discharges to ground water related to recycling operations under its Aquifer Protection Permit program. The state of Washington includes in its water reuse regulations specific water reuse standards for direct and indirect ground water recharge.

Relationship of Regulation Under Clean Water Act and Safe Drinking Water Act

In most potable reuse projects to date, there is an intermediate buffer (e.g., a reservoir) between the wastewater/stormwater and drinking water systems. In these cases, the NPDES permit regulates any point source pollutant discharge to a water subject to CWA jurisdiction. An NPDES permit may not be required where there is no point source pollutant discharge to a jurisdictional water (e.g., in cases where the buffer is in the form of aquifer recharge and storage). Injection activities are regulated under the SDWA UIC program.

In cases where direct potable reuse is proposed and there is no buffer between the wastewater/stormwater system and the drinking water system, an NPDES permit is not required if there is no pollutant discharge to waters of the United States. The Colorado River Municipal Water District's Raw Water Production Facility currently produces about 1.5 million gallons of reclaimed water per day that is blended with water from other sources before distribution to conventional drinking water treatment plants (CRMWD, n.d.). In this case, there is no pollutant discharge to jurisdictional waters from the wastewater treatment plant and hence there is no NPDES permit. In this case, the wastewater plant is engineered to send treated wastewater directly to the drinking water treatment plant, where national primary drinking water regulations under SDWA apply.

Discharges of Recycled Water

Using recycled water for firefighting or for snowmaking at a ski resort may result in discharges to a waters of the United States. Recycled water associated with excessive landscape irrigation may also result in a discharge to waters of the United States, even if unplanned.

Some NPDES permits for discharges from MS4s explicitly authorize discharges of recycled water operations that reach storm drains or receiving waters, as long as the recycled water receives appropriate treatment prior to use and is used in ways that minimize the discharges (City of Long Beach MS4 Permit No. CAS004003). Other MS4 permits do not authorize incidental discharge to a MS4. For example, the City and County of Honolulu MS4 permit only authorizes discharges specifically identified in the permit (such as landscape irrigation and lawn watering using potable water). The permit does not prohibit other occasional, incidental non-stormwater discharges that the permittee demonstrates are not a significant source of pollutants (City and County of Honolulu MS4 Permit No. HI-S000002).

Addressing Information and Data Needs

Applications for individual NPDES permits require prospective permittees to submit data and information about the subject discharge. Individual permit applications typically require applicants to provide permitting authorities with detailed information about the facility, treatment system, proposed discharge points, discharge flows, and pollutant content to assist the permitting authority in developing individual permit provisions. The process through which dischargers and recycling project managers interact with permitting authorities can positively or negatively affect the permit development process (Sherman et al., 2020). Ideally, regular, early communication and coordination clarifies data and information needed in any individual permit application process. It can be difficult to collect and provide the data permitting authorities require, particularly in cases where new or newly applied treatment technologies are involved and performance data are not readily available (Irlbeck and Voutchkov, 2013). For potable reuse projects, it is common for project proponents to build demonstration scale facilities to generate the data necessary for regulatory approvals and issuance of required permits.

Recommendations to Further Address How NPDES Permits Can Facilitate Water Reuse

Several follow-up activities could continue to build the capacity of permit writers, permittees, permitting authorities, and other practitioners to address permitting challenges in the context of water reuse projects.

Develop Training Module for Permit Writers

Partners of WRAP action 2.6 indicated that training for permit writers to better understand the range of available permitting approaches would be beneficial to achieving the action's goals. They also indicated that such training would help project proponents guide their facilities' planning and participation in the permitting process. EPA should consider partnering with the Association of Clean Water Administrators (ACWA), WateReuse Association, National Association of Clean Water Agencies (NACWA), National Municipal Stormwater Alliance (NMSA), and other stakeholders to develop a permit writer training module focusing on potential strategies for addressing NPDES permitting challenges that may arise with water reuse projects.

