Opportunities for improvement in Bermuda's water sector

Consultation document

31 August 2022

Introduction

The Government of Bermuda has tasked the Department of Public Works with developing recommendations to improve Bermuda's water and wastewater regulatory structure. Bermuda's traditional approach to water services and water sector management has served the island well but opportunities for improvement exist. If the sector remains unchanged, there is a risk of negative public health and environmental outcomes, higher costs for Bermudian households and businesses, and impacts to country's reputation as a premier vacation destination and a location for global business.

The Department of Public Works has engaged Castalia, a strategy consulting firm specializing in water sector policy, to assist with the review of Bermuda's water and wastewater regulatory structure. As part of the review, the Ministry of Public Works and Castalia have analysed the water and wastewater sectors in four other case study countries. These countries include, the United Kingdom, the Cayman Islands, Florida (United States), and New Zealand. Key elements of each country's water and wastewater regulatory structure have been compiled and are presented in a summary in Appendix A

Analysis of the current water and wastewater regulatory system, as well as input from the case studies and the stakeholder feedback sessions will inform the Ministry of Public Works' initial assessment. The Ministry of Public Works recently completed a first round of consultations with other Ministries and government agencies, service providers, and commercial customers to identify opportunities for improvement. This consultation will be followed by a round of public consultations and a second round of stakeholder consultations in late 2022. These sessions will provide feedback on the Ministry of Public Works' understanding of the opportunities for improvement and the recommendations on regulatory changes. The Ministry of Public Works will then submit its initial assessment which will inform the modified regulatory framework.

Current problems and risks in Bermuda's water sector

Current problems in Bermuda's water sector, as well as potential future risks, could lead to negative public health and environmental outcomes. These problems and risks may also contribute to higher costs for Bermudian households and businesses. In addition, they could jeopardize the country's reputation as a premier vacation destination and an attractive location for global business.

This document summarizes the current problems and potential risks that have been identified during an initial assessment. The Ministry of Public Works is seeking feedback from the public as stakeholders to better understand these problems and risks and determine how they should be managed.

Based on a common understanding of the most urgent problems and risks, the Ministry of Public Works will propose a modified regulatory framework that can respond effectively, contributing to the health and prosperity of current and future Bermudians.

Wastewater treatment plants discharge into the ocean

Wastewater treatment plants are discharging minimally treated sewage through two outfalls,[1] one operated by the Corporation of St. George's and the other by the Corporation of Hamilton. The St. George's outfall is currently being decommissioned.[2] The Tynes Bay Septage Facility has limited screening capabilities and is connected to the sewer network that leads to the Front Street Wastewater treatment plant.

The Corporation of Hamilton operates the larger of these outfalls, which discharges wastewater and occasionally grease into the Atlantic Ocean. When easterly winds blow, greaseballs can form and wash up on south-shore beaches. In addition to impacting the aesthetic value of the beaches, greaseballs are also a potential public health risk.

The Department of Health tests seawater and monitors for greaseballs at 15 sites across Bermuda on a weekly basis using United States Environmental Protection Agency guidelines. Only 0.4 percent of sample reports (13 out of 3,312) taken by the Department of Health since 2014 have identified greaseballs.[3]

Grease often comes from restaurants that do not use grease traps and dispose of used oils into drains. As part of its fats, oils, and grease policy developed in 2015, the Corporation of Hamilton replaced its wastewater filtering screens and hired a retired health inspector to work with restaurants to enforce the use and regular cleaning of grease traps. This has significantly reduced the amount of grease reaching the Front Street plant. As part of its operating license, the plant is required to add additional microfiltering screens and equipment for chemical disinfection.[4] The Corporation of Hamilton has budgeted for these investments, which have not yet been implemented.[5]

Bermudians do not get as much water as they would like when rainfall is low

Unlike most countries, Bermuda gets most of its water from rainwater harvesting, with piped and trucked water supplementing demand. Though rainwater harvesting has functioned well for over 400 years, however the approach has been and will continue to be impacted by climate change.

