

Puget Sound Stormwater Runoff

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Executive Summary

How large of an impact does stormwater runoff really have? The answer is quite a lot. Stormwater runoff poses a major threat to the Puget Sound. Pollutants have been found throughout the Sound's water and have even been found in local shellfish produced there. Luckily, local government agencies such as the Department of Ecology (Ecology), the Department of Fish and Wildlife, and the Port of Olympia are all in the works to help reduce the amount of stormwater runoff that flows into the Puget Sound (Watershed Forestry Research Guide, 2016).

Introduction

When rainfall occurs, pollutants from various surfaces have the ability to run off into streams, lakes, rivers, and yes even the Sound. When this happens numerous contaminants enter the water which causes water quality to decline drastically (Watershed Forestry Research Guide, 2016). Another factor that contributes to stormwater runoff in the Sound is the amount of people living along the shore. There are currently about 4.4 million people that live around the Puget Sound; this is a colossal increase from past populations. This growth in population is another known factor from which increased amounts of pollution enter the Sound (Washington State Department of Ecology, 2016).

In Washington State, stormwater runoff is the number one source of pollution. Over the years about 1/3 of the state's water has been unable to meet the state's water quality standards (Washington State Department of Ecology, 2016). This is an important issue because

federal law requires all states to follow and address stormwater runoff , pinpoint source discharges and have permits in place to help limit the amount of runoff (Driscoll *et al.*, 2004).

The Puget Sound is known as a valuable economizing component and is the second largest estuary in the U.S. Over the years about 70 percent of the Sounds estuaries and wetlands have been compromised because of pollution and local development. In recent years, Congressmen Denny Heck and Congressman Derek Kilmer have introduced efforts to “save our Sound” in the Puget SOS act. This bill, which was introduced in 2015, is meant to improve the federal government's role in regulating the Puget Sound and the bill has multiple plans for restoration (Denny Heck, 2016).

As one can see, stormwater runoff has become a major issue throughout the years and it is a tremendous threat to the Puget Sound. It is essential we find new ways to prevent the runoff from continuing to harm the Sound. Hopefully with hard work from the State of Washington, and local cities such as Olympia we will be able to reduce the amount of stormwater pollutants entering the Sound.

Background

At first glance Puget Sound may seem pristine and beautiful. But if you take a closer look you will find pollution and toxic substances. Even in the deepest of waters, banned pollutants have been found which causes the Sound to be a toxic mess. One of the largest contributors to polluting the Puget Sound, especially in the Olympia area, is stormwater runoff (Washington State Department of Ecology, 2016). Stormwater runoff has become a major issue

in recent years. It has caused the health of the Puget Sound to deteriorate and harms the health of many.

Stormwater runoff can be defined as rainfall that flows on the ground from various surfaces. These surfaces make it so the runoff cannot be absorbed into the ground and the water then flows to local streams, rivers, lakes, and the Puget Sound. Runoff water carries multiple contaminants such as nitrogen, phosphorus, numerous bacteria, oil, grease and many more which can come from a wide range of sources. All of these pollutants cause the stormwater runoff to pollute the water it enters (Watershed Forestry Research Guide, 2016).

There are around 4.4 million people that live on and around the Puget Sound which results in immense amounts of pollution. Since the 1960's, population around the Sound has increased exponentially with about 67% of Washington State's residents living on or by the Puget Sound. Over the course of the next few decades it's predicted that the population will increase even more. Washington's Office of Financial Management has recently estimated that around 5.1 million people will live around the Puget Sound by the year 2020; this is a colossal increase. Adding more than 700,000 more people to this area will result in increased pollution exponentially (Washington State Department of Ecology, 2016).

Stormwater runoff has the ability to come from multiple sources. When it flows it can pick up harmful pollutants. In the Puget Sound the immense amount of stormwater runoff has been proven to degrade water quality and hurt marine habitat. With declining water quality, stormwater runoff has become the leading factor in water pollution in the state. Also, there is a loss of habitats since the runoff pollutes the water where living organisms live. This is a

predominate factor to the decline in salmon. (Washington State Department of Ecology, 2016). Also, the loss in habitat can be a factor through flooding and erosion, which can cause an array of problems (Natural Resources Defense Council, 2001).