Create Checklists for Reviewing Reuse-Related NPDES Permits

Many permitting authorities use permit review checklists to assist in the development and review of permit applications. EPA and some states are developing permit review checklists tailored to support the review of NPDES permit application materials for water reuse projects. EPA and state permitting authorities could consider developing or sharing permit review checklists, in coordination with discharger associations, to support permit writers and instruct permit applicants on assembling informative applications. We recommend that permitting authorities confer with discharger associations and other stakeholders in developing such checklists. Using checklists in the training modules discussed above could be an effective way to organize the trainings.

Coordinate Technical and Policy Actions Focused on Discharge of Concentrated Filtrate Residuals

Discharges of concentrated residuals from RO treatment processes can be a technically complex waste streams to permit (Irlbeck and Voutchkov, 2013). Such permitting in settings where a discharge to inland waters with limited mixing potential is involved can raise unique considerations. The WRAP action 2.6 partners identified a need to better characterize concentrated residual discharges (and their associated permitting), and to identify practical strategies to address them. The National Alliance for Water Innovation (NAWI) Energy-Water Desalination Hub is implementing a multi-year process of evaluating desalination treatment methods, including RO and micro-filtration methods relevant to water reuse operations. In its process to support research and development work in this space, NAWI should work with permitting authorities and other interested parties, such as the Water Research Foundation and the U.S. Bureau of Reclamation, to sponsor work to improve the understanding of desalination permitting and develop practical approaches to facilitate it.

Develop Tools and Strategies to Support Permitting Innovative Technologies

Many of the permitting-related lessons learned concerning water reuse projects also apply to other innovative water management systems (e.g., resource recovery, energy efficient water systems, water conservation, and integrated water management). As this white paper demonstrates, the careful evaluation of water reuse permitting has highlighted the value of analyzing and sharing permitting practices that can facilitate their

implementation. Similarly, EPA could work with stakeholders to more rigorously evaluate regulations that impact the permitting of discharges from innovative water management technologies and develop tools and strategies to support their permitting.

Develop and Regularly Update Compendium of NPDES Permits with Water Reuse Components
EPA should work with permitting authorities and permittees to develop and maintain a compendium of permits and associated project descriptions that illustrate how water reuse-related topics have been addressed in NPDES permits and potentially other regulatory contexts.

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APPENDIX: CASE STUDIES OF WATER REUSE PERMITTING

To assist preparation of this paper, NACWA and WateReuse contracted with Brown and Caldwell to develop three case studies to illustrate some of the issues and solutions utilities encountered in implementing water recycling projects and associated NPDES permits.

Wichita Falls, Texas

Case study description**:** Facing severe drought conditions, the City of Wichita Falls, Texas approachedthe Texas Commission on Environmental Quality (TCEQ) in 2012 with their plans to start supplementing their drinking water supply with potable reuse of wastewater. Starting in 2014, Wichita Falls implemented a two-phase project consisting of an emergency temporary direct potable reuse (DPR) system and a permanent indirect potable reuse (IPR) system. A Texas Pollutant Discharge Elimination System (TPDES) permit was required for discharges that occurred as part of the IPR system.

The temporary DPR system went online in 2014 after 27 months of design, regulatory authorizations, and construction, and was decommissioned in 2015 because significant rainfall made the project unnecessary. Wichita Falls was able to rapidly deploy the DPR system because the Cypress Water Treatment Plant (WTP) already treated brackish surface water from Lake Kemp with microfiltration (MF) and reverse osmosis (RO). The Cypress WTP was scheduled to be taken offline because the total dissolved solids of the Lake Kemp water source exceeded the RO design basis. Instead, the Cypress WTP was re-purposed to receive effluent from the River Road Wastewater Treatment Plant (WWTP), with the addition of UV treatment for targeted pathogen inactivation. The Cypress WTP MF and RO processes discharged brine to the Big Wichita River under the TPDES permit. Since there are no regulatory guidelines for DPR in Texas, TCEQ and the City of Wichita Falls Public Works Department collaboratively discussed the necessary treatment requirements and effluent limitations.

