Ocean Ambassadors Canada

2159 Kings Ave, West Vancouver, BC V7V 2B9

Memo

To: Alison Wood, Chair, Ocean Ambassadors Canada
From: Ishan Lodwal, CFO; Nicholas Messere, CAO; Hamza Malik, CTO; Ahmed Negm, COO;
Luke McCutcheon, OM; Imani Nyambaka, OM
Subject: Proposal for Recommendation Report to Organize a Cleanup of the Great Pacific Garbage Patch
Date: Tuesday, November 1st, 2022 `````

1.0 Organization Profile

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Ocean Ambassadors is a non-profit organization whose goal is to forge relationships between people and the ocean, and educate them about the problems caused by plastic pollution (“Ocean Ambassadors Canada”, n.d.). You've been effective in raising awareness of the issues surrounding plastic pollution through your educational programs and community activities, and you've inspired many to actually make a real change ("Connecting People With the Ocean", n.d.). Your organization offers school programs and summer camps to educate our youth about the threat marine pollution poses on the ocean, and participants are invited to discuss, learn and take action.Within your first two months, 670 youth participated in your Ocean CampTM program and became passionate towards the cause (“Ocean Ambassadors Canada”, n.d.). Ocean Ambassadors Canada strives to challenge our youth to think innovatively about addressing the issue of plastic pollution.Through your programs, students have created prototypes of their ideas about how to decrease the amount of plastic waste in the ocean, and are currently working hard to make these ideas come to life (“Our Programs”, n.d.).

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2.0 Recommendation Report Purpose and Problem Statement

The “Great Pacific Garbage Patch”, commonly referred to as the Pacific Trash Vortex, is one of the most prominent garbage patches in the world. Located in the Pacific Ocean between Hawaii and California, the vast region stretches from the west coast of North America to Japan (The Ocean Cleanup, 2021). This region encompasses 1.6 million square kilometers, where plastics and microplastic marine debris accumulate (Leal Filho, Hunt, & Kovaleva, 2021).

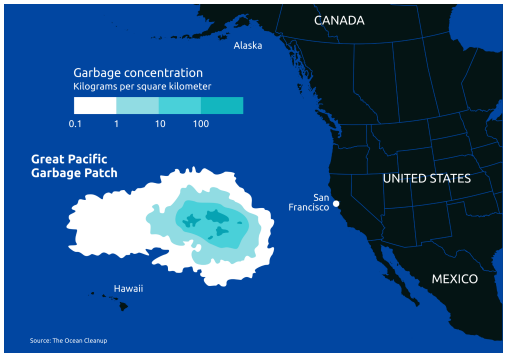

Figure 1: The size and location of the Great Pacific Garbage Patch (“The Ocean Cleanup”, 2022)

Plastic pollution poses a great threat to the health of our ocean, to marine life, and to humans. Unless concrete steps are adopted to reduce and prevent waste movement into our oceans, the Great Pacific Garbage Patch will continue to grow and expand.

- **Animals:** When garbage is dumped into the oceans, the oxygen levels in the water can be reduced, as a result of which marine life would be adversely affected. Sea creatures can be choked, suffocated, or mistake these indigestible plastics for food, causing great harm to their health (Mckenzie, 2020).

- **Humans**: We as humans eat fish and other sea animals that have ingested harmful chemicals from plastics. Toxins such as lead, calcium and mercury can be found in marine life, which is very dangerous for humans who consume them (Andrews, 2021).

- **The Environment**: Our oceans have accumulated so much plastic pollution, because much of the accumulated waste is not biodegradable (Evers, 2022). For instance, plastic

breaks down into smaller microplastic bits over time and instead of decomposing, they become suspended in the water column or sink to the bottom of the ocean (Schoell, 2019).

When it comes to the idea of a "garbage patch," it invokes images of floating trash islands. In reality, these garbage patches primarily consist of microplastics that the naked eye cannot always observe; even satellite imaging cannot always detect signs of a large patch. Due to their ability to release and absorb harmful pollutants, plastics pose additional risks, such as photodegradation, which causes plastics to release chemicals that can harm the environment (*How Does Plastic End up in the Ocean?,* n.d.).

