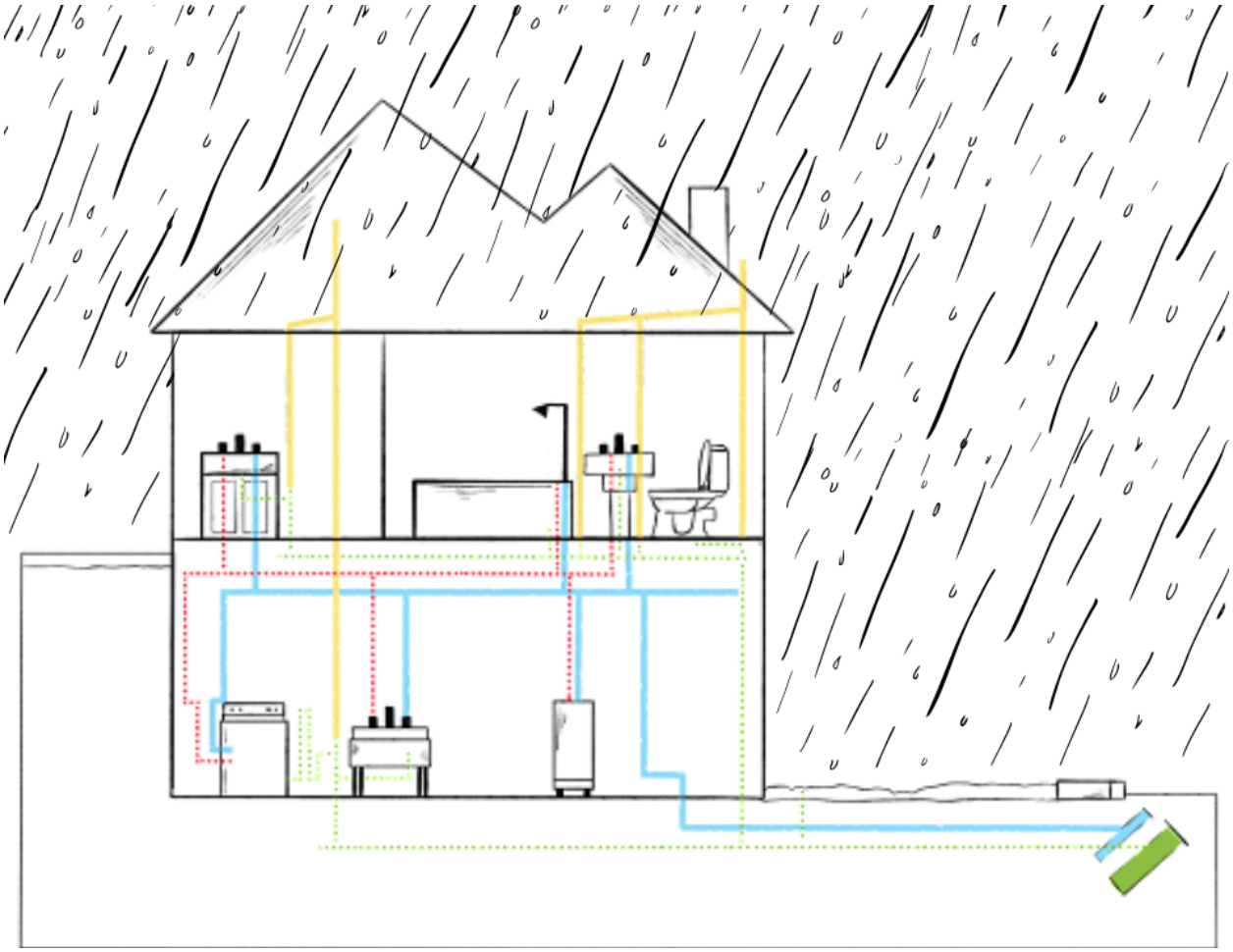
GLOBAL WATER ALLIANCE

A Household Level Guide to Water Literacy:

A Comprehensive Guide on What a Homeowner/Renter Should Know About Water and their Home



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Purpose of this guide

Het Nederlandse Gezinsboek (The Dutch Book of Families) is the reference for writing this text about water. During a large part of the 20th century the book was often donated to couples when they made wedding plans. Later The Gezinsboek has seen specialty versions regarding health, recreation, gardening, etc. This guide has been envisioned as the step beyond what an individual needs to know about water, from childhood through old age, and befitting her surroundings.

The audience

Our "family water guide" targets the general public. We wrote it to be understandable for the average person. It is set in the built environment that characterizes much of modern humanity, and works with the gestalts, laws, and norms of what western families in the early 21 century experience when 'homesteading.' Overall, the guide addresses any form of households – families with or without children, young homeowners/renters who live by themselves for the first time, people who have recently moved to cities or vice versa, and immigrants or non-native speakers. While this guide has a Western basis, the text can easily be adapted to the lived environment in other countries, with different climates, population densities and histories. Our guide is meant to be understood as the household occupying a fixed place of residence, whether in high rises, rowhomes or single-family dwellings.

Our purpose

Access to clean water and sanitation without limits is something that many take for granted. However, many lack knowledge about these issues, whether they were not taught or afraid to ask about it. We often don't know how to approach many of the topics in our guide, so we hope this guide will be a "one stop shop" that addresses many different topics related to household water literacy. We believe that education for all is the first step to make a change. To do this, it is important to educate homeowners/renters on everything they need to know about water related to the home. This includes but is not limited to insurance, paying for water and protecting the home from damage. We would like to persuade people to be more sustainable with their use of water and be aware of their water footprint. We want this to be easily understandable and something that people will find useful. We hope this guide will also be useful as climate change progresses and brings with it more flooding, water scarcity, water pollution, price increases, and other water issues that will most directly impact the home and will only increase over time.

Introduction on water: As consumers/users of water

Everyone interacts with water daily to varying extents, whether it is through drinking, bathing, or cleaning – it is an element that is the foundation of all life, but how much does the average person know about it? Water literacy can be defined as a person's knowledge, attitudes, norms and behaviors about water (McCarroll & Hamaan, 2020) that are required to plan, manage, store, distribute and use water (Morssink, 2021). Water literacy prepares people for and defends them from water-induced threats to life and livelihood. It is of vital importance to not just stakeholders in the water sector but every human being, especially as climate change threatens our clean water supply sources and increases the frequency and intensity of flooding and in the United States – more than two million Americans live without running water and basic indoor plumbing (DigDeep, 2019).

Otaki et al. (2015) identified three categories of water literacy: (1) Practical water literacy, which involves knowledge about actions that can protect one's life such as water quality and handwashing, (2) living water literacy, which includes knowledge about how to use water wisely in the home such as septic tank maintenance, and (3) social water literacy, which involves knowledge and decision making about water conservation, treatment, and use for society as a whole. Many studies have highlighted the importance of water literacy and found that it leads to greater public support for water management decisions (Dean et al., 2016), desalinated and recycled water (Fielding & Roiko, 2014; Dolnicar et al., 2010) and water conservation policies (Salvaggio et al., 2013). Addo et al. (2019) found that water conservation messages can reduce household water use and Madias et al. (2022) found that perceived knowledge about water usage is associated with higher rates of water conservation actions such as using smart water meters.

Many water literacy programs lack a focus on hydrosocial knowledge, which is the interaction between humans and water and studies how the hydrologic cycle is interlaced with social, political, economic and cultural processes and functional knowledge, which connects water knowledge to real world applications such as conservation and sustainability. A study that surveyed undergraduate students at a university in Ohio found that only 38% of respondents were able to identify the source of their hometown drinking water and only 62% first considered whether water was safe before drinking it (Johnson and Courter, 2020). A 2017 poll of Western voters by the Water Foundation found that only 56% of Western voters know where their water supply comes from (waterpolls.org).

An important aspect of water literacy that is not included in this guide, but will be included in another, is water and hygiene. When living in a household with other people, whether it is family members, a romantic partner, or roommates, many hygiene practices, behaviors and norms need to be negotiated and organized. This includes factors such as gender relations and menstruation, culture/religion, and teaching hygiene practices to young children. While this will not be discussed in this guide, it is important to be aware of this other aspect of water literacy and knowledge.

Overall, we are all consumers of water, but often lack knowledge about it due to many barriers such as lack of education, lack of time, and misinformation. This guide seeks to be a resource for you to learn more about water and how you interact with it in your home and daily life.

Water and Home

Introduction

Water has many domestic uses – it includes indoor and outdoor uses at residences such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, watering lawns and gardens, and maintaining pools. Domestic water use includes water provided to households by a public water supplier and self-supplied water use such as groundwater from wells or rainwater captured in a cistern. Whether you are a homeowner or a renter, there are many water-related subjects and problems in your home you should be aware of. From Homeowners and Renters Insurance to maintenance and wastewater treatment to paying your water bill, odds are you will have to deal with these tasks at some point in your life and it is important to know what to do and how to handle these tasks and issues when they arise. Knowledge of these subjects will not only help you to become more water literate, but can save you time and money and help to reduce your water footprint.

Before you buy/rent a home or apartment

Before you even consider moving into a new home, there are a few things you might want to look into. First is inspecting the home to make sure there is not any previous water damage or mold issues. A home inspection is necessary if a person wants to sell a home, but a landlord typically does not need to have an apartment inspected before renting it out to you. Water damage can be caused by a flood event, as discussed later in this guide, or could be from something as simple as a broken or leaky pipe behind a wall, in an attic or basement, or somewhere else that is hard to find (ISN, 2021). Water damage can result in mold growth, which can grow behind walls or other places that are not visible, so you may not know about it until it becomes a serious problem. Oftentimes, especially in older homes, there could be issues that the previous owner did not even know existed or that they are trying to pass off to the next person. Sometimes it could even be years of damage, which could cost thousands of dollars to repair and make your home inhabitable. Some signs of water damage you can look for on your own include peeling paint, wet or dark spots on the walls or ceilings (often brown or yellowish in color), a damp, musty, or moldy smell, flaking or cracked drywall, bowing or warped wood, and standing water in the basement or signs that the basement has been flooded, like water marks on the walls.

