

Washington Conservation Action and Duwamish River Community Coalition

Please see attached comment letter, submitted by Jamie Hearn, Duwamish River Community Coalition, and Mindy Roberts, Washington Conservation Action. We also include two attachments in separate files.



July 7, 2023

Tricia Miller, Permit Administrator and Sean Wilson, Permit Manager
Department of Ecology – NWRO
PO Box 330316
Shoreline, WA 98133-9716

Dear Ms. Miller and Mr. Wilson:

Thank you for the opportunity to provide input on the National Pollutant Discharge Elimination System (NPDES) Permit No. WA0029181 for King County's West Point Wastewater Treatment Plant. Washington Conservation Action Education Fund (WCA) is a 501(c)(3) organization founded in 1967 as Washington Environmental Council. Our mission is to develop, advocate for, and defend policies that ensure environmental progress and justice by centering and amplifying the voices of the most impacted communities. We are committed to clean water protections for all Washington State waters. Duwamish River Community Coalition (DRCC) is a 501(c)(3) organization that has long been a community steward for environmental justice in the Duwamish Valley, which is one of the most polluted areas in the entire Pacific Northwest following 100 years of industrial dumping and release of toxic waste. DRCC has worked tirelessly alongside community groups and neighbors for 20 years to clean up the water, land and air while fighting to eliminate ongoing industrial pollution that makes our communities among the least healthy in the County.

WCA has a deep history of pushing for measurable progress to prevent and manage sewage pollution. We have been involved with the Puget Sound Nutrient Forum and Nutrient General Permit Advisory Committee and remain committed to achieving clean water throughout the State. DRCC has actively pursued clean water strategies and has advocated for sewer infrastructure investments for years. DRCC is committed to protecting people most impacted by the cumulative impacts of living in a community with multiple sources of toxic exposure.

Each NPDES permit cycle must make progress toward eliminating pollution that impacts people, water, and aquatic life. For this permit cycle we would like to see exceptional progress towards the goal of clean water for all and have identified several priority areas key to achieving this goal: ensuring that King County reduces nitrogen pollution at West



Point, prohibit any status quo facility expansion, strengthen Combined Sewer Overflow (CSO) provisions, accelerate progress toward reducing metals and toxics, increase public transparency and accountability, address environmental justice and affordability, and decrease inflow and infiltration.

Unfortunately, West Point Wastewater Treatment plant operators, including King County and its predecessor Metro, have a long history of requesting exceptions to the normal practices and pace of reducing sewage pollution that other wastewater treatment plants have adopted. As the Fact Sheet notes, when the Clean Water Act was amended in 1972 to require that all sewage treatment plants meet secondary treatment requirements by 1977, West Point's predecessor agency Metro applied for a waiver of those requirements, even while other wastewater treatment plants in the Puget Sound region, across the state, and across the country complied with that deadline. Ecology had to issue an Administrative Order, Docket No. DE 84 577, in September 1984 to direct Metro to proceed with planning for secondary treatment at the West Point plant no later than February 1991. When that deadline would not be met, Ecology amended the order to extend the compliance date until December 1995. King County assumed control of Metro's assets and obligations in 1994, and secondary treatment was brought online in 1995 – 18 years after the date set in the federal Clean Water Act, and one of the last major municipalities in the country to do so. That was unacceptable at the time and should not have required nearly two decades to comply with clean water requirements, especially in a municipality that prides itself on its environmental protection practices.

The February 2017 catastrophic failure of the West Point wastewater treatment plant required 89 days to return to normal operations. During that time, municipal sewage discharged to Puget Sound did not receive adequate treatment. While operators used a creative suite of practices to maximize other transmission system options to minimize pollution, there is no denying that inadequate sewage discharges caused harm, including harm to geographies outside of King County's boundaries. Surprisingly, King County's monitoring programs conducted in the wake of the failure found no detectable changes in Puget Sound water quality. This conclusion is beyond belief. At the time, King County also attempted to deflect blame for the power failure to Seattle City Light, even though King County alone is legally responsible for providing adequate power to its facilities. Ecology issued its largest pollution penalty in state history as a result.

West Point also suffered a power failure in July 2019 that led to the discharge of inadequately treated sewage to Puget Sound. As a result, a number of beaches were closed even across Puget Sound in Kitsap County. Multiple shellfish harvesting areas were closed



as well. People participating in the annual tribal Canoe Journey passed through the “closed” areas as the Suquamish Tribe hosted one of the nightly camping stops. The Suquamish Tribe noted this impact in its Notice of Intent to Sue King County over its failure to address recurring pollution violations and power issues.

From 2019 to 2022, King County hosted a forum of stakeholders to advise it on its clean water investments, and WCA served on the advisory group. Multiple times during that period, we and others noted that King County was incorrect and misleading in its assumption that complying with Clean Water Act requirements for sewage treatment and CSO abatement were optional. We invested untold hours trying to get King County’s Wastewater Treatment Division on a better path toward achieving clean water. Yet time and time again, the materials distributed in that process were wholly biased against addressing sewage treatment requirements and CSO requirements.

In fact, King County’s own independent Auditor’s Office found unsubstantiated escalated cost estimates for sewage upgrades and CSO controls and issued a report September 30, 2021, on the need for increased transparency around the costs, risks, and guiding principles of the Clean Water Plan process (<https://kingcounty.gov/depts/auditor/auditor-reports/cpo/clean-water-plan.aspx> and attached as a separate file to this comment letter). The King County Auditor’s Office found that the Wastewater Treatment Division incurred substantial risk by downplaying regulatory requirements around sewage treatment and CSO abatement. Importantly, the Auditor’s Office found a lack of transparency on cost estimates provided to the advisory group and that the information was biased away from actions related to sewage treatment and CSO controls.

After Ecology issued the Puget Sound Nutrient General Permit in 2022, King County appealed that permit on a variety of process and content terms to the Pollution Control Hearings Board. In addition, King County joined litigation currently in the Appeals Court alongside Tacoma to thwart the Puget Sound Nutrient General Permit, which Ecology designed to give the dischargers flexibility. King County essentially argues that Ecology has no basis for regulating nitrogen discharges to Puget Sound, fights the well-established science around the impacts of sewage discharges, and then obfuscates an astounding array of regulatory processes in a quest to avoid its obligations under the Clean Water Act. This is occurring even as King County states in multiple public venues that it will follow all clean water regulations.

In 2020, the Governor’s Office convened a meeting of scientists as King County began disputing the science around sewage discharges. WCA, then called Washington



Environmental Council, has provided expert scientific information that summarizes the robust 20+ years of modeling and analyses conducted by Ecology. As stated in the attachment, *"Parts of Puget Sound experience low levels of dissolved oxygen, which is vital for aquatic life.... Human activities increase nitrogen and carbon contributions through both wastewater treatment plant discharges and watershed activities, with wastewater loads the dominant source in the summer months.... Added nutrients from human-derived activities cause or contribute to violations of the Washington State water quality standard for dissolved oxygen in Puget Sound due to complex circulation and biogeochemical processes.... Future growth and development will increase nutrients from human activities in the Puget Sound watershed, which will worsen dissolved oxygen impacts from local human activities unless nutrients and carbon are managed differently.... The Salish Sea Model, built on years of application, is the most appropriate tool to explore the relative impacts of different natural and human stressors that influence dissolved oxygen. At each phase of model development, Ecology concluded that human nutrient sources likely were violating the dissolved oxygen criteria in portions of Puget Sound. The magnitude and location of the violations have remained remarkably consistent over 19 years, even as the modeling tools continued to be refined in response to uncertainties identified by the modeling team.... At each phase of model development, Ecology was held to the highest standards of peer review, stakeholder input, and public review to ensure the integrity of the work and to hold up in a court of law...."*

In a 2022 briefing to the legislature, King County claimed it would be better for Puget Sound to fund programs such as reducing septic system impacts to Penn Cove in Island County and reducing agricultural pollution in Snohomish County. We note that pursuing actions in Island County or Snohomish County in lieu of cleaning up its own pollution would be contrary to environmental justice principles; King County cannot sacrifice the health and environment of people impacted by its CSOs and West Point discharge to clean up pollution in other communities, particularly those with lower populations of BIPOC people. In addition, the 2021 King County Auditor's Office report flagged that alternative compliance approaches are not currently legal and that changes to Washington Administrative Code would be needed to allow King County to pursue alternative water quality investments in lieu of CSO investments. This out-of-kind mitigation attempt is also wholly out of scale to the problems caused by sewage from King County's system.

We also note that many of the arguments that King County is currently using to avoid tertiary treatment are nearly identical to the arguments previously used to avoid expanding from primary treatment to secondary treatment in the 1990s – costs are too high, technology is untested, Puget Sound does not need the protection, upgraded sewage



treatment will not result in any measurable improvement to Puget Sound water quality, and no one is actually harmed.

Appendix E to the Fact Sheet lists an extraordinary number of violations of the current permit for the period between 2015 and 2021, not limited to the 2017 West Point catastrophic failure. For West Point, 16 months exceeded 85% of the design capacity for carbonaceous biochemical oxygen demand (CBOD) or total suspended solids (TSS) and one month (February 2017) exceeded the actual design capacity for TSS during the plant failure. Every CSO plant violated permit limits for fecal coliform, pH, and/or total residual chlorine. The Elliott West CSO Plant alone violated permit limits more than 100 times. The latter led to Ecology and EPA issuing stipulated penalties of \$184,000 in December 2022 for violating the County's CSO Consent Decree.

Given that West Point is the largest source of sewage discharge anywhere in the state, and given the long and deep history of the West Point and CSO facility violations of its NPDES permit, Ecology needs to develop stringent permit conditions and hold King County accountable for any violations of those permit terms. The final permit must require far more progress toward achieving long-term reductions in sewage pollution to Puget Sound than reflected in the draft permit.

We offer the following comments on the draft permit and look forward to seeing these issues resolved in the final permit.

Reduce Nitrogen Pollution

King County is pursuing litigation fighting the Puget Sound Nutrient General Permit, currently in the Court of Appeals, and is appealing the permit through the Pollution Control Hearings Board, currently stayed pending the appeal. If King County succeeds in undermining the permit on procedural arguments, then the West Point facility will have no obligations to monitor for nitrogen, no pathway toward planning for nutrient-removal technology, and no progress toward reducing nitrogen in the short term. That is too big of a risk for the largest sewage discharge in the entire State of Washington, and the largest U.S. sewage discharger to the Salish Sea.

While the Puget Sound Nutrient General Permit had been intended to give dischargers more flexibility in complying with nitrogen reductions, it is clear from King County's actions that they will continue to fight this inevitable conclusion as long as they possibly can,



consistent with trying to avoid adding secondary treatment in the 1970s, 1980s, and 1990s. In addition to litigation, King County is obfuscating the science through a sham process, consistent with finding no measurable harm to Puget Sound following the February 2017 catastrophic plant failure. Ecology intended to roll nitrogen requirements into future iterations of the individual permits, but that needs to happen now and in this permit.

Pierce County knew that nutrient regulations were coming when it upgraded the Chambers Creek plant in the early 2000s and has been decreasing nitrogen discharges even before the Puget Sound Nutrient General Permit was issued. Joint Base Lewis McChord rebuilt its wastewater treatment plant and is achieving very low nitrogen concentrations even though EPA had not yet required the reductions. The Lacey Olympia Tumwater Thurston County (LOTT) plant has been implementing nutrient removal since the mid-1990s. As you know, multiple mid-size plants have gone to nutrient removal technology. Ecology must require King County to begin this transition for West Point in this NPDES permit and must not reward poor decisionmaking by King County Wastewater Treatment Division.

Ecology should incorporate monitoring, planning, and engineering provisions building from those in the Puget Sound Nutrient General Permit into the West Point permit, strengthen those provisions for the largest sewage source to Puget Sound, establish a technology-based nitrogen limit for West Point, and eliminate West Point from general permit coverage now.

In WCA's appeal of the Puget Sound Nutrient General Permit with the Suquamish Tribe to the Pollution Control Hearings Board, the appropriate venue for addressing pollution disputes and not the Courts, we argue that the "action levels" that Ecology calculated for the West Point plant and the other discharges used an egregiously lax statistical basis. The 99th percentile of the existing discharge loads would allow King County to continue to increase nitrogen pollution loads over many years. We urge Ecology to review King County's 2022 nitrogen loads reported under the Puget Sound Nutrient General Permit, which have not been made available to the public, and calculate the ratio of the actual 2022 loads to the action levels. We anticipate that King County's West Point 2022 nitrogen discharge loads were significantly below the action levels in the Puget Sound Nutrient General Permit. This is why we do not recommend adopting the action levels as permit limits. The King County Auditor's Office report provided a timeline of discharge loads from West Point, including what would happen at a technology-based limit of 8 mg/L of nitrogen. We encourage Ecology to establish a technology-based limit of 2 mg/L based on what the LOTT plant and JBLM plant are currently achieving.



We also anticipate that King County will pursue a facility expansion request to Ecology as it nears its design capacity at West Point during the next permit term, a concern described in the next section. Therefore, particularly if King County succeeds in overturning the Puget Sound Nutrient General Permit, Ecology must establish stringent nutrient limits in this individual permit for West Point. Ecology must require King County to make progress on planning for nutrient-removal technology at West Point, where King County is currently reserving physical space for future tank expansions to treat more sewage as population increases.

Given that the shift from primary to secondary treatment at the West Point Wastewater Treatment Plant required 18 years after the federal deadline and an Administrative Order, Ecology needs to incorporate meaningful progress toward nitrogen reduction in the individual West Point permit.

Prohibit Status Quo Facility Expansion at West Point and Address Emergency Bypass

As presented in Appendix E of the Fact Sheet, CBOD and TSS loads have already exceeded the 85th percentile for 15 separate months between 2015 and 2021. We expect that King County will begin work toward status quo expansions during this permit term, which would be allowable by this permit as written. **Ecology needs to be clear that status quo facility expansions are not acceptable.**

Special Condition S4.B(a) describes the conditions triggering the requirement to submit a plan for maintaining adequate capacity when actual flows and loads reach 85 percent or when projected flows and loads within 5 years exceed any of the triggers in Table 31.

However, the provision as written leaves open the option that King County will be approved for an expansion of plant capacity. Because King County's West Point discharge already contributes to violations of the water quality standards for nitrogen, Ecology cannot approve any expansion without a concomitant technology change that reduces the concentration of nitrogen in the effluent. Therefore, Ecology must add clarity that any plant expansion process must include all parameters covered by both the individual and general permits that apply to the facility, if West Point remains subject to the Puget Sound Nutrient General Permit. Ecology should include a clear statement under Special Condition S4.B.b that the engineering design report must address all parameters included in the individual permit as well as the Puget Sound Nutrient General Permit.



Special Condition S4.E includes a requirement for a Wasteload Assessment. Because all nitrogen monitoring and analyses are proposed to be in the separate Puget Sound Nutrient General Permit, Ecology must include a clear statement that this Wasteload Assessment must include nitrogen if any or all provisions of the Puget Sound Nutrient General Permit are overturned.

Special Condition S4.A Table 31 now includes a distinct discharge flow limit of 300 mgd for secondary treatment flow capacity (maximum daily flow) in addition to the maximum month design flow of 215 mgd. We agree with having a flow limit that includes a maximum daily value. The fact sheet should include more information around how often this value had been met or exceeded in previous years to justify the establishment of the 300 mgd value.

Fact Sheet Table 4 presents the projected average annual flows through the 2060s as 127 mgd, substantially below 215 mgd. However, 215 mgd is the maximum monthly design flow, not the average annual flow. Table 4 should include more of an apples-to-apples comparison and the maximum monthly flows relative to the design of the plant since that is the statistical basis for the flow trigger for expanding capacity.

