Wastewater improvement affordability

Implications of implementation timeframes for affordability

Greater Wellington Regional Council

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→ **The Power of Commitment**

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The National Policy Statement for Freshwater Management 2020 (NPS-FM) requires that water quality targets are set for *E.coli* one band above the current state. *E.coli* is one of the key contaminants in wastewater.

Greater Wellington Regional Council (GWRC) has previously consulted with the community and mana whenua on the values and desired outcomes for water quality. These engagements, known as Whaitua processes, set target attribute states for *E.coli* and a timeframe for achievement.

The question now turns to *affordability* of the target attribute states. While the report also quantifies some of the benefits of the proposed improvements and funding tools that may be applied to pay for the improvements, the focus is affordability. Consequently, the report sets out different ways of measuring the affordability of the proposed changes against estimates of the costs to improve the wastewater network to reduce *E.coli* levels in water bodies across two whaitua – Whaitua Te Whanganui-a-Tara and Te Awarua-o-Porirua Whaitua.

It is important to note that in addition to the costs discussed here, there will be significant additional spending required to achieve the desired stormwater outcomes. In some cases this will more than double the costs of water improvements covered in this report.

The key points from this report are:

- ***The estimated cost of achieving the E.coli target states is $344-419 million for Te Awarua-o-Porirua and $2.50-3.10 billion for Te Whanganui-a-Tara*** in cashflow terms expressed in today's dollars, and subject to the assumptions and caveats set out in this report.
- ***There are seemingly no easy fixes or "quick wins" that may allow the majority of the E.coli improvements to occur quickly at low cost***. Water specialists we spoke to identified the condition and capacity of the bulk network; and cross-connections where private property owners have their wastewater connected into the stormwater network as the two biggest problems. The former is expensive to fix, while the latter is particularly difficult to identify and therefore time-consuming and also expensive.
- ***Implementing the wastewater improvements within the ambitious 20-year timeframe will increase costs for ratepayers significantly***. While the final mechanism for funding the wastewater improvements has not been decided, if the costs were seen as an add-on to existing rates bills, property rates would need to rise by a sustained 12% to 37% to accommodate the wastewater improvements over a 20-year timeframe, depending on the Council area and whether a low or high estimate of costs is adopted.
- If wastewater improvements were to be funded by general or targeted rates, or through water charges by a new water entity, in all council areas, based on the cost estimates in this report, total rates or equivalent burden would remain below the 5% of household income threshold recommended by the Shand Inquiry.[1] However, given the likelihood that cost estimates in this report are at the lower end of the true cost of achieving the target states for *E.coli*, given this study does not consider costs associated with achieving other target attributes, and given the large rates increases already required in many council jurisdictions to deal with other costs, the 20-year implementation timeframe taken with these other factors ***may result in rates and water charges breaching the 5% threshold***.
- ***Benefits of the proposed reduction in E.coli levels are significant***. Public benefits include use values; non-use values; the cultural value to mana whenua of cleaner water due to less *E.coli* contamination; and reducing reputational damage from the region's wastewater challenges, which may already be affecting visitation and spending in the region. International studies suggest that improving *E.coli* levels by two-thirds to three-quarters (as proposed) could add large private benefits in the form of higher property values to properties located within 500 metres of a cleaner water body.
- ***Most of the costs of the wastewater improvements are likely to be funded by ratepayers more broadly*** although new development will need to make a significant contribution. This fact limits the number of appropriate tools. Most of the costs will likely need to be funded via targeted or general rates, water charges if under the four-entity model, and/or direct investment by central government.

[1] Shand, D et al. (2007). *Funding Local Government: Report of the Local Government Rates Inquiry*.

2. Introduction and purpose of the report

The National Policy Statement for Freshwater Management 2020 (NPS-FM) requires that water quality targets are set for *E.coli* one band above the current state. *E.coli* is one of the key contaminants in wastewater to be managed.

Greater Wellington Regional Council (GWRC) has previously consulted with the community and mana whenua on the values and desired outcomes for water quality. These engagements, known as Whaitua processes, set target attribute states for *E.coli* and a timeframe for achievement.

Previous work has been done on the aggregate costs of infrastructure to enable the proposed improvements across the two Whaitua of Te Awarua-o-Porirua (Porirua plus a few northern suburbs of Wellington City) and Te Whanganui-a-Tara (Upper Hutt, Hutt City and most of Wellington City). That work did not focus on ***where*** the cost would fall or the ***affordability*** of the upgrades that would be required to meet the targets.

GWRC engaged GHD to consider the following questions:

1. What is the total cost, broken down for each whaitua, territorial authority (City or District Council jurisdiction) and household within each whaitua to achieve the *E.coli* target attribute state across different timeframes?
2. What is the affordability impact of different levels of improvement and different timeframes of implementation?
3. Can the benefits of the improvements be economically quantified or proxied to demonstrate more clearly the benefits to decision-makers and residents?
4. Are there elements of the improvements that can be implemented earlier on that achieve a greater share of the benefits at a lower cost ("quick wins")?
5. How might these costs be funded? i.e. who should bear the costs directly, and what tools could be applied to collect the revenue needed for the improvements?[2]

2.1 Scope of the work: wastewater

It is important to note that this report is focused on *E.coli* and therefore on wastewater improvements, which would form the bulk of the improvements that would improve *E.coli* levels. Improvements to the stormwater network, which could also have some benefits for *E.coli* levels, are not within the scope of this work.

As a consequence, the work at hand should be seen as part of a suite of improvements (and not necessarily even the most costly improvements) required to overcome the other water challenges of quantity passing through the stormwater system in severe rain events, or quality of water as it relates to chemicals and sediments that can enter the stormwater system.

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[2] As highlighted earlier, while this report provides estimates of costs and some benefits, it is not a cost-benefit analysis. Its primary focus is on the affordability of the proposed wastewater improvements, and therefore uses comparisons of costings in today's unescalated and undiscounted dollars against today's household incomes and rates bills.

3. Costs of the improvements

Two previous studies[3],[4] for GWRC have examined the potential costs of stormwater and wastewater improvements. Each of these studies provided lower and upper estimates of the costs of improving the wastewater network. We undertook a process of updating the original figures to today's dollars and estimating the costs in aggregate for the two whaitua, and the implication for the cost per household. In summary:

- The studies demonstrated that the cost of wastewater improvements is high although this may be less than half the costs involved in the combined stormwater and wastewater improvements in some areas.
- Headline cost estimates for improving the wastewater network alone, and thus reducing *E.coli* levels in water bodies, is $344-419 million for Te Awarua-o-Porirua and $2.50-3.10 billion for Te Whanganui-a-Tara in unescalated, undiscounted terms.
- Dividing these costs by the number of households in each whaitua today suggests a per-existing-household cost of between $10,350 and $22,900 in undiscounted, unescalated terms.
- A number of caveats and assumptions accompany these estimates and should be kept in mind when interpreting the results.

3.1 Reconciling the original cost estimates

We did not re-interrogate the cost data in the original reports for accuracy. However, we did work with the report authors to understand some of the technical details behind their figures so as to present the total cost of the scenarios in each report in common units of measurement (2022 dollars). This required reconciliation between approaches based on the real discount rates used, assumed lifecycle of the assets, and checking with the authors on assumptions about ongoing maintenance. Report authors were at pains to point out that the initial estimates they used were headline figures based on the interventions developed by a wider team. For wastewater, there is an information deficit with regard to how much maintenance and renewal costs are likely to be. It is possible that maintenance costs are under-estimated.

Having removed all discounting, we updated the costs in each report to December 2022 dollars so that the costs closely resemble current values of a dollar. It is important to note the updated dollar values do not reflect cost escalation or change of scope within the construction and maintenance costs, but simply general inflation.

We also cross-checked these estimates with Wellington Water data to ensure that the figures we used are of the right magnitude, although not identical.

3.2 Headline cost estimates

Low and high estimates are provided in the original cost estimation reports for each whaitua and constituent council area.[5]

The resultant, nominal (in today's dollars, undiscounted) costs of stormwater and wastewater improvements by whaitua are consequently estimated as:

- Te Awarua-o-Porirua: $344-419 million
- Te Whanganui-a-tara: $2.50-3.10 billion.

[3]Blyth, J. M. 2020. Whaitua te Whanganui-a-Tara - An overview of the Wellington City, Hutt Valley and Wainuiomata Wastewater and Stormwater networks and considerations of scenarios that were assessed to improve water quality**.** Prepared for Greater Wellington Regional Council Whaitua Committee.

[4] Ira, S J T. 2018. The Cost Aggregation Model and Indicative Life Cycle Cost Estimates for Various Intervention Scenarios for the Te Awarua-o-Porirua Whaitua Collaborative Modelling Project. Report prepared for Greater Wellington Regional Council as part of the Te Awarua-o-Porirua Collaborative Modelling Project.

[5] It is important to note that the assumed actions undertaken to improve wastewater in this report align with those in the original two reports by Blyth and Ira. Any more stringent or rapid changes proposed by GWRC would lead to higher or more pressing costs, while any reduced programme of improvements would lead to lower estimates of costs.

3.2.1 Caveats in interpreting these results

Presenting these figures as a simple cost/person or cost/household is not particularly insightful for at least two reasons. First, a discussion of who will pay and what funding tool will be used is highly material. For instance, if it was decided that the entire infrastructure costs should be covered by growth or new development (an extreme end of the spectrum), the direct cost to the existing ratepayer would be zero. At the other extreme, if the full costs of this approach were funded equally by ratepayers, the cost would be very high. Second, there are a number of reasons to conclude that the costs given here may be significantly lower than the true cost of achieving the outcomes covered in the original reports. These reasons include:

- While the reports both covered stormwater and wastewater improvements, the focus of the current work is on wastewater improvements because of the focus on improving *E.coli* levels. ***Only the work previously completed on wastewater is therefore covered in the figures in this report***.[6] The full costs of achieving all the water improvement outcomes (both wastewater and stormwater related) will therefore be significantly higher than reported here, and in some cases more than double.
- Current projections for growth in the number of households in the whaitua are significantly higher than the projections originally used in the modelling. The implications for the estimates below are that these are likely to ***low estimates*** as more households will create more demand for wastewater capacity.
- Wastewater maintenance costs are notoriously hard to estimate, as highlighted above. Some estimates of these maintenance costs have been included for Te Awarua-o-Porirua, but the report author believes the true cost may be higher. ***No estimate of maintenance costs has been included in the Te Whanganui-a-Tara figures***.
- ***Cross connections***, which occur when private wastewater connections are made into the stormwater network rather than the wastewater network, are a cost estimated here, but there is in fact ***little certainty about how big this problem is***, and the costs would be borne by each individual property where this is shown to be a problem. Unfortunately, detecting which properties have this incorrect connection is difficult and expensive.

Keeping these caveats in mind, a sense of scale of the huge changes required can nevertheless be seen dividing the estimated cost of the improvements in each whaitua by the current estimated number of households of each whaitua:

- Te Awarua-o-Porirua: $10,350-$12,600 per household
- Te Whanganui-a-Tara: $18,500-$22,900 per household.

3.3 Cost implications by implementation timeframe

The original Whaitua Implementation Programmes (WIPs) call for an improvement implementation period of around 20 years. But questions remain over what impact a slower or more rapid implementation period may have on the annual costs and therefore affordability of the proposed changes. We therefore consider the following:

- The ***total cost*** at the whaitua and council level of the low and high cost estimates, by implementation timeframe of 10 to 40 years (with 20 years assumed to be the base case for implementation timeframe for the WIPs).
- The ***cost per household*** at the whaitua and council level of the low and high cost estimates, by implementation timeframe of 10 to 40 years.

Crucial to interpreting these figures is to bear in mind that:

- All figures are expressed in nominal (cashflow) terms, not in discounted terms.
- No cost escalation or inflation is included.

