Title: Asset Management Strategy for Scottish Water's Treated Water Storage Tanks: A Cost-Effective Intervention Model

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1. **Introduction**

1.1 Business Context

Scottish Water is trusty for delivering clean and safe drinking water to millions of customers across Scotland. Its asset portfolio includes over 2,500 Treated Water Storage Tanks, which are important components in the dispersion network, storing treated water before it is distributed to consumers.

These tanks were exposed to single worsening factors such as corporeal ageing, biology stress, and reflexive wear as well as making them able to bankruptcy over time. The effective direction of these assets is based on checking the continued appendage of Scotland's water append system.

With increasing regard for water, growing concerns about climate change, and the need for cost efficiency,' Scottish Water must have adopted a property and live asset direction strategy. The contravention is balancing the costs of intercession and exchange with minimizing the risk of bankruptcy and ensuring the semipermanent dependableness of the water append infrastructure.

This account uses the Asset Stewardship Model ASM to reckon asset execution and grow a cost-efficient intercession schema that guided Scottish Water in optimizing its direction of treated water entreat tanks over the next 60 years.

1.2 Objectives

The base objectives of this account are:

- To grow an efficient intercession schema that balances redevelopment and exchange of treated water entreat tanks.
- To bar the touch of clime exchange on the worsening of these assets and aim backlog interventions to palliate accelerated deterioration.
- To integrate these insights into Scottish Water's asset direction framework as well as enabling the secondary to optimize resourcefulness allocation, budget planning as well as and semipermanent sustainability.

1.3 Scope

The scope of this account focuses on the Treated Water Storage Tanks under the direction of Scottish Water. It uses the Asset Stewardship Model ASM, which incorporates prognosticative modelling techniques, to bar the delineation of assets and determine the optimum intercession strategies.

The account also examines the fiscal implications of clear-cut strategies, including active versus active approaches to asset management, and evaluates how clime exchange may have impacted the boilersuit execution and seniority of the assets.

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2. Methodology

2.1 Asset Stewardship Model (ASM)

The Asset Stewardship Model ASM is a Markov Chain-based tool designed to prognosticate the rising to delineate of assets over time. This model incorporates skilful judgments and past data to delineate the probabilities of an asset transitioning from one delineate state to another.

For treated water entreat tanks, these delineate states range from Grade 1 excellent condition to Grade 5 failure or end-of-life condition.

Key components of the ASM include:

- **Transition Probabilities**: The likelihood that an asset will deteriorate to a different condition grade over a given time period.
- **Maintenance Costs**: Costs associated with refurbishment, repair, and replacement for each condition grade.
- **Asset Life Cycle**: The model forecasts the asset's remaining life span and calculates the financial implications of various interventions.

The ASM serves as the backbone of Scottish Water's asset management strategy, helping the company plan for the future by forecasting asset performance and identifying the most cost-effective maintenance strategies.

2.2 Datasets and Assumptions

The dataset used for this analysis consists of 2,500 treated water storage tanks managed by Scottish Water. Key data includes:

- **Asset Age**: The age of each tank, which directly impacts the rate of deterioration.
- **Material Type**: The composition of the tanks, such as concrete or steel, influences how they degrade over time.
- **Historical Maintenance Data**: Information on previous refurbishments, repairs, and replacements, which allows the model to account for past interventions.

Assumptions for the analysis include:

- **Asset Grouping**: The tanks are grouped into 38 clusters based on similar deterioration characteristics.
- **Climate Change Impact**: The model simulates the effects of climate change on asset performance by increasing the deterioration rate in certain scenarios, such as more frequent flooding or extreme weather conditions.