Special Condition S16 requires King County to “... submit a new application or addendum at least one hundred eighty (180) days prior to commencement of discharges, resulting from the activities listed below, which may result in permit violations. These activities include any facility expansions, production increases, or other planned changes, such as process modifications, in the permitted facility.” However, this implies that Ecology could approve an increase in capacity. This permit must state definitively that King County should not expect Ecology to approve any applications for increases in flows or loads from the West Point Treatment Plant.

Fact Sheet page 16 describes that “*During wet weather, flow through the West Point WWTP can exceed the design capacity of the secondary treatment processes. When instantaneous internal flow rates reach 300 MGD...*” and that “*KC-WTD is in the process of redesigning this bypass to rely on passive weirs to allow emergency bypasses rather than the hydraulically-operated gates. Ecology’s review of the passive weir project concluded that the redesign improves overall protection of the plant during emergency conditions without increasing the potential for inadvertent bypasses. Although Ecology recognizes the need for this safety feature to protect against catastrophic conditions that may risk operator safety or severe property damage, the proposed permit considers any discharge through the emergency outfall as an unpermitted bypass*” (underlining added). Ecology describes the emergency bypass outfall as discharging



in 40 feet of water in the Fact Sheet and includes the following text: *"While Ecology recognizes the importance of this outfall to protect the facility and its operators, the proposed permit does not consider the outfall as a permitted discharge location. Ecology may take enforcement actions for discharges through this outfall. Figure 2 also shows the location of this outfall."* (Underlining added)

We recognize that this solution was added in the wake of the 2017 catastrophic failure and agree that worker safety is critical. However, this does not appear to be a long-term solution that protects the health of Puget Sound as it still essentially provides the plumbing for under- and un-treated sewage to enter Puget Sound. Rather than simply build this into the permit, Ecology needs to require King County to develop a long-term fix that eliminates the need to bypass secondary treatment. After all, the state spent 18 years forcing West Point to build secondary treatment. Ecology should not settle for allowing King County to avoid secondary treatment, even if it is considered an unpermitted bypass. Fining a discharger for something they are already planning to allow for does not achieve clean water. Ecology must require King County to plan for a permanent solution that avoids the need for emergency bypasses except in truly exceptional conditions. Emergency bypasses should not become annual or more frequent events.

Specifically, the permit must state unequivocally that Ecology will take enforcement action for discharges through the emergency bypass outfall, not may take action. Ecology also needs to require a long-term fix that eliminates the need to bypass secondary treatment.

Strengthen Combined Sewer Overflow provisions

The Fact Sheet history on page 12 notes that EPA finalized the federal policy for reducing pollution from combined sewer overflows in 1994. While King County made some progress, in 2007 EPA concluded that King County's ongoing CSOs violated state and federal regulations. A 2012 Crosscut article (<https://crosscut.com/2012/06/surface-water-pollution-consent-decrees>) provides a good summary of the issues at the time. This led to a 2013 Consent Decree between King County, Ecology, EPA, and the US Department of Justice that required actions necessary to bring King County's CSO program into compliance with the Clean Water Act. King County has repeatedly noted that it is not achieving the deadlines in that Consent Decree, and King County has requested that the terms be renegotiated. To



date, no public review draft has been released and all negotiations have occurred behind closed doors.

We urge Ecology to continue to require the largest municipality in the State of Washington to achieve its clean water obligations, including addressing its CSOs. King County personnel have repeatedly diminished the importance of reducing CSOs with an antiquated perspective that no one is harmed by CSOs. However, people are impacted by CSOs, including through exposure to toxic chemicals from CSOs, diminished use of beaches along Lake Washington, decreased fishing and shellfishing opportunities in the Duwamish Waterway, not to mention the accumulation of metals and other toxics in fish. Controlling CSOs is fundamentally an environmental justice issue, and those who are most impacted by and live in close proximity to CSOs are disproportionately low-income, BIPOC, and immigrant communities. See below for a related comment on requiring an environmental justice analysis as a condition in this permit.

Fact Sheet Table 26 also lists the numerous violations of the Sediment Management Standards surrounding most of the CSO outfalls, including those that discharge in and near Superfund sites and state Model Toxics Control Act sites. As those sites are cleaned up, source control will be even more important to protect those investments. Controlling CSOs is an integral part of achieving the EPA's long-term cleanup goal for PCBs in East Waterway sediments of two parts per billion. This type of health-protective standard will be impossible to achieve without controlling CSOs. Uncontrolled CSOs represent one category of many ongoing toxic sources, which is another reason to maintain strong CSO provisions in this permit as other sources are addressed through other regulatory mechanisms.

The Fact Sheet describes the Status of the CSO Program beginning on page 29 with a list of what has been done since 1988. However, this section should **begin with the clear statement that the CSO Program does not meet state and federal regulations and that the CSO Program is currently subject to a Consent Decree.** Further, the Fact Sheet should clearly state that King County requested that the Consent Decree be renegotiated and the outcomes have not been released to the public for comment.

Further, page 31 of the Fact Sheet describes that the permit will not include requirements related to a number of projects, and that Ecology is using the timelines established in the Consent Decree. We do not support any changes to the timelines and urge Ecology to require that King County meet its obligations relative to CSOs.

Overall we agree with increased attention to CSOs in this permit. After Everett finishes its CSO abatement work in a few years, King County will remain the only jurisdiction not



complying with the national standard of no more than one discharge per year per location in the Puget Sound region. That means that on both a regional and a national level, King County will be one of the last municipalities to fulfill its CSO obligations. Communities like Port Angeles and Bremerton have invested in solutions and have been complying with modern requirements for years. King County needs to do the same. We appreciate that the fact sheet notes that *"Due to the history of poor performance of the Elliott West CSO treatment plant, the proposed permit includes a compliance schedule that requires KC-WTD to complete planning and design for a replacement facility."* Historical context is important to document for future reference.

We concur with adding zinc (246 ug/L) and copper (84.1 ug/L interim and 15.0 ug/L) permit limits to the Elliott West CSO Treatment Plant and Henderson/MLK CSO Treatment Plant outfalls in Special Condition S1.B Tables 5 and 6, as well as decreasing the concentrations for total residual chlorine. However, the limits are still high in comparison with the marine water quality standards (<https://app.leg.wa.gov/WAC/default.aspx?cite=173-201A-240>) for these parameters – for zinc 90.0 ug/L acute and 81.0 ug/L chronic; for copper 4.8 ug/L acute and 3.1 ug/L chronic. The draft permit limits are roughly three times the allowable zinc concentrations and 17 to 27 times allowable copper concentrations. We are unclear why the ratios are different if using the same mixing zone calculations. We also disagree on the use of dilution factors and mixing zones for even controlled CSO discharges, especially for toxic chemicals.

The previous permit also included the maximum number of discharge events per year for the Alki CSO Treatment Plant (29 events per year and 108 million gallons per year long-term average), which we do not see in this permit. We recommend adopting the national standard of no more than one CSO event per year per location and specifically identifying the current Consent Decree signed with EPA, Ecology, King County, and Seattle regarding the CSO compliance requirements.

Special Condition S2.C describes the monitoring schedule for untreated CSO events and requires monitoring results be reported using electronic DMRs in Special Condition S3.A. However, this does not provide timely information to the public. As described under Public Transparency and Accountability below, Ecology must require King County to post this information in a more accessible format on its website alongside other events such as sewage spills. See below for specifics.

We concur with Special Condition S.11.F that an amendment is needed for the CSO reduction plan, and that any changes must comply with King County's 2013 federal CSO



Consent Decree, Civil Action No. 2:13-cv-677 or any modifications. We understand that King County has reopened negotiations on this Consent Decree and we are awaiting a public comment draft. We urge Ecology to keep the public's interest and needs in the forefront as that proceeds, even though the public is not part of the confidential negotiations process.

We concur with requiring a CSO Solids Characterization Study in Special Condition S12, and again urge Ecology to ensure that the resulting reports are easily locatable by the public, searchable using standard web searches, and communicated in effective formats with the public.

We concur with incorporating the Elliott West CSO Treatment Plant Improvements in the permit Special Condition S15. Annual progress reporting will be important to ensure the work stays on schedule. Given that King County has a long history of missing deadlines for CSO improvements, and will be one of the two last municipalities to meet the national performance standards in the state, Ecology needs to add specific penalties if progress falls behind. Simply documenting schedule slippage will not achieve clean water, and the permit needs specific steps toward enforcement.

Ecology should reconsider the use of mixing zones to establish discharge standards for the CSOs. Fact Sheet Section II.F.6 for the Henderson/MLK CSO Treatment Plant, Ecology mentions that "... *the Norfolk outfall also discharges stormwater from multiple jurisdictions in addition to untreated CSOs from the Norfolk Street Regulator Station and treated CSOs from the Henderson/MLK CSO Treatment Plant. In addition, multiple other public and private outfalls discharge stormwater into the Duwamish River near the Norfolk outfall.*" As a result, while Ecology is proposing mixing zones for individual outfall locations, this does not protect water quality because the cumulative impact of multiple pollution sources would cause violations of the water quality standards at the edge of the mixing zones. We do not believe this is legal to both note other sources that impact waters and also to grant a mixing zone. Therefore, Ecology must require more stringent requirements for CSO outfalls and also greater progress toward meeting the federal performance standards for these outfalls.

One option is for Ecology to recalculate mixing zone-based effluent standards that account for the additional pollution sources nearby. Another option is to require King County to address any of the mixing zones for controlled CSOs that overlap in the Duwamish Waterway or that overlap with other discharges that contribute pollution within the mixing zones. Either way, approving mixing zones that neglect other sources is inconsistent with meeting water quality standards as well as state and federal law.



Accelerate Progress toward Reducing Metals and Toxics

Tables 11, 13, 15, and 17 of the Fact Sheet summarize the existing water quality concentrations for a variety of parameters of interest. We note that the copper and zinc concentrations in the Lower Duwamish are much higher than those in Elliott Bay, which are much higher than those in Puget Sound. In addition, PCBs are many orders of magnitude higher in the Duwamish Waterway than they are in Elliott Bay, which are still elevated. In fact, recent research has found such high levels of PCBs in the Duwamish that they are impairing the survival of juvenile chinook salmon. PCBs in fish tissue in the Duwamish are also much higher than values considered safe for human consumption. Some communities, including indigenous populations, AAPI communities, and immigrant communities consume more fish than average for the overall population of the region.

Clearly, the Duwamish Waterway remains a hot spot for multiple toxic chemicals, due to the discharges they receive. This is another reason why CSOs absolutely need to be addressed as they remain ongoing sources of metals and other toxic compounds. We realize that other sources are present in the Duwamish Waterway, but this permit is the mechanism to make progress on reducing toxics and other pollution from CSOs and we urge Ecology to establish stringent requirements that accelerate the pace of reducing pollution.

Fact Sheet Tables 21, 22, 23, and 24 summarize the CSO treatment plant effluent data. We note that metals concentrations and a variety of toxic chemicals are high across the board. These chemicals do not break down and some can bioaccumulate in fish. Therefore, the slow pace of progress on controlling King County's CSOs means that more and more chemicals are impacting the beneficial uses of the receiving waters and downstream water bodies, and the people that depend on these waters and resources. Most toxic chemical concentrations are much higher than state water quality standards designed to protect the public's use and enjoyment of public resources. We mention this here because regulatory permit processes can lose sight of why reducing pollution is important.

The implications of these tables are that pollutants known to cause cancer continue to discharge into waterways used by real people, and King County is behind not just other jurisdictions in the Puget Sound region but nationally in controlling these pollution sources. Arguments that the work is too expensive and that CSOs do not really impact people have been around for decades. However, there remain real costs to people unable to access food, cultural, and recreational opportunities, not to mention treaty-reserved resources that can never be quantified.



Because the PCB concentrations are so high and have a direct impact on juvenile chinook survival, Ecology needs include a separate condition for King County to report on the magnitude and timeline for reducing CSO impacts on PCBs. To do so, Ecology's Water Quality Program should work with its Toxics Cleanup Program, Tribes, DRCC, and other organizations that represent impacted communities to develop this condition to add to the work already underway on PCBs.

More importantly, Ecology's use of mixing zones to determine compliance with water quality standards is problematic. Given the very high number of CSO pipes in the region, the mixing zone of individual pipes could be impacted by other known pollutants. Therefore, Ecology should require King County to verify that mixing zones do not overlap before granting them. Moreover, Ecology should revisit its policy of allowing mixing zones at all for metals and other toxic chemicals, especially in CSO discharges.

The Fact Sheet includes a summary of the 2018 Copper Assessment Report, which did not determine a clear explanation for the elevated copper levels in the Elliott West CSO Treatment Plant effluent. Many factors were ruled out, but the report had no strong conclusions as to the source of the elevated copper. Nothing in the current permit requires King County to continue this work. We urge Ecology to require further source identification for elevated copper levels in the Elliott West CSO Treatment Plant and piping network. Given the very high levels of PCBs, we suggest that this source tracing also include PCBs as well.

We concur with adding PFAS monitoring in Section 2, Table 21. However, given that the West Point treatment plant is the largest single source of sewage in the entire state, the quarterly frequency for the influent is insufficient to fully characterize the level of PFAS coming into the plant. We urge Ecology to require weekly influent and effluent monitoring for the first two years of the permit, with a provision to decrease to monthly monitoring if King County can demonstrate statistically that monthly monitoring would sufficiently characterize the variability in concentrations received at the plant. In addition, Ecology needs to require biosolids monitoring as well given the widespread dispersal of biosolids.

We concur with adding a new Special Condition S6.E Identification and Control of PFAS Discharges to the permit requirements. The industrial categories described in Special Condition S6.E.1 miss some previously documented potential sources of PFAS, including laundries, electronic products, hazardous waste, chemical wholesalers, and more. We note that these facilities tend to be concentrated in communities with large populations of BIPOC and low-income people, and addressing other impacts to surrounding communities



should be considered in addition to local source control work within the sewage and stormwater transmission systems. We encourage Ecology to expand this list to all well documented sources. We agree with the sequential reporting proposed, with April 30, 2025 for the IU inventory and July 1, 2025 for pretreatment requirements for IUs and BMPs plus pollution prevention to reduce PFAS in West Point influent.

In addition, Ecology should require 6PPD-related monitoring of the CSO treatment plant effluent and in untreated CSO discharges. As Ecology knows, 6PPD was found to cause direct mortality to coho salmon adults returning to spawn. More recent research has identified potential impacts to other species and other life stages as well. Given that CSO discharges are 90% stormwater, and King County's CSO basins all contain intensively developed land covers that are highly associated with tire and other road runoff, CSOs should be characterized. Ecology should require a QAPP for monitoring in the first year of the permit followed by 3 years of monitoring and one year to summarize the data in a technical report.

While local jurisdictions are making some progress toward local source control, which many have identified as the least expensive way to reduce metals and toxics, King County can do more through its own municipal holdings. Many of these land holdings are in other jurisdictions, like the City of Seattle. Rather than leaving those facilities to Seattle's responsibility, King County should be required to address its own facilities under its local source control program. Moreover, King County should be required to work throughout the transmission system to reduce sources of toxics and metals, and not all of its municipal customers are investing adequately in source control. Ecology should do all it can to incentive strong source control programs throughout King County's network and upstream jurisdictions.

Finally, Ecology and its partners completed the Control of Toxic Chemicals in Puget Sound (<https://ecology.wa.gov/Water-Shorelines/Puget-Sound/Issues-problems/Toxic-chemicals>) nearly a decade ago yet this remains the best available science on which sources contribute which contaminants through which pathway. We urge Ecology to consult its final report (<https://apps.ecology.wa.gov/publications/SummaryPages/1103055.html>) and focus sheet (<https://apps.ecology.wa.gov/publications/SummaryPages/1103060.html>) to identify toxic chemicals that should be monitored in sewage effluent at West Point and in controlled and untreated CSO discharges.



