King County

DEPARTMENT OF NATURAL RESOURCES AND PARKS
WASTEWATER TREATMENT DIVISION

Capital Investment Forecasting Methodologies and Recommendations

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King County

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Introduction

This report builds on the information gathered from the peer agencies on methods for developing short- and long-term capital investment and rate forecasts. This report provides descriptions and recommendations for short- and long-term methodologies for capital program forecasting and describes the Wastewater Treatment Division's (WTD) current methodologies for developing short- and long-term capital investment forecasts. Differences between WTD's current methods and the recommended methods are noted and recommended steps for WTD to follow to move towards the recommended methods are also provided.

As part of the King County (County) Department of Natural Resources and Parks (DNRP), the WTD provides wholesale wastewater treatment in the Puget Sound region. WTD's wholesale services are contracted by Local Sewer Agencies (LSAs), which include 18 cities, 15 sewer districts and the Muckleshoot Tribe located in King County, southern Snohomish County, and northern Pierce County.

WTD is responsible for the construction, operation, and maintenance of the County's regional wastewater conveyance and treatment system. The system includes:

- 3 major secondary treatment plants (West Point in Seattle, South Plant in Renton, and Brightwater in southern Snohomish County)
- 397 miles of conveyance lines
- 48 pump stations
- 25 regulator stations

Other key WTD facilities include:

- 5 combined sewer overflow (CSO) treatment plants
- 4 CSO storage facilities
- 39 CSO outfalls
- 2 secondary treatment plants (Vashon Island and Carnation)
- 1 community septic system on Vashon Island

Utilities such as WTD are self-supporting and therefore must set fees and sewer rates to recover the cost of providing services. Utility costs include operations and maintenance (O&M), debt service, and construction of new capital infrastructure.

Transparency and appropriate validation of the methodologies used to forecast sewer rates are important considerations to WTD, the governance, customers, and other interested stakeholders. Because WTD's Capital Improvement Program (CIP) is such a significant driver of sewer rates, WTD is seeking methodologies from other peer agencies and utility best practices for extending CIP forecasts for a minimum of 10 years and a maximum of 75 years.

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Purpose

The purpose of this report is to provide descriptions and recommendations for short- and long-term methodologies for capital program forecasting based on the findings from peer agencies and best practices. WTD's current methodologies for developing short- and long-term capital investment forecasts are also summarized. Differences between WTD's current methods and the recommended methods are noted and recommended steps for WTD to follow to move towards the recommended methods are also provided. This work is in response to County Council motion No. 2023-0257.1, which requested that WTD research and develop methodologies for forecasting the extended costs associated with maintaining and enhancing its infrastructure. WTD intends to present the findings of this report to the general Metropolitan Water Pollution Abatement Advisory Committee (MWPAAC) as well as the MWPAAC Asset Management Work Group (AMWG) subcommittee. MWPAAC is comprised of representatives of wholesale customer LSAs. This research will be used to inform the development of a long-term financial forecast template in 2024.

Methodology Development Process

WTD engaged Raftelis, a nationally known firm specializing in providing financial and management consulting expertise to local utilities, to provide support to perform this work. Refer to the *Peer Agency Methods for Developing Long-term Capital Forecasts* report dated November 14, 2023, for the research and findings from the peer agencies review. The following key findings from the peer review are provided below:

1. Peer agencies perform long-term capital forecasting generally 30 to 40 years into the future. Rates are typically only forecasted for 5 years due to the uncertainties associated with long-term capital forecasting and future costs.

2. No peers are performing 75-year long-range capital planning or forecasts.

3. Forecasting capital costs for 20 to 40 years into the future depending on available data and cost assumptions can generally be of value. Asset management costs can be forecasted for longer than 40 years depending on available data and assumptions used for asset condition and consequence of failure.

4. Methodologies for developing capital projects and forecasting costs are unique to each project category, i.e., asset management, growth, consent decree, new regulations, etc.

5. Long-term capital forecasting is a balance of needs and available resources. The peer utilities identified more project needs than the funding available and affordability concerns to increase funding through rates or additional borrowing. Staff resources to execute and deliver the projects also needs to be evaluated and balanced.

From the peer review and knowledge of utility best practices, it was identified that developing short- and long-term capital investment and rate forecasts is primarily a balance of three elements:

1. Project selection - based on system needs and risk-based priorities

2. Financial and rates implications
3. Capital delivery and project staffing considerations

Further discussion of each element is provided below:

1. System Needs and Risk-Based Priorities Project Selection

When developing short- and long-term capital forecasts, the peer utilities selected, prioritized and ranked projects including the following criteria at a minimum:

a. Risk of failure
b. Consequence of failure
c. Immediate and long-term regulatory requirements
d. Growth/Capacity Needs
e. Community input and priorities

The methods for developing and selecting projects varies by the type of project and project categories, i.e., asset management, growth, consent decree, new regulations, climate change, operational enhancements, etc. These categories and methods for identifying projects is discussed in more detail in the Capital Program Forecasting Methodologies section below.

2. Financial and rates implications

Peer utilities set capital spending limits generally based on regulatory obligations, asset risk profiles, and their community ratepayer's affordability. Rates are often forecasted for 5 years, but capital funding sources and considerations often extend further out 20+ years. Projects identified in Element 1 are selected to fit within the identified rate and spending limitations. The selected projects' capital costs are developed at a planning level with defined cost contingencies appropriate for the level of project information available. The associated project unknowns or uncertainties that are used to select the appropriate cost contingencies are also clearly defined for each project. Generally, the Association for the Advancement of Cost Engineering (AACE) guidelines and cost contingency classes are used when selecting the appropriate levels of cost contingency.

Peers develop greater certainty for projects' scopes and costs across the project categories for the 5- to 10-year projected capital budgets. Projects scopes and costs uncertainty increases for capital forecasting beyond a 10-year period and appropriate qualifications on the selected projects are provided. Peers generally use 5- to 10-year intervals to update master plans and long-term financial forecasts.

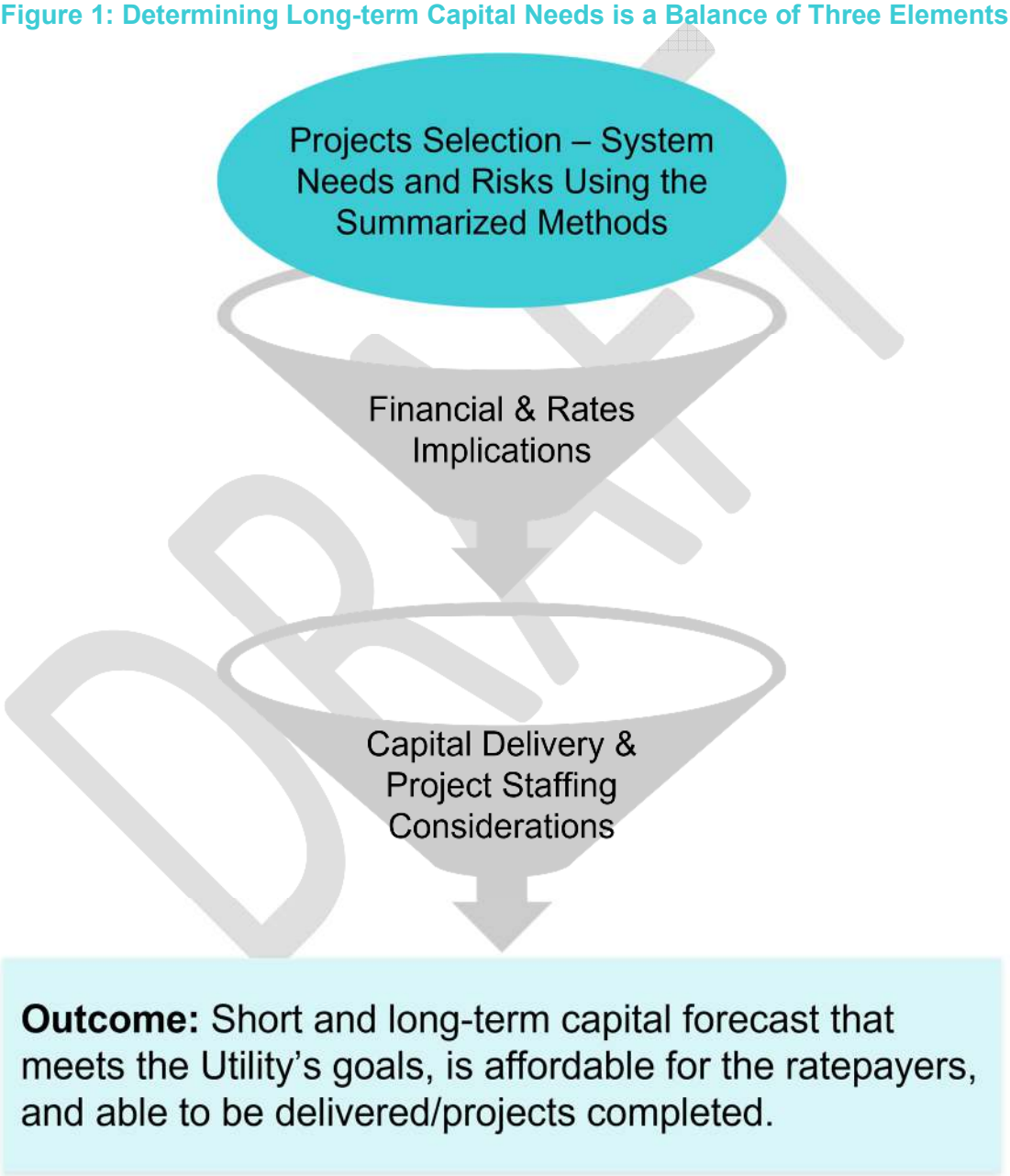
3. Capital delivery and project staffing considerations

The selected projects from Element 1 balanced with the spending targets and rate limitations from Element 2 are then further balanced with realistic and achievable capital delivery and project staffing needs and considerations. Annual capital spending and 5- to 10-year forecasted capital budgets were selected by the peers to be realistic and fit within the utility's capital delivery capabilities and available staffing. If increased capital delivery to meet annual capital spending targets was identified, peers performed the following:

- Evaluated current capital delivery processes and staffing,
- Identified limitations and realistic incremental and achievable recommended improvements,
- Implemented changes to meet the selected capital delivery targets.

