Title: Consultation Stage Impact Assessment on the proposal to ban the distribution and/or sale and of plastic drinking straws in England **IA No:** Defra/ENV/021 **RPC Reference No: TBA** **Lead department or agency:** Department for Environment, Food and Rural Affairs (Defra) **Other departments or agencies: N/A**	**Impact Assessment (IA)** **Date:** 16/10/2018 **Stage:** Development/Options **Source of intervention:** Domestic **Type of measure:** Secondary legislation **Contact for enquiries:** **Tom.Murray@defra.gsi.gov.uk**

Summary: Intervention and Options

RPC Opinion: RPC Opinion Status

Cost of Preferred (or more likely) Option				
Total Net Present Value	**Business Net Present Value**	**Net cost to business per year** (EANDCB in 2014 prices)	**One-In, Three-Out**	**Business Impact Target Status**
-£85m	-£37m	£4.3m	Not in scope	Qualifying provision

What is the problem under consideration? Why is government intervention necessary?

Plastic drinking straws are not commonly recycled or re-used, causing multiple environmental harms particularly when they are discarded incorrectly, including harm to marine animals and visual pollution. Even if disposed of correctly, plastic straws may end up in incineration, generating high carbon emissions. These are negative externalities as they are experienced across society and are not accounted for within the market price of plastic straws. Providers of drinking straws do not have incentives to cover the externality costs. Intervention is required in order to shift the straw market to the plastic-free alternatives that already exist and decompose much quicker.

What are the policy objectives and the intended effects?

To help protect our environment for the future generations, improve the quality of the environment and reduce harm to human health and marine life. The ban will ensure that drinking straws sold in England are made of more environmentally friendly materials that will decompose quicker and will have low life-cycle impacts on the environment. It will encourage businesses to invest in biodegradable alternatives to plastic. The ban also intends to increase consumer awareness of the environmental harms drinking straws can cause when they are not correctly disposed of. The policy objective is also to ensure suitable exemptions are in place so those who rely on using plastic straws suffer no welfare costs following a ban.

What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)

Two options are considered for consultation, including 'do nothing' (option 0) and a ban with specified exemptions (option 1, preferred). A ban without delay is preferred as it would have the maximum impact in reducing the social costs of plastic drinking straws. The impacts of a ban is proportionate to secure the environmental benefits without major costs given the current trend in the market for straws is to move away from plastic. Alternative options such as taxes, information campaigns and making plastic straws available in stores by request only were rejected as they would not be as effective as a ban in reducing the significant social costs of plastic drinking straws. A ban will also encourage firms to invest in environmentally friendly alternatives to plastic. The preferred option includes exemptions for medical purposes and to allow continued easy access upon request for those who rely on platic straws in their everyday lives.

Will the policy be reviewed? It will be reviewed. **If applicable, set review date:** Month/Year

Does implementation go beyond minimum EU requirements?		Yes		
Are any of these organisations in scope?	**Micro** Yes	**Small** Yes	**Medium** Yes	**Large** Yes
What is the CO_2 equivalent change in greenhouse gas emissions? (Million tonnes CO_2 equivalent)		**Traded:** 796	**Non-traded:** 4138	

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible SELECT SIGNATORY: ..... Date: .....

Summary: Analysis & Evidence

Policy Option 1

Description:

FULL ECONOMIC ASSESSMENT

Price Base Year 2017	PV Base Year 2017	Time Period Years 10	Net Benefit (Present Value (PV)) (£m)		
			Low: -£112m	**High:** -£59m	**Best Estimate:** -£85m

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	£25.1m		£4.9m	**£69m**
High	£42.6m		£8.2m	**£117m**
Best Estimate	£33.8m		£6.5m	**£93m**

Description and scale of key monetised costs by 'main affected groups'

Production costs of paper straws, the expected alternative, are greater than plastic straws and so there will be costs to businesses, a portion of which will pass to consumers. We have also monetised the cost of additional emissions expected from paper straws sent to landfill, as plastic emits very few carbon dioxide equivalent (CO2 e) emissions when placed in landfill relative to paper.

Other key non-monetised costs by 'main affected groups'

Some consumers may lose out if they prefer plastic straws to alternatives although exemptions will ensure those who rely on plastic straws for medical or accessibility reasons can continue to access them easily. There will be a fuel cost from paper straws being heavier than plastic straws, which will have a carbon impact. Monitoring and enforcement costs.

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	£1.9m		£0.4m	**£5m**
High	£3.6m		£0.7m	**£10m**
Best Estimate	£2.8m		£0.5m	**£8m**

Description and scale of key monetised benefits by 'main affected groups'

Alternatively made straws, expected to become paper, are cleaner to produce and to incinerate than plastic, resulting in environmental savings. As paper decomposes much quicker than plastic, we expect to see a reduction in the presence of litter on beaches; clean beaches are highly valued by the public.