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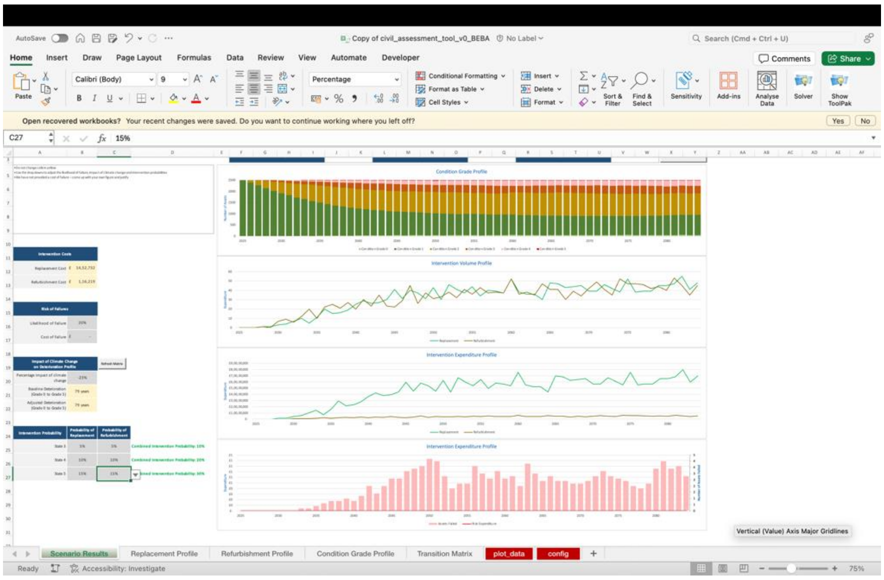
3. Analysis and Findings



3.1 Intervention Costs

- **Replacement Cost**: £1,452,732 – This cost reflects the total projected disbursement for replacing assets when they reach the end of their utile life or an important worsening stage likely Condition Grade 5.

- **Refurbishment Cost**: £116,219 – This is the estimated cost of refurbishing assets to extend their life or improve their condition without a full replacement.

These costs are essential for scenario analysis to compare the financial impacts of replacement versus refurbishment over the 60-year planning horizon.

3.2 Risk of Failures

- **Likelihood of Failure**: 20% – Indicates a calculated probability of asset failure, likely based on current deterioration trends or condition grades.
- **Cost of Failure**: This quantifies the fiscal touch if a bankruptcy occurred, such as remediable costs,' effectiveness redevelopment disruptions, or regulative penalties not specified in the dataset but important for rising planning.

Assessing the risk of failure is critical to ensure interventions are timed to minimize unexpected failures that could lead to high costs and service disruptions.

3.3 Impact of Climate Change on Deterioration Profile

- **Percentage Impact of Climate Change**: 23% – This suggests that climate change is expected to accelerate the deterioration rate by 23%.
- **Deterioration Baseline**: 79 years for the asset to degrade from Grade 0 (new) to Grade 5 (critical deterioration).
- **Adjusted Deterioration**: With clime impact, this abjection Ameline might have shortened, though it isn’t expressly shown in this dent.

This clime fitting is a quantitative brainstorm for semipermanent planning, highlighting the need to describe for increased redevelopment or exchange frequency under worsening clime conditions.

3.4 Condition Grade Profile (Top Chart)

This bar chart illustrates the distribution of assets across different condition grades (0 to 5) over time from 2025 to 2084.

- **Green Bars (Grade 0 to 2)**: Assets in good to moderate condition, indicating limited or no intervention required.
- **Yellow/Orange Bars (Grade 3 and 4)**: Assets showing wear and deterioration that may require refurbishment.
- **Red Bars (Grade 5)**: Critically deteriorated assets needing immediate replacement.

This profile helps visualize how asset conditions evolve over time, providing insight into when clusters of assets may require refurbishment or replacement.

3.5 Intervention Volume Profile (Second Chart)

This line chart shows the book of interventions replacement and refurbishment required over time.

- Peaks in the chart cleverly correlated with planned intercession cycles, indicating periods of high execution to hold or advance assets.

Understanding intercession volumes helps with budgeting and custody planning to deal with peaks in asset maintenance.