Climate change is expected to lead to more severe storms and longer dry spells in Bermuda. Though total rainfall is likely to increase, it will be in the form of more severe storms and hurricanes, which can contaminate household cisterns with saltwater. During dry spells, household cisterns are depleted and demand for trucked water spikes, which has led to rationing in some cases.

Rising sea levels resultant from climate change will impact salinity levels in Bermuda's freshwater lens and limestone bedrock. Higher levels of salinity in lens water will necessitate greater treatment requirements thus negatively impacting freshwater availability and resilience.

In addition, demand for water has risen while the capacity for rainwater harvesting has remained mostly constant. Demand for water in Bermuda has tripled in the last 50 years, increasing from 10 imperial gallons per person per day in 1968 to 30 imperial gallons in 2002.[6] There has been somewhat of plateau due to a recession and the pandemic over the last 10 years but these events will subside. However, the maximum amount of rainfall that can potentially be collected is limited by the combined surface area of Bermuda's rooftops, which has been impacted by the increased use of multistory housing. As a result, rainwater alone is unlikely to meet demand.

Risk of consuming unsafe water by customers and tenants

In 2018, due to uncertainty over drinking water quality the United States Center for Disease Control recommended visitors to Bermuda avoid drinking tap water.[7] Additionally, a 2013 survey found 88 percent of residential tap water was contaminated by bacteria commonly transmitted through bird feces.[8] The bacteria, Salmonella Mississippi, causes about 150 reported cases of gastroenteritis each year.[9] Seven out of ten of these cases are in children under five years old, who are at greater risk.[10] Older people are also at greater risk, which is a concern given Bermuda's aging population. However, the problem is not currently severe. In 2019, about 0.2 percent of the population in Bermuda reported a waterborne illness compared to 2.4 percent in the United States.[11]

The monitoring of piped and trucked water quality is not consistent across all providers. Some are very conscientious and follow best practices while others a not so reliable. The Department of Health does what they can with the resources available with regard to a drinking water quality monitoring program. Currently however, water testing is usually done on a voluntary basis, or in response to specific complaints from customers. This creates a risk that customers could consume unsafe water, as it is difficult for them to evaluate the quality of the drinking water by themselves.

Additionally, If residence drink Cistern water, it is unfiltered, exposing them to potential health risks. Homeowners are ultimately responsible for the quality of the water in their cisterns. To measure their drinking water quality, they can have their water tested by the Department of

Health and private labs for bacterial and salt content, although no labs in Bermuda offer chemical testing. However, it is more difficult for tenants in rental housing to assess the safety of the water they drink

Lack of incentives to keep costs low

In any free market, competition between sellers helps keep costs low. When there is little or no competition, businesses are less likely to provide efficient services at the lowest cost possible. Like water utilities in other countries, public and private service providers in Bermuda do not have direct competition. While the owners of private service providers will push managers to control costs, public service providers do not face the same pressure. When their costs are high, citizens pay more for services, either directly through tariffs or indirectly through taxes.

Non-revenue water, a measure of utility efficiency, is the percentage of water produced that is lost due to leaks, meter inaccuracies, and other reasons. When the non-revenue water rate is high, utilities have higher costs since they must produce more water to make up for these losses.

Incomplete cost recovery for the cost of service

Public service providers in Bermuda set their own prices, unlike utilities in many other countries. Higher tariffs are unpopular, so there is a risk they could set their tariffs below what it costs to provide piped water and sewerage.

However, costs that cannot be covered through tariffs are indirectly paid through higher taxes. This discourages efficient consumption, as consumers do not see the true cost of service. Since everyone pays higher taxes as a result of low tariffs, heavy users of water are also subsidized at the expense of households that are not connected to the network.

