

Cigarette Butt Litter Reduction Initiative with Voting Ballot Box Unit at Alexandra Beach, Sunshine Coast Australia

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submission for final major assignment of MOOC Marine Litter,
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July 2019

Abstract

Cigarette butts are the world's most common type of marine debris. They have been documented to negatively impact biodiversity, ecosystems, human health, and the economy. In order to address this, we conducted a social experiment of cigarette butt littering behaviour modification through the employment of a Cigarette Butt Voting Ballot Box to encourage appropriate and safe disposal of cigarette butts in a targeted area at Alexandra Beach, Sunshine Coast Australia. Utilising the Honolulu Strategy and in keeping with the United Nations Sustainable Development Goal 14, the initiative was an opportunity to educate the public as to the environmental and punitive consequences of improper disposal and generate awareness across the Sunshine Coast Region. It was also an opportunity to demonstrate collaborative partnerships between government, non-profit, local citizens and private sector organisations in response to the prevalence of this form of waste through the employment of behaviour modification initiative to achieve a 40% reduction in cigarette butt litter at this location at the conclusion of the trial.

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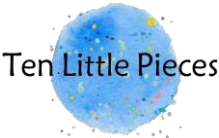
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Executive Summary:

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) has found that the vast majority of marine debris in Australia derives from land-based sources (Hardesty & Wilcox, 2014). Clean up data for the Sunshine Coast Region indicates that cigarette butts are consistently collected in large numbers (EnviroCom, 2019). Ten Little Pieces and Sunshine Coast Council discovered high concentrations of disposed butts on Alexandra Beach and near Alexandra Headland Surf Club.

In response to these findings, Ten Little Pieces collaborated with Sunshine Coast Council to conduct a source reduction management intervention at this identified source point. A Cigarette Butt Voting Ballot Box (CBVBB) was installed at the juncture of 3 pathways with beach access in a high traffic tourist destination at the Alexandra Headland Surf Club. Location-specific directional signage was installed on existing bins in the trial area, as was a large information board to inform the public of “did you know?” facts about the environmental impacts of cigarette butt waste and provide project updates.

Utilizing the principles of the Honolulu Strategy, stakeholders to the project included:

Principle Stakeholders	Secondary/Supporting Stakeholders
Ten Little Pieces	Tangaroa Blue Foundation
Sunshine Coast Council	Sea Shepherd Marine Debris Campaign Australia
EnviroCom	Alexandra Headland Community Association
Cleanwater Group	Sunshine Coast Environment Council
Alexandra Headland Surf Life Saving Club	Australian Industry Trade College
The smoking public	Surfrider Foundation Australia

In keeping with the findings of New South Wales Environmental Protection Agency (NSW EPA) (2018) report on littering behaviour and United Nation (UN) Sustainable Development Goal 14 (SDG 14), the objectives of the trial were:

- To demonstrate a collaborative approach between various stakeholders to address cigarette butt littering.
- To increase awareness of cigarette butts as a litter issue by employing game theory to encourage participation at the highly visible CBVBB unit.
- To inspire behaviour change by bridging the disconnect between individual action (littering one cigarette butt) and collective consequence through education on the environmental, aesthetic, economic and social impacts of littering toxic waste.
- To measure the overall amount of cigarette butt litter at this site and demonstrate a reduction in cigarette butt litter through data collection and analysis.
- To assess public perceptions of cigarette butt litter and its impact on the Region.
- To learn from the trial and further develop the methodology as a basis for replication across the Sunshine Coast Region in keeping with a vision for a #buttfreesunshinecoast.

The 12-week CBVBB trial was successful in preventing 1,999 cigarette butts from potentially entering the environment. At the same time, an incidental count from the trial area recorded 1,041 littered cigarette butts, while data from Gross Pollutant Traps (GPTs) installed in surrounding stormwater drains captured 143. In total, 3,183 cigarette butts were collected during the trial. Of the butts collected, 62.5% were captured in the CBVBB unit, 4.5% in the 3 GPT's under the trial area and the remaining 33% in incidental counts from litter collected in the trial area. Additionally, just prior to the commencement of the trial, Clean Up Australia Day volunteers collected 4,200 cigarette butts from an area including but extending outward from the trial area. During Week 9 of the trial, a mass beach clean-up covering a similar area, retrieved 3,500 cigarette butts. This indicates a 16.66% reduction in incidental cigarette butts littered at this location. 51 volunteers participated in the post trial area clean up held on July 21st 2019 by Sunshine Coast Council and Ten Little Pieces to cover the same areas as pre and mid trial clean ups. A total of 1265 littered cigarette butts were recorded. Extrapolating from the time intervals these clean ups were conducted at, this data represents a 40% reduction in cigarette butt litter recovered from at the trial location at the conclusion of the trial.

In addition to reducing cigarette butt litter and motivating proper disposal behaviour, the CBVBB trial included 72 population surveys in order to: gather qualitative data on public perceptions of cigarette butt litter; assess knowledge of possible punitive consequences for incorrect disposal; assess perceptions towards the provision of appropriate disposal units; and gauge public receptivity to the CBVBB technology.

In summary, the Cigarette Butt Voting Ballot Box trial at Alexandra Beach Sunshine Coast Australia led to the following recommendations:

- The development of an education and awareness campaign to inform the public of the environmental consequences of inappropriate and illegal disposal of cigarette butts.
- The enforcement of existing fines and/or cautioning by enforcement officers with regards to littering cigarette butts and smoking in prohibited areas including Sunshine Coast Beaches.
- The enforcement of the 10m smoking exclusion zone around the Alex Skate Park (Tobacco and Other Smoking Products Act, 1998).
- The retrofitting of existing cigarette butt disposal units to enhance their visibility to the smoking public.

Introduction

Cigarette butts are the most littered item in the world, with an estimated 4.5 trillion cigarette butts thrown away every year. Despite declining smoking rates, 20 billion cigarettes are consumed annually in Australia, resulting in an estimated 7 billion cigarette butts being discarded into the environment each year (Scollo and Winstanley, 2015). They are the most frequently reported item from activist organisation beach clean-up data in the Sunshine Coast Region (EnviroCom, 2019). In the preceding 2 years of this initiative, the Sunshine Coast Council Beach Clean Up Program recorded the incidence of cigarette butts at 18% (2016-17) and 15% (2017-18) in collected marine debris totals. These figures are augmented by Clean Up Australia Day data counts reporting cigarette butts and remnants as 13% of total collected clean up items across the nation, and 14% of recorded debris for the Sunshine Coast Region (Rubbish Report, 2018).

A large body of research has found that cigarette butts pose a major risk to the environment (Register, 2000; Gall & Thompson, 2015; Slaughter et al., 2011). Due to their small size and light weight, they are easily carried in stormwater runoff through drainage systems, eventually ending up in local streams, rivers, and waterways. Cigarette filters contain cellulose acetate, a form of plastic that does not readily biodegrade and can persist in the environment. It has been found that even just one cigarette butt can contain over 4000 toxic, and leachable, chemicals (Register, 2000). Marine debris is defined as “any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment” (UNEP, 2009). Cigarette butts can thus be considered as a toxic form of marine debris. Gall & Thompson (2015) write that marine debris is listed among the major perceived threats to biodiversity, and is cause for particular concern due to its abundance, durability and persistence in the marine environment.

In response to community concerns regarding the prevalence of cigarette butt litter at Alexandra Beach and Headland, Sunshine Coast, a 12-week trial of a Cigarette Butt Voting Ballot Box was conducted. The purpose of the trial was to prevent further litter from polluting the environment, raise awareness within the community about the negative impact of cigarette butt litter, and motivate smokers as to proper disposal methods.



Figure 1. Synoptic Scale Map of Sunshine Coast, Australia (marked by the red pin) (Google Maps, 2019)

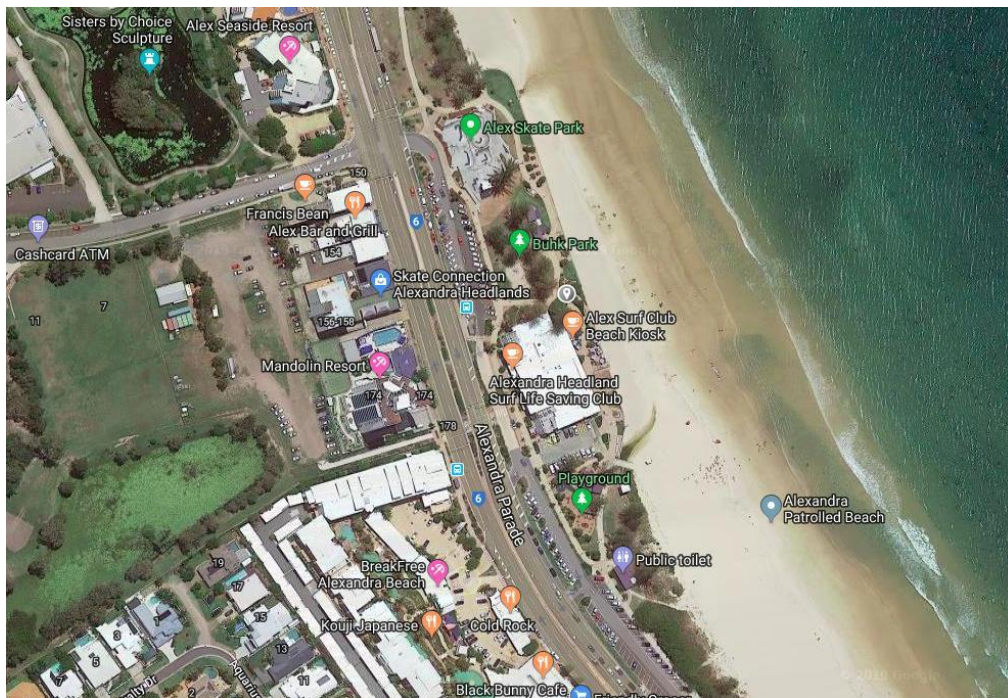


Figure 2. Map of Trial Area (location of CBVBB marked by the grey pin, north east of the Surf Life Saving Club) (Google Maps, 2019)

In preparation for the project, research was undertaken to gather insight from similar projects around Australia. Findings from the NSW EPA Cigarette Butt Litter Reduction Experiment (2018) were utilised identifying 4 pillars of effective cigarette butt littering behaviour change:

- 1) An awareness of the environmental consequences of littering cigarette butts.
- 2) The availability of suitable disposal units.
- 3) The absence of accumulated cigarette butt debris.
- 4) The knowledge of and likely enforcement of fines for littering.

The CBVBB initiative was predominantly an opportunity to raise awareness of cigarette butt litter as a pressing environmental issue. It intended to inspire behaviour change that could be measured scientifically through a recorded reduction in littered cigarette butts at the trial location by comparing pre-trial, trial and post-trial data collections. The initiative demonstrates the necessity of enforcement of existing legislation to mitigate illegal disposal of cigarette butts, as well as the aesthetic, environmental, human health and economic impacts of cigarette butt litter across the Sunshine Coast Region. Expansion of the CBVBB technology at other identified source locations for cigarette butt litter will be considered by Sunshine Coast Council based on the results of this trial.