3.6 Intervention Expenditure Profile (Third and Fourth Charts)

These line and bar charts illustrate the expenditure on interventions over time.

- **Replacement Expenditure (Green Line/Bar)** vs. **Refurbishment Expenditure (Brown Line/Bar):** These allow an optic equivalence of costs, with the green replacement ordinarily being high due to the all-encompassing unreliable of replacements compared to refurbishments. Tracking intervention expenditures helps in forecasting future budget requirements and assessing the financial viability of different maintenance strategies.

3.7 Combined Intervention Probability (Table in Bottom Left)

This table outlines probabilities for both replacement and refurbishment, segmented by asset state.

- **State 0**: Low probability of intervention (5%), as these assets are in the best condition.
- **State 2 and State 3**: Higher combined probabilities (15% and 30%), indicating a greater likelihood of intervention as assets deteriorate.

These probabilities help to plan when interventions will be most necessary, focusing resources on assets in moderate to severe condition.

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4. **Recommendations**

4.1 Optimal Intervention Strategy

- **Refurbishment at Grade 4**: Begin refurbishing tanks when they reach Grade 4 to preserve them from deteriorated hike and reaching Grade 5. This admittance balances the need for cost-efficient tending to prolong asset life.

- **Replacement at Grade 5**: Schedule replacements only for tanks that have reached Grade 5. This ensures that new tanks was installed when redevelopment is no thirster viable, optimizing both the fiscal and life outcomes.

4.2 Climate-Resilient Maintenance

To palliate the impacts of climate change, Scottish Water should have adopted climate-resilient materials for the building and tending of its water entreat tanks. These materials were designed to dare immoderate bold conditions as well as reduce the likeliness of accelerated deterioration.

Additionally, advanced coatings should be used to protect tanks from erosion and water ingress, which could hike and cheapen the morphologic unity of the tanks.

4.3 Preventive Maintenance Program

A preventive maintenance program should be implemented to reduce the risk of catastrophic failures. This program would involve:

- **Routine inspections**: Regular assessments of the tanks' condition to identify potential issues before they become critical.
- **Minor repairs**: Performing small repairs and interventions to extend the life of the tanks and reduce the likelihood of expensive, large-scale interventions.

4.4 Integration with Business Processes

The outputs of the ASM model should be integrated into Scottish Water's asset management processes. By using the model's forecasts to inform budgeting and decision-making, Scottish Water can:

- Allocate resources more efficiently.
- Reduce unplanned downtime and service disruptions.
- Incorporate data-driven decision-making into its long-term asset management planning.

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5. **Conclusion** :
    - This account had developed an all-encompassing intercession schema for managing Scottish Water's treated water entreat tanks. By utilizing the Asset Stewardship Model ASM, we have shown that an active intercession schema that balances redevelopment and exchange can be both cost-efficient and operationally sustainable.
    - Additionally, by integrating clime resiliency into asset direction planning, Scottish Water could palliate the unfavourable effects of clime

exchange on its asset portfolio. This admittance ensures the semipermanent viability of the water append basis and supports Scottish Water's commission to allow high-quality water services to its customers crossway Scotland.

6. References:

- Scottish Water. (2023). *Asset Management Strategy: Optimizing the Future of Water and Wastewater Services*. Scottish Water.
  Available at: https://www.scottishwater.co.uk/
- Water UK. (2019). *Water Industry Asset Management and Resilience*. Water UK.
  Available at: https://www.water.org.uk/
- GHD Group. (2017). *Water Storage Tank Asset Management and Maintenance Planning: A Guide for Asset Managers*. GHD Group
- Woods, T., & Stevens, J. (2019). *The Impact of Climate Change on Infrastructure: Strategies for Asset Management*. Elsevier.
- Sullivan, K. & Tew, M. (2018). *Asset Management for Water and Wastewater Utilities*. CRC Press.