Wichita Falls implemented the IPR system in 2018. It conveys treated effluent from River Road WWTP to Lake Arrowhead, which serves as an environmental buffer before being sent to the City's conventional WTPs.

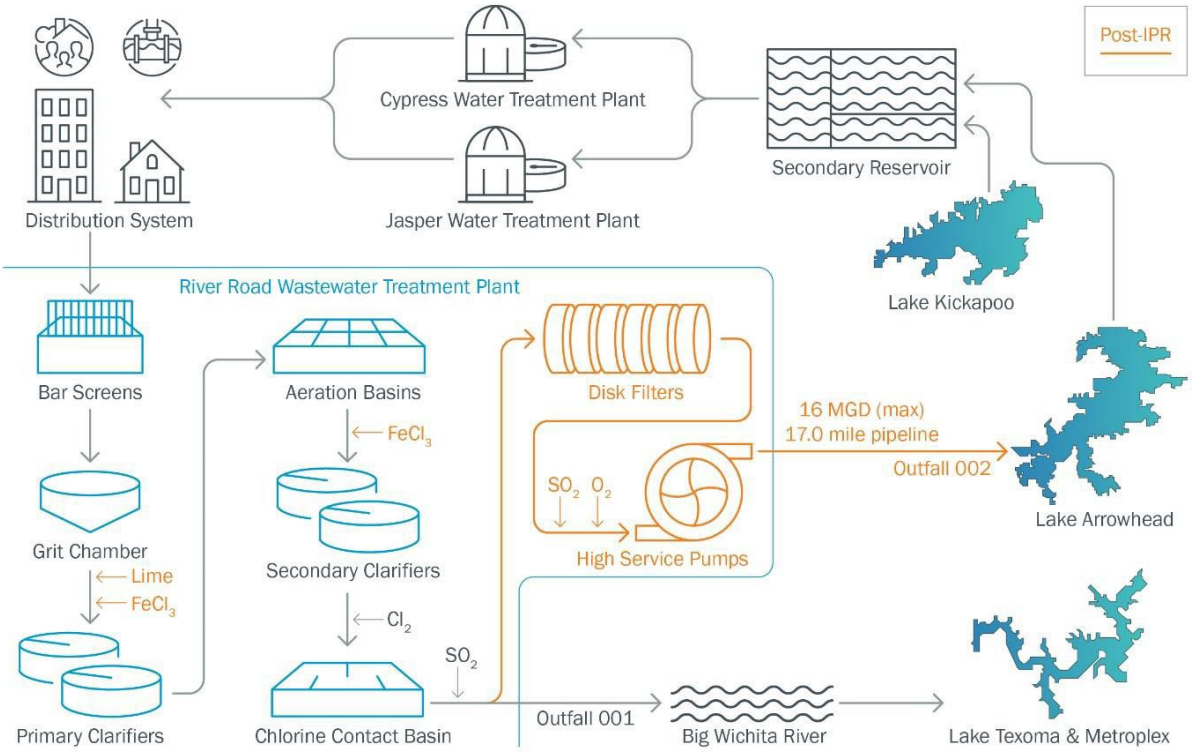
TPDES Permitting: The DPR system did not require a new TPDES permit because the DPR system evolved from an existing MF/RO WTP with a TPDES permitted discharge. However, the IPR system required a new TPDES permit for the discharge from the River Road WWTP to Lake Arrowhead. The discharge to Lake Arrowhead was subject to a lower phosphorus limit than the discharge to the Little Wichita River. Even with the lower nutrient limits, there were concerns about the outfall location and how adding nutrients would affect the lake. In addition, an issue associated with protozoans needed to be resolved. Wichita Falls installed disc filters to effectively remove both phosphorus and protozoans, including Cryptosporidium and Giardia, prior to discharge to Lake Arrowhead.