The precautionary principle holds that when an activity raises threats to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically (Barnes, 2011). This principle has been embodied in relevant laws including the Tobacco and Other Smoking Products Act (1998) the Waste Reduction and Recycling Act (2011) and in international treaties (Barnes, 2011).

In March 2011, the Fifth International Marine Debris Conference (5IMDC) brought the marine litter community together to develop and create a document known as the Honolulu Strategy. The Honolulu Strategy is a framework for a comprehensive and global effort to reduce the ecological, human health, and economic impacts of marine litter. It is intended for use as a planning tool, common frame of

reference for collaboration, and a monitoring tool on multiple levels —global, regional, national, and local— involving the full spectrum of civil society, government and intergovernmental organizations, and the private sector (UNEP & National Oceanic and Atmospheric Agency, NOAA, 2011).

The accumulation of marine debris, 80% of which comes from land, is a compounding ecological threat (Jambeck et al., 2015). With degradation rates of hundreds of years, it is estimated that by 2050, there will be more plastic in the oceans than fish (Solheim, 2017). With a staggering 60% reduction in global biodiversity in the last 35 years (WWF, 2018), every effort to mitigate the impact of plastic and reduce the input of plastics to our oceans is worthwhile.



Figure 3. "How Long Until It's Gone?" (NOAA, 2015)

Impacts of Cigarette Butt Litter

Ecological Impacts

Novotny et al. (2009) purport that whatever their direct health impact on, or benefit to, smokers, cigarette filters pose a serious litter and toxic waste disposal problem. Cellulose acetate contained in filters is photodegradable but not biodegradable and although ultraviolet rays from the sun will eventually break the filter into smaller pieces under normal environmental conditions, the source material never disappears; it essentially becomes diluted in water or soil (Smith and Novotny, 2011).

This presents a significant problem as cigarette butts contain over 4000 toxic, and easily leachable, chemicals including arsenic, carbon monoxide, ammonia and vinyl chloride (Slaughter et al., 2011). This research is affirmed by the findings of Moriwaki, Kitajima & Katahira (2009) who reported that arsenic, nicotine, polycyclic aromatic hydrocarbons and heavy metals are released into the environment by littered 'roadside waste' cigarette butts. When combined with the findings of Tanaka et al. (2012) that transfer of plastic-derived chemicals to biological tissues may occur in many species of birds, the toxicity and leachability of chemicals suggests likely biomagnification throughout the food chain (British Medical Journal, 2016).

Plastic ingestion by wildlife has thus far been widely documented. Wilcox, Seville & Hardesty (2015) found that over 90% of seabirds have been found to have plastics in their stomachs (including cigarette butts) and that the highest recorded numbers of effected seabirds are located on the Southern Ocean Boundaries where large concentrations of sea bird species eat, forage and breed. Qamar et al. (2016) identified that the regions of highest risk to global sea turtle populations are off the east coasts of the USA, Australia and South Africa, the east Indian Ocean, and Southeast Asia. Based on currently available data, initial calculations indicate that up to 52% of sea turtles may have ingested debris (Qamar et al., 2016).

According to research conducted by Wilcox, Seville & Hardesty (2015), plastics have the most devastating impact in regions with the greatest biodiversity. The Sunshine Coast Region of South East Queensland has significant ecological value as evidenced by the proposed nomination for UNESCO Biosphere status supporting the Sunshine Coast Council's vision to be Australia's most sustainable region (Sunshine Coast Council, 2019). The regions waterways feed to the Coral Sea, hosting 49 separate ecosystems (Australian Marine Conservation Society, AMCS, 2019). The Region is also home to over 300 endangered, threatened and vulnerable species including Loggerhead Turtles that nest on Sunshine Coast beaches, and Humpback Whales that migrate through these waters (AMCS, 2019). The efficient translocation of cigarette butts, their small size and impressive durability heightens the likelihood of ingestion by wildlife in the rich local environment and beyond (Gould, 2015).

Human Health Impacts

Novotny (2011) found that nicotine from cigarette butts may cause vomiting and neurological toxicity in animals and children. Further, he discovered leachates of cigarette butts in aquatic environments may cause exposure to additional toxic chemicals including heavy metals, ethyl phenol, and pesticide residues, 50 of which are known carcinogens. Cigarette butts are thus considered a continual point source of toxic pollutants when released to aquatic environments (Slaughter et al., 2011).

The attractiveness of Sunshine Coast beaches and coastal environment is a major drawcard for the thriving tourist industry. As beachgoers enjoy the temperate waters and surf breaks, there is also a risk of injury from non-extinguished cigarette butts being disposed of on beaches.

Due to their ease of translocation, and fragmentation over time into microplastic fibres, Auta, Emenike and Fauziah (2017) suggest that identifying the main sources of microplastic pollution in the environment and creating awareness through education at the public, private and government sectors will go a long way in reducing the entry of microplastics into the marine environment.

The ubiquity of cigarette butt waste and its potential for adverse effects on human and animal health warrants the application of the precautionary principle to preserve the natural, cultural, socio-economic and heritage values (Director of National Parks, 2018).

Socioeconomic Impacts

The Queensland Litter and Illegal Dumping Action Plan (2013) states that littering of all kinds pollutes our environment and significantly diminishes the use, enjoyment and value of our public places, costing millions of dollars each year in waste management and clean up expenses. An environment polluted with rubbish deters visitors and impacts on the Sunshine Coast Region tourism industry which attracted 2 million domestic visitors and generated \$2.4 billion in the year ending September 2018. 319,000 international visitors were also welcomed spending \$248.2 million (Tourism Research Australia, 2019).

The traditional owners of the Sunshine Coast area are The Gubbi Gubbi Dyungungoo people whose spiritual connection to the land and duty to protect it from environmental damage and degradation have earned this initiative their support (Stuart, 2019).

The Queensland Waste Management Act (2011) encourages publicised acts of deterrence to gain the support of the community and demonstrate that the Queensland Government is serious about tackling litter and illegal dumping. The Act aims to ensure active and timely enforcement of the legislation across the state and that this commitment is clearly articulated to the wider community.

Clean up activities and maintenance of public spaces require significant investment that is borne, for the most part, by municipal-level governments (Wallbank, MacKenzie and Beggs, 2017). These funds derive from a limited pool of fiscal resource and diverts funds from other council services.

Project Proposal

The prevalence of cigarette butts on Sunshine Coast beaches has recently been brought to attention with thousands collected in community clean ups (Clean Up Australia Day, Sea Shepherd Marine Debris Australia and Sunshine Coast Council's clean-up for the turtle hatchlings). Having participated in all these clean-ups, Ten Little Pieces approached Sunshine Coast Council and the Alexandra Headland Surf Club to collaborate on a cigarette butt reduction initiative in a specific location known to be a pollution source. Ten Little Pieces motivated stakeholders to raise awareness and collaborate to find intervention solutions to the issue of cigarette butt litter at a local level. A Cigarette Butt Voting Ballot Box with directional signage in the trial area was installed on 6th April 2019. Research indicates that individuals who feel attached to a place and who have taken this place on as part of their identity would be expected to behave in a way that protects that place (Jorgensen & Stedman, 2001). As such, the strong community of Alexandra Headland Surf Club was leveraged in support of this trial.

The primary ambition of the project is to challenge the social acceptability of cigarette butt littering in keeping with the NSW EPA Cigarette Butt Litter Experiment (2018) and the work of Heaton, Cummings, O'Connor and Novotny, (2011) who suggest that perceptions of social acceptability of cigarette butt littering are grounded in a lack of awareness and education around their toxicity to the environment.

Objectives

- To reduce the incidence of cigarette butt litter at the trial location demonstrated by comparison of clean up data before, during and after the trial with the ambition of reducing this source of marine debris.
- To increase public awareness of cigarette butts as litter at a local and regional level.
- To encourage behaviour change through voting game play and bridge the disconnect between individual action (littering one cigarette butt) and collective environmental and social consequence (thousands of cigarette butts littering Alexandra Beach, the coastlines of the region and coastal waterways).
- To utilise the findings of the CBVBB as the basis for a Region wide initiative to reduce the incidence of cigarette butt litter incorporating the identification of other source points for cigarette butt litter across the Region in accordance with UN SDG 14.
- To provide education to the local community, visiting tourists and the local smoking public on the environmental consequences of cigarette butt waste, the dangers of irresponsible disposal of cigarette butts and the penalties that can apply under existing law.
- To encourage a cultural shift in the acceptability of littering cigarette butts in a defined area monitored by the community who frequent it (Alexandra Headland Surf Club staff and patrons).
- To gather qualitative data from user surveys to influence local government education and awareness campaigns, and to encourage enforcement of existing anti-littering law.
- To assess existing infrastructure (signage and bins) and its adequacy for cigarette butt waste capture and the encouragement of appropriate disposal.

Honolulu Strategy Principles

Developed in 2012, the Honolulu Strategy encourages innovative solutions to tackle marine debris and has, in this case, been utilized by Not For Profit and member of the UNEP Global Partnership on Marine Litter, Ten Little Pieces. It has provided a framework for addressing the ecological, human health and economic impacts of cigarette butt litter as a source of marine debris. As a planning tool for developing this specific marine debris project it has been utilized as a common frame of reference for sharing best practices and has encouraged collaboration between stakeholders including civil society, government and private sector actors.

The CBVBB initiative addresses Goal A of the Honolulu Strategy to reduce the amount and impact of land-based sources of marine debris introduced to the sea by using innovative intervention to raise awareness and has encouraged collaboration with invested stakeholders to bring about behaviour change.

The CBVBB initiative intended to build capacity to monitor and enforce compliance with regulations and permit conditions regarding litter, dumping solid waste management, stormwater and surface runoff in keeping with Strategy A6 and to conduct education and outreach on marine debris impacts and the need for improved solid waste management (Strategy A1). This project also incorporated Strategy A7 by conducting regular clean-up efforts at the location of the trial, an identified source point of marine debris.

Strategies

Awareness and Support Seeking Strategies

Ten Little Pieces approached local council with data counts and anecdotal evidence to support the importance of addressing the source reduction of cigarette butts at this location. In discussions, Sunshine Coast Council indicated a range of internal policies and action plans in place to address litter across the Region including the Marine Debris Action Plan. After securing the support of the Alexandra Headland Surf Club and the Alexandra Headland Community Association in a series of solution focused consultations, the trial of a cigarette butt voting ballot box was proposed to council with responsibility for managing the trial and reporting on the progress and outcomes by Ten Little Pieces.