Not only does stormwater runoff negatively affect marine and salmon habitat, it also makes water unsafe for the general public. Untreated stormwater contains various toxic metals, bacteria, and organic compounds which makes it unsafe to drink or even swim in. Untreated stormwater even has the ability to contaminate aquifers that are used as sources of drinking water (Driscoll *et al.*, 2004). Runoff flows carry pollutants with it which has caused about one-third of Washington State's water to become too polluted to even meet the state's water quality standards. In recent years, local beaches have even been closed for swimming and shell fish harvesting due to bad water quality. Salmon have also been suffering due to poor water quality because of stormwater runoff. It's said that salmon have been suffering from not only runoff pollutants but also from soil being washed into their waters (Washington State Department of Ecology, 2016).

Water pollution has become a major factor in Washington State and stormwater runoff is the number one source of pollution throughout the state. It is also known to contribute to flooding. Flooding occurs when excess rainwater is unable to be absorbed into the ground because of surfaces covered by pavement. When undeveloped ground is covered it can cause the volume of water that enters streams and rivers to increase exponentially (Natural Resources Defense Council, 2001).

Local, State, and Federal Regulations

Stormwater runoff is the leading contributor to pollution in urban waterways and there are federal laws in place that address this. Under Federal law, all states must follow and address that stormwater runoff is a point source discharge. As of now there are over 100 municipalities in the state of Washington that require stormwater runoff permits under multiple phases. Some proposals for action by the government include; public education/involvement, discharge elimination, controlling construction site stormwater runoff/post contraction site control, and pollution prevention. These stormwater permits are implemented by the Washington State Department of Ecology and the permits are vital for federal law stormwater management plans. As good as it may sound, these permits are unable to prevent all stormwater runoff impacts (Driscoll *et al.*, 2004).

It's important to take the health of the Puget Sound seriously. The Sound is home to many different organisms and it provides jobs to many local residents. However, past loopholes in the Clean Water Act have allowed pollutants to enter the Puget Sound over the years. Some of these loopholes included leaving about 54% of water and streams unchecked for pollutants for Washington State residents (Environment Washington, 2013). Essentially, the Clean Water Act is the basic structure of regulating the discharge of pollutants into the water throughout the United States. It was enacted in 1948 and it was previously known as the Federal Water Pollution Act (Environmental Protection Agency, 2015). In spite of having the Clean Water Act enacted there are still copious amount of pollutants throughout the waters of the world.

In 2010, the Washington State Department of Ecology estimated the Puget Sound receives about 14- 94 million pounds of pollutants each year. This includes, oil, grease, PCB's,

toxic heavy metals and many other contaminants. Oil and grease make up most of the toxic pollution. The problems with these pollutants are not only the amounts of contaminants, some metals that are released in smaller amounts have the ability to hurt the ecosystem even more. For example, salmon are extremely sensitive to low concentrations of pollutants such as copper and zinc (Washington State Department of Ecology, 2010).

Puget Sound is home to a very diverse marine ecosystem. The shorelines of the Sound incorporates both developed urbanized and industrial areas. As a result of all of this, fish and shellfish from these waters are exposed to a lot of toxic contaminants. Freshwater inputs in the Sound are known as the greatest contributor of toxic contaminants into the Puget Sound which mostly comes from stormwater runoff. Many species in the Puget Sound are also known to complete their entire life in the same waters of the Sound. This increases their risks of exposure to toxic chemicals. Fish, such as Coho and Chinook salmon, may be impacted from remaining in the Sound. Over the years, multiple studies have found that the contaminants that have entered the Puget Sound have had astronomical effects on marine life (Washington State Department of Fish and Wildlife, 2016).