It is important to check for these things before you sign a mortgage or lease so you don't sign up for much more than you bargained for. If you are renting an apartment, make sure to

thoroughly read your lease beforehand and see what the policy on mold is and who is responsible for cleanup (you or your landlord). Oftentimes, your landlord is responsible for cleanup if you report the issue in a timely manner, but if you let a leak continue for a long period of time and don't report it, you may have to pay the costs of cleanup. If you are having trouble understanding your lease, there are many legal services available that will help you read and understand your lease for free. Check with your city's housing office or local housing authority to see if they have a landlord-tenant counseling agency, which is typically free. If you do have mold, it is probably best to hire a professional mold remediation company, as it can be dangerous to remediate mold yourself, especially if it has spread to many parts of your home.

You may also think it would be important to know if a property you are looking to rent or buy has been flooded before, but that is much harder than you may expect. You can use Federal Emergency Management Agency (FEMA) maps or other flood maps to see if you live in a high risk area, but it is not as easy to learn about a property's flooding history because many states in the United States do not require home sellers to disclose past damages to potential buyers. States such as Texas, Oklahoma, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, New York and New Jersey have strong flood disclosure laws, but if you live in many other states, you are not able to find any information about the flood history of a property. Check out this map created by the National Resources Defense Council to see the flood disclosure laws in your state. If you do live in a state with strong flood disclosure laws, a seller legally has to give you a document listing the flood history of a property you are looking to buy or rent before you purchase, and you are allowed to back out of the deal if you are not comfortable with it.

Homeowners/Renters Insurance

While Homeowners insurance doesn't cover flooding, it does cover damage from other water related issues such as hurricanes and accidental discharge or overflow of water from plumbing, heaters, air conditioning, automatic fire-protection sprinkler systems, or household appliances. Homeowners insurance can protect you in the event of an unexpected disaster and can make a huge financial difference in your recovery process. There are four types of coverage: (1) Coverage for the structure of the home, (2) Coverage for personal belongings, (3) Liability protection and (4) Additional living expenses.

Homeowners Insurance	
Type of Coverage	**What it covers**
Coverage for structure of the home	The physical structure of your home such as your walls and roof

Coverage for personal belongings	Items such as furniture, clothes, sports equipment and other personal items that are stolen or destroyed by fire, hurricane or other insured disaster
Liability protection	Protects against lawsuits for bodily injury or property damage that policyholders or family members cause to other people
Additional living expenses	Pays the additional costs of living away from home if a house is inhabitable due to damage from a fire, storm or other insured disaster. It covers hotel bills, restaurant meals and other living expenses incurred while the home is being rebuilt.

There are three coverage options: (1) Actual Cash Value, (2) Replacement Cost and (3) Guaranteed/Extended Replacement Cost. Actual Cash Value pays to replace the home or possessions minus a deduction for depreciation (the reduction in the value of items due to age and use). Replacement Cost pays the cost of rebuilding or repairing the home or replacing possessions without a deduction for depreciation. Guaranteed/Extended Replacement Cost offers the highest level of protection and pays whatever it costs to rebuild the home as it was before the fire or other disaster, even if it exceeds the policy limit.

A renters insurance policy and a homeowners insurance policy are almost identical but a renters policy doesn't include coverage for the building, since your landlord owns that. Like Homeowners Insurance, Renters Insurance does not cover flooding or mold. Renters Insurance typically provides three types of coverage: (1) Personal property coverage, (2) Renters liability coverage and (3) Additional Living Expenses.

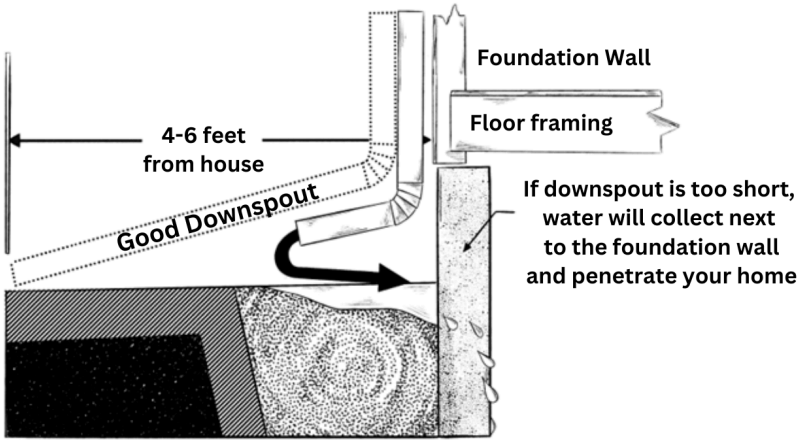
Renters Insurance	
Types of Coverage	**What it covers**
Personal Property Coverage	Furniture, clothing and shoes, electronics and devices, appliances and kitchen equipment, home goods such as bedding and towels, and most sports and hobby equipment such as bicycles and musical instruments. *Certain personal belongings may be excluded from a standard policy if they're above a certain value, such as jewelry & artwork
Renters Liability	Covers the policyholder in case of a lawsuit resulting from incidents originating on the rental property, such as accidental injuries, injuries from household pets, or accidental damage to a neighbor's personal property

Additional Living Expenses	Provides reimbursement if a covered disaster results in temporary relocation from the rental property.

There are two types of renters insurance policies – Actual Cash Value, which pays to replace your possessions minus an amount for depreciation up to the limit of your policy, and Replacement Cost, which pays the actual cost of replacing your possessions (with no deduction for depreciation), up to the limit of your policy. The price of Replacement Cost coverage is about 10% more than Actual Cash Value coverage but can be worth the extra cost. Some landlords require renters insurance as part of your lease agreement, so keep an eye out for that when signing your lease.

Water and Shelter Roofs, Gutters and Downspouts

Roofs and gutters are very important for your home as they help divert moisture away from your home's foundation and basement and prevent flooding and mold growth, especially during storms. They also of course provide shelter and protect you and your home from storms. A gutter is a shallow trough that is attached to the bottom of your roof and used to direct whatever away from your house. This water is directed through a downspout, a vertical pipe attachment that leads water down and away from your home (as seen by the image to the right), and to the ground. If you want to preserve the water that flows through your downspout, you can purchase a rain barrel to catch the water and use it to water your garden or grass. Many cities such as Philadelphia will provide rain barrels for free through programs such as Green City Clean Waters.



Gutters are important because if you don't have a gutter system, your roof can pick up leaves and other debris, causing water to stagnate and overflow. Make sure to clean your gutters out often to prevent damage or install a gutter guard to prevent debris from getting stuck in your gutter. It is important to ensure that your home's roof drainage system is performing effectively, so try to schedule a roof inspection once every few years to check on it.

Wastewater

Wastewater is used water. It contains substances such as human waste, food scraps, oils, soaps, and chemicals. Wastewater is produced by businesses, and industries, but also by

individuals. On the household level, all water that leaves your home is wastewater. This includes the water and waste that comes from your sink, your shower, your bathtub, your toilet, your washing machines, and dishwasher.

Once water leaves your home it is treated at a wastewater treatment plant, drainage beds behind septic tanks, or through sediment ponds. Wastewater treatment describes the handling of wastewater and sewage before releasing it back to the environment. Nature can only deal with a small amount of pollution and water wastes, thus, wastewater treatment plants help to reduce contaminants, nutrients and organics in wastewater to a level nature can handle. Today, wastewater treatment systems face new pollution problems due to heavy metals, chemical compounds, and toxic substances that find their way into our water and are difficult to remove. Knowing this, it is important to consider what you are flushing down your drains and toilets. While the water you use in your house can go to a wastewater treatment plant, there are other options for its use. Greywater is domestic wastewater produced on the household level by all streams free of feces, meaning all streams except toilet wastewater. Greywater can be generated from sinks, showers, baths, washing machines, and dishwashers. Greywater may still contain pathogens from soiled clothing or cleaning products, traces of dirt, grease, and hair. However, although it may look "dirty", it usually is easy to treat and safe and beneficial to reuse for toilet flushing, landscape and crop irrigation, and other non-potable uses due to lower amounts of pathogens than domestic wastewater. Given the global issue of the decrease of water availability on the planet, and the fact that water scarcity will affect approximately 2.7 billion people by 2025 (Musie & Gonfa, 2023), the reuse of greywater is an important solution which helps slow down the process of the deterioration of water resources. The use of treated greywater for toilet flushing can save up to 35% of drinking water (Mourad et al., 2011) and recycled greywater from showers and bathtubs used for irrigating lawn and flushing toilets can save the average household up to 30% on water consumption (Eriksson et al., 2022) which will result in a decrease in the price of your water bill.