According to Storrier & McGlashan, (2006), raising public awareness is the only guaranteed way of reducing marine litter. They go on to purport that a combination of education, provision of adequate waste reception facilities and enforcement of legislation is needed to tackle beach litter.

Research and Innovation

The CBVBB incorporates Game Theory to encourage participation by the local smoking public by encouraging smokers to vote with their butts in an either/or situation. With two visible receptacles for the containment of disposed butts, smokers can properly dispose of their butts in a fun way in response to popular culture questions. The novelty of the disposal method allows for environmental consequence information to be provided to participants by way of a large information board behind the CBVBB with data on cigarette butt litter incidence and impact as well as trial butt count updates.

The collected debris from the Gross Pollutant Traps in the storm water drains under the trial area has been used as a training opportunity for students at the Australian Industry Trade College who have analysed that data, entered it into the Tangaroa Blue Australia Marine Debris Initiative Database and used the trial as an opportunity to identify source reduction opportunities under the guidance of representatives from The Cleanwater Group. Additionally, The Cleanwater Group will utilize the collected cigarette butt debris from the entire CBVBB initiative to demonstrate circular economic outcomes by using this waste product to design a larger voting ballot box for placement at the major regional hospital.

Linking and Relational Management Strategies:

A project plan was drafted identifying the relevant stakeholders to the initiative and a collaborative forum was established to discuss expectations and roles. The stakeholders committed to their roles for the duration of the trial with the agreed principle objective, to reduce the incidence of cigarette butt litter at this location. The scope of the project was expanded to include the Cleanwater Group to leverage an existing collaborative partnership on the reduction of marine debris between Cleanwater Group and Sunshine Coast Council. As the trial progressed, Clean Up Australia, Tangaroa Blue and Sea Shepherd Marine Debris Australia offered their support in terms of data capture, clean-up activities and public relations support. The involvement of social media and local print media to raise public awareness and provide updates on the progress of the trial has been highly successful with 38 national and international groups and councils requesting the final project plan for replication in their areas.

Stakeholders

- Ten Little Pieces committed to develop the project proposal, present the management and service plan, to maintain the CBVBB for cleanliness and data capture, to liaise with all stakeholders and report on the findings of the trial.
- Sunshine Coast Council utilized several areas of operation to support the initiative including the Coastal Projects Team, the Litter Management and Waste Collections Team and Parks and Gardens Staff. Council committed to provide infrastructure funding, management resources, to install the CBVBB trial infrastructure and to align the project with the Sunshine Coast Council Waste Management Strategy with a view to replicating the trial in a region wide effort to reduce the incidence of cigarette butt litter. Further, the Council committed to develop and coordinate media activities and press releases.
- Parks and Gardens Services committed to additional area surveys throughout the trial to report on incidental cigarette butt counts from the immediate area of the CBVBB
- EnviroCom committed to providing historical cigarette butt data counts for comparison to trial results and assisted with data analysis.
- Cleanwater Group committed to manage and monitor the 3 Gross Pollutant Traps (GPT's) closest to the trial area by screening debris from the storm water drains under the trial area with the objective of minimizing land-based litter reaching open water. Cleanwater Group are investing in the circular economic ambition of recycling the captured cigarette butt litter from this CBVBB trial to create additional CBVBB's for use at other point source sites across the Region.
- Australia Industry Trade College students identified data from GPT's for upload to the Australian Marine Debris Initiative Database (AMDI) developed by Tangaroa Blue.
- Alexandra Headland Surf Life Saving Club committed to sharing trial updates with their strong community base and display "Vote with Your Butt" posters within their establishment to encourage participation from their patronage and support the objectives of the trial.

Supporting Actors

- Sunshine Coast Environment Council endorsed the initiative as Ten Little Pieces is a member of the Council.
- Alexandra Headland Community Association committed to inform local businesses of trial updates and work towards source reduction initiatives in the local area.
- Sea Shepherd Marine Debris Australia coordinated the mid-trial area clean-up.
- Clean Up Australia endorsed the initiative as Ten Little Pieces is an official community ally.
- 5 Gyres endorsed the initiative as Ten Little Pieces is a 5 Gyres Ambassador.
- UNEP Global Partnership on Marine Litter – Ten Little Pieces is a partner.
- Surfrider Foundation Australia indicated support for community engagement of local businesses to achieve Ocean Friendly status, a framework for businesses to reduce the impact of single use plastic.

Methodology

The Cigarette Butt Voting Ballot Box (CBVBB) was installed to take advantage of a high traffic juncture of pathways and beach access points at a popular tourist destination for the region, Alexandra Headland Surf Life Saving Club overlooking Alexandra Beach, Sunshine Coast. The project commenced just prior to the Easter School holidays coinciding with the second largest influx of tourists to the Region (see Figure 2).

The CBVBB was serviced weekly to collect data and maintain cleanliness with a weekly change of voting question (Appendix 2) to encourage participation through Game Theory to encourage more “(eco)rational” behaviour among trial participants (Hargreaves, 2011). The collected butt data for the CBVBB and incidental counts for the location was entered weekly into the Australian Marine Debris Initiative Database.

A large information board was installed next to the unit providing trial data updates and informing the public of the environmental consequences of cigarette butt litter both in the region and in the wider marine environment (Appendix 3).

Directional signage was installed on all existing bins across the trial area (Appendix 4) and “Vote With Your Butt” posters were designed (Appendix 5) for distribution to local businesses to engage the wider community surrounding the location of the trial.

A population survey was designed (Appendix 6) for gathering qualitative data around perceptions of cigarette butt litter and incentives for behaviour change. In total, 72 surveys were conducted throughout the trial.

Parks and Gardens maintenance teams from Sunshine Coast Council conducted weekly incidental cigarette butt monitoring and recording from the trial area.

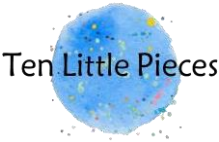
Cleanwater Group provided monthly counts from the Gross Pollutant Traps installed in the storm water drains under the trial area (Appendices 7 & 8) facilitated by the involvement of students from the Australian Industry Trade College who were trained in the analysis of marine debris in accordance with the Tangaroa Blue Australian Marine Debris Initiative database guidelines.

EnviroCom provided data counts of cigarette butts at this location from previous clean-ups including Clean Up Australia Day data which was held just prior to the commencement of the trial on March 4th 2019. EnviroCom also collated data on the incidence of cigarette butt litter collected across the region to provide context to the pervasive impact of this waste item on the local environment.

Reporting on the outcomes, learning opportunities and the identification of additional resources required for this initiative also form part of the methodology of the trial to support the successful expansion of a wider cigarette reduction initiative across the Sunshine Coast Region.



Top L: Sandie Johnson of EnviroCom and Alison Foley of Ten Little Pieces at the unveiling of the CBVBB trial
 Top M: Directional and instructional signage installed across all existing waste disposal units in the trial area
 Top R: Servicing the unit and recording weekly data counts
 Mid L: Information Board installed next to the CBVBB
 Mid M: Incidental debris collected from the trial during week 3
 Mid R: Cigarette butt on Alexandra Beach July 2nd 2019.
 Lower L: Personalized cigarette butt disposal units provided to participants of the initiative survey
 Lower M: Evidence of incidental cigarette butt debris collected during week 8
 Lower R: Sea Shepherd Marine Debris Campaign & Ten Little Pieces collection of 3500 cigarette butt debris from Alexandra Beach, Headland, Carpark, Skate Park, Buhk Park, Main Street, Walkways and CBVBB location on Sunday June 8th 2019.



DPSIR

According to the DPSIR framework developed by Kristensen (2004) there is a chain of causal interdependent links used for describing the interactions between society and the environment. Starting with 'driving forces' (economic sectors, human activities) through 'pressures' (emissions, waste) to 'states' (physical, chemical and biological) and 'impacts' on ecosystems, human health and functions, eventually leading to political 'responses' (prioritisation, target setting, indicators) and other interventions by community or private sector actors. In this application, the pervasive problem of cigarette butt litter is defined as follows:

Drivers:

- Inappropriate and illegal disposal of toxic cigarette butts by smokers visiting Alexandra Beach, a major tourist destination.
- The perceived social acceptability of littering cigarette butts (Curnow and Sperh, 2017).
- Lack of knowledge as to environmental consequences of littering cigarette butts.
- Lack of enforcement of fines for littering cigarette butts.
- Translocation of toxic cigarette butts into the Coral Sea, home to 300 endangered species.

Pressures:

- The continued accumulation of cigarette butts at this naturally beautiful location which draws hundreds of thousands of tourists annually.
- The presence of cigarette butt litter has been identified as a contributing factor in encouraging other smokers to litter their butts (Curnow & Sperh, 2017).
- With population growth expected to increase via net migration of 14% (2016-2021), to reach a predicted 345,782 in 2021, pressures on existing infrastructure and the local natural environment are expected to increase also (Sunshine Coast Council Environment and Sustainability Report, 2018).
- The construction of expanded airport facilities is expected to boost tourism both from international and interstate visitors.
- The ready translocation of cigarette butt toxic waste to the fragile coastal ecosystems of the region and their impact on the Coral Sea environment.

State:

- Statistical evidence from recent beach clean ups highlights the enormous volumes these toxic, highly durable and translocatable cigarette butts are being retrieved in (EnviroCom, 2019).
- The recent attention that marine debris has had in the media has seen volunteer numbers for beach clean ups increase significantly with a corresponding growth in the awareness of the impact of marine debris on the environment (EnviroCom, 2019).
- The release of toxins from discarded cigarette butts affects water quality, soil quality, and habitat integrity (Harris, 2011).
- With economic dependence of the Region on tourism due to its natural beauty and subtropical climate, the statistical evidence highlighting the prevalence of cigarette butts recovered in beach clean-up activities, means the issue deserves immediate intervention.

Impact:

- The prevalence of cigarette butts in the Region (and on a global scale) has environmental, social, economic, health, and aesthetic impacts. The 4000 toxins within a cigarette butt leach easily into water and are readily ingested by wildlife due to their small size and propensity to float for extended periods (Dangerfield, 2018). Of the toxins they release to the environment, over 50 are known carcinogens and many are heavy metals that can biomagnify through the food chain (Curtis, Novotny, Lee, Freiberg & McLaughlin, 2017).

- The presence of cigarette butt litter on coastal areas can depreciate the aesthetic value of beaches negatively effecting tourism in terms of quality of experience and appreciation for the natural beauty of the region.