Increase Public Transparency and Accountability

While we appreciate the Fact Sheet retrospective synopsis of discharge monitoring and receiving water conditions, the public needs to access this information in real time. We note that King County maintains a web page reporting on active CSOs at any one time. However, there is no way to access other important information related to the West Point and CSO discharges. Unfortunately, Ecology's PARIS database used to track submittals required by the permits is simply unusable by the general public. Therefore, Ecology must require that King County establish a dedicated web page where all information transmitted to Ecology for compliance with its permit terms can be accessed by members of the public. To serve people without internet access, we also recommend that King County summarize annual NPDES permit requirements in fact sheets that they make available through their community networks and community hubs such as libraries and community centers. We provided similar comments during Ecology's recent MTCA rulemaking period recently and urge Ecology to modernize public communications throughout the organization. The public does not know what it has no idea exists. Ecology needs to require increased transparency and accountability for the largest jurisdiction in the state, above and beyond what the Permit Manual may require of all jurisdictions.

The PARIS database is woefully out of date and insufficient to make the information in Discharge Monitoring Reports available to the public. During the 2022 Municipal Wastewater Permit Fees Advisory Committee proceedings, in which WCA participated, Ecology stated that even the flow monitoring data are not trustworthy, which calls into question the ability to reflect more complex parameters. We recommend that Ecology overhaul PARIS because it is insufficient to ensure compliance with the Clean Water Act. We realize that this is outside of the scope of the West Point permit. The West Point plant is the largest in the state, and it has had catastrophic failures and numerous permit violations and penalties over the years. This is why Ecology must require more transparency and accountability to the public in this permit while modernizing communication approaches overall. The public has a right to know about pollution releases.

Special Condition S3.A, Discharge Monitoring Reports, allows King County "... to submit written reports that summarizes the performance of the West Point WWTP and the CSO treatment plants during the monitoring period. If the Permittee chooses to submit supplemental written reports, it must consolidate all reports for the monitoring period into a single PDF document attached to the DMR." However, given that Ecology does not trust the records stored in PARIS and that members of the public would need to first know the permit



number of this facility, navigate through PARIS, and then look for individual PDFs that are not text searchable, this option does not protect the public's right to know. Ecology must require a more accessible way for the public to find this information through web-based searches and not buried in insufficient databases.

Further, the permittee is responsible for the quality of the data in PARIS. Ecology needs to begin stipulating that each permittee is solely responsible for the accurate and complete reporting in databases such as PARIS and any errors in reporting are subject to fines. We recommend that Ecology add a new provision to Special Condition S3.A such as *"The permittee is solely responsible for ensuring that electronically-submitted data are accurate and reflect the actual conditions of the plant. Any errors are the responsibility of the permittee and subject to fines for inaccurate reporting."*

Special Condition S3.B allows the permittee to submit hard copy reports. Because these would not be available to the public, this option must be removed from the final permit. Further, all PDFs submitted to Ecology must use text recognition so that the information is searchable.

Special Condition S3.F needs far more transparency added to the permit provisions around reporting permit violations. We generally agree with the distinct phases of notification, beginning with "immediately" in Special Condition S3.F.c. However, Ecology needs to define "immediately" – is that within 2 hours of discovery? The phone number listed for Public Health Seattle – King County 206-296-4932 has been disconnected when tried on June 27, 2023. The draft permit includes no information as to how the information is collected and maintained in the files related to the permit itself. While multiple options are available, including Ecology's Northwest Regional Office and Public Health Seattle – King County, all reports need to be gathered in one location and clearly searchable by the public.

Special Condition S3.F.b, Twenty-four Hour Reporting, now appears to include CSOs, an improvement from the previous permit. We concur, and we also urge Ecology to identify a clear repository for these reports that is searchable by the public.

We commend Ecology on requiring sewage spill reporting within 5 days under Special Condition S3.F.c to the central Water Quality Permitting Portal. We concur with the required elements of the report. However, Ecology must ensure that the ERTS reports are available to and searchable by the public. Relatedly, we disagree with S3.F.d, which allows Ecology to waive the requirement for a written report based on an oral report. Oral reports are not available to the public and are insufficient to document sewage spills. Ecology should strike



this section entirely, and should also ensure that the oral reports mentioned in (a) and (b) are documented and searchable in a public-facing portal.

Special Condition S3.F.e describes the quarterly violation reports and provides a spreadsheet option. While we concur with the content, we are unclear how a spreadsheet would be available to and searchable by the public. This is an important element of transparency, as multiple jurisdictions may impact the same waterbody, such as the Duwamish Waterway. Therefore, this information needs to be easily compiled by Ecology, and Ecology should consider what the permittees will need to do to facilitate this step toward transparency.

Special Condition S5.C describes provisions related to Bypass Procedures, but there is no information on where the records would be kept or how Ecology would know whether King County is in compliance or not. When flows exceed 300 mgd as a result of precipitation, effluent quality would likely be impaired and would not meet standards. The public needs to be able to access this information. In addition, Special Condition S5.C.2.a allows bypasses for non-essential maintenance yet requires King County to notify Ecology within at least 10 days notice "if possible." Ecology should strike "if possible" from this section.

Special Condition S.11.D describes CSO Annual Report requirements, including summaries of events. However, the section lacks clarity on where these must be submitted, and we suggest adding specificity to ensure the public can easily locate and access the report.

Ecology needs to add a provision that King County compile an annual report with all CSOs and unpermitted discharges from the West Point facility and the CSO facilities, including the water bodies potentially impacted by those discharges. The Fact Sheet describes each facility including the location of outfalls. However, Ecology should also require King County to conduct an environmental justice analysis of the communities near those receiving waters or using those receiving waters. See additional information below.

Address Environmental Justice and Affordability

Washington State is making strides toward achieving a future where everyone has access to clean water. Until that time, the state has more work to do, and needs to pick up the pace where pollution-reduction schedule delays impact some people disproportionately more than others. Given the passage of the HEAL Act and the goals outlined in Ecology's 2023 – 2025 Strategic Plan, this permit cycle must make environmental justice a direct and



actionable component of the requirements under individual sewage permits, and in this permit specifically for West Point and CSOs.

We recommend that Ecology require King County to conduct an environmental justice assessment of what Black, Indigenous, and other People of Color currently experience impacts from both the West Point discharge and the combination of treated and untreated CSOs covered in this permit. This is not a new concept. In fact, 2012 was the 40th anniversary of the Clean Water Act, and a news article published at that time acknowledges the environmental justice impacts of King County's CSO discharges (<https://crosscut.com/2012/06/surface-water-pollution-consent-decrees>). Over a decade later, those concerns remain.

The Fact Sheet section II.B. describes the receiving waters of Puget Sound and the Duwamish River but there is no mention of who uses those waters for what. This leads to a disconnect between the discharges and the end users of the system, which hides the real impacts of this pollution on people's uses of the receiving waters. First and foremost, the description of receiving waters must include the Tribes with treaty-protected resources in the impacted waterways, and we urge Ecology to consult directly with Suquamish Tribe and Muckleshoot Tribe, and also the Tribes with Usual and Accustomed Areas that are downstream of the discharges. This includes the Puyallup, Nisqually, and Squaxin Island Tribes, given the results of Ecology's Salish Sea Modeling and circulation patterns in the Salish Sea. For example, after the first sentence on page 32 of the Fact Sheet, Ecology should include the following:

"This proposed permit authorizes discharges of treated domestic wastewater to various locations in central Puget Sound, Elliott Bay, and the Lower Duwamish Waterway. Due to Puget Sound circulation patterns, effluent from the West Point outfall flows southward, toward and into Commencement Bay and South Puget Sound. Collectively, these receiving waters are within the Usual and Accustomed Areas of the Suquamish Tribe, Muckleshoot Tribe, Puyallup Tribe, Nisqually Tribe, Squaxin Island Tribe. In addition, members of the public recreate within these waters, including for swimming, boating, shellfishing, fishing, and other active and passive uses."

Members of the public use the receiving waters impacted by the West Point and CSO discharges extensively, and the Fact Sheet needs to be updated with this information. Public Health – Seattle and King County will have good information on Duwamish Waterway users, including communities engaging in fishing and shellfishing. We urge you to connect with Shirlee Tan (shirlee.tan@kingcounty.gov) for more specific information on communities using the Duwamish Waterway.



Even if this information is not required by the Permit Writers Manual, Ecology is evolving its practices around Environmental Justice and Tribal Sovereignty. We stress that the West Point discharge is the largest in the state and warrants exceptional attention to new and evolving information and practices. Further, Ecology has new obligations under the HEAL Act and needs to center environmental justice throughout your operations, including in permits that are designed to achieve swimmable, fishable, and diggable waters for everyone in the State of Washington. Who is impacted by these discharges may be even more important than the water quality data summarized in the Fact Sheet for the discharges.

Finally, as King County's schedule for addressing known water quality problems continues to slip, infrastructure costs will continue to rise. We realize that rates are an issue for households with low income. We have advocated for increasing federal and state infrastructure funds for many years, including in advocacy letters alongside a number of local jurisdictions. We will continue to do so with Members of Congress and in the Washington State Legislature. King County cites costs as a reason for further delay. As described above, the costs of the impacts to real people have never been and can never be calculated. Moreover, other local jurisdictions, most notably the Lacey Olympia Tumwater and Thurston County sewage treatment system, have managed to both produce high-quality sewage effluent and address CSOs while also keeping rates affordable. Part of LOTT's success has been attributed to their governance structure where its member organizations have agreed to standard annual rate increases. In contrast, rate fights permeate the King County geography and lead to uncertainty in financing future infrastructure upgrades.

We recommend that Ecology require King County to conduct a funding and finance evaluation for the total of its clean water obligations, including deep engagement and review by its local government customers. In recent years King County has chosen not to pursue state funds because it found lower interest rates through other mechanisms. As economic conditions have changed, it would be helpful for the state to know how much demand there will be for state funding to help King County achieve its clean water obligations.



Reduce Inflow and Infiltration

Fact Sheet section II.A.3 on Inflow and Infiltration (I/I) lists values of 17.5 mgd of dry weather flow and 27.5 mgd of non-storm wet weather flow, or approximately 25% of the influent to the West Point plant. The Fact Sheet also notes that the local jurisdictions have no flow limits to what they can convey to the County system nor are there incentives for reducing I/I. In December 2021, King County WTD published technical reports on guidance to the Metropolitan Water Pollution Abatement Advisory Committee to help manage private side sewer connections. However, Special Condition S4.B.b is the only permit provision covering I/I, and simply mentions that reducing excessive I/I should be part of any future plan for achieving plant capacity once certain thresholds are exceeded.

Rather than wait for a future trigger, Ecology needs to include more substantive work around reducing I/I in a special study in this individual permit. During the King County Clean Water Plan discussions that WCA attended in 2019-2022, system metering was discussed as a standard element that is done throughout the country yet is behind in King County. King County's responses generally described metering within the transmission system as too expensive or too difficult.

However, jurisdictions on the East Coast, including a comparable system in the greater Boston area managed by the Massachusetts Water Resources Authority, have been metering the transmission system for decades to pinpoint sites with high I/I. Further, the metering was a critical component to incentivize local jurisdictions to track down and address excessive I/I. In the 1990s, the City of Boston found that every \$1 invested in I/I reduced their overall costs paid for sewage treatment by >\$1, and in doing so significantly reduced I/I in their part of the transmission system. Only through metering was this viable.

Therefore, Ecology should require a much more detailed I/I assessment as a permit provision, including metering of jurisdictions and incentives for I/I abatement plus video of pipe condition to support asset management. The local jurisdictions that figure this out more quickly will be deeply incentivized to invest in addressing excessive I/I abatement, but only once cost shares are based on metered flows.

Additional Specific Comments

In addition to the priority areas identified above, we offer the following comments on specific Special Conditions of the permit and in the Fact Sheet:



- We concur with adding Enterococci monitoring in Special Condition S2 Table 17; however, this should be analyzed once per day, coincident with the fecal coliform monitoring frequency as they both indicate pathogenic organisms.
- We concur with adding Total Ammonia, Nitrate plus Nitrite Nitrogen, and Total Kjeldahl Nitrogen to CSO monitoring requirements for the plants in Special Condition S2 Tables 26 and 27.
- Table 29 of Special Condition S2.C has no monitoring requirements for sediments nor settleable solids, which were in the previous permit, S13.C. These need to be added back in to provide a more complete quantification of pollutant loads from untreated CSOs.
- We concur with the new calibration requirements included in Special Condition S2.E3.
- Special Condition S2.3 A.8 has a typographical error – “Not report zero for bacteria monitoring” is more likely “Do not report zero for bacteria monitoring.”
- Special Condition S2.3.A.9 needs to be reflected because Enterococcus does not use a geometric mean for water quality compliance. From the state water quality standards for marine waters Table 210(3)(b) *“Enterococci organism levels within an averaging period must not exceed a geometric mean value of 30 CFU or MPN per 100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample values exist) obtained within the averaging period exceeding 110 CFU or MPN per 100 mL.”*
- The previous permit included a requirement that If permittee monitors sediment or untreated CSO discharges more frequently than required, the permittee must enter that data into the EIM database. Special Condition S3.E no longer includes this provision. However, this is important information that must be reported and should be included in the final permit as data entered into the DMR database, not EIM.
- We concur with the addition to Special Condition S5.A that “... *Permittee must notify Ecology when the operator in charge at the facility changes.*”
- Special Condition S5.D on Electrical Power Failure should be expanded to clearly include the provisions of the agreement reached with the Suquamish Tribe regarding maintaining adequate electrical service to the West Point plant.



- Special Condition S6.A on Pre Treatment references a 1996 King County Ordinance No. 11963 on Industrial Pretreatment and a 1981 document on Industrial Pretreatment. Pretreatment practices have improved over the past 42 years, and we encourage King County and Ecology to revisit the content and approach for pretreatment programs to ensure modern approaches are used.
- Special Condition S6.A.1.f requires King County to publish all domestic water users not in compliance with pretreatment requirements in the largest daily newspaper. This is no longer sufficient to reach the King County populace. Ecology should add a requirement that King County publish this information on the front page of the Wastewater Treatment Division web page and leave it visible for the duration of the permit term, adding sequentially each of the five years of the permit term.
- We concur with Special Condition S6.A.1.j that King County “... *must develop a Memorandum of Understanding (or Inter-local Agreement) that outlines the specific roles, responsibilities, and pretreatment activities of each jurisdiction.*”
- The pretreatment report described in Special Condition S6.A.4 needs a specific due date and S6.A.4.c should also require reports of any issues in jurisdictions covered by MOUs in S6.A.1.j. We concur with including PFAS source identification and/or reduction activities included in the pretreatment report.
- We concur with sections S9.A and S9.C on the Sediment sampling and analysis plan requirements around the West Point and CSO plant outfalls.
- While Ecology requires reporting on sediment quality under Special Condition S9.B and S9.D, storing the data in EIM decouples the data from DMRs. Ecology should require King County to summarize sediment data within their DMRs, in addition to adding to EIM. In addition, the previous permit allowed the Sediment Data Report to be submitted in hard copy, which has been removed from the draft. However, Ecology should explicitly include instructions that the PDF must be searchable and available to the public electronically. The sediment reports should also include trend analyses including data from previous permit terms, which was required for the CSO sediment data the previous permit term.
- We appreciate that Ecology included the status of each CSO location in Special Condition S.11.A Table 32 as Controlled or Uncontrolled. As noted in S.11.A, only Controlled CSOs may receive a mixing zone. However, we urge Ecology to revisit the status of each CSO annually during the permit term to check for any previously



Controlled CSOs that no longer meet requirements, which would then eliminate the use of a mixing zone. We concur with the corrective actions described in Special Condition S.11.C.d for facilities that no longer meet the performance standard of no more than one overflow per year and simply add a clarification through a footnote to Table 32 that the status would be re-evaluated annually. Ecology should clarify how King County should submit the Tier I and Tier II Corrective Action Reports and where they will be stored so the public can access this information.