Our aim is to successfully tackle the issue of the earth's growing marine pollution head-on, and reduce the amount of waste that finds its way into the Great Pacific Garbage Patch. In this report, we will discuss our suggestions for possible solutions to this issue of plastic pollution and will analyze the impact each suggestion would have on completing our goal.

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3.0 Possible Solutions and Proposed Sources

Below are six possible solutions that will be further investigated to determine which one would be the most efficient approach to clean out the Great Pacific Garbage Patch.

3.1 Wasteshark Drone: Ishan Lodwal

Background:

Wasteshark is a water drone that was developed in 2018 by Ranmarine technology and based on the whaleshark (Hasany et al., 2021). It is a drone that uses a suction mechanism to intercept garbage in the ocean before winds, currents etc. can carry it out into the ocean (Adhwaryu, P., & Alam, S. S. ,n.d.). It collects floating garbage like plastic and biowaste as it floats along the water's surface. Each unit of watershark can collect upto 500 kg of garbage that can be found in water bodies and can work for upto 10 hours(Wasteshark. RanMarine Technology., n.d.). The drone moves in water with the help of 2 electric propulsion motors. We can control the drone remotely or we can insert pre-defined routes in the drone which ensures that it covers the areas which have the highest volumes of garbage (Hasany et al., 2021). Wasteshark also has the ability to detect and transmit the quality of water which includes characteristics like salinity and pH levels (Adhwaryu, P., & Alam, S. S. ,n.d.). It is an intelligent drone which allows for it to be used in urban, rural and industrial environments.

Advantages:

Wasteshark is a drone which is easy to use along with zero green house emissions. It has a low cost and is easily transportable due to its small form factor. (Wasteshark. RanMarine Technology., n.d.)

Because of its intelligence it can be used in waters which have alot of debris as it can easily navigate through such waters (Hasany et al., 2021).

The watershark also uses a gps system on the 4G network which allows for easy tracking of the drone in water. (Wasteshark. RanMarine Technology., n.d.)

Disadvantages:

The Wasteshark drone floats only on the surface, therefore it is impossible for it to catch any plastic that is below the water level, which is a major drawback (Adhwaryu, P., &

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Alam, S. S. ,n.d.). Another disadvantage is that the drone utilizes propulsion motors to move which can get damaged either by debris that the wasteshark transverses through or by extensive use of the motors(Hasany et al., 2021) .

References:

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3.2 Interceptors: Nicholas Messere

Background:

The Interceptor Solutions represent various technological solutions to rid the rivers and oceans of the world of garbage. The idea for presenting these range of interceptor solutions came from the Ocean Cleanup which is a non-profit organization dedicated to decrease the presence of plastics in our oceans. The motivation behind the movement of developing these solutions is due to research conducted by the Ocean Cleanup showing that 1000 rivers in the world contribute to 80% of ocean pollution (Lee, 2020). With this information, technological and man-made solutions such as the Interceptor Original, Interceptor Barrier, Interceptor Tender and Interceptor Trash-Fence were created by the Ocean Cleanup organization to help fight ocean pollution and especially reduce the buildup of the Great Pacific Garbage Patch (Slat, 2022).

Solution Implementations:

The solutions invented by the Ocean Cleanup Organization either work independently or can be used together to catch plastic in rivers. To begin, the Interceptor Original was the first solution produced by this organization to capture and remove plastics from rivers (Lee, 2020). This solution is implemented as a barrier and conveyor belt system that funnels and extracts plastics from the river(Zhongming et al., 2019). Next, the Interceptor Barrier is another alternative solution implemented by the Ocean Cleanup that consists of a floating U-shaped barrier that is placed at the mouth of small rivers in which intercepts plastic waste flowing with the current(Slat, 2022). To continue, the Interceptor Tender works alongside the Interceptor Barrier to extract the buildup of plastic from the barrier and offload it into offshore dumpsters(Slat). This innovative creation utilizes a conveyor belt system similar to that of the Interceptor Original to collect garbage from Interceptor Barriers and is capable of servicing

multiple barriers. Lastly, inspired by avalanche protection systems, the Interceptor TrashFence was implemented for flash floods in highly-polluted and inaccessible locations (Slat). This method includes the usage of chain-link fences that are connected to the banks of rivers to capture plastic and other garbage for collection in the future. To put into perspective, all of the previously derived solutions were implemented to achieve the goal of 90% reduction of floating plastics in the ocean by 2040(Zhongming et al.).