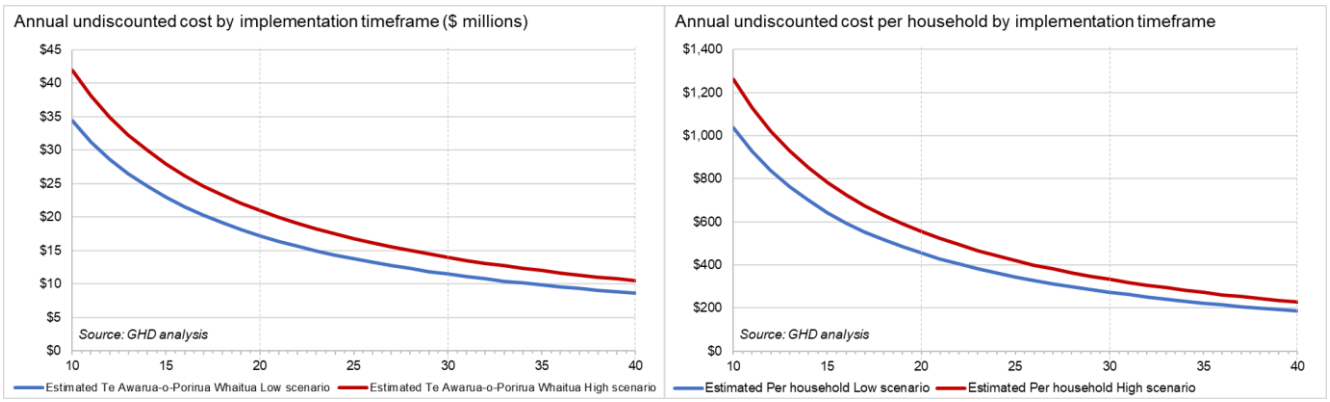
[6] The wastewater improvements outlined in the reports by Blyth and Ira include the following assumed interventions: inspection and repair of laterals to remove significant ground infiltration and wastewater leakage; fixing and removing cross connections (although these costs are uncertain and unlikely fully included); increased capacity of network and treatment plant capacity reducing wastewater overflows (that limits overflows to two per site per year); wastewater network renewals; upgrades to rising mains stream crossings and in contributing catchments to convey residual overflows.

- Estimates of cost per household are to provide a sense of scale of total impact on a community. How the improvements will be funded has not yet been finalised. As suggested previously, a funding approach that places all these costs on growth, for instance, would have very different outcomes on the typical ratepayer, but may have other effects too such as suppressing housing delivery (a point discussed later in this report).
- The cost per year, whether total cost for the whaitua, council or household within a whaitua or council area, should be interpreted as the cost per year for each year of the implementation timeframe. e.g. if a ***10***-year implementation timeframe is used, and the estimated cost for a scenario is ***$2,000*** per household, that implies that the cost to achieve the outcomes is the equivalent of each household paying ***$2,000 a year for 10 years***.

3.3.1 Te Awarua-o-Porirua Whaitua

At the 20-year implementation timeframe, the annual cost without discounting or cost escalation is $16.9-20.6 million. At a 10-year implementation timeframe, the cost per year would be $34.4-41.9 million. At the other end of the spectrum, a 40-year implementation timeframe would cost $8.6-$10.5 million a year in undiscounted, unescalated terms. These numbers are represented in Figure 1.

Figure 1 Total and household cost per year by number of years of implementation, Te Awarua-o-Porirua Whaitua



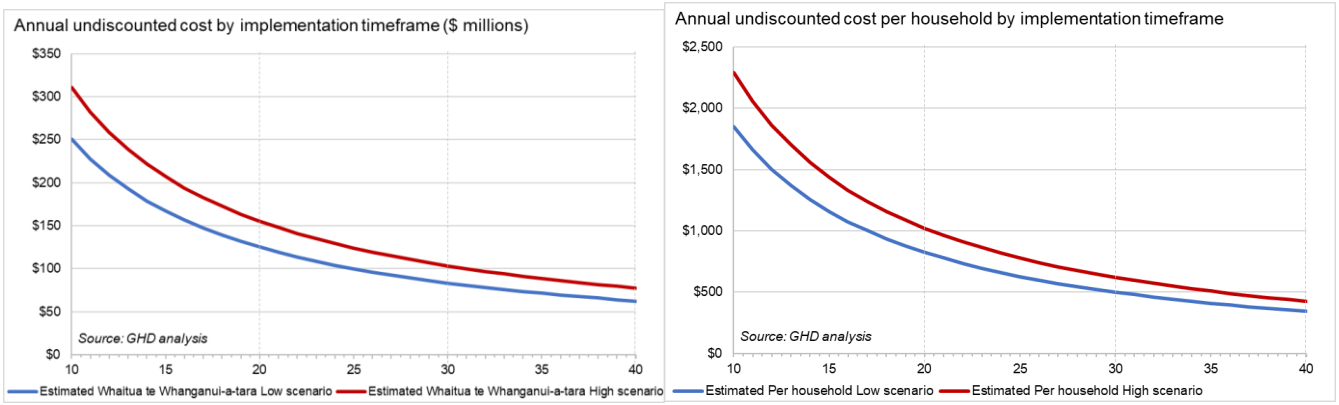
From a household perspective, the cost of reducing *E.coli* in waterbodies for the Te Awarua-o-Porirua Whaitua is estimated at $1,035-$1,260 a year for 10 years, to $185-$225 a year for 40 years at the other end of the spectrum.

3.3.2 Whaitua Te Whanganui-a-Tara

The bulk of the anticipated wastewater improvements are in Whaitua Te Whanganui-a-Tara. Consequently, the costs in this whaitua are significantly higher in aggregate and per household than in Te Awarua-o-Porirua Whaitua.

At the 20-year implementation timeframe, the annual cost without discounting or cost escalation is $125-155 million. At a 10-year implementation timeframe, the cost per year would be $250-310 million. At the other end of the spectrum, a 40-year implementation timeframe would cost $63-78 million a year for 40 years in undiscounted, unescalated terms. These numbers are represented in Figure 2.

Figure 2 Total and household cost per year by number of years of implementation, Whaitua Te Whanganui-a-Tara

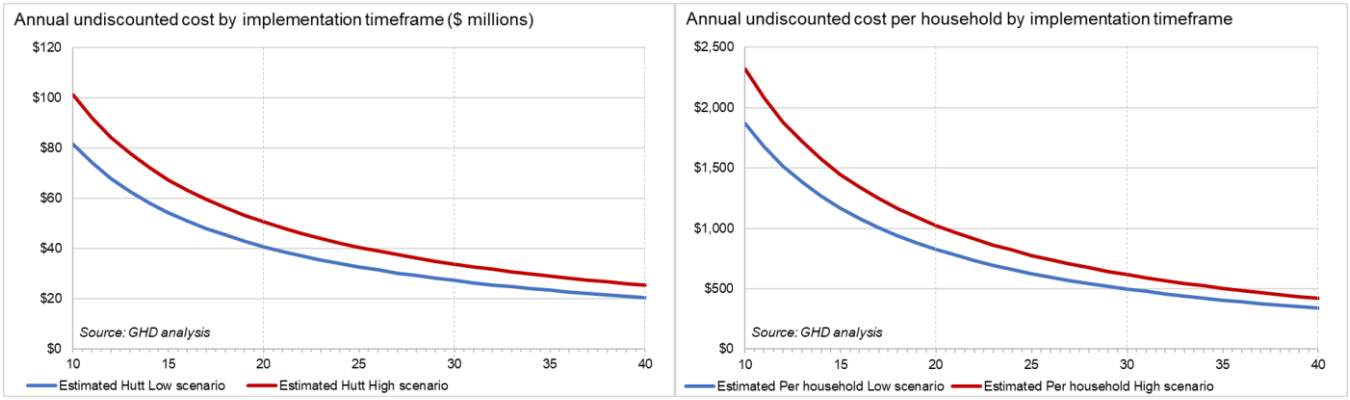


From a household perspective, the cost of reducing *E.coli* in waterbodies for the Whaitua Te Whanganui-a-Tara is estimated at $1,850-$2,290 a year for 10 years, to $345-$425 a year for 40 years at the other end of the spectrum.

3.3.3 Hutt City

At the 20-year implementation timeframe, the annual cost without discounting or cost escalation is $41-51 million. At a 10-year implementation timeframe, the cost per year would be $81-101 million. At the other end of the spectrum, a 40-year implementation timeframe would cost $20-25 million a year in undiscounted, unescalated terms. These numbers are represented in Figure 3.

Figure 3 Total and household cost per year by number of years of implementation, Hutt City

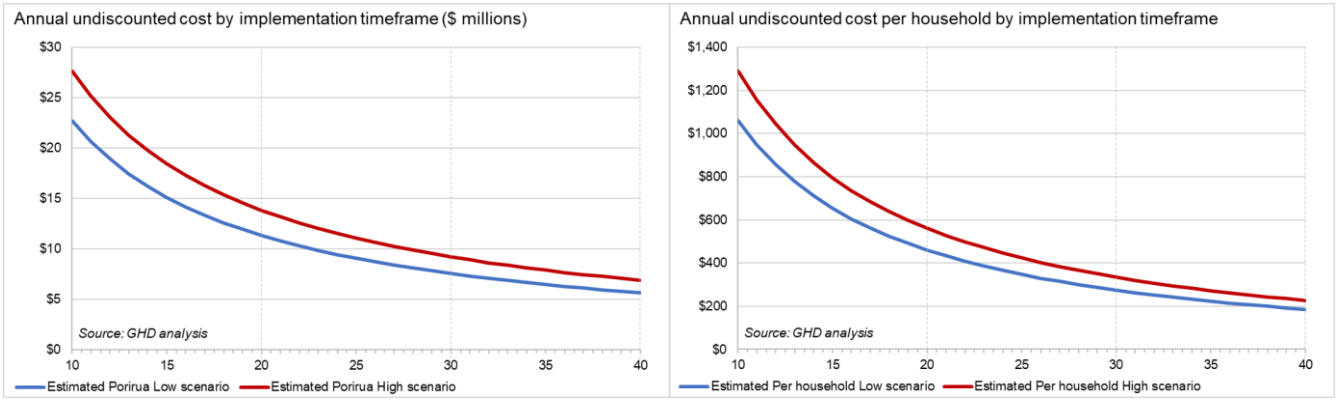


From a household perspective, the cost of reducing *E.coli* in water for Hutt City is estimated at $1,870-$2,320 a year for 10 years, to $340-$420 a year for 40 years at the other end of the spectrum.

3.3.4 Porirua City

At the 20-year implementation timeframe, the annual cost without discounting or cost escalation is $11.1-13.6 million. At a 10-year implementation timeframe, the cost per year would be $22.3-27.3 million. At the other end of the spectrum, a 40-year implementation timeframe would cost $5.6-6.8 million a year in undiscounted, unescalated terms. These numbers are represented in Figure 4.

Figure 4 Total and household cost per year by number of years of implementation, Porirua City

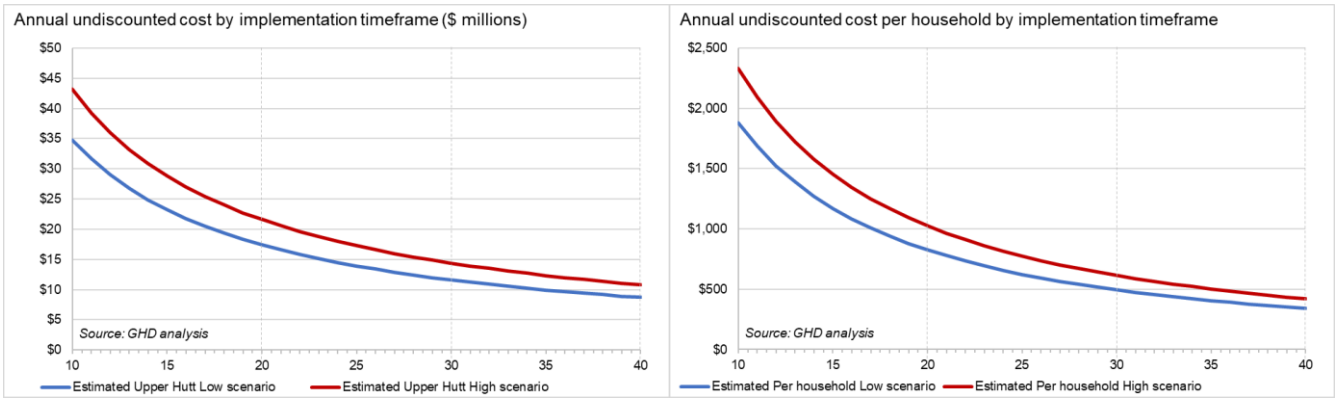


From a household perspective, the cost of reducing *E.coli* in water for Porirua is estimated to cost from $1,060-$1,290 a year for 10 years, to $185-$225 a year for 40 years at the other end of the spectrum.

3.3.5 Upper Hutt City

At the 20-year implementation timeframe, the annual cost without discounting or cost escalation is $17.4-21.6 million. At a 10-year implementation timeframe, the cost per year would be $35-43 million. At the other end of the spectrum, a 40-year implementation timeframe would cost $8.7-10.8 million a year in undiscounted, unescalated terms. These numbers are represented in Figure 5.