Things you should NEVER flush down your sink toilet:

- Wipes (even the ones labeled 'flushable')
- Feminine hygiene products
- Diapers
- Paper towels
- Cotton swabs
- Dental floss
- Medications/pharmaceuticals
- Insoluble rubbers/plastics/papers
- Toothbrushes
- Cat litter
- Oil based paints and solvents
- Cooking grease
- Food (unless you have a working garbage disposal)

Setting up a greywater system can be simple such as using a bucket that collects shower water, but you can also choose a whole-house system that includes pumps, filters, and treatment. The simpler the system, the lower the cost, and the easier it is to take care of. A bucket to collect shower water is the least expensive greywater system and it can be used to flush the toilet or to water your garden. It is important to know that your greywater must be applied subsurface and remain within the boundaries of your property. Many people, especially those who live in more

arid climates such as Arizona, have set up greywater systems on their property to irrigate plants on their property and make up for the lack of rainwater to do so.

Greywater reuse can also help to reduce combined sewer overflow (CSO), which will be discussed further in the 'Water and Flooding' section. Reducing the amount of wastewater that goes into the sewer system by reusing greywater is a way to help reduce CSO events. Overall, the reuse of greywater is a great opportunity to save money on your water bill, but most importantly, to decrease your greywater footprint (please refer to the following section on water footprints) and thus, to make a sustainable choice in the fight against global water scarcity.

System maintenance at home

Septic Systems

A septic tank is a buried, water-tight container usually made of concrete, fiberglass, or polyethylene that holds wastewater that exits your home from your house and holds it underneath the yard. Solids (called sludge) and oil and grease (called scum) remain in the bottom and top of the tank respectively while liquid wastewater, also called effluent, exits into a buried drain field. Having a septic tank on your property means that your wastewater is being treated on your property and therefore you are not hooked up to a municipal sewer and will not receive a sewer bill from your city or utility. Not all houses have septic tanks, but if you do have a septic tank, you are responsible for it and there are some things you should know about its maintenance. Septic tanks need to be routinely inspected, emptied and maintained to avoid potential system failures. They should typically be pumped every 3-5 years, but the exact time frame depends on your household size, amount of wastewater generated, the volume of solids in your wastewater and the size of your septic tank. Thankfully, you do not have to pump your septic tank yourself and can hire a professional to do so. You can use the National Onsite Wastewater Recycling Association's (NOWRA) directory of septic tank professionals to find a professional in your area. It is also important to know that flooding can impact the functioning of your septic system, so if you have one, you may want to consider purchasing flood insurance in the event of unforeseen emergencies.

Sump pumps

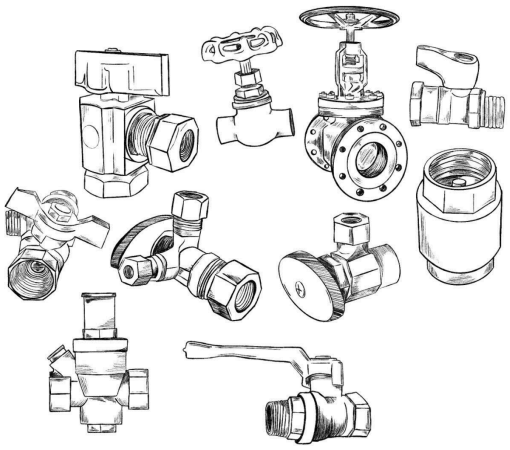
A sump pump is a device that removes flooded water from your basement. It works by detecting when water level is rising and turning on to direct water into a discharge pipe and away from your home to a municipal storm drain, a dry well, or an open site downhill from the foundation of the building. There are four main types of sump pumps: submersible, pedestal, battery-powered, and water-powered. A submersible sump pump has both the watertight submersible motor and pump in one piece of equipment that is hidden within the sump while a pedestal one has a separate pump unit and motor that projects out of the pump and above the basement floor (SSPMA, 2013). Battery-powered and water-powered sump pumps are ones that

only work when there is a power failure or your regular pump does not work; one just utilizes a battery to operate while the other uses water pressure.

Not every home has a sump pump— for example, it is not needed if you don't have a basement in your home. If you do have a basement, a sump pump is a good thing to have, as seen by the impacts of flooding mentioned in the Water and Flooding section of this guide. If you do have one, there are some good things to know about maintenance. You should clean the pump screen or inlet opening every 3 to 4 months. Make sure to disconnect power to the pump before doing this and reconnect it afterward. You may need to do this more often if your sump pump disposes of water from a washing machine. You should also pour enough water into the pump to cycle it and make sure it functions properly. On a yearly basis, you should remove your sump pump and clean the pump and pit.

Emergency Protocols in Your Home

There are many basic things you need to know about keeping your home safe from water-related accidents and emergencies. If you have a dishwasher or washing machine in your home, you should not leave while either is running, just in case there is a leak or fire that occurs. You should also know where the main shut off valve in your home is. The main shut off valve stops the flow of water into your home and needs to be shut off in case of a burst pipe, sewage backup, or plumbing accident. You can typically find your home's valve inside your home along the perimeter of the wall facing the street, next to your water heater, or in a crawl space. If you have a basement, it may be located there. If you live in an apartment, it could be outside near your unit or in the laundry room, if there is one. You should ask your landlord where it is located. Your shut off valve should look like one of the ones in the picture to the right – which one it is depends on your home. If your toilet starts to overflow with water, there is also an individual shut off valve on the bottom left of your toilet that can stop the flow of water either by turning it once or multiple times depending on the toilet – turn it until you feel resistance to stop the flow of water. You should turn your valve off and on every once in a while so that it does not get stuck and should also never try to force the valve open or closed. If it is stuck, call a plumber – you don't want to accidentally break the valve. Always have the phone number and contact information of a plumber on hand in case of an emergency.



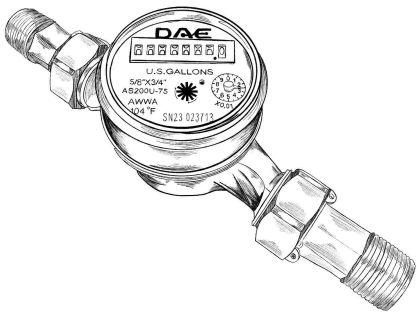
Understanding your water bill

It is necessary to have safe, clean, potable water delivered to your home. In some areas, that water is delivered in trucks, like homes in the very water stressed Navajo nation or in refugee centers. Sometimes it is delivered by vendors using a ricksha as in rural villages in Pakistan or using a mule and cart. In still too many places, it is hauled and delivered by designated members of the household whose chores include the routine. But in most urban and suburban regions of the world, water is delivered to the homes through lines, pipes, almost always underground. And similarly, water is delivered to businesses, community centers, schools, hospitals, sport arenas, mosques and churches.

The cost of water is not that high; after all it falls free from the sky, and when captured in a clean receptacle, is almost always safe and clean and potable. Treating, testing, and filtering surface or groundwater, however, definitely add costs to that water. And then of course the delivery of water is the costliest component. Delivery, however, is almost always related to a home, a building, a shelter. The delivery is to all who reside at such address, and the billing for that delivery is always to the owner, renter, sub renter, business manager.

One of the most important ways to improve your water literacy is to understand how much you are paying for water and why. It is the responsibility of the household or the business manager to have a contract with the delivery company, whether a private entity or a public enterprise, and pay the bill as it comes due. In some societies that can be an annual fee, paid regardless of the amount of water used. However, in most systems of piped water delivery the trend is to pay by quantity or water used, and meters are installed to measure that usage. Never per person, always per household, or business.

So, knowing that the household will have to pay the water bill is one thing, and knowing the consequences of not paying that bill is another; but knowing what the household's responsibility regarding maintenance and repair is relevant as well. These issues are highly variable across service systems and often have some communal, say political component woven into it. Moreover, in some scenarios, the homeowner may be billed, but the renter is not. When owners don't pay, renters may become the victim. A story too often witnessed.