Advantages:

Interceptor Original

- This technological solution is eco-friendly as it is solar powered and does not disrupt flowing paths of water as the catamaran design enables plastic to freely flow into the device and water continues along with the current(Slat, 2022).
- The capture system of this vessel is worth analyzing as it can collect debris that is around 10 m long and micro-plastics within the range of 0.5 to 5.0 mm (Initiatives for the Future of Great Rivers, 2022).
- The barge on this vessel can hold up to a capacity of 50 tonnes of waste per day(Lee, 2020).
- In addition, this device works autonomously and can extract around 50,000 to 100,000 kg of plastic per day making it a very efficient solution(Initiatives for the Future of Great Rivers, 2022).

Interceptor Barrier

- The barrier is permeable and optimized to efficiently buffer garbage in the water (Slat, 2022).

Interceptor Tender

- The ability for the Interceptor Tender to service multiple barriers is economically cost-efficient as the cost of collecting and offloading plastics is shared among multiple barrier sites instead of just one and with that, barrier deployments are more likely to be placed within close proximities of one another (Slat, 2022).

Interceptor TrashFence

- The Interceptor TrashFence is already proving its usefulness in one of the most polluted rivers in the world, the Rio Las Vacas in Guatemala.

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3.3 System 002: Hamza Malik

System 002, otherwise known as Jenny, is the first large-scale cleanup technology developed in July 2021 by The Ocean Cleanup (The Ocean Cleanup, n.d.). This Cleanup system works by two vessels dragging an 800-meter-long tensioned artificial coastline along the ocean's surface, maintaining a relative speed. The 800-meter-long tensioned artificial coastline has a three-meter-long barrier which extends below the ocean's surface, allowing floating plastic fragments to get caught along the way (CNET, 2021). A large opening in the center of the System 002 allows fish and other marine life to swim underneath it for easy wildlife passage (CNET, 2021). As water flows through the system, all the debris moves toward the center, which acts like a collection area called the retention zone (Designboom, 2021). Once the retention zone reaches its maximum capacity with marine debris, it is offloaded onto one of the two vessels and later taken to waste-sorting facilities to be recycled appropriately (Designboom, 2021).

- **Advantages:** System 002 makes it possible to perform large-scale cleanups without harming marine life. Each unit can collect over 1000 kg of garbage/plastic every 24 hours (The Ocean Cleanup, n.d.). Since July 2021, System 002 has removed over

169,565 kilograms of marine debris, covering almost 4,453 square kilometres (The Ocean Cleanup, n.d.).

- **Disadvantages:** Although System 002 is a great way to reduce plastic pollution and marine debris, the two vessels that drag system 002 across the ocean surface require fueling, which burns fossil fuels and results in frequent trips back to shore (Lavars, 2021). Recent studies suggest that plastic waste from the ocean can be converted into fuel by hydrothermal liquefaction. At highly heated temperatures, marine debris and ocean plastic liquefies into oils with an energy density similar to marine diesel (Lavars, 2021).

- **Environmental Impacts:** By using system 002 to collect marine debris/floating plastic from the ocean and converting it into fuel for the vessels on board, we can help improve the cleanup process and shorten the long travel without harming the environment and marine life. The remaining debris can be taken to waste-sorting facilities once it reaches its max collection capacity to be recycled appropriately (Lavars, 2021).