Balancing the above three elements when developing short- and long-term capital forecasts allows utilities to meet their goals, develop affordable rates for their ratepayers, and deliver their capital projects on budget and schedule, as depicted in Figure 1 below.

Figure 1: Determining Long-term Capital Needs is a Balance of Three Elements



Capital Forecasting Scenarios Example

To illustrate the above elements and how other peers are generally developing their short- and long-term capital program forecasts and scenarios, the following examples are provided and discussed:

Example: Question: What is the right amount of capital we need to spend over the next 5 years? Over the next 10 years? Over the next 20 plus years? To help answer these questions, peers are asking and answering the following questions to build their capital forecast scenarios.

Scenario 1: If $X billion (2024$) is spent over 5 years:

- ❑ What Regulatory Obligations will not be fulfilled, if any?
- ❑ What Extreme and High-risk assets will fail, if any?
- ❑ What assets won't be completed to meet estimated growth requirements, if any?
- ❑ What Community priorities will not be achieved, if any?

Scenario 2: If $2X Billion is spent over 5 years:

- ❑ What Remaining Regulatory Obligations will not be fulfilled, if any?
- ❑ What remaining Extreme and High-risk assets will fail, if any?
- ❑ What assets won't be completed to meet estimated growth requirements, if any?
- ❑ Will all Community priorities be achieved?

Is another Scenario greater than $2X billion required to meet all of the regulatory, asset risk of failure, growth estimations, and community priorities? If Yes, then that capital scenario is also developed.

These Scenarios then form the basis for comparing capital forecasts for the short- and long-term and evaluating those scenarios against the financial and rate implications, and capital delivery considerations.

For extreme and high-risk assets, peers recognize the need to balance renewal and replacement with the available funding and with available condition assessment and business risk exposure (BRE) scores for their various linear and facilities assets. It may simply be too expensive or not possible from a capital delivery standpoint to renew or replace (R/R) all extreme risk (and/or high-risk) assets in a 5-year period or even in a 10-year period. Forecasting asset management projects needs careful consideration of available condition assessment and consequence of failure data. Simply using age, material and assumed useful life data, compared to a BRE based approach, can often oversimplify the estimations and lead to higher estimated capital cost needs, especially for timeframes beyond 5 years. The BRE-based approach for forecasting asset management costs is discussed further in the Methodologies section of this report.

With the above capital forecasting scenarios questions asked and answered, capital forecast scenarios cost tables can then be built similar to the example in Table 1 below. The capital forecast scenarios can then examine

multiple levels of expenditures based on the answers to the questions above and further balanced with the financial and rate implications and capital delivery and project staffing considerations.

Table 1: Capital Forecasting Scenarios Example

Project Category[1]	Annual Spend
1. Consent Decree to meet required schedules	$A
2. Asset Management based on reducing risk scores	$B
3. Regulatory/Permit Requirements a. New Regulations. i.e., nutrients b. Emerging Contaminants, i.e., PFAS, pharmaceuticals, etc.	$C
4. Growth/Capacity Limitations	$D
5. Planning and Administration	$E
Total	Target Annual Spend ($A + $B + $C + $D +$E)[2]

[1] All project categories would include relevant design criteria to address Resiliency items – natural hazards and climate change, such as seismic, sea level rise, flooding. etc.

[2] If the 5 above project categories don't exceed the target annual spend or rate limitations then add in projects from Operational Enhancements, Resource Recovery, other resiliency projects, etc.

The utility can use their current list of projects, results of their growth and biosolids master plans, regulatory studies, climate change assessments, operational enhancements/energy recovery studies, etc. to build these capital forecast tables. Where there are gaps in the projects, studies or evaluation costs can then be included in the budget to complete these studies over the next several years to help complete and fill-in any missing projects and budgets for the long-term capital forecasting. The recommended methods by project category for short- and long-term capital program forecasting are discussed in the next section.

Capital Program Forecasting Methodologies

For short- and long-term capital program forecasting, it was found the peer utilities developed projects and the associated capital cost estimates in four primary stages for capital forecasting as described below and illustrated in Figure 2:

- Years 1-5: Specific asset management and new infrastructure projects with accurate cost estimates were developed and adjusted as needed to fit within ratepayer affordability limitations. Staffing and capital delivery needs were also considered for the immediate next 5 years and beyond to ensure the cash flow spending projections could be realistically achieved.

- Years 6-10: Specific asset management and new infrastructure projects scopes and costs were less specific and defined, with added cost contingencies, because projects are likely to change or receive modifications. Consent Decree required costs were based on the long-term control plan or integrated watershed plan and cost estimates defined with appropriate contingencies for the implementation years. Rate forecasts were generally not performed or appropriately qualified as subject to change, because of the cost uncertainties.

- Years 11-20: Some projects such as sewer or equipment asset renewal/replacement could be defined based risk scores. Historical costs were used for estimating the asset renewal/replacement projects' future costs. Consent Decree required costs were based on the long-term control plan or integrated watershed plan and cost estimates defined with appropriate contingencies for the implementation years. Other projects identified to address items, such as new regulations, emerging contaminants and climate change, were included, but cost estimates were generally based on high level planning estimates and assumptions. Costs were noted to be order of magnitude and subject to large changes. Where possible climate change impacts, such as sea level rise, were estimated and design criteria developed to incorporate into future applicable asset renewal and replacement projects at the WWTPs, remote facilities and outfalls.

- Years 20+: Some projects such as sewer or equipment asset renewal/replacement could be defined, and historical costs used for estimating those asset renewal/replacement future costs. Other projects such as additional consent decree costs, new regulations, emerging contaminants, and climate change were included as order of magnitude costs. Historical costs were used where available, such as dollars per overflow gallon reduced, for estimating further potential overflow reductions, but detailed projects and cost estimates were not performed. Placeholder cost allowances based on limited information were used for new regulations, emerging contaminants, and climate change impacts.

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Figure 2 illustrates the identified Capital Planning and Financial Forecasting Stages the peer utilities generally followed.

Figure 2: Capital Planning and Financial Forecasting Stages

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From the peer review findings and knowledge of utility best practices, recommended methods for developing short- and long-term capital program financial forecasts were developed. The methods vary by the types of projects, so the various types of projects typically included in capital improvement program budgets are broken into project categories. The categories shown are generally based on the project categories used by the peer utilities. It was also identified that the number of methods for program forecasting also varies by project category. For example, there were three primary methods identified for determining short- and long-term financial forecasts for the sewer/conveyance asset renewal/replacement project category. Whereas, for the new infrastructure for growth project category, one primary forecasting method was identified and recommended. The project categories and number of forecasting methods identified are summarized in Table 2.

Table 2: Capital Program Forecasting Methods Vary by Category

Categories	1-5 Years	6-10 Years	11-20 Years	20+ Years
Asset Renewal/Replacement: Sewers/Conveyance	**Methods:** 1 *More Detailed,* 2, and/or 3 *Less Detailed*			
Asset Renewal/Replacement: WWTP/Remote Facilities Equipment	**Methods:** 1 *More Detailed,* and/or 2 *Less Detailed*			
New Infrastructure: Consent Decree/IWM Plan	**Methods:** 1			
New Infrastructure: Growth	**Methods:** 1			
New Regulations – i.e., Nutrients, PFAS, Biosolids	**Methods:** 1			
Emerging Contaminants – i.e., Pharmaceuticals, Endocrine Disruptors, etc.	**Methods:** 1			
Climate Change	**Methods:** 1			
Resource Recovery/Operational Enhancements*	**Methods:** 1			

** For illustration purposes. Operational Enhancements could include residual upgrades and energy recovery projects or those projects could be added in separate categories, as appropriate. Projects and costs definition would be similar to the above categories.*

Detailed descriptions of the recommended short- and long-term capital program forecasting methods for each project category shown in Table 2 are provided below.

Asset Renewal/Replacement: Sewers/Conveyance Category

This category includes all linear assets associated with the sewer conveyance system. Pump stations are included in the next category: Asset Renewal/Replacement: WWTP/Remote Facilities Equipment. It was found there is one primary method for identifying and developing projects in this category for Years 1-10 of capital program forecasting and three primary methods for Years 11-20 and Years 20+.

The methods are described in Table 3. For Years 1-5 and Years 6-10, the primary recommended method is similar and described in more detail below:

- Develop a target annual R/R rate by total system length of at least 1 percent tailored to the Utility. This R/R rate represents an average asset renewal timeframe of once every 100 years for renewing or replacing the asset. This R/R rate could be higher or lower depending on the actual condition of the linear assets and consequences of failure. Utilities that have invested in R/R for some time, or have newer sewer assets, may find 1 percent is too high because the sewer condition does not warrant the need for that much R/R. Other utilities moving from reactive to proactive asset renewal may find increasing the R/R rate to greater than 1 percent for the first several years of their program may be

needed to "catchup" on renewing existing Extreme or High-risk assets. Therefore, it is important to consider these details when selecting and tailoring an annual R/R rate for the utility.

