Climate Resilience Proposal Plan for the City of Salisbury

Eric Fisher, flickr.com

Introduction:

The world is facing constant and evolving environmental challenges that could pose a risk to the functionality of cities. While many are feeling the impacts of climate change, cities such as Salisbury are particularly at risk of natural disasters such as flooding, erosion, and changing weather patterns. Natural disasters are typically expensive to recover from and can threaten the well-being of Salisbury residents. Climate change is not reversible; however, there are ways to help mitigate and adapt to our changing environment. To this end, a class of seniors majoring in Environmental Studies at Salisbury University have proposed a Climate Resilience Plan which will focus on the following:

Please see the Appendix (Pg. 86) for summary information about possible recommendations, and approximate pricing.

The following sections provide information on potential practices and actions that can benefit the Salisbury community. When we as a community work together to confront the climate crisis, many benefits follow. Local businesses and companies create more jobs for residents, all the while saving money for residents to spend locally to reduce our carbon footprint. Community benefits are already delivered through Salisbury's efforts; however, the following shares equitably within the economic and health benefits that are available for low-income people as well as communities of color.

Helpful Terminology:

Battery Electric Vehicles (BEVs)- An electric vehicle that operates only off of electricity. It can be operated through either regenerative braking or a charging outlet.
Bio slurry- Fertilizer made from the liquid discharged from the processing system for turning compost into biogas.
Bottom-Up approach- A management style in which the decision making and the process implementation originate at lower levels in an organization, then work their way upwards.
Clean/ renewable energy- Energy obtained from sources from the earth that do not get depleted.
Composting- Nature's way of recycling. It is decaying organic material such as food scraps and garden debris that can then be used as a plant fertilizer.
Construction and demolition- Also known as C&D, it refers to the waste generated directly or incidentally from construction or demolition debris.
Cool roof- Similar to green roofs, cool roofs reflect more sunlight and absorb less heat than a standard roof and can be built in a variety of ways. (Hawken, 2017, 91).
CSA- Community-supported agriculture.
Emissions- The discharge of something such as gas or CO2.

Environmental Literacy- The capacity of an individual to act successfully in daily life on a broad understanding of how people and societies relate to each other and natural systems, and how they might do so sustainably.
Food Desert- An urban area in which it is difficult to buy affordable or good-quality fresh food. See the USDA definition on page 3.
Food Insecurity- The state of being without reliable access to a sufficient quantity of affordable, nutritious food.
Greenhouse gases (GHG)- Any gas that can absorb and emit radiant energy which causes the greenhouse effect on Earth.
Groundwater system- Water underground within the saturation zone; a vital part of the hydrological cycle.
Home First model- An approach to successfully and quickly connect individuals or families experiencing homelessness to permanent housing without preconditions and barriers to entry, such as sobriety, treatment, or service participation requirements.
Hybrid electric vehicles (HEVs)- An electric vehicle that operates off of electricity and petrol. The car is further operated by a process called regenerative braking.
ICLEI- A group of local governments for sustainability.
Impervious surface- These are water-resistant surfaces that do not allow water to properly drain through. Examples of this include roads, sidewalk, driveways, roofs, etc.
Landfill- A place to dispose of refuse and other waste material, typically by burying it and covering it over with soil.
LFG- Landfill gas.
Litter- Any waste materials, refuse, garbage, trash, debris, dead animals, or other discarded material.
Low Income Neighborhood- A census tract where 30% or more of its residents have low income.
Mitigation- Reducing the severity of something.
Multimodal transport- Transportation that carries goods under a single contract, that is performed by at least two different modes of transport.
Municipal fragmentation- The degree to which local governments separate and/or divide the land and up for a variety of purposes.
Municipal Solid Waste- Also known as MSW, it consists of everyday items we use then throw away. This can range from food waste, product packaging, grass clippings, appliances, etc.
Net-zero- The total amount of energy being used equals the total amount of energy generated
Newland Park Landfill- A landfill located in Salisbury where garbage produced in Wicomico County is sent.
Non-motorized transport- Transportation that is reliant upon being human power. This includes walking, bicycling, roller-skates, skateboards, and wheelchairs.
Pervious surface- Surfaces that allow water to drain through the soil to return to the water table. An example of this being a gravel driveway.
Petrol- Another word for gasoline.
Plug-in hybrid electric vehicles (PHEVs)- An electric vehicle that operates off of electricity and petrol that can be plugged into an outlet for a charge.
Racial zoning- The exclusionary land-use policy that perpetuates segregation of communities based on race.
Rain garden- A garden of native species typically in low-lying to absorb runoff water.
Recycling- The action or process of converting waste into reusable material.
Refuse- Any solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, or agricultural operations, or community activities, which is discarded, or is being accumulated, stored, or physically, chemically, or biologically treated before being discarded; or has served its original intended use and sometimes is discarded, or is a manufacturing or mining by-product and some time is discarded.
Regenerative Braking- The process for which the car battery is recharged through its braking system.
Retention basin- An artificial pond surrounded with vegetation, designed to hold extra stormwater.
Riparian buffer- Vegetated area around a waterway to protect it from runoff and help filter groundwater.
Solid waste acceptance facility- Any sanitary landfill, incinerator, convenience center, or plant, whose primary purpose is to dispose of, treat, or process solid waste.

Solid Waste- Any garbage, refuse, sludge, or liquid from industrial, commercial, mining, or agricultural operations, and community activities, but does not include solid or dissolved material in domestic sewage or irrigation return flows.
Subsurface storage vault- This is an underground storage system that is designed to manage excess stormwater.
Vector- An organism, typically a biting insect or tick, that transmits a disease or parasite from one animal or plant to another.
Walkability- A measurement of how pedestrian and non-motorized transportation accessible an area is.

Stormwater & Water Management

Introduction:

Water is an important aspect in considering climate resilience as well as improving living conditions for all residents. Also, a cleaner Wicomico River would provide a boost to the city's economy and would have many positive environmental impacts. Salisbury, which contains 13.87 square miles of land, is at risk of sea-level rise, flooding, and erosion along waterways. Sea-level rise can result in many hazards for coastal regions, including increased flooding, back-flooding of stormwater infrastructure, and disruption to coastal industries as well as infrastructure development. Another problem sea-level rise can have is overwhelming drainage systems which can lead to a sewer overflow. While these issues can have devastating effects, there are ways to help mitigate these issues to better help the city.

Emergency Preparedness:

As the climate changes, Salisbury is at more risk of natural disasters. Most of downtown Salisbury is within a flood zone; this could have serious negative consequences for the buildings in this area. Concerning preparedness, Salisbury should focus on flood prevention, management of stormwater runoff, and preparing for sea-level rise. By focusing on these areas, Salisbury could prevent greater damages caused by natural disasters.

A. Flood Prevention Methods

1. *Reducing impervious surfaces*

When looking at improving the water quality of the Wicomico River there are several different steps the city could implement. First, it is important to look at the number of impervious surfaces that currently exist within the city. Impervious surfaces include roads, sidewalks, buildings, and any other type of surface that will prevent rainwater from absorbing into the ground. This surface creates two large problems in that they lead to increased flood risks as water sits on top of them and they decrease water quality. The city of Salisbury currently has 2,550 acres of impervious surfaces out of a total of 8,876 acres; that equates to 28.7 percent of the city covered by impervious surfaces (A.H. Pollack, personal communication, March 31, 2020). Research has shown that with 30 percent impervious surface cover, this will lead to a 10 times increase in small flood events (Ogden, et al., 2011). This is often seen in low-lying areas of Salisbury after moderate rain.

Impervious surfaces are harmful to water quality because they do not give water a chance to be naturally filtered by vegetation and absorbed into soil before running off into bodies of water. Also, when water touches impervious surfaces it picks up pollutants like oil, bacteria, and sediments and carries them into the closest water body (McGrane, 2016, 2296). Once these pollutants enter a body of water, they have detrimental impacts on marine life, as sediments can lead to eutrophication, where algae blooms take over sucking up a lot of the oxygen in the river leading to dead zones where marine life simply cannot exist. The city of Salisbury has a Municipal Separate Storm Sewer System (MS4) permit through the State of Maryland, and to keep that permit they have to decrease their impervious surfaces by 20 percent by 2025 (A.H. Pollack, Personal Communication, 2020). A 20 percent decrease would bring the total acreage of impervious surfaces in the city down to 2,040 acres, or 22.9 percent of the city. **That would be a good start, however, according to Tom Horton's book *Turning the Tide*, research has shown that the hydrological cycle of an area begins to show negative effects at 10-15 percent impervious surface coverage; and at 25 percent very little marine life can be supported (Horton, 2003, 113).** So, even with a 20 percent decrease in our current impervious surface count, we would still be flirting dangerously close to a near collapse of our river's ecosystem.

To give the Wicomico River more of a chance to be an ecological success it would be better to attempt to reduce our impervious surfaces to 15%, which would bring the total acreage down to 1,331. This would equate to replacing 1,219 acres of impervious surfaces. This would be quite a large reduction from our current number; however, it is possible. Replacing impervious surfaces with pervious surfaces costs roughly $6-13 per sq. foot (Department of Environment & Energy). This does not mean that all 1,219 acres would have to be replaced with pervious surfaces, as much of it can be converted to forests which will be less expensive. With the conversion of vacated lots to forested lands, more eco-friendly development practices like green roofs and pervious

driveways, Salisbury can significantly reduce their impact on the local waterways. (To learn more about green roofs, see page 7 in the infrastructure section). New communities developing within one mile of the Wicomico River should be required to develop houses with pervious driveway surfaces. Pre-existing developments within this one-mile region should also be encouraged to convert to pervious driveway surfaces.

Figure 1: *Example of a semi-permeable surface option for walkways. The gaps allow water to easily drain through.*

MPCA Photos, Flickr.com

2. Establishing rain gardens and Reforestation

Rain gardens are a great method in reducing the damages from flooding. These gardens are placed in low lying depressions where native species are planted. This allows runoff water from impervious surfaces to properly drain back into the groundwater system. By planting native species, this also attracts more native insects and wildlife which is beneficial to the ecosystem. Rain gardens on average cost about $10-40 per sq. foot and would provide an added benefit of being aesthetically pleasing (Interstate Commission on the Potomac River Basin).

Figure 2: *This is a rain garden constructed by volunteers in Annapolis, MD in 2009. This rain garden utilizes native plant species to help native wildlife thrive as well as reduce flooding.*
Chesapeake Bay Program, Flickr.com

Another natural route the city could go to help improve the Wicomico's River quality as well as prevent flooding would be increasing the total forested space within the city. Forests provide many ecosystem services that are beneficial to humans. They sequester carbon, provide oxygen, prevent soil erosion, and are amazing at absorbing

water. There are two ways to attempt reforestation, either with natural succession or through planting. Either way is effective, but natural succession will take longer while being cheaper, and planting trees will be a bit more expensive (Hawken, 2017, 41). Through planting and maintenance, there would be an estimated cost of $70 per acre, but this varies due to what type of land previously occupied a certain area (Hamilton). In the long term, however, more forested areas will save the city more money than reforestation projects would cost (Hawken, 2017, 129). By reforesting certain areas and allowing nature to take over in other areas, the city can create a better functioning water cycle that would save the city a large deal of money while also allowing its citizens the opportunity to become more connected to nature.

B. Stormwater Runoff Mitigation

Considering that the Wicomico River runs directly through Downtown Salisbury, it becomes even more imperative that the city attempts to limit runoff from directly entering the river. There are two different ways this problem could be addressed, naturally or artificially. The natural ways are, for the most part, cheaper and more effective as ecosystem processes and are more efficient at filtering water than any artificial system. It would be impossible to attempt to revert Salisbury to a fully functioning ecosystem with the current population size and amount of businesses that currently reside here, so some artificial means of controlling water quality are necessary. Such as subsurface storage vaults; this method can be slightly more costly and results in more involvement with infrastructure. Subsurface storage vaults hold extra stormwater which helps to limit flooding (Boswell et al., 2019, 211). The price of these vaults is determined by the materials used to make them and fluctuate in different parts of the country. The three main types are metal, plastic, and concrete. A good example of a subsurface storage vault project would be Glen Burnie, Maryland where they built a 150,000 cubic feet system of corrugated steel pipes that cost the city $453,000 (EPA, 2001, 7). For a high-density polyethylene system, Rhode Island built a vault with a volume of 1,420 cubic meters of storage, costing $250,000 (EPA, 2001, 7). Then finally for concrete, in Knoxville, Tennessee they built a system with 106 cubic meters of storage costing them $85,000 (EPA, 2001, 7).

C. Sea-level Rise

Sea-level rise is a serious problem that certain parts of the world are going to face for the rest of this century and beyond. Currently, the National Oceanic and Atmospheric Administration (NOAA) has suggested that the global mean sea-level will rise somewhere between a minimum of 8 inches and a maximum of 6.6 feet by the year 2100 (Parris, et al., 2012, 1). This doesn’t mean that every region on the planet will be affected by sea-level rise, but in areas like ours that sit close to sea-level, it will come

with a lot of negative impacts. At the very least, there will be more flood events and larger bodies of water, which could threaten city infrastructure. The following steps are recommended to attempt to prepare the city for changes that sea-level rise could bring.

1. Restoring Riparian Buffers

The first natural way to work towards solving this problem would be to restore riparian buffers along the edges of the river, riparian buffers are crucial because they are a river's last defense from runoff pollution, as well as being a first defense against storm surges and floodwaters (Hawken, 2017, 113). They serve as a natural water filtration system, increasing water quality while also recharging aquifers. They can be wetlands, forests, or any other kind of vegetation that is efficient at absorbing water. Restoring these zones won't be difficult for the city as it won't require much effort to restore these zones along the Wicomico River. It's quite the opposite as all it requires is allowing natural succession to take place. This is called passive restoration and is a cheap and effective option for rebuilding these extremely important ecosystems. It might require some rezoning to free up land on the shore of the river to allow succession to take place, but it won't require a large amount of money and once they are there they won't come at any cost and will save the city money in the long-term. As opposed to active restoration management which would cost an estimated $4,695 per acre with installation, rental, and maintenance costs (Michie, 2010). Either option is effective with passive being more economically friendly, while active will provide faster results. One project that can be funded to help in these efforts is the North Prong Park which involves a City-owned property on Lake and Isabella Street which involves similar goals of promoting riparian ecosystems.

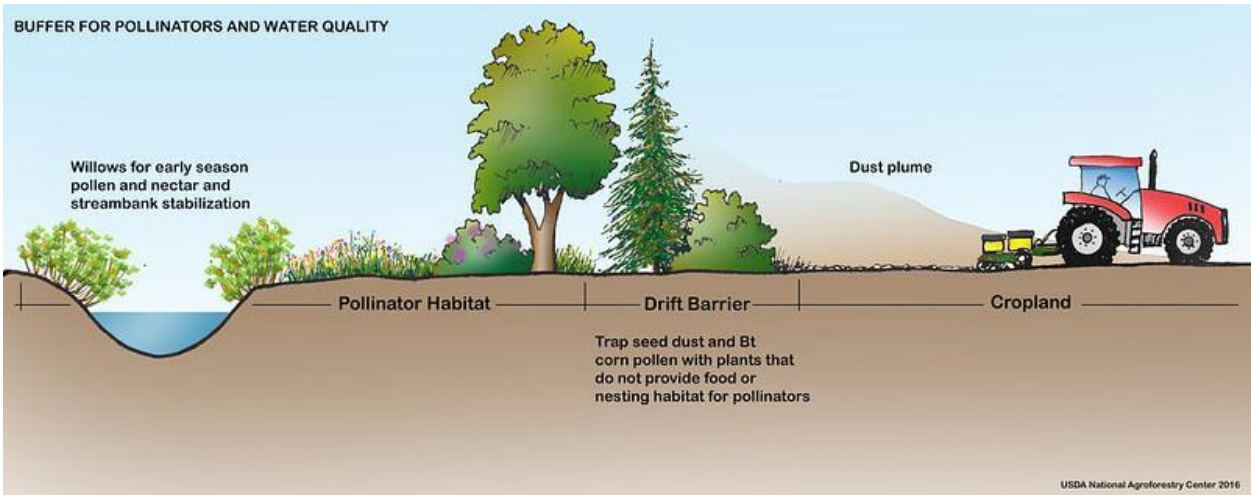


Figure 3: *This is an example of a buffer which can be utilized around waterways. National Agroforestry Center, Flickr.com*

Economic Impact:

The city of Salisbury will benefit economically from having a cleaner Wicomico River running through the city. It will give the city a clean image while boosting the property and use-values of the Wicomico River. The health of the Wicomico River and the Chesapeake Bay has a large impact on the economic health of the region. The Wicomico River has low water clarity, especially around the city of Salisbury. By helping to improve water clarity and health, the economy also benefits.

The benefits of a cleaner Wicomico River include:

1. Fishing and Crabbing- Cleaner water will be more supportive of marine ecosystems, and would, therefore, lead to healthier and more plentiful fisheries.
2. Recreation- Cleaner water boosts the recreational value of the Wicomico as it will be more enjoyable to spend time on the river
3. Land value- Cleaner environments lead to higher property value. Properties will also have a more natural visual appeal which also increases property value.
4. Tourism- A clean river would make downtown Salisbury a much more popular destination.

Environmental Justice:

Salisbury needs to ensure that in low-income and minority communities, water pollution is mitigated and drinking water quality standards are maintained. The biggest sources of water pollution in Salisbury are agriculture, industry, gas stations, and fuel storage. By providing additional regulation checks of fuel storage containers, this would help find areas that need to be addressed immediately. Controlling and solving water pollution in the Wicomico will, in turn, protect low-income communities.

To ensure that all community members have clean drinking water, the community should be encouraged to get their water tested. The Department of Water Work offers a tri-annual lead and copper sampling which is free to the public. This program can help to identify homes with old pipes that result in poor drinking water quality. For this reason, older homes should be strongly encouraged to get their water tested. This can be achieved by sending out letters to all Salisbury residents to inform them of this free program. Letters are cheap to send, as a first-class priority letter costs about $0.55 each

for an ordinary citizen to send (Postage Rate Increase, 2020). While this information is public knowledge, most residents may not be aware of this information. By encouraging more residents to take part in this water testing program, this will also allow the Department of Water Works to keep their title of “award-winning drinking water quality.”

Another way to protect low-income areas would be to reevaluate the floodplain. This is mainly for insurance purposes to make sure everyone is adequately protected. Sea-level rise causes the extension of the 100-year flood plain to encroach further inland. By reevaluating the 100-year flood plain, this will allow homeowners the chance to qualify for flood insurance that otherwise would not have been considered.

Critical Vulnerabilities:

These are the areas that Salisbury needs to improve on to become more climate-resilient. These points should have the greatest focus to allow Salisbury to continue to function through the changing climate.

A. Flood Zones

The flood zones in Salisbury may change each year, for this reason, these zones should be reevaluated to ensure the most current data. Through this data, areas at higher risks of flooding will be detected, helping to identify areas that need more focused mitigation practices.

B. Low Water Quality in Wicomico River

Phosphorus in the Wicomico River decreased between 2006-2014, but nitrogen increased during this same time. As of the 2016 Wicomico Creek Watchers report, phosphorus has seen an increase while nitrogen levels have remained similar. Also, there has been an increase in fecal bacteria in the Wicomico River since 2014, resulting in swimming risks and threshold being very poor throughout waterways (Wicomico Creek Watchers, 2016, 1).

Strict regulations for industries and gas stations should be practiced. This will help to limit the large quantity of gasoline and other pollutants the Department of Water Works is detecting. Industries, gas stations, and fuel storage areas are known to be the biggest sources of water pollution in Salisbury.

C. Littering

The Wicomico River is an important body of water that also is one of the Chesapeake Bay's tributaries. The health of the Chesapeake Bay is directly affected by the health of the Wicomico River, resulting in the need to protect the river from pollutants. Urban areas close to the Wicomico River have great potential to limit their ecological footprint. Due to their proximity to the river, these areas can also negatively impact the Wicomico River's health.