Figure 5 Total and household cost per year by number of years of implementation, Upper Hutt

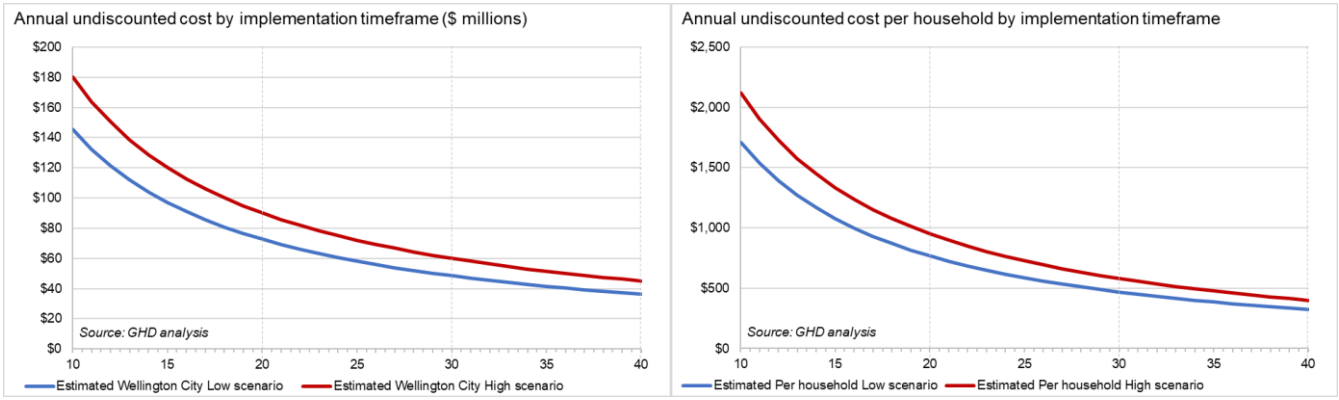


From a household perspective, the cost of reducing *E.coli* in water for Upper Hutt is estimated to cost from $1,880-$2,335 a year for 10 years, to $340-$420 a year for 40 years at the other end of the spectrum.

3.3.6 Wellington City

At the 20-year implementation timeframe, the annual cost without discounting or cost escalation, is $73-90 million. At a 10-year implementation timeframe, the cost per year would be $146-180 million. At the other end of the spectrum, a 40-year implementation timeframe would cost $36-45 million a year in undiscounted, unescalated terms. These numbers are represented in Figure 6.

Figure 6 Total and household cost per year by number of years of implementation, Wellington City



From a household perspective, the cost of reducing *E.coli* in water for Wellington City is estimated to cost from $1,710-$2,120 a year for 10 years, to $325-$400 a year for 40 years at the other end of the spectrum.

4. Potential for quick gains

Having considered the large cost of improvements, the question arises as to whether there are opportunities for elements of the wastewater improvement programme that could be delivered quickly and with significant gains to water quality at relatively low cost.

Scale of the problem

There are an estimated 1,000 wastewater overflow points across the four councils. Some overflows into streams happen on an almost monthly basis. While a desirable end goal may be no overflows, according to water specialists spoken to, this is likely unachievable given the cost associated with that level of service.

However, with climate change large-scale wet weather events will likely become more common and leakage into pipes from rising sea water levels will become a greater challenge, meaning there will be a need to better manage water flows. This likely outcome presents both an argument for improving water management and an opportunity to improve climate resilience at the same time as improving water quality.

The biggest challenges in the system

Discussions with stakeholders confirmed that the two most challenging components of the wastewater challenge across the two whaitua are:

- Limited capacity of the existing bulk wastewater network to deal with:
    - population growth
    - wet weather overflows, as a result of the wastewater and stormwater systems being combined
- Cross connections, whereby private wastewater connections have been incorrectly made into the stormwater network.

There are other challenges with regard to leaking pipes that result in wastewater leaking into the environment and stormwater entering the wastewater system, leading to further capacity constraints when there is heavy rain.

Solutions will be costly and take time

Unfortunately, both these major wastewater challenges are expensive and difficult to fix. Upgrading the existing network to better cope with population growth and heavy rain events will cost billions of dollars and form the bulk of the costs covered in this study.

Cross connections occur on private land and are hard to isolate and therefore fix. While these costs accrue to the private land owners, a fix-order can only be issued when the problem is known to exist, and finding where faults exist is a challenge. Pilot projects have been undertaken to identify cross connections with mixed levels of success in actually reducing wastewater contamination of water.

Although there are no quick fixes, we would anticipate that as part of the programme investigation, an assessment of the severity of overflows would be undertaken. This would at least provide a prioritisation opportunity to fix the most pressing issues.

5. Affordability of the improvements

There are a number of ways affordability of the proposed improvements can be considered. We consider three primary approaches and comment on the implications of a fourth factor.

- Estimated equivalent percentage increase in property rates bill by timeframe of implementation
- Cost per household as a share of household income by timeframe of implementation
- Equivalent total rates implication as a share of household income
- Proportion of population aged under 15 or over 65.

In summary:

- Were the costs to be covered by traditional general rates or targeted rate mechanisms, the impact across council areas would vary from ***an equivalent of a 12% step-change in rates*** (i.e. rates rise by 12% and remain 12% higher than they would otherwise in subsequent years) ***to a 37% step change in rates*** assuming a 20-year implementation period.
- As a ***share of household income***, the additional cost given the other assumptions in this report would fall ***between 0.3% and 0.8%*** of current household incomes assuming a 20-year implementation period.
- Adding the current rates burden to the existing rates burden on the different council areas suggests a ***rates burden on ratepayers of between 3.6% and 4.8% of 2022 household incomes*** at a 10-year implementation period just to meet the *E.coli* requirements. This is below the 5% maximum rates burden threshold recommended by the Shand Inquiry into local government funding.[7]
- However, given the likelihood that cost estimates in this report are lower than the true cost of achieving the target states for *E.coli*, given this study does not consider costs associated with achieving other target attributes, and given the large rates increases already required in many council jurisdictions to deal with other costs, the 20-year implementation timeframe taken with these other factors ***may result in rates and water charges breaching the 5% threshold***.
- Of the four council areas, ***Upper Hutt and Porirua*** have the largest proportion of residents aged under 15 or over 65. Consequently, higher incomes in these areas are more concentrated within a smaller share of households, and ***at the margins there may be more households that struggle to afford significant increases*** in costs for wastewater improvements.

5.1 Estimated equivalent percentage rates increase

As this report has explicitly highlighted, the final mechanism for funding the improvements in infrastructure have not yet been finalised. It seems unlikely that all these costs will be charged to general rates, for instance. Some may be funded by central government or other mechanisms. However, as a simple way to consider the affordability impact of the costs of the improvements on the community more broadly, the costs can be presented as the equivalent of a certain percentage increase in rates per household to provide a sense of scale of affordability at a community level.

There are several assumptions to be considered here.

- We do not discount or inflate dollar values but use cashflow dollars.
- Related to the previous point, we do not allow for any other growth in rates spending. Equivalent percentage rates increases are the increase on rates paid in the June 2022 rates year.
- We assume none of the infrastructure costs are debt-funded. It is unlikely that all this infrastructure would be cash-funded, but adding in assumptions about interest rates, borrowing terms, and construction timeframe versus debt timeframe adds further complexity that will not materially change the outcomes presented here.

[7] Shand, D et al. (2007). *Funding Local Government: Report of the Local Government Rates Inquiry*.

The best way to interpret the data here is that the infrastructure is funded year-by-year as the revenue is gathered.

- We assume the population grows in line with the GWRC regional and council-level population projections.[8]
- We divide all current rates (residential and commercial) across households in the relevant council area. This is because although some rates are charged on businesses rather than households, ultimately people own businesses and therefore these costs are borne by people who are predominantly local residents. We note this assumption may hold less well for Wellington City, which has a high proportion of commercial buildings occupied by government rather than private businesses.
- We assume future rates are split across councils in the approximate proportions that today's local and regional council rates are spread.
- We assume the costs of improving water quality with regard to *E.coli* levels are spread across council areas in line with the current spread of council rates at the city and regional level. It is important to note that the relevant councils may decide on a different cost distribution from what is presented here.
- We divide the implied increase in cost per whaitua or council area to achieve the wastewater outcomes by the total rates collected in each whaitua and council area in the year to June 2022 to indicate what percentage increase in rates (costs borne by the community) would be necessary to support the wastewater infrastructure upgrades over different time horizons.

Results at a whaitua level are displayed in Figure 7. The bulk of the costs associated with improvements are expected to be in the Whaitua Te Whanganui-a-Tara. As a result, in the extreme case of these costs being covered entirely by general rates, in this whaitua rates would need to rise by up to 50% at implementation (and remain at that higher level throughout the implementation period) if the changes were implemented over a 10-year timeframe. Over a longer 40-year timeframe, rates would need to rise by up to a sustained 13% to cover the costs of improvements in undiscounted, unescalated terms.

Figure 7 Equivalent percentage rates increase by implementation timeframe, by whaitua

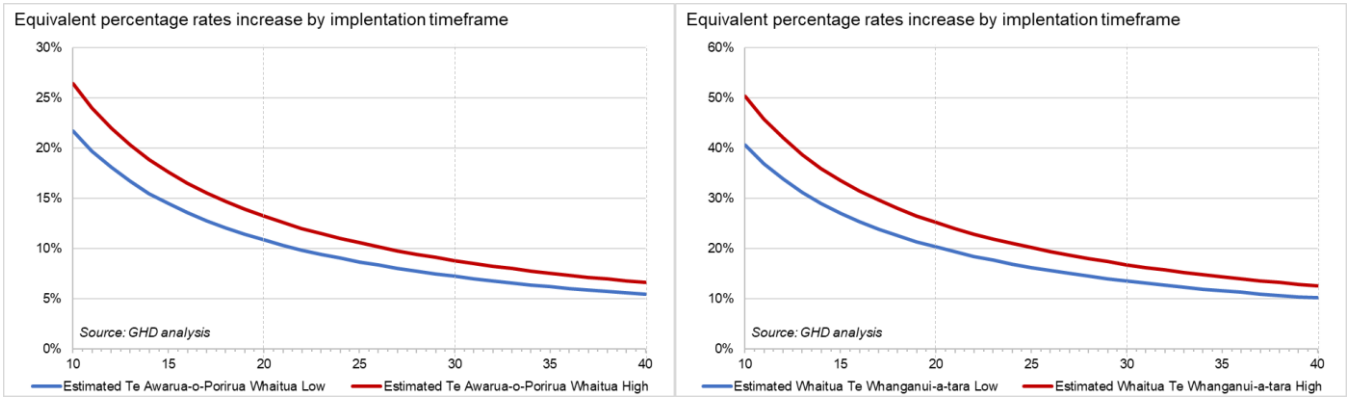


Figure 8 and Figure 9 show the effect on rates if that mechanism was chosen for covering the costs of improvements targeting *E.coli* levels. Implementing the proposed wastewater improvements in Hutt City over the current targeted 20-year implementation timeframe would impose a cost on residents equivalent to a 25-31% rates increase in Hutt City, a 12-14% increase in Porirua, a 29-37% increase in Upper Hutt, and a 16-20% increase in Wellington City. Shorter implementation timeframes would have much larger impacts on equivalent rates burden. If the changes were implemented over 10 years, the impacts would be 49-61% for Hutt City, 24-29% for Porirua, 59-73% for Upper Hutt, and 32-40% for Wellington City in undiscounted, unescalated terms. Over longer timeframes, the burden becomes more manageable, at an estimated 12-15% one-off and maintained rates rise for Hutt City, 6-7% for Porirua, 15-18% for Upper Hutt and 8-10% for Wellington over 40 years.

[8] GWRC. *Household and population forecasts*, completed by Sense Partners. Retrieved from http://demographics.sensepartners.nz/ on 10 March 2023.