Water Quality Challenges

- Potential impact to Lake Arrowhead water quality with the addition of the nutrients, nitrogen, and phosphorus
- Pathogenic protozoans in treated wastewater effluent

TPDES Solutions

- A CORMIX model was used to predict mixing and select outfall locations
- A monitoring program to confirmmodeling results
- Addition of disc filters to remove protozoans



City of Wichita Falls Reuse Projects Process Flow Diagram

Success factors/ barriers overcome

- Communication and good working relationships with regulators, both on the part of Wichita Falls and the consultants supporting the water quality modeling.
- Shared goals driving the DPR and IPR process, including urgent need to respond to drought conditions and stewardship of water sources.
- Collaboration and improved communication between drinking water and wastewater divisions (both internally and at TCEQ) to ensure everyone was on the same page on project objectives, treatment operations, and permitting and took into account the dual nature of water and wastewater treatment.

Permitting innovations/strategy

- Recognition that both the applicant and the regulator have a stake in the outcome. Lake Arrowhead is the water supply for Wichita Falls, and its quality must be assured for the community.
- Leveraging existing permits. Wichita Falls had an existing MF/RO filtration WTP with permitted discharges of brackish water to the Big Wichita River, a brackish stream. Changing to a DPR did not require additional permitting changes from TCEQ.
- Building from experience. Wichita Falls had the opportunity to work through permitting for both IPR and DPR applications. Though the permitting requirements were different, the experience helped them understand the permitting process better.
- Mixing zone modeling. TCEQ required Wichita Falls to use a CORMIX model to select outfall locations for the discharge from the IPR and better understand the potential effects of adding nutrients to Lake Arrowhead.

Northern Valley Regional Recycled Water Program

Case study description: The Northern Valley Regional Recycled Water Program (NVRRWP) provides 25,000 acre-feet of recycled water every year (19 million gallons per day) to California's Central Valley for agricultural irrigation. The program connects discharges from the City of Turlock and the City of Modesto water pollution control facilities to the Delta-Mendota Canal. The Delta-Mendota canal is part of the United States Bureau of Reclamation's (USBR) Central Valley Project (CVP), a network of water infrastructure that moves water throughout central California. It is connected to several water contractors, such as Del Puerto Water District (Del Puerto WD), an irrigation district whose service area delivers water directly from the Delta-Mendota Canal to 45,000 acres of productive farmland.

The NVRRWP partnership started in the early 2010s when Modesto and Turlock needed to upgrade filtration and disinfection to meet increasingly stringent discharge requirements to the San Joaquin River. These upgrades created an opportunity to take advantage of the higher quality treated effluent. Flows in the Delta-Mendota Canal that exceed those used by irrigators are stored in a reservoir until needed, thereby decoupling the seasonal demands of irrigators and the availability of treated wastewater. This also helps buffer the variability of CVP supplies.