There is a risk that some piped water and wastewater services are priced above cost

Like public water and wastewater service providers, private providers set their own prices in Bermuda. Since they are selling a basic daily need in a market without competitors, there is the risk that private service providers could charge prices far above their cost of service.

Providing adequate access, reliability, and customer service

Without competition, service providers are less likely to provide high quality service and expand coverage to less-profitable areas. In addition, if public providers cannot charge what it costs to provide services, there is a risk that they may postpone maintenance or infrastructure investments, reducing the quality of service and limiting their ability to connect new customers.

The Ministry of Public Works has placed a moratorium on new connections in certain parts of their existing distribution network and has not extended the network in over a decade. There is currently a database of approximately 331 potential customers who have not yet been

connected.[12] Additionally, aging infrastructure has led to frequent mains failures, impacting reliability.

There is a risk that some trucked water and wastewater services are priced above cost

Since most households rely primarily on rainwater harvesting and cesspits, water truckers and septage haulers are an important part of Bermuda's water sector, although there is a risk that limited competition could lead to higher prices for customers.

In a market with many competing businesses, each one is pushed to provide the highest quality service at the lowest price to attract customers. If new businesses cannot easily enter the market, or businesses agree on a common price, then competitive pressure decreases.

The Bermuda Water Truckers Association sets a standard price per tank load for its members.[13] Additionally, the Ministry of Transport is not issuing new water trucker licenses, which limits the number of businesses providing trucked water.[14] Additionally, in a series of focus groups conducted in 2013, many Bermudians expressed concerns about high prices for trucked water.[15]

Compared to the number of water truckers, there are few septage haulers in Bermuda, which may also lead to limited competition.

Appendix A: Case study summary

The Department of Public Works and Castalia analyzed the water and wastewater regulatory structures of several countries and jurisdictions to determine possible adjustments that could improve Bermuda's water and wastewater regulatory. Below we discuss the rationale for selecting each country and then describe key elements of its respective regulatory structure.

The Department of Public Works and Castalia analyzed the water and wastewater structures of England, the Cayman Islands, Florida, and New Zealand.

We used the following rationale for selecting each jurisdiction:

- England has a similar legal system based on common law and Bermuda is a British colony
- The Cayman Islands are similar to Bermuda in many ways; It is an island nation in a tropical climate and a British colony with an economy supported by tourism. The Cayman Islands also use water truckers to a significant extent to meet water demand.
- Florida is a tropical and coastal jurisdiction that supplies a significant portion of its water through reverse osmosis, like Bermuda.
- New Zealand, similarly to Bermuda, has had nationwide issues with its water and wastewater systems and is currently undergoing a restructuring of its water and wastewater regulatory system.

There are several key differences between Bermuda and the case study countries that help to inform the proposed water and wastewater regulatory changes:

- All jurisdictions have a water sector regulator (be it an economic regulator or water quality regulator) that is separate from a government department.
- Most jurisdictions strongly regulate or discourage the use of water truckers.
- Most jurisdictions have service quality standards.
- Most jurisdictions do not rely on rainwater harvesting as the primary source of drinking water.

Table Error! No text of specified style in document.**.1: Case study summary table**