Figure 8 Equivalent percentage rates increase by implementation timeframe, Hutt City and Porirua

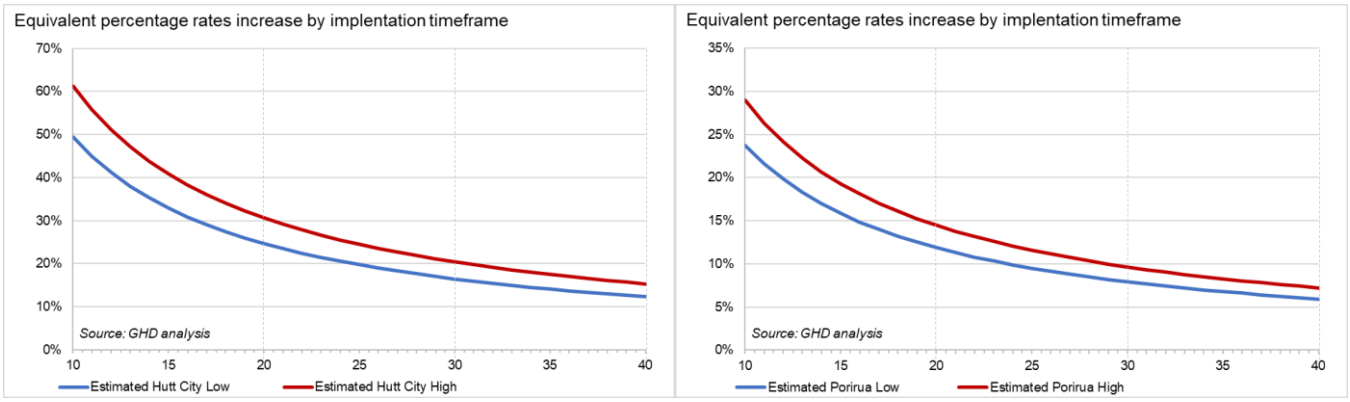
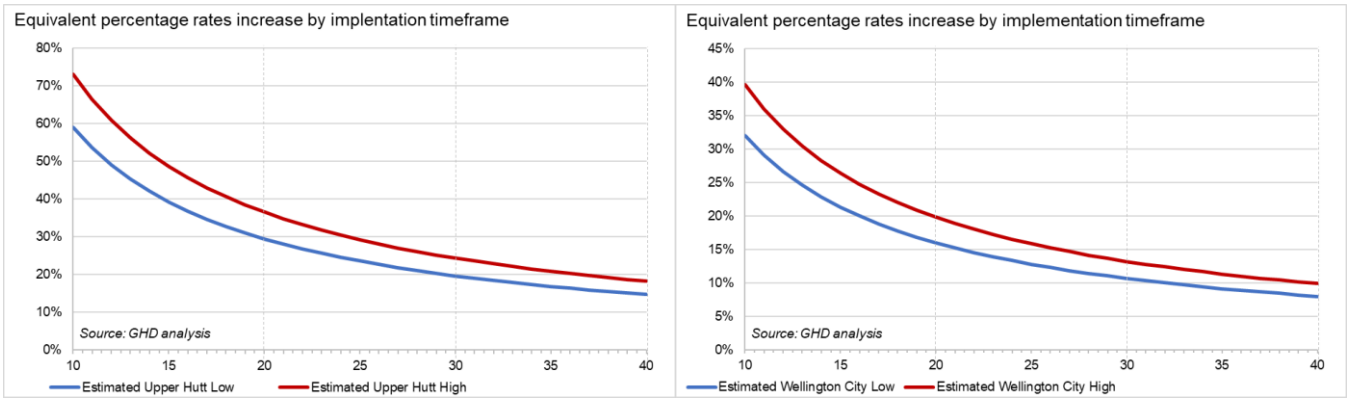


Figure 9 Equivalent percentage rates increase by implementation timeframe, Upper Hutt and Wellington City



5.2 Equivalent cost relative to household incomes

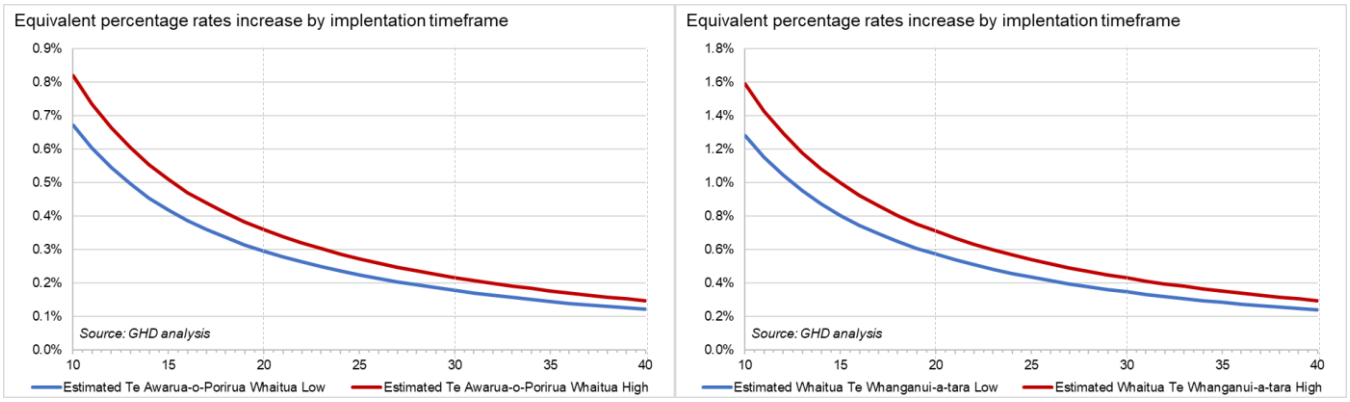
Another way to consider the affordability of the costs to improve water quality is to estimate the equivalent annual cost per household (bearing in mind previous comments that not all these costs will be covered directly by general rates) as a share of today's household income.

We use household incomes today again for the sake of simplicity, and in acknowledging that, while somewhat transitory, New Zealand is in an environment where inflation is growing faster than wages. This means trying to allow for growth in real wages (stripping out inflation) may imply having to assume real wages fall over the next two to three years.

Statistics New Zealand census data provides household incomes as of 2018 by council area. This data was used, along with the estimate of the number of households in each whaitua in 2018, to estimate household incomes by whaitua for 2018. Data from Infometrics provided estimates of household incomes for constituent councils for 2022. Using these growth rates, we were again able to estimate household incomes by whaitua for 2022.

Dividing the estimated per-year spend required for each whaitua and council area by household income in 2022 for each implementation timeframe provides an estimate of the additional share of household incomes that would be required for the wastewater improvements. The results are shown in Figure 10 for the two whaitua and in Figure 11 and Figure 12 for the four constituent council areas.

Figure 10 Equivalent share of household income required by implementation timeframe, by whaitua



Because of the higher share of costs to improve water quality in the Whaitua Te Whanganui-a-Tara, a larger share of household income will be required to apply to improving wastewater infrastructure with regard to *E.coli* than in the Te Awarua-o-Porirua Whaitua. At the target 20-year timeframe, an equivalent of 0.3-0.4% of 2022 household income would need to be committed to *E.coli* focused projects in Te Awarua-o-Porirua Whaitua each year for 20 years, compared with 0.6-0.7% for Whaitua Te Whanganui-a-Tara, in undiscounted, unescalated terms. At a 10-year timeframe, these proportions double, while they halve over a 40-year timeframe.

Figure 11 Equivalent share of household income required by implementation timeframe, Hutt City and Porirua

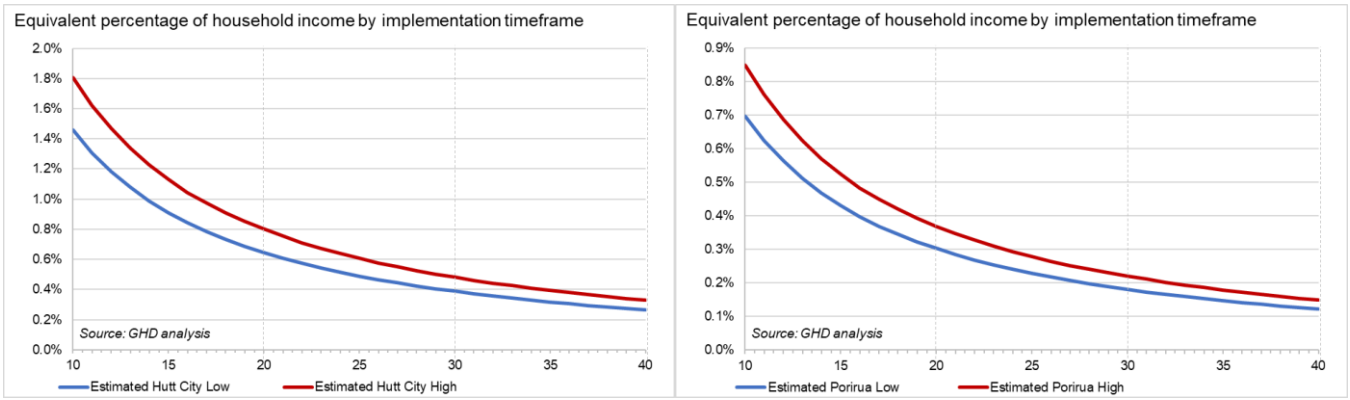
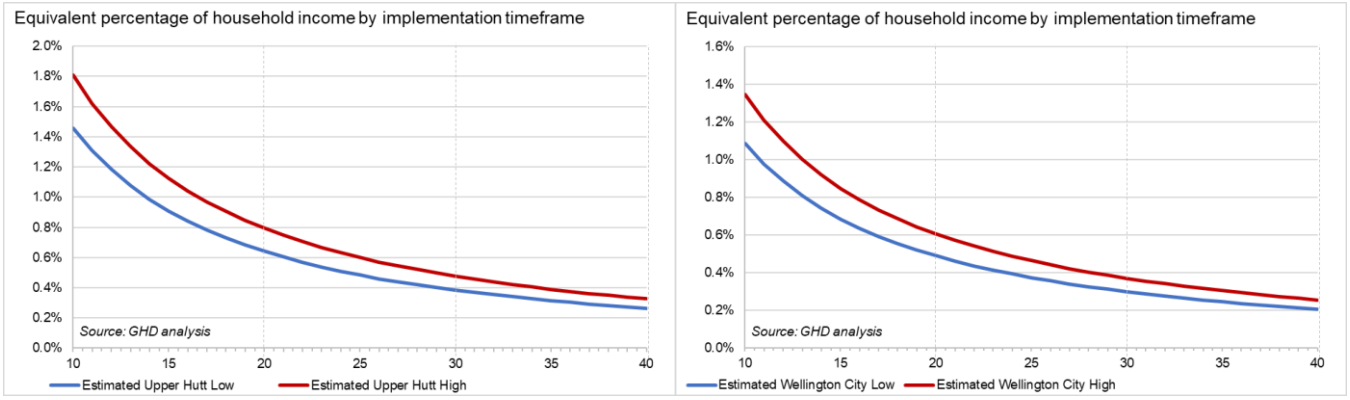


Figure 12 Equivalent share of household income required by implementation timeframe, Upper Hutt and Wellington City



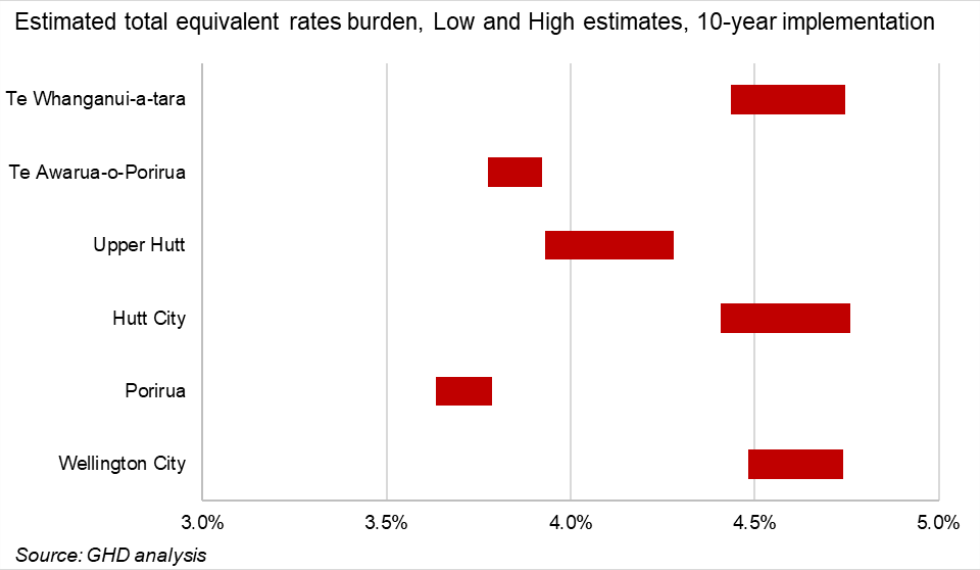
Of the four council areas, assuming that the costs are shared across councils within the whaitua roughly in line with current rates shares, the biggest impacts are in Upper Hutt and Hutt City, where up to 1.8% of annual household incomes in 2022 would be consumed by actions to reduce *E.coli* levels. Over a 20-year implementation timeframe, the equivalent shares of household income required would be the equivalent of 0.6-0.8% in Hutt City, 0.3-0.4% in Porirua, 0.6-0.8% in Upper Hutt, and 0.5-0.6% in Wellington City.

5.2.1 Overall impacts on affordability

The Shand Inquiry recommended that property rates should not account for more than 5% of a household's income at the upper end of charges.[9] Having evaluated the equivalent impact of the investment needed to reduce *E.coli* levels in terms of rates and in terms of household incomes, those two components are now brought together with current rates bills. This allows us to estimate the total burden of current rates levels and potential costs to improve wastewater outcomes as a share of household incomes.