By increasing the strictness of the "no littering" law, this will greatly discourage people from littering if they know law enforcement will charge them a fine. Businesses along the waterway also are a huge contributor to littering. If the fines for littering were doubled for businesses, then this will help them to enforce proper disposal of waste. This would come at little to no cost for the city, as it mainly requires the time of city officials and police officers and will also give the city more money.

The Wicomico River also has stormwater drainage pipes all along the river. These drainage pipes were meant to contain a net around the output pipe to collect any litter. Due to how quickly the litter fills these bags; these nets are rarely replaced. If more volunteers could be recruited, these nets could be replaced more often. Volunteers are a great way to clean out the Wicomico River as many people in the area would like to see the river trash-free. Holding multiple river cleanups, a year would be relatively cheap, and the only cost is the price of supplies like bags, nets, etc. The city can also utilize Salisbury University as a way to get more volunteers as multiple classes require some form of community service.

Wastewater:

Wastewater use is only going to increase as the population also increases. For this reason, it is important to consider wastewater at the residential and industrial levels. The wastewater treatment plant is currently undergoing a $54 million-dollar project to upgrade to an Enhanced Nitrogen Removal rated facility that will keep over 1,283,000 pounds of nitrogen and 150,000 pounds of phosphorus out of the Wicomico River and the Chesapeake Bay. Methane is also produced by wastewater treatment plants which contribute to greenhouse gases. To limit this contribution of methane gases, wastewater treatment facilities should practice similar practices discussed on page three in the solid waste section.

A. Stormwater Treatment

When it comes to artificial solutions, the city of Salisbury already has a solid stormwater treatment plant, but that does not mean the system is perfect. There is always room for improvement and the city should continue to fund the stormwater treatment plant to ensure that it can operate to the highest of its potential. Also, the city still adds a lot of runoff pollution to the Wicomico especially downtown where water often runs straight into the river before it can find its way down a drain. So, along with riparian buffers, it would be recommended for the city to add more drains to prevent even more polluted water from making it to the river untreated. By replacing drainage infrastructure with higher-capacity pipes, this would allow stormwater to better drain. Another stormwater mitigation method would be to install more retention basins around communities. Retention basins help limit the amount of water the stormwater system must deliver (Boswell et al., 2019, 215). It is hard to estimate the exact cost of this because the current system needs a thorough review to determine exactly what needs to be done. However, a report from Sacramento State estimated that an overhaul of a stormwater system would cost roughly $10,000 (Sacramento State, 22).

Sustainable Development:

Development is a major factor in environmental health; therefore, Salisbury is no different than any other city developing. With sustainable infrastructure and sustainable development practices, Salisbury could continue to develop with minimal consequences to the environment. However, developers also need to keep in mind that some natural land such as riparian lands should remain untouched to allow for a healthy, functioning, sustainable city. There are three main goals of developing a more sustainable water system in Salisbury: improving the water quality of the Wicomico River, reducing water usage within the city, and improving flood control systems both natural and manmade within the city to help prepare for sea-level rise. Some of these will overlap as many proposed solutions will provide benefits in multiple ways.

A. Reducing Water Usage

Currently, the city of Salisbury is not in any sort of water crisis or shortage that is currently known. However, this does not mean that the city should not be preemptive in addressing this concern so that future generations will be less likely to face this problem. There are many ways to reduce water usage, some can be done on a city-

wide scale and others will have to be done by the citizens and businesses of Salisbury. Reducing water usage isn't just about prevention of future water shortages, it also saves everyone money as less water being used means that less water has to be treated, saving money for the city, and lowering citizen water bills.

1. City-wide Water Usage Reduction

The city of Salisbury should set an exemplary model for its citizens on how water should be used. Citizens of Salisbury will be more likely to reduce their water usage if they see that the city thinks that it is a worthy cause. Ways that the city can do this is by renovating their buildings to be more water-efficient, utilizing gray water, promoting vegetation choices that require less water, improving the efficiency and flow of water distribution through proper management techniques, and encouraging and supporting citizens to be less wasteful with water.

Renovating city buildings to be more water-efficient can include low-flow showers, toilets, and sinks. These are not particularly expensive methods and they only have a one-time upfront cost that will quickly pay for themselves. In Boston, a building replaced 126 toilets that averaged 3.5 gallons per flush to 1.6 gallons per flush, this cost them $32,000 but provided an annual return of $22,800 in savings (Massachusetts Water Resource Authority). Meaning they would make their money back in roughly 1.7 years and then profit over the following years. An option for faucets could be adding faucet aerators to all faucets in city buildings. These are designed to slow the flow of water out of the faucet and are remarkably cheap. In Brookline, MA, 30 faucet aerators were implemented, costing $300 to install, and provides a return of $1,250 annually (Massachusetts Water Resource Authority). City buildings could also implement once-through A/C condensers that are more water-efficient with cooling. Implementing costs $1,800 and provides a return of $3,000 annually (Massachusetts Water Resource Authority).

Next, the city can utilize gray water, which is reusing water for things like watering gardens and flushing toilets. This is an effective way to lower water usage, while again not having too high of a cost. Greywater systems vary in size and complexity which makes their price vary quite a bit, roughly costing between $1,000-10,000 (Green Building Alliance).

The city can also promote vegetation that doesn't require large amounts of water to maintain. There are plenty of beautiful flowers in the world, like lavender, globe thistles, and orange daylilies that don't require much water and can still provide the city with beautiful scenery.

The city can also work to improve how efficiently water flows through the city. Research has shown that most water that leaks out of pipes is lost through small leaks rather than large spills, this emphasizes the importance of being vigilant in the monitoring of water pipes and the detection of leaks. The speed at which water moves is also important as moderate to low water pressure is most efficient and results in the least amount of water lost. To accomplish this, the city can implement district metered areas that can act as gatekeepers to maintain a steady, low to moderate flow of water throughout the city (Hawken, 2017, 105). It's hard to get a read on how much this would cost the city, but to put it in a global perspective, according to Paul Hawken's book *Drawdown*, applying these on a global scale would cost $137.4 billion and would provide a net savings of $903.1 billion (Hawken, 2017,105). So, it would be very profitable for the city in the long-term to look into implementing district metered areas.

Finally, the most important thing that the city can do is encouraging and supporting its citizens to be less wasteful with water. Since most of the city's water is going to be used residentially and commercially rather than by the city itself the city must encourage its citizens to reduce water usage. This can be done by incentivizing low water usage, to provide an added benefit for people to work together towards a more sustainable Salisbury. When looking into how to incentivize the city, one can look at Denver Water, which gives businesses $21.50 for every thousand gallons of water saved, with a cap of $40,000 per year (Lower Colorado River Authority, 2012). Also, San Diego could be a good reference as they provide rebates for smart controllers ($35), high-efficiency nozzle sprinkler nozzles ($6/nozzle), flow sensors ($60), drip irrigation (20 cents per sq. foot of landscape), high-efficiency washing machines ($85), and high-efficiency toilets ($40) (San Diego County Water Authority). The city can also look into regulating plumbing to reduce the usage of inefficient toilets, faucets, laundry machines, showers, etc. Regulations are always tricky and often lead to a backlash from its citizens. So, any regulations need to take into account the different economic statuses of all citizens in the city, as we cannot expect people who cannot afford new plumbing to change their plumbing. This makes plumbing regulations difficult but with city support, it is not an impossible goal. The city can also use its platform to educate and encourage citizens on how to conserve water and why it is both important and beneficial.

2. Residential/Commercial Water Usage Reduction

The average American household uses 98 gallons of water per day (Hawken, 2017, 170). 60 percent is from indoor usage (showers, toilets, faucets, etc.), 30 percent comes from outdoor usage (watering lawns, gardens, and plants), and 10 percent is lost to leaks. (Hawken, 2017, 170) By implementing low-flush toilets, water-efficient washing machines, low-flow fixtures, and more water-efficient appliances, water usage can be reduced by 45 percent (Hawken, 2017,170). This would be beneficial to the citizens of

the city long-term as they would have lower water bills, but it does come with the upfront cost of installing these fixtures. Providing the previously mentioned incentives would help influence citizens to make the switch. The city also can support good water-saving habits like, shorter showers, washing only full loads of clothes, and flushing which could reduce water usage by another 7-8 percent (Hawken, 2017, 170). So, by taking advantage of those ideas any citizen in the city could effectively cut their water bill in half by using half the water, and the city could further incentivize that reduction to make it even more worthwhile for citizens.

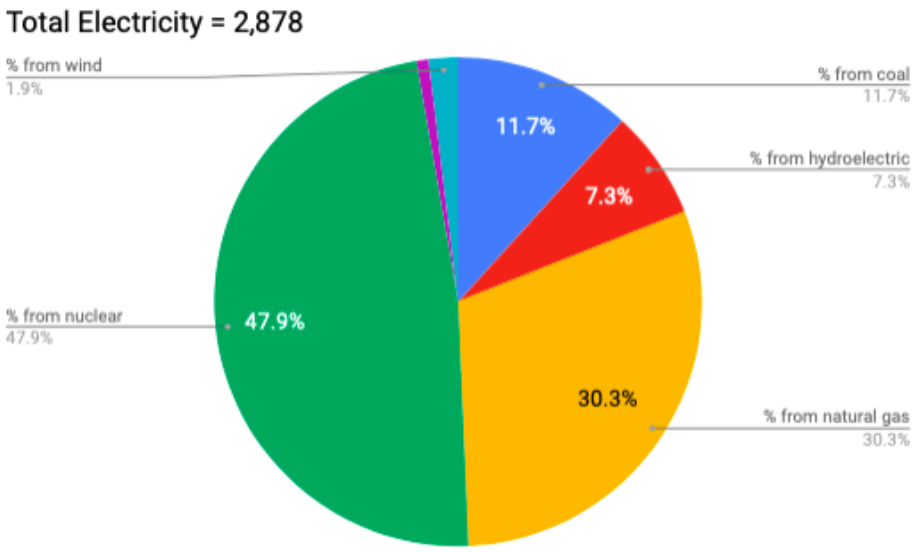
ENERGY & EMISSIONS

Introduction:

Climate change poses a serious threat to many natural habitats - waterways, forests, beaches, mountains - and our Earth as a whole including the health, economy, and well-being of the human race. Currently, buildings account for 70 percent of total electricity use and about 40 percent of greenhouse gas emissions (Fuller, Portis, Kammen, 2009). The human race burning fossil fuels is known to be the predominant cause of climate change and global warming. The fossil fuels we burn to produce energy to heat, cool, and light our homes emit a great amount of carbon dioxide (CO_2) into the atmosphere. Electricity and power come from either zero-carbon sources or nonzero-carbon sources, meaning that these electricity sources greatly contribute to the release of greenhouse gasses.

Maryland Electricity in Thousand Megawatt Hours

The state of Maryland generates electricity through multiple energy sources such as hydroelectric, natural gas, nuclear, solar, and wind. Obtaining energy from natural resources has its drawbacks, such as the release of CO_2 into the atmosphere.
Ultimately, energy is used for a handful of things.



(chooseenergy.com)
Figure 1. *Maryland's current energy usage in percentage.*

Street lighting, lighting, heat, and cooling for your home, charging electronics, television, and many more aspects of things used daily. Those that are privileged enough to have luxuries tend to not appreciate them in a way that is respectable to the planet. Lights, televisions, running water, central air, and heat are all privileges, and we must be responsible to turn them off when not in use. These actions contribute more to climate change by increasing the rate of CO_2 emissions into the atmosphere.
Not all energy is clean energy. Energy from coal is known to be the dirtiest form of energy, and in Maryland, coal is one of the top three sources of energy used. Natural gas burns clean; however, the production of methane resulting from this method greatly warms the atmosphere. As many people may believe nuclear power is the worst form of energy, it is actually one of the best given some negative effects. Nuclear energy has no direct emissions and using nuclear energy has a small to no carbon footprint whereas, coal, oil, and natural gas have a large carbon footprint. Nuclear energy uses uranium, and mining and transporting uranium releases CO_2 into the atmosphere. However, given all of this, the carbon footprint from nuclear energy is still even smaller than the carbon footprint from other sources of energy. The waste products from nuclear energy, called spent nuclear fuel, is what is so contradictory when using this source of electricity. Waste generated by nuclear power remains radioactive for very long periods leading to health issues within surrounding communities that they may be blind too.

People within the city of Salisbury must know exactly what is happening in their community and surrounding environment to ensure they are receiving the respect they deserve from their city. Your power is not as green as you may think it is, and it is

important to practice sustainable methods that are beneficial for both humans and the environment, and for the overall well-being of your community and those to join your community in the future. As a community, the following goals should be taken into consideration and action by 2030…

2030 Objectives:

1. **Reducing the total energy use of all buildings built before 2012 by 30%.**
2. **Reach net-zero carbon emissions in newly built homes and buildings.**
3. **Supply 50 percent of all energy to buildings and homes from renewable resources**

These goals are reachable through sustainable methods practiced by businesses and major corporations as well as the community as a whole. What we do to the climate, the climate does to us. Putting great work and determination into creating a healthier environment and community for the overall well-being and health of your friends, family, and neighbors. Everyone benefits from climate action; there is no injustice presented by nature without the impact of human society. Therefore, human society should impact nature in positive ways to ensure the best possible outcome and benefits for your community as a whole. We need to prepare for dangerous impacts by learning more about what exactly is happening in your very own community.

Economic Vitality:

Many people do not seem to understand the part of being sustainable that actually benefits people economically. In the economy today, job opportunities are very scarce which leads to people not receiving the benefits they deserve. With new sustainable projects and construction in action around Salisbury, new job opportunities throughout the city will be presented such as in energy management, renewable energy, construction of clean energy sources, engineering, electricians, and many more various opportunities for all peoples.

A. Money-Saving

Saving money is beneficial to all peoples within a community and cutting back on electricity and energy usages is easier than you may think as well as extremely beneficial to your pockets.

1. *Sustainable design*

Solar panels are a great way to save on energy costs while emitting fewer greenhouse gases and CO_2. Solar panels can be installed anywhere around Salisbury. For example,

efficient street lighting can use solar panels to gain energy throughout the day to provide light during the night. With global warming quickly skyrocketing, extreme use of air conditioners follows. Air conditioners use up a lot of electricity and are not cheap to keep on every day, all day. A simple way to reduce the need for air conditioners is to plant trees around homes to provide shade and naturally keep your home at a cooler temperature. Using this method could at least cut back the hours the air conditioning unit is turned on and burning up the electricity. Personal residents in Salisbury could produce their own energy, reduce energy usages while saving money through clean energy practices such as solar panels and planting vegetation.

Transportation:

The city of Salisbury promotes clean mobility around the community such as providing bike paths on streets and sidewalks for people to walk safely on. With more people walking to their destinations rather than driving, there will be fewer emissions produced while receiving personal and environmental benefits. Decisions made by residents will also help reduce emissions from transportation.

A. Walking and Biking

- Walking and bike riding are forms of fitness and relaxation and improve peoples' moods. This greatly saves in Salisbury's total emissions by reducing the amount of fossil fuel energy used for transportation.
- To save emissions, Salisbury could implement public transportation such as bus services for many people to travel at once without contributing to CO_2 emissions.
    - See Walkable Cities on pages 4-6 in the infrastructure section for more details.

(Marco Verch, flickr.com)

B. People's Decision Making

People's decisions are a big contributor to the amount of CO_2 that goes into the atmosphere.

- Things like deciding to drive to your destination instead of biking or even the decisions made in one's diet.
- When we decide to eat certain foods from livestock such as chicken or beef, we are leaving a large carbon footprint that increases the amount of greenhouse gas emissions going into the atmosphere and causing climate change. A lot of transportation is involved with livestock raising to get meat onto a person's plate.
- Promoting urban gardening, roof-top gardens, and vertical farming in buildings around Salisbury are possible ways to urge the residents of the city to shop locally.

These implementations would greatly reduce the carbon footprint of residents in Salisbury. With sustainable development, planning, and more public response to climate change in Salisbury, we can create things throughout the city that reduces CO_2 emissions from transportation. This would make Salisbury a city that reduces carbon emissions from transportation while mitigating the problems that threaten us from climate change.

Sustainable Development/Design:

Many may have heard the promotion of *sustainable development* but have no idea what sustainable development really means. Sustainability refers to the ability to be maintained at a certain rate. This relates to the environment in many ways, for one, the generation today should practice and promote sustainable methods to ensure a healthy, maintained environment for generations to come.

A. Limiting Consumption

Today, mass human consumption is a major issue for various reasons. Humans' overconsumption of goods is not only drastically taking away from the Earth’s natural resources, but this action also increases the emission rate of CO_2 and greenhouse gasses. Whether humans purchase goods from a store or online, the carbon footprint behind those goods is through the roof. Driving to a grocery store emits CO_2 into the atmosphere, and the goods you buy in the grocery stores have their very own carbon footprint. Those goods were transported from all around the world just to get to your store for convenience. On the other hand, the corporations and businesses producing those goods also emit tons of greenhouse gasses and CO_2 into the atmosphere. One of

the main reasons this is occurring in the world every day is because of our need for food, and more specifically, agriculture.

(Outsanity Photos, flickr.com)

(EcoShare, flickr.com)

B. Rethinking Agricultural Practices

Agriculture is the greatest reason for climate change in the world today. When compared to other GHG emitters such as transportation, fracking, deforestation, and the burning of fossil fuels for energy usage, agriculture and the raising of livestock is responsible for emitting hundreds of times more GHG emissions into the atmosphere. The raising of livestock is the form of agriculture with the most impacts on the environment. Of all the forms of livestock, dairy is the biggest contributor to GHG emissions, since cows emit Methane (CH_4), a GHG that is 28 times more powerful than CO_2 *(See page 3 in the waste section for more details).* The CH_4 being emitted from cows isn't the only contributor of GHG emissions from livestock. If you are a consumer of meat, the carbon and ecological footprint behind that action are enormous. First, methane is released from cows. Then, the meat from dairy or other livestock such as chicken is transported to a plant. Through transportation and the operating of the factory, CO_2 is being emitted. After the meat is processed, it is taken to

the store; then to the consumer's house. Both of these are releasing even more CO_2 into the atmosphere. On top of the immense number of GHG emissions that come from agriculture, several other impacts arise such as habitat destruction, species extinction, and pollution. The impacts that are associated with agriculture from the raising and eating of livestock are severe, and that is why it is important we focus on more sustainable land development and design strategies that allow a growing population to be fed, but without devastating the environment. These strategies should be considered not only in large cities but smaller ones like Salisbury.

C. Practices to Consider

1. Reduce the amount of meat consumed

When the topic of eating less meat is brought up, many people think the world's population can't be fed without the raising of livestock, or that not enough protein can be acquired through a plant-based diet. This is not the case, and there are sustainable design strategies that could feed everyone while living a sustainable lifestyle. One way that this can be done from a small scale and can be focused on in the city of Salisbury, by developing vertical and urban gardens. Through sustainable development and better city designing, we could potentially have small farms throughout the city. Vertical farms can be created in old buildings such as warehouses and shut down businesses. By designing urban and vertical farms in old buildings around the city, we can occupy the once abandoned building while supplying food to the entire city in a sustainable way. If Salisbury were to create vertical and urban farms throughout the city, it would promote people to not only shop locally but to eat less meat; which reduces even more environmental problems such as habitat destruction and pollution. Promoting people of Salisbury to shop and eat local would be a great step towards not only reducing GHG emissions in the city of Salisbury but in cities around the world. If we can get Salisbury on track with other cities that have already developed these sustainable design strategies, we can greatly mitigate the problems of climate change.

(Sharyn Sather, flickr.com)

Even shopping online has a carbon footprint. Goods purchased online have to be transported to the delivery company and then the company transports the goods to your home. Any form of transportation emits CO_2 into the atmosphere, and any small amount of CO_2 emissions is degrading out climate. Lessening your consumption of goods not only saves our natural resources greatly but this action also decreases the rate of climate change by lessening human emissions.