- Special Condition S.11.E outlines engineering reports and plan requirements, including the need to submit a Quality Assurance Project Plan to Ecology. We suggest that Ecology add “for approval” to clarify the role that Ecology will have on the QAPP.
- The Fact Sheet history on pages 11-12 completely misses the July 2019 West Point Wastewater Treatment Plant power failure that led to the discharge of inadequately treated sewage to Puget Sound. This then led to beach closures, shellfish closures, and people exposed to sewage pollution, including participants in the annual Canoe Journey. The Suquamish Tribe noted this impact in its Notice of Intent to Sue King County, that then led to a negotiated Settlement Agreement requiring King County to provide adequate power and backup power to West Point, among other provisions. Ecology also issued stipulated penalties for CSO violations in December 2022, which are an important part of the Administrative Record for this facility. Ecology needs to add this important context to the history in the Fact Sheet.
- In the Fact Sheet sections summarizing water quality in the receiving waters, data are averaged over the entire water column. This is not appropriate for parameters such as dissolved oxygen, especially where the water quality standards specifically preclude averaging that would hide an impairment. We suggest that the DO values in Table 11, Table 13, and Table 15 be updated to present the minimum DO values and not the water column average. Similarly, the 90th percentile high values are not appropriate for this parameter and should be interpreted as the 10th percentile to remain consistent with the intent of the other water quality parameters like metals, where higher values are worse. For DO, lower values are worse and these tables hide the problematic water quality.
- Fact Sheet page 11, first paragraph contains a typographical error: “... two small community wastewater treatment plants....”



~ ~ ~

Thank you again for the opportunity to comment on the draft permit. If you have questions on these comments, please do not hesitate to contact us.

Sincerely,

Mindy Roberts, Ph.D., P.E.

Jamie Hearn

Puget Sound Program Director

Superfund Program Manager

Washington Conservation Action

Duwamish River Community Coalition

ATTACHMENTS (see separate files)

ATTACHMENT 1 – Effects of Nutrient and Carbon Loadings on Dissolved Oxygen and Ocean Acidification Conditions in Puget Sound – Scientific Perspectives, Mindy Roberts, Washington Environmental Council (March 16, 2020).

ATTACHMENT 2 – Clean Water Plan Strategies: Need for Increased Transparency around Costs, Risks, and Guiding Principles, King County Auditor’s Office Report, September 2021. (<https://kingcounty.gov/~media/depts/auditor/new-web-docs/cpo-reports/cwp/cwp-letter-2021.ashx?la=en>)

Effects of Nutrient and Carbon Loadings on Dissolved Oxygen and Ocean Acidification Conditions in Puget Sound – Scientific Perspectives (March 16, 2020)

Mindy Roberts, P.E., Ph.D., Washington Environmental Council (206-485-0103, mindy@wecprotects.org)

What is known, with what level of confidence, about the contributions of nitrogen and carbon inputs derived from regional human activity to changes in biogeochemical cycles, and in particular, dissolved oxygen reductions in bottom layers and ocean acidification in Puget Sound marine waters?

Concise Characterization of Agreements with Published Works

A – Parts of Puget Sound experience low levels of dissolved oxygen, which is vital for aquatic life.

1. In several areas, and mostly in near-bottom waters, oxygen concentrations do not meet part 1 of the Washington State water quality standard (Washington Administrative Code 173-201A-210(1)(d)). (Albertson et al., 2002a; Roberts et al., 2008)
2. Lowest dissolved oxygen concentrations typically occur in late summer, when river flows are low, temperatures warm, and sunlight is available. (Albertson et al., 2002a; Roberts et al., 2008)
3. Areas of Puget Sound naturally experience low oxygen due to factors like bathymetry, and are susceptible to further decreases due to human-derived nutrients. (Albertson et al., 2002a; Roberts et al., 2008)
4. Primary productivity declines when sunlight and/or water temperature is low, as typically occurs in the winter in the Puget Sound region. (Albertson et al., 2002a; Roberts et al., 2008)
5. Low levels of dissolved oxygen result from decomposition of organic matter, driven by materials that settle through the water column and reach the sediment. Both water column and sediment processes influence the levels of dissolved oxygen in bottom waters, where oxygen is typically the lowest. (Pelletier et al., 2017a; Ahmed et al., 2014; Albertson et al., 2002a; Roberts et al., 2008)

B – Human activities increase nitrogen and carbon contributions through both wastewater treatment plant discharges and watershed activities, with wastewater loads the dominant source in the summer months.

1. Nitrogen from municipal wastewater treatment plants contribute much of the annual average load of dissolved inorganic nitrogen from human-derived activities and the vast majority of the load in the summer season. This finding has been consistent from the initial South Puget Sound Dissolved Oxygen Study to present. (Mohamedali et al., 2011a; Mohamedali et al., 2011b; Roberts et al., 2008; Albertson et al., 2002a)
2. Wastewater treatment plants typically discharge treated wastewater lower in the water column to keep nitrogen away from the surface layer where light drives primary productivity and

nitrogen is generally the limiting nutrient. (Ahmed et al., 2014; Mohamedali et al., 2011a; Mohamedali et al., 2011b; Roberts et al., 2008)

3. Watershed human-derived activities add to the average annual load to Puget Sound but proportionally less of the summer load of dissolved inorganic nitrogen from human-derived activities than wastewater treatment plants. (Mohamedali et al., 2011a; Mohamedali et al., 2011b; Roberts et al., 2008; Roberts and Bilby, 2009)
4. Rivers and other freshwater sources typically discharge to the surface layer, where the presence of sunlight can accelerate primary productivity. (Mohamedali et al., 2011a; Mohamedali et al., 2011b; Roberts et al., 2008)

C – Added nutrients from human-derived activities cause or contribute to violations of the Washington State water quality standard for dissolved oxygen in Puget Sound due to complex circulation and biogeochemical processes.

1. Part 2 of the Washington State water quality standard for marine dissolved oxygen stipulates that the cumulative effect of all human sources cannot worsen oxygen by more than 0.2 mg/L. (Washington Administrative Code 173-201A-210(1)(d)(i))
2. Circulation is quite complicated throughout Puget Sound and the Salish Sea. (Khangaonkar et al., 2017; Banas et al., 2015; Roberts et al., 2014b)
3. Nitrogen is the primary nutrient driving primary productivity. (Ahmed et al., 2014; Albertson et al., 2002a)
4. Carbon contributions from human-derived activities also impact oxygen and acidification in Puget Sound. (Pelletier et al., 2017b)
5. Nitrogen and carbon from municipal wastewater treatment plants cause or contribute to violations of the Washington State water quality standard for dissolved oxygen in Puget Sound. (Ahmed et al., 2019; Pelletier et al., 2017a; Pelletier et al., 2017b; Ahmed et al., 2014; Roberts et al., 2014a; Khangaonkar et al., 2012b; Albertson et al., 2002a)
6. Nitrogen and carbon from watershed contributions of human-derived nutrients cause or contribute to violations of the Washington State water quality standard for dissolved oxygen in Puget Sound. (Ahmed et al., 2019; Pelletier et al., 2017a; Pelletier et al., 2017b; Ahmed et al., 2014; Roberts et al., 2014a; Cope and Roberts, 2013; Khangaonkar et al., 2012b; Albertson et al., 2002a)
7. Nitrogen and carbon released in one location negatively impact dissolved oxygen and acidification miles away. (Ahmed et al., 2019; Pelletier et al., 2017a; Pelletier et al., 2017b; Ahmed et al., 2014; Roberts et al., 2014a; Khangaonkar et al., 2012b; Albertson et al., 2002a)
8. The areas most impacted by human nitrogen and carbon contributions are distant from the sources of those contributions. (Ahmed et al., 2019; Pelletier et al., 2017a; Pelletier et al., 2017b; Ahmed et al., 2014; Roberts et al., 2014a; Khangaonkar et al., 2012b; Albertson et al., 2002a)

9. Human nitrogen and carbon cause dissolved oxygen levels to fall by more than 0.2 mg/L. (Ahmed et al., 2019; Pelletier et al., 2017a; Ahmed et al., 2014; Roberts et al., 2014a; Albertson et al., 2002a)

D – Future growth and development will increase nutrients from human activities in the Puget Sound watershed, which will worsen dissolved oxygen impacts from local human activities unless nutrients and carbon are managed differently.

1. The population of the Puget Sound region is expected to double by 2070. (Estimates do not include any effect of climate refugees from other parts of the United States or abroad) (Roberts et al., 2014a)
2. Increasing the population will increase nitrogen from wastewater without changes to wastewater treatment plant technology. (Roberts et al., 2014a)
3. Technology exists today to upgrade plants to nutrient removal, which several have elected to plan and design for now (Roberts et al., 2014a). (Upgrades will require additional capital and operating expenditures, which will require creative solutions to implement and permit.)
4. Projected land development patterns will result in increased nitrogen contributions without substantial changes to managing nutrients from nonpoint sources including onsite sewage systems, fertilizer applications, and conversion from forests to developed land. (Roberts et al., 2014a)
5. Salish Sea Model scenarios indicate that increasing nitrogen from increased wastewater contributions will worsen dissolved oxygen concentrations in Puget Sound. (Roberts et al., 2014a)

E – The Salish Sea Model, built on years of application, is the most appropriate tool to explore the relative impacts of different natural and human stressors that influence dissolved oxygen. At each phase of model development, Ecology concluded that human nutrient sources likely were violating the dissolved oxygen criteria in portions of Puget Sound. The magnitude and location of the violations have remained remarkably consistent over 19 years, even as the modeling tools continued to be refined in response to uncertainties identified by the modeling team.

1. The Salish Sea Model and its precursors have been developed under the strict requirements of tools used for regulatory purposes at the Department of Ecology, including Quality Assurance Project Plans, peer review, documentation, and public and stakeholder engagement.
2. The Salish Sea Model represents the evolution of a model framework initially applied to South Puget Sound beginning in 2000 to understand whether low dissolved oxygen in South Sound inlets was due to natural factors or human nutrient contributions from wastewater treatment plants and/or watershed sources. The Phase 1 South Puget Sound model results indicated that wastewater treatment plants could be contributing to dissolved oxygen impairments. (Albertson et al., 2002a) However, lack of facility-specific data and the influence of sources near the

northernmost boundary limited firm conclusions and additional data and model development were needed.

3. South Puget Sound modeling Phase 2 focused on the biogeochemistry and hydrodynamics of South and Central Puget Sound and the potential impacts of human nutrients on dissolved oxygen in South Puget Sound. The effort included effluent data collected from many wastewater treatment plants and model simulations for 2006 and 2007 (Mohamedali et al., 2011b; Norton, 2009; Albertson et al., 2007). Phase 2 of the South Puget Sound Dissolved Oxygen Study concluded with the finding that wastewater treatment plants could be contributing to dissolved oxygen impairments (Ahmed et al., 2014). However, the strong influence of sediment/water interactions limited firm conclusions and additional data and model developments were needed.
4. Ecology and Pacific Northwest National Laboratory began developing a model of the larger Salish Sea, including shared waters with Canada (Sackmann, 2009). Ecology refined loading estimates from wastewater treatment plants and watersheds (Mohamedali et al., 2011a). The initial findings of the Salish Sea Model were that wastewater treatment plants could be contributing to dissolved oxygen impairments (Khangaonkar et al., 2012a; Khangaonkar et al., 2012b). However, the strong influence of sediment/water interactions limited firm conclusions and additional data and model developments were needed.
5. The next iteration added sediment diagenesis to the Salish Sea Model (Roberts et al., 2015a). The refined model was used to quantify impacts from wastewater treatment plants and human sources in watersheds. The updated findings of the Salish Sea Model were that wastewater treatment plants could be contributing to dissolved oxygen impairments (Ahmed et al., 2019; McCarthy et al., 2018; Pelletier et al., 2017a).
6. The Salish Sea Model was adapted to evaluate impacts from wastewater treatment plants and human sources in watersheds on acidification in the Salish Sea (Roberts et al., 2015b). Increased dissolved inorganic nitrogen (DIN), phytoplankton biomass, and non-algal organic carbon caused by regional anthropogenic nutrient sources can constitute significant contributors to acidification in the Salish Sea (Bianucci et al., 2018; Pelletier et al., 2018; Pelletier et al., 2017b). These sources are impacting acidification parameters include aragonite saturation state. Decreasing regional human sources of nitrogen and carbon would improve acidification in the Salish Sea.

F – At each phase of model development, Ecology was held to the highest standards of peer review, stakeholder input, and public review to ensure the integrity of the work and to hold up in a court of law.

1. Each modeling and monitoring stage included Quality Assurance Project Plans (McCarthy et al., 2018; Roberts et al., 2015a; Roberts et al., 2015b; Sackmann, 2009; Albertson et al., 2007; Roberts, 2007a; Roberts, 2007b; Roberts and Pelletier, 2007).
2. Where monitoring data limited interpretations, refined monitoring programs were developed (Gonski et al., 2019; Norton, 2009; Roberts et al., 2008; ; Roberts, 2007a; Roberts, 2007b; Roberts and Pelletier, 2007).

3. Where work by others lacked documentation or public review, Ecology summarized their work and had that publicly reviewed and independently reviewed (Cope and Roberts, 2013).
4. Ecology published interim and final data reports for public review and comment (Mohamedali et al., 2011a; Mohamedali et al., 2011b; Roberts et al., 2008).
5. Ecology published model calibration and scenarios reports for public review and comment (Ahmed et al., 2019; Pelletier et al., 2017a; Pelletier et al., 2017b; Ahmed et al., 2014; Roberts et al., 2014a; Roberts et al., 2014b).
6. Given the complexity of the issues, Ecology developed simple summaries of the findings (Roberts and Kolosseus, 2011; Albertson et al., 2002b).
7. Ecology authors published journal articles (Pelletier et al., 2018; Bianucci et al., 2018; Khangaonkar et al., 2017; Khangaonkar et al., 2012a; Roberts and Bilby, 2009).

G – Ecology’s regulatory processes protect public health and aquatic life.

1. Ecology has no history of weakening water quality standards, other than an interim measure related to Total Dissolved Gas in the Columbia River system related to increasing spill for the benefit of salmon survival.
2. Weakening the water quality standards for dissolved oxygen in Puget Sound would not likely be supported by the public, based on polling on the value of clean water.
3. Models developed by Ecology have long been used to make regulatory decisions for multiple purposes (Albertson, 2013).

Rationale for any Points of Disagreement

While I do not disagree with the statements in the references cited in the call for papers, I feel compelled to document my concerns regarding the scientific integrity of this process.

Academic-oriented journals require peer review of typically three anonymous reviewers, who must agree that a paper and revised versions of a paper pass scientific muster before they can be published. Otherwise, the journal loses credibility and scientific integrity would be lost. This does not mean that every scientist gets to weigh in on every paper before it is published. The journal articles included in the references list in the call for papers have passed scientific muster by the review process before they were accepted for review. Opinions to the contrary in no way rebut these published works.

The Department of Ecology is required to follow strict procedures for ensuring that technical products like the Salish Sea Model are developed transparently and without bias. At each stage in its development, Ecology modelers developed Quality Assurance Project Plans and results reports all subject to strict peer review and public review. Ecology documented these critical quality assurance and public review steps from its earliest related publications in 2002 through present day.

Finally, this process concerns me as a credentialed and published scientist and engineer. The Halo Effect occurs when society attributes a set of skills to someone beyond their actual areas of expertise due to

favorable impressions, hierarchical standing, or credentials. Experts routinely overestimate the breadth of their own expertise, in part due to society's impressions. The Halo Effect negatively impacts decisionmaking when it substitutes expert opinions for evidence-based findings in fields as wide ranging as pharmacology (Austin and Foster, 2019) and avalanche risk assessment (McCammon, 2004). Opinions and unsubstantiated hunches are no substitute for scientific process.