There are caveats to this analysis. Councils are facing steep rates rises already as borrowing costs have risen and as they seek to overcome infrastructure shortfalls across various infrastructure classes. Some of the costs of improving wastewater outcomes will, on the other hand, be captured in those planned investment budgets. Consequently, the figures presented here should only be considered as indicative. In none of the scenarios, council areas or whaitua, does the sum of current rates bills plus the equivalent implied increase in rates for funding wastewater improvements breach the 5% threshold, as demonstrated in Figure 13.

Figure 13 Equivalent total rates burden assuming 10-year implementation period



Across a 10-year implementation period, acknowledging the assumptions set out throughout this report, the total equivalent rates burden (notwithstanding not all the costs may be paid in rates) could see costs to households reach 4.8% in Hutt City. At longer implementation timeframes, the total equivalent rates burden would be lower.

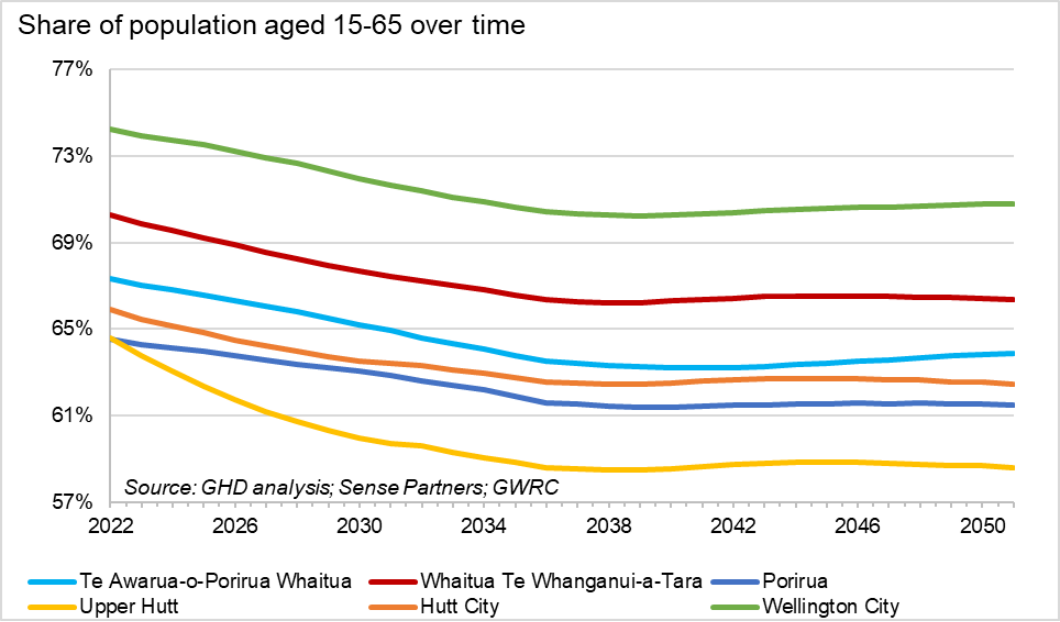
5.3 Local population demographics

People under the age of 15 and over the age of 65 are far less likely to be earning an income than those aged 20-65. While median household incomes provide a good idea of the burden of an increase in costs, they do not provide an indication of households with residents at either end of the age spectrum, where affordability can be more of a challenge.

GWRC population projections provide an insight into the current and potential future mix of age groups across the four constituent council areas. Figure 14 shows changes in the share of the population in each whaitua and council area that are working age over the next 30 years.

[9] Shand, D et al. (2007). *Funding Local Government: Report of the Local Government Rates Inquiry*.

Figure 14 Estimated share of population of working age by whaitua and council area, 2022 to 2052



Wellington City has by far the highest share of people of working age. This is a function of its role as a university city that attracts young people, and the large role government and government support industries play in the region.

At the other end of the spectrum, Upper Hutt has an unusually large share of over-65s for the region, while Porirua has a large proportion of young people and children. This means larger proportions of households in these two council areas are likely to find the impact of a large increase in costs to cover water infrastructure upgrades harder to afford than would be the case in Wellington City for instance.

6. Benefits of the improvements

This section quantifies the public use and non-use value benefits of lower *E.coli* levels in water bodies due to wastewater improvements. It further discusses the cultural value of improved water quality and provides a proxy for the private benefit that improved water quality can have on property values. These benefits are summarised in Figure 15.

Figure 15 Summary table of benefits identified of wastewater improvements

Benefit	Quantified, proxied or described value
Value of cleaner water for users of water bodies	$159-235 million over 50 years
Value of cleaner water for non-users of water bodies	$229-337 million over 50 years
Cultural value of cleaner water	Unquantified
Potential impact on tourism spending from better environmental reputation	$700 million over 50 years
Private property value increase from proximity to cleaner water bodies	$24-34,500 per property in proximity

In summary:

- ***Use values*** are estimated at $159-235 million in undiscounted, unescalated terms over the next 50 years ***($212 million at a 20-year implementation*** timeframe).
- ***Non-use values*** are estimated at $229-337 million in undiscounted, unescalated terms over the next 50 years ***($305 million at a 20-year implementation*** timeframe).
- The ***cultural value*** to mana whenua of cleaner water due to less *E.coli* contamination is hard to quantify and has not been quantified in this report, but is likely to be considerable given traditional ties to water and land.
- The state of water quality in Wellington is sufficiently poor that it ***affects the region's reputation*** as a part of the "100% pure New Zealand" brand. If even 1% of tourists who would otherwise visit the region do not materialise because of a poor *E.coli* reputation, that would be around $700 million in costs over the next 50 years (undiscounted and without allowing for growth in tourism numbers nationally).
- Target states for water bodies in the two whaitua suggest reduction in *E.coli* levels of two-thirds to three-quarters across the whaitua. International studies suggest this could add ***private benefits of between $24,000 and $34,500 in value per property*** located within 500 metres of a cleaner water body.

6.1 Public benefits of better wastewater outcomes

There are a number of public benefits that result from a reduction of *E.coli* levels due to better wastewater management. These are the main reasons to implement the changes. However, they are often hard to meaningfully quantify in dollar terms because they are what economics calls "non market traded" values. The cultural value people derive from knowing the waterways their families have traditionally been connected to are cleaner than they were, for instance, is hard to express in dollars. That does not make these benefits any less real; it just makes them more intangible. The genuine benefits set out in this section should always be held in mind when considered against the (typically financial) costs of implementing the changes.

6.1.1 Use values from improved water quality

Use values of cleaner water include:

- use of water for fishing or food gathering
- use of water for cultural practices
- recreational use of water for swimming and other water-based activities.

Waterways have value as ***food sources***. People derive value from access to clean water bodies for drinking and food purposes (fishing, gathering and the like). Māori in particular value water for its *mahinga kai* (value of food resources and their ecosystems) and for *kai moana* (food from the sea).

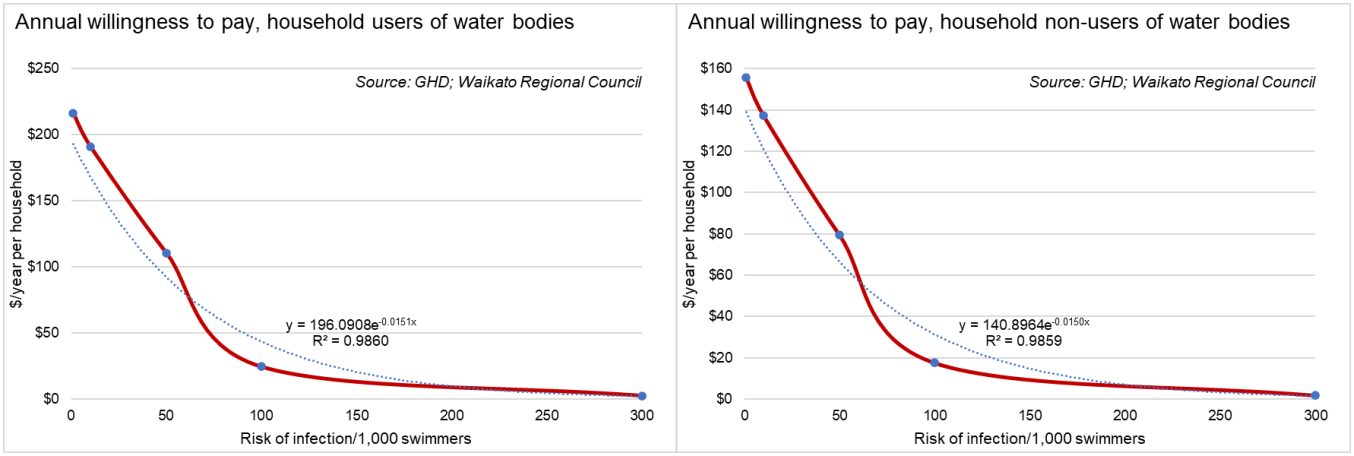
Secondly, improved access to cleaner water is likely to improve the ***recreational value*** of rivers, lakes and the coast. Being able to use water recreationally supports a healthier lifestyle.

Putting a dollar value on these values is hard. Work done by Auckland Council demonstrated how many Council amenities provide value to those who use them as well as to those who do not.[10] One pertinent example for the work at hand is what the Auckland Council work demonstrated about the use value of parks. Those who use Council parks derived significant value from them – around $376.50 per household per year in today's dollars. They derive this value from parks based on the way they can use parks. Other amenities that provide some of the same uses as rivers, lakes and beaches that were covered by the Auckland Council study include swimming pools ($290 of value a year for user households) and sports parks ($147 of value a year for user households). These figures provide an indication of the recreational value of amenities that have some overlap with water bodies. They do not account for the financial value to those who use them for gathering food, for instance. Nor is it likely these figures capture the cultural value of a clean waterway (dealt with separately in this report).

But a study in the Waikato Region provides possibly the most useful estimates of the use (and non-use) values for differing levels of risk of infection from water bodies.[11] The study estimated the willingness to pay that people have for different (lower) levels of risk of infection, updating figures from an earlier 2014 report.[12] The original study found that 31% of people had used a river, stream, lake or wetland in the Waikato (i.e. users) and 69% were non-users. It then used revealed and stated preference analysis to estimate the willingness to pay that users and non-users had from different levels of risk of infection.

Figure 16 shows the results of the study, updated to 2022 dollars, for users and non-users of the water bodies. We have also shown the approximate modelled pattern of the curves that allow us to estimate the value people derive from movement between any two points on the curve. It demonstrates, for instance, that as the risk of infection falls from 300 per 1,000 swimmers to 100 per 1,000, willingness to pay rises about $23 for users (from $2 to $25). As risk of infection falls even lower, the value to people rises far more sharply. As risk of infection falls from 100 to 10 per 1,000 swimmers, the value rises by a further $167 per household.

Figure 16 Willingness to pay for lower risks of infection



GWRC has set current and targeted freshwater attribute states for *E.coli* for both whaitua.[13] Combining this Wellington level of risk by water body grading with the curves in Figure 16 allows us to estimate what an

[10] Auckland Council. (2020). *Use and non-use values of Auckland Council amenities*. Retrieved 13 March, 2023, from https://knowledgeauckland.org.nz/media/1892/use-and-non-use-values-of-auckland-council-amenities-july-2020-nexus-et-al.pdf
[11] Ministry for the Environment (2020). Essential Freshwater Package: Benefits Analysis. Retrieved 15 March 2023, from https://environment.govt.nz/assets/Publications/Files/essential-freshwater-package-benefits-analysis.pdf
[12] Waikato Regional Council (2014). *Non-market values for fresh water in the Waikato region: a combined revealed and stated preference approach*. Retrieved 15 March 2023, from TR201417.pdf (waikatoregion.govt.nz)
[13] Current state and desired target attributes states for *E.coli* provided by GWRC as outlined in Te Whaitua te Whanganui-a-Tara Implementation Programme (gw.govt.nz) and Te-Awarua-o-Porirua-Whatiua-Implementation-Programme.pdf (gw.govt.nz).

improvement in water bodies from, say, Grade D to Grade C would mean in value per using and non-using household.

Te Awarua-o-Porirua whaitua

The five target attribute state sites within water bodies in the Te Awarua-o-Porirua whaitua had particularly high levels of *E.coli*, contibuting to a simple average risk of infection of 110 per 1,000 people in the current state. The proposed improvements would dramatically reduce the risk of infection across water bodies to around 26/1,000. Figure 16 shows that as we move from the higher risk to lower risk, the difference in willingness to pay between these two levels of risk of infection is around $95 per ***using*** household per year.