Response:

- The installation of a Cigarette Butt Voting Ballot Box to encourage appropriate disposal of cigarette butts using Game Theory to encourage participation. Additionally, the installation of area wide signage and monitoring of incidental cigarette butt litter counts in the direct vicinity of the unit including the Gross Pollutant Traps in the storm water drains under the trial area for the 3 month trial duration.
- A collaborative approach between Ten Little Pieces, Sunshine Coast Council, Cleanwater Group, Parks and Gardens and Alexandra Headland Surf Club as a supporter of the trial has demonstrated an awareness of the negative environmental, aesthetic, social and economic impacts of cigarette butt litter by civil society, government and private sector actors. Further, there is intention to raise awareness of the issue across the wider community through a targeted awareness and education campaign.
- On reviewing the data of collected cigarette butts at this single location, the necessity of employing all available mechanisms within existing legislation must be considered.
- By using this CBVBB as a trial for replication at other identified source points for cigarette butt litter, stakeholders can identify opportunities for learning and methodology adjustment to assess the effectiveness of the technology in reducing cigarette butt litter.
- The focus of the initiative is on source reduction and consumer responsibility to appropriately dispose of cigarette butts and minimise their pollution of the environment.
- Once collected, the cigarette butts will be recycled by Cleanwater Group and converted into new CBVBB's using a innovative recycling technologies. These units will be installed at other identified source points for cigarette butt litter across the region.

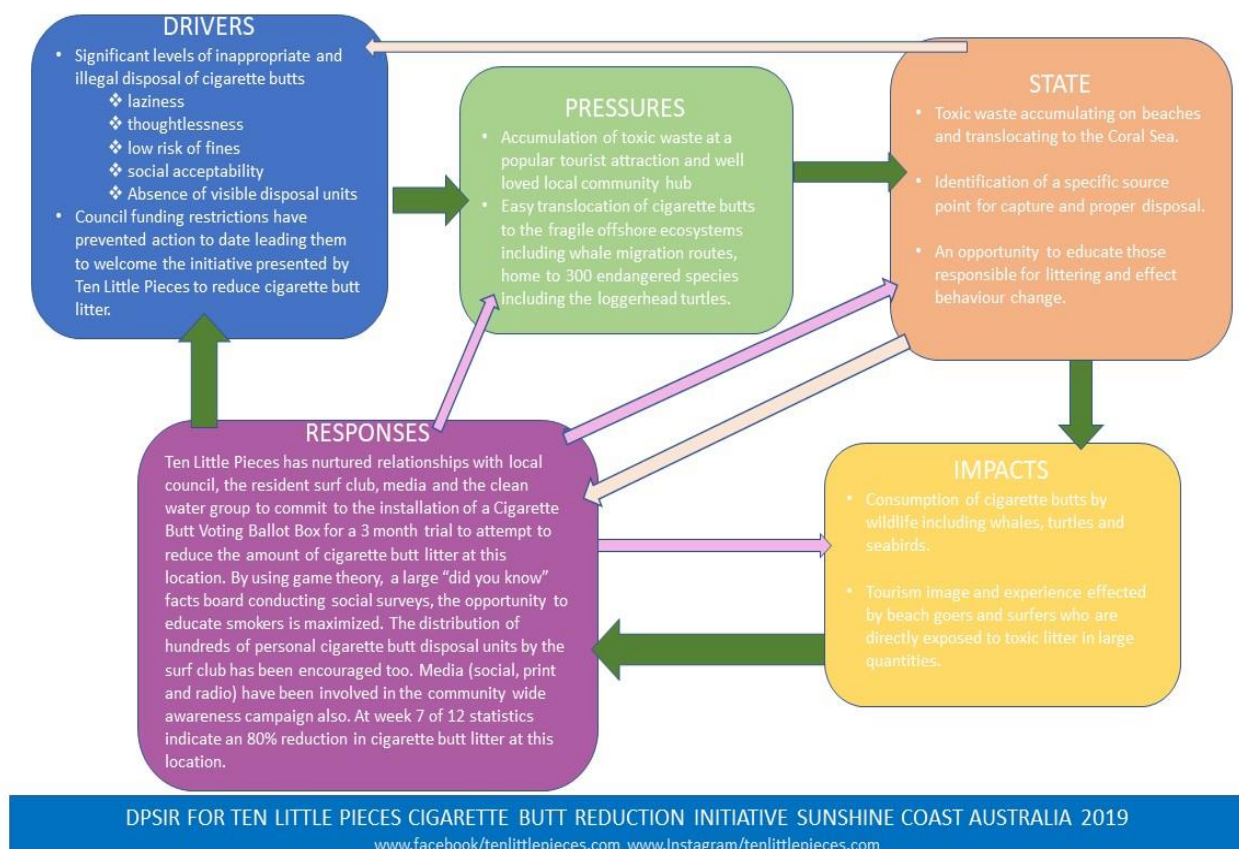


Figure 4. DPSIR For Ten Little Pieces CBVBB Initiative

UN Sustainable Development Goal 14

Adopted by all United Nations Member States in 2015, The United Nations Sustainable Development Goals are a blueprint to achieve a better and more sustainable future for all in promoting prosperity while protecting the planet. Addressing 17 global challenges, they interconnect to influence policy to reach their attainment by 2030.

Sustainable Development Goal 14 aims to conserve and sustainably use the oceans, seas and marine resources. Subtitled “Life Below Water” target 14.1 identifies that by 2025, member states commit to prevent and significantly reduce marine pollution of all kinds from land-based activities, including marine debris and nutrient pollution.

It directs that 1) we should focus on the implementation of short-term solutions to reduce immediate negative effects of marine debris and waterway pollution and 2) we should focus on long term changes in production and consumption (UNEP 2015) in support of circular economic practices (Schroeder, Anggraeni and Weber, 2018).

In Nairobi 2019, the United Nations Environment Assembly under Resolution 4/6 of the UNEP supported recognizing the work of the regional seas conventions and programmes for the protection of the marine and coastal environment and reiterated its invitation to regional and international organizations and conventions to increase their action to prevent and reduce marine litter, including plastic litter and microplastics, and the harmful effects thereof and, where appropriate, coordinate such action to achieve that end (UNEP/EA 2019).

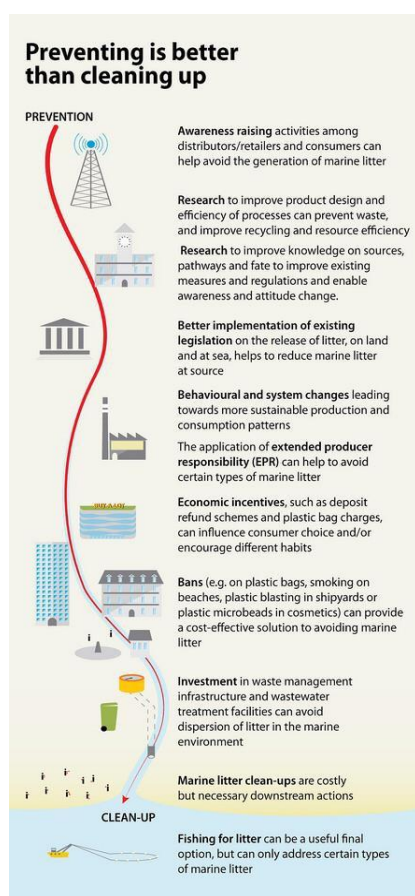


Fig 5: UNEP Marine Litter Vital Graphics

Awareness Raising

In relation to the issue of cigarette butt litter and its effect on the local Sunshine Coast Environment, the CBVBB initiative has utilized many of the suggested methods of preventing this waste leaving land and entering the waterways of the region.

Primarily, the CBVBB initiative aims to raise awareness not merely among the smokers who are directly responsible for inappropriate and illegal disposal but also for the local community, local council, state level governance, interstate councils, and national and international community groups who are encouraged to adopt this methodology to address cigarette butt litter in their own environments.

As part of United Nations Environment Program - The Global Partnership on Marine Litter, Ten Little Pieces acknowledges awareness raising is the first step in bringing together governments, civil society, local authorities, academia and the private sector to find realistic solutions to reducing and managing marine litter.

The pervasive and insidious nature of cigarette butt waste warrants novel and wide-spread approaches to mitigate the vast volumes that are reaching our waterways as supported by the assertions of Watkins et al., (2015).

Implementation of Existing Legislation and Regulation

There are several mechanisms within existing Queensland law designed to prevent the illegal disposal of waste including cigarette butts. The devastating environmental, aesthetic, health and economic impacts of this toxic waste must be mitigated in keeping with Barnes (2011) assertion that the Precautionary Principle should be employed in relation to cigarette butt litter and that this has been embodied in the laws and international treaties on the management of marine debris (Goldstein, 2001). However, the volume of cigarette butts disposed each year throughout the region (EnviroCom, 2019) pose a significant challenge for disposal regulators, primarily because there are thousands of points of disposal (Barnes, 2011).

The NSW EPA Cigarette Butt Litter Reduction Program (Curnow & Spehr, 2017) concluded the knowledge of and likely enforcement of fines (or cautions) is one of the 4 factors necessary to encourage behaviour change in those littering cigarette butts. In combination with the provision of appropriate disposal units, the absence of cigarette butt litter and the knowledge of environmental consequences of inappropriate disposal, Byron Shire Council NSW achieved a %78 reduction in the incidence of cigarette butt litter over the course of the first year of the #buttfreebyron campaign (Akkerman, 2019).

Queensland's Litter and Illegal Dumping Action Plan, (2013) oversees the delivery of five interactive state level programs to mitigate the impact and incidence of litter on Queensland environments.

- reactive compliance and evaluation
- education, engagement and awareness raising
- data, research and evaluation
- hotspots
- capacity building and networking

The Queensland Waste Reduction and Recycling Act (2011) aims to:

- promote waste avoidance and reduction, resource recovery and efficiency actions
- reduce the consumption of natural resources and minimise the disposal of waste by encouraging waste avoidance and the recovery, re-use and recycling of waste
- minimise the overall impact of waste generation and disposal
- ensure a shared responsibility between government, business and industry and the community in waste management and resource recovery
- support and implement national frameworks, objectives and priorities for waste management and resource recovery.

The act of littering just one cigarette butt is deemed an offence under this Act which can incur a \$266 on the spot fine and is classified under s103(1)b: general littering. Arguably, given the toxic nature of cigarette butt waste, littering cigarette butts could be considered under s103(1)a: dangerous littering which can incur a penalty infringement notice of \$533 per offence.

The Sunshine Coast Council Litter Management Plan (2014-2016) aims to increase the enforcement of littering and illegal dumping, increase community awareness of littering and illegal dumping and encourage community involvement in litter and rubbish dumping prevention. By Sunshine Coast Councils own admission, resources have not been adequately allocated to enforce punitive deterrence efforts.

Given the toxic nature of cigarette butt waste there is an argument that citizens are bound by a general environmental duty as defined in the Environmental Protection Act (1994). In assessing the fulfillment of general environmental duty the following should be considered:

- nature of the harm or potential harm
- sensitivity of the environment effected
- current state of technical knowledge for the activity including best practice disposal methods.

Whilst there is no specific offence for a citizen failing to fulfil general environmental duty, if the action causes environmental harm, there are mechanisms within local law to develop location specific regulations including banning harmful activities at specific locations.