- Projects should be selected from BRE scores developed for each asset (likelihood of failure [LOF] (asset condition) × consequence of failure [COF] scores) to address Extreme and High-risk assets. If asset condition or COF data is not available, the utility should spend the first year or so of its asset management program determining COF scores for the missing assets, and the first few years collecting and developing the missing asset condition data. When considering asset condition data, inspections or physical condition data of the asset should be collected. Using age, material and assumed useful life data can often oversimplify the estimations and lead to higher estimated capital cost needs, especially for timeframes beyond 5 years compared to a BRE based approach. This age, material and assumed useful life data can be used for initial future projections of asset renewal needs but should be appropriately qualified and BRE scores updated routinely as asset condition data gaps are filled from collected data.

- Accurate costs for the R/R projects should be developed based on recent bid costs or recent cost estimates. Engineering and construction costs should be calculated and used to develop a total project cost following the Association for the Advancement of Cost Engineering (AACE) Class 4 estimates or better, as WTD currently does for projects that are in delivery and estimated to cost more than $2.5M. For years 1-5, when projects are nearing funding approval and delivery, but before any engineering is performed, cost estimates should be Class 5 or better. For Years 6–10, larger contingencies may be appropriate depending on the unknowns and data availability for the particular asset R/R projects. These unknowns and reasons for larger contingencies should be clearly documented for the project so they can be addressed as the project proceeds into planning and design.

- For Extreme and High-risk assets, it may be too expensive or not possible from a capital delivery standpoint to renew or replace all Extreme risk (and/or High-risk) assets in a 5-year period or even in a 10-year period. There needs to be a balance and priority developed with asset renewal and replacement with the available funding and available condition assessment and BRE scores data.

For Years 11–20 and Years 20+, there are two primary recommended methods as highlighted in blue outline in Table 3 below. They are differentiated by the amount of condition and COF data available at the time when the budgets are being developed:

- Continue at the selected annual R/R rate by length and BRE score tailored to the Utility as described for Years 1–10 above.

- Where sewer condition data is not fully available use available age, material and useful life data to draw comparisons to similar assets that have available condition data. Set an annual budget spending amount or allowance based on the selected renewal rate and tailored to complete the remaining High-risk assets, then begin any Medium Risk assets R/R.

- Include budget for condition assessment costs to fill any remaining gaps in the asset condition data and for follow-up inspections of assets to confirm asset condition, monitor any changes and update BRE scores.

- The cost basis for the budget allowances should be based on historical costs with appropriate contingencies clearly defined based on the types and number of unknowns.

Table 3: Asset Renewal/Replacement: Sewers/Conveyance Capital Forecasting Methods

Methods	1-5 Years	6-10 Years	11-20 Years	20+ Years
1 *More Detailed*	• Target annual R/R rate – at least 1% by total system length tailored to the Utility. • Projects selected from BRE risk scoring (condition and consequence of failure scores) to address Extreme and High-risk assets. • Accurate costs – AACE Class 5 estimates or better. • Defined cost contingencies.	• Target annual R/R rate – at least 1% by total system length tailored to the Utility. • Projects selected from BRE risk scores. • Complete addressing Extreme Risk assets; continue addressing High-risk assets. • Scopes and costs basis similar to Years 1-5. • Larger cost contingencies if there are more unknowns.	• Continue at selected annual R/R rate by length tailored to the Utility. • Sewers R/R based on available condition and risk scoring data. • Focus on addressing remaining High-risk assets, then Medium Risk assets. • Cost basis = historical costs with contingencies.	Same as Years 11-20, except completing any remaining Medium Risk assets and continuing R/R on at least 1% annual rate by length.
2			• Continue at selected annual R/R rate by length tailored to the Utility. • Sewer condition data not available: R/R based on Risk scores from available age, material and useful life data. • Budget for condition assessment costs to fill gaps. • Focus on addressing remaining High-risk assets, then Medium Risk assets. • Cost basis = historical costs with contingencies.	Same as Years 11-20, except completing any remaining Medium Risk assets and continuing R/R on at least 1% annual rate by length.
3 *Less Detailed*			• Continue at selected annual R/R rate by length tailored to the Utility. • Sewer condition, age or material data not fully available. • Use assumptions based on available data; include an annual allowance for R/R costs based on the assumptions. • Budget for condition assessment costs to fill gaps. • Cost basis = historical costs with contingencies.	Same as Years 11-20.

The primary recommended steps for WTD to apply the above-described methods to develop the short- and long-term capital program budgets for the sewers/conveyance asset management category are:

1. Evaluate WTD's applicable linear asset classes, available linear asset condition, age and attribute data, and expected lifecycles/remaining useful life. Determine and list any data gaps.

2. Complete the existing work in the Asset Management Work Plan to develop a condition assessment and documentation program based on industry standards.

3. Establish an existing baseline of assets needing R/R, available BRE scores (Extreme, High, Medium, Low). Define assumptions for missing data and develop a plan and budget to acquire the missing data.

4. Establish the recent history of WTD's projects, level of service, and what assets still need R/R. Establish an annual R/R rate tailored to this history and level of service.

5. Develop BRE scores for missing assets using available data on asset condition and consequence of failure factors.

6. Use WTD recent project bid data, available design cost estimates, and regional project cost data to support the development of expenditures for assets by class, prioritized by BRE scores, and based on the selected annual R/R rate. Also include cost estimates for gathering the missing data. Project cost estimates should be defined with appropriate contingencies consistent with the developed project, level of unknowns, and the implementation years consistent with the AACE guidelines.

7. Develop short- and long-term forecast of expenditures based on the selected annual R/R rate, BRE scores (focus on Extreme assets first, then High-risk assets), available condition and COF data, available cost data, and defined assumptions (to address missing data and add cost contingencies for amount of unknowns).

8. The selected budgets to include in the short- and long-term capital forecast should then be balanced with financial and rates implications, capital delivery and staffing considerations, as discussed in the Methodology Development Process.

Asset Renewal/Replacement: WWTP/Remote Facilities Equipment Category

This category includes all treatment and remote facilities assets, including pump stations. It was found there is one primary method for identifying and developing projects in this category for Years 1-10 of capital program forecasting and two primary methods for Years 11-20 and Years 20+.

The methods are described in Table 4 below. For Years 1-5 and Years 6-10, the primary recommended method is similar and described in more detail below:

- Projects should be selected primarily from BRE scores developed for each asset (LOF [asset condition] × COF scores) to address Extreme and High-risk assets. If there is a backlog of existing projects or assets that need improvements, those projects should be prioritized for implementation based on the asset BRE score. If asset condition or COF data is not available, the utility should spend the first year or so of its asset management program determining COF scores for the missing assets, and the first few years collecting and developing the missing asset condition data. When considering asset condition data, inspections or physical condition data of the asset should be collected. Using age, material and assumed useful life data can often oversimplify the estimations and lead to higher estimated capital cost needs, especially for timeframes beyond 5 years compared to a BRE based approach. This age, material and assumed useful life data can be used for initial future projections of asset renewal needs but should be appropriately qualified and BRE scores updated routinely as asset condition data gaps are filled from collected data.

- Implement reliability centered maintenance approaches for all WWTP and Facilities primary assets to inform ongoing asset O&M and triggers for asset replacement. Evaluate if the current CMMS software

is sufficient for recording the necessary RCM data and adjust as necessary to efficiently record the needed data. Use the collected data to monitor asset performance and proactively rehabilitate or replace wear components of the assets, when O&M costs become excessive, or performance drops below allowable levels. Record O&M costs at the asset level and review annual asset O&M costs to compare to replacement costs for critical assets. Use this data to determine which assets should be prioritized to be replaced through a capital investment versus continuing to maintain. A good metric is when annual maintenance cost divided by asset replacement cost exceeds 4% to 5%, asset should be evaluated for replacement. Use the RCM data and the BRE scores to inform the asset life-cycle and the priority for inclusion of the asset renewal or replacement in the capital budget.

- Accurate costs for the R/R projects should be developed based on recent bid costs or recent cost estimates. Engineering and construction costs should be calculated and used to develop a total project cost following the Association for the Advancement of Cost Engineering (AACE) Class 4 estimates or better as WTD currently does for projects that are in delivery and estimated to cost more than $2.5M. For years 1-5, when projects are nearing funding approval and delivery, but before any engineering is performed, cost estimates should be Class 5 or better. For Years 6–10, larger contingencies may be appropriate depending on the unknowns and data availability for the particular asset R/R projects. These unknowns and reasons for larger contingencies should be clearly documented for the project so they can be addressed as the project proceeds into planning and design.

- For Extreme and High-risk assets, it may be too expensive or not possible from a capital delivery standpoint to renew or replace all Extreme risk (and/or High-risk) assets in a 5-year period or even in a 10-year period. There needs to be a balance and priority developed with asset renewal and replacement with the available funding and available condition assessment and BRE scores data.

For Years 11–20 and Years 20+, there are two primary recommended methods as highlighted in blue outline in Table 4. They are differentiated by the amount of condition and COF data available at the time when the budgets are being developed:

- Asset R/R should continue to be based on available condition and BRE scoring data. Where asset condition data is not fully available, use available age, material and useful life data to draw comparisons to similar assets that have available condition data. Set an annual budget spending amount or allowance based on the available asset BRE data or based on historical annual spending to complete the remaining High-risk assets, then begin any Medium Risk assets R/R.

- Include budget for condition assessment costs to fill any remaining gaps in the asset condition data and for follow-up inspections of assets to confirm asset condition, monitor any changes and update BRE scores.