Scientific Confidence

It is virtually certain that human-derived nutrients, primarily from municipal wastewater treatment plants, cause or contribute to violations of the water quality standards for dissolved oxygen standards in Puget Sound. Throughout its 19-year investigation of the impacts of human-derived nutrients on Puget Sound dissolved oxygen levels, Ecology's findings have consistently identified impacts from human nutrients as early as 2002 through recent analyses.

It is virtually certain that adopting nutrient-control technology, which is available today, would more than offset the expected increases in nitrogen contributions expected from doubling the regional population by 2070. This will substantially but not completely resolve dissolved oxygen impairments.

It is virtually certain that human nitrogen and carbon sources in watersheds must be reduced to resolve dissolved oxygen impairments.

Citations

Ahmed, A., Figueroa-Kaminsky, C., Gala, J., Mohamedali, T., Pelletier, G., and McCarthy, S. 2019. Puget Sound Nutrient Source Reduction Project. Volume 1: Model Updates and Bounding Scenarios. Washington State Department of Ecology Publication No. 19-03-001. <https://fortress.wa.gov/ecy/publications/SummaryPages/1903001.html>.

Ahmed, A., G. Pelletier, M. Roberts, and A. Kolosseus. 2014. South Puget Sound Dissolved Oxygen Study: Water Quality Model Calibration and Scenarios. Washington State Department of Ecology Publication No. 14-03-004. <https://fortress.wa.gov/ecy/publications/SummaryPages/1403004.html>.

Albertson, S.L., K. Erickson, J.A. Newton, G. Pelletier, R.A. Reynolds, and M.L. Roberts. 2002a. South Puget Sound Water Quality Study, Phase 1. Washington State Department of Ecology Publication No. 02-03-021. <https://fortress.wa.gov/ecy/publications/SummaryPages/0203021.html>.

Albertson, S.L., K. Erickson, J.A. Newton, G. Pelletier, R.A. Reynolds, and M.L. Roberts. 2002b. Summary of South Puget Sound Water Quality Study. Washington State Department of Ecology Publication No. 02-03-020. <https://fortress.wa.gov/ecy/publications/SummaryPages/0203020.html>.

Albertson, S., J. Bos, K. Erickson, C. Maloy, G. Pelletier, M. Roberts. 2007. Quality Assurance Project Plan: South Puget Sound Water Quality Study Phase 2: Dissolved Oxygen. Washington State Department of Ecology Publication No. 07-03-101. <https://fortress.wa.gov/ecy/publications/SummaryPages/0703101.html>.

Albertson, S. 2013. Addendum to Quality Assurance Project Plan South Puget Sound Water Quality Study Phase 2: Dissolved Oxygen for Evaluation of Shellfish Harvesting near Joint Base Lewis-McChord and Chambers Creek. Washington State Department of Ecology Publication No. 13-03-102. <https://fortress.wa.gov/ecy/publications/SummaryPages/1303102.html>.

Austin, J.P. and B.A. Foster. 2019. How Pediatric Hospitalists Must Contend With the Expert Halo Effect. *Hospital Pediatrics* July 2019, 9 (7) 560-562; DOI: <https://doi.org/10.1542/hpeds.2019-0053>. <https://hosppeds.aappublications.org/content/9/7/560>

Banas, N. S., L. Conway-Cranos, D. A. Sutherland, P. MacCready, P. Kiffney and M. Plummer. 2015. Patterns of River Influence and Connectivity Among Subbasins of Puget Sound, with Application to Bacterial and Nutrient Loading. *Estuaries and Coasts* Vol. 38, No. 3, pp. 735-753. <https://www.jstor.org/stable/44851502?seq=1>

Bianucci, L., W. Long, T. Khangaonkar, G. Pelletier, A. Ahmed, T. Mohamedali, M. Roberts, C. Figueroa-Kaminski. 2018. Sensitivity of the regional ocean acidification and carbonate system in Puget Sound to ocean and freshwater inputs. *Elem. Sci Anth.* 6(1):22. DOI: <http://doi.org/10.1525/elementa.151>.

Cope, B. and M. Roberts. 2013. Review and Synthesis of Available Information to Estimate Human Impacts to Dissolved Oxygen in Hood Canal. Washington State Department of Ecology Publication No. 13-03-016. <https://fortress.wa.gov/ecy/publications/SummaryPages/1303016.html>.

Gonski, S., C. Krembs, G. Pelletier. 2019. Quality Assurance Project Plan: Ocean Acidification Monitoring at Ecology's Greater Puget Sound Stations. Washington State Department of Ecology Publication No. 19-03-102. <https://fortress.wa.gov/ecy/publications/SummaryPages/1903102.html>.

Khangaonkar, T., B. Sackmann, W. Long, T. Mohamedali, and M. Roberts. 2012a. Simulation of annual biogeochemical cycles of nutrient balance, phytoplankton bloom(s), and DO in Puget Sound using an unstructured grid model. *Ocean Dynamics*. DOI 10.1007/s10236-012-0562-4.

Khangaonkar, T. and W. Long (Pacific NW National Laboratory) and B. Sackmann, T. Mohamedali, and M. Roberts (Department of Ecology). 2012b. Puget Sound Dissolved Oxygen Modeling Study: Development of an Intermediate Scale Water Quality Model. Washington State Department of Ecology Publication No. 12-03-049. <https://fortress.wa.gov/ecy/publications/SummaryPages/1203049.html>.

Khangaonkar, T., W. Long, W. Xu. 2017. Assessment of circulation and inter-basin transport in the Salish Sea including Johnstone Strait and Discovery Islands pathways. *Ocean Modelling*, 109:11-32. <https://www.sciencedirect.com/science/article/abs/pii/S1463500316301408>.

McCammon, I. 2004. Heuristic Traps in Recreational Avalanche Accidents: Evidence and Implications. *Avalanche News*, No. 68, Spring. <http://www.sunrockice.com/docs/Heuristic%20traps%20IM%202004.pdf>

McCarthy, S., Figueroa-Kaminsky, C., Ahmed, A., Mohamedali, T., and Pelletier, G. 2018. Quality Assurance Project Plan: Salish Sea Model Applications. Washington State Department of Ecology Publication No. 18-03-111. <https://fortress.wa.gov/ecy/publications/SummaryPages/1803111.html>.

Mohamedali, T., M. Roberts, B. Sackmann, and A. Kolosseus. 2011a. Puget Sound Dissolved Oxygen Model Nutrient Load Summary for 1999-2008. www.ecy.wa.gov/biblio/1103057.html.

- Mohamedali, T., M. Roberts, B. Sackmann, A. Whiley, and A. Kolosseus. 2011b. South Puget Sound Dissolved Oxygen Study: Interim Nutrient Load Summary for 2006-2007. Washington State Department of Ecology Publication No. 11-03-001. <https://fortress.wa.gov/ecy/publications/SummaryPages/1103001.html>.
- Norton, D. 2009. Sediment Trap Monitoring in Four Inlets of South Puget Sound. Washington State Department of Ecology Publication No. 09-03-006. <https://fortress.wa.gov/ecy/publications/SummaryPages/0903006.html>.
- Pelletier, G., L. Bianucci, W. Long, T. Khangaonkar, T. Mohamedali, A. Ahmed, and C. Figueroa-Kaminsky. 2017a. Salish Sea Model: Sediment Diagenesis Module. Washington State Department of Ecology Publication No. 17-03-010. <https://fortress.wa.gov/ecy/publications/SummaryPages/1703010.html>.
- Pelletier, G., L. Bianucci, W. Long, T. Khangaonkar, T. Mohamedali, A. Ahmed, and C. Figueroa-Kaminsky. 2017b. Salish Sea Model: Ocean Acidification Module and the Response to Regional Anthropogenic Nutrient Sources. Washington State Department of Ecology Publication No. 17-03-009. <https://fortress.wa.gov/ecy/publications/SummaryPages/1703009.html>.
- Pelletier, G., M. Roberts, M. Keyzers, S. Alin. 2018. Seasonal variation in aragonite saturation in surface waters of Puget Sound – a pilot study. *Elem. Sci Anth.* 2018;6(1):5. DOI: <http://doi.org/10.1525/elementa.270>.
- Roberts, M., J. Bos, and S. Albertson. 2008. South Puget Sound Dissolved Oxygen Study: Interim Data Report. Washington State Department of Ecology Publication No. 08-03-037. <https://fortress.wa.gov/ecy/publications/SummaryPages/0803037.html>.
- Roberts, M. 2007a. Addendum to Quality Assurance Project Plan: South Puget Sound Water Quality Study, Phase 2: Dissolved Oxygen. Washington State Department of Ecology Publication No. 07-03-101ADD1. <https://fortress.wa.gov/ecy/publications/SummaryPages/0703101ADD1.html>.
- Roberts, M. 2007b. Addendum #2 to Quality Assurance Project Plan: South Puget Sound Water Quality Study Phase 2: Dissolved Oxygen. Washington State Department of Ecology Publication No. 07-03-101ADD2. <https://fortress.wa.gov/ecy/publications/SummaryPages/0703101ADD2.html>.
- Roberts, M. and G. Pelletier. 2007. Addendum #3 to Quality Assurance Project Plan: South Puget Sound Water Quality Study Phase 2: Dissolved Oxygen. Washington State Department of Ecology Publication No. 07-03-101ADD3. <https://fortress.wa.gov/ecy/publications/SummaryPages/0703101ADD3.html>.
- Roberts, M.L. and R.E. Bilby. 2009. Urbanization alters litterfall rates and nutrient inputs to small Puget Lowland streams. *Journal of the North American Benthological Society*, 28(4):941-954.
- Roberts, M. and A. Kolosseus. 2011. Focus on Nutrients and Puget Sound: Nitrogen in surface water runoff to Puget Sound. Washington State Department of Ecology Publication No. 11-03-035. www.ecy.wa.gov/biblio/1103034.html.
- Roberts, M., T. Mohamedali, B. Sackmann, T. Khangaonkar, and W. Long. 2014a. Puget Sound and the Straits Dissolved Oxygen Assessment: Impacts of Current and Future Human Nitrogen Sources and Climate Change through 2070. Washington State Department of Ecology Publication No. 14-03-007 <https://fortress.wa.gov/ecy/publications/SummaryPages/1403007.html>.

Roberts, M., S. Albertson, A. Ahmed, and G. Pelletier. 2014b. South Puget Sound Dissolved Oxygen Study: South and Central Puget Sound Water Circulation Model Development and Calibration. Washington State Department of Ecology Publication No. 14-03-015. <https://fortress.wa.gov/ecy/publications/SummaryPages/1403015.html>.

Roberts, M., G. Pelletier, T. Khangaonkar, and W. Long. 2015a. Quality Assurance Project Plan: Salish Sea Dissolved Oxygen Modeling Approach: Sediment-Water Interactions. Washington State Department of Ecology Publication No. 15-03-103. <https://fortress.wa.gov/ecy/publications/SummaryPages/1503103.html>.

Roberts, M., G. Pelletier, T. Khangaonkar, W. Long, and L. Bianucci. 2015b. Quality Assurance Project Plan: Salish Sea Acidification Model Development. Washington State Department of Ecology Publication No. 15-03-109. <https://fortress.wa.gov/ecy/publications/SummaryPages/1503109.html>.

Sackmann, B. 2009. Quality Assurance Project Plan: Puget Sound Dissolved Oxygen Modeling Study: Intermediate-scale Model Development. Washington State Department of Ecology Publication No. 09-03-110. <https://fortress.wa.gov/ecy/publications/SummaryPages/0903110.html>.

Washington Administrative Code 173-201A-210(1)(d) – Part 1. Aquatic Life Dissolved Oxygen Criteria in Marine Water. <https://apps.leg.wa.gov/WAC/default.aspx?cite=173-201A-210>.

Washington Administrative Code 173-201A-210(1)(d)(i) – Part 2. Aquatic Life Dissolved Oxygen Criteria in Marine Water. <https://apps.leg.wa.gov/WAC/default.aspx?cite=173-201A-210>.

Yang, Z., T. Khangaonkar, R. Labiosa, and T. Kim. 2010. Puget Sound Dissolved Oxygen Modeling Study: Development of an Intermediate-Scale Hydrodynamic Model. Washington State Department of Ecology Publication No. 14-03-022. <https://fortress.wa.gov/ecy/publications/SummaryPages/1403022.html>.



KING COUNTY AUDITOR'S OFFICE

SEPTEMBER 30, 2021

Presentation of Clean Water Plan Strategies: Need for Increased Transparency around Costs, Risks, and Guiding Principles

The King County Wastewater Treatment Division (WTD) is at a critical juncture in development of the Clean Water Plan (CWP) as it prepares to develop its preferred strategy for billions of dollars in future wastewater investments. We reviewed WTD's presentation of Actions and strategies to policy-makers and identified a lack of transparency about the risk that some strategies being considered may not meet current and future regulatory requirements, a lack of clear project cost information, and an absence of clarity in guiding principles that could leave optimal strategies off the table.

In this letter, we describe our observations and suggest questions policy-makers may ask WTD to resolve before a preferred strategy is presented for adoption. These questions are provided in blue callout boxes at the end of each section and in Appendix 1.

Policy-maker opportunity to provide input on Clean Water Plan development

King County policy-makers currently have an opportunity to weigh options and ask questions about the strategies proposed by WTD for how the County prioritizes and spends billions of dollars on wastewater facilities and water quality investments over the next 40 years. These wastewater investments will directly impact monthly base rates and capacity charges as well as water quality throughout the region.

Development of the CWP is a five-step process, illustrated in exhibit A, below. In step 2, WTD identified Actions¹ that King County could implement, ranging from wastewater treatment plant upgrades to enhanced source control programs. WTD is currently in step 3—Strategy Development and Analysis—where WTD has grouped selections of Actions into five strategies that represent different approaches to wastewater investment. WTD now has initial strategies and has presented them to policy-makers for discussion and feedback. After the conclusion of the current step, the County Executive will select a preferred strategy and refer a proposal to the Regional Water Quality Committee for both its review and the recommendation to transmit it to the King County Council for adoption.

¹ WTD summarized these Actions in its *Actions: Characterizing Water Quality Investment Options* (2021) report.

EXHIBIT A: Development process for Clean Water Plan.



Source: King County Auditor's Office modified graphic from Wastewater Treatment Division Clean Water Plan.

Some WTD strategies may not be viable under current and potential future regulations

WTD is asking policy-makers to affirm whether the range of strategies presented should proceed to evaluation without clear information from WTD on how external conditions could affect the feasibility of the proposed strategies and component Actions. By exploring different strategies, policy-makers can discuss and weigh priorities, such as ensuring rate affordability and maximizing water quality improvement. However, wastewater conveyance and treatment are highly regulated, and regulatory decisions, both current and future, can have significant impacts that limit the range of feasible options. For these discussions to be meaningful, and to effectively inform decision-making, policy-makers must have clear information about each strategy's viability in the wastewater regulatory environment and how both WTD assumptions and federal and state regulations could affect strategy feasibility. Without this information, policy-makers may find themselves choosing a strategy which is not viable under current or future regulations, risking the imposition of wastewater investment decisions by regulatory agencies and losing control over rates.