From September 1, 2016, smoking has been banned within 10m of playgrounds or skate parks under the Tobacco and Other Smoking Products Act (1998). This law is primarily enforced by Queensland Health Environmental Health Officers. The Alex Skate Park is located within the trial area. From the cigarette butt litter observed and retrieved from the skate park during the trial, we conclude that this exclusion zone is not enforced. Not only is it illegal to smoke in this restricted area (one offence can incur 2 penalty units totalling \$261.10), to litter one cigarette butt can incur the additional and separately applicable fine discussed above under The Queensland's Waste Reduction and Recycling Act (2011).

It is also an offence under the Tobacco and Other Smoking Products Act (1998) to smoke between the patrolled flags at Sunshine Coast Beaches, including Alexandra Beach. Whilst it is not inferred that all smokers on beaches litter their butts, evidence suggests that many do. No data was collected from this trial in relation to cigarette butts found between the flags of this patrolled beach.

There is an argument that tobacco and liquor laws should be expanded to include safe disposal of the waste products generated through smoking (Wallbank, MacKenzie, and Beggs, 2017), which are presently covered only by waste management and littering law. The increasing evidence of the ubiquity of plastics contamination in the marine environment, the continued rapid growth in plastics production, and the evidence of demonstrated impacts to marine wildlife support immediate implementation of source-reducing measures to decrease the potential risks of plastics in the marine ecosystem (Law, 2017).

Behavioural and Systems Change

The volume of cigarette butts recorded at region wide clean ups indicates that littering cigarette butts is extremely common (EnviroCom, 2018, 2019; Clean Up Australia, 2018, 2019). Moreover, Curnow & Sephr, (2018) conclude that there is a degree of social acceptability to cigarette butt disposal that can be changed through the combination of 4 factors:

1. Availability of and proximity to appropriate disposal units:
In the CBVBB trial location there were 23 waste disposal bins, 3 recycling bins and 2 designated cigarette butt receptacles (although these are not clearly indicated through appearance or signage)
2. Awareness of the environmental consequences of littering cigarette butts:
The large information board installed beside the CBVBB provided factual information, local clean up data on recovered butts, statements of environmental impacts and characteristics of this toxic waste.
Coverage of the trial on social media by the stakeholders to the initiative, and reporting on local radio and print news has contributed toward awareness raising of the issue.
3. The absence of accumulated cigarette butt debris:
The weekly incidental butt count necessitated a thorough sweep and recovery of butts from within the trial area.
4. Knowledge of and likely enforcement of punitive action (fines).
The CBVBB participant surveys indicated that it was not widely known that littering cigarette butts could incur a \$266 on the spot fine. (88.9 % of respondents).

In accordance with the Sunshine Coast Council Waste Strategy (2015-2025) the Council has committed to continuing to work with and engage their community to help change personal behaviours, including outreach and education campaigns in relation to littering.

Research

Hardesty and Wilcox, (2014) purport that in working together, scientists, industry partners, coastal managers and citizen scientists can make significant strides to reduce debris impacts in coastal areas and in the marine environment. As such the CBVBB trial has provided an opportunity to quantify the incidence of cigarette butts at this identified source point. By networking and collaborating with many stakeholders, the initiative serves as a learning opportunity to assess the receptivity of the smoking public to the technology and provide the basis for a wider awareness and education campaign to reduce the impact of this toxic waste on our coastal and aquatic environments.

The Cleanwater Group has utilised the input of the Australian Industry Trade College to monitor and measure the debris collected from the Gross Pollutant Traps under the trial area and the extension of these efforts over the next 12 months could indicate peak litter times which could be useful in enforcement activity scheduling.

The media coverage that the initiative has generated has resulted in the identification of several significant source points for cigarette butt debris across the Region. These will be assessed for inclusion in the expanded CBVBB initiative.

Extended Producer Responsibility

With growing awareness of the impact of single use plastics on our environment, it is necessary to consider the extension of producer responsibility on tobacco products. Made of cellulose acetate, a durable form of fibrous plastic, it can be argued that given the cumulative impact of the 5.8 trillion cigarette butts disposed of improperly annually, that redesign should be considered and that producers should be central to efforts to mitigate the damage they are wreaking to the environment.

Tobacco companies have misled their consumers for decades as to the benefits of cellulose acetate filters in their products (Harris, 2011). Two thirds of participants surveyed did not know cigarette filters are made from plastic (66.6%). There is an argument that producers should share in clean-up costs or disposal mechanisms to account for the full life cycle of their products (Wallbank, MacKenzie, & Beggs, 2017). If producers were convinced to adopt biodegradable alternatives to existing butt design, this would not eliminate the concentrated toxins contained within the waste product that enter the environment. Having said that, some producers have designed biodegradable cigarette filters which have native seeds in them. Karma Filters suggest that in disposal, their waste products can be planted to regenerate communities with herbs, shrubs, bee supporting species and even trees. While this redesign removes single use plastic as a waste product from cigarettes, it does not address the leaching of toxic chemicals to the environment which are likely to be absorbed by the soil where they are planted. It may also imply endorsement of irresponsible disposal by consumers who may then justify littering them due to their biodegradable nature.

Producers could be encouraged to extend their responsibility not only through redesign, but through funding education and awareness campaigns for safe and appropriate disposal of the waste generated by their products to account for their full life cycle. Funding for appropriate disposal infrastructure could be requested as could investment in circular economic applications of the waste to improve the communities that their products effect.

Another suggestion is to activate the networks of tobacco product retailers across the region to disseminate the message at point of sale of responsible disposal and encourage the provision of personal cigarette butt disposal units or pouches. The inclusion of retailers and consumers in sharing responsibility for waste management and capture is referred to by Barnes (2011) as Product Stewardship.

Economic incentives

Reducing Clean-up Costs

As the most frequently reported single item in Sunshine Coast Council Clean Up Data (EnviroCom 2019) the costs of maintaining shared spaces to be free from debris must be considerable for municipal authorities. The cost of not maintaining these areas to be debris free is more difficult to assess given that tourist experiences and perceptions of enjoyment do not have a direct financial measure and the impact on environmental degradation due to plastic pollution is incalculable. Efforts should therefore be driven by the precautionary principle to employ any and all available methods to reduce the amount of debris entering our waterways. The incidence of littering contributing to the volume of debris collected in clean ups can be reduced through the development of a program of awareness and education, the encouragement of community initiatives focused on litter collection, the provision of adequate waste disposal units and the enforcement of fines (Curnow and Sephr, 2018)

Tourism Industry and UNESCO Biosphere Nomination

Protection of the natural environment from the impacts of marine debris is critical to the local economy. The Sunshine Coast Region drew 2 million tourists in 2018, generating \$2 billion in economic stimulus (Tourism Research Australia, 2019). As such, mitigating the impact of marine debris is a not only a moral obligation but an important economic incentive. The Region has been nominated as a UNESCO biosphere and upholding the “healthy, smart, creative” vision must include the address of marine debris at its source.

Revenue Generation Through Fines

The penalty for littering one cigarette butt is \$266. Consideration should be given to the potential revenue generation that could be provided through the enforcement of fines for this ubiquitous behaviour.

Bans

Smoking is banned on all Sunshine Coast patrolled beaches. Anecdotally, the volume of cigarette butts retrieved from these locations with minimal weathering implies that this is poorly enforced. This ban could be extended to all Sunshine Coast beaches.

Investment

The trial area of the CBVBB has 22 existing waste bins, 3 recycle bins and 2 cigarette butt extinguishing receptacles. From the 1041 incidental cigarette butts collected in the trial area, it is apparent that many visitors to the area are not using them. Of note is the intention of Sunshine Coast Council to install graphics on these existing waste bins with the “Clean Alex, It’s In Our Hands” message.

Sunshine Coast Council will consider the most appropriate permanent installation of smoking waste infrastructure at the location of the CBVBB once the technology is removed. It is likely that this area will have signage installed on the footpath to direct smokers to a designated area and that pole mounted cigarette butt receptacles for cigarette butts will be installed. The collected content of the cigarette butt poles will be made available to Cleanwater Group for circular economic activities and research. Replication of the CBVBB technological innovation will be considered for other sites across the region to encourage behaviour change and raise awareness, this could also be viewed as an investment in a wider education and awareness campaign.

Investment in appropriate signage may be required to inform visitors of the 10m smoking exclusion zone around the Alex Skate Park. Additionally, inclusion of a “no smoking” symbol on beach access point signage might also be considered.

The Cleanwater Group reports that of the 23 storm water drains servicing the trial area, only 5 are fitted with Gross Pollutant Trap Protection. Given that the remaining 18 drains lead directly to Alexandra Beach through storm water outflows, investment in protecting these drains would undoubtedly reduce the amount of land-based litter reaching the sea. Investment could also be focused on research into circular economic applications for collected cigarette butt waste as proposed by Cleanwater Group's intention to 3D print additional CBVBB units out of waste product.

Beach Clean Ups

There are many beach clean ups scheduled throughout the year mostly staffed by volunteers from community groups. Collecting cigarette butt litter is difficult due to the small size and easy translocation and camouflaged colouring in beach settings. Once the toxic waste has left the shore, recovery is not likely with current technology. The toxins contained within the butts are easily leachable and impossible to retrieve.

Understanding how much plastic is going in and where it originates is a necessary first step to designing solutions to stop the flow of plastic into the ocean (Law, 2017). Cigarette butts were collected from the CBVBB weekly with incidental counts from the trial area and beach directly beside the unit also collated. The data clearly demonstrates that this location is a point source for cigarette butt litter (Clean Up Australia 2019, EnviroCom 2019).

Baseline and Clean Up Cigarette Butt Data

A base line recording of 4200 cigarette butts were reported to have been collected during Clean Up Australia activities at this location on Sunday March 3rd 2019 (EnviroCom, 2019). The areas included in these clean ups extended beyond the CBVBB trial area but included it and this has and will be compared to mid and post trial clean up data for the wider area.

During week 9 of the CBVBB trial The Sea Shepherd Marine Debris team and 56 volunteers joined Ten Little Pieces for an area wide clean up. Although the scope of the clean-up covered a much larger area than the trial location, it remained within 40m of the beachfront and the trial location fell within its boundaries. The clean-up area was similar in size to the Clean Up Australia Day efforts. As a result, 3500 cigarette butts were retrieved on June 9th 2019 (Appendix 8). These clean up counts of cigarette butt litter at the trial location and surrounding areas indicates a 16.66% reduction.