Whaitua te Whanganui-a-tara

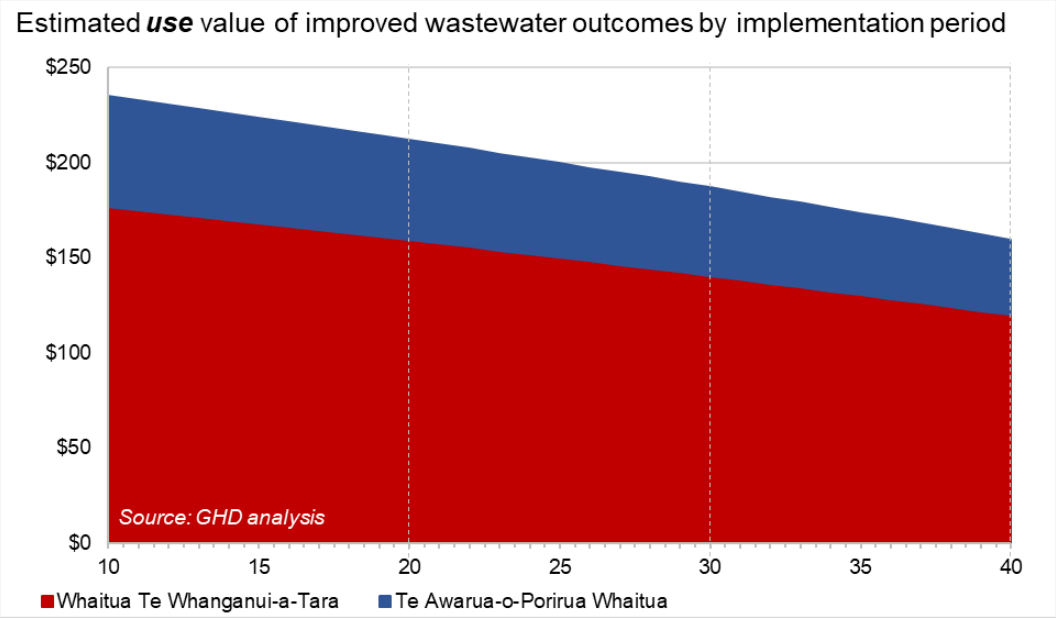
The 12 target attribute states within water bodies in the Whaitua Te Whanganui-a-Tara also had high levels of *E.coli*, contibuting to a simple average risk of infection of 77 per 1,000 people in the current state. The proposed improvements would dramatically reduce the risk of infection across water bodies to around 25/1,000. Figure 16 shows that as we move from the higher risk to lower risk, the difference in willingness to pay between these two levels of risk of infection is around $73 per ***using*** household per year.

Estimate use value by implementation period by whaitua

Multiplying these values by the number of ***user*** households (rounded down to 30%) assumed to be in each whaitua over the next 50 years provides a basic estimate of the value of use benefits in ***undiscounted*** terms so as to match the cost stream, which is measured in today's dollars undiscounted.

We are able to modify this value based on the assumed implementation timeframe. For instance, if we assume the benefits are implemented over a 10-year timeframe, they are higher than if the timeframe taken is longer because in any given year the share of the remediation work completed is lower when a longer implementation timeframe is adopted. We present the benefits based on implementation timeframes in Figure 17.

Figure 17 Estimated use value of wastewater improvements by years to full implementation



Because of its much smaller number of households, Te Awarua-o-Porirua receives about a third of the benefit that Whaitua te Whanganui-a-Tara is estimated to receive even though its benefit per household because of the greater improvement in water quality is higher. Total use value benefits to households over a 20-year period by improving water quality by reducing *E.coli* risk are around $212 million in undiscounted terms. Over a 40-year implementation timeframe this drops to $159 million in undiscounted terms.

6.1.2 Greater cultural value of knowing water is cleaner

Te Mana o te Wai is part of the National Policy Statement for Freshwater Management and describes the vital importance of water. The presence of *E.coli* is a significant issue for mana whenua, and is the cause of cultural distress. According to Māori beliefs, the presence of wastewater in waterbodies impacts significantly on the mauri of the waterbodies. Further, it creates an unacceptable health risk associated with various cultural practices, including collecting and eating mahinga kai. The inability of mana whenua to undertake their traditional cultural practices results in a loss of cultural identity and intergenerational knowledge. Improving the wastewater network, and thus removing the presence of *E.coli* in water bodies will bring significant benefits from a cultural perspective that are hard to quantify. Healthy waterways are important for cultural practices such as exercising *ahikaroa* and *kaitiakitanga*.[14]

Clean water is an integral part of life satisfaction and happiness, as clean water plays an important role across many cultural traditions.[15] *Kaitiakitanga* (guardianship and protection) is the traditional Māori concept focussed on the protection and conservation of the environment. Māori consider water to be the source or foundation of all life.

The improvement of water bodies may have financial and social implications. Water bodies within the whaitua were rich for kaimoana and related resources, pipi, pupu, kina, paua, mussels, oysters and other species of fish and seafood that sustained the people.[16] Having clean, safe, sustainable water ways for all reduces peoples need to travel to alternative swimming/food sources, or to purchase food that can be collected instead. This will also reduce the health risks, particularly those who, despite health warnings, choose to swim and collect food in the water polluted harbours and streams.

Investing in wastewater improvements works towards restoring the mauri of waterways. The reduction of human waste prevents the contamination of water, and the subsequent spiritual and cultural loss to the community. Improving the quality of water, through minimising the presence of human waste, works to restore the mana whenua relationship with their *takiwā* (traditional region), restoring the ability for cultural practices and the transmission of intergenerational knowledge.[17]

Improving water quality can also improve people's sense of place. Through improving the quality of water, this can enhance people's connection and sense of responsibility for sustaining and caring for the wellbeing of local waterways and estuary.

6.1.3 Non-use values from improved water quality

Non-use value of cleaner water include:

- Option value
- Bequest value
- Visual or sensory amenity value.

Access to cleaner water has an ***option value***. This well-documented economic concept refers to the benefit conferred upon people by having the option to use the water, even if they do not use it.[18] Even those who are non-users of the waterways enjoy the benefit of knowing that it is there for use, and that it is clean.

Bequest value refers to the value people derive from knowing their children or grandchildren will also get to benefit from the same amenities, such as clean waterways.

Finally, cleaner water can have ***amenity value*** that is enjoyed by non-users. For instance, it can look cleaner, smell cleaner and give them enjoyment even though they do not use it.

[14] Ministry for the Environment — Manatū Mō Te Taiao (2021). *Sources and impacts of freshwater pollution*. Retrieved 16 March, 2023, from Sources and impacts of freshwater pollution | Ministry for the Environment
[15] United Nations Educational, Scientific and Cultural Organisation. (2022). *UN World Water Development Report 2021: Cultural values of water*. Retrieved 16 March, 2023, from Cultural values of water | 2021 World Water Development Report (unesco.org)
[16] Ngati Toa Rangatira (2012) *Deed of Settlement of Historical Claims*. Retrieved on 16 March, 2023, from Ngāti Toa Rangatira Deed of Settlement 7 Dec 2012 (www.govt.nz)
[17] Te Kāhui Taiao (2021). *Te Mahere Wai, a Mana Whenua Whaitua Implementation Programme*. Retrieved 16 March, 2023, from te_mahere_wai_20211028_v32_DIGI_FINAL.pdf (gw.govt.nz)
[18] Science Direct. (1999-2021). *Option Value*. Retrieved January 12, 2022, from https://www.sciencedirect.com/topics/social-sciences/option-value

Again, the Auckland Council works provides some figures that set a range for the potential value of cleaner waterways for non-users. Even those who ***do not use*** Council parks derived significant value from them – around $185.50 per household per year in today's dollars. They derive this value from parks based on the visual amenity parks provide, and the option to use them if they so wish. Other amenities that provide some of the same uses as rivers, lakes and beaches that were covered by the Auckland Council study include swimming pools ($153 of value a year for ***non***-user households) and sports parks ($123 of value a year for ***non***-user households).

But again, the Waikato Regional Council work provides good estimates specifically for the non-use of water bodies. The curve for willingness to pay by non-users has already been introduced in Figure 16. Again as one shifts from a risk of infection of 300 per 1,000 swimmers to 100 per 1,000, the willingness to pay (in 2022 dollars) rises about $16 per household per year. As water quality improves from a risk of 100 to a risk of 10 per 1,000 swimmers, the change in non-user value rises by $120.

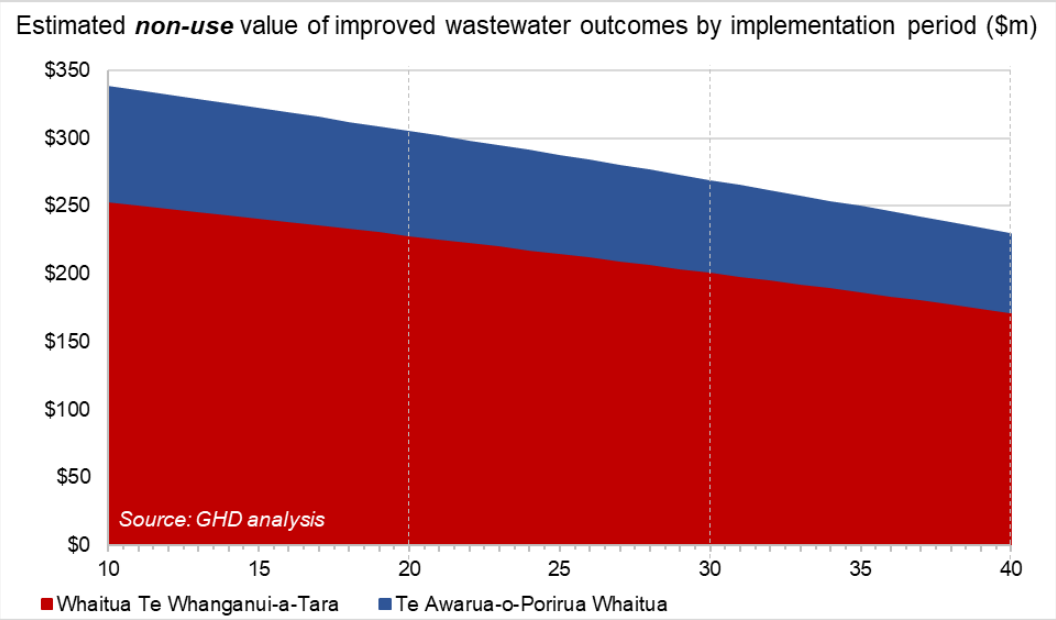
Estimate non-use value by implementation period by whaitua

Multiplying these values by the number of ***non***-user households (rounded to 70%) assumed to be in each whaitua over the next 50 years provides a basic estimate of the value of use benefits in ***undiscounted*** terms so as to match the cost stream, which is measured in today's dollars undiscounted.

We are able to modify this value based on the assumed implementation timeframe. For instance, if we assume the benefits are implemented over a 10-year timeframe, they are higher than if the timeframe taken is longer because in any given year the share of the remediation work completed is lower when a longer implementation timeframe is adopted. We present the benefits based on implementation timeframes in Figure 18.

The total benefit to non-users is actually greater than to users simply because more households are assumed to be non-users (70%) and because the difference in value derived by users and non-users is not that great). The total value derived by non-users over a 20-year implementation timeframe is estimated at around $305 million in undiscounted terms in total, compared with $229 million in total over a 40-year timeframe, as Figure 18 demonstrates.

Figure 18 Estimated non-use value of wastewater improvements by years to full implementation



6.1.4 Reputational value of improved water quality

New Zealand is known internationally for its "100% pure New Zealand" branding. Water quality challenges around the country put this image at risk. According to Infometrics, annual tourism GDP (gross domestic product) in New

Zealand was around $15 billion pre-COVID, or $41 million a day.[19] With borders now open, we can expect tourism to return to these sorts of levels over the next couple of years.

Within the total, the Wellington Region accounted for around 10% of total tourism GDP pre-COVID, or $1.4 billion a year. If even a small share of this tourism spending is at risk due to ongoing and growing wastewater management challenges, the impact on Wellington tourism GDP and employment could be significant. For instance, if just 1% of Wellington's pre-COVID visitors were to choose not to visit because of a growing reputation for wastewater challenges and poor water quality, the cost to the region would be over $14 million a year. Over a 50-year timeframe, this impact would be $700 million.

6.2 Private benefit to property owners

Living near water bodies that are not as prone to contamination by *E.coli* as they used to be improves the amenity of those water bodies (because of their greater useability) and therefore the value of properties nearby. This is a private benefit that accrues to property owners near water bodies that benefit from reduced *E.coli* levels. A meta-analysis conducted by the US Environmental Protection Agency demonstrated that there are statistically significant benefits from reduced *E.coli* levels for properties near water bodies.[20] For properties within 500 metres of a water body, a 1% reduction in *E.coli* levels is associated with a 0.05% increase in property value. In the two whaitua, where the targeted reduction in *E.coli* levels is between 67% and 76%, this implies a gain in property values of between 3.5% and 4.0% for properties near to water bodies.