One of the best sustainable energy practices is clean energy. Clean energy refers to gaining energy through renewable resources such as wind energy, hydropower energy, geothermal power, solar power, and energy from biomass from plants and animals. Renewable energy is very beneficial for humans and the environment by increasing human and ecosystem health due to less to no air pollution associated with energy generated from fossil fuels. Coal, the most common fossil fuel is not a renewable resource; therefore, the supply can run out leaving us with no coal to generate energy all the while greatly contributing to greenhouse gas emissions

(Boswell, Greve, 2019, p. 159). There is controversy about the coal industry supplying many job opportunities; however, renewable energy programs also provide that benefit to communities and could potentially provide new, well-paying jobs for citizens of Salisbury as well. Renewable energy could spark economic growth by providing new job opportunities such as hiring employees to manufacture and install solar panels, wind turbines, and hydroelectric power.

(Salisbury.edu)

2. Solar panels

Solar panels are a very common form of generating energy through a renewable resource. There are three main types of solar panels: monocrystalline, polycrystalline, and thin-film panels. Monocrystalline has the highest efficiency compared to the other two but tends to cost more in terms of manufacturing and disposal. Thin-film panels tend to be the cheapest and easiest to mass-produce, but only have a fourth of the output as their monocrystalline counterparts (*Sendy, 2020*). Solar panels can be installed with street lighting, traffic lighting, charging stations, on homes, and as is on a

large-scale area. Salisbury University has very beneficial solar panels installed over one of its parking lots that provide energy for surrounding campus buildings. The campus also provides tables with charging stations that are generated through solar energy and provide seating and efficiency for students.

Other buildings, companies, and colleges around the Salisbury area also use solar energy, more could be implemented throughout Downtown Salisbury and along highway 13 and 50. The Perdue chicken plant has solar panels installed in a field along highway 50 covering about 90% of the plant's power. Big corporations moving to solar power is a major step in reducing CO_2 emissions. We have the potential to install many more solar energy sources throughout the city of Salisbury on more businesses, personal residences, and recreational/ community areas to create a more sustainable source of energy for the community all the while gaining economic benefits.

(Salisbury.edu)

3. Implementing green infrastructure

The methods and practices within green infrastructure are also a great way to start developing sustainably to reduce energy emissions. Green infrastructure solves urban challenges by building with nature. For example, rain gardens and community gardens are beneficial for water management purposes as well as the absorption of CO_2 from human emissions due to the process of photosynthesis by vegetation. Vegetation also absorbs water through their roots and acts as a filter to strain out any pollutants contaminating the water before it enters our waterways. Trees and vegetation also act as barriers to homes and other buildings. Planting them around a home provides wind resistance and blocks wind from cooling your home. Trees also provide shade and reduce the rate of heat entering your home on a hot day. Both of these benefits also include the reduction of your heating and cooling bills. Green infrastructure also promotes energy-efficient buildings and green roofs. Referring back to Salisbury

University, the academic commons building has a green roof. A green roof is a roof that is covered with vegetation that serves many purposes.

4. Green roofs

Green roofs save great amounts of energy by reducing the heat flux through the ceiling; reducing the amount of cooling needed in the building. On the other hand, the vegetation on the roof also provides shade that keeps the interior of the building cool and is known to be more effective than internal installation as well as an environmentally friendly way to reduce heating and cooling bills. Along with those benefits, vegetation on green roofs also provide the benefit of absorbing CO_2

emissions and hazardous air particles. Transforming roofs into green roofs in the city of Salisbury would benefit the community in many ways. Plants provide oxygen, absorb human emissions, and lessen utility bills for those living in the building and would be very beneficial to implement these green roofs on

(Salibsbury.edu)

apartment buildings in Downtown Salisbury and businesses along Route 13 for the benefit of our surrounding environment and overall well-being of the community.

5. Light pollution

Light pollution not only affects our ability to see a beautiful, starry night, but it also greatly affects our environment, our energy consumption, our health, and our safety

(IDA International Headquarters). Inappropriate and excessive use of energy and light emits pollutants at a scale similar to air, water, and land

pollution. What is meant by “light pollution” is that stars seem to look washed out or non-visible due to light directed or reflected upward

(Beca Paloa, flickr.com)

(Longcore, Rich, 2004). This excess use of energy is reflected from trapped particles in our atmosphere, causing great harm to the health of humans as well as the natural world. An increase in headaches, fatigue, stress, anxiety, etc. are all common effects of light pollution; however, implementing the Dark Skies Initiative is crucial to reduce the extremity of light pollution.

6. Dark Skies Initiative

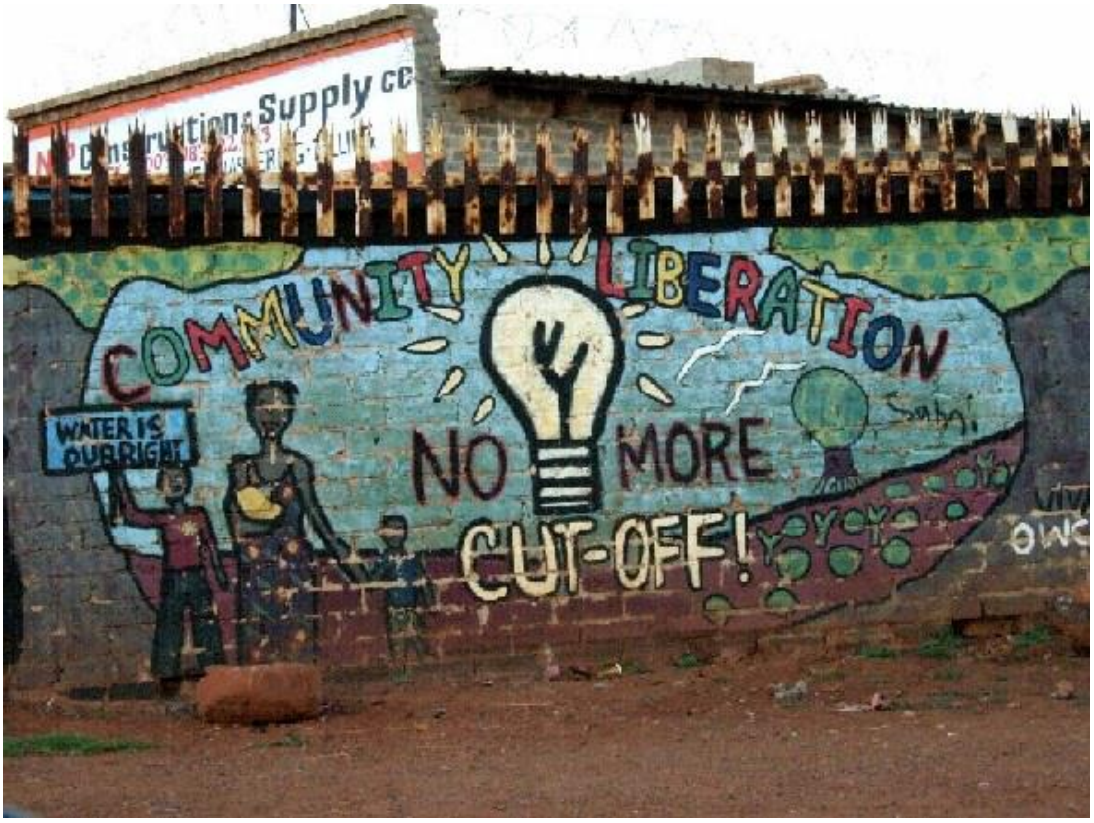
The Dark Skies Initiative is a movement that promotes the reduction of light pollution by educating community members about how to control and reduce personal light pollution. Turning off lights during the dark hours of the night is a simple way to reduce light pollution in your community. The city of Salisbury can implement designated places around the community to participate in this movement by following the guidelines of the IDA.

- **Communities:** Must have some type of legal organization that is officially recognized by outside groups. This can be in the form of a town, city, municipality or other legally organized community (such as an urban neighborhood or subdivisions). There is no night sky quality criterion associated with this category.
- **Parks:** Must be public or private land, accessible to the public in part or whole, that is legally protected for scientific, natural, educational, cultural, heritage and/or public enjoyment purposes. The core area must provide an exceptional dark sky resource, relative to the communities and cities that surround it, where the night sky brightness is routinely equal to or darker than 21.2 magnitudes per square arc second.
- **Reserves:** Must be a public or a private land of at least 700 km², accessible to the public in part or whole, that is legally protected for scientific, natural, educational, cultural, heritage and/or public enjoyment purposes. The core area must provide an exceptional dark sky resource, relative to the communities and cities that surround it, where the night sky brightness is routinely equal to or darker than 20 magnitudes per square arc second.
- **Sanctuaries:** Must be a public or a private land, accessible to the public in part or whole, that is legally protected for scientific, natural, educational, cultural, heritage and/or public enjoyment purposes. The site must provide an exceptional dark sky resource where the night sky brightness is routinely equal to or darker than 21.5 magnitudes per square arc second.
- **Urban Night Sky Places**: Must be a a municipal park, open space, observing site, or other similar property, accessible to the public in part or whole, located within the region enclosed by a perimeter extending 50 km beyond the edge of the continuously-built area of a municipality with a permanent population of 10,000 or more people within its territorial jurisdiction, or 50,000 or more people if defined as a “metro area” of two or more adjoining municipalities. There is no night sky quality criterion associated with this category.

(Darksky.org)

Figure 2. *IDA Dark Skies eligibility requirements and guidelines for various places within a community*

Environmental Justice:



(Unitarian Universalist Service Committee, Flickr.com)

The city of Salisbury is a community, and a community should thrive off of equality and fairness for all peoples unbiased of gender, race, income, geographical location, etc. This means all peoples should receive a fair distribution of environmental benefits and burdens regardless of where their homes reside within the Salisbury community. Mass energy is consumed from big corporations and businesses causing citizens to be vulnerable to health issues from poor air quality. Depending on where a household may be in regard to the polluting corporation, the air quality could be much healthier in areas further away. The location of mass energy-consuming corporations and businesses is crucial in determining whether air quality is toxic to surrounding neighborhoods. Around Salisbury, those who live in Downtown may be suffering from underlying health conditions due to poor air quality from surrounding corporations. If Salisbury promotes having more energy-efficient buildings, and ones that emit less carbon into the atmosphere, the city would be creating better equality for the citizens that live here. It is estimated that 27.5% of Salisbury's residents live in poverty (*2017 ACS 5 Year*). With many residents of Salisbury living in poverty, it may be hard for these residents to switch to a more sustainable lifestyle. Whether it is paying for solar panels, switching to

energy-efficient appliances, transitioning to a healthier plant-based diet, or driving an electric car, these all come at a price. For many residents, these things may be out of the question. That is why Salisbury must provide the resources that its residents need to be sustainable.

A. Equal rights

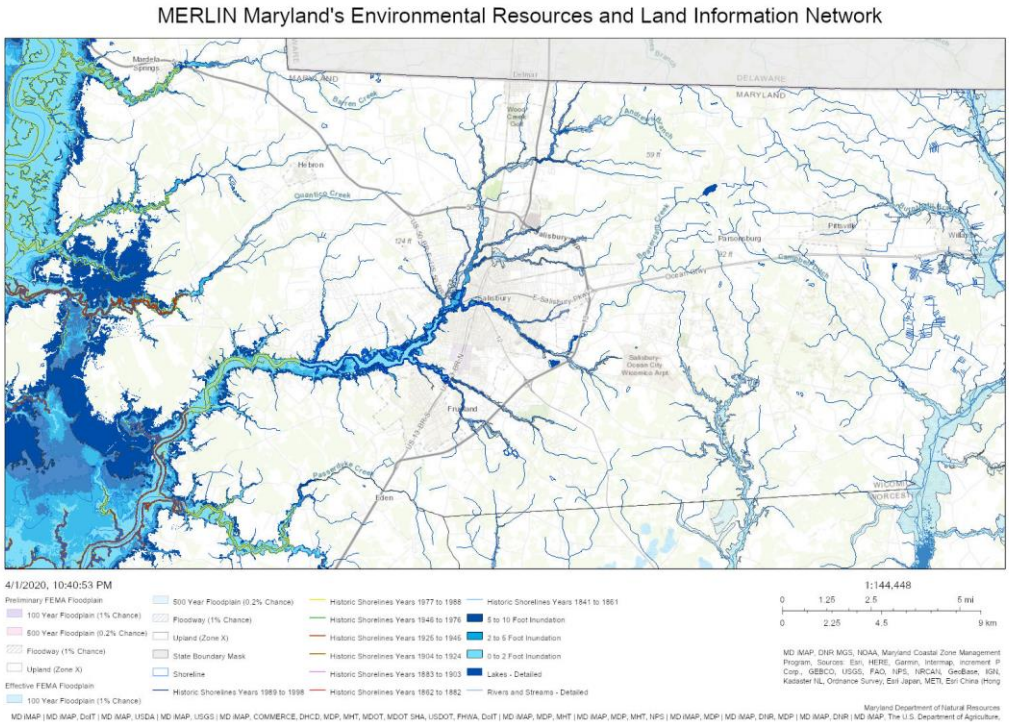
Citizens of Salisbury deserve fair and equal housing rights unbiased of income level or race. Emissions from surrounding businesses and companies cause bad air quality for those living close by. A vast majority of Salisbury citizens live in poverty and are more vulnerable to bad health conditions. The location of a home should not determine whether or not the air quality is healthy or not, for all peoples, regardless of geographic location should be safe from any toxic chemicals and emissions from polluting corporations. Salisbury should ensure safety for those that have been under the exposure to toxic chemicals, pollution, and any natural disasters to strike Salisbury. Fair and equal housing rights are often overlooked in communities such as Salisbury; therefore, this policy would ensure equality amongst the city of Salisbury for all citizens, not based on income level, geographic location, or race.

1. *Transportation for everyone*

Many people live in Salisbury without any form of personal transportation. Salisbury can provide those without personal transportation with affordable transit busses that are also zero-emission transit busses, meaning they run on clean energy rather than fossil fuels. Salisbury could also provide rent-a-bike stations for people to share bikes to commute around Salisbury for work, school, grocery stores, pharmacies, and many other essential living needs. *See page 6 in the Infrastructure section for more detail.*

Local and affordable markets, rent-a-bikes, and community transportation would not only benefit those living in Salisbury but would also result in less energy consumption and rates of climate change. It is important that within a community, protection is ensured to citizens of all income levels and have equal opportunity and potential to partake in energy-efficient material.

Weakness/Threats/Vulnerabilities:



(Coyne,K. J.& Edmonds,G, MERLIN Online)

Figure 3. *A map detailing the both historic, current, and future predicted shoreline levels of the Wicomico River and the surrounding region. The figure also shows the current and future flood plains if sea level continues to rise at the current rate it is now.*

Many threats arise from climate change in a community such as Salisbury. Not limiting out CO_2 emissions and limiting our energy usage greatly contributes to the warming of the Earth as a whole and will affect Salisbury greatly if nothing is done about it. Extreme greenhouse emissions from fossil fuels cause temperatures to rise, and sea level to increase. Salisbury, being so close to the Atlantic Ocean and the Chesapeake Bay, puts the city at a much greater risk than other cities due to its location.

A. Salisbury Vulnerabilities with Location

- Flooding
    - See pages 1-2 in the water section for more details.
- Erosion of roadways and shorelines
- Habitat loss.

The threats of flooding and erosion bring massive costs from damages in infrastructure and will impact Salisbury if we don't plan and respond to the problem. Mass energy consumption and the emitting of greenhouse gasses into the atmosphere brings major burdens to a small community that is vulnerable to these threats. Corporations' massive energy usages also affect the health of society, waterways, and biodiversity.

With 1 out of every 3.6 residents of Salisbury living in poverty, it may be difficult to overcome these threats due to the expensive costs of practicing sustainable methods. Clean energy is not cheap, which is why it is important to gain awareness throughout the city and promote more sustainable development and practices to lessen the community's vulnerability to these threats.

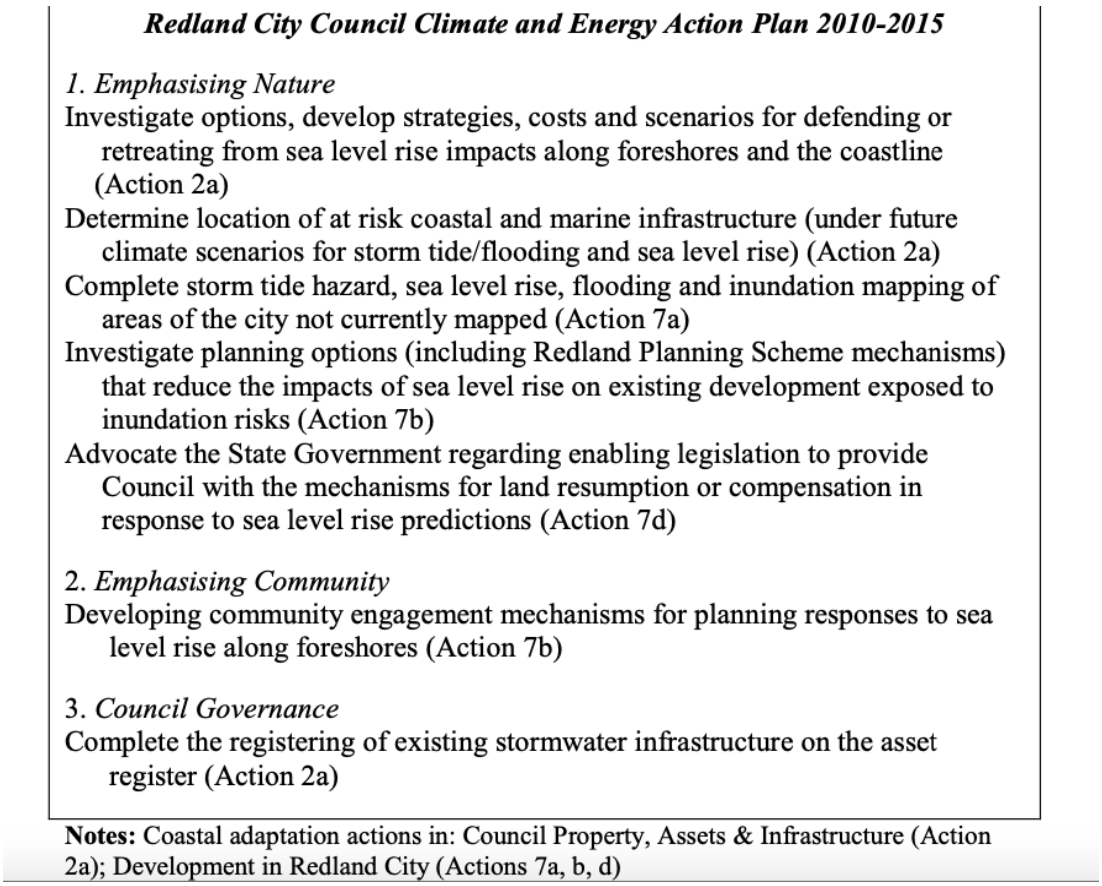
Emergency Preparedness/ What's Next:

As discussed in the session above, the city has various weaknesses and vulnerabilities that need to be addressed and taken care of. Of course, this begs the question: "How will we achieve said goal and what's next?". To answer this question, you first must prepare for any emergency or threat ahead of you. With this Climate Action and Resilience Plan, we hope to teach the city of Salisbury exactly what needs to happen.

To achieve any task, it's best to split them up into smaller, more manageable parts, and to do that, let's first focus on Regional Efforts. Regional Efforts the city of Salisbury can participate in include interaction and cooperation with other cities in the Delmarva region. One such example may be contacting and working with Ocean City and the support of offshore wind turbines. The city of Salisbury can help to promote the installation of these wind turbines and then buy the energy from Ocean City as opposed to other sources further away. By focusing on Wind Power, the city and its surrounding region prepare for the future. Oil, coal, and natural gas are all limited energy sources with the inevitability of running out. By switching over to alternative wind energy early, Salisbury would already have a foothold in the market regarding Ocean City's Wind Energy.

But those were regional efforts, what can the city of Salisbury do locally? Well, local efforts the city can participate in may include setting up small programs and projects throughout the city. An example of this can include setting up solar panels and solar arrays around areas of the city that are vacant and unused. By switching these areas over solar arrays, even small ones, the city can have a source of its own renewable energy while utilizing otherwise worthless areas within the city. Other ideas may include continuing the utilization of natural gas that comes from landfill waste, albeit not the best

solution as burning the gas would still emit GHG though in much smaller quantities compared to burning coal for electrical power. However, the biggest goal the city needs to accomplish is reaching either net-zero emissions or zero emissions, and the next section describes how the city can do just that.