- The cost basis for the annual spending should be based on historical costs with appropriate contingencies clearly defined based on the types and number of unknowns.

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Table 4: Asset Renewal/Replacement: WWTP/Remote Facilities Equipment Capital Forecasting Methods

Methods	1-5 Years	6-10 Years	11-20 Years	20+ Years
1 *More Detailed*	• Projects selected primarily from BRE risk scoring to address Extreme and High-risk assets. • Implement reliability centered maintenance approaches to inform ongoing O&M and triggers for asset replacement. • Accurate costs – AACE Class 5 estimates or better. • Defined cost contingencies.	• Projects selected primarily from BRE risk scoring to complete addressing Extreme Risk assets; continue addressing High-risk assets. • Scopes and costs basis similar to Years 1-5. • Larger cost contingencies if there are more unknowns.	• Equipment R/R based on available condition and risk scoring data. • Focus on addressing remaining High-risk assets, then Medium Risk assets. • Cost basis = historical costs with contingencies.	Same as Years 11-20.
2 *Less Detailed*			• Equipment R/R based on Risk scores from available age and useful life data. • Budget for condition assessment costs to fill in gaps. • Focus on addressing remaining High-risk assets, then Medium Risk assets. • Cost basis = historical costs with contingencies.	Same as Years 11-20.

The primary recommended steps for WTD to apply the above-described methods to develop the short- and long-term capital program budgets for the WWTP/Remote Facilities Equipment asset management category are:

1. Evaluate WTD's applicable equipment asset classes, available equipment asset condition, age and attribute data, and expected lifecycles/remaining useful life. Determine and list any data gaps.

2. Complete the existing work in the Asset Management Work Plan to develop a condition assessment and documentation program based on industry standards.

3. Establish an existing baseline of assets needing R/R and available costs, available BRE scores (Extreme, High, Medium, Low). Define assumptions for missing data and develop a plan to acquire the missing data.

4. Establish the recent history of WTD's facilities equipment projects, level of service, and what assets still need R/R. Determine how much has been spent annually to-date on facilities assets R/R.

5. Implement reliability centered maintenance approaches for all WWTP and Facilities primary assets to inform ongoing asset O&M and triggers for asset replacement. Evaluate if the current CMMS software is sufficient for recording the necessary RCM data and adjust as necessary to efficiently record the needed data. Use the collected data to monitor asset performance and proactively rehabilitate or replace wear components of the assets when O&M costs become excessive, or performance drops below allowable levels. A good metric is when annual maintenance cost divided by asset replacement cost exceeds 4 to 5 percent, asset should be evaluated for replacement. Use the RCM data and the BRE scores to inform the asset life-cycle and the priority for inclusion of the asset renewal or replacement in the capital budget.

6. Develop BRE scores for missing assets using available data on asset condition and consequence of failure factors.

7. Use WTD recent project bid data, available design cost estimates, and regional project cost data to support the development of expenditures for assets by class and prioritized by BRE scores. Also include cost estimates for gathering the missing data. Project cost estimates should be defined with appropriate contingencies consistent with the developed projects, level of unknowns, and the implementation years consistent with the AACE guidelines.

8. Develop short- and long-term forecast of expenditures based on the BRE scores (focus on Extreme assets first, then High-risk assets), desired level of service, available cost data and defined assumptions (to address missing data and add cost contingencies for amount of unknowns).

9. The selected budgets to include in the short- and long-term capital forecast should then be balanced with financial and rates implications, capital delivery and staffing considerations, as discussed in the Methodology Development Process.

New Infrastructure: Consent Decree/IWM Plan Category

This category includes all projects necessary to meet the regulatory requirements associated with a Consent Decree or Integrated Watershed Management Plan. It was found there is one primary method for identifying and developing projects in this category for Years 1-20 of capital program forecasting and one primary method for Years 20+.

The methods are described in Table 5. For Years 1-20, the primary recommended method is described in more detail below:

- Specific projects are selected based on the developed Long-Term Control Plan (LTCP) or integrated watershed plan. If a plan has not yet been developed, then confirm if any regulatory milestone schedule dates are required to be met within Years 1-20. If yes, align the identified projects to meet those milestone schedule dates. If a plan has not been developed and will be required in the next 5 years, include the appropriate cost budget line item(s) for the plan development in Years 1-5.

- Project cost estimates should be defined with appropriate contingencies consistent with the developed plan, level of unknowns, and the implementation years consistent with the AACE guidelines.

For Years 20+, there is one primary recommended method as summarized in Table 5:

- Projects to include for beyond 20 years are dependent on the length of the LTCP or integrated watershed plan. Detailed projects and cost estimates are not included unless those projects are identified in the LTCP or watershed plan.

- If there may be additional overflow or pollutant reduction projects after Year 20, historical costs are used where available, i.e., dollars per overflow gallon reduced, to provide planning level costs for those projects.

- Project cost estimates should be defined with appropriate contingencies consistent with the level of available details for the projects, level of unknowns, and the implementation years consistent with the AACE guidelines.

Table 5: New Infrastructure: Consent Decree/IWM Plan Capital Forecasting Methods

Methods	1-5 Years	6-10 Years	11-20 Years	20+ Years
1	• Specific projects based on Long-Term Control Plan (LTCP) or integrated watershed plan. • Cost estimates defined with appropriate contingencies for the implementation years.	Same as Years 1-5, except cost contingencies may be larger if there are additional unknowns.	Same as Years 1-5.	• Dependent on length of LTCP or integrated watershed plan. • If there may be additional overflow or pollutant reduction projects after Year 20, historical costs are used where available, i.e., dollars per overflow gallon reduced. • Detailed projects and cost estimates not performed unless included in LTCP.

The primary recommended steps for WTD to apply the above-described methods to develop the short- and long-term capital program budgets for the New Infrastructure: Consent Decree/IWM Plan category are:

1. Evaluate WTD's applicable LTCP projects, costs, and schedule data. Define cost assumptions and any need for cost refinements.

2. Determine regulatory obligations/milestone schedule dates and community priorities for any required implementation dates for select projects.

3. Define necessary assumptions based on uncertainties or limited data. Project cost estimates should be defined with appropriate contingencies consistent with the developed project, level of unknowns, and the implementation years consistent with the AACE guidelines.

4. If plan(s) need to be updated or developed and will be required in the next 5 years, include the appropriate cost budget line item(s) for the plan development in Years 1-5. Otherwise include plan update costs in the years after Year 5, as applicable.

5. Use the project scopes, cost data/cost allowances (depending on assumptions), and regulatory milestone schedules to develop expenditures and timeframes for LTCP implementation.

6. The selected budgets to include in the short- and long-term capital forecast should then be balanced with financial and rates implications, capital delivery and staffing considerations, as discussed in the Methodology Development Process.

New Infrastructure: Growth Category

This category includes all projects necessary to meet the estimated future growth capacity requirements anticipated within the service area. It was found there is one primary method for identifying and developing projects in this category for Years 1-5 and Years 6-10, and one primary method for Years 11-20 and Years 20+.

The methods are described in Table 6. For Years 1-5 and Years 6-10, the primary recommended method is similar and described in more detail below:

- Specific projects are selected based on known growth areas as identified in the service area capacity master plans and other available growth projections.

- Growth assumptions should be reviewed and adjusted annually to implement projects "just in time." Flow monitoring should be considered in portions of the service area to confirm actual flows and schedule the completion of growth-related capacity improvement projects to meet actual flow data versus prior assumptions. Include project budget cost(s) to provide for annual growth projects updates, as needed.

- For Years 6-10, projects scopes and costs are noted to be subject to change based on future annual review of growth assumptions. If master plans examine different growth scenarios, the range of projects and costs per scenario can be included.

- If growth plan(s) need to be developed for portions of the service area include the appropriate cost budget line item(s) for the plan(s) development in Years 1-5.

- Project cost estimates should be defined with appropriate contingencies consistent with the developed plan, level of unknowns, and the implementation years consistent with the AACE guidelines.

For Years 11-20 and Years 20+, there is one primary recommended method as summarized in Table 6:

- General projects are included based on anticipated growth areas as identified in the service area capacity master plans and other available growth projections beyond 10 years.

- If growth projections have not occurred beyond 10 years, define the assumptions and use the best available information to develop allowance costs for growth capacity projects. Include project budget cost(s) to provide for studies or evaluations of growth capacity needs beyond 10 years.

- If current master plans examine different growth scenarios beyond 10 years, the range of projects and costs per scenario can be included.

- Project cost estimates should be defined based on historical costs with appropriate contingencies consistent with the developed plan, level of unknowns, and the implementation years consistent with the AACE guidelines.

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Table 6: New Infrastructure: Growth Capital Forecasting Methods

Methods	1-5 Years	6-10 Years	11-20 Years	20+ Years
1	• Specific projects based on known growth areas. • Accurate costs consistent with AACE guidelines and level of unknowns. • Defined cost contingencies. • Growth assumptions reviewed and adjusted annually to implement projects "just in time".	• Specific projects based on anticipated growth. • Scopes and costs may change based on future annual review of growth assumptions. • Larger cost contingencies depending on level of unknowns.	• General projects based on master plans and growth trends with less specific scopes. • If master plans examine different growth scenarios, the range of projects and costs included per scenario. • Allowance costs, if growth projections have not occurred beyond 10 years, based on best available information and defined assumptions. • Cost basis = historical costs. • Contingencies, dependent on level of unknowns.	Same as Years 11-20.