It is beyond the scope of this work to estimate the number of properties within 500 metres of each water body, or the value of properties within each of those catchments. But median property values for Wellington City, Porirua, Upper Hutt and Hutt City range between $685,000 and $950,000.[21] At these proposed water quality improvements levels and these median house prices, properties within 500 metres of benefitting water bodies could see ***property values rise by between $24,000 and $34,500 per benefitting property*** within the various catchments.

[19] Infometrics. Retrieved on 13 March, 2023, from https://ecoprofile.infometrics.co.nz/Wellington%2bRegion/Tourism/TourismGdp

[20] U.S. Environmental Protection Agency National Center for Environmental Economics. (2019). *Property values and water quality: A nationwide meta-analysis and the implications for benefit transfer*. Retrieved on 22 March, 2023 from https://www.epa.gov/environmental-economics/property-values-and-water-quality-nationwide-meta-analysis-and-implications Retrieved on 22 March 2023 **from** https://www.epa.gov/environmental-economics/property-values-and-water-quality-nationwide-meta-analysis-and-implications

[21] REINZ. (2023). *REINZ Monthly Property Report - February 2023*. Retrieved on 22 March, 2023, from https://www.reinz.co.nz/libraryviewer?ResourceID=513 Retrieved on 22 March 2023 from https://www.reinz.co.nz/libraryviewer?ResourceID=513

7. The funding toolkit

Given the significant costs associated with improving water quality set out in the previous chapters of this report, considering who should pay and what tools are available is fundamentally important from an equity, transparency or affordability perspective. This chapter sets out some basic principles of project prioritisation and funding, before evaluating the range of funding tools available in some detail. In summary:

- Infrastructure needs to be of the right type, delivered to the right place, paid for by the right people at the right price announced at the right time using the right funding mechanism if it is to be effective.
- There are numerous funding mechanisms or tools available, ranging from general rates and targeted rates to tools targeting new development such as development contributions or infrastructure growth charges, through to ad-hoc tools such as developer agreements to deliver infrastructure or central government investments when projects meet certain criteria.
- Not all funding tools are equally good, nor appropriate for wastewater investment. There are at least 10 considerations in choosing an appropriate funding tool, including whether use of a tool unlocks further borrowing capacity or enjoys public acceptance and transparency.
- Under central government's current plan to manage water through four entities, the tools available are likely to be more limited, and the bulk of costs will be borne by water customers, who are by and large the same people as ratepayers.

7.1 The six principles of prioritisation and funding

To make good investment choices, and to enjoy widespread support, it is crucial to deliver the right infrastructure to the right place, paid for by the right people at the right price, announced at the right time using the right funding mechanism.

7.1.1 The right infrastructure

"…*deliver the* right infrastructure *to the* right place *paid for by the* right people *at the* right price *announced at the* right time *using the* right funding mechanism."

"***Should we be building this infrastructure at all?***" is the first question to ask. This report has already discussed the challenges of prioritising projects that have maximum benefit, given the cost involved.

Not every project that can be delivered, even if it meets one or more objectives, is a good project to deliver because of the inevitable trade-offs required with a limited budget. In an ideal world with unlimited resources and time, one would undertake a comprehensive cost-benefit analysis of each project's quantified benefits and costs. But in the real world, while large projects should still be subject to that very detailed level of scrutiny, time and resource constraints mean smaller projects cannot practically be subjected to the same level of testing. But the key is to have a good idea of whether the benefits of the project (in meeting objectives) outweigh the costs.

7.1.2 The right place

Infrastructure and, consequently, infrastructure charges should ***incentivise development and water quality improvement in places that achieve the desired objectives***. The natural way this happens is through accurate pricing (discussed further below). If it is cheaper to improve water quality in a certain area, for instance, then that should be reflected in the costs of development there.

7.1.3 The right people

In thinking about who pays for something, economics starts with the position that those who benefit from something most (in this case, infrastructure) should be the ones who pay the bulk of the cost. Following this rule reduces the risk of bad investment decisions where some areas receive investment at huge subsidy from others, creating artificially low development costs that do not get accounted for in local land prices. It is important to

acknowledge that determining who benefits and by how much is sometimes a challenge, so often this is a best estimate rather than a calculation with certainty.

Occasionally, it may also be appropriate to depart somewhat from this principle on equity grounds (e.g. where the cost of water quality improvement in one location is so high that it cannot be borne only by the residents of that discrete location). However, this should be the exception, not the norm. In summary, areas that benefit most should contribute most to the cost of those improvements.

7.1.4 The right price

This discussion has already touched on the importance of charging the right price for infrastructure provision in general or water quality improvements more specifically. When the true cost of infrastructure is not charged, it incentivises undesirable behaviours. This exacerbates not only the funding shortfall that infrastructure agencies often struggle with through the under-collection of the true cost of those infrastructure projects but can also mean poorer outcomes.

A further point that must be made on pricing is that charging a higher, more accurate price for infrastructure or expecting development to keep to a better standard on water quality does not push house prices up. It pushes land prices down.

If infrastructure providers signal that development will need to pay its own way for water quality, land prices will fall to reflect that fact, rather than house prices rising."

The Auckland experience and the international literature both demonstrate this. Work completed by the Chief Economist Unit at Auckland Council suggested that, at the time of the work, land purchasers outside Auckland's Rural Urban Boundary were overpaying for land on the assumption that the general ratepayer would continue to greatly subsidise infrastructure in those areas. In other words, land prices reflect the price developers believe they will have to pay for infrastructure. If infrastructure providers signal that better infrastructure is needed to better manage water quality on (re)development sites, own way, land will fall to reflect that fact, rather than house prices rising.[22]

The international evidence on this trend for costs to pass up the chain rather than down to house prices is also instructive. In almost all cases, the vast majority of costs passed up to land values.[23]

7.1.5 The right timing

The signal that those who benefit from improvements will primarily need to pay for it is a vital message to communicate. Infrastructure plans should not be announced before it is clear how those improvements are proposed to be funded. This avoids the risk that properties continue to trade hands without the information needed for buyers to make informed decisions about what the infrastructure costs for improving water quality in that location may be. Announcing intentions about how new infrastructure will be in advance ensures that property sales do not occur at true market prices.

Right timing also refers to when the infrastructure is built. Infrastructure should be built at a time that ensures timely uptake of the new capacity that justifies the investment.

7.1.6 The right funding mechanism

The funding tool or mechanism is the actual legal instrument and process that accesses the money to undertake the infrastructure improvements. Funding tools that can be charged by local governments can range from general rates charged on all residents of an area, to targeted rates for a specific use in a specific location, to development contributions (DCs), financial contributions, infrastructure growth charges, targeted levies with central government or even ad-hoc agreements with specific developers for them to directly deliver certain infrastructure components.

[22] See Shane Martin and David Norman, *An evidence based approach: Does the Rural Urban Boundary impose a price premium on land inside it?* 2020. https://www.aucklandcouncil.govt.nz/about-auckland-council/business-in-auckland/Reports/does-the-rub-impose-a-price-premium-on-land-inside-it-20-Feb-2020.pdf

[23] See Harshal Chitale, *Unshackling growth Growth paying for itself*. 2018. https://www.aucklandcouncil.govt.nz/about-auckland-council/business-in-auckland/docsoccasionalpapers/unshackling-growth%20-%20April%202018.pdf

Other tools that do not yet have a legal basis are also being discussed, such as value capture (VC) mechanisms. There are several criteria against which to evaluate funding tools, as will be discussed later in this report.

7.2 The commonly used funding tools

There are several tools already available to local government for funding infrastructure, and an additional tool is currently being proposed. We would note that other ad-hoc grants and funding channels are at times accessible (such as shovel-ready projects in the wake of the COVID-19 lockdowns). These are not dealt with here because their structure and use varies on a case-by-case basis. Nevertheless, there are arguments for using these ad-hoc tools where the costs to be locally borne would otherwise be prohibitively large, a point we return to later.

- **General rates** are the largest single source of income for local governments. These are charged on residential and business properties and include both a fixed (general uniform) rate and a component based on property value. The variable component can be based on the property's capital value (land plus improvement value) or on land values. In cases where specific infrastructure charges do not cover the full cost of that infrastructure, general rates (all ratepayers) pick up the tab, which can be a misalignment with the economic principles set out above, specifically that those who benefit should pay.
- **Targeted rates** are collected by local councils for a specific purpose and in a specific geography, for example to fund the construction of the Wellington Regional Stadium in 1999. Some councils charge a rate targeted to a specific purpose but not geography, but this is effectively a general rate charged as a flat charge per rateable property or as a function of rateable value.
- **DCs** are most commonly used by local governments to ensure new development contributes toward new infrastructure to facilitate that growth. DCs are generally charged at subdivision resource consent, at building consent for an additional dwelling on a site or, in rare instances, at service connection.
- **Infrastructure growth charges** (IGCs) are functionally similar to DCs but are contractual charges at the time a property first connects to the network. Like DCs, they are designed to ensure that the cost of new infrastructure is allocated to those who will benefit from the assets or require the addition of new assets to service demand. Conceptually, IGCs could be applied to any network but connection to a water network is a more practical scenario for using an IGC than for roading infrastructure, for instance.
- **Financial contributions** can be charged under the Resource Management Act provisions rather than the Local Government Act provisions used for most other funding tools introduced here. The purpose of financial contributions, which can be in the form of money and/or land, is to address the environmental effects of development. They can be used to fund similar assets as DCs, but DCs and financial contributions cannot both be charged on the same asset.
- **Developer agreements** are voluntary agreements between developers and a council agency. They allow for the direct provision of infrastructure or land by the developer. The developer agreement can in these instances replace other funding tools that would otherwise have been applied, such as DCs.
- **Targeted levies** are functionally equivalent to targeted rates in how they are administered. The big difference is that they allow access to third-party funding (the Crown in the current form of the law) via the new Infrastructure Funding and Financing Act of 2020. Subject to legislative change, it may be possible, at some point in future, to use targeted levies to provide access to non-government third parties.
- **Value capture tax tools** (not yet legal in New Zealand) seek to capture, for government, some of the private value gains that accrue to property owners in particular locations, as a function of government investment there. They are based on the economic principle of "beneficiary pays"; those who benefit from investment in a specific location should be the ones who primarily pay for it. As such, they make good economic sense, but as described above, can be very hard to accurately measure and enforce.

7.3 Choosing the right funding tool

There are at least 10 considerations in choosing the right funding tool. This section sets out these considerations with some practical examples of tools that meet them well or that do not.

7.3.1 Is this tool easy to administer and enforce?

Any tool that is hard to calculate or where the infrastructure provider has no ability to enforce collection is weak. For instance, the processes to establish property values (land and improvements) are well documented and have been similar for many years. This makes the use of general or targeted rates on capital value or land value easy to administer. They are also easily enforceable. This paper has already touched on the ability to estimate VC impacts at the other end of the scale. In the middle are any more ad-hoc tools such as targeted levies or developer agreements, where the tool is relatively new (in the case of a targeted levy) or where court action may lead to unexpected outcomes.

Best tools in the toolbox: DCs, general rates, and targeted rates

7.3.2 Can this funding tool be borrowed against?

This is one of the great weaknesses of DCs. DCs require councils to forecast what the development community is going to do, which is hard both in times of rapid house price growth and in times of decline as is currently being experienced. This means the revenue stream from DCs is uncertain and is not counted as a stable revenue stream against which to borrow by credit ratings agencies. General and targeted rates, on the other hand, are practically guaranteed revenues, underpinned by the property against which they are issued.

"…the revenue stream from DCs is uncertain... General and targeted rates, on the other hand, are practically guaranteed revenues…"

Best tools in the toolbox: General rates, and targeted rates

7.3.3 Does this funding tool create certainty of timing?

Closely tied to the previous point, any tool involving guesswork (even if informed by data) about when the revenue will be generated and therefore when it can be borrowed against or spent on infrastructure, creates uncertainty. If one is relying on an uncertain revenue source like DCs, it also means one cannot have the confidence to start building a piece of infrastructure because if the development market hits a downturn, one's revenue stream to pay for the infrastructure becomes highly uncertain.

Best tools in the toolbox: General rates, targeted rates, and targeted levies

7.3.4 Does this tool incentivise development?

To make sure that a piece of new infrastructure does not sit under-utilised if development materialises more slowly than anticipated, a funding tool that encourages more rapid development is needed. Tools like DCs, which are triggered when a developer begins development, disincentivise development because the longer development is delayed, the longer until payment is required. Tools like targeted rates, which are charged regardless of whether development slows or accelerates, nudges development along because the landowner at any given time contributes whether they are developing or not. Developers are, albeit to a limited extent, incentivised to develop.

One other major incentivising element to funding tools is available through the economically-sound application of general or targeted rates. While general rates are not always a good way to fund new infrastructure, if they are used, basing them on land values rather than capital values is more likely to incentivise efficient use of land. The advantages of a land value-based ratings system are covered in depth in a paper by Auckland's Chief Economist Unit.[24] In summary, capital value-based taxes penalise people for developing land efficiently. Land value-based taxes incentivise people to use land efficiently. Both approaches are legal in New Zealand.