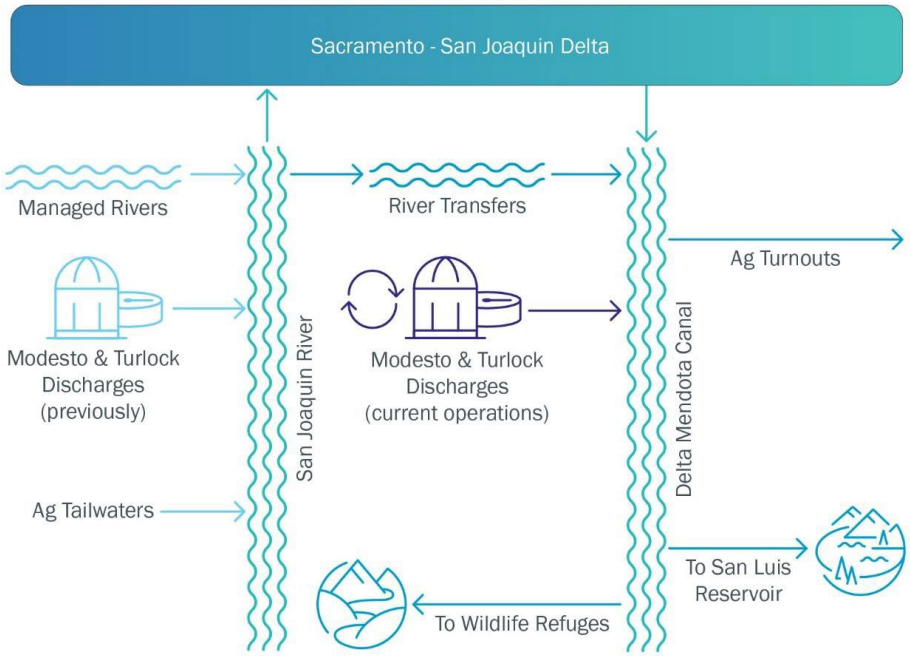
National Pollution Discharge Elimination System (NPDES) Permitting: Modesto and Turlock hold a joint NPDES permit issued by the Central Valley Regional Water Quality Control Board for discharges to the Delta-Mendota Canal. Both cities also hold separate NPDES permits for discharges to the San Joaquin River as a contingency if they are not able to discharge to the canal. For the NPDES permit for the Delta-Mendota Canal discharges, the cities demonstrated that because the discharges comprise only a small portion of the canal flows and the quality of the discharge, they would not cause, have the reasonable potential to cause, or contribute to an exceedance of a water quality standard.

Water Quality Challenges

- Potential water quality degradation in the Delta-Mendota canal
  - Total Dissolved Solids (TDS) – Turlockis supplied by groundwater that hashigh TDS
  - Nitrate – Modesto water was higher innitrate than the Delta-Mendota Canal
  - Selenium – Is a feature of local geology and is high in local watersupplies

NPDES Solutions

- Enhancing treatment
- Moving discharges to the San Joaquin River which had a larger assimilative capacity – the combined volume of the Modesto – Turlock discharge is < 1% of the Delta Mendota Canal Flow
- Receiving water quality – maintain waterquality of the San Joaquin River at the Delta-Mendota discharge point



NVRRWP Operations

Success factors/barriers overcome

- Good communication and working relationships with regulators, project partners, and consultants who did not have the opportunity to collaborate previously was key to coordinating a joint NPDES permit for Modesto and Turlock.
- Availability of 2014 Drought Funding to incentivize shovel ready projects, which allowed water to be more affordable.
- Common goals driving the process, as all parties understand the importance of water supplies, particularly during times of drought in California.
- Effective project managers to keep track of the various collaboration aspects of the project and stay on top of monitoring requirements.

Permitting innovations/strategy

- Leveraging permitting requirements as an opportunity for innovation. Modesto and Turlock were required to upgrade their treatment processes. The more stringent requirements presented an opportunity for the cities to leverage the higher quality effluent by creating an innovative water recycling program.
- No fear of being a test case. This project was the first of its kind to establish a regional recycling water program. Rather than being deterred by the lack of precedent, all parties worked together to identify opportunities and demonstrate approaches that can be built upon and expanded by other communities.
- Comprehensive studies to understand the system and potential impacts. Several studies were needed to understand potential impacts to the San Joaquin River (where the flows were previously being discharged) and ensure there would be no negative impacts to the Delta Mendota Canal flows or water quality.

Orange County Water District/ Orange County Sanitation District

Case study description: Orange County Water District (OCWD) recycles treated wastewater for water supply augmentation via groundwater recharge by direct injection and by infiltration in spreading basins. About 70% of the purified water is transported to recharge basins in Anaheim or injection wells in Santa Ana and is later pumped by local water producers to supply drinking water for north and central Orange County. The other 30% of the purified water is pumped to Talbert Gap seawater intrusion barrier injection wells, which also provide water supply augmentation. Membrane filtration backwash is returned to Orange County Sanitation District (OC San) for treatment and reuse, while reverse osmosis (RO) concentrate is returned for combination with final effluent and discharge via an ocean outfall.