The primary recommended steps for WTD to apply the above-described methods to develop the short- and long-term capital program budgets for the New Infrastructure: Growth category are:

1. Evaluate WTD's applicable growth and system build-out master plans. Develop project lists, costs, and schedule data for each forecasting time period (i.e., Years 1-5, 6-10, 11-20, and 20+). Define cost assumptions and any need for cost refinements.

2. Determine any adjustments based on new information and community priorities. Determine need for recent flow monitoring to confirm prior estimates of growth and capacity needs. Include budget costs for flow monitoring as applicable.

3. Determine need for new growth evaluations or updates to master plans and likely costs for those study projects. Include those update projects and budget costs in Years 1-5.

4. Define necessary assumptions based on uncertainties or limited data for each forecasting time period. Project cost estimates should be defined with appropriate contingencies consistent with the developed plan, level of unknowns, and the implementation years consistent with the AACE guidelines.

5. Use the project scopes, cost data/cost allowances (depending on assumptions), and schedules, to develop expenditures and timeframes for growth projects implementation.

6. The selected budgets to include in the short- and long-term capital forecast should then be balanced with financial and rates implications, capital delivery and staffing considerations, as discussed in the Methodology Development Process.

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New Regulations and Emerging Contaminants Category

This category includes all projects necessary for meeting anticipated new regulations and emerging contaminants requirements. It was found there is one primary method for identifying and developing projects in this category for Years 1-5 and Years 6-10, and one primary method for Years 11-20 and Years 20+.

The methods are described in Tables 7 and 8. For Years 1-5 and Years 6-10, the primary recommended method is similar and described in more detail below:

New Regulations

- If the new regulation(s) is likely to be required in the next 5 years, project alternatives, scopes and costs should be developed. Cost estimates should follow AACE Class 5 estimates or better, as applicable and all assumptions clearly defined.

- Where studies and costs have not yet been completed, allowance costs based on the best available information should be included in the capital forecast. Assumptions should be clearly defined. Include projects and costs for the necessary studies to be completed in Years 1-5.

- For Years 6-10, same process as Years 1-5, if the new regulation(s) is likely to be required in the next 10 years. Cost estimates should follow AACE Class 5 estimates depending on the number of unknowns and all assumptions clearly defined.

Emerging Contaminants

- Projects and costs are not typically defined, unless the new regulations and timing for emerging contaminants are well defined. If the new regulation(s) is likely to be required in the next 5 years, project alternatives, scopes and costs should be developed. Cost estimates should follow AACE Class 5 estimates or better, as applicable and all assumptions clearly defined.

- If the emerging contaminants regulations are not likely in the next 5 years but may be likely within 10 years, include project scopes and cost estimates based on high level planning allowances and assumptions.

- Where studies and costs have not yet been completed, allowance costs based on the best available information should be included in the capital forecast. Assumptions should be clearly defined. Include projects and costs for the necessary studies in the budget to be completed to inform this category.

For Years 11-20 and Years 20+, there is one primary recommended method as summarized in Tables 7 and 8 for both New Regulations and Emerging Contaminants:

- Project scopes and cost estimates are generally based on high level planning estimates and clearly defined assumptions. Project timing is adjusted based on the best available information for the likely schedules for the pollutant regulations.

Where studies and costs have not yet been completed, allowance costs based on the best available information should be included in the capital forecast. Assumptions should be clearly defined. Include projects and costs for the necessary studies in the budget to be completed to inform this category.

Table 7: New Regulations – i.e., Nutrients, PFAS, Biosolids Capital Forecasting Methods

Methods	1-5 Years	6-10 Years	11-20 Years	20+ Years
1	• Project alternatives, scopes and costs developed if new regulation(s) is likely to be required in next 5 years. Costs are AACE Class 5 or better depending on the number of unknowns. • Allowance cost based on best available information included where studies and costs have not yet been completed. Assumptions clearly defined.	• Same as Years 1-5, if new regulation(s) is likely to be required in next 10 years. • Costs may be AACE Class 5 depending on number of unknowns.	• Project scopes and cost estimates generally based on high level planning estimates and assumptions. • Allowance cost based on best available information and defined assumptions where studies and costs have not yet been completed. • Costs are order of magnitude AACE Class 5 and subject to large changes.	Same as Years 11-20.

Table 8: Emerging Contaminants – i.e., Pharmaceuticals, Endocrine Disruptors, etc., Capital Forecasting Methods

Methods	1-5 Years	6-10 Years	11-20 Years	20+ Years
1	Projects and costs not defined unless new regulations and timing are well defined.	• Project scopes and cost estimates generally based on high level planning allowances and assumptions. • Costs are order of magnitude AACE Class 5 and subject to large changes.	• Same as Years 6-10. • Project timing adjusted based on information available for likely schedule of pollutant limits.	• Same as Years 6-10. • Project timing adjusted based on information available for likely schedule of pollutant limits.

The primary recommended steps for WTD to apply the above-described methods to develop the short- and long-term capital program budgets for the New Regulations and Emerging Contaminants category are:

1. Confirm likely timeframes for the new regulations and emerging contaminants and clearly define those assumptions.

2. Evaluate WTD's available past or ongoing studies/analyses for needed projects scopes and costs. Define cost assumptions and any need for cost refinements.

3. Determine where additional studies/analyses may be required to determine project scopes and costs. Where studies and costs have not yet been completed, allowance costs based on the best available information should be included in the capital forecast. Assumptions should be clearly defined. Include projects and costs for the necessary studies to be completed in Years 1-5 or outer years, as applicable.

4. Develop list of potential projects and cost allowances. If studies have not yet been completed discuss with qualified staff/outside engineer(s) likely treatment processes needed and appropriate cost allowances to include in the capital forecast.

5. Cost estimates should follow AACE Class 5 estimates or better depending on the number of unknowns and all assumptions clearly defined.

6. Use the project scopes, cost data/cost allowances (depending on assumptions), and schedules, to develop expenditures and timeframes for projects implementation.

7. The selected budgets to include in the short- and long-term capital forecast should then be balanced with financial and rates implications, capital delivery and staffing considerations, as discussed in the Methodology Development Process.

Climate Change Category

This category is intended to include all projects necessary to address the likely impacts from climate change on the utility and infrastructure. It was found there is one primary method for identifying and developing projects in this category for Years 1-5 and Years 6-10, and one primary method for Years 11-20 and Years 20+.

The methods are described in Table 9 below. For Years 1-5 and Years 6-10, the primary recommended method is described in more detail below:

- Studies/evaluations are performed to understand the likely climate change impacts to the utility and the infrastructure. Climate change impacts can include sea level rise, changing weather patterns, increased amounts and intensity of rainfall or snowfall, drought conditions, changes in temperature, seismic activity changes, etc. A list of potential climate change impacts should be developed for the utility and the potential impacts clearly defined.

- The studies/evaluations should identify potential projects to address climate change impacts and design criteria to include in future applicable facility and system asset R/R projects.

- Develop list of potential projects and cost allowances. If studies have not yet been completed discuss with qualified staff/outside engineer(s) appropriate cost allowances to include in the capital forecast.

- Where studies have not yet been performed or completed, include projects and costs for the necessary studies to be completed in the capital forecast to inform this category.

- Project cost estimates should follow AACE Class 5 estimates or better depending on the number of unknowns and all assumptions clearly defined.

- Projects to address climate change should be incorporated into and generally follow the schedules for asset management and new infrastructure projects. Stand-alone climate change projects should be clearly defined and scheduled for implementation based on the likely timing of the impacts.

For Years 11-20 and Years 20+, there is one primary recommended method as summarized in Table 9:

- Project scopes and cost estimates are generally based on high level planning estimates, historical spending and clearly defined assumptions. Project timing is adjusted based on the best available information for the likely timing of climate change impacts.

- Where studies and costs have not yet been completed, allowance costs for projects based on the best available information should be included in the capital forecast. Assumptions should be clearly defined. Include projects and costs for the necessary studies to be completed to inform this category.

Table 9: Climate Change Capital Forecasting Methods

Methods	1-5 Years	6-10 Years	11-20 Years	20+ Years
1	• Projects developed to account for estimated climate change impacts. • Studies/evaluations performed to understand likely climate change impacts. • Determine appropriate design criteria for projects. • Design criteria included in future applicable facility and system asset R/R projects. • Projects generally follow schedules for asset management and new infrastructure projects. • Costs are generally AACE Class 5 or better.		Project scopes and cost estimates generally based on high level planning allowances or historical spending, and defined assumptions.	Same as Years 11-20.

The primary recommended steps for WTD to apply the above-described methods to develop the short- and long-term capital program budgets for the Climate Change category are:

1. Evaluate WTD's available past or ongoing studies/analyses for climate change and applicable design criteria for projects scopes and costs.

2. Determine where additional studies/analyses may be required to address the likely impacts from climate change. Determine costs for those studies. If studies have not yet been completed discuss with qualified staff/outside engineer(s) likely cost allowances to include for climate change projects. Include projects and costs in the capital forecast for the necessary studies to be completed to inform this category.

3. Determine appropriate climate change-related design criteria to include in future applicable facility and system asset R/R projects. Clearly define scope and cost assumptions. Update design guidance documents as applicable.

4. Confirm applicable facility and system asset R/R projects to include climate change-related design criteria. Update project scopes and costs, if needed. Climate change projects will generally follow schedules for asset management and new infrastructure projects (from the other categories).

5. Use the project scopes, cost data/cost allowances (depending on assumptions), and schedules, to develop expenditures and timeframes for projects implementation. Cost estimates should follow AACE Class 5 or better estimates depending on the number of unknowns and all assumptions clearly defined.