Best tools in the toolbox: Value capture, targeted rates, and targeted levies

[24] See David Norman and Shane Martin, *Landing on the right ratings base for Auckland*. 2020. https://www.aucklandcouncil.govt.nz/about-auckland-council/business-in-auckland/docsoccasionalpapers/landing-on-the-right-ratings-base-for-auckland.pdf

7.3.5 Can this funding tool be hypothecated?

Local governments are challenged by a period of huge cost escalation, necessary infrastructure investment and insatiable demands for service improvements from the public. These realities are triggering bigger rates rises to avoid infrastructure failure. Charging extra to fund a specific piece of infrastructure, using a tool that can be ring-fenced for that purpose, can be more palatable to residents. Targeted rates, targeted levies and DCs can all be used in this way, providing transparency as to what the funding goes toward.

Best tools in the toolbox: Value capture, DCs, IGCs (if they could be applied to the transport network), developer agreements, targeted rates and targeted levies

7.3.6 Is this tool publicly acceptable?

In general, if a tool can be shown to primarily charge those who directly benefit from new infrastructure, it is likely to enjoy greater support. However, this is an area misunderstood, particularly by existing residents and ratepayers. Often, infrastructure investment results in improved or maintained property values (either because of improved amenity like a new bus route, or reduced risk because of water quality or flood protection work), but landowners do not always make the connection between the rise in their property value and infrastructure that enables this through, for instance, better transport or three waters provision.

Further, options such as rates postponements already exist for those who are asked to contribute a fair share to the cost of infrastructure that guards their property value, but who do not have the regular income to afford to pay for this. Under these policies, rates can be deferred until the property is sold and the windfall gain in value attributable to infrastructure can be realised.

Nevertheless, public acceptability of a tool can be a challenge. Some tools that show that development is broadly paying for itself are likely to be more acceptable, especially for greenfield growth where few people live at present.

Best tools in the toolbox: Value capture, DCs, IGCs (if applicable), financial contributions, developer agreements, targeted rates, and targeted levies

7.3.7 Does this tool unlock third-party spending?

This paper has already introduced some forms of third-party funding – primarily targeted levies in conjunction with central government, or voluntary developer agreements. The value of third-party funding comes only if this contribution to delivering infrastructure can be kept off the infrastructure agency's balance sheet.

There is scope to widen the list of agencies that may be able to provide this third-party funding, including NZ Green Investment Finance for example. This will increase the choice of financing partners available to local governments where the tool is already being applied.

Best tools in the toolbox: Developer agreements, and targeted levies

7.3.8 Is this tool inter-generationally fair?

In net present value terms, there should be no difference between a one-off accurately estimated DC charged to a developer (and included in house prices) and a 30-year targeted rate or levy imposed on a property instead. They should pay for the same infrastructure at the same approximate cost. However, the latter rate/levy mechanism is arguably considerably more transparent and logical to the non-technical observer of a contribution toward infrastructure costs because it is paid annually by the occupier of the property at any given time. This means the incidence of the levy or rate falls on the developer while they own the land, and on the home or business owner when they occupy the land. This creates a sense of intergenerational fairness that may favour targeted rates and levies over DCs for instance.

Best tools in the toolbox: Value capture, targeted rates, and targeted levies

7.3.9 Can this tool be used to build a kitty in advance of building?

A further consideration is whether a tool can be charged in advance of starting to build the infrastructure. This allows debt-heavy infrastructure agencies to build up a kitty to help pay for the infrastructure down the track. In the

case of targeted rates, there is the added bonus of allowing councils to borrow against those collected funds to leverage up available funds to build infrastructure sooner.

Best tools in the toolbox: Value capture, DCs, IGCs (if applicable), financial contributions, general rates, targeted rates, and targeted levies

7.3.10 Is a legislative change needed to use this tool?

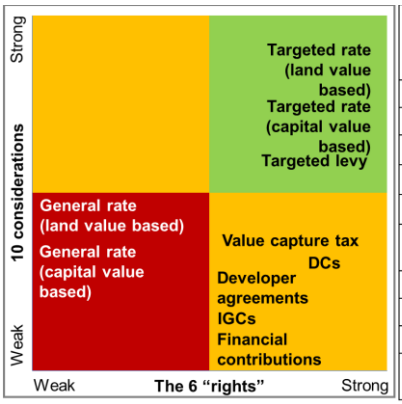
Except for value capture taxes, all these tools already exist in New Zealand law, so legally they can be applied although there may be limitations on the types of activities that can be funded by specific tools. Any time new legislation is introduced, it is a lengthy process that creates risk of perverse outcomes. That is not a reason to avoid new tools or legislation but does encourage one to consider the usefulness of existing tools before leaping after new ones.

Best tools in the toolbox: All tools other than value capture

7.4 Evaluating funding tools against the considerations

This paper has considered the need to deliver the right infrastructure to the right place paid for by the right people at the right price announced at the right time using the right funding mechanism. It has further examined 10 considerations in choosing the right funding mechanism or tool. This section provides a summary of where the different tools sit in their performance against the six "rights" and the 10 considerations.

Figure 19 Performance of different funding tools against the six "rights" and the 10 considerations



Considerations in choosing a funding tool in the transport growth context	Value Capture	DCs	IGCs	Financial contributions	Developer agreements	General Rates, Capital Value	General Rates, Land Value	Targeted Rates, Capital Value	Targeted Rates, Land Value	Targeted Levy (IFF)
Easy to administer / enforce?		✓				✓	✓	✓	✓	✓
Can be borrowed against?						✓	✓	✓	✓	
Creates certainty of timing?						✓	✓	✓	✓	✓
Incentives development?	✓							✓	✓	✓
Can be hypothecated?	✓	✓	✓	✓	✓			✓	✓	✓
Is publicly acceptable/ beneficiaries pay?	✓	✓	✓	✓	✓			✓	✓	✓
Can access 3rd party funding?					✓					✓
Is intergenerationally fair?	✓							✓	✓	✓
Can be charged in advance?	✓	✓	✓	✓		✓	✓	✓	✓	✓
Doesn't require legislative change?		✓	✓	✓	✓	✓	✓	✓	✓	✓

Targeted rates (levied by a council) and targeted levies agreed with central government (as being applied in Milldale in Auckland) are the tools that do best across both these ways of evaluating tools. General rates of various forms are among the weakest ways to fund infrastructure for several reasons.

7.4.1 When the funds would be received

It is vitally important to understand ***when*** funds would be received for infrastructure delivery. Any change in the tools used that means there would likely be a delay in accessing funding for infrastructure compared with the status quo would be a step backwards in terms of delivery.

Most tools can be implemented to collect money in advance of delivering the infrastructure to build a pool of funding to apply (consideration nine). However, to get a fuller picture of which tools are best for receiving the funds earlier and therefore getting infrastructure delivered faster, this question should be viewed along with whether:

- the tool provides leverage in terms of the ability to borrow against
- the tool provides certainty of timing of receiving funding
- the tool incentivises more rapid development
- the tool can be used to access third party funding.

Combining these considerations, Figure 20 shows the spectrum of how quickly different tools unlock a pool of money that can be accessed for infrastructure delivery if that infrastructure needs to be centrally delivered. It also takes into account the other points made above about incentivising development or accessing third party funding.

Figure 20 Certainty, speed and scale of accessing more funding

Of any of the common tools, targeted rates and levies provide the most rapid access to the funding stream while incentivising faster development.

7.5 Application of tools to wastewater challenges

As discussed previously, cross connections on private property, when identified, are remediated at the cost of the property owner, not by ratepayers more broadly.

Our focus here is therefore primarily the range of tools applicable to the wastewater capacity challenge. For stormwater, where water sensitive design is proposed, for instance, a different set of tools may be appropriate.

7.5.1 Inappropriate tools

Two of the tools discussed in this report are inappropriate for funding the wastewater improvements needed to reduce *E.coli* levels: ***value capture*** mechanisms and ***financial contributions (FCs)***.

Value capture is inappropriate primarily because it is not currently an available tool even though some of the benefits of wastewater improvements will benefit private land owners. This will also make it hard to identify how land values have been affected directly by improved water quality in specific locations.

FCs are used to offset additional environmental impacts from new development. As most of the costs for improving wastewater are due to existing development, not new development, FCs are unlikely to be able to be used to recoup much of the cost anyway, but will also be inappropriate when the costs of improved infrastructure would far more simply be covered by some of the other mechanisms described below.

7.5.2 Tools to apply to growth areas

Some of the costs associated with wastewater improvements will be the consequence of growth. As this report has highlighted, the original modelling accounted for some growth in households in the two whaitua. GWRC's current projections suggest even more dramatic growth in households over the next 50 years.

It is therefore appropriate that growth shoulder a significant portion of the cost of improving wastewater outcomes. The exact share would need to be established through a thorough analysis of who benefits from the improvements, i.e. how much of the benefit of improved wastewater outcomes accrue to existing residents versus those being added through growth.

Tools that can be used to ensure that growth bears an appropriate share of the cost of reducing *E.coli* levels include:

- Targeted rates
- DCs
- IGCs
- Targeted levies.

All these tools have functionally the same intent, which is to collect funds from growth to pay its share of the cost of infrastructure. One advantage of targeted rates is that they can be applied to both growth (so that new development pays its share) and to existing development where a service improvement (better wastewater services) occurs.

A further tool that could be adopted is ad-hoc ***developer agreements***, where rather than providing a share of the funding, a developer agrees to deliver a new piece of infrastructure, an improvement or upgrade that allows their growth to be accommodated by the network.

7.5.3 Tools to apply more broadly

All the tools mentioned under the previous heading will only meet some of the cost of the wastewater improvements – the share that can be shown to be attributable to accommodating growth. The rest will have to be funded by:

- more traditional tools
- ad-hoc central government tools
- in the case of cross-connection remediation, ***owners of individual properties will pay***.

The two most traditional tools likely to be used are ***general rates*** or ***targeted rates***, with general rates carrying most of the load at present in Wellington. As discussed previously, general rates are charged across all ratepayers typically based on land or land plus improvement value. Targeted rates are charged for a specific purpose in a specific location.

The latter tool tends to be politically more acceptable because it is targeted to a specific use, which gives the public confidence that it will not be spent on other uses. Some councils, most notably Auckland Council, have introduced "targeted rates" that are targeted by use, but not by geography. In the case of the two whaitua it may be possible to introduce different rates in different areas based on the level of improvement in water quality enabled by the interventions. The greater the clarity ratepayers have between what they are paying for and improvements in their communities, the less opposition there is likely to be.

7.5.4 The impact of a separate water entity

At the time of writing it remains government policy to establish four new water entities for managing three waters. In the event that this occurs, the challenge of wastewater network funding will pass to the new entities. While they will be able to use the mechanisms of ***IGCs*** to cover the costs of infrastructure for the connection of new development to the network, the other growth funding tools are unlikely to be available.

Similarly, in the case of the bulk of the wastewater improvements required, funding tools will be limited. As an entity that is to broadly fund itself, operating on a commercial model, Entity C (of which Wellington Region is a part) would need to source the funding for wastewater improvements primarily from its customers. This means ***charging for the improvements through water charges reflected on customers' water bills***. Water customers are the same people as ratepayers by and large, so while the entity charging would be different, the same significant costs discussed in this report would be imposed.

In some cases, there may be an argument that the scale of the improvements may be too large to place upon local water customers alone. In this case ***central government may provide ad-hoc funding assistance*** for projects. This shifts the costs from water customers or ratepayers to taxpayers, who are also by and large the same people although the burden may be shifted outside of the geographic area that benefits. Wellington Region, however, with one of the highest average household incomes in the country, is more likely to be a net subsidiser of other parts of the country rather than a net beneficiary of ad-hoc taxpayer funding.

Subject to the final revenue raising policies of the emerging Entity C, there might an opportunity to spread some of the costs across the wider entity area beyond the Wellington region given a premise of the reforms is to spread costs across greater areas. However, this policy has not yet been developed or adopted so cannot be relied upon at this stage.

8. Limitations

This report has been prepared by GHD for Greater Wellington Regional Council and may only be used and relied on by Greater Wellington Regional Council for the purpose agreed between GHD and Greater Wellington Regional Council as set out this report.

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Accessibility of documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

8.1 Assumptions

This report has relied on documents produced for Greater Wellington Regional Council as well as rates and other data sourced from constituent councils. Where possible, we have interrogated this data to better understand its sources and implications, but this has not always been possible. Costs presented in the original reports are indicative life cycle cost estimates based on the available information at the time of publishing. We have not verified the accuracy of the cost data and have used this information inflated to 2022 dollar values

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