In 2014, Scientists from the Department of Fish and Wildlife underwent a study on shellfish to date pollution levels around the Puget Sound area. In this study, the Washington State Department of Fish and Wildlife placed mussels along the shore lines at about 100 various sites in the Sound. The shellfish were then retrieved a few months later. Scientists found traces of fossil fuel pollution, flame-retardants, metals and multiple other contaminants in the shellfish. They found that the shellfish that came from the more urbanized areas had the

highest trace of contaminants. In addition, polycyclic aromatic hydrocarbons (PAHs) were found in the muscles at every area tested. PAH's essentially come from wood smoke, oil and exhaust. Some of these are known carcinogens. Additionally, they also found the shellfish also contained PCB's (Ahearn, 2014).

Overall, this study found contaminants have been entering the ecosystems shore line food web and are continuously damaging other organisms and people who consume the species. In the past China has even banned shellfish imports from a majority of the West coast due to elevated levels of contamination found in shellfish. The Department of Fish and Wildlife plans on continuous monitoring and testing of the muscle population in the Puget Sound in order to better control these contaminants. (Ahearn, 2014). Hopefully, with the continuous testing of these muscles, scientists can figure out ways to reduce the amount of pollution that harms marine life.

Locally Addressing the Issue

One way we can go about protecting marine life and the Puget Sound is to install more permeable pavements in parking lots to and reduce the amount of runoff. In Olympia, permeable pavements have been installed in order to do just that. Essentially, permeable pavement is made out of aggregate, which allows water to move and drain through it. There has been long term research done on permeable pavements which shows that it is effective at removing pollutants from paved surfaces (University of Maryland Extension, 2012). An office parking lot in Olympia was set as a demonstration site in order to test out how the pavement is working. Two parking stalls were constructed using multiple different types of permeable

pavement. After the demonstration, it was found that the permeable pavement had reduced the amount of surface runoff significantly and the benefits were consistent throughout the study (Field Evaluation of Permeable Pavements for Stormwater Management, 2000). Also, in Tumwater, the Washington State's Employees Credit Union (WSECU) has constructed a porous pavement in their parking lot which is said to "manage stormwater and reduce their pollution".

Local agencies, such as the Port of Olympia and the Washington State Department of Ecology, have been working to reduce stormwater pollution that enters the Puget Sound for many years. In particular, the Port of Olympia has a stormwater management program that plays a major role in reducing the pollutants that enter the Sound locally. The Port of Olympia and the Department of Ecology have been working together to help better the Puget Sound and minimize potential harm from pollutants. Together, their goal is to reduce the runoff that flows off impervious surfaces around Olympia. As of now, there is a permit required from the federal government and state water quality laws that are in charge of rain water and snow discharge. The permits control water that is flowing on surfaces in order to protect bodies of water. (Port of Olympia, 2016).

Under these new runoff permits, the overall goal is to maintain multiple ways to discharge stormwater pollution into water ways. These permits are tailored after the Port's Stormwater Management Program or SWMP and are required for rainwater, or snowmelt that drain. The SWMP works with the Port's Engineering Department and multiple Port branches, including the seaport and real-estate. The SWMP works to better management practices in order to have more control over pollutants, and helps prevent spills. It also looks to control

construction site runoff, post contraction stormwater runoff and educate the public on the current issues regarding stormwater runoff problems (Port of Olympia, 2016).

Overall, the Port of Olympia works very hard in order to protect and regulate stormwater runoff through the city. Their job is to improve multiple stormwater management practices to reduce the amount of stormwater runoff pollution in the community. The Port of Olympia's actions and practices are improving to better protect the Sound. By having these practices in place, hopefully the Port of Olympia will be able to reduce the amount of stormwater runoff significantly in the future (Port of Olympia, 2016).

Recently, the Department of Ecology has been working to implement different and new ways to improve stormwater runoff. They are promoting rainwater collection as a stormwater management tool. With rainwater collection, Ecology is using it as not only beneficial use to local residents but also as means to protect our waters (Washington State Department of Ecology, 2016).