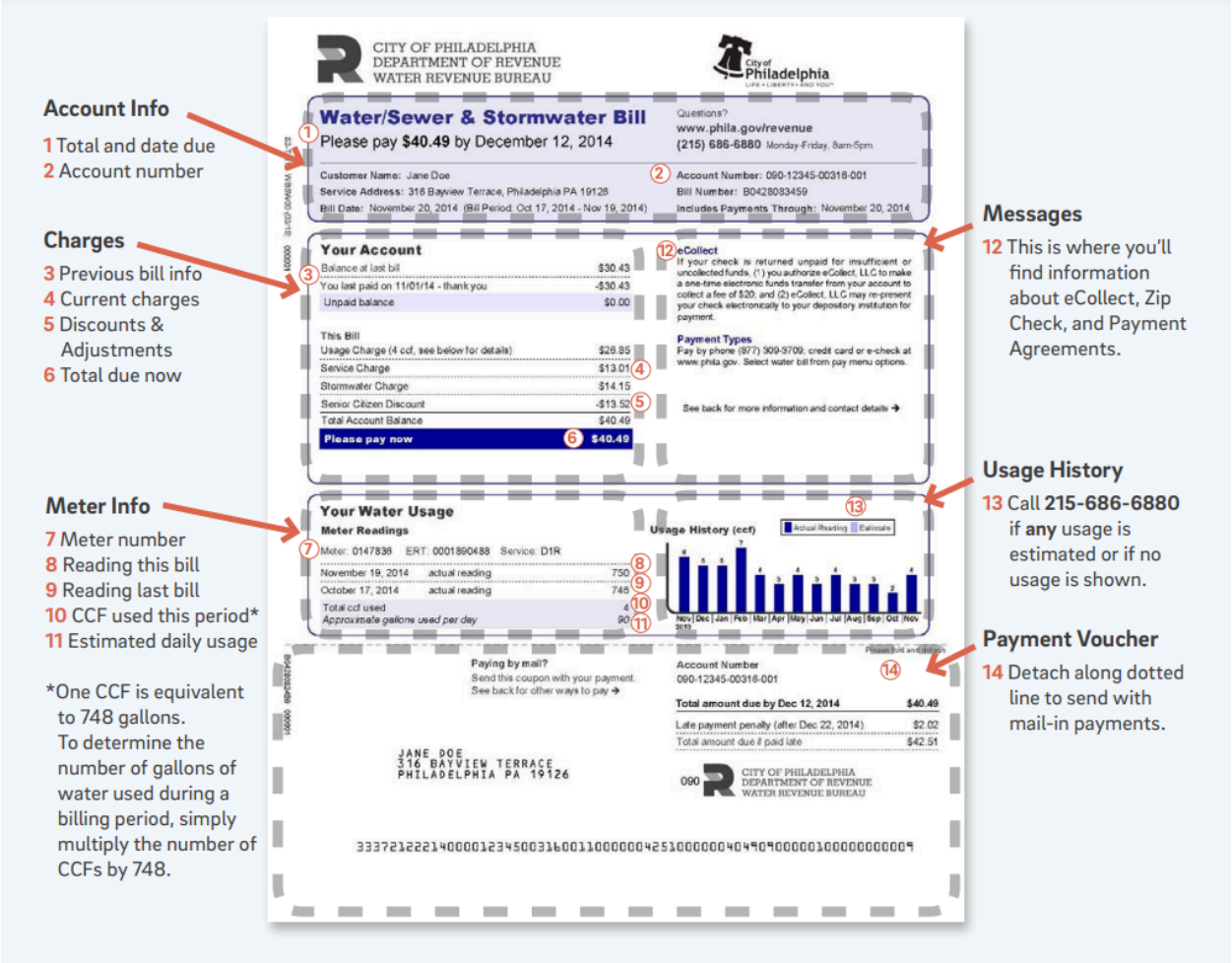


The household – as a whole – will be billed, and the use of each member is not measured. Often the bill specifies what the fixed costs are and what is paid for the volume of water itself. CCF (centum cubic feet), or cubic meters, are the metrics most often used. One CCF is equivalent to 748 gallons, so you can determine the number of gallons of water used during a billing period, by multiplying the number of CCFs by 748. In many service systems, where wastewater is collected through sewerage, a price for that service is added to the bill. Finally, the bill may also have a line item for stormwater charge, which is calculated on the size of the property where the rain falls. Overall, the water bill can be a neat display of what is involved in delivering safe water and managing waste and stormwater. It can be instructive for each family

member to understand the basic part of their “water footprint”; what to reference when to implement water frugality. Knowing your water footprint may also be relevant for preparing the household for calamities (weather extremes) that could interrupt water services, like where and how to store potable water and for how long.

Members of the household should also investigate availability of insurance, whether through “the Man/Woman/Head of the House” or through a collective (some families have a kitchen table management system). This should also extend to insurance for fires, wind damage and flooding, discussed late in this guide.

Finally, paying the water bill is a bit like paying taxes, you cannot escape it. But sometimes hardship can occur, and a bill will not be paid. Since access to safe water is also a human right, such situations create a moral dilemma. Water suppliers can shut off delivery, but in many situations, they need to work first and foremost with the household to find solutions. The members of a household should be aware of the rules, regulations, and programs that apply in their service area. Whether you yourself are the head of household and responsible for paying your bill, you live at home with your family, or your landlord pays your water bill and charges you, it is extremely helpful to be able to read a water bill. If you have a water bill on hand, you can pull it out and look at it for reference, but if not you can read the picture of a typical water bill below.



Each water utility has its own bill that will look different from others, but they all have the same general information. The main things to take note of are current charges, your balance, and how much is due and when. You will typically have to pay your bill monthly and it is important to pay on time or your water could be shut off. On your bill you will also see your meter information, which includes your meter number, the reading on your meter for the month, CCF used during the period, and estimated daily usage. A water meter measures the volume of water used in your home. It is also important to pay attention to your meter information on your bill to make sure there is no leak. Your Average Daily Consumption, or ADC, is an average of your water consumption over the indicated time period. Knowing how much water you use daily is important because using less water can not only save you money, but reduce your water footprint. It is also important to pay attention to the ADC on each bill, because increases could be signs of a water leak. WaterSense by the EPA has some helpful tips for finding and fixing leaks. For even more information on understanding your water bill, check out the EPA Watersense website.

You will also have a payment stub at the bottom of your bill that you can detach and send in with your payment if you are paying by mail, or you can pay your bill online. If you are having trouble paying your bill, many water utilities have customer assistance programs to help

you pay your water bill through providing bill discounts, flexible billing (forgiving previous debt, establishing a payment plan, moving from quarterly to monthly billing cycles, etc.,), temporary assistance, or water efficiency measures to help you save money in the long run. For example, Philadelphia has senior citizen discounts, tiered assistance programs that help you pay based on your income, and special hardship programs to help you cover costs and New York City's Home Water Assistance Program provides eligible customers with a credit on their water bill. American Water's New Jersey American Water's H2O Help to Others Program includes a bill discount program that provides low-income customers in New Jersey a water bill credit (grant) of up to $500 while Pennsylvania American Water Company's H20 Help to Others Program offers income-qualified drinking water customers an 80% discount on their monthly water service fees and grants of up to $500 per year. In Seattle, Seattle Public Utilities offers its drinking water and sewer customers a bill discount of 50% if their household income is at or below 70% of the state median household income. To find if your water utility has a customer assistance program, call your local utility or do an internet search of "[Water Utility Name] Customer Assistance Program". At the federal level, the United States has the Low Income Household Water Assistance Program (LIHWAP), which provides funds to assist low-income households with water and wastewater bills.

Knowing how much you spend on water can help you not just by saving money, but can help you reduce your water footprint, or how much water you are using on a daily, monthly, or yearly basis. This includes not just the water you drink and bathe with, but also everything we use, wear, buy, sell, and eat that takes water to make (pretty much everything we consume). While we cannot decrease the amount of water in many of these processes, we can try to reduce the amount of water we use in our homes, especially as both water scarcity and the global demand for water increase over time. Overall, tracking your water usage and consumption patterns can give you insight on what you can do to reduce your individual water footprint and help to manage water for both people and nature.

Water and Health

Introduction

While water is essential for life, it can also make us sick and harm us. Two billion people in the world lack access to safely managed drinking water (CDC, 2022), and contaminated drinking water can lead to waterborne illnesses such as cholera, diarrhea, dysentery, hepatitis A, typhoid, and polio (NHI, 2022). Standing water can also be a breeding ground for insects that carry diseases such as malaria. Contaminated water is typically the result of untreated or improperly treated water and water delivery systems such as pipes, but can also be caused by flooding that creates conditions for pathogens to thrive and contaminate bodies of water. If we are not careful about the water around us we can get sick, but there are many ways to prevent sickness and signs of dangerous or contaminated water to be aware of.

Water that is not contaminated can also cause issues if it gets into your home in places it does not belong. Excess moisture and flooding can lead to mold and mildew in your home and can cause many health impacts, especially for people with preexisting conditions such as asthma. In many parts of the world, people must walk many miles to retrieve water from clean sources and transport it back to their homes. Carrying heavy loads of water on the head, back, or with a head strap can result in headaches, backache, harm to the spine, and can cause a pregnant woman to lose her baby due to strain (Conant & Fadem, 2008). Overall, everyone needs water for drinking, cleaning, bathing, etc., but it is important to understand that water can harm us if not treated properly and to be able to recognize signs of dangerous or contaminated water and how to treat water-related illnesses.

Another piece that plays into water and health is trust. A recent survey from the Environmental Working Group found that more than 50% of people surveyed say their tap water is unsafe and 40 percent won't or can't drink it (Environmental Working Group, 2022). While you may think it is safer to drink bottled water, the United States actually has stricter standards for tap water and does not require bottled water to be safer than tap (NRDC, 2023). Tap water in most big cities has to be disinfected, filtered, and tested for pathogens much more often than bottled water, so there is no guarantee bottled water is safer. If you are in the United States, we have federal drinking water standards such as the Safe Water Drinking Act that make one of the safest public water supplies in the world. But, that doesn't mean that there aren't crises in the U.S. like lead contamination in the water supply of Flint Michigan in 2014 and failure of the main water treatment plant in Jackson, Mississippi in 2022. If you are concerned about your water, you can contact your state drinking water certification officer to obtain a list of certified laboratories in your state or find a list of EPA certified labs here. The EPA's Safe Drinking Water Information System also has information about public water systems and their violations. While there are steps you can take to ensure your water is safe, city governments and water utilities need to work to build this trust with homeowners.

Contaminated Water and Waterborne Illness

The impacts of lack of knowledge about water contamination were seen firsthand in Philadelphia recently, with stores running out of bottled water when an advisory was sent to Philadelphia residents to not drink tap water after a latex-based solution spilled into the Delaware River from a nearby chemical plant (Forman & Vadala, 2023). Water can be contaminated when hazardous materials such as chemicals from industry and agriculture leak into waterways or when waterways become contaminated with fecal matter. Globally, at least 2 billion people use a drinking water source contaminated with feces (Berihun et al, 2023). In addition, tap water and groundwater can be contaminated, both of which will be discussed later. All of these sources of contamination, along with water that is untreated, can lead to waterborne illnesses.

Cholera is a diarrheal illness that occurs when someone consumes food or water that is contaminated with cholera bacteria. About 1 in 10 people who have cholera experience severe symptoms including watery diarrhea, vomiting, thirst, leg cramps and irritability and severe cases can lead to dehydration (CDC, 2022). Cholera is an issue in many developing countries,

with Malawi currently experiencing the deadliest cholera outbreak in its history. The best way to prevent the spread of cholera is to properly dispose of the waste of sick patients and make sure it does not get into food or water sources and to wash your hands properly after touching anything that might be contaminated by feces.