Redland City Council Climate and Energy Action Plan 2010-2015

1. Emphasising Nature

Investigate options, develop strategies, costs and scenarios for defending or retreating from sea level rise impacts along foreshores and the coastline (Action 2a)

Determine location of at risk coastal and marine infrastructure (under future climate scenarios for storm tide/flooding and sea level rise) (Action 2a)

Complete storm tide hazard, sea level rise, flooding and inundation mapping of areas of the city not currently mapped (Action 7a)

Investigate planning options (including Redland Planning Scheme mechanisms) that reduce the impacts of sea level rise on existing development exposed to inundation risks (Action 7b)

Advocate the State Government regarding enabling legislation to provide Council with the mechanisms for land resumption or compensation in response to sea level rise predictions (Action 7d)

2. *Emphasising Community*

Developing community engagement mechanisms for planning responses to sea level rise along foreshores (Action 7b)

3. *Council Governance*

Complete the registering of existing stormwater infrastructure on the asset register (Action 2a)

Notes: Coastal adaptation actions in: Council Property, Assets & Infrastructure (Action 2a); Development in Redland City (Actions 7a, b, d)

Figure 4. *Redland City Council Climate and Energy Plan from 2020-2015 (Heather Zeppel,informit.com)*

A. Getting to ZERO

If we begin to promote low to no energy usages in businesses and big corporations around Salisbury, we can begin implementing sustainable, energy-efficient construction-techniques and practices. These practices would consist of the use of renewable energy sources and reducing our energy outputs by using the following forms of infrastructure:

- **Green roofs** are roofs of a building that is partially or completely covered with plants and vegetation. These roofs can include a drainage system to help mediate stormwater and surface runoff to reduce water pollution. Green roofs would be very beneficial for downtown Salisbury's buildings, for most of them consist of flat roofs. These roofs also improve our oxygen throughout the community while mitigating community CO_2 emissions.

- **Net-zero/ zero-energy buildings** are buildings that absorb the same amount of energy that is being emitted. This includes sustainable heating and cooling methods along with planting vegetation around the property to act as shade and wind barriers.
- **Renewable energy** is the energy obtained from renewable sources that can never run out. Renewable energy has many forms, such as solar, wind, hydropower, geothermal energy, and biomass energy. Renewable energy provides the same benefits as non-renewable energy sources. This “clean energy” can come directly from the sun or wind on a windy day and heat and cool your homes, heat water, and a variety of other commercial household uses. Installing these energy sources in Salisbury could greatly reduce greenhouse gas emissions while still obtaining the energy we need.

You can promote these sustainable methods without the city being involved. Simple actions such as turning off your lights when you leave a room, turning off the water when you brush your teeth, taking shorter showers, planting gardens and vegetation around homes to mitigate heating and cooling bills, etc. These practices are simple, daily actions that can be shared throughout the community of Salisbury by just talking to neighbors, family, and friends. These practices also provide the health benefit of better air quality and economic benefits such as saving money on personal residents’ energy bills.

Infrastructure and Land Use

Introduction:

Infrastructure and land use are central to any functioning municipality. Smart and sensible planning is necessary to prevent uncontrolled sprawl, waste management issues, maintain economic vitality and attract businesses, as well as protecting the local environment. Infrastructure and land use planning is also vital to endure the pending climate issues our city faces. Chief among the problems Salisbury faces relates to sea-level rise and increased flooding events. To better protect citizens of Salisbury against these events, the

wicoclimate.weebly.com

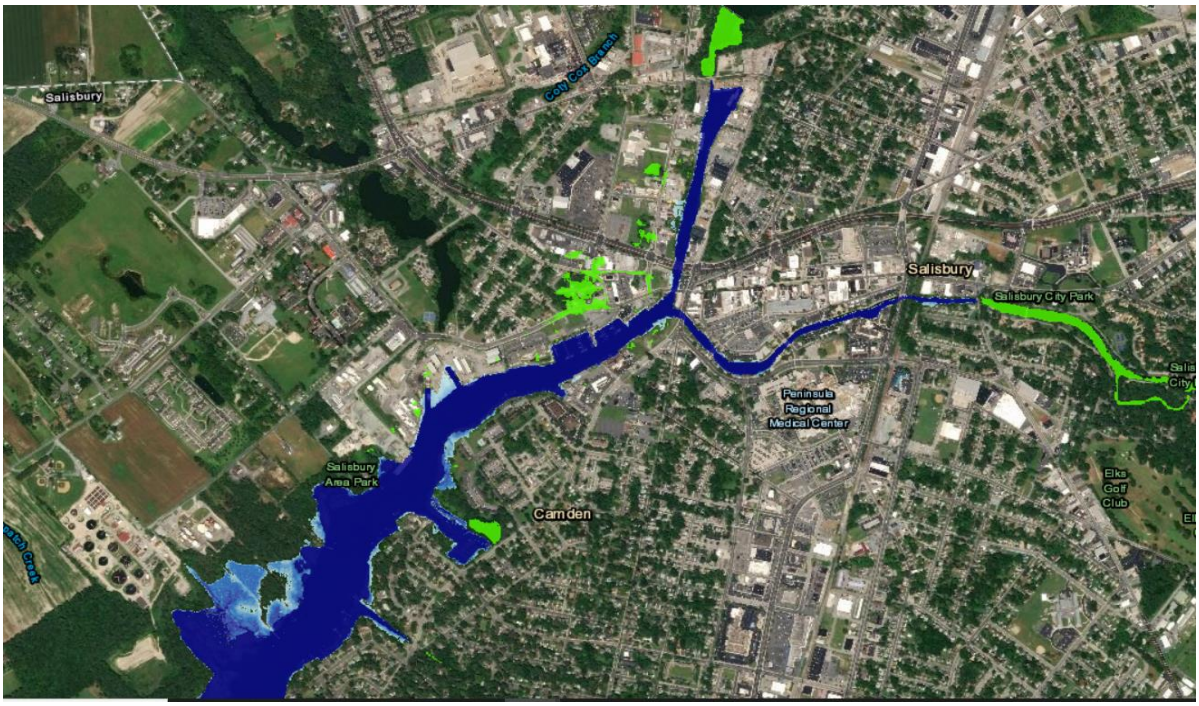
problems must be addressed from multiple fronts within this topic. There are many different things the city can do to improve its preparedness and increase its sustainability, such as redesigning districts to become more walkable, improving public transportation, implementing smart growth practices, revamping stormwater systems, and waste management infrastructure. Infrastructure and land use are at the forefront of defending against the physical impacts that come from climate change. Without proper planning and consideration in this field, it makes preparing for other fields extremely difficult, consistent with the ever-evolving rate of climate change impacts.

Baseline Data:

- 2018 was the wettest summer on record in Maryland. From May through July 2018, the Mid-Atlantic region experienced rainfall amounts up to 300% more than what is considered normal. (Liberto, 2018)

Climate change will bring unprecedented challenges to the city of Salisbury. Located on the Wicomico River and a part of the Chesapeake Bay watershed, Salisbury is especially prone to sea-level rise and all of the implications surrounding it. The Wicomico River runs right through the downtown region of the city, a center of economic and population concentration.

Downtown Salisbury is already experiencing issues with flooding downtown. This problem will only continue to worsen as water levels rise and storm frequency increases. Sea-level rise projections for Salisbury show that in the coming century, the downtown area is particularly at risk.



Map: wicoclimate.weebly.com

Above is a projection of what a three feet water rise would look like in downtown Salisbury. The areas highlighted green are low lying places that will experience frequent flooding, and the light blue areas are land that will be submerged underwater. This projection was based on average high tide data and is subject to much change.

Current projections for sea-level rise, nationally, are at about one inch every 5 years (IPCC). This number is under heavy debate and can fluctuate quite frequently given current understanding of our climate.

The Mid-Atlantic region of our country has seen first-hand what climate change can do. In the summer of 2018, the region saw an unusually hot summer. The reason it was unusual was due to the record amounts of rainfall experienced. Typically, when there are large amounts of rainfall, temperatures are lowered. (Boesch et. al) This was not the case in 2018.

Uve-Rain Uusrand, flickr.com

Maryland saw all-time rainfall records during the summer of 2018. Ellicott City got hit with devastating flooding in May of 2018, and Baltimore alone saw 250% more rainfall than what was average. (climate.gov) These are all signs and implications of climate change coming faster than the public truly thinks.

Transportation:

A. Nine GHG reduction strategies (Boswell et. al, 2019, 146)

- **Pricing and taxes:** Raise the costs associated with the use of the transportation system, including the cost of vehicle miles of travel and fuel consumption.
- **Land use and smart growth:** Create more transportation-efficient land use patterns, and, by doing so, reduce the number and length of motor vehicle trips.
- **Non-motorized transport:** Encourage greater levels of walking and bicycling as alternatives to driving.
- **Public transportation improvements:** Expand public transportation by subsidizing fares, increasing service on existing routes, or building new infrastructure.
- **Ridesharing, car-sharing, and other commuting strategies:** Expand services and provide incentives to travelers to choose transportation options other than driving alone.
- **Regulatory strategies:** Implement regulations that moderate vehicle travel or reduce speeds to achieve higher fuel efficiency.

- **Operational and intelligent transportation system (ITS) strategies:** Improve the operation of the transportation system to make better use of the existing capacity; encourage more efficient driving.
- **Capacity expansion and bottleneck relief:** Expand highway capacity to reduce congestion and to improve the efficiency of travel.
- **Multimodal freight sector strategies:** Promote more efficient freight movement within and across modes.
- **Encouraging community members to carpool or utilize higher-efficiency:** Vehicles such as hybrids, electric vehicles, or high-fuel efficiency vehicles can be achieved by making these options more convenient than the alternative.
- **Designated lanes or parking for carpool, hybrid, and electric vehicles provide incentives for use,** and increased parking or driving fees (such as congestion pricing) are disincentives for driving. Electrical vehicle charging stations at workplaces also serve as a common incentive.

B. Modes of Transportation

1. Walkable cities

Cost-Benefit Analysis:

For implementing crosswalks, the price can range from a striped crosswalk at $750 to a high visibility crosswalk at $2,600 (walkinginfo.org). If the city were to create 15 new striped crosswalks, for example, the price would come to around $11,250. This would be a high impact action. These crosswalks will also, of course, need pedestrian signals. Countdown pedestrian signals come at a low price of $300-$800 per signal (walkinginfo.org). To implement 15 new crosswalks equipped with countdown pedestrian signals, the cost would come to between $4,500 -12,000. Ultimately,

Alex Proimois, wikimedia.org

depending on how many crosswalks and signals are implemented, this can be a low impact or high impact action. At 15 crosswalks, it is a low impact action.

If more people are out walking as opposed to driving, there will be fewer emissions produced. Walking also serves as a valuable form of fitness and allows for an improvement in people's mental health. It is also necessary to make sure that walkable cities are safe and accessible. For downtown Salisbury, this is an aspect that can certainly be improved upon considering the inaccessibility to a proper crosswalk in some areas.

Crosswalks and crosswalk signals are a necessary component of this climate plan. Today, in some areas of the city, there is no other option but to jaywalk. By putting a greater focus on walkability, there will be a greater incentive to walk around downtown and GHG emissions would be reduced significantly by the decreased rate of people driving.

By increasing walkability, the city is allowing for all people, regardless of income, to meet together. A very important aspect of walkable cities is that they are accessible to those in wheelchairs. Crosswalk markings must be placed in alignment with a curb ramp so that people in wheelchairs can safely cross the street. Also, when cities become more walkable, there is a greater incentive for civic engagement and connections to nature.

Around the country, cities and towns are taking part in a “walkable school bus” initiative. A walkable school bus consists of a group of children and one or more adults who walk to nearby schools. Walkable school busses not only offer exercise to everyone involved but can also help students form good walking habits.

To make Salisbury a more walkable city, there must be a shift in real estate practices, zoning ordinances, and municipal policies. This move would not only be to the benefit of sustainability and health in Salisbury but for the overall happiness of residents and businesses.

Raingkun Sittikan, pxhere.com

2. Biking

Raingkun Sittikan, pxhere.com

<u>Cost-Benefit Analysis:</u>

For bike infrastructure, there are many prices to take into account. First, the average cost of a bike lane is around $133,170 per mile and $660 for a regular bike rack. The bike lane would be a high impact action while the bike rack would be low impact. Bike-sharing, similar to bike lanes, is not a cheap implementation. Bike-sharing systems can vary in price. The price for a bike-share system typically includes a cost of $5,000 per bike for capital and the operating expenses are often around $100-$200 per bike per year (shareable.net). Given that Salisbury would likely have at least 10 bikes, the implementation of a bike-sharing system in Salisbury would be a high impact action.

Biking is a straightforward form of exercise that, like walking, can improve people’s moods. Biking is also, of course, dependent upon a city being accessible to bikers. For those who bike, it can be intimidating when there is not an established bike lane or if the

terrain is unfit for biking. It is important to make sure that bikers have safe and comfortable access to the road.

It is important to note that there are several different critical aspects of infrastructure for biking. For example, bikers require secure parking, good lighting, and connections to desirable destinations such as parks or city squares (Hawken, 2017, 88). Just as walking helps to reduce emissions, biking also helps to do just that. However, if Salisbury wishes to make biking more accessible to the public, bikers must be able to feel safe when traveling and infrastructure must cater to their needs. For example, it is important to have bike lock stations so people's bikes can be kept safe when they are away.

Another important aspect of biking that does not often get considered is how it reduces noise pollution. Noisy cities can cause stress, anxiety, and high blood pressure. These issues can lead to more serious problems down the line such as species abandoning their habitats.

Also, if enough people are biking in the city, there would not be as large of a need for vehicle space such as large parking lots. For instance, with automobiles, a huge aspect of driving is having somewhere to park. If enough people are biking within the city, a typical space for parking could be transformed into a designated green infrastructure space or a local farmer's market.

There is also the popular option of bike-sharing. This is a shared service for bicycles in which individuals use a bike for a short-term basis either for free or at a cost, and they eventually return it to a designated bike-sharing rack. At the docks, bikes are locked until the individual pays or registers the bike. This also eliminates the need to carry around a hefty bike lock everywhere. Bike-docks could realistically be implemented throughout downtown and the rest of the Salisbury area such as on Main Street or near Calvert Street across from the Wawa on Route-13.

With the folk festival that occurred last Fall in Salisbury, a bike lane was created on Waverly Street. Why not extend the effort to other areas downtown? By creating more bike lanes, the city of Salisbury will become much more connected and enjoyable for bikers. As stated earlier about walkable cities, bicycle infrastructure must also be available to all people within Salisbury, regardless of their socioeconomic background. Ultimately, making Salisbury more bike-friendly will allow for a reduction in GHG emissions, help bring people together, help improve the mental and physical health of people in Salisbury, and it will make the city of Salisbury more sustainable.

3. Electric Vehicles

Cost-Benefit Analysis: For electric vehicles, the main thing to consider regarding land use and infrastructure is charging stations. The price of electric vehicle charging stations can vary greatly. For instance, a low-end charger might be around $247 while a high-end charger can cost up to $1,700 (homeadvisor.com). However, the typical range

is around $436 to $979 with the national average being $706 per charger. (homeadvisor.com). The city would likely want around ten to fifteen chargers which would cost between $7,060 to $10,590. Implementing these charging stations throughout Salisbury would be a high impact action.

Electric vehicles are a more efficient form of transportation compared to gasoline-powered vehicles. With zero direct emissions from electric vehicles, they are a much more sustainable and necessary part of working to reduce climate change impacts. At the university, there are multiple electric vehicle charging stations both at the Perdue Hall and Fulton Hall locations. Unfortunately, there has been some skepticism when it comes to electric vehicles because of their limited range. But, as technology continues to rapidly evolve, more electric vehicles are being produced with wider ranges. Also essential to the electric vehicle are charging stations. Perhaps a charging station or multiple charging stations could be implemented throughout downtown. For instance, an ideal location could be the parking lot across from the public library and by Calvert Street where the flea market is held every weekend.

Below: In 2017, Salisbury University finished installing a solar canopy parking lot equipped with electric vehicle charging stations. Retrieved from salisbury.edu

The new university installment includes four canopies and five electric vehicle charging stations. The solar panel canopies provide power to TETC/Conway Hall and Fulton Hall. A similar set up could be utilized at the locations ideal for the electric vehicle charging stations (the parking lot by the public library downtown and the parking lot by Calvert Street. This would not only be to the benefit of electric vehicle users but also an efficient and sustainable way to power nearby buildings. (For more information on solar energy, see p. 22-23 in energy & emissions).

It is important to note that there are three types of electric vehicles: hybrid electric vehicles (HEVs), plug-in hybrid electric vehicles (PHEVs), and Battery Electric

Vehicles (BEVs). HEVs are powered both by petrol and electricity (energy.gov). Electric energy is generated through the car's braking system, a process known as regenerative braking as the battery is also recharged through the braking system (energy.gov). The petrol engine is utilized as speed increases (energy.gov). PHEVs are also again powered by petrol and electricity but have the option of being charged through regenerative braking and a plug-in electric charging outlet (i.e. the charging station above) (energy.gov). Lastly, BEVs are completely electric and therefore do not require petrol energy. These vehicle types have the two options of electrical charging via outlet as well as regenerative braking (energy.gov).

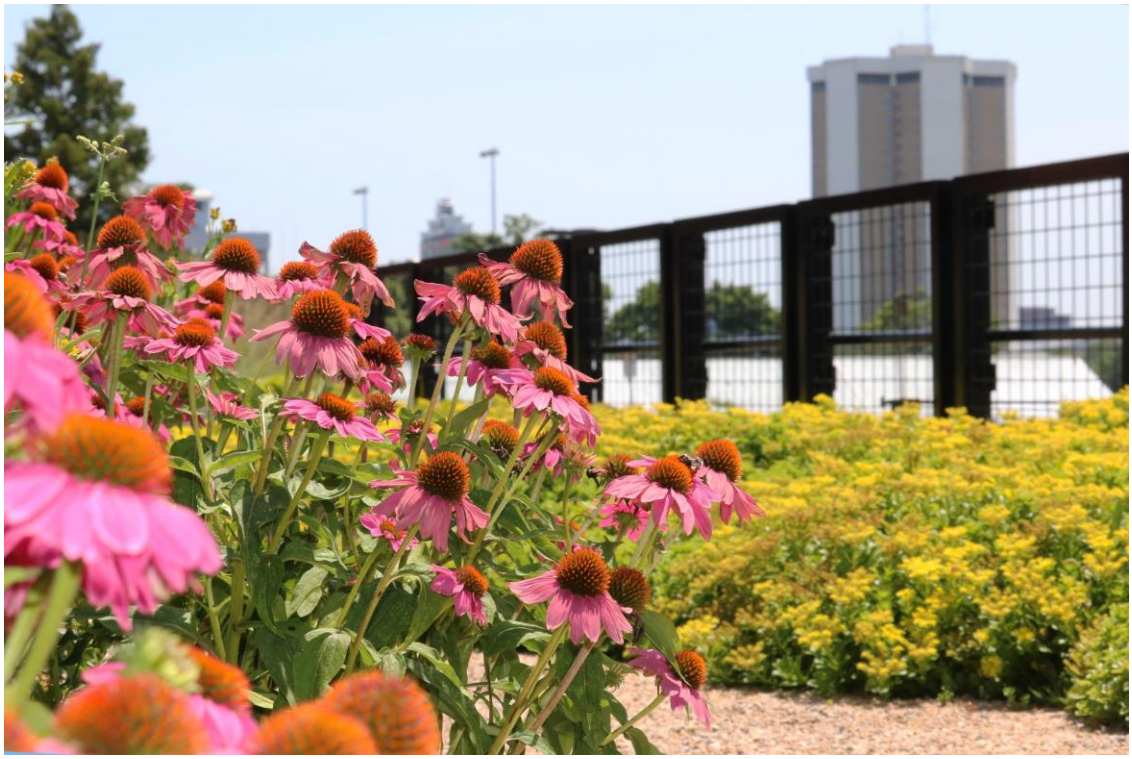
Sustainable Development/Design:

A. Modes of Sustainable Development/Design

1. Green Roofs/cool roofs

Cost-Benefit Analysis: For green roofs, the costs will vary depending on the type of green roof being implemented. Extensive green roof systems will cost about $10 per square foot while intensive systems will cost around $25 per square foot (italladdsup.umn.edu). It is also important to note that the cost of annual maintenance for these two systems can range from 75 cents to $1.50 per square foot. For semi-intensive green roofs, the cost can range anywhere between $15 to $30 per square foot. The implementation of green roofs overall is a high impact action. Cool roofs in comparison to green roofs are much cheaper. For cool roofs, solar reflective shingles typically range from $2 to $3 per square foot. This is also a high impact action.