In the Puget Sound and other areas in Washington State, stormwater and wastewater often share pipes which is together called "combined sewer systems". Large storms can cause combined stormwater and sewer water to overflow straight into the Puget Sound, streams and lakes. When this happens the result is called combined sewer overflow or CSO. The goal is to capture the rainwater before it even has a chance of becoming stormwater therefore decreasing stormwater that needs to be treated to prevent contaminated waters from entering into lakes, rivers and the Puget Sound (Washington State Department of Ecology, 2016).

By having both the Port of Olympia, and Ecology working together in order to reduce the amount of runoff that enters the Sound, their results have been generally successful. Both agencies have been able to successfully bring awareness over the years on pollution and what to do in order to decrease its impact on the environment. It is essential to know not only the problem with stormwater runoff but know how to fix it. This is what these two agencies are working to achieve.

The Repair

Now that the problems and complications with stormwater runoff have been addressed, it's crucial to understand not only the problem and how to fix it but also where to go from here. Washington State is now providing funding to improve the waters in Olympia Washington. As of December of 2015, the Washington Department of Fish and Wildlife began distributing around \$8.2 million to fund local projects that are meant to protect and restore the Puget Sound's shorelines. Sponsors for these projects include; tribes, local governments, and multiple non-profit organizations. The funding distributed to these programs comes from the state capital funds and federal grants from the EPA (Washington Department of Fish and Wildlife, 2015).

This past year, all of the funded projects involved restoring beaches, habitat, correcting fish barriers and restoring the tidal functions that have been altered by land use over time. The restoration of the Puget Sound can not only help the shorelines and water quality, but it can also increase jobs, and economic activity (Washington Department of Fish and Wildlife, 2015).

The Local Approach

Locally, Congressman Denny Heck has been very open about his feelings on the protection of the Puget Sound. Heck's mission is to generally restore the Sound and to have this issue remain a large priority around the area. By having people such as Denny Heck on board, hopefully in the future more can and will be done to restore the Sound and shelter it from problems such as stormwater runoff pollution (Congressman Denny Heck, 2016).

Some amazing feats have been made in recent years in order to protect the Puget Sound by the local government. Congressmen Denny Heck and Congressman Derek Kilmer have introduced efforts to "save our sound" in the Puget SOS act. This bill, which was introduced in 2015, is meant to improve the federal government's role in regulating the Puget Sound. In detail, this bill puts in place efforts for restoration and includes local, state and tribal governments. The bill also amends the Clean Water Act. It adds new sections which are specifically dedicated to the Puget Sound's recovery (Congressman Denny Heck, 2016).

Looking at the Sound long term it is essential to defend it. Protecting the Sound and reducing pollution is a major concern and needs to be given more federal attention. This is why, what Congressman Denny Heck and Congressman Derek Kilmer are doing is so important. Together, they are working with the federal government to get the Sound the attention it needs in order to preserve it for the long run. By learning from Congressman Heck, and Kilmer one can really grasp the importance the Puget Sound really has to our local community. Pollution such as stormwater runoff over the years have caused major health related problems to the

overall quality of the Sound. By working with grants and local governments the solution the fixing the Sound doesn't seem so distant after all.

Conclusion

To sum up the topic of how stormwater runoff directly affects the Puget Sound, it's essential to study the facts about what it does and how to reduce its impact on the environment. Luckily, in Washington State, there are numerous organizations, state departments and local politicians who realize the importance of the Sound and the need to protect it from stormwater runoff.

In order to entirely improve the Puget Sound's water quality and fix the stormwater runoff dilemma, I believe there needs to be more work and collaboration between local, state, and federal government agencies in order to better regulate stormwater runoff pollution. This theory applies not only in the Puget Sound but in all places. Without this collaboration I don't see our impacts capable of protecting the Puget Sound and other bodies of water from pollution.

Beneath it all, the Puget Sound, and locally the city of Olympia are full of harmful contaminants that damages sea life and overall water quality every day. With confidence, the state of Washington and the multiple municipalities that surround it will someday restore the Puget Sound back to its previous health; to pristine waters once again. However, before this can happen there needs to be group efforts to resolve these problems.

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