		Bermuda	England	Florida	Cayman Islands	New Zealand
Water resources and wastewater	**Drinking water sources (annual)**	▪ Ground water extraction approximately 30 percent ▪ Rainwater harvesting, approximately 42 percent ▪ Desalination by reverse osmosis, approximately 27 percent	▪ Ground water: 30 percent ▪ Surface water: 70 percent	▪ Ground water: 87 percent ▪ Surface water: 13 percent	▪ Ground water: 5 percent on Grand Cayman, with higher percentage on the Sister Islands ▪ Surface water: none available ▪ Rainwater harvesting 7 percent ▪ Desalination: ~80 percent	▪ Ground water: 1.67 billion cubic meters ▪ Surface water: 3.53 billion cubic meters ▪ Rainwater harvesting about 10 percent of households rely on this water source.
	Water Stress	▪ No official measure, but baseline water stress is estimated to be medium to high due to occasional droughts.	▪ South-east areas of England are seriously water stressed. North-east and western parts of England are not water stressed.	▪ Medium to high baseline water stress	▪ No official statistics available	▪ Baseline water stress of 15.7 percent which falls within the United Nation's no water stress category.
	Drinking water: public versus self-supply	▪ More than 95 percent residential premises have onsite rainwater harvesting systems.	▪ Public supply: 99 percent ▪ Self-supply: 1 percent	▪ 92% of water is supplied through piped networks, with the remainder self-supplied	▪ Public supply: 88 percent ▪ Self-supply: 12 percent	▪ Public supply: 82 percent ▪ Self-supply: 18 percent
	Wastewater: public versus self-supply	▪ Primarily self-supply	▪ Public supply: 96 percent ▪ Self-supply: 4 percent	▪ Public supply: 67 percent ▪ Self-supply: 33 percent	▪ Public supply: 20 percent ▪ Self-supply: 80 percent	▪ Public supply: 80 percent ▪ Self-supply: 20 percent
	Wastewater treatment and disposal	▪ Over 50 percent of wastewater is disposed in deep boreholes. The remaining water is managed by WWTPs, septic tanks, and marine outfall.	▪ All wastewater receives at least secondary treatment; seven percent receives tertiary treatment.	▪ All wastewater receives at least secondary treatment.	▪ Approximately 20 percent of wastewater is treated by a WWTP (to a secondary standard). The remaining 80 percent of wastewater is managed using onsite solutions (septic tanks or aerobic	▪ 85 percent of wastewater receives tertiary treatment. The remainder receives secondary treatment.

		Bermuda	England	Florida	Cayman Islands	New Zealand
					treatment units used by commercial and industrial properties).	
Sector structure	**Water and wastewater service providers**	▪ Bermuda Waterworks (Watlington Water) provides water services. ▪ Corporation of Hamilton provides wastewater services. ▪ Ministry of Public Works(MPW),Corporation of St. George, Bermuda Land Development Company (BLDC), and the West End Development Corporation (WEDCO) provide both water and wastewater services.	▪ Nine large integrated water and wastewater providers, as well as several water-only and small-scale water and wastewater providers.	▪ More than 150 utilities provide water or wastewater, or both.	▪ Two utilities: Water Authority Cayman (WAC) which provide water and wastewater services, and Cayman Water Company (CWC) which only provides water services to the western part of George Town.	▪ 67 territorial authorities provide water and wastewater services across the country. New Zealand is currently reforming its water sector and plans to amalgamate service provision into four water utilities.
	Use of water truckers	▪ Water truckers provide supplementary water, as required by customers.	▪ Water truckers provide back-up water sources for commercial customers, and water companies. Water truckers do not serve residential customers directly.	▪ Water truckers provide services to customers, as required, and provide back-up supplies in emergencies.	▪ Private water trucking operations operate across the Cayman Islands. These operators purchase water from WAC and transport it to end users. Water truckers are the main source of freshwater on Little Cayman.	▪ 202 registered water trucking organisations supply communities through temporary water shortages.
	Corporate form of service providers	▪ A mix of ownership models ranging from private companies (Bermuda waterworks, truckers, hotels, condo associations), to quasi-autonomous non-	▪ Private companies. Some are listed on stock exchanges, others are privately own subsidiaries, or owned by infrastructure funds.	▪ Some are private companies, and others are owned by local government.	▪ WAC is a government owned and operated body corporate established under the Water Authority Law in 1982	▪ Water and wastewater assets are either directly owned and operated by the territorial authority or held in a council-controlled organisation.