The project has been in operation since 1976 (originally as the Water Factory 21 facility). It was the first of its kind serving a seawater intrusion barrier in a potable aquifer. In 2008, the project was upgraded with a new 70 million gallons per day (MGD) Groundwater Replenishment System (GWRS), which included an advanced water purification facility (AWPF) in Fountain Valley that took treated secondary effluent from the OC San Plant 1. The GWRS was later expanded to 100 MGD in 2015 and construction of the 130 MGD final expansion is currently underway, which will utilize wastewater from OC San Plants 1 and 2.

Today, the GWRS treatment process includes membrane filtration (MF), reverse osmosis (RO), and advanced oxidation (UV-AOP with hydrogen peroxide), followed by decarbonation and lime addition. The facility also houses equalization tanks to help the GWRS operate at a more constant flow rate and maximize production despite diurnal fluctuations in wastewater.

National Pollutant Discharge Elimination System Permitting: The GWRS is permitted by the California Regional Water Quality Control Boards (Santa Ana Region 8) via water recycling requirements and a more recent master recycling permit for limited non-potable uses.

GWRS membrane filtration backwash is returned to Plant 1 where it treated and

Technical Challenges

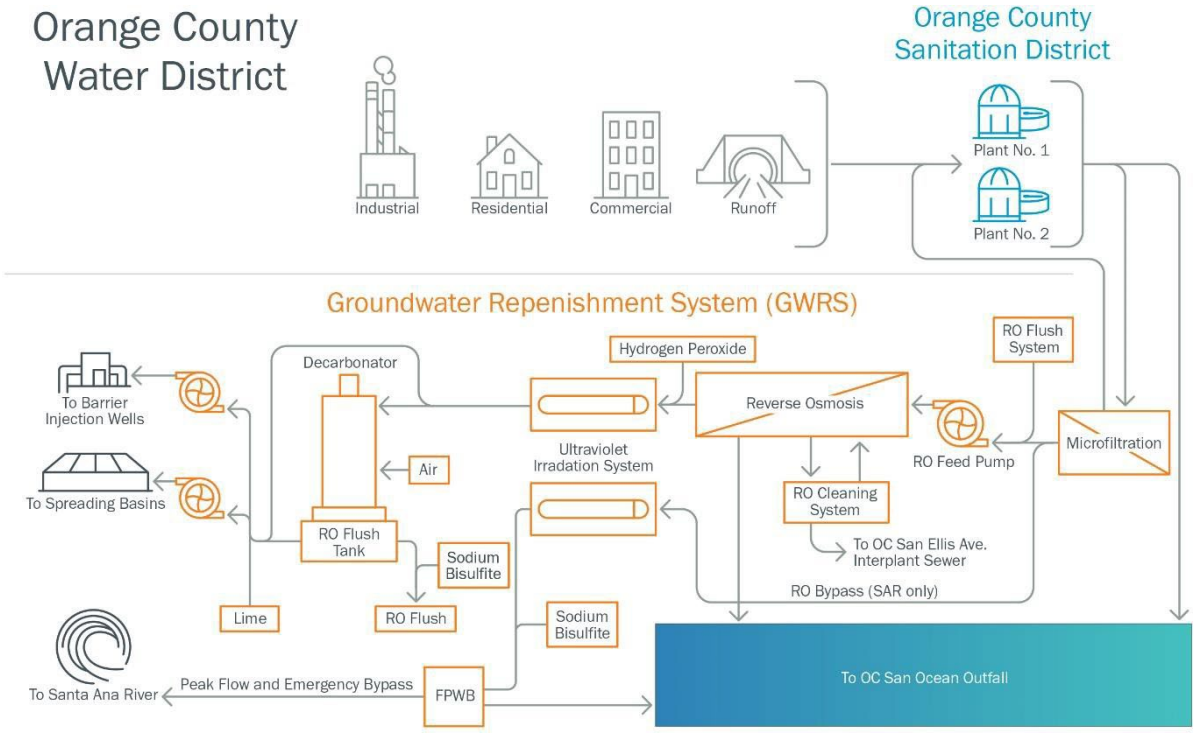
- Performance goals and mass emission benchmarks are backward-looking and confoundtreatment innovation.
- Applicability of standard toxicity testing organismsto recycled water with low hardness
- Wastewater plume tracking models often suffer from inadequate background characterization (ocean conditions) and are performed without consideration of the engineered dilution ratio as originally designed and constructed.