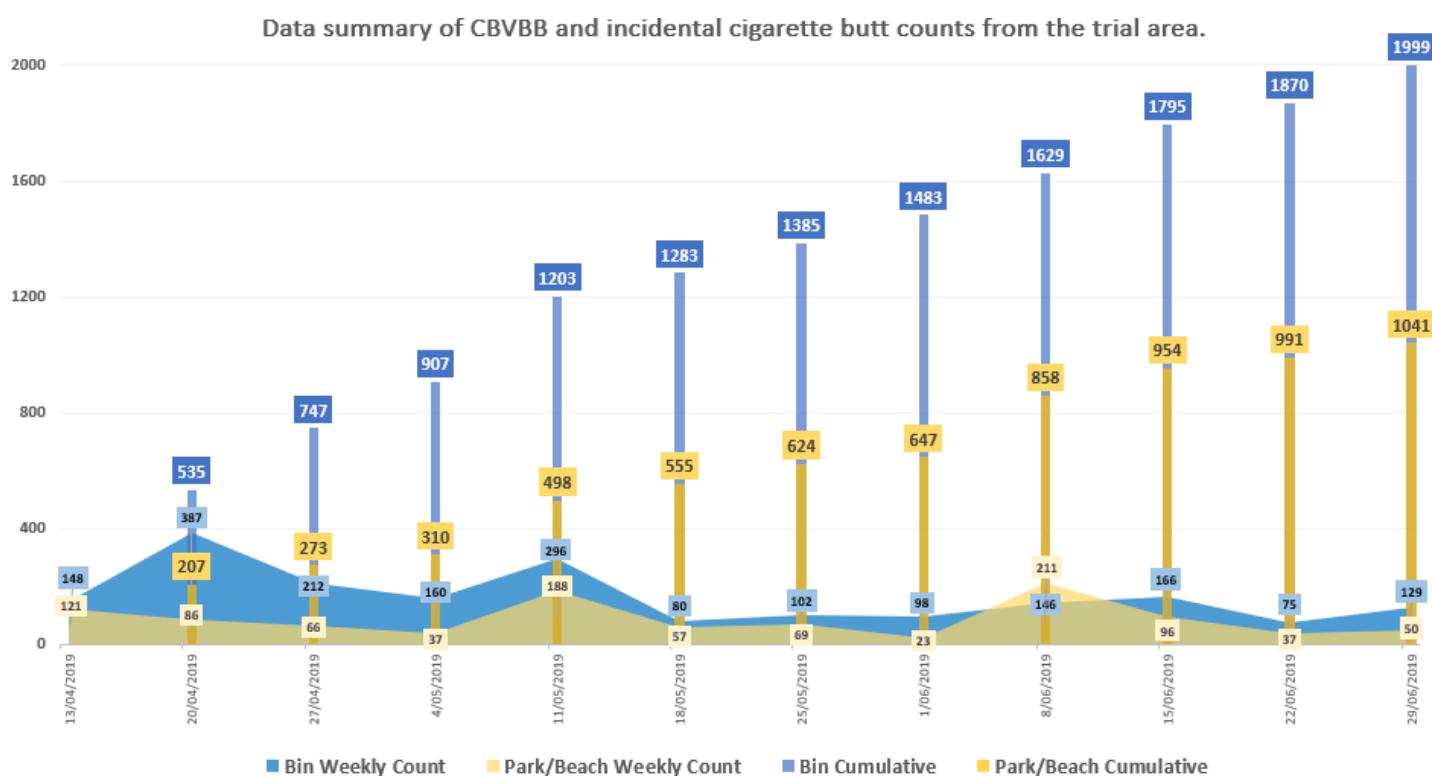
51 volunteers participated in the post trial area clean up held on July 21st 2019 by Sunshine Coast Council and Ten Little Pieces to cover the same areas as pre and mid trial clean ups. A total of 1265 littered cigarette butts were recorded. Taking into account the time intervals between the clean ups, **This data represents a 40% reduction in cigarette butt litter recovered from at the trial location at the conclusion of the trial.**

It is suggested that this reduction reflects the effectiveness of the CBVBB technology, however there are some significant considerations to take into account including the timing of the first clean up at the conclusion of the busiest tourist influx compared to the final clean up during the winter period.

The pre, mid and post-trial clean up data was not included in the incidental counts of the CBVBB trial but certainly indicates the pervasive and significant environmental threat cigarette butts pose to the local area and surrounding coastal and aquatic environments.

Modelling and Measuring - Results

CBVBB and Incidental Cigarette Butt Data Counts



1999 cigarette butts were collected at the CBVBB during the 12-week trial. 1041 cigarette butts were collected in incidental counts from the surrounding park area, skatepark and beachfront of Alexandra Beach and the GPT's under the area retrieved 143 cigarette butts therefore, 1184 cigarette butts were considered as incidental counts with 3183 considered as the total number of butts retrieved during the trial. The incidental (littered cigarette butt) count accounted for 37.19% of the total number of butts collected during this trial. The incidental litter counts were entered into the AMDI Database to contribute to an Australia wide record of types and frequency of litter items recorded and aid in the development of policy related to source reduction efforts.

The trial area was equipped with adequate disposal units, (22 bins, 3 recycling bins and 2 specific butt disposal units), accumulated cigarette butt litter was systematically reduced by way of the incidental cigarette butt collections throughout the trial and information regarding the negative environmental consequences of littering cigarette butts was provided at the CBVBB and through displayed posters at the Alex Surf Club. Despite this, more than 1 in 3 cigarette butts collected during the trial were inappropriately disposed of, potentially contributing to marine litter. According to the NSW EPA cigarette butt litter reduction program, one major factor necessary to encourage behaviour change was missing from our trial, and that is the enforcement of cautions or fines relating to illegal disposal. No fines or cautions for illegal disposal of cigarette butts were issued during the trial.

Incidental counts were steady with across the trial with several weeks recording increased incidental litter. Appendix 2 illustrates the weekly questions displayed, the associated CBVBB counts and incidental butt counts of each week. Generally, low butt count weeks corresponded with inclement weather and increased counts coincided with school holidays (weeks 1, 2, and 3 incorporating the Easter break) and a public holiday (week 5 included the Labour Day long weekend 6th May 2019).

Gross Pollutant Traps

Cleanwater Group services 5 Gross Pollutant Traps located in the 23 storm water drains within a 150m radius of the CBVBB unit. Given the unlikely effect of the CBVBB intervention on such a wide spatial area, it was decided that data would be recorded from the 3 Gross Pollutant traps closest to the CBVBB trial. It is important to note that the 18 remaining unprotected drains have outfeed pipes that lead directly onto Alexandra Beach. Cleanwater Group also noted that a number of unprotected drains previously contained Gross Pollutant Traps that have been removed in the past two years due to road improvement works and parking lot upgrades in the area (see Appendix 7).

Students from the Australian Industry Trade College were employed to assess, sort and log the litter from the traps using the Tangaroa Blue Australian Marine Debris Initiative (AMDI) data collection method. In total 143 cigarette butts were retrieved from the 3 monitored traps. The AMDI database creates a comprehensive overview of what amounts and types of marine debris are impacting beaches and coastlines around Australia. The employment of the AMDI data base assists in modelling the impact of cigarette butts by quantifying collections and recording collection locations. For the purposes of this trial, Ten Little Pieces also uploaded the number of cigarette butts collected from the CBVBB, and incidental counts to the AMDI database.

Participant Surveys

72 anonymous participant surveys were conducted during the trial comprised of 8 simple yes or no questions to gauge public responsiveness to the CBVBB technology and investigate the level of public knowledge of the environmental consequences of littering cigarette butts and legislation around the issue.

CBVBB Participant Survey	Yes	%	No	%
Are you a local resident?	57	79.2%	15	20.8%
Do you think there are enough bins in this area?	59	81.9%	13	18.2%
Did you know that cigarette butts are made of plastic?	24	33.3%	48	66.7%
Do you consider cigarette butt litter a pressing environmental issue?	68	94.4%	4	5.6%
Did you know that littering one cigarette butt can incur a \$266 on the spot fine?	8	11.1%	64	88.9%
Do you think people should be fined or cautioned for littering cigarette butts?	70	97.2%	2	2.8%
Did you know smoking is banned on patrolled beaches on the Sunshine Coast?	30	41.6%	42	58.4%
Should the 10m smoking exclusion zone around the skate park be enforced?	68	94.4%	4	5.6%
Would you like to see more CBVBB units at other locations across the Sunshine Coast?	58	80.5%	14	19.5%

Table 1: Results of 72 participant surveys of the CBVBB trial.

The participant surveys were conducted weekly with passers by of the unit during the scheduled servicing of the CBVBB. On average, 6 surveys were conducted each week. 79.02% of participants were local residents who did not know that cigarette butts were made of plastic (81.9%). Almost all participants considered cigarette butt litter as a pressing environmental issue (94.4%) but did not know that littering one cigarette butt could incur a \$266 on the spot fine (88.9%). 97.2% of respondents thought that litterers should be fined or cautioned for littering cigarette butts. Over half of the respondents were unaware of the smoking ban applicable to patrolled beaches of the Sunshine Coast (58.4%). 94.4% of respondents believed the 10m smoking exclusion area around the Skate Park should be enforced. And 80.5% of respondents would like to see more CBVBB units at other locations across the Region.

Limitations of results:

- High tides are likely to have effected beach litter counts.
- Carpark gutters were not included in the Parks & Gardens weekly incidental counts
- In considering the seasonal timing of the pre, mid and post trial clean up data comparison in the assessment of the overall effectiveness of the CBVBB technology as a behaviour modification intervention should include an estimate of visitor numbers to the area.

Conclusion

This cigarette butt reduction initiative has trialled the effectiveness of the CBVBB in encouraging appropriate disposal at a defined location. The pre, mid and post trial area wide clean up data demonstrates the pervasive and significant environmental threat cigarette butts pose to local coastal and aquatic environments. Through data comparisons of the area wide clean ups, and taking into account the time intervals between the area wide clean ups, a 40% reduction in incidental cigarette butt litter at the trial location has been recorded. This suggests that the CBVBB unit itself, the social media efforts, the involvement of community groups, directional signage and weekly incidental litter collections have combined to modify cigarette butt littering behaviour at this location. In raising awareness of the issue of cigarette butt litter, it has been successful in gaining the support of community, local government, business and not for profit actors. The volume of cigarette butts recovered during this trial indicates the pervasive nature of this form of littering and that steps can and must be taken to mitigate their effect on the sensitive coastal and aquatic environments into which they can easily travel.

Hartley et al., (2015) assert that “prioritising cleaning-up marine litter rather than preventing it getting there in the first place is like trying to stop an overflowing bath when the tap is still running”. As such efforts to minimize and mitigate the impacts of cigarette butt waste and its contribution to marine debris should use every mechanism available including community collaboration, local government enforcement of existing legislation, education and awareness campaigns and informational signage to discourage littering. This assertion supports the conclusion of Chen (2015) who suggests that marine litter can be prevented and controlled through an effective collaboration of education and outreach programmes, strong regulations and policies, effective enforcement and adequate support infrastructure.

The forecasted impacts of marine litter demand the urgent development of alternative, efficient solutions. Short-term solutions should be implemented to reduce the immediate negative effects, while the necessary long-term changes in consumption and production must be incentivised through policy (Marine Litter Vital Graphics 2015).