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		governmental organizations (Quangos, such as BLDC and WEDCO), Municipalities (St. George and Hamilton), and Government			▪ CWC is a wholly owned subsidiary company of Consolidated Water Company, which is privately owned and listed on the Nasdaq stock exchange.	▪ Under the water sector reforms, the amalgamated utilities will continue to be publicly owned.
	Key policy making and regulatory institutions	▪ Cabinet sets sector policy ▪ Environmental Authority issues abstraction licences, and monitors compliance with water and wastewater standards. ▪ The Department of the Environment and Natural Resources (DENR) monitors compliance with abstraction rights. ▪ Department of Health sets water quality standards	▪ Cabinet sets sector policy ▪ Environment Agency (EA) is the environment regulator ▪ Drinking Water Inspectorate (DWI) enforces drinking water standards, and ▪ Ofwat is the economic regulator	▪ Florida Department of Environmental Protection (FDEP) is the environment regulator ▪ The US Environmental Protection Agency sets minimum quality standards ▪ Florida Public Service Commission (FPSC) or the Board of County Commissioners are the economic regulator	▪ Cabinet sets sector policy (as well as drinking water standards via regulations on the advice of the Health Services Authority) ▪ WAC sets and enforces wastewater treatment and quality standards. ▪ OfReg is the economic regulator	▪ Cabinet sets sector policy ▪ The Ministry of Health sets and enforces drinking water quality standards. Under the reforms, a new water sector regulator will enforce drinking water standards. ▪ Regional councils manage environmental impacts. ▪ Territorial authorities set and monitor service standards and tariffs. However, under the reforms, the multisector economic regulator, the Commerce Commission, will take over these responsibilities.
Water allocation and abstraction	**Allocation mechanism**	▪ The Environmental Authority issues water rights to applicants via licences.	▪ The Environment Agency (EA) allocates water on a catchment level. It issues licences authorising abstraction and enforces abstraction rules. Licences are issued on a	▪ Each of the 5 Water Management Districts (WMDs) allocate freshwater withdrawal permits by: approving applications that best serves the public	▪ WAC allocates rights to abstract groundwater through licences. WAC can only issue a licence if it is satisfied that the abstraction is for a beneficial use (which	▪ Regional councils allocate water within their council region (which broadly corresponds with river catchments) via water abstraction permits.

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		‘first-come, first-served’ basis. Abstraction rights are tradable.	interest, giving preference to renewals and to the user closest to the source (where competing applications serve the public interest equally).	accounts for economic and public interests). ▪ WAC must protect groundwater lens, and this duty impacts allocation decisions.	▪ Allocation is guided by regional plans, and the first-come, first-served rule.
Water abstraction rules	▪ All water abstraction requires a licence. ▪ There are three classes of water rights: Commercial Water Supply Business, Commercial Water Rights, and Domestic Water Rights. Each class comes with varying licence conditions.	▪ Water abstraction is prohibited unless the abstractor has a permit or a statutory exemption. ▪ The licence will permit volumes of abstraction for a specified purpose. If the right is not used, the EA can revoke the licence. ▪ The EA can limit abstraction rights during droughts.	▪ Residences can abstract water without a permit where a well serves no more than one rental residence or no more than four non-rental residences. ▪ All other water abstraction activity requires a water permit.	▪ Water abstraction for use by a single residence is permitted without a licence. All other water abstraction activity requires a licence issued by WAC. ▪ The licence will specify the maximum quantity that may be abstracted in any period, the rate of abstraction, and the purpose of the abstraction.	▪ Water abstraction is prohibited unless the abstractor has a permit or a statutory exemption. ▪ Permits will specify the volume and any other conditions on water abstraction, as well as the duration of the permit.
Compliance monitoring	▪ DENR monitors commercial water supply business reports and compliance with quarterly reporting conditions. DENR also monitors the state of the lenses on a quarterly basis and may alter abstraction limits in response to threats to the sustainability of the resource.	▪ Licence holders are responsible for monitoring abstraction in line with conditions specified in their licence. They must provide monitoring data to the EA.	▪ Water suppliers should report, record, and submit reports to the WMD as required by their permit ▪ With advance notice, the WMD's staff can enter, inspect, observe, collect samples, and take measurements of permitted facilities.	▪ Each licence holder is responsible for monitoring its water use and reporting this information to WAC. The terms of the licence will specify the required monitoring approach, including the technical specifications of flow meters.	▪ Permit holders are required by regulation to keep daily records measuring water flow in 15-minute intervals. The regional council can set stricter rules in the permit.