Another waterborne illness that impacts the developing world is Hepatitis A, which is a contagious liver infection caused by close contact to an infected individual or by ingesting water or food contaminated with the virus (CDC, 2023). Symptoms can last up to 2 months and include fatigue, nausea, stomach pain, and jaundice. There is a vaccine for Hepatitis A and the infection is typically not fatal, but can be. The best way to protect yourself is to avoid close contact with people who are infected, to wash your hands regularly, and to receive the Hepatitis A vaccine.

Diarrheal diseases are the cause of 1 in 9 child deaths worldwide and most are caused by water, food or objects that are contaminated by infected stool. For example, if people with improper sanitation facilities or animals defecate in a river that others drink from, that water can be contaminated. The best way to avoid diarrheal diseases is to get vaccinated for rotavirus, to dispose of human waste properly, and wash hands with soap regularly. If you do have a diarrheal disease, take antibiotics and make sure to drink water regularly, as most who die of diarrheal disease die due to dehydration.

Typhoid fever is another waterborne illness that impacts the developing world. It is caused by the bacterium Salmonella Typhi and can cause prolonged fever, fatigue, headache, nausea, abdominal pain, constipation or diarrhea, and in rare cases death (WHO, 2023). It is caused by drinking contaminated food and water and can be treated with antibiotics and prevented by a vaccine. It is important to try to prevent typhoid fever by ensuring food is properly cooked and still hot when served, avoiding raw unpasteurized milk, boiling water, and by washing hands regularly, especially if you are handling food. It is important to be aware of how to treat and prevent typhoid fever if you live in or are traveling to an area where it is common such as African, Eastern Mediterranean, South-East Asia and Western Pacific Regions.

What should you do if your water is contaminated? Boiling water will disinfect it – once it starts boiling, let it boil for 1 full minute before taking it off heat to cool. Boiling changes the taste of the water, so pour it into a bottle and shake it strongly, which will add air to the water and improve the taste. It is important to recognize that boiling water can kill germs, but not chemicals or lead.

Flooding

Flooding can overwhelm sewage treatment facilities, causing bacteria like Legionella and Escherichia coli (E. coli) to grow and develop in stagnant water, such as in unused pipes. Floodwaters can pollute drinking water supplies and cause eye, ear, skin, and gastrointestinal infections and leave bacteria and mold behind, which can lead to respiratory illnesses such as asthma and Legionnaires' disease. Floods can also lead to fatalities from drowning during flash floods, nonfatal injuries and mental health issues such as post-traumatic stress disorder. If your home or community does flood, it is important to stay out of floodwaters as you are at risk for

drowning and because they can contain dangerous materials such as downed power lines, human and livestock waste and hazardous waste. Floodwater can potentially contain sewage, so eating or drinking anything contaminated can cause diarrheal diseases such as E. coli or salmonella infection.

Be sure to wash your hands with soap and water after coming into contact with floodwater and avoid bathing in water that has been contaminated with floodwater. If you do come in contact with floodwater, make sure to wash the area with soap and water and wash any clothes contaminated with the water before wearing them again. If you have any open wounds that come in contact with floodwater, seek medical help as soon as possible. Mold can also develop in your home after a flood event due to water damage and excess moisture, so it is important to wear a mask when cleaning your home if it floods. The health effects of mold will be discussed later.

Standing water and insects

In many areas of the world, insects such as mosquitos live or breed in standing water, which is water that does not move (CDC, 2014). These insects, called vectors, can carry dangerous diseases such as malaria, zika, yellow fever, and dengue fever. These diseases can be prevented by simply covering water storage containers and cisterns and creating good drainage for taps, wells, and water runoff channels. If you have standing or stagnant water next to your home, you should remove it and you should not drink from it, wear long sleeves and pants if outside, use mosquito nets or window screens, and use insect repellent, especially if you live in or are traveling to parts of the world that have high rates of malaria, zika, yellow fever and dengue fever such as tropical or subtropical areas of Africa and Central and South America. You can also get vaccinated for malaria and yellow fever, but zika and dengue fever do not have vaccines.

Lead poisoning in water

Another health effect of water, and one that has been very newsworthy in the United States in the last few years, is lead poisoning. Flint, Michigan made national headlines in 2014 when the city's water supply became contaminated with lead after the city switched its municipal water supply from Lake Huron to the Flint River, causing pipes to corrode and release lead. The most common source of lead in water is from lead pipes, faucets and fixtures that corrode. In the U.S., lead pipes are more likely to be found in homes built before 1986, so you should consider checking your pipes for lead if you know your home was built before then. You can't see, smell, or taste lead, so even water that runs clear can contain it.

Lead exposure can be extremely harmful, especially for children. There is no safe level of lead in water. Children exposed to even low levels of lead can have symptoms such as behavior and learning problems, slowed growth, lower IQ, hyperactivity, loss of appetite, pica (eating things that are not food such as paint chips), and anemia and in few cases, ingestion of lead can

lead to seizures, coma and even death (Mulvihill, 2021). Lead exposure can also be harmful for pregnant women and adults and can cause high blood pressure, joint and muscle pain, concentration issues, headaches and reproductive issues. Human skin does not absorb lead in water, so you can shower in water that has lead in it, but you should avoid drinking water if you believe it is contaminated with lead.

If you believe there is lead in your water, there are a few steps you can take. First, you can look at your water utility's annual water quality report (also called a consumer confidence report). You can typically find it posted online and your water utility is required to disclose if contaminants have been found in your water and to contact customers if contaminants do reach dangerous levels. The EPA's Safe Drinking Water Information System also has information about public water systems and their violations. You can have your water tested. Sometimes your local water authority will do it for free but if not, you can contact a certified lab. You can find a list of EPA certified labs here. You can also use this EPA Quick Check for Lead to help you determine if your water is contaminated with lead.

It is important to note that boiling water does not remove lead! You should stick to bottled water or filter your water. In order to safely filter lead from water, you should use a National Science Foundation certified lead filter, which you can find here. If you do find that your pipes have lead in them, do not remove the pipes yourself. The pipes in your home are connected to your water utility's water main, so you can call your city and water provider and have them hire a professional to remove them, as removing the pipes improperly could lead to more lead issues. Filter your water for at least 6 months after pipe removal, as lead can stay in your indoor plumbing system for many months.

Groundwater Contamination and Wells

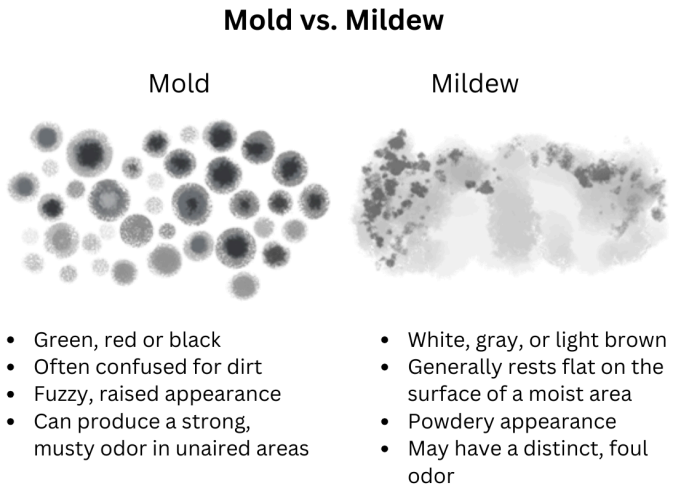
Groundwater, which is the water that is held in soil or rock beneath the Earth's surface, can be contaminated by agriculture, flooding, mining and oil drilling. If your water comes from a well, it is groundwater that can potentially be contaminated. According to the CDC, about 1 in 8 American residents get their drinking water from a private well (CDC, 2022) . The Safe Water Drinking Act, which ensures that drinking water meets health-based water-quality requirements, only applies to public water systems and does not apply to private wells, meaning that there are no national standards for the quality of private well water. Many people who get their drinking water from wells lack knowledge about how to properly test and maintain their water, (MacDonald Gibson & Pieper, 2017), with many believing they could detect contaminants through taste, odor, and appearance, when in reality contaminants like arsenic are tasteless, odorless, and colorless (WHO, 2022). If you do have a private well, you should test your water annually to detect contaminants such as total coliform, fecal coliform, nitrates, and volatile organic compounds (VOCs).

You should test more frequently if you have young children, pregnant people, or elderly populations in your home, as they may be more likely to be vulnerable to pollutants and chemicals. Also test if there are potential changes in your water such as known problems with

groundwater or drinking water in your area, flooding, land disturbances, and new construction or industrial activity. Also test if you replace or repair any part of your well system or if you notice a change in your water quality such as odor, color, or taste. If you are expecting a new baby in your home, test for nitrates in the early months of a pregnancy, before bringing an infant home, and again during the first six months of the baby's life. It is best to test for nitrates during the spring or summer following a rainy period. To test your water, contact a State Certified Laboratory in your state or our local health department, which may provide private well testing for free.