6. The selected budgets to include in the short- and long-term capital forecast should then be balanced with financial and rates implications, capital delivery and staffing considerations, as discussed in the Methodology Development Process.

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Resource Recovery/Operational Enhancements Category

This category includes all projects associated with operational enhancements within the utility. Operational Enhancements could include residual upgrades and energy recovery projects, or those projects could be added in separate categories, as appropriate. It was found there is one primary method for identifying and developing projects in this category for Years 1-5 and Years 6-10, and one primary method for Years 11-20 and Years 20+.

The methods are described in Table 10. For Years 1-5 and Years 6-10, the primary recommended method is similar and described in more detail below:

- Business case evaluations are performed to identify projects to increase efficiencies and reduce costs across the asset classes. Projects can include reduction of power costs, income generation, reduction in O&M costs, etc.

- Schedule projects implementation based on return on investments, the scheduled timing of asset R/R projects associated with the operational enhancements, and available capital funding.

- Determine where additional studies/analyses may be required to address operational enhancements. Determine costs for those studies. If studies have not yet been completed discuss with qualified staff/outside engineer(s) likely cost allowances to include in the capital forecast for operational enhancement projects. Include projects and costs in the capital forecast for the necessary studies to be completed to inform this category.

- Cost estimates should follow AACE Class 5 or better estimates depending on the number of unknowns and all assumptions clearly defined.

For Years 11-20 and Years 20+, there is one primary recommended method as summarized in Table 10:

- Project scopes and cost estimates are generally based on high level planning estimates, historical spending and clearly defined assumptions. Project timing is adjusted based on the best available information for the likely timing of the operational enhancements based on expected return on investments.

- Where studies and costs have not yet been completed, allowance costs for projects based on the best available information should be included in the capital forecast. Assumptions should be clearly defined. Include projects and costs for the necessary studies in the capital forecast to be completed to inform this category.

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Table 10: Resource Recovery/Operational Enhancements Capital Forecasting Methods

Methods	1-5 Years	6-10 Years	11-20 Years	20+ Years
1	• Business case evaluations performed to identify projects to increase efficiencies and reduce costs across the asset classes. • Projects include reduction of power costs, income generation, reduction in O&M costs, etc. • Projects scheduled based on return on investments, scheduled timing of asset R/R projects, and available capital funding. • Costs are generally AACE Class 5 or better.		Project scopes and cost estimates generally based on high level planning allowances or historical spending, and defined assumptions.	Same as Years 11-20.

** For illustration purposes. Operational Enhancements could include residual upgrades and energy recovery projects or those projects could be added in separate categories, as appropriate. Projects and costs definition would be similar to the above categories.*

The primary recommended steps for WTD to apply the above-described methods to develop the short- and long-term capital program budgets for the Operational Enhancements category are:

1. Evaluate WTD's available past or ongoing studies/analyses for projects to increase efficiencies and reduce costs across the asset classes, i.e., power costs, income generation, O&M costs, etc.

2. Develop lists of applicable projects, costs and return on investments. Define cost assumptions and any need for cost refinements. Cost estimates should follow AACE Class 5 or better estimates depending on the number of unknowns and all assumptions clearly defined.

3. Determine where additional studies/analyses may be required. Determine costs for those studies. If studies have not yet been completed discuss with qualified staff/outside engineer(s) likely cost allowances to include for operational enhancement projects. Include projects and costs in the capital forecast for the necessary studies to be completed to inform this category.

4. Develop expenditures and timeframes for projects/additional studies implementation based on return on investments, and scheduled timing of associated asset R/R projects.

5. The selected budgets to include in the short- and long-term capital forecast should then be balanced with financial and rates implications, capital delivery and staffing considerations, as discussed in the Methodology Development Process.

WTDs Current Methodologies Assessment

This section describes WTD's current methodologies for developing short- and long-term capital investment forecasts. The primary differences between WTD's current methods and the recommended methods are noted. Recommended steps for WTD to follow to move towards the recommended methods are also provided. Developing 20 year or longer capital forecast scenarios is expected to take approximately 12–18 months following the recommended process described in the Capital Forecasting Scenarios Example section in this report. WTD should perform a detailed gap analysis to fully understand the appropriate steps and confirm available resources required to implement the long-term plan when verifying this 12 – 18 month timeline.

It should be noted the recommended steps are not necessarily to implement all items listed in each step. For example, where there are gaps in data, some steps recommend identifying projects scopes and budget costs to complete the studies/evaluations to obtain the missing data. This does not mean those studies/evaluations need to be completed to develop the capital forecast scenarios, just that the studies/evaluations scopes and budget costs are included in short- or long-term capital forecasting.

In addition, short- and long-term capital forecasting is an iterative process and a snapshot in time. A 5-, 10-, or 75-year capital program forecast prepared this year may be different when updated the following year because new information is available and data gaps that may exist this year may be partially or completely filled the following year. Those changes, assumptions and uncertainties should be clearly defined in the capital forecast.

Capital forecasting can also not be done without balancing these three elements (as discussed in the Methodology Development Process section):

1. Project selection – Based on system needs and risk-based priorities
2. Financial and rates implications
3. Capital delivery and project staffing considerations

There will likely be more project needs and costs than financial rates and capital delivery capabilities can support in any given year. Therefore, it is essential that multiple capital forecast scenarios balancing these three elements are developed (as discussed in Capital Forecasting Scenarios Example section). Capital forecasts are meant to inform, not dictate, a specific required capital investment and be balanced with all three elements.

WTD completed a self-assessment describing their current methods for determining capital projects for short- and long-term capital forecasts. The details of WTD's self-assessment are included in Table 11 below. The primary differences and steps to implement the recommended methods are also provided in Table 11. The steps to implement the recommended forecasting methods are summarized in Table 11 and refer the reader back to the recommended steps described in detail in each project category in the Capital Program Forecasting Methodologies section.

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Table 11: Capital Forecasting WTD Assessment and Steps to Implement Recommended Methods