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	Enforcement	▪ DENR works with licence holders to resolve licence condition breaches. Where non-compliance continues, DENR can issue fines or revoke the water right.	▪ EA enforces licence conditions using a range of tools such as advisory letters, enforcement notices, or prosecution.	▪ Enforcement tools include letters of complaint, warning notices, seeking a temporary injunction, pursuing felony penalties, or seeking remedial actions.	▪ WAC enforces licence conditions. WAC has a range of enforcement tools including working with the licence holder to remedy the breach, issuing compliance notices, and prosecution (can result in up to one year imprisonment, and a $6,000 KYD fine).	▪ The regional council enforces water abstraction rules. Its enforcement tools include advisory letters, enforcement notices, formal warnings, and prosecution (can result in two years imprisonment and a $300,000 NZD fine).
Drinking water regulation	**Quality standards**	▪ Drinking water quality standards are based on WHO drinking water guidelines. These standards are issued by the Department of Health. ▪ The standard applies to commercial water suppliers (It does not extend to water truckers).	▪ Drinking water quality standards are based on WHO drinking water guidelines. These standards are issued by DEFRA. ▪ All water suppliers (including water truckers) are subject to the standard.	▪ The United States Environmental Protection Agency sets the National Primary Drinking Water Regulations which are the minimum standards for drinking water quality. The US EPA also sets non-mandatory aesthetic water quality standards, which the Florida DEP has made mandatory (except for PH).	▪ The World Health Organization (WHO) guidelines on drinking water quality are the de facto standard. Cabinet has not exercised its power to issue Cayman specific water quality regulations. ▪ This standard is imposed on CWC under its licence, and WAC as a statutory duty.	▪ Drinking water quality standards reflect WHO drinking water guidelines. These standards are issued by the Ministry of Health. ▪ All water suppliers (including water truckers) are subject to the standard.
	Compliance monitoring	▪ Water suppliers self-monitor and voluntarily collect samples for DOH to analyze. ▪ The Department of Health might take its own samples if unsafe water supply is suspected.	▪ Water suppliers must monitor their compliance with water quality standards and pass this data to DWI.	▪ Water utilities must collect and monitor water samples at the entry points and various points within the distribution system. Water utilities must submit the analytical results of samples to the FDEP. Sampling and	▪ Monitoring processes are not prescribed in statute or regulations. ▪ Both WAC and CWC monitor their water and provide this data to the Chief Medical Officer.	▪ Water suppliers must monitor their compliance with water quality standards and pass this data to the Ministry of Health.

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			reporting frequencies vary based on water system type, contaminant type, and other factors.		
Enforcement	▪ There are limited enforcement powers. ▪ Consumers can pursue civil claims of negligence if they are harmed by a breach of water quality standards by a supplier.	▪ DWI's enforcement options include advisory letters, enforcement orders, and criminal proceedings (can result in a fine and two years' imprisonment).	▪ The FDEP enforces drinking water quality standards. The FDEP can impose penalties on utilities for non-compliance with drinking quality standards. Penalties can be up to US $10,000 for each day in which a violation occurs. The FDEP may order the water supplier to take the corrective action needed to meet any of the requirements in laws, regulations, or permits	▪ The Chief Medical Officer (employed within the Health Services Authority) can seek a range of court orders which are necessary to protect the health of water consumers. ▪ Non-compliance with Court orders may result in a fine of $1,000 KYD, and up to four years imprisonment.	▪ The Ministry of Health's enforcement options include working with the supplier to remedy the action, issuing compliance orders, or prosecution (can result in a fine not exceeding $200,000 NZD). ▪ New offences with more severe penalties—including imprisonment up to five years for negligently supplying unsafe drinking water—would be introduced under the water sector reforms.
Water trucker regulation	▪ Water truckers are regulated under the Motor Car Act 1951. They are not regulated under water quality and service standards.	▪ Water truckers are subject to general water provider duties. Additionally, truckers must monitor their water every 48 hours until distribution is complete.	▪ All water tankers need proof of proper washing and sanitation. Water tankers must obtain certification from the Food and Drug Administration.	▪ Provided their water truckers source their water from WAC or CWC, water truckers are exempt from water quality requirements. WAC is the only source of water for water trucking operations in the Islands.	▪ Water truckers are subject to general water provider duties. Additionally, all truckers must register with the Ministry of Health.