Mold, Mildew and Indoor Humidity

What are mold and mildew? Both are fungi, organisms that produce spores and feed on organic matter, breaking down old plant material. They exist everywhere in nature and are a very vital part of our ecosystem, but they often become unwanted when they invade our homes. You may wonder why the Global *Water* Alliance is talking about fungi and not water, but the two are very intertwined, as mold and mildew can grow in your home in areas of excess moisture such as leaks in roofs, windows, or pipes, or where there has been flooding. It can grow in many places in your home such as on or behind walls and wallpaper, on ceiling tiles, wood, showers, carpet and upholstery. Mold can develop in your home due to water damage and leaks and can develop in drywall, HVAC (Heating, Ventilation, and Air Conditioning) systems, and carpets. It is not always visible. What is the difference between mold and mildew? Both grow in areas of moisture, but mildew is usually white or gray and is always flat and not raised above the surface. Mold can be black, gray, green or many other colors and is much harder to clean up than mildew because it grows inside walls, wood, carpet, etc., and the only way to fully get rid of it is to remove whatever it is growing on in your home.



Besides growing quickly and being unsightly, mold can have health effects such as respiratory issues, coughing, wheezing and asthma, especially for children who are exposed. It can also cause stronger symptoms for people who already have allergies or asthma. If you find mold in your home, you should clean it up by removing moldy items such as furniture and carpets. You can remove mold from hard surfaces with household cleaning products, soap and water, or a bleach solution of 1 cup of household laundry bleach in 1 gallon of water. *It is extremely important to never mix bleach with ammonia or other household cleaners, as it will*

produce a poisonous gas. Make sure to wear proper protective equipment such as masks and gloves while disposing of mold. If you can find the source of the moisture in your home (leak, damaged window, etc.), repair that and try to keep the humidity low in your home. If you do not have an exhaust fan in your bathroom consider getting one to lower humidity, which is the amount of water vapor in the air.

It is very important to control the amount of humidity in your home, as humidity that is too high or too low can come with issues. High humidity can lead to mold, fungi and bacteria growth. However, low humidity can increase the transmission of viruses in the air and increase the risk of colds, flus, or even COVID-19, as well as worsen eczema, which is a condition that causes dry, itchy skin. To reduce humidity, consider ventilation methods like extraction fans in bathrooms and make sure water cannot get into your home through holes or gaps in your roof or bricks, especially after a storm. If the air in your home is too dry, consider purchasing a humidifier.

Water and Flooding: What Households Need to Know to be Resilient in the Years to Come

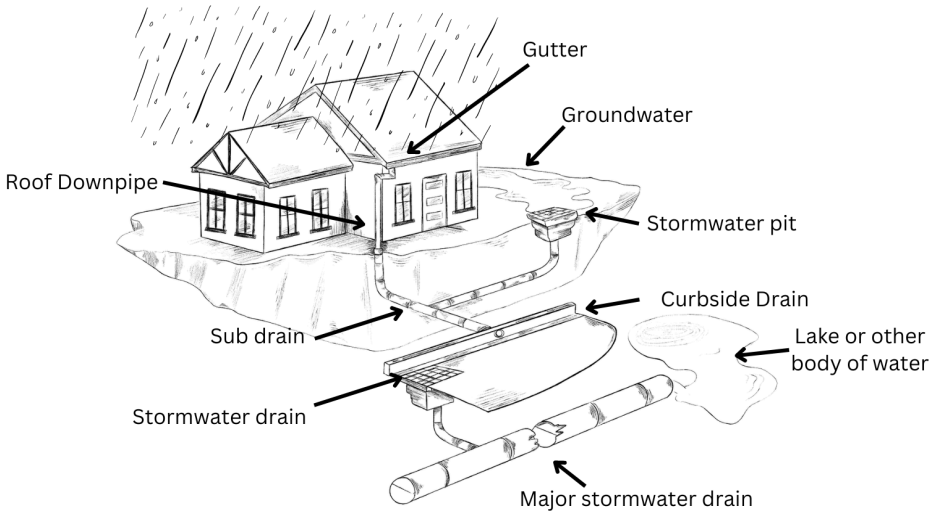
Introduction: Climate Change and Increased Flooding

Our climate is changing, and with it comes stronger, more frequent, and longer natural disasters such as flooding (IPCC, 2012). Flooding is defined as " the covering or submerging of normally dry land with a large amount of water" (Oxford English Dictionary) and is the most frequent natural disaster in the United States (Denchak, 2019). Over one billion people located in low-lying cities and settlements globally are expected to be at risk from climate hazards such as storm surge, intense rainfall, and sea level rise by 2050 (IPCC, 2022). This is exacerbated by high rates of migration into high risk areas such as coastal zones – future coastal migration and population growth is projected to lead to over a billion people living in low-elevation coastal zones by 2060 (Neumann et al., 2015). To understand flooding, one must first be able to differentiate between different types of flooding, as they have different causes and can vary in terms of impact.

Type of Flooding	What it is caused by	Who it Impacts
Pluvial/Stormwater	Rainfall and stormwater	People living in areas prone to hurricanes and extreme rainfall, especially those in cities with combined sewer systems
Fluvial/Riverine	Overflow from rivers	People living near rivers

Coastal Flooding	Sea level rise and storm surge (when a coastal storm pushes a wall of water onto land)	People living in coastal areas
Compound	Two or more types of flooding in close succession (for example, if a hurricane occurs near a coast, residents may experience flooding caused by both extreme rainfall and sea level rise)	Can impact anyone

In many cities such as Philadelphia, stormwater, sewage and industrial wastewater is combined in the sewer system and separated later on during water treatment. When the volume of water exceeds the capacity of the combined sewer system or treatment plant such as during a heavy rainfall event, untreated stormwater and wastewater can discharge into nearby rivers or streams as well as into peoples' basements and homes. This discharge is called combined sewer overflow and can pollute water bodies with harmful pathogens. The picture to the right shows how rainwater near your home enters stormwater pipes and discharges into nearby water bodies.



Increased flooding has consequences such as traumatic injury and death, mental health impacts, infrastructure disruptions, post-event disease spread, and carbon monoxide poisoning related to power outages, as well as billions of USD in damage. Floodwaters can pollute drinking water supplies and cause eye, ear, skin, and gastrointestinal infections and leave bacteria and mold behind which can lead to respiratory illnesses such as asthma (Hurley, 2023). Understanding all facets of flooding, including but not limited to insurance, preparation, and recovery can help improve water literacy as well as better prepare you to adapt to climate change and increased flooding.

What is flood insurance and how can I get it?

In general, insurance involves paying premiums to an insurance company that the company pools with money from other insured people to provide guaranteed funds that cover

high costs when an unexpected financial shock occurs. Having insurance can provide you with financial resilience and help you recover from disasters such as floods.

You can potentially receive federal disaster insurance after a flood incident, but it is not guaranteed and may not cover all of your expenses. There are two options for federal disaster assistance: (1) a loan that must be paid back with interest and (2) a Federal Emergency Management Agency's (FEMA) Individual Assistance program disaster grant, which is typically not enough to cover all damage expenses. In addition, federal disaster assistance requires your state to have a Major Disaster Declaration from the president and is only designed to make your home safe to live in again, not to restore it to its original condition before the flood. You can check to see if your county has been declared at DisasterAssistance.gov. It can also often take a long time, sometimes months, for grant money to be dispersed. To have guaranteed coverage, you would have to have flood insurance.

Insurance terms:

Premium: The amount of money you pay for your insurance. Can be paid monthly or yearly, but the yearly option is typically cheaper

Deductible: the portion of damage costs you will cover when you file a claim with the insurer; a higher deductible lowers your premium

In the United States, homeowners and renters policies won't cover flood damage, so those at risk need separate flood insurance. You can either purchase flood insurance from the Federal Emergency Management Agency (FEMA)'s National Flood Insurance Program (NFIP) or from a private insurance company. It is important to note that the NFIP has a specific definition of a flood and what is covered by insurance – the flood must cover at least two acres or two properties, there must be an "unusual and rapid accumulation" of floodwater, and the flood condition must also be "temporary". Basements are not always covered, but may be covered by private insurance. Seepage (slow drip leaks of water into your home) and sewer backup may not be covered unless you pay extra to add it to your Homeowners Insurance. The NFIP in the U.S. offers two types of coverage: building coverage and contents coverage.

National Flood Insurance Program		
Types of Coverage	**Cost Coverage**	**What it covers**
Building Coverage	Up to $250,000	Flood damages to items in your building such as electrical and plumbing systems, water heaters, furnaces, foundation walls, built-in appliances and cabinets, permanently installed carpets, detached garages, and fuel and well water tanks *Consider keeping receipts of purchases of electronic equipment, wall-to-wall carpeting, and major appliances like washing machines, as it can help

		process your claim faster if you know how much your items are worth
Contents Coverage	Up to $100,000	Flood damage to your belongings such as clothing, furniture, electronics, original artwork (up to $2,500), curtains, washers, dryers and microwaves, and portable air conditioners *Covers the cash value of these items at the time of the flood, not at the time you purchased them *Building and contents policies have separate deductibles, which means that if your building and contents are both damaged due to a flood event, both deductibles are applied.

NFIP flood insurance policies do not cover damage from mold, so it is recommended that policyholders begin cleanup and documentation immediately after a flood to prevent the growth and spread of mold.You can purchase flood insurance from NFIP or from the same company that sells your home or car insurance. If you are looking for a provider, Floodsmart.gov has a Flood Insurance Provider tool that can help you. There is typically a 30-day waiting period for flood insurance to go into effect after you purchase it and it lasts exactly a year before you have to renew or cancel.