A very fast-growing sustainable design in cities is green roofs. At our university, there is a green roof on top of the Guerrieri academic commons building. Implementing green roofs throughout the city's Main Street -- one of the city's most frequented roads – for instance, will not only provide aesthetic value, but it will also reduce the total emissions being produced within the city. In 2016, San Francisco became the first U.S. city to adopt a green roof mandate (Hawken, 2017, 91). Given that Salisbury is much smaller in size than San Francisco, it is certainly manageable for the city to implement green roofs not just on Main Street but throughout downtown and possibly even propose a green roof mandate.



Dan, Keck, flickr.com

There are three different types of green roofs that the city should consider. These include extensive green roofs, semi-intensive green roofs, and intensive green roofs (greenrooftechnology.com). Extensive green roofs are often used for buildings of living (houses and apartments), semi-intensive green roofs are used for diversity & habitat, and lastly, intensive green roofs are used in parks (greenrooftechnology.com).

Similar to green roofs, cool roofs are a more cost-efficient and simpler option. A cool roof on a 99-degree day can reflect up to 80 percent of solar energy back into space compared to 5 percent for a conventional dark roof (Hawken, 2017, 91). Cool roofs have many different forms such as light-colored metal, shingles, tiles, coatings, and membranes (Hawken, 2017, 91).

Both green roofs and cool roofs are realistic options for the city of Salisbury. Green roofs have already been implemented at the university, consistent with the ever-evolving rate of climate change impacts.

2. *LED* (light-emitting diode) *lighting*

Cost-Benefit Analysis: With the average streetlight pole costing around $2,000-$2,500, if 50 streetlights were to be installed the total price would end up being around $100,000-$125,000 (gotitwholesale.com). This would be a high impact action for the city of Salisbury. For traffic signals, one LED signal would cost around $73 per year to operate (howstuffworks.com). If Salisbury were to install 50 LED-operated traffic signals

it would cost $3,650 annually to maintain. LED traffic signals would be a high impact action. The average cost of one light bulb is $8 making it a low impact action (thesimpledollar.com).

	LED	CFL	Incandescent
Average Life Span	**25,000+ hours**	8,000 hours	1,200 hours
Watts Used	**8-12 watts**	13-15 watts	60 watts
Kilowatts used*	**44 KWh/yr**	55 Wh/yr	219 KWH/yr

Data from Boston University's website (bu.edu).

LED lighting plays both a crucial role in the infrastructure and land-use sectors, as well as the energy sector. LED light bulbs have several advantages over incandescent bulbs. Mainly, LED bulbs will last longer than incandescent bulbs and are more efficient in that they use 90 percent less energy (Hawken, 2017, 92). Speculation around LED is often centered around its price. However, the cost of LED lighting is decreasing every year and when implemented, maintenance costs are reduced because of the light bulb's efficiency. LED lighting can be implemented in a myriad of ways whether indoors or outdoors. Ultimately, LED lighting offers several benefits to infrastructure, energy, and the economy.

As noted above, one of the main benefits of LED lighting is the maintenance that would be put into keeping the lighting operated. Due to the long lifespan of LED light bulbs, more time can be spent in other areas of sustainability within the city. For instance, the same electricians that would be working on the LED lighting in the city could also work on building LEED-certified buildings.

A wonderful aspect of LED light bulbs is that they do not contain any hazardous chemicals, which therefore allows for them to be safely disposed of in the trash. To make sure the light bulbs are recycled properly, they should be brought to a local recycler.

In May of 2001, New York City became the first large American city to use LED traffic signals. NYCDOT (New York City Department of Transportation) began this process by converting incandescent traffic and pedestrian signals at 12,000 intersections to LED (Nyc.gov). According to the agency, "the capital cost of the project was recovered in less than five years with energy and maintenance savings of approximately $6.3 million a year. From this operation, the city's energy savings from LED traffic signals are 81% annually. In 2001 the city of Yakima in Washington state decided to follow in the footsteps of New York City. The traffic signals operate 24-hours a day, every day of the year. Between 2001-2002, the city was able to install 650 LED fixtures (yakimawa.gov). According to Yakima's government website, the cost to power the 650 LED bulbs for one year is approximately $6,000 compared to $35,600 to power 650 incandescent bulbs (yakimawa.gov). It is also stated that power companies have been very supportive

of LED traffic signal conversions at a national level (yakimawa.gov). Much smaller in size than NYC and Yakima, the city of Salisbury can also take the same direction in its infrastructure.

Some potential locations for implementing LED light poles could be up and down Main Street, near Brew River, and down Camden Avenue. Implementing these light poles will allow for people to feel safe when walking around Salisbury at night and is also the best option for sustainability when it comes to lighting.

3. *LEED* (Leadership in Energy and Environmental Design)- *Certified/Net-zero buildings*

Cost-Benefit Analysis:
Depending on the methods used for the LEED-certified building, the cost of operation can be cheaper than a typical non-LEED-certified building. By using less energy through energy-efficient heating and LED lighting, the overall costs of maintenance are greatly reduced in certified buildings. The costs will vary from building to building based on their size and infrastructure techniques. However, LEED-certified buildings remain a low impact action. Similarly, the costs of a net-zero building depend greatly upon its varying components. Net-zero is likely to be a low impact action, but, again, it depends on the infrastructure of the building.

Rob Freeman, flickr.com

It is important to note that there are both green roofs and LEED-certified buildings at Salisbury University's campus. By following the direction of the university, the city of Salisbury can truly become a green city.

LEED-certified buildings are given certification when energy is evaluated within a building based upon how sustainable it is. The range of certification is from silver to platinum. The type of certification is based around the points the building is given.

Seven Areas of Concentration for the LEED rating system: (escsi.org)

1. Sustainable sites: 26 points
2. Water efficiency: 10 points
3. Energy and atmosphere: 35 points
4. Materials and resources: 14 points
5. Indoor environmental quality: 15 points
6. Innovation in the design process: 6 points
7. Regional priority: 4 points

* There is a total of 110 possible points

On a similar note, net-zero buildings are buildings that are completely self-supporting in that they consume zero energy. These buildings are quickly becoming more common throughout the world, particularly for houses. One of the unique advantages of this building type is its resilience during disasters and blackouts (Hawken, 2017, 84). Newer net-zero buildings also harvest rainwater and process sewage on-site into compostable forms (Hawken, 2017, 84).

In Cambridge, MA, the city has created a plan to have all buildings be net-zero by 2040 (Hawken, 2017, 84). Luckily, net-zero buildings utilize cost-effective measures and incorporate renewable components. Therefore, given the much smaller size of Salisbury in comparison to Cambridge, it should be a realistic goal to have at least a few net-zero buildings implemented downtown.

In considering where to implement LEED-certified buildings and net-zero buildings, there are many possibilities. For instance, it could be very interesting to see the Salisbury public library become LEED-certified or net-zero or perhaps on a larger scale, the Peninsula Regional Medical Center. Salisbury could create brand new LEED-certified and net-zero buildings. By going net-zero and working towards a multiplicity of LEED-certified buildings, Salisbury will be taking a huge step to becoming more sustainable.

Economic Vitality:

Reducing emissions and improving the overall sustainability of Salisbury's infrastructure and land use practices will save both the public and private sector millions if properly planned. The biggest threat that climate change will bring to Salisbury will be sea-level rise, closely followed by increased storm frequency and intensity. It is in the best interest of every business, governmental service/program, homeowner, and individual to realize what is coming will have severe impacts on the local economy if no action is taken ahead of time. Outlined in this section are some infrastructure-related projects that will render our local economy more prepared for climate-related issues in the future.

A. Improved Stormwater Management Systems (For more information, see stormwater and water management on page 4).

Storms with heavy rainfall and high winds are common on the Eastern Shore, especially during the summer months. Maryland has experienced record rainfall amounts in 2018. From May to July, Salisbury averages 11.71 inches of precipitation (usclimatedata.com). Across the state, rainfall totals were far above average during the summer of 2018, with the lower Eastern Shore seeing averages near 300% of the average (climate.gov).

Rainfall averages are projected to rise with the increasing climate change. Without proper stormwater management infrastructure, storms can cause erosion, pollution of surface waters, and problematic flooding that can be detrimental to businesses and homes. Another negative impact of an overwhelmed stormwater management system comes from areas outside of the immediate city limits. Stormwater carries pollutants from agricultural operations, chemicals used on lawns, automobile emissions, and various fertilizers. These pollutants affect the local fishing economy of the Chesapeake Bay watershed and are altering our aquatic ecosystem. Lastly, stormwater runoff affects groundwater recharge rates. Instead of percolating through the ground and into our aquifer, the water runs off and flows into our waterways with all of its pollutants.

Groundwater is our only available source for drinking, irrigation, plumbing, and more. In a 2008 report conducted by the Advisory Committee on the Management and Protection of the State's Water Resources, it was found that, in 2007, "total fresh water use on the Eastern Shore was about 140 to 180 million gallons per day, and the amount used for irrigation was between 50 and 60 percent of the total demand" (Wolman, 2008, 7). The report continues, noting that farmland acreage has decreased, the number of irrigated acres has increased from 40,000 to 70,000 acres over the past 20 years (Wolman, 2008, 8). These statistics are undoubtedly higher today, over 10 years after this report was written.

The need to protect our groundwater supply is of the utmost importance. Stormwater management can implement sustainable practices to ensure better rates of groundwater recharge, especially needed as Salisbury's population will continue to grow. This can be achieved in many different ways:

- Implementing “rain gardens” on the sides of buildings to serve as a drain for rainfall coming off roofs. An excellent example of these can be seen outside the Academic Commons building at Salisbury University, highlighted to the right.
- Encouraging the use of permeable surfaces for new/renovating construction (i.e. gravel driveways/parking lots, sidewalks)
- Natural sinks for rainwater gutters
- Detention ponds for large buildings/areas requiring high amounts of paved surfaces

Aerial image retrieved from salisbury.edu

Recommendations:

Incentives for the above practices should be put in place to encourage better stormwater management systems in the city of Salisbury. Preventing unnecessary flooding and long-term aquifer depletion will save the local economy millions. Implementing previous surfaces, in many cases, is cheaper than conventional methods. An outside example of this was a shopping mall in Hartford, Connecticut where developers opted to build an overflow lot at a cost of $500,000, where the cost to build a paved lot with a detention pond would have been over 1 million dollars. (Wilson 1994).

B. Incentivizing Green Building Practices

Green buildings can have an immediate payout to developers, all while reducing the city’s overall carbon footprint. Solar is becoming increasingly popular around the globe as we begin to transition to renewable energy sources. Salisbury University is a prime example of an institution in the city that has taken advantage of renewable energy. Dorm buildings on campus are powered by geothermal units and some pull from solar sources. Solar panels over a faculty parking lot provide power to academic buildings and a few dorms as well.

Solar energy: (For more information on solar energy, see pages 22-23 in energy & emissions).

Solar energy should be incentivized for use in the city of Salisbury to cut back on emissions. The state of Maryland currently provides a 30% tax credit for the use of home solar systems. While solar systems are costly upfront, they will eventually pay

themselves off. The city could implement the use of solar panels over parking lots such as how the university has done. Not only do they provide clean, renewable energy to nearby buildings, but they also provide shade and protection against the elements to those using the lots.

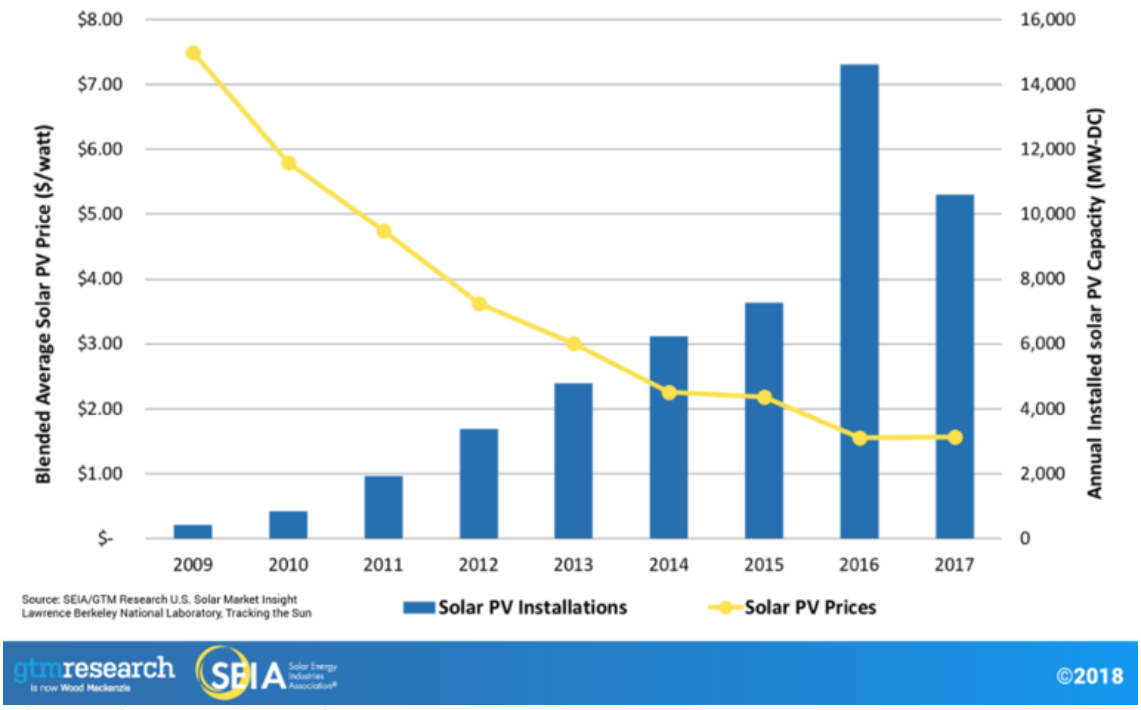


Chart: Unknown author, seia.org

Solar energy installation and overall costs have been dropping at a promising rate. The city can further incentivize businesses and homeowners, along with implementing solar energy into government buildings. This will cut back on energy costs from conventional sources, reduce greenhouse gas emissions, and bring jobs into the city. In our country, solar installation is becoming a growing career. In 2016, 73,000 jobs were added in this sector, a 25% increase over 2015. The solar field is rapidly expanding, it is estimated that out of every 50 new jobs created in the country, one works with the solar industry. (energy.gov)

<u>Green Retrofits:</u>

Like solar, retrofitting an existing building with green applications can be cost-effective and beneficial. Lighting in buildings can consume a considerable amount of energy. Salisbury should encourage residents to switch to energy-efficient bulbs and evaluate city buildings, looking for ways to reduce the amount of lighting or replacing old halogen bulbs with more energy-efficient ones.

Another large consumer of energy comes from heating and cooling buildings. One form of renewable, clean energy is geothermal. Geothermal units are expensive to implement but can pay themselves off within years of installation. Incentives to local businesses

and homes should be put in place to take advantage of this renewable source of energy. This action would result in a reduction in greenhouse gas emissions and cost savings for the parties who make the decision.

Environmental Justice:

Stacy, Brown, pridepublishingroup.com

The Maryland Commission on Environmental Justice and Sustainable Communities (CEJSC) defines the term environmental justice as seeking “equal protection from environmental and public health hazards for all people regardless of race, income, culture and social class” (Maryland Department of the Environment 2020, 1). In the context of infrastructure and land use planning, environmental justice ensures that no people of socioeconomic, racial, ethnic, or religious groups are disproportionately impacted by negative environmental consequences as a result of municipality planning and policies. To ensure that environmental justice is being upheld with regards to proper land use planning and infrastructure development, the city of Salisbury should undergo the implementation of three new goals. The first involves the application of zoning ordinances to ensure proper land use. The second refers to the development of fair housing opportunities for low-income and minority households. The final goal is to achieve transportation justice. Environmental hazards such as toxic waste sites, transportation, pollution facilities, and landfills have historically been disproportionately located near low-income, minority housing communities. As a result, these individuals are subjected to higher levels of harmful toxins compared to their affluent counterparts. Ensuring that the perpetuation of this cycle does not continue is at the forefront of environmental justice advocates and organizations, deeming it as a crucial component of all climate plans.

Goal 1: *Zoning ordinances can be implemented to ensure the proper use of land.*

Zoning ordinances offer municipalities, states, and the federal government the opportunity to determine how a specific geographic region can be used. It has the power to dictate whether the land is designated for residential use or industrial/commercial operations, as well as placing regulations on lot sizes and building heights. The city of Salisbury is already in the process of rewriting its current zoning ordinance, with a primary focus on how the historic downtown buildings can be modified or rebuilt to mitigate the inevitable implications of sea-level rise. In addition, this newly revised zoning ordinance contains sections dedicated to improving public health, safety measures, equitable housing opportunities, reclamation of protected lands, and general welfare for the residents of Salisbury. With the city of Salisbury's overarching goals of reducing pollution, nonrenewable energy use, and greenhouse gas emissions, this zoning ordinance, if thoroughly outlined, has the potential to combat racial zoning while also protecting native species and the natural environment. Environmental compliance, monitoring, and pollution reduction measures should be followed for developmental endeavors about the zoning ordinance, regardless of who resides in nearby or surrounding communities.

Goal 2: *Development of fair housing opportunities for low-income and minority households in areas with proper environmental clearance.*

Fair housing opportunities ensure that individuals have the right to choose a place of residence without facing unlawful discrimination during a rental, sales, lending, and other housing transactions. The unequal burden people of color and low-income individuals face in pursuit of housing falls within the realm of environmental injustice. Many of these individuals cannot afford to find housing opportunities that protect them from poor environmental conditions, further contributing to questionable health outcomes. Likewise, older buildings that are more likely to experience structural issues, energy inefficiency, and the inability to retrofit are more often than not inhabited by low income and communities of color. This also involves unnecessary exposure to lethal chemicals such as lead and heightened exposure to natural disasters. Municipal fragmentation, disinvestment, and boundary-drawing resources of low-income and minority communities is a common yet overlooked occurrence in many places (Haberle 2006, 271). Oversight is required for subsidized housing to ensure equality and unnecessary exposure does not occur. As well as increased funding to create more housing opportunities and to retrofit older buildings to increase energy efficiency and promote safety.

Goal 3: *To achieve transportation justice.*

Within the state of Maryland, vehicles make up the transportation sector's second-largest emitter of greenhouse gases and consumers of fossil fuels (Maryland Department of the Environment 2011, 170). Ensuring that people who do not own or

have access to personal vehicles can access jobs, grocery stores, pharmacies, and other locations to obtain essential needs is imperative. To achieve transportation justice, equal access to transportation requires making pre-existing transportation more affordable, increasing funding for transit authorities, incorporating zero-emission transit, and improving sidewalks and bike lanes to ensure pedestrian safety. Three strategies can be implemented to provide equitable transit opportunities (Environmental Justice analysis of the City of San Diego's Climate Action Plan, 2018); reducing individual vehicle miles traveled, putting pedestrian and mass transit opportunities first, and incorporating clean transportation endeavors.

1. *Vehicle Miles Travelled (VMT):* "VMT is important for EJ communities because it forces cities to move away from transportation planning centered on single-occupancy vehicles and toward solutions that move a greater number of people" (Environmental Justice analysis of the City of San Diego's Climate Action Plan, 2018). Investments in mass transit opportunities reduce congestion on the roads during rush hour, decrease gasoline consumption, and emit less greenhouse gas emission into the atmosphere more so than if each individual were to occupy their vehicle.