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Wastewater regulation	**Treatment and discharge standards**	▪ Treatment and discharge standards are set by the Environment Authority in operating licences. All WWTPs require a licence. ▪ The treatment and discharge standards are set based on the sensitivity of the receiving environment.	▪ Wastewater treatment and discharge standards, along with monitoring requirements are stated in regulation. The EA imposes these requirements on WWTPs via permits.	▪ The FDEP sets discharge and treatment requirements in permits. Standards vary depending on the type of discharge and characteristics of the water body.	▪ Regulations specify minimum discharge parameters. Permits issued by WAC will prescribe wastewater treatment processes, and additional discharge standards to protect the receiving environment.	▪ Regional councils impose discharge standards on WWTPs via discharge consents. ▪ Treatment technology is largely un-regulated: the consent holder can choose the treatment technology that best meets their discharge standards.
	Compliance monitoring	▪ The licence holder must monitor its effluent discharge and report this information to DENR. The operating licence will specify the reporting frequency (with annual reporting set as a minimum).	▪ Permit holders must monitor influent and effluent in line with regulated requirements, and permit specific conditions set by the EA.	▪ The wastewater utility must monitor and report to the FDEP, according to the frequency, sample types, and monitoring locations set out in the permit.	▪ The permit holder is responsible for monitoring its compliance with its permit conditions and WAC issued guidelines. ▪ Permit holders must pass on their monitoring information to WAC and the Chief Environment Health Officer.	▪ Consent holders are responsible for monitoring the parameters set out in their consent conditions and reporting this information to the regional council
	Enforcement	▪ DENR adopts a collaborative approach where it works with the licence holder to address non-compliance. Where non-compliance continues, DENR can issue fines or revoke the licence.	▪ EA is responsible for enforcing permit conditions. Its enforcement tools include advice and guidance, to enforcement notices, and criminal proceedings (can result in a fine and 5 years imprisonment).	▪ The FDEP is responsible for ensuring that permit holders that violate the terms of their permit correct the problem. ▪ The FDOH, WMD, can also take legal action.	▪ WAC enforces treatment and discharge standards using a range of tools including compliance notices, licence termination, and prosecution (which can result in up to one year imprisonment and a fine of $15,000 KYD).	▪ Regional councils have a range of enforcement tools including letters of direction, abatement notices, formal warnings, and prosecution (which can result in two years imprisonment and a maximum fine of $300,000)