Other key non-monetised benefits by 'main affected groups'

Plastic straws contribute to marine litter which impacts wildlife as materials can entangle or be ingested by marine wildlife, causing injury and loss of life to marine animals. Marine litter has a disamenity cost, affecting pristine seascapes and quality of life which impacts those who use marine environments and also impacts those who value knowing that there is a pleasant environment available to them and to others.

Key assumptions/sensitivities/risks **Discount rate (%)** 3.5

Following commitments already made we assume most retailers switch away from plastic straws regardless of the ban. We assume paper will be the replacement material due to their current usage and trend in replacing plastic. We assume over time the cost of paper straws and the overall consumption of straws will remain constant. If these fall it will reduce the monetised costs. We assume 44m plastic straws are still consumed under exemptions following a ban with no welfare costs on these users.

BUSINESS ASSESSMENT (Option 1)

Direct impact on business (Equivalent Annual) £m:			Score for Business Impact Target (qualifying provisions only) £m:
Costs: £4.3m	**Benefits:** £0m	**Net:** -£4.3m	£3.7m

Problem under consideration

Plastic straws are lightweight and predominantly used in resturants, pubs, fast food outlets, schools or workplaces, or at parties. As a result they are typically discarded to general waste or littered rather than recycled due to the effort required to segregate and clean them and to sort at recovery facilities. Littering of plastic drinking straws contributes to the global marine plastic problem, damaging the marine environment, increasing risk to public health when fragments of plastic enter the food chain. It is estimated that there are over 150 million tonnes of plastic in the world's oceans and every year one million birds and over 100,000 sea mammals die from eating and getting tangled in plastic waste[1].

Conversely, for some of the population, plastic drinking straws are necessity either for medical purposes or to allow accessibility in every days to hot and cold beverages and liquid food. Disposable drinking straws are typically made of polypropylene and may come wrapped in film for hygiene purposes. Polypropylene is widely considered one of the most versatile plastics, found in most market sectors that use plastics. Its characteristics include a high melting point, it is resistant to cracking and stress even when flexed and it doesn't react with water, detergents or acids so it won't break down easily.

Straws are made for a variety of purposes and the majority come in two sizes; large drinking straws to suit cups and glasses, and smaller straws to use in small drinking cartons. Smaller portions of the straw market are made up by durable straws including cocktail straws and those in sport drink bottles, and there are also medical-enabling straws.

Plastic-free single-use alternatives already exist in the market for some types of products. For example, paper-based straws are available for certain types of drinking straws, and these can be laminated to improve their strength. There is a developing market for single-use straws made of bio-based materials such as Polylactic Acid (PLA) and these items are being sold to some sectors of the catering industry.

We estimate that 4.7 billion straws are consumed in England each year[2]. Single use plastics, including plastic drinking straws, are associated with negative effects on the environment. Resources and greenhouse gas emissions are associated with plastics production since they depend on finite fossil fuels. Once made, plastic drinking straws have impacts on land and in seas and rivers if they are littered or discarded incorrectly after their use. There are costs associated with their clean-up and externality costs imposed on the tourism and fishing industries from littering and the transfer of littered plastics into the environment. They can damage terrestrial and marine life and there is widespread and significant public concern regarding plastics and litter. All of these impacts contribute towards negative well-being. Every straw, if not properly disposed of, can contribute towards these social costs over a long period of time as it can take plastic 300 years to decompose[3].

Rationale for Intervention

Plastic drinking straws are not commonly recycled due to the effort required to segregate and clean them. Incorrect disposal methods lead to costs to society including visual pollution and harm to the marine environment and marine animals, all of which have a negative well-being impact on people. These social costs are not accounted for within the market price of plastic

[1] Estimates by Defra

[2] Estimate based on a quote from McDonald's that they use 1.8m per day in the UK and scaling up to reflect their market share. The estimate is then scaled down using ONS figures for population of England and UK.

[3] US National Park Service

drinking straws, so consumers are not currently incentivised to limit their use and disposal of plastic drinking straws, and businesses are not directly incentivised to use alternative materials.

Intervention is required in order ensure a full shift in the straw market away from plastic. Suitable alternatively-made drinking straws made from paper are available which decompose more quickly and therefore cause less environmental damage. Intervention in the market will help those businesses who have already invested, and will encourage businesses to continue to invest in alternatives to plastic drinking straws.

A recent YouGov report found that the 'public are overwhelmingly supportive of banning' "problem plastics", with 77% in favour of banning plastic drinking straws[4]. This finding suggests that the negative impacts associated with plastic straws are being experienced on a large scale by the public, and therefore that intervention is appropriate.