2. *Prioritizing Pedestrian and Transit First:* The primary focus of prioritizing cars and freeways has been at the forefront for years. However, focusing on mass transit and improved walkability endeavors makes transportation more accessible to those without personal vehicles, while also reducing the city's carbon footprint within the transportation sector.

3. *Clean Transportation in EJ Communities:* Placing an emphasis on investing in EJ communities is a crucial step in improving the welfare of all individuals. While the overwhelming majority of mass transit authorities rely upon diesel-fueled vehicles, implementing new electric vehicles that are more efficient, cheaper to run, and emit fewer emissions may work to reduce the overall cost of transportation and therefore increase affordability.

Weaknesses, Threats, and Critical Vulnerabilities:

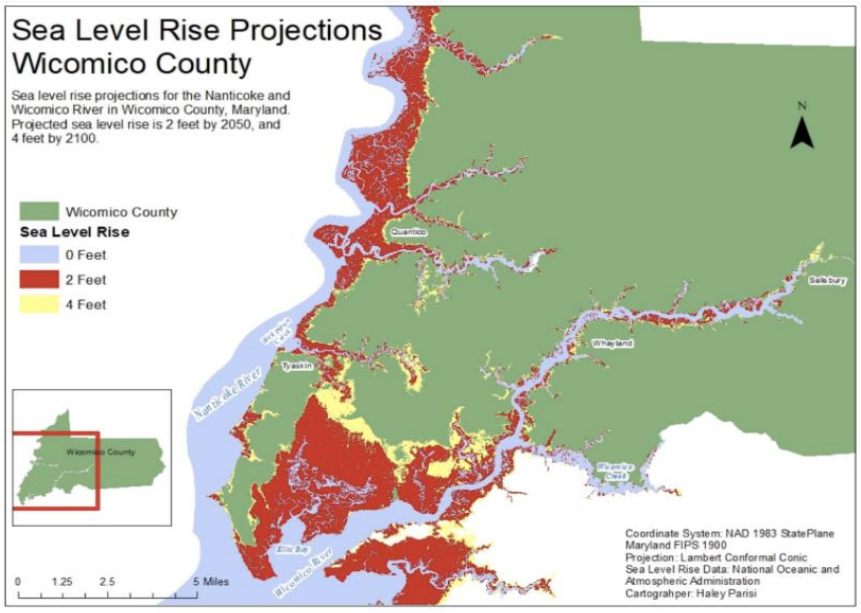
Assessing the vulnerabilities of infrastructure and land is imperative when attempting to understand how the changing climate will impact any city. Vulnerability is defined as the "the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard. There are many aspects of vulnerability, arising from various physical, social, economic, and environmental factors" (Office of Disaster Preparedness and Management, 2013). With the city of Salisbury being one of the largest cities on the Eastern Shore, its low-lying, flat land located along the Wicomico River, is facing threats to residential, agricultural, and commercial areas. Critical vulnerabilities to the city include poor design or construction of buildings,

insufficient protection of land and surrounding aquatic ecosystems, lack of funding and public awareness of emergent issues, and lack of urgency when addressing impending environmental degradation. However, determining these vulnerabilities is not nearly enough, the next step is to prioritize what issues must be tackled first. Climate change projections for the city of Salisbury indicate sea-level rise driving erosion, warming temperatures, as well as more frequent and intense precipitation. Anticipated changes associated with these extreme weather events will dictate what is deemed as a priority also determining the amount of funding granted.

The costs associated with implementing both mitigation and revitalization efforts are challenging given the city of Salisbury's limited budget. This poses challenges to implementing new infrastructure endeavors such as more bike and walking lanes, improved bus system, green roofs on existing buildings, LEED-certified buildings, and much more. To overcome challenges associated with funding, the city can pursue grants opportunities and increase taxation to fund these extensive projects.

Sea-Level Rise (SLR) (For more information, see page 7 of stormwater and water management)

The Eastern Shore region of Maryland, in which the city of Salisbury resides, consists of tidal shorelines, coastal bays, low-lying landscapes, and urban waterfronts. All of which makes this region in particular extremely vulnerable to current and future projections of sea-level rise. The rate of sea-level rise is attributed to continued global warming, making it extremely critical for the city to protect against hazards and adapt to foreseeable conditions to ensure citizen safety and ecosystem vitality. Sea-level rise is already in full effect, heightening "shoreline erosion, deterioration of tidal wetlands, and saline contamination of low-lying farm fields" (UMCES 2020). Preparing for the inevitable will require comprehensive planning for existing and future construction of facilities, adaptive coastal management, and significant reduction of greenhouse gas emission.



Parisi, Haley, wicoclimate.weebly.com

The Chesapeake Bay's tributaries, the Wicomico River, and the Nanticoke River are local areas susceptible to sea-level rise. The National Oceanic and Atmospheric Administration (NOAA) projects an estimated increase of 2 feet by the year 2050 and 4 feet by the year 2100, leaving nearby development and infrastructure in Wicomico County compromised. In addition, the amount of land loss as a result of sea-level rise and erosion is equivalent to 10% of the total land in Wicomico county.

Extreme Weather-Related Events

Changing precipitation patterns and increasing temperatures are currently affecting Maryland's Eastern shore region. By the year 2025, global mean temperatures are projected to increase by 2°F, while rainfall will become more sporadic and intense (Maryland Commission on Climate Change 2008). The future of severe storms and storm surges is unclear, however, future storms that will impact this region will contain stronger winds, higher rains, and storm surges. With the growing intensity of extreme weather events, data has shown that storm surges are generated by hurricanes and tropical storms, which will result in significant damage to the surrounding infrastructure and environment. Extreme precipitation and storm surges will also establish a need for repairing weathered roads, damaged buildings and improving flood control measures.

Extreme heat events' effects on city infrastructure will result in heightened electricity demands used to cool and power homes, businesses, and other critical buildings, further exacerbating greenhouse gas emissions contributing to global climate change. Likewise, warmer air correlates with increasing water temperatures, therefore threatening the composition and vitality of the nearby aquatic ecosystems, such as the Wicomico and Nanticoke Rivers. Not only will the health of ecosystems be compromised, but human health is also at the expense of increased temperatures. An increase in heat-related illnesses attributed to warmer temperatures indicated that as environmental health becomes degraded, so follows human health.

Emergency Management:

The role of emergency management in climate change planning is to identify risks and develop mitigation response and recovery framework policies in the event of a natural disaster. By design, it connects policy decision-makers, public and private agencies, the local community, and responders to safeguard property and life. The key concept of emergency management involves prevention, preparedness, response, and recovery (PPRR) (Climate Change Planning and the Role of Emergency Management 2015, 2).

Viha.ca

1. *Prevention/Mitigation*: Assessment and reduction of disaster risk as it pertains to natural and man-made disasters.

2. *Preparedness:* Assemble emergency services and prepare the community for the upcoming disaster.

3. *Response:* Ensures that emergency services are fully equipped with the proper tools and manpower to do their job.

4. *Recovery:* Provides the community with government relief payments, donations, and reconstruction assistance impacted by disaster to get back on their feet.

Recommendations

A. *Road and Bridge Integrity*

Extended periods of extreme precipitation and storm surges negatively impact the composition and integrity of roads and bridges. Consequently, this impacts an individual's ability to transport into, out of, and within the city of Salisbury. Bridges can and should be sustainably redesigned so that they are significantly higher than the storm surge predictions to compensate for the influx of water entering nearby waterways. In addition to funding for this reconstruction, there should also be regular

monitoring to assess the condition of roads and bridges, as well as maintenance to fix what needs repairing.

B. Motorist Safety

Due to heightened extreme weather events, the safety of pedestrians, bikers, and motor vehicles will become compromised. During extreme precipitation and flooding events, sidewalks, bike lanes, and even roads become no longer accessible. Therefore, the integration of alternatives becomes necessary. This may involve tilted roads, sidewalks, or bike lanes to improve the flood of pending water, increased number of storm drains to collect otherwise standing water, elevated pumps to remove water off roads, or additional pervious vegetative surfaces to allow water to percolate through the ground as an effort to reduce flooding. The establishment of a city fund can be used to support efforts that mitigate the flooding alongside roads, sidewalks, and bike lanes.

C. Critical Buildings

Incorporating green infrastructure techniques to pre-existing buildings and newly renovated ones will work as a carbon offset but also prevent degradation of buildings due to severe weather. To protect development against emergency events, emergency management must include sustainable development practices and extensive urban planning. Creating a zoning ordinance for new development will prevent construction in highly vulnerable areas susceptible to flooding. Pre-existing buildings can use drainage outfall pumps to divert nearby water to prevent flooding and incorporate sustainable landscaping strategies. Such strategies include increasing vegetation in surrounding areas to help with percolation of water as well as adding water-tolerant plants that withstand high levels of precipitation to combat flooding. All of which increase pervious surfaces that act as a carbon sink and fight flooding due to extreme weather-related events.

Solid Waste

Introduction:

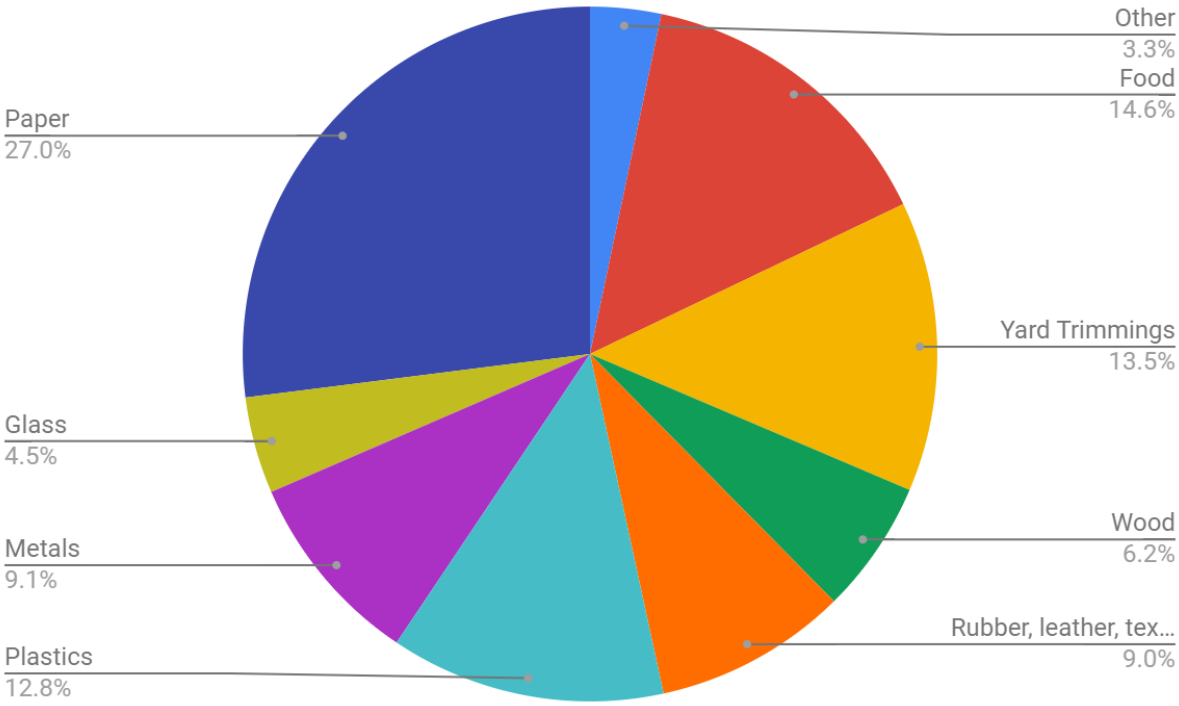
As populations grow, so does the amount of solid waste that is produced. With that being said, the city of Salisbury is not getting any smaller. Our current waste disposal methods are not fully efficient and sustainable, and not living up to their full potential. Currently, the city of Salisbury's solid waste management methods contributes to climate change, global warming, and other issues both global and local. At the rate we are living, not only will the amount of waste-related emissions increase but so will our need to find room for landfills. We must use alternative waste disposal methods and

source reduction strategies to reduce our waste generation and dispose of whatever waste is leftover in a way that is better suited for the environment.

Year	True and Estimated Future Population - Salisbury, MD	% Increase
2000	84644	N/A
2010	98733	16.6%
2020	109200	10.6%
2030	119200	9.2%

Figure 1. Past Population of Salisbury Maryland and Projected Future Population. (EA Engineering, Science, and Technology, Inc. 2015)

As of 2017, the world's cities create 1.4 billion tons of solid waste each year; that total may reach 2.4 billion tons by 2025 (Hawken, 2017, 100). With such high amounts of waste being packed into landfills, the amount of greenhouse gases in our atmosphere, such as carbon dioxide and methane, rises. One of the most common greenhouse gases emitted from landfills is known as methane. Methane is produced from the decomposition of organic matter, such as food scraps, treated wastewater sludge, waste paper, junk wood, and yard trimmings. For over a century, methane has up to thirty-four times the greenhouse effect of carbon dioxide. Landfills are a top source of methane emissions, releasing 12 percent of the world's total which is equivalent to 800 million tons of carbon dioxide. (Hawken, 2017, 100). Another problem associated with the formation of solid waste is the creation of leachate. Leachate is formed when liquid leaks through the landfill picking up heavy metals and other soluble. When landfill liners degrade over time and form tears, leachate pollutes groundwater as well as nearby waterways. In Salisbury, lots of waste from litter and runoff, such as plastics, end up in local waterways polluting the water as well. A two-fold approach to reduce waste and the number of emissions generated from waste treatment would include, first, reducing the amount of waste we create all together, and then reducing the number of emissions associated with waste disposal (Boswell et al.,2019, 166). This chart shows the type of items typically sent to a landfill.



MSW Generated by Type.

What *does* Salisbury *Currently* do about Solid Waste?

Currently, the city of Salisbury does have some waste management practices in effect. These are some of the ways that the city of Salisbury manages its solid waste today:

- Weekly curbside garbage pickups
- Weekly curbside recycling is a free service to all city of Salisbury residents who utilize the City's once a week trash collection
- Wicomico County currently operates 11 convenience centers that accept recyclables and 9 recycling convenience drop off centers
- Recycle bins are available at no charge to anyone who reaches out to the city to get one
- Methane capturing technology in the local landfill
- Capturing methane emissions from the breakdown of organic material to turn it into a renewable energy source that can be sold back to the grid.
- A statewide ban on single-use Styrofoam containers and materials
- Collect wood and yard trimming to turn into mulch that is available to citizens
- Created a 10 Year Comprehensive Plan for Solid Waste Management 2014-2024

Looking Forward: What *can* Salisbury do about Solid Waste?

As written above, the city of Salisbury already has solid waste management plans in effect. However, to keep in line with our changing climate, these plans could be changed or improved upon for maximum sustainability and efficiency. The overall goal would be to first reduce the amount of waste that is produced and generated in general, then reduce the number of emissions associated with whatever waste is still being sent to the landfill.

There are a variety of ways in which the city of Salisbury could reduce their waste production while also reducing the number of emissions generated from waste that is still disposed of. The vast majority of the examples and ideas for improvement in this plan for Salisbury, MD are also present in other climate action plans from other cities around the country, notably, Pacifica, CA, Lancaster, PA, Albany, NY, Boulder, CO, Portland, OR, Santa Fe, NM, Howard County, MD, Annapolis, MD, and San Francisco, CA. We have used the successful ideas and actions that these other cities have implemented to drive our analyses of what can be done here in Salisbury, MD. Examples of potential improvements and changes to the way Salisbury, MD manages their solid waste include:

A. Improvements for the Landfill

1. Increase efficiency of landfill methane capturing technology
    - Ex. if the landfill captures 60% of methane emissions now, strive to capture 80%+ with new and improved methods or technology.
    - This technology has been around for quite some time and can be upgraded in terms of efficiency. This is a passive action that will help with any waste that still ends up in the landfill. Although one of the main goals of this plan is also to reduce the amount of waste sent to landfills in general, there is still going to be methane emissions coming from those areas, so this is a big improvement in that sector. Many other CAP's, such as Lancaster City, PA, Howard County, MD, and San Francisco, CA all mention upgrading or implementing methane-capturing technology in landfills as the main method of decreasing emissions.
2. New waste-combustion technology can capture emissions from combustion and turn it into energy for the city
    - Wicomico county already transforms some methane into energy, but with better technology, we can make the landfill more efficient and sustainable.
    - Some CAP's such as Lancaster City, PA, has implemented a new type of technology to convert waste into energy through combustion. New incineration methods can capture all emissions from the combustion of waste and turn it back into energy for the city.
        - Lancaster City, PA has a state-of-the-art facility that burns the waste and turns it into electricity, which is sold back to the grid. This

reduces the volume of waste that goes to landfills by 90%, thereby eliminating all landfill related emissions.

3. New waste-to-energy technology using organic compost waste.
    - Although Wicomico county transforms methane into energy by collecting methane as it rises through pipes, the amount of methane that is captured from food waste can be much higher. By using the compost from curbside and drop off sites in New York, the compost is then turned to a bio-slurry that is fed into digesters that heat the sludge turning it into biogas. Energy is produced during this process, and the city currently produces enough energy to offset the greenhouse gas equivalent of heating 2,500 homes (Simpson, 2020, 25). By providing the city of Salisbury with opportunities to regularly compost, the city can produce energy and save money in the long run.
4. Less “demolition” and more “de-construction + salvage” to reuse building material
    - Ex. Require an increased percentage of demolition material diversion from landfill as part of the permit approval process for construction/demolition. This cuts down on the amount of wood and other construction waste being sent to landfills that would otherwise increase methane emissions.
    - Many other cities have implemented this strategy into their CAP, such as Albany, NY, Boulder, CO, Portland, OR, Santa Fe, NM, and Annapolis, MD.
    - One way the amount of demolition waste can be recycled here in Salisbury is with the creation of a Resource Recovery Park (see pages 7-8). A large percentage of waste generated comes from the commercial sector, so getting businesses involved would be critical. By providing technical assistance to local contractors and setting construction and demolition debris requirements for the city of Salisbury, the number of materials recycled from demolition would be increased substantially. The city of Portland, OR has one of the highest recovery rates in the country and sets a great example for what Salisbury should strive for.
    - (https://beta.portland.gov/sites/default/files/2019-07/cap-2015_june30-2015_web_0.pdf)

Nasa Goddard Flight Center, flickr.com

B. Improvements for the City

1. **Best Option:** Require recycling and composting in the community, making it mandatory for all residents, instead of just offering it for those who want to participate.
    - Composting in the city of Salisbury would provide many environmental and economic benefits. In a city as large as New York, they have been working extremely hard to improve the city's composting efforts. Currently, there are over 160 drop-off sites throughout the city and that number continues to grow. New York also has a curbside compost pickup that has seen great results since it began. Most of these drop off centers are operated at no cost by environmental non-profit groups. Once collected, the compost is sent to industrial composting facilities where it is dispersed throughout the city. In 2019, more than 2,250 tons of finished compost was sent out to city gardens, street tree stewards, and nonprofits (Simpson, 2020, 24).
    - Many cities on the West coast of the U.S. have done this with great success. For example, Pacifica, CA, which is similar in size to Salisbury, has required the separation of recyclables, compostable material, and landfilled waste. The emission of methane through landfilled waste is the biggest contributor to climate change in the solid waste sector in most cities. This is Pacifica's main and most effective way of lessening GHG emissions in the solid waste sector. Although the whole idea of recycling and composting regularly is new to many people in the Salisbury area, it is a standard way of life in many areas of the U.S. where citizens do not think twice about their actions. That is how we need to be in Salisbury if we are to make substantial improvements in the solid waste sector.
2. Curbside compost pickup program similar to the way trash and recyclables are picked up
    - Provide households with recycling bins and compost bins to promote recycling and composting.
    - Portland, OR, Pacifica, CA, Boulder, CO, and many other cities have already required that their citizens regularly compost their organic wastes as part of their CAP's. This drastically cuts down on the amount of organic waste sent to the landfill, which in turn, means a drastic reduction in methane generation at the landfill. Other areas such as Albany, NY do not exactly require composting, but it is highly encouraged by the city, which has still increased their overall participation.
3. Increase the number of businesses and households that regularly recycle/compost through public/community outreach and education
    - Educate the community about the recycling/composting process - Customers, both residential and commercial, should be provided with comprehensive educational materials in the form of annual brochure and flyers, as well as the waste hauler's website address that describes the city's residents' recycling options. This idea is simple; if customers do not know about the option to recycle or compost, or about the viability of the

program, they likely won't participate. Let everyone know these programs are available and why it is important that everyone participates.
    - Santa Fe, NM, and Portland, OR are two cities that believe that education and outreach are very effective and important ways to get citizens to participate in recycling and composting programs.
    - Provide resources such as Portland, Oregon's "Sustainability at Work" program, to local businesses around Salisbury. This program contains a green business directory and allows businesses to receive a green business certification as well as providing sustainability assistance and ideas. By providing green business certifications to businesses, it will promote competition to recycle among local businesses.
4. Increase the amount of recycling and composting containers in public areas
    - Although this idea seems simple, the more options there are for recycling and composting, the more available it is for people of Salisbury, the more people will take advantage of it. Currently, most businesses, restaurants, supermarkets, etc. do not have the option to send customer waste to the landfill, compost, or recycle; they only have regular trash cans.
    - Annapolis, MD also indicated on their CAP that they plan on increasing the availability of recycling/compost containers throughout their city for the same reasons explained above.
    - Pass a universal recycling ordinance requiring all commercial businesses, multi-family complexes, special events, and other spaces to offer on-site traditional recycling and organics composting to residents and patrons.
5. Create a Resource Recovery Park
    - Resource recovery parks are areas used to recycle a variety of materials such as composting, household hazardous waste, electronics/appliances, construction and demolition, tires, scrap metal and other second chance items/materials to provide recycling, creative, and employment opportunities. This reduces the amount of unnecessary waste going to a landfill never to be used again. A great example of how Salisbury can reduce the amount of waste that is sent to the Wicomico County Landfill can be seen in the climate action plan for Portland, OR. Portland's recovery rate is one of the highest in the country with over 70% of all waste recovered through recycling, composting, and anaerobic digestion. (https://beta.portland.gov/sites/default/files/2019-07/cap-2015_june30-2015_web_0.pdf)
        - Also present in Santa Fe, New Mexico's CAP
6. Continue to practice and encourage Source Reduction Strategies
    - Source reduction refers to reducing and/or eliminating waste materials at their point of generation.
    - The County has encouraged source reduction through education by discussing the importance of using both recycled and recyclable materials to reduce the amount of waste reaching the landfill.
        - (EA Engineering, Science, and Technology, Inc., 2015)

- Although Wicomico County has acknowledged the importance of source reduction strategies, source reduction efforts can still be increased.