WTD Portfolio Categories	WTD Current Forecasting Methods				Difference Between Current and Recommended Method	Steps to Implement Recommended Forecasting Method
	20+ Years	11-20 Years	6-10 years	1-5 Years		
Asset Management – Conveyance	Condition assessment information is available for all conveyance lines and is updated for each segment at least once every 10 years.	Program staff identify assets that are deteriorating faster than expected and adjust the prioritization and timing of projects accordingly. Very little information is documented this early, usually just a title and a rough order of magnitude (ROM) estimate.	Begin developing scope and budget information (ROM/Class 10 estimates) for projects that, based on their condition, will need to be R/R in 6 to 10 years. Projects are selected for inclusion based on scores developed for each asset that consider asset condition and consequence of failure. Projects included in Years 6-10 are high risk assets.	Conceptual projects are defined to the level needed for prioritization and budget approval. Costs are generally based on Class 5 estimates and are subject to change. Prioritization may be repeated if scope/budget changes significantly. Projects are selected for inclusion based on scores developed for each asset that consider asset condition and consequence of failure. Projects included in Years 1-5 are the highest risk assets and may include other coincidental benefits. WTD's Capital Project Formulation Program (Formulation) conducts a business case evaluation for complex, high-risk and/or expected to exceed $5M and be prioritized for funding in years 1-5.	Implement projects to achieve a target annual renewal/ replacement (R/R) rate of at least 1 percent by total system length tailored to the Utility. WTD has developed some of this risk data already. This data is currently used for project selection. WTD should continue to fill in data gaps on the asset level by completing Asset Management Work Plan items related to risk and condition assessment. Costs should be AACE Class 5 or better for Years 1-5, when available. Absent this information, typically a high-level planning cost estimate is developed and assumptions for those costs clearly defined. Historical costs with appropriate contingencies clearly defined based on the types and number of unknowns for Years 6-10 and beyond 10 years.	Detailed implementation steps are provided following Table 3. A summary is provided below. 1. Establish an annual R/R rate tailored to WTD's R/R history and desired level of service. 2. Complete the existing work in the Asset Management Work Plan to develop a condition assessment and documentation program based on industry standards. Develop BRE scores for missing assets using available data on asset condition and consequence of failure factors. 3. Use WTD recent project bid data to support the development of expenditures for assets by class, prioritized by BRE scores, and based on the selected annual R/R rate with appropriate contingencies clearly defined based on the types and number of unknowns. This work can be completed in phases with the available BRE data and then refined and adjusted as additional data is collected. 4. Develop short- and long-term forecast of expenditures based on the selected annual R/R rate, BRE scores (focus on Extreme assets first, then High-risk assets), available cost data and defined assumptions (to address missing data and add cost contingencies for amount of unknowns).
Asset Management – Plants/Facilities	Asset management is a division-wide, continuous process that initiated WTD's first formal Strategic Asset Management Plan (SAMP) in 2005. It includes program improvement recommendations and takes overall direction and guidance from WTD Management.	Update SAMP every 5 years to re-align changing program goals, objectives, and strategies with WTD's mission, vision, and goals.	Update SAMP. Identify assets, process areas and/or facilities that need to be repaired or replaced in the next decade; develop conceptual scopes and Class 10 estimates. Projects are selected for inclusion based on scores developed for projects that consider asset condition, obsolescence, and consequence of failure. Projects included in Years 1-5 are the highest risk assets and may include other coincidental benefits.	Update SAMP. Conceptual projects are defined to the level needed for prioritization and budget approval. Costs are generally based on Class 5 estimates and are subject to change. Prioritization may be repeated if scope/budget changes significantly. Projects are selected for inclusion based on scores developed for projects that consider asset condition, obsolescence, and consequence of failure. Projects included in Years 1-5 are the highest risk assets and may include other coincidental benefits. WTD's Formulation Program conducts a business case evaluation for complex, high-risk and/or expected to exceed $5M and be prioritized for funding in years 1-5.	Establish an existing baseline of assets needing R/R and available costs, available BRE scores (Extreme, High, Medium, Low). Define assumptions for missing data and develop a plan to acquire the missing data. WTD has developed some of this risk data already. This data is currently used for project selection. WTD should continue to fill in data gaps on the asset level by completing Asset Management Work Plan items related to risk and condition assessment. Costs should be AACE Class 5 or better for Years 1-5, when available. Absent this information, typically a high-level planning cost estimate is developed and assumptions for those costs clearly defined. Historical costs with appropriate contingencies clearly defined based on the types and number of unknowns for Years 6-10 and beyond 10 years.	Detailed implementation steps are provided following Table 4. A summary is provided below. 1. Establish an existing baseline of assets needing R/R and available costs, available BRE scores (Extreme, High, Medium, Low). Define assumptions for missing data and develop a plan to acquire the missing data. 2. Continue to implement reliability centered maintenance approaches for all WWTP and Facilities primary assets to inform ongoing asset O&M and triggers for asset replacement. 3. Complete the existing work in the Asset Management Work Plan to develop a condition assessment and documentation program based on industry standards. Develop BRE scores for missing assets using available data on asset condition and consequence of failure factors. This work can be completed in phases with the available BRE data and then refined and adjusted as additional data is collected. 4. Use WTD recent project bid data, available design cost estimates, and regional project cost data to support the development of expenditures for assets by class and prioritized by BRE scores. Also include cost estimates for gathering the missing data. Add appropriate cost contingencies clearly defined based on the types and number of unknowns. 5. Develop short- and long-term forecast of expenditures based on the BRE scores (focus on Extreme assets first, then High-risk assets), desired level of service, available cost data and defined assumptions (to address missing data and add cost contingencies for amount of unknowns).
Regulatory Consent Decree/LTCP	**Combined Sewer Overflows (CSO)** Required by Ecology to reduce the frequency of combined sewer overflows to one event per year on a 20-yr average at each CSO location. The CSO Long-Term Control Plan is updated every 5 years and describes how WTD will achieve and maintain CSO control at every CSO location. **Sediment Management**	For CSO control, update CSO Long-Term Control Plan and launch any projects as required. For sediment management, update the Sediment Management Plan and launch any projects as required.	For CSO control, update CSO Long-Term Control Projects and launch any projects as required by the applicable milestone dates. For sediment management, update the Sediment Management Plan and launch any projects as required.	For CSO control, update CSO Long-Term Control Projects and launch any projects as required by the applicable milestone dates. Several CSO control projects are planned to launch within the next 5 years per regulatory requirements. CSO projects are defined through planning options analysis and problem definition. Budgets are generally based on Class 5 estimates, and subject to change. For sediment management, launch any projects as required.	WTD's current method appears similar to the recommended method. Some differences may include: • Confirming any regulatory milestone dates that must be met over the next 1-5 years and future years beyond Year 5 upon final approval of revised Consent Decree. • Cost estimates should be consistent with the expected implementation year. For example, for projects to be implemented in Years 1-5, cost estimates should generally be AACE Class 5 estimates or better. • For projects that may be required after Year 5, include projects and costs based on the level of information	Detailed implementation steps are provided following Table 5. A summary is provided below. 1. Evaluate WTD's applicable LTCP projects, costs, and schedule data. Define cost assumptions and any need for cost refinements consistent with the AACE guidelines. 2. Determine regulatory obligations/milestone schedule dates and community priorities for any required implementation dates for select projects. 3. If plan(s) need to be updated or developed and will be required in the next 5 years, include the appropriate cost budget line item(s) for the plan development in Years 1-5. Otherwise include plan update costs in the years after Year 5, as applicable.

WTD Portfolio Categories	WTD Current Forecasting Methods				Difference Between Current and Recommended Method	Steps to Implement Recommended Forecasting Method
	20+ Years	11-20 Years	6-10 years	1-5 Years		
	WTD updates its sediment management plan as required by Ecology.				available. Costs can be planning level allowances if the projects have not been definitively determined yet.	4. Use the project scopes, cost data/cost allowances (depending on assumptions), and regulatory milestone schedules to develop expenditures and timeframes for LTCP implementation.
Growth/Capacity Improvements	**Separated Conveyance and Treatment Process Capacity:** Long-term plans [i.e., Conveyance System Improvement (CSI) Program Update; Long-term Treatment Plan (LTTP)] identify long-term capacity needs and conceptual projects over a 40- to 50-year planning horizon. These plans provide a prioritized list of projects to improve capacity in the separated conveyance system. Project scope/budget are conceptual, with ROM budgets, and subject to change. **Separated Conveyance Capacity:** CSI Plan is updated every 10 years and projects reprioritized based on updated flow monitoring, updated planning assumptions, and regional needs assessment. **Treatment Process Capacity:** This is WTD's first iteration of the LTTP and is anticipated to be updated on a similar timeline to the CSI Plan, with updated assumptions and project reprioritization every 10 years.	Further refine/update plans based on updated information. Project scopes and budget are conceptual, and subject to change. Some plans may develop Class 10 estimates for specific projects (see * note in next column) and are prioritized based on known information.	Conceptual projects are defined to the level needed for prioritization and budget approval. Costs are generally based on Class 5 estimates and are subject to change. Prioritization may be repeated if scope/budget changes significantly. *Large or complex projects that may take 8-10+ years to design and construct may go through planning alternative analysis or problem definition 10+ years prior to project funding. Less complex or smaller projects are more likely to go through planning alternative analysis or problem definition within 2-5 years prior to project funding. Projects are selected for inclusion based on remaining capacity as determined through monitoring and/or modeling efforts and coincidental benefits such as asset condition.	Conceptual projects are defined to the level needed for prioritization and budget approval. Costs are generally based on Class 5 estimates and are subject to change. Prioritization may be repeated if scope/budget changes significantly. Projects are selected for inclusion based on remaining capacity as determined through monitoring and/or modeling efforts and coincidental benefits such as asset condition. If needed, WTD's Formulation Program conducts a business case evaluation for complex, high-risk and/or expected to exceed $5M and be prioritized for funding in years 1-5. Many of WTD's planning programs produce Class 5 estimates as part of their plan so Formulation isn't usually required but may be needed if other programs are resource limited.	WTD's current method is similar to the recommended method. WTD will confirm growth assumptions are reviewed and adjusted annually to implement projects "just in time", where applicable. WTD currently performs flow monitoring in portions of the service area to confirm actual flows and schedule the completion of growth-related capacity improvement projects to meet actual flow data versus prior assumptions. Include project budget cost(s) to provide for annual growth projects updates, as needed. Project cost estimates should be defined with appropriate contingencies consistent with the developed plan, level of unknowns, and the implementation years consistent with the AACE guidelines.	Detailed implementation steps are provided following Table 6. A summary is provided below. 1. Evaluate WTD's applicable growth and system build-out master plans. Develop project lists, costs, and schedule data for each forecasting time period (i.e., Years 1-5, 6-10, 11-20, and 20+). Define cost assumptions and any need for cost refinements consistent with the AACE guidelines. 2. Determine any adjustments based on new information and community priorities. Determine need for recent flow monitoring to confirm prior estimates of growth and capacity needs. Include budget costs for flow monitoring as applicable. 3. Determine need for new growth evaluations or updates to master plans and likely costs for those study projects. Include those update projects and budget costs in Years 1-5. 4. Use the project scopes, cost data/cost allowances (depending on assumptions), and schedules, to develop expenditures and timeframes for growth projects implementation.
Regulatory New Regulations/ Emerging Contaminants	**New, Existing Regulations** Studies to determine technologies and estimate conceptual costs needed to achieve new or existing regulations. Conceptual projects are not defined but may include a range of possibilities to achieve the regulation's objective. **Potential Future Regulations** Monitor state and direction of wastewater industry and federal, state, and local regulatory environment for emerging contaminants, potential future regulations. Monitor state of technology for removal of emerging contaminants and potential for source or upstream control. Conceptual projects are not defined until the regulation is developed and close to implementation.	Initiate studies to determine potential removal technologies and estimate conceptual costs. Conduct technology pilots as/if needed to test potential technologies.	Potential regulations are likely shifting to become New and Existing; continue to monitor regulatory environment and using studies and pilots to determine technologies that will meet regulatory objectives. Depending on the anticipated cost and complexity of the potential projects, and any compliance timelines within recently implemented regulatory permits, further scope definition is done via planning alternative analysis and/or problem definition. Project scopes and budgets are conceptual, with Class 5 to Class 10 estimates, and subject to change. Projects are selected for inclusion if they are the result of an issued regulatory order.	Projects are further defined through planning alternative analysis and/or problem definition; consider interdependencies with projects in other categories. Conceptual project scopes are further defined and budgets are generally based on Class 5 estimates, and subject to change. Any interim regulatory requirements (for example, optimization to achieve limited removal or stay below interim limits with existing infrastructure) is implemented with project scope and costs generally at Class 5 estimates, and subject to change. Projects are selected for inclusion if they are the result of an issued regulatory order.	WTD's current method appears similar to the recommended method. Some differences may include: • Confirming any regulatory milestone dates that must be met over the next 1-5 years and future years beyond Year 5. • Defining cost assumptions and developing cost estimates consistent with the expected implementation year. For example, for projects to be implemented in Years 1-5, cost estimates should generally be AACE Class 5 estimates or better. • If the new regulation(s) is likely to be required in the next 10 years, cost estimates should follow AACE Class 5 estimates depending on the number of unknowns and all assumptions clearly defined. • Where studies and costs have not yet been completed, allowance costs based on the best available information should be included in the capital forecast. Assumptions should be clearly defined. Include projects and costs in the budget in the appropriate years for the necessary studies to be completed to inform this category.	Detailed implementation steps are provided following Table 8. A summary is provided below. 1. Confirm likely timeframes for the new regulations and emerging contaminants and clearly define those assumptions. 2. Evaluate WTD's available past or ongoing studies/analyses for needed projects scopes and costs. Define cost assumptions and any need for cost refinements. 3. Determine where additional studies/analyses may be required to determine project scopes and costs. Include projects and costs for the necessary studies and allowance costs for potential future projects to be completed in Years 1-5 or outer years, as applicable. 4. Cost estimates should follow AACE Class 5 estimates or better depending on the number of unknowns and all assumptions clearly defined. Complete based on available information. Note where cost refinements are needed and expected completion dates for the updated cost estimates. 5. Use the project scopes, cost data/cost allowances (depending on assumptions), and schedules, to develop expenditures and timeframes for projects implementation.