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3.4 Educating Children on Ocean Pollution: Ahmed Negm

A person's behaviour is strongly influenced by childhood practices ("Childhood Personality", 2010). When a person is introduced to a new concept or practice in childhood, it denotes that they will follow the concept in adulthood. When people pollute the ocean carelessly, it is a vital sign that they were not taught about the consequences of their actions during their childhood stage, leaving them to repeat the same harmful action. Therefore, implementing an anti-ocean pollution program in schools for children will influence their behaviour in adulthood, causing them to acknowledge the issues of ocean pollution. According to the great psychologist Sigmund Freud, the primary source of human behaviour is the unconscious mind one's feelings, decisions, and notices occur due to the events that influenced one's mind in childhood (Mcleod, 2009). For this reason, providing children with knowledge about the ocean's pollution will increase their awareness and influence their unconscious mind to make better decisions regarding ocean pollution. One might question the likelihood of young children learning or responding to participation in activities and lessons about ocean pollution and whether their response will be negative. This question is answered by the data that was collected by the survey conducted by Naître et grandir and Équiterre in Quebec, which discovered that 35% of children ask their parents many questions about environmental pollution, as well as 77% of parents, stated that their child does not have anxious, negative feelings about having discussions of environmental pollution (Cournoyer, 2021).

Environmental Impact: By implementing ocean pollution educational courses for children in school in Canada, 371,059 children per year will be taught about the consequences of ocean pollution, and thus the pollution will be reduced tremendously ("Canada birth rate", n.d.).

References:

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3.5 The Need for Volunteers: Luke McCutcheon

Whether you are poor or wealthy we can not evade the destruction to our oceans that excess garbage has created (Kolstee, 2017). Although this issue is universally acknowledged the level of awareness is low. Efforts will have to continue to evolve to meet the demanding needs of this problem. Green Offices offer an attractive way to increase awareness. These sustainability hubs empower students and staff to initiate their own activities to create a more sustainable environment (Kolstee, 2017). Our social and capitalistic elites must continue to flex their influence on the general population to join this movement to clean our oceans and bolster a more sustainable future. In October of last year Mr.Beast, a Youtube sensation pledged to donate $1 for every pound of trash removed from the ocean. In total Mr.Beast, his team, and a slew of volunteers were able to remove just over 33 million pounds of trash from the ocean. This is a small feat when the total weight of plastic floating at sea in 2014 was 268,940 tons (Lebreton. Et al, 2014). As the problem of plastic waste continues to balloon, an extremely practical approach that can be deployed is to focus efforts on regular beach clean ups (Eunomia Research & consulting, 2016) similar to what Mr.Beast did.

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3.6 River Trash Traps : Imani Nyambaka

Poor waste management and inadequate disposal of plastic debris is one of the major causes of plastic pollution (Bremer, 2019). People create, consume and carelessly toss garbage, and the debris ends up in bodies of water, posing a risk to marine life (Heimbuch, 2022). Thankfully, many solutions have been implemented to clean out the accumulated debris in the Earth's water. One solution is the use of river trash traps, which have two outstretched boom arms attached to nets that catch any waste floating just below the water's surface (Woods, 2021). The system is anchored by a detachable metal collection trap to increase mobility and ease maintenance. These traps are made to float and catch debris by allowing the current of the water to pull the trash into the trap ("Lat Phrao Canal, Thailand", 2022). They would be positioned along the water at regular intervals to prevent debris from floating downstream. The captured waste can be removed by any method that fits best, then transported to a nearby sorting facility. Up to 2500 kg of garbage can be removed from the water each day, with the majority of it being recycled and the remainder being compacted for use as fuel (Russel, 2021).

- **Environmental Impacts:** By selling all recyclables to nearby recyclers and sending non-recyclables to a waste-to-energy facility, the project hopes to limit the quantity of waste that is dumped in landfills. Additionally, since aquatic species can pass through the floating traps uninjured, the trap's effects on aquatic life are minimal (Silva et al., 2021).

- **Suitable Conditions**: The majority of the plastic in the Great Pacific Garbage Patch comes from waste that has traveled via rivers. Trash traps can be placed in various

types of waterways and can catch floating plastics, stopping them from entering the ocean (Silva et al., 2021).

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