Short Term Recommendations:

- At the site of the CBVBB, invest in permanent infrastructure which provides safe and appropriate cigarette butt disposal units with adequate signage.
- The enforcement of the 10m smoking exclusion zone around the Alex Skate Park in accordance with the Tobacco and Other Smoking Products Act (1998)
- Installation of stencils on stormwater drains “the sea starts here, don’t litter”
- Retrofit existing cigarette butt disposal units within the trial area with bright colouring to enhance visibility and encourage usage (at present they are camouflaged with no signage).
- By employing the Precautionary Principle, local government is encouraged to enforce existing anti-littering law in accordance with the Waste Reduction and Recycling Act (2011), to mitigate the effects of this toxic waste. We know the source and regardless of a misplaced wish to avoid the perception of encouraging smoking, decisions must be based on the information we have at hand now to meet the obligation of social and environmental responsibility and uphold UN Sustainable Development Goal 14. This rule in environmental management states that if serious damage can be caused to the environment and/or to the health of humans, immediate steps should be taken in order to contain or to prevent such an event from happening.
- Further, a lack

of full scientific knowledge about the situation should not be allowed to delay containment or remedial steps if the balance of potential costs and benefits justifies enacting them.

- Inclusion of the “no smoking” symbol on beach access signage.
- Replace directional signage that has been installed on existing waste disposal bins for the duration of the trial with “Clean Alex, It’s in Our Hands” graphic (Appendix 9).
- Encourage Product Stewardship of tobacco retailers across the region with “bin your butt” posters and encourage the upsell of personal cigarette disposal units.
- Refine suggestions for additional CBVBB locations across the Region.

Longer Term Recommendations:

In keeping with the reviewed literature, and in particular, the views of Hardesty and Wilcox (2014) who purports the most effective way to reduce the harmful effects of sea debris is to prevent it from getting there in the first place, the following longer term efforts are recommended:

- Develop an education, awareness and media campaigns related to cigarette butt litter for the Sunshine Coast Region.
- Higher activation of communities supporting further cigarette butt reduction initiatives across the region including the provision of posters, guided community consultation, and the distribution of personal cigarette butt disposal units.
- Develop and access community associations to encourage support for residents to take environmental stewardship of the Alex headland community association – over 50 local businesses have agreed to display posters and inform clientele of the policy shift and ensure adequate cigarette butt disposal units at their establishments. There by working together to reduce the incidence of this toxic waste on their direct environment.
- Investigate product stewardship and extended producer responsibility avenues including the display of educational posters in tobacco retailers and an explanation of the proposed enforcement of anti-litter laws as an opportunity to upsell to customers by way of personal cigarette butt disposal units. It also allows retailers to develop rapport and enhance service to their clientele.

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Relevant Legislation, Policy, Local Government Strategies and Programs

- Tobacco and Other Smoking Products Act (1998)
- Waste Reduction and Recycling Act (2011).
- Sunshine Coast Council Beach Clean Up Program of Non-Bathing Reserves
- Queensland's Litter and Illegal Dumping Action Plan, 2013 – (currently under revision).
- Coral Sea Marine Park Management Plan (2018)
- South Pacific Regional Seas Agreement
- Commonwealth Clean Oceans Alliance
- United Nations Clean Seas Campaign
- G20 Marine Litter Action Plan
- 2018 National Waste Policy

Appendices

Appendix 1: CBVBB Servicing Methodology & Equipment

Servicing Methodology:

1. Take photo of front of unit with weekly collections in each side clearly visible.
2. Conduct incidental cigarette butt collection and record count.
3. Remove padlock and slide metal holding pin at base of unit to release chamber on right. Leave metal pin half-way inserted to hold left chamber in place.
4. Count butts collected from right hand chamber and record
5. Remove metal pin to release left hand chamber.
6. Count butts collected from left hand chamber and record.
7. Combine counts for weekly data analysis.
8. Clean chambers with disinfectant and/or baby wipes
9. Reinsert chambers
10. Use locking key to open top of CBVBB and slide question board out. Clean with baby wipe
11. Change question, replace question board and lock CBVBB
12. Record the results of current week on main information board with whiteboard pen and update running tally with incidental count.

Equipment required:

- 1 Locking key
- 2 Protective gloves
- 3 White board marker
- 4 Large vacuum sealed plastic bag for storage of butts then placed inside a separate plastic sealed box to contain odour
- 5 Baby wipes
- 6 Disinfectant spray
- 7 Disinfectant hand gel
- 8 Camera or camera phone for photographic recording
- 9 Data collection sheet with incidental count, CBVBB count and weekly questions displayed.
- 10 Participant survey forms

Appendix 2: CBVBB Voting Questions and Running Tallies

Week	CBVBB Question	weekly count	Running tally CBVBB	Incidental count	Running tally incidental
1	Board Shorts or Budgie Smugglers?	148	148	121	121
2	What's your favourite Sunshine Coast Beach? Alex or Mooloolaba?	387	535	86	207
3	What's your favourite Sunshine Coast Beach? Alex or Mooloolaba?	212	747	66	273
4	Would you rather explore the Ocean or Space?	160	907	37	310
5	Who will sit on the Iron Throne? Daenerys or Jon Snow?	296	1203	188	498
6	Sushi or Tacos?	80	1283	57	555
7	State of Origin: NSW or QLD?	102	1385	69	624
8	State of Origin: NSW or QLD?	98	1483	23	647
9	True Love or 1 Million Dollars?	146	1629	211	858
10	Cigarette butts are the most littered item in the world. True or False?	166	1795	96	954
11	Did you know cigarette butts are made out of plastic?	75	1870	37	991
12	Did you know littering a cigarette butt can incur a \$266 on the spot fine?	129	1999	50	1041

Appendix 3: Information board installed next to CBVBB unit.

Ten Little Pieces and Sunshine Coast Council are working together to reduce cigarette butt litter around Alexandra Headland.

Did you know?

- Cigarette butts are the MOST littered item in the world
- Cigarette butts contain plastic
- Over 90% of sea birds have been found with plastic (which includes cigarette butts) in their stomachs
- If a turtle eats 1 piece of plastic it increases its risk of death by 22%
- 80% of the world's marine turtles have ingested at least one piece of plastic
- In 2016 Council conducted a litter survey of local residents - 58% of respondents suggest that littering occurs because of a lack of community pride and 92% of respondents think it never acceptable to litter
- In that same survey, cigarette butt litter was peoples number 1 litter problem that needed to be addressed
- In the 2016/17 Sunshine Coast beach clean ups, cigarette butts made up 18% of the total litter collected
- In 2017/18 beach clean ups 13 814 cigarette butts were picked up by almost 1900 volunteers

Project Updates:

WEEK 1: Q BOARD SHORTS OR BUDGIE SMUGGLERS? BOARDERS WIN 116 VOTES
TOTAL RUNNING TALLY # 148 BUTTS COLLECTED.

Clean Sunshine Coast
It's in our hands.

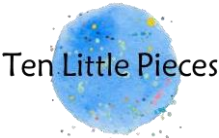
This project is managed by: This project is supported by:

www.sunshinecoast.qld.gov.au
07 5475 7272

Appendix 4: Directional signage installed on existing bins across the trial area



Appendix 5: Vote with your butt poster graphic for display in Alex Surf Club and local businesses



Appendix 6: Participant Survey Template

CBVBB Participant Survey	YES	NO
Are you a local resident?		
Do you think there are enough bins in this area?		
Did you know that cigarette butts are made of plastic?		
Do you consider cigarette butt litter a pressing environmental issue?		
Did you know that littering one cigarette butt can incur a \$266 on the spot fine?		
Do you think people should be fined or cautioned for littering cigarette butts?		
Did you know smoking is banned on patrolled beaches on the Sunshine Coast?		
Should the 10m smoking exclusion zone around the skate park be enforced?		
Would you like to see more CBVBB units at other locations across the Sunshine Coast?		

Appendix 7: Cleanwater Group

Project Update – Reducing Land-Based Sources of Marine Debris on the Sunshine Coast.



Project Update

PROJECT

Monitoring Land-Based Sources of Marine Debris on the Sunshine Coast

PARTIES

- [Cleanwater Group](#)
- Australia Industry Trade College in Maroochydore
- Sunshine Coast Council
- Ten Little Pieces
- [Envirocom](#)
- Surfrider Foundation

BACKGROUND

The purpose of this year-long project is to collect data on the quantities and types of gross pollutants such as plastic and other debris captured by at-source gross pollutant traps around the Sunshine Coast in order to inform source reduction planning. The overall intention is to improve knowledge and understanding of land-based marine debris traveling through the stormwater network; address gaps in knowledge for the Sunshine Coast Regional Council; and teach local students from the Australia Industry Trade College about marine debris and terrestrial pollution, as well as how to collect data according to Tangaroa Blue's Australian Marine Debris Initiative.

The project includes the monitoring of pollutants in three stormwater drains located near the Alexandra Headlands Surf Lifesaving Club (Alex Surf Club), where a cigarette butt voting bin has been piloted by Ten Little Pieces, the Sunshine Coast Council, Alex Surf Club, and [Envirocom](#).

This Project Update provides specific information on [Cleanwater Group's](#) component of the Ten Little Pieces' project titled "2019 Cigarette Butt Litter Reduction Initiative with Voting Ballot Bin Unit at Alexandra Headlands Surf Club."

SCOPE OF WORK

As part of the year-long project, [Cleanwater Group](#) agreed with Sunshine Coast Council to monitor and assess the prevalence of cigarette butts found in stormwater gross pollutant traps (in this case, referred to as 'at-source litter traps'; see Figure 1) near the Alex Surf Club. The primary reasons for this were:

- It was discovered that there is a high concentration of cigarette butts found in the vicinity of Alex Surf Club, the Promenade and Headland.
- Ten Little Pieces and Sunshine Coast Council initiated a 3-month trial of a cigarette butt voting ballot box (see Figure 2) adjacent to the Alex Surf Club in order to



educate the public and encourage behavior change towards the correct disposal of cigarette butts in the area.

- Stormwater drains in the Surf Club parking lot and along the main street, Alexandra Parade, lead directly onto Alexandra Headland Beach via an outfeed pipe (see Figure 3).
- Cleanwater Group is servicing and maintaining all litter traps for Sunshine Coast Council, including those in and around Alex Surf Club, for the purpose of preventing pollutants from entering waterways and the ocean.
- The Commonwealth Scientific and Industrial Research Organisation (CSIRO) has found that the vast majority of marine debris in Australia derives from land-based sources and that stormwater drains are a significant contributor to shoreline debris as they act as an outflow point of litter in urban runoff.
- As part of the project, Cleanwater Group agreed with the Australian Industry Trade College in Maroochydore and Sunshine Coast Council to monitor pollutants from 12-15 litter traps around the Sunshine Coast using the Tangaroa Blue Australian Marine Debris Initiative (AMD I) data collection method, over a year-long period, and in order to identify hotspots, trends and assist Council with any specific marine debris related studies.
- It was therefore agreed that monitoring the prevalence of cigarette butts in stormwater drains (as a source of butts found on the beach) around the Alex Surf Club would provide an additional data source for evaluating before and after effects of the management intervention. The frequency of monitoring was agreed to be every 4-6 weeks, over a one-year period. Details on the location and number of monitored drains are included below.