WTD Portfolio Categories	WTD Current Forecasting Methods				Difference Between Current and Recommended Method	Steps to Implement Recommended Forecasting Method
	20+ Years	11-20 Years	6-10 years	1-5 Years		
Resiliency/Climate Change	Studies to determine technologies and estimate conceptual costs needed to address likely climate change impacts. Conceptual projects are not defined but may include a range of possibilities to achieve the objective. WTD is implementing a resiliency plan that will be updated on a routine basis.	Initiate studies to determine potential projects and estimate conceptual costs. Conduct technology pilots as/if needed to test potential technologies.	Continue to monitor climate change estimates and likely impacts. Use studies to determine potential projects that will meet climate impact objectives. Depending on the anticipated cost and complexity of the potential projects, further scope definition is done via planning alternative analysis and/or problem definition. Project scopes and budgets are conceptual, with Class 5 to Class 10 estimates, and subject to change. Projected spending is capped based on an average of the previous 5 years adjusted for inflation. For seismic resiliency, projects are selected for inclusion based on scoring that incorporates life safety, system criticality, impacts to public health, level of redundancy, and level of asset degradation.	Projects are further defined through planning alternative analysis and/or problem definition; consider interdependencies with projects in other categories. Conceptual project scopes are further defined, and budgets are generally based on Class 5 estimates, and subject to change. Where climate change impacts and associated design criteria can be incorporated into current projects that work is completed. Projected spending is capped based on a percentage of the overall capital program as directed by leadership. For seismic resiliency, projects are selected for inclusion based on scoring that incorporates life safety, system criticality, impacts to public health, level of redundancy, and level of asset degradation. Inclusion of climate change projects is still to be determined based on upcoming Climate Adaptation Planning efforts. If needed, WTD's Formulation Program conducts a business case evaluation for complex, high-risk and/or expected to exceed $5M and be prioritized for funding in years 1-5. Many of WTD's planning programs produce Class 5 estimates as part of their plan so Formulation isn't usually required but may be needed if other programs are resource limited.	WTD's current method appears similar to the recommended method. Some differences may include: • Establish Climate Adaptation planning program. • Determine where additional studies/analyses may be required to address the likely impacts from climate change. If studies have not yet been completed discuss with qualified staff/outside engineer(s) likely cost allowances to include for climate change projects. Include projects and costs in the capital forecast for the necessary studies to be completed to inform this category. • Determine appropriate climate change-related design criteria to include in future applicable facility and system asset R/R projects. Clearly define scope and cost assumptions. Update design guidance documents as applicable.	Detailed implementation steps are provided following Table 9. A summary is provided below. 1. Establish Climate Adaptation planning program. 2. Evaluate WTD's available past or ongoing studies/analyses for climate change and applicable design criteria for projects scopes and costs. 3. Determine where additional studies/analyses may be required to address the likely impacts from climate change. If studies have not yet been completed discuss with qualified staff/outside engineer(s) likely cost allowances to include for climate change projects. Include projects and costs in the budget for the necessary studies to be completed to inform this category. 4. Determine appropriate climate change-related design criteria to include in future applicable facility and system asset R/R projects. 5. Confirm applicable facility and system asset R/R projects to include climate change-related design criteria. Update project scopes and costs, if needed. 6. Use the project scopes, cost data/cost allowances (depending on assumptions), and schedules, to develop expenditures and timeframes for projects implementation. Cost estimates should follow AACE Class 5 or better estimates depending on the number of unknowns and all assumptions clearly defined.
Resource/Recovery/ Operational Enhancements **Resource Recovery -** recycled water, biosolids, energy, sustainability, technology assessment	Technology Assessment and Innovation Program (TAIP) identifies innovative, sustainable and resilient ways to improve treatment processes and system reliability to increase efficiency and reduce WTD's environmental footprint. At this stage, TAIP identifies and investigates opportunities that are consistent with WTD's vision, mission, and goals. WTD is creating strategic plans (Biosolids, Recycled Water, Energy, Sustainability, Technology Assessment). All plans are updated every 5 to 10 years. Existing plans, like the Strategic Climate Action Plan (SCAP), are updated every 5 years.	Update TAIP to re-align changing program goals, objectives, and strategies with WTD's mission, vision, and goals. Further refine/update plans based on updated information. Project scopes and budget are conceptual, and subject to change with ROM costs estimated for large, significant projects.	Begin developing scope and budget information (ROM/Class 10 estimates) for projects that are desired in 6-10 years. Further refine/update plans based on updated information. Project scopes and budget are conceptual, and subject to change with ROM costs/Class 10 estimates for large, significant projects. Project prioritization is done when project scope and objective are more definite. Plans like the SCAP contain longer term commitments that drive project development. The SCAP is updated with new specific priority actions every 5 years and the next update is in 2025. Projected spending is capped based on an average of the previous 5 years adjusted for inflation. Projects are included based on relative criteria scoring in the respective categories.	Conceptual projects are defined to the level needed for prioritization and budget approval. Costs are generally based on Class 5 estimates and are subject to change. Prioritization may be repeated if scope/budget changes significantly. Projected spending is capped based on a percentage of the overall capital program as directed by leadership. Projects are included based on relative criteria scoring in the respective categories. If needed, WTD's Formulation Program conducts a business case evaluation for complex, high-risk and/or expected to exceed $5M and be prioritized for funding in years 1-5. Many of WTD's planning programs produce Class 5 estimates as part of their plan so Formulation isn't usually required but may be needed if other programs are resource limited.	WTD's current method appears similar to the recommended method. Some differences may include: • Determine where additional studies/analyses may be required to address operational enhancements. If studies have not yet been completed discuss with qualified staff/outside engineer(s) likely cost allowances to include in the budget for projects. Include projects and costs in the budget for the necessary studies to be completed to inform this category. • Clearly define scope and cost assumptions. Cost estimates should follow AACE Class 5 estimates or better depending on the number of unknowns and all assumptions clearly defined.	Detailed implementation steps are provided following Table 10. A summary is provided below. 1. Evaluate WTD's available past or ongoing studies/analyses for projects to increase efficiencies and reduce costs across the asset classes. 2. Develop lists of applicable projects, costs and return on investments. Define cost assumptions and any need for cost refinements. Cost estimates should follow AACE Class 5 estimates or better depending on the number of unknowns and all assumptions clearly defined. 3. Determine where additional studies/analyses may be required. If studies have not yet been completed discuss with qualified staff/outside engineer(s) likely cost allowances to include for operational enhancement projects. Include projects and costs in the budget for the necessary studies to be completed to inform this category. 4. Develop expenditures and timeframes for projects/additional studies implementation based on return on investments, and scheduled timing of associated asset R/R projects.

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Table 11 General Notes:

- WTD's official rate and financial forecasts cover a 10-year period based on capital spending estimates as described in Table 11 above. However, some internal rate analyses require capital spending projections that go beyond 10 years (e.g., CSO completion scenarios). For these types of analyses, WTD assumes each CIP portfolio category maintains a level of spending based on its 5-year historical average, escalated to the year of spending.

- WTD currently lacks a holistic, comprehensive plan like the Regional Wastewater Services Plan (RWSP), last updated in 2017, or the now paused Clean Water Plan that was intended to replace the RWSP. The detailed plans that made up the RWSP are still revised, and new ones created as needed. Those plans are what is summarized above. More information on all of WTD's system plans can be found here: System planning – King County, Washington;[1] some of the plans noted above are being updated or created and have not yet been published publicly.

- Section 110 Proviso P1 of the 2015/2016 Biennial Budget Ordinance 17941 required establishment of a cost estimating Technical Working Group (TWG). As part of its work plan, the TWG performed a current-state analysis of the processes that WTD used to evaluate projects as they move through time in the table described above. That group found that problems and potential needs do not have enough information to be described as formal projects. The TWG recommended that WTD adopt a Project Formulation Program to develop conceptual needs into recommended projects and that program was initiated in 2017. WTD's Capital Project Formulation Program (aka Formulation) confirms expected benefits and conceptual scope of potential projects in a business case development exercise that also delivers Class 5 estimates. Due to limited resources, Formulation focuses on potential projects that are complex, high-risk and/or are expected to cost more than $5M and be prioritized in a near-term budget (years 1-5). The program primarily estimates projects in WTD's Asset Management – Plants, Asset Management – Conveyance, Operational Enhancements, Resource Recovery and Capacity Improvement portfolio categories.

[1] https://kingcounty.gov/en/legacy/depts/dnrp/wtd/system-planning