Policy objective

The objective is to help protect our environment for the future generations, improve the quality of the environment and reduce harm to human health and marine life. The ban forms part of the wider government waste strategy as the UK Government's 25 Year Plan[5] to improve the environment has specific targets for eliminating 'avoidable' plastic waste by the end of 2042 and a target for significantly reducing and where possible preventing all kinds of marine plastic pollution.

The ban is intended to ensure that straws sold in England are made of environmentally friendly materials that will decompose more quickly and have lower life-cycle impacts on the environment. The ban will also encourage businesses to invest in biodegradable alternatives to plastic.

It is also intended that banning plastic drinking straws will foster an increased degree of consumer confidence that the products they buy will not harm wildlife and the environment, and will also increase consumer awareness of the environmental harms straws can cause when they are not correctly disposed of.

A key policy objective is also to ensure that suitable exemptions are in place so those who rely on plastic straws to assist their everyday lives are not negatively impacted by a ban. This will ensure easy access for sale in pharmacies and across the catering and hospitality industry where they should remain available on request.

Options under consideration

This impact assessment considers two options for consideration during consultation. **The preferred option is to ban plastic drinking straws without time delay but with exemptions.** A ban with exemptions will be the most effective option to reduce the social and environmental costs associated with plastic straws.

Option 0: Do nothing

[4] YouGov finds overwhelming support for banning 'problem plastics'.

[5] A Green Future: Our 25 Year Plan to Improve the Environment

The **do nothing** option would allow plastic drinking straws to continue being used with little incentive for consumers to switch products. The costs and benefits of this option is zero against the baseline. Some business are voluntarily moving away from plastic straws and this will be factored into the do nothing scenario.

The problem associated with this option is although there is a concerted voluntary reduction in plastic straw use, there will still be many that continue to be used and disposed of. This means the environmental costs associated with plastic straws will continue to persist into the future.

Option 1: Implement a regulatory ban of plastic straws with exemptions from October 2019 (preferred option)

The preferred option to ban plastic straws will encourage businesses to invest in more sustainable alternatives to plastic. The incremental impacts of a ban is proportionate to secure the environmental benefits without major costs given the current trend in the market to move away from plastic straws and the availability of non-plastic alternatives. The ban will foster an increased degree of consumer confidence that the products they buy will not harm wildlife and the environment, and will also increase consumer awareness of the environmental harms straws can cause when they are not correctly disposed of.

A delay would reduce the environmental savings of a ban given there is a current trend away from plastic already. The availability of non-plastic alternatives and voluntary public commitments already made by some businesses to switch away from plastic suggests that switching costs are be small and therefore a transition period would not be necessary. The preferred option seeks to implement a ban by October 2019.

Exemptions

The ban on the sale and supply of plastic drinking straws has been proposed at consultation stage to include the following exemptions:

- For medical use **'Plastic medical-enabling straws'** for administration of medicines and also flexible 'enabling' straws for individuals that need them for accessibility needs or other reasons.
- For use within hospitals "**pre-dosed granular medicines in hospitals and homes"**
- Pharmacies – for purchase by those with accessibility or medical needs where they are vital.

Plastic medical-enabling straws are used to administer (durably and safely) pre-dosed granular medicines in hospitals and homes. Flexible plastic straws are used to assist/enable drinks and liquid food consumption in older adults and disabled groups with specific needs.

It is proposed to provide for these exemptions by allowing wholesalers to import and stock plastic straws for distribution to, pharmacies and pharmacy departments in both hospitals and retailers for supply to those that need them. We will be seeking views on whether online pharmacies should be allowed to supply plastic straws. It is also proposed that we allow catering establishments such as pubs and restaurants to provide plastic straws to customers on a specific 'on demand' basis.

This impact assessment assumes that these groups will not be affected by the ban. The consultation will be seeking comments from the public on the effectiveness of proposed exemptions to ensure uninhibited access to plastic straws to those that need them. Any shortcomings will be addressed by considering further exemptions as opposed to imposing welfare costs on these groups.

Disregarded options:

The following options were considered but most were rejected as they would not reduce the impacts to the environment in the same speed and scale as a ban would.

Information and education could be used to encourage firms and consumers to move away from plastic straws. However there is evidence that consumers are already acutely aware of the harms of single-use plastics. There having been multiple campaigns in recent times including the BBC's Blue Planet II series, Daily Mail's Break the habit, Turn the Tide on Plastic and the Stir-Crazy Campaign, as well as the carrier-bag 5p charge in supermarkets. The additional impact of further information being provided on top of these campaigns may be marginal.

Request only option - plastic straws could be made available by request only e.g. available only if a customer specifically asks for one, but this may cause inconvenience to businesses and consumers and the impacts in reducing usage would be less, and less certain, than a ban.