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Economic regulation	**Water and wastewater service standards**	▪ Service standards are not regulated.	▪ Regulations specify measurable service standards, and an automatic payment which a provider must pay to its customers if the standard is not meet. Ofwat administers and enforces this scheme.	▪ The Florida Administrative Code includes requires each utility to: provide continuous service, notify customers of scheduled interruptions, and provide a refund if water or wastewater service is interrupted for more than 48 hours. ▪ Local governments can set additional requirements at the county or utility level.	▪ Providers must provide their services to standards reasonably expected of a competent provider of those services. This standard is not defined by law, or by OfReg.	▪ Service standards are voluntarily set by territorial authorities. Legally, territorial authorities must report against a range of service standards, however, territorial authorities set their own performance targets.
	Service standards monitoring and enforcement	▪ Due to the lack of service standards, there is no monitoring or enforcement.	▪ Ofwat monitors and enforces the sectors' compliance with the service standards.	▪ The Florida Public Services Commission (FPSC) monitors and enforces standards for utilities for which it has jurisdiction. The FPSC can impose a penalty of up to $5,000 per day on utilities violating rules or orders in the certificate or law. ▪ Where the FPSC does not have jurisdiction, service standards are monitored by the Board of County Commissioners.	▪ OfReg monitors and enforces service standards. ▪ OfReg can consider customers' written service standard complaints. It has the power to make findings which are binding on the complainant and the provider. ▪ CWC's must pay a complainant 25 percent of its previous six months of water bills if it does not investigate water meter accuracy concerns.	▪ Territorial authorities monitor service standards as part of their annual reporting requirements. ▪ Service standards are enforced using democratic accountability: if an authority repeatedly fails to meet its performance targets, it risks being voted out

	Bermuda	England	Florida	Cayman Islands	New Zealand
Tariff regulation	▪ Water and wastewater tariffs are not regulated.	▪ Ofwat sets prices controls on each company through price reviews. Ofwat must set prices in a way that best achieves its duties which include ensuring companies can finance their functions, advancing consumer objectives, and ensuring resilient water supply.	▪ The FPSC regulates tariffs for the utilities over which it has jurisdiction. The FPSC imposes a rate structure that uses a base facility charge and a gallonage charge rate. ▪ For utilities where the FPSC does not have jurisdiction, the Board of County Commissioners can regulate tariffs.	▪ OfReg regulates water tariffs. It must exercise its duty consistently with a range of principles including allowing providers to recover their costs plus a fair return in exchange for providing efficiently and acceptable quality services at a fair price. ▪ OfReg uses a rate cape adjustment mechanism to adjust prices over time to account for energy costs, and inflation or deflation.	▪ Water and wastewater tariffs are not externally regulated. ▪ Territorial authorities have broad discretion to set rates and charges. The only limits come from local government legislation limiting the rates they can charge, and a political constraint where constituents can vote out a territorial authority which raises rates.

[1] A marine outfall is a pipeline for discharging wastewater into the ocean, relying on seawater's salinity and dilution for safe disposal. They are significantly less expensive than more advanced treatment technologies. However, if they are not properly designed, marine outfalls can cause environmental and public health risks.
[2] *Bernews*, "Minister Burch: Water & Wastewater Plan Update", 12 May 2021
[3] Department of Health data with calculations by Mott MacDonald, 26 July 2021
[4] Department of Environment and Natural Resources, "Corporation of Hamilton Sewage Plant Operating License (OL-142)"
[5] *The Royal Gazette*, "City of Hamilton upgrades sewage filtering screens", 6 August 2021
[6] Government of Bermuda Sustainable Development Unit, "Charting Our Course: Sustaining Bermuda", 2008
[7] *The Royal Gazette*, "US issues tap water warning", 15 March 2018
[8] De Leon, Mota-Meira, Pirkle, Rouja, "Highly prevalent contamination with bacterial faecal indicator species in Bermudian drinking water", *International One Health Conference*, March 2015
[9] Bermuda Ministry of Health, "Health in Review", Second Edition, Government of Bermuda, 2017
[10] De Leon, Mota-Meira, Pirkle, Rouja, "Not the Usual Suspect: S. Mississippi and Gastroenteritis in Bermuda", 2015
[11] IHME, Global Burden of Disease, 2019
[12] Ministry of Public Works data
[13] *The Royal Gazette*, "Cost of a water truck load set to reach $80", 11 February 2011
[14] *Bernews*, "Moratorium: Water Truck Licences", 30 January 2012
[15] Ministry of Works & Engineering, "Bermudian and Guest Worker Water Conservation Attitudes and Practices", October 2007