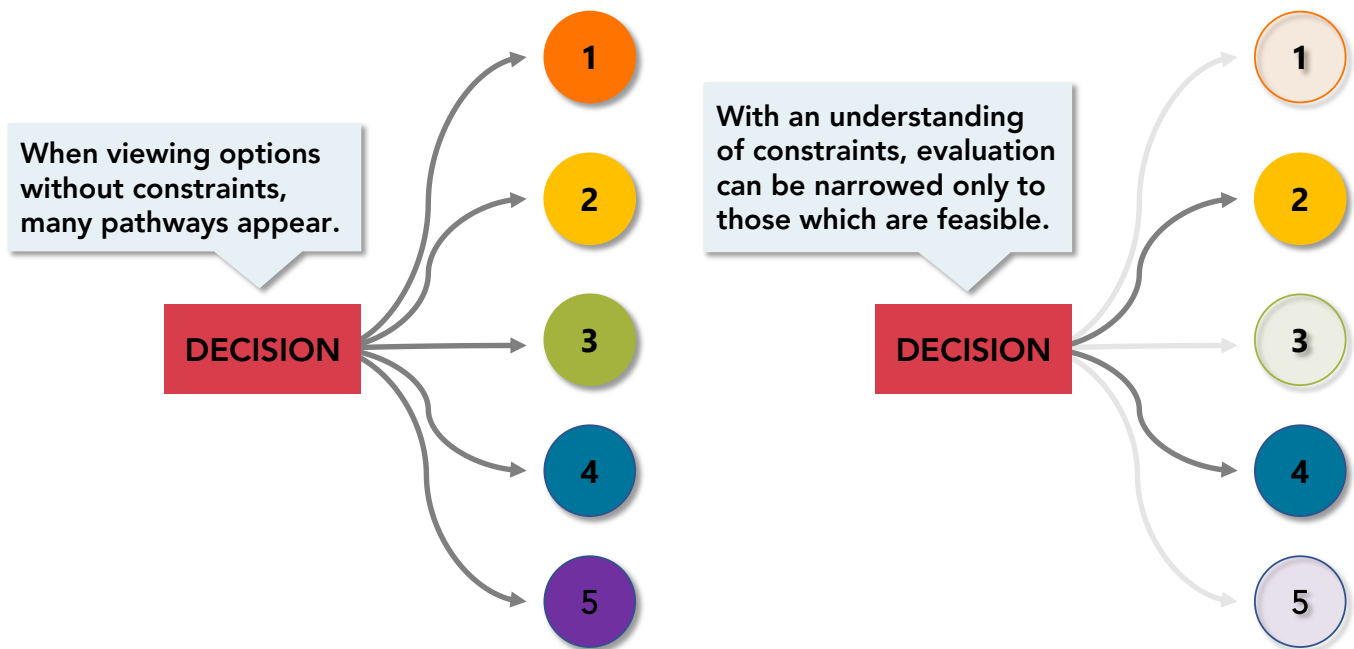
Additionally, if WTD does not analyze strategies against current and future regulatory considerations, plans for plant expansion could be at risk. Based on the 2019 *Treatment Plant Flows and Loadings Study Summary Report*, King County's largest wastewater treatment plants (WWTP)—Brightwater, South Plant, and West Point—are at or expected to exceed design parameters² and require expansion or facility re-

² All three facilities are expected to exceed max month influent loading for Total Suspended Solids (TSS) and 5-day Biological Oxygen Demand (BOD₅) within the planning period. According to the 2019 *Treatment Plant Flows and Loadings Study Summary Report* West Point is already near the maximum month influent levels. South Plant is expected to reach max month loading between 2025 and 20230, and Brightwater is expected to reach maximum month loading between 2020 and 2023.

rating³ to serve forecasted demand growth in the region. As part of the plant expansion process, WTD will need to modify each facility's National Pollutant Discharge Elimination System permit, at which time the public—including tribal and non-governmental organizations—will have the opportunity to weigh in and could oppose changes on the basis of the WWTPs by applying all known, available, and reasonable methods of prevention, control, and treatment. If this were to occur, WTD may find that it cannot meet the needs of new growth, leading to a moratorium on new service connections.

Modeling the impact of regulatory outcomes on various strategies by WTD will help ensure policy-makers are considering viable strategies, that they understand the impacts of regulatory outcomes on consumer rates, and ensure plants are able to serve growth in the region. Moreover, it can help the County create a roadmap of alternatives should a crucial assumption prove false.

EXHIBIT B: Evaluating constraints, such as regulatory changes, allows policy-makers to focus only on feasible plans of action.

































Source: King County Auditor's Office.

The five strategies proposed by WTD are unlikely to be feasible given current expectations around future regulatory outcomes. Regulatory uncertainty comes largely from two areas, both related to federal Clean Water Act compliance: King County's consent decree with the US Environmental Protection Agency (EPA) for combined sewer overflows (CSO) and the Puget Sound Nutrient Source Reduction Program. These

³ Re-rating is a process by which a plant's design parameters (Flow, Total Suspended Solids, Biological Oxygen Demand) are modified without making capital improvements. Facility expansion is the process of adding infrastructure to the plant to support higher design parameters.

regulations can dictate the range of feasible Actions within two of the highest cost decision areas identified by WTD: wastewater treatment⁴ and wet weather management.⁵

EXHIBIT C: Federal and state regulatory decisions may make many of the strategies proposed by WTD infeasible.

SCENARIO	Existing consent decree; no nitrogen limits issued	Modified consent decree; no nitrogen limits issued	Modified consent decree; nitrogen loading set at current levels	Existing consent decree; nitrogen loading set at current levels	Nitrogen loading set at 8mg/L equivalent	Nitrogen set at 3mg/L equivalent
STRATEGIES PROPOSED BY WTD						
						
						
						
						

Source: King County Auditor's Office analysis of WTD strategies as presented to the Regional Water Quality Committee on July 7, 2021.

None of the strategies presented by WTD⁶ would result in a nitrogen reduction within the range of nutrient loading limits likely to be set by the Department of Ecology (DOE).⁷ WTD has identified

⁴ The wastewater treatment decision area cost will vary based upon actions selected for implementation, but is estimated by WTD to have a cost at most optimistic between \$710 million to \$27.7 billion. WTD states conceptual capital cost estimates are provided with an accuracy of most optimistic to plus 150%.

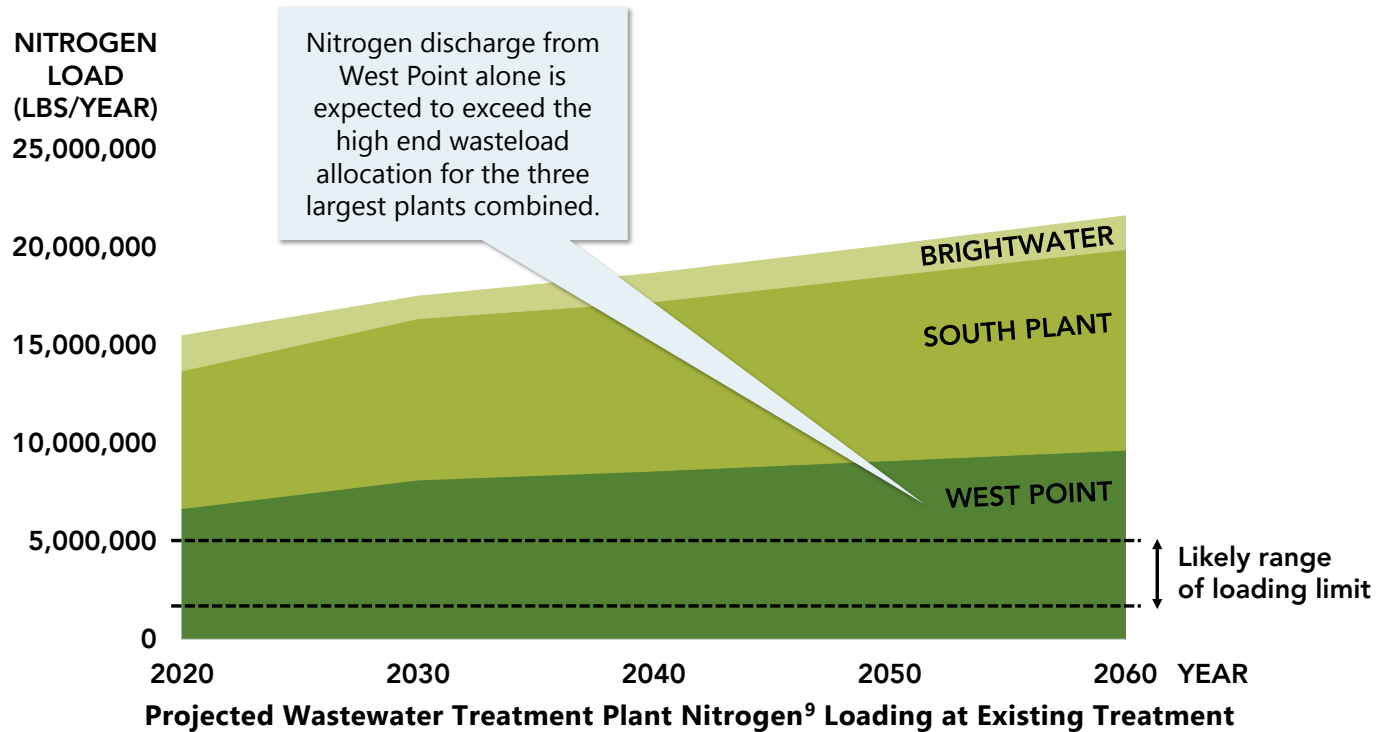
⁵ The wet weather management decision area cost will vary based upon actions selected for implementation, estimated by WTD to cost, at most optimistic, between \$3.3 billion and \$20 billion in conceptual capital. WTD states conceptual capital cost estimates are provided with an accuracy of most optimistic to plus 150%.

⁶ Strategy A, as presented to date by WTD in *Actions: Characterizing Water Quality Investment Options* (2021), proposes individual nitrogen reduction at each regional WWTP at 8mg/L.

⁷ The Puget Sound Nutrient Source Reduction Program (PSNSRP) is a Department of Ecology (DOE) program to develop a nutrient reduction plan and accompanying wasteload allocations for anthropogenic sources of nitrogen within the Puget Sound watershed. While wasteload allocations are in development, DOE plans on issuing the first Puget Sound Nutrient General Permit (PSNGP) effective January 1, 2022, which will set action levels for municipal wastewater treatment plants that directly discharge to Puget Sound. These action levels are based upon historical nitrogen loading and were set with the goal of preventing nitrogen loading to Puget Sound from increasing from current levels. For jurisdictions like King County with multiple plants, the most recent draft permit allows a jurisdiction to choose to either use a bubbled action level for all three plants, allowing flexibility for improved nitrogen treatment at one plant to offset nitrogen increases at another, or individual plant action levels. In the second permit cycle, the PSNGP will set a nitrogen-loading limit, in pounds per year (lb/yr), for King County's wastewater treatment plants (WWTP). The wasteload allocation is not a concentration-based limit. If an 8mg/L effluent limit on nitrogen achieves the required loading limit in the second permit cycle, future growth in the service area will require further nitrogen removal efforts or a decrease in effluent volume to Puget Sound (i.e., through

wastewater treatment plant improvements and decentralized approaches⁸ that may result in a nitrogen reduction within the likely range of outcomes, but this approach is not presented as a wholistic strategy to demonstrate what compliance with potential nitrogen limits would require. Exhibit D, below, shows nitrogen loading under various scenarios, with bars representing the lower and higher range of wasteload allocations currently being modeled by DOE.

EXHIBIT D: Without significant reductions, King County will not comply with potential future nutrient limits developed by the Department of Ecology.



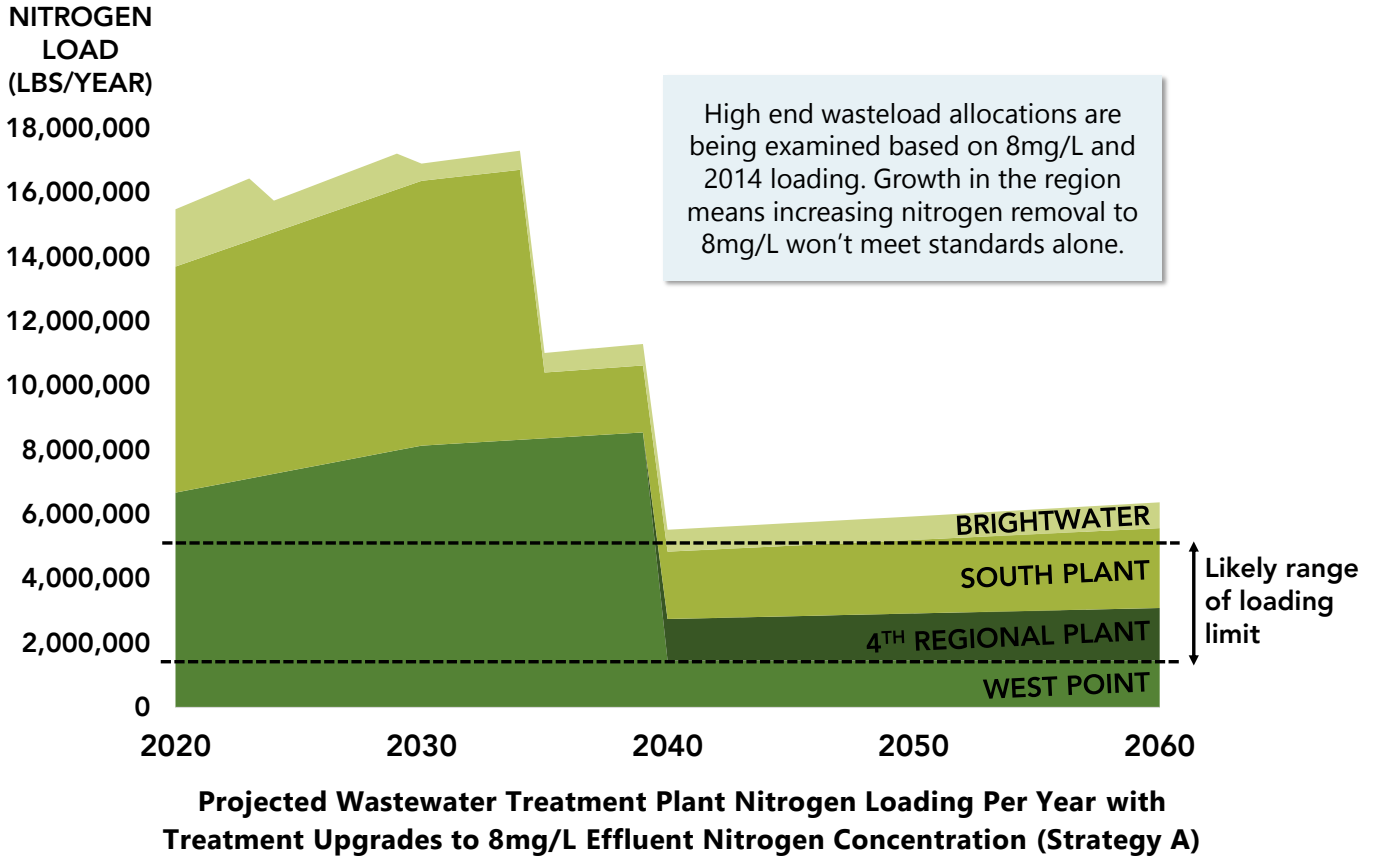
Source: King County Auditor's Office analysis of data from WTD Priority 1 question responses dated August 16, 2021, Brown and Caldwell *King County Nitrogen Removal Study: Final Report*, September 2020, *Brightwater Treatment Plant Peak Flow and Wasteload Projects 2010-2060*, January 2019, *South Plant Treatment Plant Peak Flow and Wasteload Projects 2010-2060*, January 2019, *West Point Treatment Plant Peak Flow and Wasteload Projects 2010-2060*, January 2019, and Department of Ecology Salish Sea Year 2 Modeling Inputs provided August 2021.

aquifer recharge or indirect potable reuse) in order to maintain the same nitrogen-loading level. DOE is currently modeling scenarios that evaluate water quality improvements based upon different nitrogen reduction scenarios. For King County's plants, these scenarios range from nitrogen-bubbled loads of approximately 11 to 33 percent of 2020 levels (wasteload allocation range of 1,690,010 lbs/yr to 5,076,150 lbs/yr). It is, therefore, reasonable to assume the wasteload allocation for King County's WWTPs will be in this range.