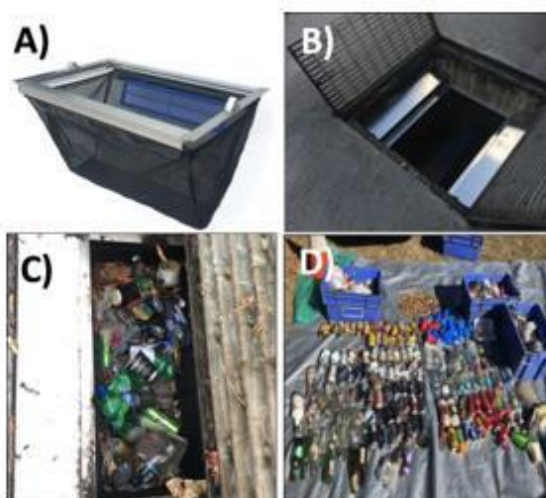


Figure 1. Example of an at-source gross pollutant trap (A) installed in a stormwater drain (B), capturing litter (C), and being collected for sorting and analysis following the AMD I process (D)



Figure 2. Cigarette Butt Voting Bin installed in Alexandra Headland

IDENTIFYING GPTs FOR MONITORING

After initial discussions between the various parties, a preliminary assessment of the local stormwater network and catchment area around Alex Surf Club was carried out. It was discovered that 5 of the roughly 23 stormwater drains within a 150 metre radius of the Surf Club were protected with a stormwater quality improvement device such as a litter trap (see Figure 3). While the cigarette butt voting bin management intervention is unlikely to have an effect on such a wide spatial area, this figure is important to note as each of the unprotected drains have outfeed pipes that lead directly onto Alexandra Headlands Beach, and thus, are likely to be playing a role in the number of incidental butts found on the beach (see Figure 4). Note that a number of unprotected drains previously contained gross pollutant traps, however, have had them removed in the past two years due to road improvement works and parking lot upgrades in the area (see Figure 5).



Figure 3. Stormwater drains (Catch Pits) (depicted as solid green and solid orange squares) within a 150m radius (red circle) of Alex Surf Club (accessed using Sunshine Coast Council GIS Layers, 2019)



Figure 4. Map of Stormwater Pipes (green and orange lines), Drains (green and orange squares) and Outlets (circled in red on the beach) around Alex Surf Club (accessed using Sunshine Coast Council GIS Layers, 2019)

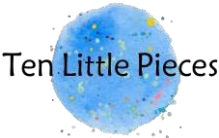




Figure 5. Map of currently protected (green points) vs. previously protected (red points) stormwater drains around Alex Surf Club

Given the minimal number of protected stormwater drains, as well as the gradient of the land surrounding the proposed location of the cigarette butt voting bin, it was decided that the two protected assets closest to the Alex Surf Club (not including those across the main road, Alexandra Parade) would be monitored. These are Assets 249112 (located directly West of the voting bin) and 280601 (located South of the voting bin, near the public bathrooms, but still within the vicinity of where butts could wash into after a rainfall event if smokers are littering in front of the Surf Club and along the promenade).

Unfortunately, while Asset 249112 has an effective gross pollutant trap preventing litter and other debris from washing onto the beach, Asset 280601 has a design flaw in that the shallowness of the pit itself has rendered the gross pollutant trap ineffective, as material seems to be escaping down the right side of the trap instead of being retained in the mesh basket (see Figure 13 in the GPT Photos section below). While it has been recommended that this asset be replaced with a more effective configuration, its current inefficacy is important to note, as it is likely to limit the amount of cigarette butts found in this trap.

In addition to the assets mentioned above, it was decided to add a third asset to the monitoring program, Asset 249161 (located on the other side of Alexandra Parade, directly West of Asset 249112), for two primary reasons. First, it can provide a good comparison to the number of butts found in the other traps closer to the cigarette butt voting bin. Second, as it is part of the same drainage network with outfeed pipes leading directly to Asset 249112, it would be useful to see how much the commercial area on Alexandra Parade is contributing to the pollutants being discharged on the beach. This could possibly provide information on the level of pollutant contribution resulting from different land-use types around the Surf Club (i.e. recreational, commercial food services and retail).



The three gross pollutant traps monitored for the Alex Heads cigarette butt voting bin project are illustrated in Figures 6 and 7 below. Figure 8 shows the stormwater pipe network in relation to these monitored assets.



Figure 6. Synoptic Scale View of Monitored GPTs (blue points) around the Cigarette Butt Voting Bin (red pin). Note that green points are other active GPTs in the surrounding area.



Figure 7. Close-up View of Monitored GPTs (blue points) around the Cigarette Butt Voting Bin (red pin)

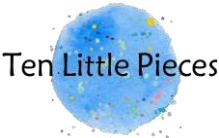




Figure 8. Synoptic Scale View of Stormwater Network (green and orange lines) and Monitored Assets (blue points) around the Cigarette Butt Voting Bin (red pin)

Note that unprotected stormwater drains were not chosen to be monitored because they do not contain a stormwater quality improvement device such as a gross pollutant trap. Without such protection, the majority of gross pollutants get washed into the stormwater network after each significant rainfall event, thereby rendering monitoring efforts futile.

UPDATES

Table 1 below provides results on the amount of cigarette butts found in each asset thus far. Various factors such as catchment size, weather, slope, population density, and land-use type can influence pollutant loads and distributions found in the stormwater network. While analysing the contribution of wind and rainfall intensity is an important aspect to identifying trends and separating the signal from noise, it is currently outside of the scope of this Update report. However, it is intended that future reports include this information.

Date Collected	Asset 249161	Asset 249112	Asset 280601
March 20 th 2019	43	3	1
May 3 rd 2019	2	14	4
June 11 th 2019	23	39	14

Table 1. Cigarette Butt Count from Each Gross Pollutant Trap Thus Far

The first monitoring event was held on the 14th of May and included 30 students from the Australian Industry Trade College (AITC) in Maroochydore. It took place in the Industry Training Room, where we reviewed the concepts of why it is important to protect our oceans, how land-use change has affected runoff, what can be considered as marine



debris, how the stormwater system works, and the importance of data collection and analysis. We then taught the students how to conduct an AMDI audit on debris collected from the 3 gross pollutant traps for the Alex Heads cigarette butt voting bin trial. They learned how to both collect data using the data sheet as well as the AMDI mobile app. The next engagement is set for mid-July after the monthly servicing cycle of the litter traps. After recent discussions with Ten Little Pieces and Surfrider Foundation, it was agreed that it would be great to have both parties attending future monitoring events with the AITC students as well.

The AITC project, as well as the cigarette butt voting bin initiative, were also showcased at the Keep Australia Blue Litter Congress 2019 in Sydney where Cleanwater Group gave a presentation titled "Bridging the Gap in Land-Based Sources of Marine Debris." We provided an update on the project, as well as a vision on how at-source litter traps can be used both as preventative, as well as diagnostic tools, for identifying land-based sources of marine debris when combined with the AMDI process.

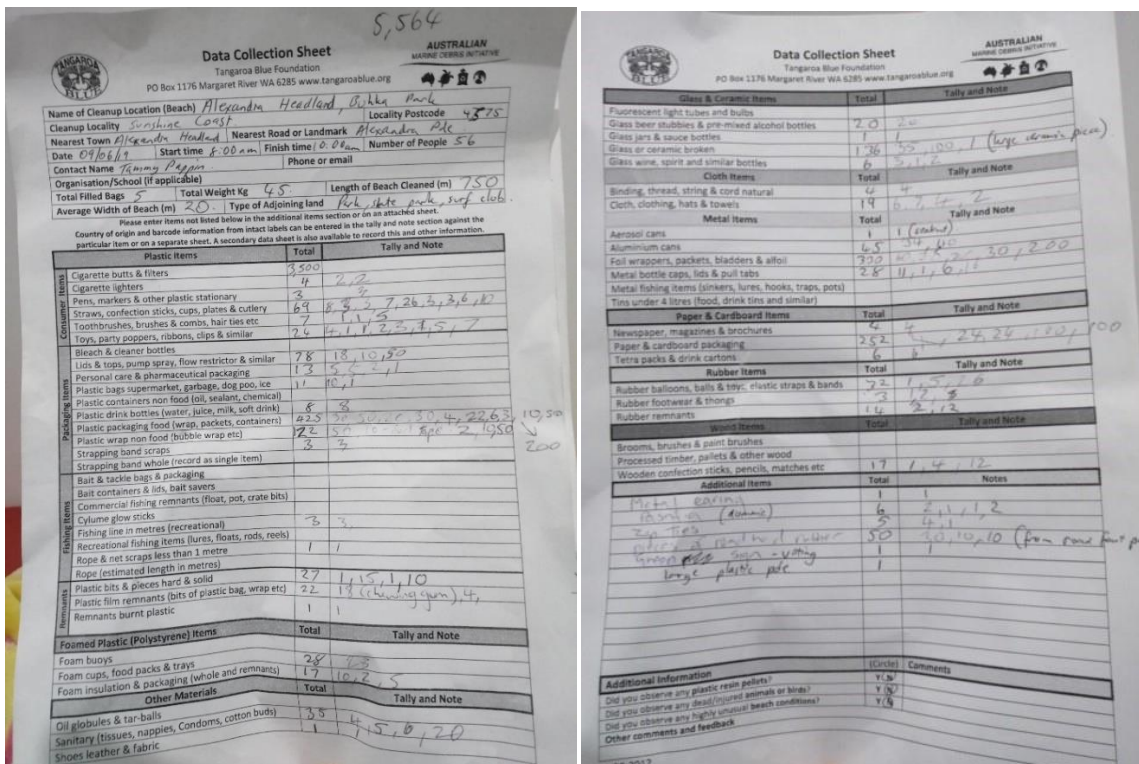
All three traps around Alex Surf Club will continue to be monitored for as long as the voting bin is in place, and/or until the Sunshine Coast Council advises otherwise. The remaining 9-12 gross pollutant traps that are to be monitored as part of this project are yet to be identified and agreed upon. It is intended that these locations be finalised prior to the next sample collection cycle in mid-July 2019, and that consideration be given to include Asset 249056 in Alex Heads as part of the monitoring project.

GPT PHOTOS



Figure 9. Asset 249161 Before Collection

Appendix 8: Sea Shepherd Marine Debris Data Entry for 9th June 2018



Appendix 9: “Clean Alex It’s In Our Hands” visual messaging for existing bins at the CBVBB trial location.