Common misconception: The 100-year flood

In news coverage of flooding, you may have come across the term "100-year flood". While this may sound like it is a flood that occurs every 100 years, this is a common misconception. It is actually a flood that has a 1% probability of occurring in any given year. 100-year floods can happen many years in a row or even more than once in a year. Think of it as a 100 sided die and if you roll a "1" it will be a 100-year flood. If you roll a "1" on one turn, you still have the same probability, a 1 in 100 chance, of rolling it on the next turn – just because you rolled it once does not mean you won't roll it again. If your area is hit by a 100-year flood, that does not necessarily mean that you won't experience it again for another 100 years. As climate change increases, the chances of a flood of this intensity is becoming more and more frequent, almost as if the die is losing more and more sides. It is important to know if you live in a 100-year flood zone, which is an extent of the area of a flood that has a 1% chance of occurring or being exceeded in a given year, because you may be required to purchase flood insurance.

Some people are required to purchase flood insurance, such as homeowners living in FEMA Special Hazard Flood Areas (SHFA), which are areas estimated to have an annual flood risk of at least 1% (also known as the 100-year floodplain). To find what flood zone your home is in, you can enter your address into the FEMA Flood Map Service Center.

Just because you are in a low risk area does not mean you should not consider purchasing flood insurance. 98% of all counties in the United States have experienced a flood event and more than 40% of all National Flood Insurance Plan policies come from non-high risk flood zones (FEMA.gov, 2023), so this is an issue that can impact us all. FEMA flood maps are also not always accurate and usually do not include rainfall-related flooding and flash floods, which means it might be better to be cautious and consider purchasing flood insurance if it is something you can afford. A nonprofit foundation called First Street Foundation has Flood Factor maps that do account for stormwater flooding, so this is another good resource to use to check your flood zone. Overall, flood insurance can help build up resilience to flooding and just one inch of flooding can cause $25,000 of damage to your home (FEMA.gov, 2023), so it is important to have knowledge about what your options for insurance are and how to apply for it.

> In many parts of the world the absence of formal insurance causes households and firms turn to 'informal' insurance such as kinship exchange of food and money. Dakar, Senegal and many other countries in Africa do not have formal insurance programs but rely on a peer-to-peer savings system called Totines, in which subscribers contribute a fixed sum to a common pot and take turns collecting the money after an agreed period (Akande & Turner, 2018). Rapid urbanization and population growth has seen an explosion of settlements in marginal, highly flood-exposed areas such as Dhaka, Bangladesh (Keating et al, 2016). Many of these areas take the form of informal slum settlements, meaning flood insurance is not an option. In 2020, about one in four people (more than 1 billion people) lived in cities worldwide lived in slums or informal settlements (Slum Dwellers International, 2022), and therefore often lack access to social security and healthcare systems as well as insurance to help them recover from flooding and other natural disasters.

How can I prepare my home before a flood or winter storm?

When preparing for a flood, your first priority should be the safety of you, your loved ones, and your pets. Have an evacuation plan in place and pay attention to emergency alerts and evacuation orders. Figure out how you will communicate with family members and friends and decide where you will stay in the event of flooding. If you are in the United States, information on shelter can be found on the American Red Cross website or you can text SHELTER + your zip code to 43362. Plan in advance for those with mobility issues, as well as for pets. You can also assemble an emergency supply kit that includes food, bottled water, first-aid supplies, medicines, and a battery-operated radio. Visit Ready.gov for a complete disaster supply checklist.

Sign up for your community's warning system, which may provide emergency notifications via text or email. (To find out what alerts are available in your area, do an internet search with your town, city, or county name and the word alerts.) When it comes to flooding alerts, it is important to know the difference between them. A flood or flash flood *watch* means flooding is possible and may or may not occur. A flood or flash flood *warning* means flooding is imminent or already happening. If you are in a flood-prone area when a flash flood warning is issued, seek higher ground. Avoid walking, swimming, and driving through floodwaters, which

can be not only extremely powerful but also hide hazards such as downed power lines, broken glass or metal, and contaminants like sewage and chemicals.

If you must evacuate, remember to take "the five Ps". Make sure to take photos and videos of all major household items and valuables. Save copies of birth certificates, passports, medical records, and insurance papers in a safe, dry place. Keep original documents in a watertight safety deposit box. If you have time, consider elevating and anchoring your critical utilities such as electrical panels, propane tanks, sockets, wiring, appliances, and heating systems. Elevating these utilities can also potentially save you costs on your flood insurance. If you have a basement, waterproof it. Install a water alarm and maintain a working sump pump to protect your basement (sump pumps will be discussed in more detail later on in this guide). Install a battery-operated backup pump in case of power failure. Clear any debris from gutters and downspouts to avoid a buildup of water. When flooding is predicted or imminent, move furniture and valuables to a safe place, such as an attic or the highest floor of your home. You should also unplug your electrical appliances.

The "Five Ps" of Flood Evacuation

- People
- Prescriptions
- Paper (birth certificates, passports, and other key documents)
- Personal needs (clothes, phones, and phone chargers),
- Priceless items (irreplaceable mementos)

If you are preparing for a winter storm or just cold weather in general, empty outdoor faucets to prevent them from freezing and bursting. If the storm is not strong enough to call for evacuation measures, prepare for a potential power outage. Stock up on non-perishable food, plastic water bottles, toilet paper, etc., (enough for your family for a couple weeks, you don't need to clear out the grocery store shelves like you did in March 2020!). You can also boil water to sanitize it if need be. You can make boiled water less flat by pouring it from one container to another and allowing it to stand for a few hours or adding a pinch of salt per quart or liter of boiled water (CDC, 2022). If you have a gas powered stove you can use it to boil water and cook. If you have an electric stove, it will not work during a power outage unless you have a generator, so you might want to stay with friends or family that do have a gas stove if you need it for cooking.

Final Thoughts

We hope that this guide has stressed the importance of household water literacy, especially as climate change increases water-related issues such as water scarcity, flooding, hurricanes and droughts. Literacy can be defined as specialized knowledge in an area, and despite interacting with it every day, many of us lack the knowledge about water needed to manage, store, distribute and use water as it relates to the home. Whether you are moving into an apartment by yourself for the first time, are a new homeowner, new to the United States, or a head of household for many years, there is always more to learn about water as it relates to the household. This guide can help guide you through hygiene and health issues in and around the house, preparing for and recovering from flooding and winter storms, insurance, understanding your water bill, and more.

Water is essential for life, but it can also harm us if we don't interact with it safely and correctly. It can flood your home, make you sick if contaminated, and of course cost you money. Being water literate can help you stay safer and healthier and help you save money, as water is unfortunately a commodity that we must pay for despite being necessary for all life on Earth. The actions discussed in this guide, such as reducing your water footprint, can also help the planet as water is a finite resource that must be conserved. Overall, this guide should serve as a resource that you can keep in your home or search up online to use as a starting point whenever you have a question about water and the home, and will hopefully contribute to you becoming a water literate individual.

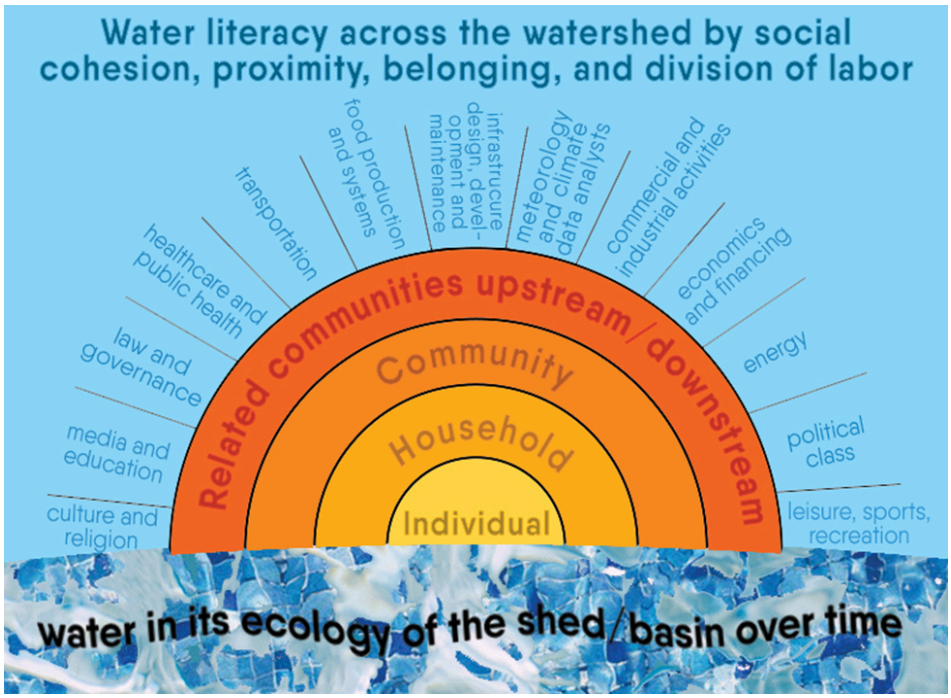
List of Acronyms and Difficult Words

Het Nederlandse Gezinsboek (The Dutch Book of Families)
WaSH (Water, Sanitation, and Hygiene)
FEMA (Federal Emergency Management Agency)
NFIP (National Flood Insurance Program)
CDC (Center for Disease Control)
ADC (Average Daily Consumption)
EPA (Environmental Protection Agency
VOCs (Volatile Organic Compounds)
HVAC (Heating, Ventilation, and Air Conditioning)
National Onsite Wastewater Recycling Association's (NOWRA)
CCF (Centum Cubic Feet)
ADC (Average Daily Consumption)
Low Income Household Water Assistance Program (LIHWAP)

Appendix

Water Literacy Paradigm and Levels

The sunrise/horizon diagram is an effective way to describe what water literacy means at both the consumer and professional level. Water literacy is a measure at the individual level and a collective measure at the community/national level, and it addresses both the consumer/citizens necessary level of skills and knowing, as well as the distribution of knowledge at the professional level, reflecting all the dominant divisions of labor, e.g., engineering, law, biology, public health, economics, communication, social science, etc. This diagram describes the levels of water literacy that capture the full capacities of the nations and regions for being optimally literate in any watershed. It makes it possible to then develop tools to measure and improve water literacy levels at the consumer level as well as in the different professional domains.