C. Incentives for reducing waste

1. Provide incentives for community members who recycle/compost regularly such as discounts
    - In order to start up a regular recycling/composting program, partner with local “green businesses and stores” to provide incentives or discounts to those who regularly recycle and compost, similar to a “frequent flyer card program”.
    - According to the CAP of Albany, NY, they also believe in incentivizing recycling and composting to get people on board and with the trend.
2. Implement a “pay as you throw” program to encourage and reward people to reduce their waste by recycling and composting, while penalizing those who have high amounts of landfilled waste. In other words, citizens have to pay per garbage bag as a means of incentivizing increased recycling.
    - A University of New Hampshire study proved “towns that have implemented pay-as-you-throw and other user fee-based pricing policies to reduce municipal solid waste have seen a substantial reduction in trash disposal rates, some by more than 50 percent. The 34 towns with trash unit-based pricing fees saw municipal waste disposal rates drop between 42 to 54 percent compared to towns without such programs. This represents an annual reduction of household waste of 631 to 823 pounds of trash. The average annual household waste of towns without unit-based pricing fees was 1,530 pounds of trash”
    - (https://www.unh.edu/unhtoday/news/release/2018/11/05/unh-research-finds-pay-you-throw-trash-policies-cut-solid-waste-disposal)
    - Albany, NY, Santa Fe, NM, and Annapolis, MD have noted on their CAP’s that they are either investigating the viability of such a program or are already planning to implement it.
3. Establish something similar to a “green office challenge” that challenges local offices and businesses to reduce their waste to a minimum and reward the winner.
    - As mentioned on page 7 of this plan, the “green business certification” is a great way to get businesses around Salisbury involved with sustainable practices. This certification would provide many incentives as it will promote business, while at the same time, allowing businesses to operate sustainably. Once certified, the business will receive a sticker to place at the business’ point of entry as well as a picture with the Mayor that will be shared on social media. The business logo will also be placed on the city’s website. Seventeen businesses around Salisbury are already “green business certified’’ such as Rise Up Coffee Roasters, Roadie Joe's Bar & Grill, Robertson & Robertson Attorneys, Ward Museum, Taco Bliss, Evolution Craft Brewing Co., and Peninsula Alternative Health just to name a few. If other businesses around Salisbury would follow the

example these businesses are setting, the amount of organic waste, as well as plastic being sent to the landfill, would be reduced greatly.
    - Could do the same thing with factories, supermarkets, etc.
4. Establish programs to give away/discount less appealing produce to the community.
    - This will reduce the amount of organic waste going to landfills and reduce other local issues such as food insecurity and hunger.
    - “Misfits Markets” type of stores

D. Sustainable materials

1. Use biodegradable materials for single-use containers wherever possible
    - MD has passed legislation banning single-use Styrofoam containers; however, plastics should also be included in this wherever possible. Many areas around the country have been increasingly aware of their single-use plastic consumption and usage, which is why many have banned the use of plastic straws, replacing them with paper. These are the kinds of actions that need to stick around and become increasingly popular in terms of sustainable materials and reducing harmful, unnecessary waste.
2. Ensure grocery stores/supermarkets offer paper bags as opposed to plastic
    - Many cities and even states around the country are making this a reality through new legislation. The Outer Banks, NC is one area where no retail or grocery stores use plastic bags, as 99% of them use paper bags or do not offer any. Since Salisbury is in an area surrounded by water, much like the Outer Banks, this would reduce the amount of plastic that ends up in local waterways like the Wicomico River, Nanticoke River, and the Chesapeake Bay.
3. Encourage customers to shop with reusable bags at grocery stores/supermarkets with discounts/coupons
    - This is an easy way to get people to stop using single-use plastic bags and start using reusable bags. The discounts/incentives will get people in a routine of bringing their own bags. Once in a routine, it should be easier for citizens to not rely on plastic at all. This can save up to 50 plastic bags per week per household.

Environmental Justice:

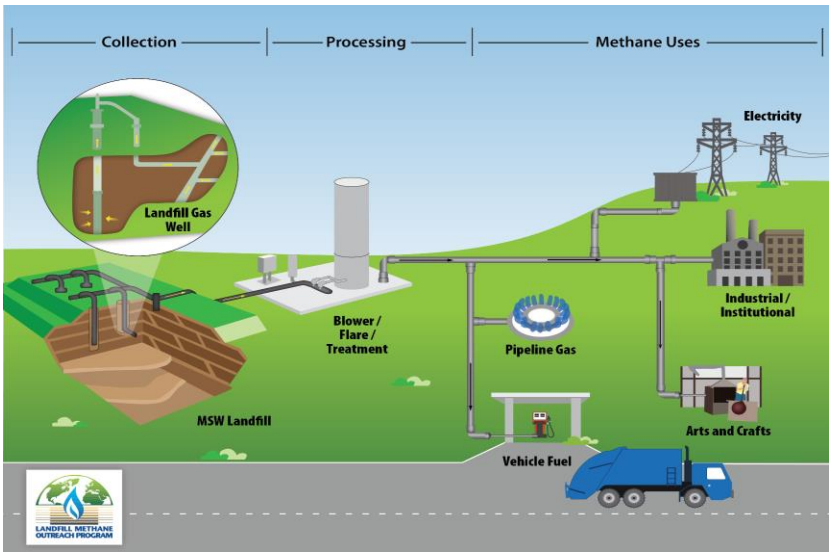
When implementing solid waste management plans and amending current ones, it is important to take environmental justice into account. Every citizen of Salisbury must be treated equally and have the same opportunity as others, without bearing any kind of environmental burdens. Everyone in Salisbury deserves to benefit from the environmental protection this plan seeks to achieve, regardless of age, culture, ethnicity, gender, race, religion, income, or location in the city. Examples of things to consider in terms of environmental justice:

- Ensure that individuals that live near landfills aren't exposed to contamination from leachate and other potentially toxic emissions
- Ensure all neighborhoods are provided equal recycle/ trash pickup
- Ensure that all citizens of Salisbury are provided with adequate and equal education about the importance of recycling and composting

Sustainable Development:

Sustainable development in waste management, as well as landfill design for the city of Salisbury, will provide many environmental benefits if implemented. One-way Wicomico County has improved its development in landfill design is by including methane capturing wells throughout the landfill. Once captured, the methane is sent to a power plant where it is converted to energy. This energy can then be sold back to the grid to supply businesses and homes with clean energy. Oftentimes in many landfills, the waste is burned in incinerators to dispose of the waste. Although this does limit how much land is needed for a landfill, it releases many harmful gases into the atmosphere that contribute to climate change. This change in landfill development is a major step in providing a more sustainable way to manage waste in Wicomico County. A change in sustainable development that would greatly reduce the amount of waste going to the Newland Park landfill is creating curbside compost pickup. Creating a system similar to a regular garbage pickup that picks up compost would provide many environmental benefits. Instead of being buried between landfill liners where the organic materials are broken down releasing potent methane gas, the compost can be used to create organic soil. This can be used by the city for planting gardens or given to farmers. Lastly, sustainable development in recycling practices to maximize the number of citizens that recycle will help to reduce landfill waste. By providing recycling centers throughout Wicomico County, as well as placing recycling bins in businesses, schools, and other public establishments, we can decrease the amount of waste that is thrown away.

- Advanced methane capture technology in landfills
- Advanced development in turning waste into energy
- Development of transfer stations to limit the number of garbage trucks on the road.
- Increased participation in recycling and composting
- Development of curbside compost pickup



Collection and processing of LFG to create energy. https://www.epa.gov/lmop/basic-information-about-landfill-gas

Critical Weaknesses/Threats:

When tackling the issue of solid waste in the city of Salisbury, some weaknesses/threats may arise. One weakness associated with solid waste is the ability to enforce recycling and composting. Although the opportunity for citizens to recycle is available in the city, a major weakness is getting people to recycle. To see a bigger reduction in the waste being buried in landfills, the city should make recycling and composting mandatory. The ability to enforce recycling and composting is a weakness that must be addressed to see a change in the amount of waste sent to the landfill. Another weakness/ threat associated with solid waste in the city of Salisbury is being able to inform the public about solid waste, as well as the environmental impacts that it produces. Without proper knowledge on the issue, the percentage of waste recycled, and compost will remain low. A weakness associated with landfill design is being able to receive the funding to implement new waste-to-energy technologies.

Critical weaknesses/threats associated with solid waste in the city of Salisbury include:

- The ability to enforce recycling and composting
- Obtaining proper services to transport curbside compost similar to trash/recyclables pickup
- Recycling and composting regularly and on a city-wide scale is relatively new to this area -- people do not currently regularly recycle and compost as they could/should
- Informing the citizens of Salisbury, the importance of recycling/composting.

Economic Impacts:

With solid waste comes many economic impacts. Recycling can sometimes be expensive because it must be hauled and managed before it is turned into a new product. Other economic impacts come from the cost of the technology used for transforming methane into energy. Although the technology would be costly at first, it would pay for itself in the long run with the energy that it will produce. Another economic impact of solid waste that is often overlooked comes from the tremendous amount of food we waste. In a study from 2012, it found that 55 million metric tons, nearly 29% of production, came from avoidable food waste in the United States. In 2009, consumer waste alone accounted for $124.1 billion, which is 64% of the total retail value for wasted food (Climate Change and Economic Impacts of Food Waste). Although the cost of formulating a curbside pickup for compost may be costly, the environmental impacts of reducing organic waste going to landfills would be enormous.

- Enacting new and improved recycling/composting programs like curbside pickups likely will not be cheap, but the environmental benefits are worth it. Recycling/composting should be a must in any climate action plan, especially considering the local landfill.
- Constructing new technology for turning methane into energy is costly but can save money in terms of energy costs and provides many environmental benefits.

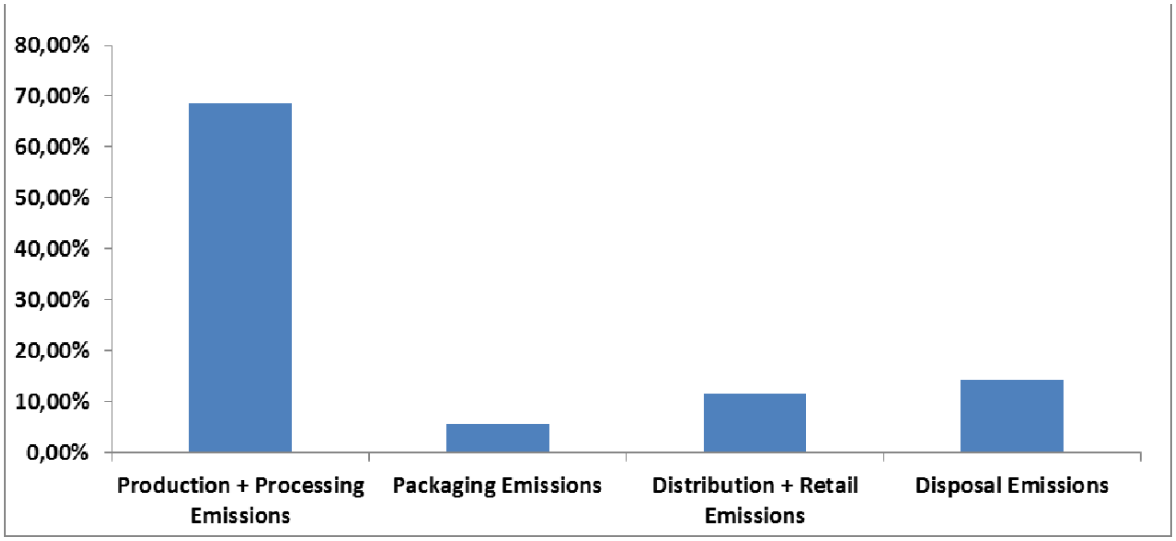


Figure 4. This graph shows the components of US national GHG emissions from avoidable food waste in 2009.
Source: The Climate Change and Economic Impacts of Food Waste (n.d.). Retrieved from http://www.cleanmetrics.com/pages/ClimateChangeImpactofUSFoodWaste.pdf

Emergency Preparedness:

In the event of a damaging hurricane or other major storms, the Wicomico county landfill is used to manage the waste generated from the cleanup efforts. The current guidelines are followed by Wicomico County in the presence of a damaging event:

- The Wicomico County Executive and Council can waive the regular tipping fee for construction and demolition (C&D) debris and yard waste. Tipping fees for MSW should remain in effect.
- MSW should continue to be landfilled by normal methods.
- Construction and demolition debris should be temporarily stockpiled on the permitted footprints of landfill cells for future reclamation or disposal. Additional sites include the closed landfills and school athletic fields.
- Land clearing debris should be temporarily stockpiled in a readily accessible location for future disposal.
- Mixed loads of waste are rejected until they are separated.
- Hazardous materials should be accepted at the Newland Park Landfill Facility for proper disposal. (EA Engineering, Science, and Technology, Inc., 2015)

Public health risks associated with solid waste following an emergency event can arise from direct contact or indirect contact. Risks from direct contact can result from coming in contact with hazardous waste such as oil and solvents, pesticides, asbestos, and medical waste left over after a disaster event. Risks associated with indirect contact can result from unstable debris and buildings as well as from vectors such as flies, mosquitoes, and rodents that are attracted to waste. This waste generated from a disaster event also causes harm to the public as it can obstruct roadways and waterways stopping the flow of traffic and making it hard for emergency response teams to reach a destination. With the many public health risks as well as the many environmental impacts associated with solid waste in the event of a disaster, the city of Salisbury needs to be prepared.

Social Justice

Introduction:

Jose F. Tello, Personal Collection

When people think of environmental health and sustainability, social programs, and environmental justice-related initiatives rarely come to mind. However, the social aspects of a community are just as important to their climate readiness as energy use, waste removal, or any other city division.

By initiating programs that support the overall health of our community, we can expect a more active, happy population. Happier residents are likely to be more engaged within their community and therefore it can be expected that they will want to see it succeed and prosper for future generations. While on the topic of future generations, it is important to provide exceptional educational opportunities to both the youth and adult populations within the city. Additionally, by promoting equal housing opportunities, we can assume more stable environments for our community's children and their families to learn and play in, as we believe that everyone has a right to a safe home environment and place of refuge. Our plan prioritizes knowledge, safe spaces, and adequate health care for all members of the community, things that are currently lacking in many of our city's neighborhoods and sub-communities. The inequalities within our community are the result of a long history of institutionalized inequality and racism existing within the city's foundations. With these social suggestions, we intend to advance our community towards equity by complying with the Principles of Environmental Justice to work towards equal housing opportunities, access to health services, and a satisfactory education for all.

Public Health:

A. Air Quality

Here in Salisbury, we strive to promote healthy lifestyles for our citizens. One of our first suggestions to promote the overall health of our citizens is to improve air quality in the areas around the city. While Salisbury, along with the majority of Maryland, is classified as having "good" air quality under many different air monitoring stations, there is always room for improvement.

In 2018, C40 Cities, a network of cities dedicated to taking climate action around the world, initiated a new air quality network. The network's goal is to improve global air quality city by city. They accomplish this by helping cities monitor air quality and implement policy to help improve it (C40 Cities, 2019). While C40 Cities currently focus on helping megacities, they still are open to contact with the public, and our city could communicate with them and ask for guidance.

There are also networks that track and map air quality, such as the Coalition for Clean Air. Our city could utilize these preexisting networks to help monitor our air quality. Some cities are setting the tone for air quality monitoring and are thinking outside the box. London, for instance, is utilizing pigeons to monitor air quality. In March of 2016, the city attached twenty-five-gram sensors to ten pigeons. These sensors monitored the levels of ozone, nitrogen dioxide, and other compounds in the air. The sensors monitored air quality for three days at a time and London residents could be updated at any time by tweeting

Jon Brinn, Flickr.com

questions to an account called '@PigeonAir', who would then respond to the best of their abilities (Bousquet, 2017). Other cities were a bit more conventional with their mobile sensors and attached them to volunteer cars, bicycles, and cell phones.

B. Mosquito-borne illness

Another problem facing the health of Salisbury residents is mosquitoes as vectors for disease. Those who call Maryland's Eastern Shore home are no strangers to mosquito-filled summers. However, some cities are taking strides to keep mosquito populations at a minimum, to ensure a healthy outdoor experience free of concern for mosquito-borne illness.

NPSPhoto, Flickr.com

One of the first steps to take would be to simply minimize areas of stagnant, standing water that mosquitoes utilize for breeding. If this seems infeasible or proves ineffective there are some alternative strategies to be tested. For instance, the sterile insect technique is a method of mosquito birth control where a magnitude of sterilized male mosquitoes is released into the environment. They then mate with females of the wild population. As the males are infertile, the population will decline over time (World Health Organization, 2019). Sterile insect technique is considered to be a wonderful alternative to chemical control, as it results in minimal environmental degradation (Duford & Dumont, 2013).

The third choice for mosquito control is mosquito traps. Certain cities are enacting 'nuisance mosquito control programs. These programs take place in multiple phases, the first being to apply larvicides to areas where stagnant water collects, with the hope that it will eradicate larval mosquitoes before they have the chance to mature. The second phase consists of monitoring the numbers of mosquitoes caught within the city traps. The traps must be checked and recorded every day. If the average trap count exceeds twenty-five individuals for two consecutive days, and at least one division of the city has an average trap count of over one hundred individuals, then the city will spray for mosquitoes to keep populations down and in check (Burton & Bailey, 2011).