⁸ These approaches included building scale decentralized treatment, secondary treatment at wet weather treatment stations, implementation of treatment upgrades to achieve 8mg/L TIN at West Point and 3m/L at South Plant and Brightwater, and advanced treatment and beneficial use of South Plant effluent.

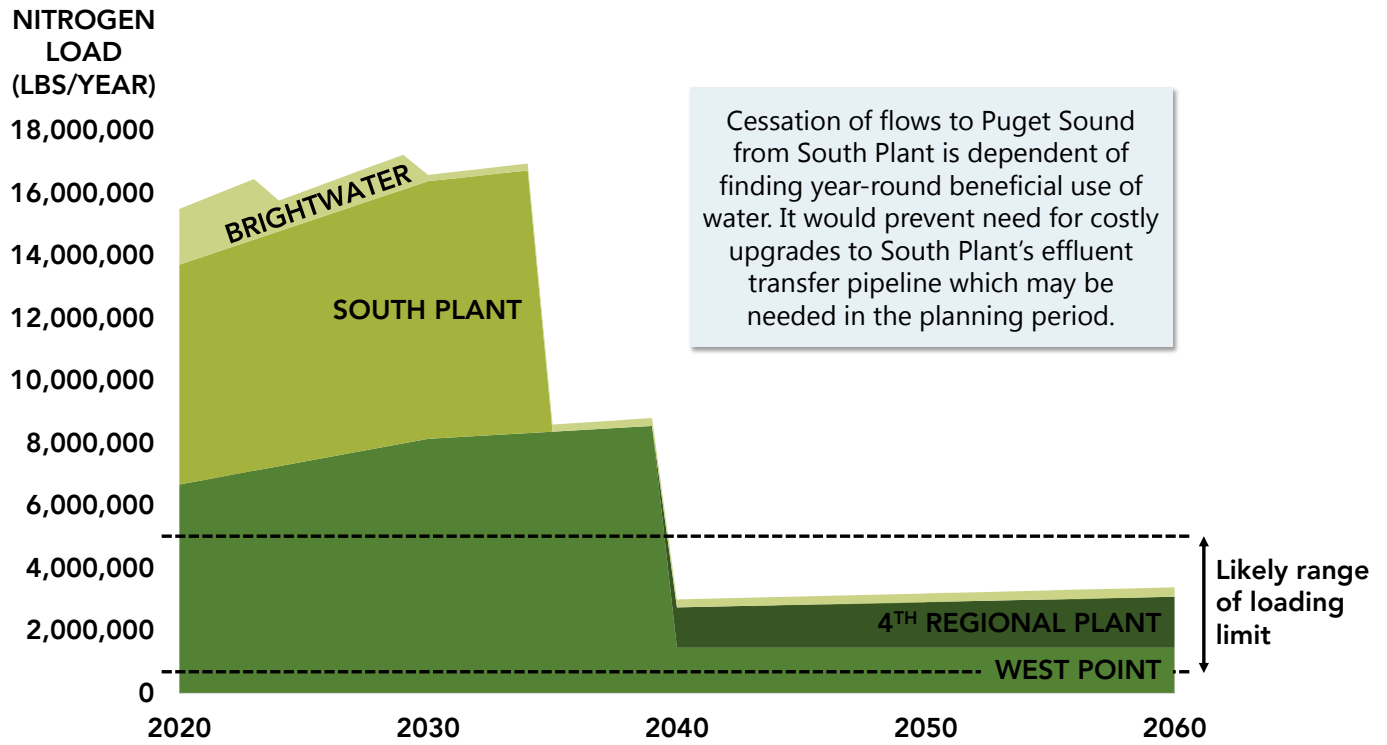
⁹ Where the word nitrogen is used in the report, it means total inorganic nitrogen or TIN.

EXHIBIT E: Even the most aggressive wastewater treatment plant reductions proposed may not meet likely nutrient limits developed by the Department of Ecology.



Source: King County Auditor's Office analysis of data from WTD Priority 1 question responses dated August 16, 2021, Clean Water Plan Advisory Group Meeting #10 Briefing Document, *Actions Characterizing Water Quality Investment Options*, May 2021, Brown and Caldwell *King County Nitrogen Removal Study: Final Report*, September 2020, *Brightwater Treatment Plant Peak Flow and Wasteload Projects 2010-2060*, January 2019, *South Plant Treatment Plant Peak Flow and Wasteload Projects 2010-2060*, January 2019, *West Point Treatment Plant Peak Flow and Wasteload Projects 2010-2060*, January 2019, and Department of Ecology Salish Sea Year 2 Modeling Inputs provided August 2021. This assumes one regional facility is upgraded every five years, starting in 2030.

EXHIBIT F: WTD has identified wastewater treatment improvements which may meet likely nutrient limits developed by the Department of Ecology, but they are not presented by any Action, or within any strategy.



Projected Wastewater Treatment Plant Nitrogen Loading Per Year Treatment Upgrades to 8mg/L Effluent at West Point, 3m/L at Brightwater, and Full Reuse of South Plant Effluent

Source: King County Auditor's Office analysis of data from WTD Priority 1 question responses dated August 16, 2021, Brown and Caldwell, *Actions Characterizing Water Quality Investment Options*, May 2021, *King County Nitrogen Removal Study: Final Report*, September 2020, *Brightwater Treatment Plant Peak Flow and Wasteload Projects 2010-2060*, January 2019, *South Plant Treatment Plant Peak Flow and Wasteload Projects 2010-2060*, January 2019, *West Point Treatment Plant Peak Flow and Wasteload Projects 2010-2060*, January 2019, and Department of Ecology Salish Sea Year 2 Modeling Inputs provided August 2021.

Given the magnitude of discharge from King County's WWTPs, compliance with strict nutrient limits set by DOE is likely to require significant capital investments at the regional WWTPs. King County's WWTPs contribute 57 percent of the total nitrogen loading to Puget Sound from domestic wastewater treatment plant marine point discharges. In the best-case scenario—meaning highest expected wasteload allocation—King County would be expected to reduce nitrogen loading by 67 percent compared to 2020 levels. Decentralized treatment at wet weather treatment stations and building-scale decentralized treatment can produce significant reductions in marine nitrogen. However, even at the most optimistic range, these reductions are only approximately 37 percent of the reductions needed, and at least optimistic only 9 percent. While non-point trading has been discussed, WTD has determined non-point trading is not a feasible option to pursue to offset improvements at wastewater treatment plants because a large amount of land is needed. Additionally, trading can only occur once water quality-based limits are set, meaning any reductions needed in the first permit cycle must occur at the WWTPs.

Four of five WTD strategies assume a successful modification of the existing consent decree, extending the timeline for compliance by 30 years—an unlikely outcome given current EPA guidance.¹⁰ King County's consent decree requires all CSO locations to be under control by December 31, 2030. In 2019, WTD requested the consent decree be renegotiated with an extended compliance timeline to 2040. While the status of the negotiations is not public due to confidentiality agreements, four of the five strategies include a renegotiated consent decree compliance timeline of 2060, effectively proposing a 47-year compliance timeframe. The EPA consent decree compliance tracking spreadsheet, dated 2017, shows average compliance timeframe for CSO and/or sanitary sewer systems consent decrees at an average of 15 years. Therefore, it is likely that negotiations may not lead to an extended compliance timeframe of 2060. If King County is unsuccessful in renegotiating the consent decree, then strategies B-E would no longer be viable, as they all assume renegotiation of the compliance timeline to 2060.

Two WTD strategies assume an approach that would require a change to Washington Administrative Code. Strategies C and D indicate the method for CSO compliance is "extended CSO Control Program timeline and/or *alternative water quality investments*"¹¹. Policy-makers should be aware there is no existing regulatory framework that would allow King County to pursue alternative water quality investments in lieu of controlling CSOs. Such a change would require an amendment to the Washington Administrative Code, which requires achievement of the greatest reasonable reduction of CSOs, defined as "control of each CSO in such a way that an average of one untreated discharge may occur per year"¹².

Questions for policy-maker consideration:

- What are the risks of an unsuccessful renegotiation of the consent decree, and what would be the impact on rates?
- What are the risks of not planning for implementation of nutrient removal, including how it might affect WTD's ability to serve new connections?
- What regulatory outcomes are required for each strategy and/or action to be viable?
- Are there examples and lessons learned from other jurisdictions in the United States, where broad regulatory changes, such as those proposed by WTD, were sought and achieved?

Lack of transparency obscures cost differences between Actions

The packaging of projects into Actions and the presentation of cost and benefits at the Action level, rather than the project level, obscures details about the costs and benefits of each Action's component projects making it more difficult for decision-makers to effectively weigh options. For example, there are two Actions proposed for compliance with the consent decree: Current CSO Long-Term Control Plan (LTCP) Implementation and Extended CSO Control Implementation (exhibit G, below). In the *2021 Actions* Report, which provides cost estimates on a high-level Actions basis, an extended LTCP implementation results in a conceptual capital cost savings of \$1.1B–2.6B—when compared to

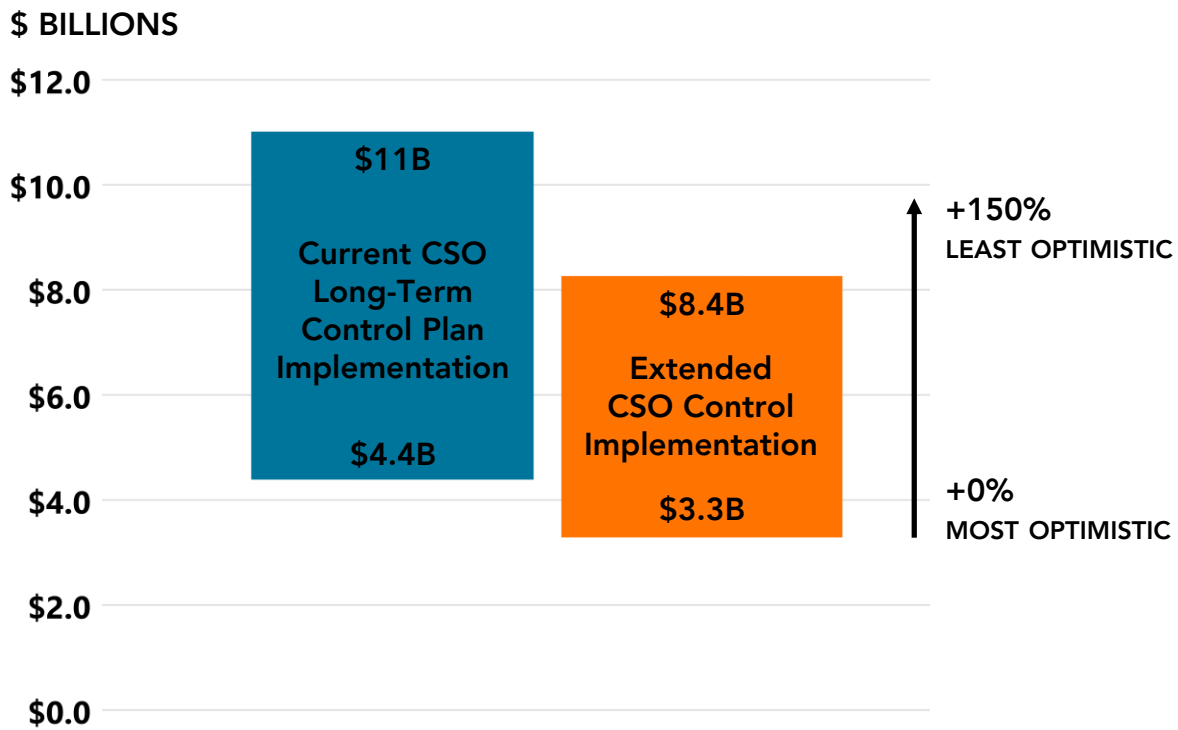
¹⁰ *Environmental Protection Agency Combined Sewer Overflows — Guidance for Financial Capability Assessment and Schedule Development*, February 1997, and *Memorandum on Financial Capability Assessment Framework for Municipal Clean Water Act Requirements*, November 2014.

¹¹ Emphasis added

¹² WAC 173-245-020 (22)

current LTCP implementation.¹³ The majority of the difference in capital cost (\$980M–2.5B) is the result of a 30 percent acceleration fee, which WTD presents as the premium for delivering the remaining LTCP within ten years. However, it is unclear why this 30 percent markup is included on supplemental compliance, which would occur after 2033 and alone contributes 20 percent to the increased conceptual capital cost when compared to the extended CSO control implementation timeline. Additionally, it is unclear why the consent decree compliance project costs continue to grow at such a fast pace. In a 2019 letter to the EPA, WTD stated the remaining consent decree compliance projects would be expected to cost \$1.9B or more, depending on alternative chosen and timeline. In the most recent cost estimates provided by WTD, the remaining projects now have a lowest, most optimistic conceptual capital cost of \$2.94B,¹⁴ an increase of nearly 55 percent.¹⁵

EXHIBIT G: Presentation of costs on Action-level basis obscures differences in costs.



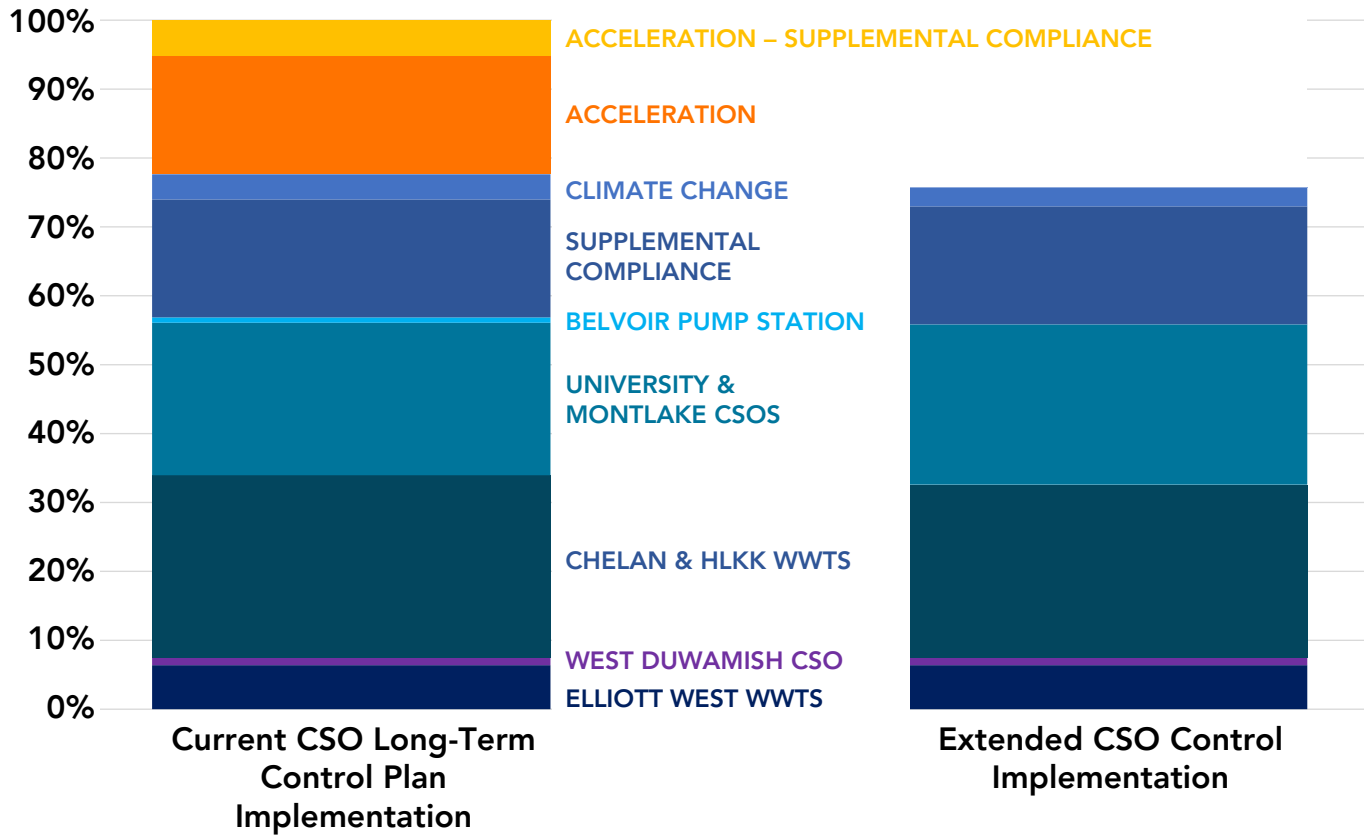
Source: WTD Priority 1 question responses, dated August 26, 2021

¹³ Comparisons made here are based upon the low-end range. WTD has presented its estimates as conceptual program planning estimates with a range of lowest, most optimistic to +150%.