Water Literacy Paradigm (Morssink, 2021)

At the bottom of the diagram, we project the phenomenon of water, the reality of water as it is in the watershed, which is a place where water flows to, such as a creek, river, or ocean. On the top of the diagram we conceptualize, using concentric semi-circles, four levels of literacy, e.g., individual, household, community, and interconnected communities. Around these circles we project professional water literacy, reflecting the usual divisions of labor in modern society. There can be siloed knowledge, crossover knowledge between disciplines, and the dynamics of knowledge expansion. Knowledge generation and dissemination are ritualized in different ways, reflecting power dynamics and cultural norms. All people in the watershed should share a sense of the right to a “stakeholdership”, as water is a commons, or something that is shared by all.

The rays of the paradigm are reflecting the divisions of labor. Here, we group them by classes in the political economy, reflecting the current trends of division of labor. In each of these rays, specialty knowledge needs to be sufficiently available to make good governance of and in the watershed a reality.

Water Literacy: The Individual consumer/user

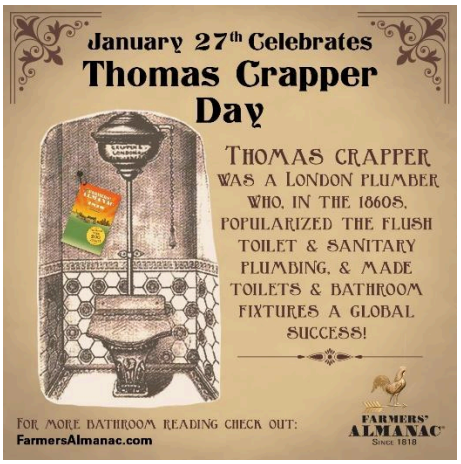
All knowledge (literacy) is stored in individuals, either as part of their cognition and/or their memory functions, or by the fact that they know where to find that knowledge in libraries, on the internet, or via elders and professionals. All persons will grow up learning about water in terms of drinking, bathing, cleaning, navigating, cooking, handling, storing, and discarding. Some go further and apply sports, or artistic exploration. Through the dynamics of developmental psychology and behavioral-emotional growth, young people will incorporate the norms and attitudes that befit the cultural aspects of water literacy. Water literacy can thus be considered to have an age-specific component at the individual level. When we are younger, we may just interact with water through drinking, swimming, and bathing, but as we get older, we learn that we interact with it in many other important ways: we must pay for water, protect ourselves from flooding, make sure the water we drink is safe to consume, etc. It is important to be literate about water in order to protect ourselves and our loved ones. In all, we can measure and assess/improve water literacy of any human being in the context of age, gender, behavior, culture, health, ecology.

Water literacy at the household level: What should be known/understood at the consuming household

At the household level, knowledge of the individual is expanded to incorporate things like gender issues around hygiene, sharing available water and facilities, doing chores regarding hygiene and sanitation, paying for services, and understanding that the home is the beginning and ending point for any measure in the water and hygiene infrastructure. This guide specifically focuses on the household level of water literacy, as the household is where behaviors around water and hygiene are taught, what people must protect (along with themselves) against flooding and other water-related disasters, where people’s water bills are sent to, where pipes are connected to, and what largely determines the quality of one's water. If the watershed that supplies a city’s water is contaminated, so will the water that comes out of the tap of one’s home. The home is a place where everyone interacts with water, but many do not have knowledge of aspects of water relating to the home such as how to purchase flood insurance, how to prevent lead poisoning, and how to clean up mold. McCarroll & Hamaan (2020) point out that while educating children about water literacy is important, adults are heads of households that are responsible for paying water bills, managing household water use and are the current generation of water users and decision-makers. In addition, domestic water demand makes up 15% of the global water demand, making household level water literacy an important and necessary topic.

The household is an important data point in the world of WASH (Water, Sanitation, and Hygiene) and it is so on several levels. It is a collective extension of the individual water literacy level, where behaviors are shaped and acculturated, where aging and water knowing and transfer of knowledge takes place, where we learn of the WASH issues around gender and gender's way of knowing; where privacy and decency and dignity are learned and engrained. In the household we learn to share water and facilities, we learn a thing or two about cleaning and staying clean. We learn about (food) hygiene in the kitchen and pantry, in the use of basins, wash cloths, bathing facilities and commodes. We learn of WASH through pets, husbandry, and wildlife. Whether in rural or urban settings, whether in homes on water/boats, on wheels, or tents and other shelter systems used by nomads, it's the household where WASH literacy is most significantly structured, acculturated and disseminated.

Barring a few items for personal use, like umbrellas, bottles, raincoats, bathing suits, flasks, handkerchiefs, etc., the whole consumer market for WASH is geared around the household. With the toilet, the tub, stall, or kitchen sink come accessories, maintenance materials, clean up tools and repair kits that cater to the users as members of a household. These markets are huge and the WASH sections in supermarkets and in hardware stores have always dedicated aisles for these products. In the open-air market of Accra, Ghana, several blocks are dedicated to this exchange of goods for WaSH. All catering to those of the household who "clean, maintain, and use" the facilities.



When shower stalls became standard in the working-class homes in Northern Europe, in the forties and fifties, it took a while to get all folks from using a large metal basin in the kitchen for bathing to these stalls. The space was sometimes used for storage, sleeping arrangements for babies, even as punishment. "Getting a cold shower."

Good water literacy at the household level is rather important and is needed to keep the systems operational. An article in the Guardian illustrates the dramatic problems that may result from under-educating and under-estimating the effect of household literacy in and on WASH. The London sewers have been around for an exceedingly long time, but some consumer habits (in kitchen and bathrooms) in the now rather affluent city have changed to such an extent that a new call for education of the household is in order.

Water literacy at the household level is also relevant because almost all data on infrastructure in any nation is set in the confines of a household. Census data, all mapping, all real estate taxes, all cadasters; all address listings, all services providers (gas, water, electricity, internet, you name it) rely on addresses as part of a person's identity. Your life expectancy is in large measure informed by where you live and the conditions your household lives in. The

plumbers never repair *my* faucet or open up *my* drain. They open up **our** drain, repair **our** faucet, leaving it to us in the household to lay blame, to learn and to check on each other. As the manager of a large water supply company in Texas said during the icy disaster that occurred in his service area in February 2021: "We have 1.4 million customers that are in deep trouble and we do not know when we and they are going to have restored services and who will pay for damages and breakdown of our services". The household/commercial entity/office is the smallest unit in the infrastructure around WaSH.

In terms of governance, the literacy level at the household is more important than the individual literacy level. People as individuals are eligible to vote in this or that election, but do so on the basis of their address, as part of their nationality, age, jurisdiction, and other criteria to vote. Taxation systems and subsidy systems for WaSH related issues are set at the household level. Water bills are to be paid on the basis of usage by the household, not by an individual. Shutoff of a water supply affects the whole home, and all that are living in it. Eviction notices are for the whole household, never an individual. As these issues pertain to water, it is for the whole of the household to figure out what to do about it. Water literacy at the household level is a crucial moment in all that is part of the management of the watershed.

Water literacy at the community level: what to know about managing water in our towns and built environment

At the community level, knowledge needs to be measured around stormwater management, how "safe" water is (made) available and at what quantity, how waste and runoff is organized, how "we are all in this together" is expressed in policies and politics, how our local ecology is suffering (or not) and can be improved through proper water management and stewardship. It is where the distinction can be made between consumer uses of water and livelihood and commercial uses of water. For example: How can firefighters and emergency personnel rely on enough water (directly, like driving a tanker to a fire, or indirectly, by hooking up to fire hydrants). At the community level, policies, politics and "cohesiveness" become a big part of the water literacy for governance.

Water literacy at the community level is much more than measuring, assessing and improving the literacy of a multitude of households that together make up a community. Even if each household has its own water supply system that is unique and not shared (e.g., not groundwater, or piped in water), and even if each household would have a unique, not shared, waste handling, the households still share in the handling of stormwater as they occupy space in a community. Indeed, at the community level we have several other elements to weave into the assessment of whether the community level water literacy is adequate. We have to grasp that WaSH management at the community level needs to include WaSH consumption as part of our livelihood, our economic and social activities, whether that pertains to restaurants, agriculture, industry, health care, education, sports, etc.

We also need to understand the forms of WaSH infrastructure we develop into our built environment, and how we assure safe water for drinking and food making, as well as how we

handle waste and wastewater. Moreover, we need to have a grasp on how stormwater is handled by the community as a whole, and how protection from water is organized and implemented. And we need to have a handle on who does what in the WaSH market, how that market is regulated to assure good WaSH in the whole, and what is done to oversee those regulations. And as WASH at the community level is a commons, we need to understand the role of all stakeholders, and how the stakeholders organize the governance of that commons. Indeed, assessing water literacy at the community level, while not done much in comparison to literacy at the individual level, has great value for identifying where the needs for literacy improvements are high, what problems in water governance directs a city council to learn more and adapt policies, etc. Professional training and certifications are mostly informed by the needs of the community as a whole, not just by the sum of its households. Overall, community level water literacy is important to ensuring everyone in the community is interacting with water safely and properly.

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