C. Community-based Food Programs

Adequate nutrition and proximity to food sources are necessary to ensure a successful, functioning community. According to the USDA Food Access Research Atlas, a large portion of our city lives more than a mile from a grocery store. While that may not seem far for some of us, for residents without access to transportation, it can be a much more difficult process. To qualify as a food desert, the USDA says that people must live more than one mile in urban areas, or ten miles in rural areas, from a supermarket. Under that definition, the majority of Salisbury's urban area qualifies under USDA guidelines as a food desert.

Additionally, see the citation for John Hopkins Center for a Livable Future to view another interactive map focusing on Maryland's health and nutrition statistics. According to this map, in 2017 ten to twelve percent of Salisbury is living in food insecurity. As we strive to provide environmental equity and justice for all, we must make efforts to provide acceptable nutrition to those living in these food deserts.

U.S. Department of Agriculture, Flickr.com

Furthermore, according to the Maryland Food Bank, one out of every nine Maryland residents face food insecurity, which amounts to roughly 650,200 individuals, over 204,000 of them are children (Maryland Food Bank, 2020). In a study conducted by Feeding America in 2016 found that not everyone who faces food insecurity in the United States qualifies for federal nutritional aid (Ahire & Pekgun, 2016). The city of Salisbury needs to do its part in combating hunger within our neighborhoods. Maryland is considered the wealthiest state in the country, the fact that anyone is going without adequate nutrition should serve as a call to action. With these proposed actions, we can hope to reduce food insecurity by 5% by the year 2025.

Food donation areas are on the front line of combating hunger here in our city. Here in Salisbury, we have the Maryland Food Bank and the Catholic Charities Basic Needs Program Eastern Shore Office which are the two food pantries officially recognized by the city. In addition, there is a HALO division that provides meals and shelter to those in need. All of these organizations accept donations from the public and local businesses, yet they all face the problem of how to incentivize the community to donate.

A study conducted by Sanjay Ahire and Pelin Pekgun, working with the Institute for Operations Research and the Management Sciences based in Maryland, developed a framework to optimize food pantry promotions and incentives to increase community donations. They write in their conclusion, “Our recommended mix of incentives can raise food and dollar donations to serve 1.72 million additional meals (a 41 percent improvement) over current levels within the existing resource limits” (Ahire & Pekgun, 2016). The citation for their methodology can be found in the bibliography of this document. By attempting to try some of the optimized incentives within their outline, perhaps Salisbury’s food pantries and shelters can improve their donation rates as well to help reach our goal by 2025.

Another outlet many cities are exploring is the support for community gardens. Salisbury already has multiple community gardens; therefore, the groundwork has already been laid out. There have been numerous studies done on how community and home

gardens can improve the overall nutrition of a community. In a study that focused on San Jose, California, participants were grouped into those utilizing home gardens, and those utilizing community gardens. Results show that both groups were able to meet U.S. dietary guidelines of daily vegetable servings when eating what their gardens were able to yield. This study also showed that gardeners who grew excess food were likely to give their food to friends and neighbors, spreading the nutritional benefit throughout the community (Algert et al, 2016).

Another study we focused on was a little closer to home and was written in Baltimore, MD. The study described how community gardens can be incredibly beneficial to those situated within food deserts and provided some tips to help other communities within food deserts establish their successful gardens. The study suggests a bottom-up approach for garden development and that the project needs a strong leader with a knowledge of gardening, and a willingness from the community to support the garden (Corrigan, 2011). However, it also stresses the importance of education, policy, and government funding to sustain food security within communities.

Elaine Casap, unsplash.com

In addition to encouraging communities to grow their own produce, providing incentives for local restaurants to use locally grown produce can be beneficial to both the community's overall nutrition as well as the local economy. Numerous cities across the country are finding new and creative ways to encourage local and seasonal agriculture in restaurants. Austin, Texas, for example, has created a sustainable food center to provide its community with information on growing produce as well as cooking seasonally, along with introducing businesses to local farmers (Mellino, 2016).

Additionally, in a document produced by the EPA titled *How Small Towns and Cities Can Use Local Assets to Rebuild Their Economies: Lessons from Successful Places*, they provide plenty of examples our city could utilize. They primarily encourage cities to first identify and then build upon their preexisting local assets. The land around the city of Salisbury is primarily agricultural. There are even small farmers still out there producing fruits and vegetables. Our city can support these farmers, as well as encourage proper nutrition, by persuading local restaurants to work with these farmers. To take that a step further, the city could attempt to revitalize the dwindling CSA programs with farmers in the area. In a study published by the *American Journal of Public Health*, researchers found that subsidized CSA programs are an effective way of decreasing the risk of diabetes and cardiovascular disease among low-income neighborhoods in the United States (Basu et al, 2020).

Another way to support the local farmers while also improving nutrition within the community is to improve our community farmer's markets. There are currently two farmer's markets within the city, one on Camden Ave, and one in the downtown area. While these are both excellent programs, there is always room for improvement. Portland, Oregon is working to take the farmers' market experience to the next level and sets an excellent example for cities like ours seeking improvement. They are creating the James Beard Public Market, a 45,000 square foot farmer's market that is powered by sustainable energy, which provides a forum for local farmers to sell their produce and offers seasonal cooking demonstrations along with other sustainable education programs (Mellino, 2016).

D. Support for Substance Abuse Recovery Services

It comes as no surprise that there is a high rate of substance abuse in our city, whether it be drugs, alcohol, or another substance. Per the Addiction Center, the five main factors that contribute to substance abuse in rural areas are poverty, unemployment, risky behavior, isolation, and low educational completion (Bezrutczyk, 2019). While our plan hopes to decrease the occurrence of all of the factors, where there is substance abuse, there must be a sort of recovery system.

Through methods such as mandating further training in treating overdoses, increasing access to counseling sources, both in terms of economic availability and transportation, as well as increasing detox centers, our community can more rigorously combat addiction in our community.

Education and Outreach:

Education has always been on the front lines of community improvement. By further educating the next generation, the community can hope that as they grow, that education will spark new ideas within them, which they will direct towards the community. However, education must be focused both on the youth and adults in our community. If the city prioritizes sustainable education for business owners especially, we can hope to reduce our city's overall environmental impact. We hope that by supporting programs that spread awareness through in-person instruction, media, and social events, residents will have multiple available outlets to increase their education and thus share their knowledge with the rest of the community.

A. Sustainable Curriculum in Public Schools

In 2011 the Maryland State Board of Education decided to mandate that all Maryland public schools must include some form of environmental education to their students. The goal of this decision, which was supported by the No Child Left Inside Coalition, was that Maryland high school graduates would emerge into the world as environmentally literate (Taproot Journal, 2010).

However, this decision left the choice of what to include in this new environmental education up to the individual school districts. It can be difficult for school boards, who

may be uneducated themselves on matters of the environment, to develop a comprehensive sustainable education to their curriculums. We suggest that school board members identify pre-existing environmental curriculum models, which would then be adopted by the staff at the local public schools.

Brisbane City Council, Flickr.com

Many programs that have identified this disconnect and are striving to close the gap. EcoRise, for example, is a program that helps educators introduce their students to solutions to the global issues surrounding natural resources, energy, and transportation, among other things. The program also hosts workshops for teachers and other education administrators to learn about the new material, as well as a consulting system to help develop the perfect curriculum for every institution (EcoRise, 2020).

Many peer-reviewed sources express the concern that an understanding of the environment cannot be obtained solely from one's formal education. Students need to practice sustainable life choices outside of the classroom as well (Cruz et al, 2015). One method at achieving environmental awareness at home is by encouraging local television networks, such as “Delmarva Now!” Or WBOC, to air programs that promote environmental mindfulness to their audience. As previously stated, it is incredibly important to educate the adults in the community, thus ensuring the education of the community's youth. Through embracing and adopting these new education opportunities, Salisbury schools can hope to be producing legitimately environmentally literate students by 2030.

B. Environmental Outreach Programs

When it comes to educating Salisbury’s adult population, it is far less straightforward than mandating a curriculum addition within the schooling system. When it comes to educating adults, the programs must be more alluring, provide something to incentivize people to spend their valued time on it. Salisbury already has some attractive programs for the exchange of environmental ideas.

One, for instance, is the SBY Green Drinks program. Green drinks is hosted once a month at a local restaurant or bar and provides a forum for those within the environmental community to come together and share ideas in a casual setting. It is open to the public for those that are interested in learning more about local environmental efforts, however, many residents are unaware of its existence. We recommend that the city allocate some resources to further promotion of Green Drinks, by perhaps listing it in local newsletters or papers.

A similar program for educating the adult public in the Salisbury University environmental colloquium series. This series takes place every semester and provides lectures on different aspects of the environment from a variety of disciplines. While the school does advertise these colloquiums across campus, the promotional effort within the community itself could be improved. While a handful of community members are typically in attendance, it would be refreshing to see many more there. Not only would this improve environmental literacy in the community, but it could also serve as a way to strengthen the relationship between the university and the city.

Jose F. Tello, Personal Collection

For city officials managing sustainability, there are programs to help with sustainability education for communities. For instance, organizations such as ICLEI for climate and sustainability funding provide grants to communities that participate in sustainability programs. The money acquired from these grants could be allocated toward sustainable city improvements. Therefore, not only would the city receive funds to put towards sustainable initiatives, but they would also be provided the opportunity to participate in a restructured sustainability education framework. Similarly, searching for support programs and grants for sustainable improvements in local businesses would be incredibly beneficial for the city.

Equal Housing Opportunities:

Equal housing equates to achieving a fair standard of living for all Salisbury residents through ensuring safe and clean neighborhoods within city limits. It should be noted that this does not include structural regulations, but rather the way the proposed building or rental property's codes and regulations will be upheld and enforced. The standards of living can be influenced by the environment and for people to have the best opportunity to deal with any crisis fairly is to enforce equal/fair housing to everyone. Our intentions for creating opportunities like this for residents is another way we can unify the community of Salisbury and minimize environmental injustices.

A. Fair Building/Rental Proposals

In the wake of growing concerns about climate change, many are discussing policy directed towards energy saving, "green" retrofitting in housing. While this is a good idea on the surface, it overlooks many residents classified as tenants, who have little financial resources or agency to upgrade their living situation. Having a line of standards for building or rental properties gives the ability for all citizens to benefit from the same regulations and codes. Environmental equity is commonly overlooked because of the area that some people reside in, but with special opportunities created for tenants that

may be more vulnerable to environmental issues, it gives the ability for everyone to be protected.

Local neighborhoods should be built at roughly equal distances to green spaces in the city and incorporating all neighborhoods into the public transportation routes, which both would reduce the amount of daily vehicle travel while also bringing unity to the city. There are many ways greenspaces and overall city beautification can aid in environmental efforts as well. For instance, studies have shown that “trees on the street may be more important to reductions in air pollution generated by traffic through dry deposition” (Karden et al, 2015).

Megan Hensel, Personal Collection

In addition, affordable utility rates and relief programs should be implemented in lease agreements. Climate change can bring more severe weather, and with that comes increased utility charges. As previously stated, tenants have little agency to upgrade their appliances to a more efficient standard, and thus the responsibility falls upon the landlord. Landlords should keep in mind that while upgrades in rental unit systems may be costly upfront, they will be more efficient in the long run, leading to happier tenants
and a better tenant-landlord relationship.

Furthermore, landlords should be acquainted with programs that support renewable energy and efficient appliances to help keep energy costs in their properties low. The assurance of a certain standard of living across all city properties can stem from a higher intensity of regulations directed towards city landlords. Utility costs are the least understood yet are the one area where the cost burden can be reduced without household relocation (Kontokosta et al, 2020).

By implementing a stricter housing inspection process for properties, we can reduce common issues in units such as poor ventilation or high sun exposure. For lower-income households, low-cost energy improvements could reduce energy costs by as much as $1,500 per year (Kontokosta et al, 2020). Climate change introduces a profound dimension of unpredictability in the sociometric relations of urban life. So, with this unpredictability, it’s amplified by the limited access that many tenants have to 'resources for adaptation', such as gardens, water efficiency, and alternative energy. This limited access is exacerbated by regulatory practices which include leases, insurance, and capital investment, therefore helping shape the socio-natural relations of tenure (Mee et al, 2014). Minority communities and low-income households are more susceptible to the effects of climate change. This is unfortunately due to their socioeconomic backgrounds, discriminatory housing policies, and poor city planning.

Our city should strive to challenge this norm and be a role model for other Maryland communities.

B. Homeless Community

There is very little research looking into how climate change will affect the homeless, one of the most vulnerable populations in the developed world. Approximately 5 to 8 million Americans are qualified as homeless under the definition used by health researchers which state they are, “individuals who sleep in shelters as well as ‘absolute homelessness’ which describes individuals who sleep outdoors or in other places not intended for human habitation” (Ramin & Svoboda, 2009).

Oded Gebert, Flickr.com

Members of the homeless community are considered to be at a heightened risk for numerous health conditions, as well as climate change-induced events such as heatwaves, air pollution, and more severe storms and floods. As urban gentrification increases across the country, so does the homeless population (Fang, 2009) and Salisbury should strive to provide homelessness relief to those who struggle within the community.

People experiencing homelessness in the community of Salisbury have multiple options provided by the city such as emergency shelters, various supportive relief programs, and street outreach. HALO and Christian Shelter are the 2 shelters in Salisbury and are within walking distance to any necessary services needed. In addition to these, and following the Maryland 2016 report on homelessness, we could expand the current Permanent Supportive Housing Program with the adoption of a Home First model by building more permanent supportive housing in other locations within the city limits. This would mean transitioning funding from shelters and temporary housing to increased support for permanent housing programs. When barriers are reduced, like requirements for sobriety or income, it has been proven to be effective when helping unsheltered individuals. (Nickelsburg, 2018).

Outreach is very important in environmental and personal hygiene so that we can keep the city clean in reducing pollution but also our community is healthy and well cared for. Being able to locate the homeless population is another step closer to the city being able to help and support them. Climate change is relocating people, possibly leading

them to homelessness, so we need to make sure our city is prepared to deal with the problem at hand.

One of the most pressing concerns towards homelessness in the city is the risk of youth homelessness. Youth who experience homelessness are burdened with added stressors which can affect their mental health, education, socialization, and career development. Certain studies recommend transitional living programs (TLPs) as a necessary defense against youth homelessness (Holtschneider, 2016). TLPs provide residential services to people in the homeless community ranging in age from 16-22. The program provides resources such as connection to group homes, host family homes, and supervised apartment complexes. There are currently nine transitional living homes in Salisbury. Our city must ensure the survival of these programs by providing support for them and the programs that they work with. By keeping youth homelessness to an absolute minimum in our city, we can hope to produce happier, more well-educated citizens.

Homelessness is a problem in nearly all cities across the country, some places more severe than others. While we emphasize the need for policy towards homelessness aid, the city must be wary not to stray towards ‘quality of life ordinances’, laws with progressive goals that are implemented through oppressive and unreasonable mandates on the homeless population. We recommend that any policy passed regarding homelessness aid be thoroughly discussed with professionals in the human service field and keep human rights in mind. Together, we can work towards a community with equal housing opportunities for all of our residents, to promote a happier, healthier lifestyle.

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Appendix

Groups	List of Proposed Actions	Monetary Cost of Actions	High/Low Impact	Page Number
Water	Replacing impervious surfaces	$6-13 per sq. foot	High	5
	Rain gardens	$10-40 per sq. foot	High	5-6
	Reforestation	Roughly $70 per acre	High	6-7
	Subsurface storage vaults	Varies (see water pg. 4-5)	Medium	4 & 7
	Restoring riparian buffers	Active- $4695/acre, Passive- Cheaper	High	1-8
	Letters to inform people of free lead and copper piping surveys	$0.55 per letter	Low	9-10
	Increasing strictness of littering/water pollution laws	None/Police and Officials Time	Medium	11
	Holding volunteer-based river clean-ups	Supplies (i.e. trash bags)	Low	11
	Upgrading stormwater drainage systems	Varies, estimate cost of $10,000	High	11
	Renovating city buildings to be more water efficient	Inexpensive/Varies (water pg. 10-11)	High	13
	Utilizing gray water in city buildings	Can range from $1,000-10,000	Medium	13
	Implementing district metered areas	City scale unknown (see water pg. 11-12)	High	14
	Incentives for residential/commercial water usage reductions	Varies (see water pg. 12)	High	14
Energy	Reduce energy usages	Inexpensive	Medium	17 & 23

	Limiting consumption	Inexpensive	Medium	19
	Solar panel instillation	Approximately $1,000-$1,500/kW for Monocrystalline, $900-$1,000/kW for Polycrystalline, and $700-$1,000/kW for Thin Film.	High	22, 27, & 29
	Green infrastructure implementations	Cost varies depending on what's implemented; $10-30 per sq. p of Green Roof, $20-40 for sq. foot of Rain Garden (Also see Infrastructure).	Medium	23
	Use renewable energy sources	Approximately $11,011-$14,208 per 6kW system for Solar, $1.3-2.2 million per MW for Wind Turbine, $5,500-$8,100/kW for Nuclear	High	30-31
	Net zero carbon emissions for newly built buildings/ homes	Cost Varies (Also see Infrastructure)	High	30-31

	Reduce meat consumption	Inexpensive/free	Low-medium	19
	Encourage businesses and personal homes to practice sustainable, energy-saving methods	Inexpensive/free	Low	Energy section
Infrastructure	Implementing more crosswalks	$750-$2,600 per crosswalk	High	34
	Implementing countdown pedestrian signals	$300-800 per signal	Low	34
	Creating more bike lanes	$133,170 per mile	High	35
	Creating more bike racks	$660 per bike rack	Low	35

	Implementing bike sharing throughout downtown	$5,000 per bike for capital	High	35
	Building electric vehicle charging stations	$706 per charger	High	36-37
	Green roof implementation (extensive)	$10 per sq. foot	High	38-39
	Green roof implementation (intensive)	$25 per sq. foot	High	38-39
	Green roof implementation (semi-intensive)	$15-$30 per sq. foot	High	38-39
	Cool roof implementation	$2 - $3 per sq. foot	High	38-39
	LED streetlights	$2,000 - $2,500 per pole	High	30-40
	LED traffic lights	1 signal = $73 annually	High	40-41
	General implementation of LED bulbs in buildings	$8 per bulb	Low	40
	Net-zero and LEED-certified buildings	Costs vary (see p. 11)	Low	41-42
Waste	Increase efficiency of landfill methane-capturing technology	Expensive, up to $1,000,000+ for new and improved technology	Medium	54-55, 61
	Implement curbside compost program	$200,000 for intial pickup and storage costs, but possibly profitable if compost is sold effectively	High	55, 57, 61-63
	Require more deconstruction and salvage as opposed to demolition	Approximately $24,000 per building before tax benefits	Medium	56

	Increase the amount of recycling and composting containers in public areas	Approximately $50 for indoor bins and $300 for metal outdoor bins	Medium	58

	Create resource recovery park(s)	Approximately $100,000+ labor costs	Medium	58
	Increase the amount of household that recycle and compost with education and outreach	Inexpensive/free	Medium	57-58
	Require recycling and composting as opposed to offering it	$50-$150 per ton of recyclables/compost	High	57
	Implement a “pay as you throw” program	Inexpensive/profitable	Medium	59
	Incentives for regular recyclers and composters	Range depends on incentive. Cheap - Expensive	Medium	59
	Encourage businesses and supermarkets to offer alternatives to plastic bags	Approximately $0.05 per paper bag	Medium	60
Social	Improving air quality	$50-$1,000 per air quality monitoring device	High	65
	Reducing mosquito-borne illness	$30-$900 per mosquito sterilizer	Medium	66
	Expand community-based food programs	Garden supplies, gain food & dollar donations	Medium	66-69
	Support for substance abuse recovery services	Counselors & supplies needed	Medium	69
	Incorporate a sustainable curriculum in public schools	Nothing (it's public education)	High	69 & 70

	Environmental outreach Programs	Promotional effort	Medium	70 & 71
	Equal Housing opportunities	Costs vary	High	71 & 72

	Fair building/rental proposals	Costs vary	Medium	71 & 72
	Aiding the homeless community	Donations, volunteers	Medium	73 & 74