¹⁴ 2020 nominal dollars. Conceptual cost estimates are provided by WTD with a range of lowest, most optimistic, to +150%.

¹⁵ This represents the conceptual capital costs presented by WTD for Duwamish CSO Storage Tank (West Michigan St. and Terminal 1 15), CSO Storage Tank near Chelan Ave. Regulator Station, HLKK WWTS, University Storage Tank, and Montlake CSO Storage Tank with the five percent climate change, and 30 percent acceleration factor.

EXHIBIT H: Difference in conceptual capital costs between current and extended CSO control implementation is due mostly to acceleration factor.

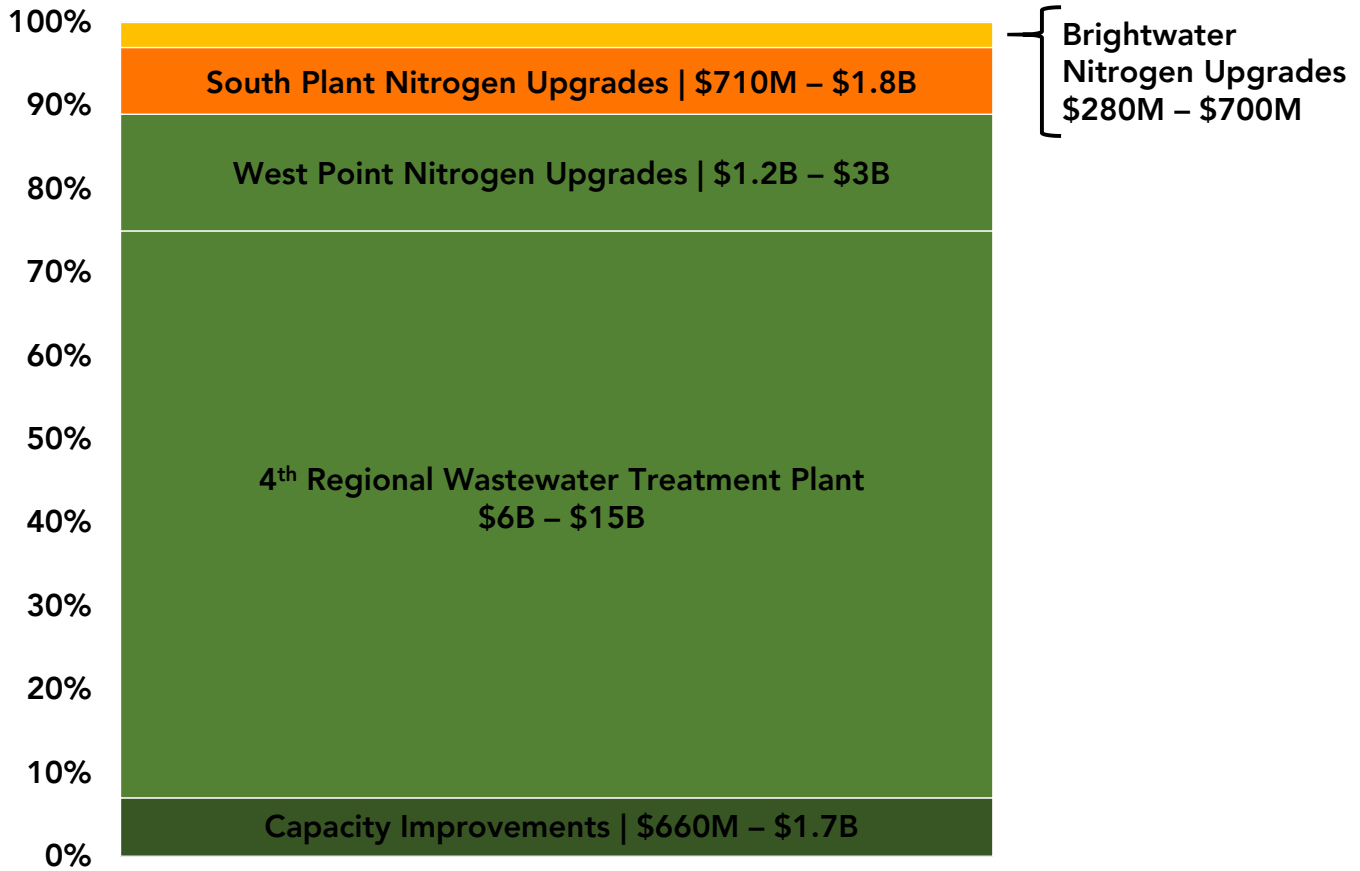


Source: WTD Priority 1 question responses, dated August 26, 2021

Similarly, the grouping of WWTP upgrades obscures the cost of upgrades at each individual plant. Grouping the projects as packages without providing a cost breakdown may make it appear that WWTP improvements are an expensive method to achieving nitrogen reductions. Viewing a detailed breakdown provides a more nuanced view and shows improvements at some plants can lead to big benefits for a fraction of the total Action cost. Exhibit I, below, shows of the needed \$8.9B–\$22B estimated by WTD to achieve individual nitrogen levels at each WWTP, \$7.2B–\$18B in capital costs are related to nitrogen removal at West Point, while only \$990M–\$2.5B in conceptual capital costs would be required to achieve nitrogen levels of 8mg/L at both South Plant and Brightwater. Implementing these upgrades at South Plant and Brightwater would result in a reduction of nitrogen loading at King County’s WWTPs by 43 percent for a conceptual capital investment of \$990M–\$2.5B.¹⁶

¹⁶ WTD presented its estimates as conceptual program planning estimates with a range of lowest, most optimistic to +150%.

EXHIBIT I: Implementing nutrient removal improvements¹⁷ at South Plant and Brightwater represents only 11 percent of the cost of individual plant nitrogen reduction.



Source: WTD Priority 1 question responses dated August 26, 2021.

Questions for policy-maker consideration:

- What are the costs of projects within individual Actions?
- Are there alternative ways projects could be grouped to improve outcomes at a lower cost?

Strategies may not ensure the best water quality outcome

The best water quality outcome may not be represented in WTD’s strategies, making it difficult for decision-makers to facilitate the best outcomes. According to the Office of Performance, Strategy and Budget, review of the strategies will include an assessment against the 2020–2025 Clean Water Health Habitat Strategic Plan. However, determination of achievement of the best water quality outcome at the lowest cost can only occur if all Actions are carefully considered by WTD. For example, Urban Growth Area (UGA) On-Site Septic System (OSS) Conversion, Regional Stormwater Facilities Program, and Regional Stormwater Retrofits are the only Actions with meaningful freshwater phosphorus reductions. Phosphorus has been identified by King County as the pollutant most frequently leading to “potentially toxic cyanobacteria blooms, reduction in water clarity, and odors and surface scums associated with nuisance

¹⁷ The capital cost to achieve 8mg/L year-round effluent concentrations.

levels of algae¹⁸ in local lakes. UGA OSS Conversion results in higher phosphorus reductions than all three stormwater treatment options combined. However, UGA OSS Conversion does not appear in any of the five strategies presented by WTD, while Regional Stormwater Facilities Program and Retrofit appear in two (strategies C and D).

EXHIBIT J: Urban Growth Area On-Site Septic System Conversion provides significantly greater phosphorus removal (lb/yr) than other Actions, but is not considered as part of any strategy.

Actions	Freshwater Phosphorus (lb/yr)		King County Costs ¹⁹	
	Low	High	Low	High
Urban Growth Area On-Site Septic System Conversion	1,700	40,000	\$940,000,000	\$2,360,000,000
Expanded Stormwater Treatment at Existing Wastewater Facilities	100	410	\$230,000,000	\$580,000,000
Regional Stormwater Facilities Program	350	1,400	\$3,560,000,000	\$9,000,000,000
Regional Stormwater Retrofit Program	630	2,500	\$1,500,000,000	\$3,800,000,000

Source: Freshwater phosphorus reductions are as provided in the 2021 *Actions* Report. King County costs were calculated by the King County Auditor's Office.

The screening lens WTD used to select Actions can also unnecessarily limit the range of projects under consideration. For example, City-Scale Decentralized Treatment limits screening of satellite wastewater facilities to those "where conveyance capacity limitations have been identified... or where significant future development has been identified."²⁰ However, satellite facilities could be located along areas of existing development and transmission mains and without these two limitations. This would create beneficial water reuse opportunities higher up in the sewershed, eliminating costly long transmission lines from South Plant, and reduce nitrogen discharges to Puget Sound. Additionally, satellite treatment could provide flow reductions to regional wastewater treatment plants, similar to decentralized building-scale treatment, without the safety concerns and potential de-incentivization of industry/commercial business growth in the county that decentralized building-scale treatment faces.

¹⁸ King County (2017) *2016 Freshwater water quality* <https://kingcounty.gov/services/environment/data-and-trends/indicators-and-performance/kingsstat/2016/indicators/aquatic-environment/fresh-water-quality.aspx>

¹⁹ King County costs are calculated as conceptual capital, operations and maintenance, and repair and replacement less revenue and avoided costs in nominal 2020 dollars.

²⁰ King County Wastewater Treatment Division, *Actions: Characterizing Water Quality Investment Options*, 2021

Question for policy-maker consideration:

- What are WTDs goals for the Clean Water Plan and how do those align with yours?
- To what extent did WTD consider water quality benefits in its development of Actions and strategies?

Conclusion

The Clean Water Plan will guide how billions of public dollars are invested over the next 40 years. By evaluating non-viable strategies and Actions, instead of a range of actionable ones that meet anticipated regulatory requirements, King County risks selecting a sub-optimal strategy that does not meet regulatory requirements, provide the lowest possible rates, or deliver the best water quality outcome. Greater clarity around regulatory constraints and project costs, along with inclusion with a wider range of strategies would increase the probability of determining the optimal approach for the future of King County's wastewater system.

Zainab Nejati, PE, Principal Capital Analyst, conducted this review. Please contact Zainab at 206-263-1692 if you have any questions about the issues discussed in this letter.

Acknowledgments

We wish to thank the Department of Natural Resources and Parks, the Wastewater Treatment Division, and the Clean Water Plan team for their cooperation with this review and provision of timely information.

Appendix 1

Questions to Wastewater Treatment Division for policy-makers to consider

This appendix consolidates the questions laid out in our Clean Water Plan management report, which policy-makers may wish to ask as they explore the water quality investments options and deliberate on what Actions should be evaluated as part of the Clean Water Plan strategies.

- What are the risks of an unsuccessful renegotiation of the consent decree, and what would be the impact on rates?
- What are the risks of not planning for implementation of nutrient removal, including how it might affect WTD's ability to serve new connections?
- What regulatory outcomes are required for each strategy and/or action to be viable?
- Are there examples and lessons learned from other jurisdictions in the United States, where broad regulatory changes, such as those proposed by WTD, were sought and achieved?
- What are the costs of projects within individual Actions?
- Are there alternative ways projects could be grouped to improve outcomes at a lower cost?
- What are WTDs goals for the Clean Water Plan and how do those align with yours?
- To what extent did WTD consider water quality benefits in its development of Actions and strategies?

Appendix 2

Conceptual Program Planning Estimates for Combined Sewer Overflow (CSO) Program Wet Weather Management Actions

Breaking down costs by project shows the difference in the projects and costs between the two programs. Projects here are grouped by CSO locations.

CSO Program — Current CSO Long-Term Control Plan Implementation		CSO Program — Extended CSO Control Implementation	
CONCEPTUAL PROGRAM PLANNING ESTIMATES (2020 DOLLARS)			
Project	Total Project Cost Range	Project	Total Project Cost Range
Elliott West Wet Weather Treatment Station (WWTS)	\$280,000,000– \$700,000,000	Elliott West Wet Weather Treatment Station (WWTS)	\$280,000,000– \$700,000,000
West Duwamish CSO Storage Tank (West Michigan St. and Terminal 115)	\$48,000,000– \$120,000,000	West Duwamish CSO Storage Tank (West Michigan St. and Terminal 115)	\$48,000,000– \$120,000,000
CSO Storage Tank near Chelan Ave. Regulator Station	\$210,000,000– \$520,000,000	Chelan Hanford Lander Kingdome King Street (CHLKK) CSO WWTS	\$1,100,000,000– \$2,800,000,000
Hanford Lander Kingdome King Street (HLKK) Wet Weather Treatment WWTS	\$950,000,000– \$2,400,000,000		
University Storage Tank	\$600,000,000– \$1,500,000,000	Consolidated CSO Tunnel for University and Montlake	\$880,000,000– \$2,200,000,000
Montlake CSO Storage Tank	\$370,000,000– \$930,000,000	Opportunistic ROW and Flow Separation in Montlake Basin: Interlaken Park Creek	\$10,000,000– \$25,000,000

Table continues on next page

CSO Program comparison table, continued

Project	Total Project Cost Range	Project	Total Project Cost Range
		Opportunistic ROW and Flow Separation in Montlake Basin: Alley Creek	\$57,000,000– \$140,000,000
		System Optimization (University Regulator Gate Setpoint Modification)	\$72,000,000– \$180,000,000
Belvoir Pump Station Overflow Storage	\$34,000,000– \$85,000,000	System Optimization (Belvoir Pump Station Modification)	\$250,000– \$630,000
Supplemental compliance: potential future operational and capital measures to maintain control given anticipated climate change conditions	\$750,000,000– \$1,900,000,000	Supplemental compliance: potential future operational and capital measures to maintain control given anticipated climate change conditions	\$750,000,000– \$1,900,000,000
		Programmatic Green Stormwater Infrastructure (GSI) for CSO Reduction (GSI Retrofit Partnership Program)	\$2,100,000– \$5,300,000
Climate Change Factor (5%)	\$160,000,000– \$400,000,000	Climate Change Factor (5%)	\$120,000,000– \$300,000,000
Acceleration Factor (30%)	\$980,000,000– \$2,500,000,000		
Total (40-year)	\$4,400,000,000– \$11,000,000,000	Total (40-year)	\$3,300,000,000– \$8,400,000,000

Advancing Performance & Accountability

MISSION Promote improved performance, accountability, and transparency in King County government through objective and independent audits and studies.

VALUES INDEPENDENCE - CREDIBILITY - IMPACT

ABOUT US The King County Auditor's Office was created by charter in 1969 as an independent agency within the legislative branch of county government. The office conducts oversight of county government through independent audits, capital projects oversight, and other studies. The results of this work are presented to the Metropolitan King County Council and are communicated to the King County Executive and the public. The King County Auditor's Office performs its work in accordance with Government Auditing Standards.



NON-AUDIT: This letter is not an audit as defined in Generally Accepted Government Auditing Standards, but conforms to office standards for independence, objectivity, and quality.