NPDES Solutions

- Robust pretreatment program that integrates therequirements of GWRS discharge and recycling permits as well as OC San's NPDES permit and biosolids management
- Permit based on the highest and best use of the water, taking into account potable water regulations and waste discharge requirements
- Consult an aquatic toxicology subject matter expert on acceptable ion imbalance mitigationmethods for aquatic toxicity testing
- Account for the engineered dilution ratio, the permittee's record of performance, and gaps in ocean condition characterization when constructing wastewater plume tracking models

largely combined with the AWPF influent, while the RO concentrate is combined with OC San's final effluent at Plant 2 prior to discharge to the ocean authorized by an NPDES permit issued to OC San that consolidates State and EPA requirements. The OC San NPDES permit went into effect on August 1, 2021. The reissued permit addresses three outfall locations, one main ocean outfall for routine use and two for emergency use. Water quality-based effluent limitations in the permit are based on a minimum initial dilution of at least 181:1 as modeled assuming no currents.

The permit includes performance goals (monthly concentration basis) and mass emission benchmarks (annual loading basis) for the main ocean outfall. The performance goals are not considered enforceable effluent limitations or standards; however, any two consecutive exceedances of the performance goals trigger an investigation into the cause of the exceedance, and three successive exceedances require a report. The performance goals are based on actual performance data from the most recent 5-year period for the OC San's secondary treatment plants.



Process Flow Diagram of Advanced Treatment at the GWRS

Success factors

- Proactive communication and good working relationships with the Division of Drinking Water and Santa Ana Regional Water Quality Control Board were key to the project's success. OCWD allowed enough time to incorporate outreach to the public and to environmental stakeholders who had a voice in the permitting process.
- Early recognition of potential water quality concerns prompted OC San to implement a robust pretreatment program, which removed pollutant burden from the wastewater treatment plants, downstream AWPF, and ultimate discharge location.
- Partnership between water/groundwater management (OCWD) and wastewater (OC San) utilities working together effectively to ensure water quality is being managed appropriately.

Permitting innovations/ strategy

- Leveraging of existing permits. RO concentrate is explicitly accounted for in OC San's NPDES ocean discharge permit. Thus, the expansion of RO treatment at the GWRS did not require a separate permit.
- Optimization of reclaimable flows. As part of the GWRS final expansion (scheduled to be completed in 2023), the flow from OC San's Plant No.2 headworks will be split into two streams, one that is non-reclaimable and discharged to the ocean and a second that is captured as reclaimable flow for conveyance to the GWRS facility.
- Advanced monitoring and modeling. OC San has advanced laboratory and analytical capabilities that allow it to keep track of the plume signature of discharges based on ocean conditions and water quality pre- and post-GWRS. This has allowed them to stay ahead of potential issues and maintain an open dialogue with regulators regarding permit conditions.
- Consulting with a third-party independent advisory panel. OCWD has access to a third- party panel that was very helpful in navigating questions with regulators when state regulations for groundwater recharge reuse projects were first being drafted. The panel is also available if independent guidance is needed for OCWD's permit.