Subsidies towards the development of non-plastic straw alternatives are not considered necessary as the incentives to switch already exist, with major chains having already committed to using them.

A taxation or charge policy was rejected as this would create disproportionate administrative burdens to businesses and would not reduce plastic consumption as effectively as a ban.

Alternatives to plastic drinking straws

A fear associated with banning a product is that there will not be alternative products that consumers can use. This is not the case with straws as paper based straws are already available and have replaced the plastic straws given out in some pubs and restaurants[6]. Commitments have been made by major chains to switch away from plastic straws including McDonalds' and Wetherspoon's commitments to switch to paper[7][8], commitments have also been made by Starbucks[9] and Costa, Pret and Leon[10], mostly towards paper. Pizza express has already stopped using plastic straws in its restaurants and will 'move to a biodegradable paper straw by this summer' [2018][11].

A similar trend has started in supermarkets. Waitrose have announced they will stop selling packs of plastic straws by September 2018 and were working on sourcing paper equivalents in January 2018, and have also replaced plastic straws with paper straws in their cafes[12], while Morrisons 'no longer buys plastic drinking straws'[13].

[6] BBC article and here – commitments from Waitrose, Costa, Wagamama, Pizza Express and McDonalds. The Drinks Businesses – commitments from Wetherspoons and All Bar One

[7] McDonald's

[8] Businessgreen

[9] BBC

[10] The Grocer

[11] Pizza Express

[12] Waitrose press area

[13] Morrisons corporate

Commitments have also been made by companies that use small straws with cartons, including Tetra Pak, where the 'development team is confident they can find a solution, and that we'll have a paper straw alternative ready to launch by the end of the year'[14].

There are some concerns about the quality of paper straws, with some users reporting that they go 'soggy' and degrade while in the drink, and that they can affect the taste of the drink[15]. There is also a developing market for bio-based straws which may soon have the performance attributes expected from a plastic straw but also be fully compostable.

However, currently there is a clear trend to move towards paper straws with commitments having been made by many retailers, cafes and restaurants, and so our modelling in this impact assessment assumes that paper will replace plastic straws after the ban. This leads to a conservative comparison, as we expect that further alternative materials that perform better than paper may start to appear within the 10 year appraisal period of this impact assessment.

Summary of Impacts and NPVs – Preferred Option

Table 1 below gives a summary of the monetised costs and benefits and total Net Present Value (NPV) estimates for the preferred option to ban plastic straws, compared to what we believe would happen if there were no government intervention (i.e. under the 'do nothing' option). The central estimate is -£90m. The largest positive contributions come from an amenity benefit resulting from there being less litter on beaches. The largest impacts that have been monetised are the costs incurred from paper straws being more expensive than plastic straws to produce, which we have modelled as being shared between consumers and businesses.

	Table 1 - Summary	**10 Year NPV estimates, £m:**		
		Low	**Central**	**High**
Benefits	Production Emission Savings	£0.0	£0.0	£0.0
	Disposal incineration emission benefit	£0.3	£0.4	£0.6
	Reduced coastal clean-up costs	£0.5	£0.5	£0.5
	Beach well-being benefit	£4.4	£6.7	£8.9
Costs	Disposal landfill emission cost	-£0.2	-£0.2	-£0.1
	Paper straw costs passed to consumers	-£69.9	-£55.5	-£41.3
	Paper straw costs to businesses	-£46.6	-£37.0	-£27.5
	Total	**-£111.5**	**-£85.0**	**-£58.9**

All figures are in 2017 prices. The range between the low and high estimates reflects the estimate ranges for the number of straws consumed in England, how long each straw would take to decompose, the proportion that end up on beaches and differing values in the literature placed on having cleaner beaches.

Although the range for the NPVs are negative, the ban remains the preferred option due to the non-monetised factors excluded from the NPV estimates. A particularly strong benefit which has not been monetised is the reduction in harm to marine wildlife that we would expect following a plastic straw ban. Another consideration is that the monetised costs may fall significantly if the price of non-plastic alternative straws fall, which is likely as their scale of production increases.

[14] BusinessGreen – Tetra Pak to develop paper straws for drinks cartons. Tetra Pak is significant for smaller straws, with near-monopoly market shares in certain markets

[15] Bon appetit

Counterfactual

In order to assess the costs and benefits of the preferred option to ban plastic straws in October 2019, we have set out what we believe would happen to the straw market if there were no ban at all (i.e. we 'do nothing'). We have estimated that 4.7 billion straws are consumed in England each year[16], and until recently almost all of these would likely have been plastic based. It would be unrealistic to assume that the consumption of plastic straws will continue to be this high under the 'do nothing' scenario as the straws market has already begun moving away from plastic to paper straws.

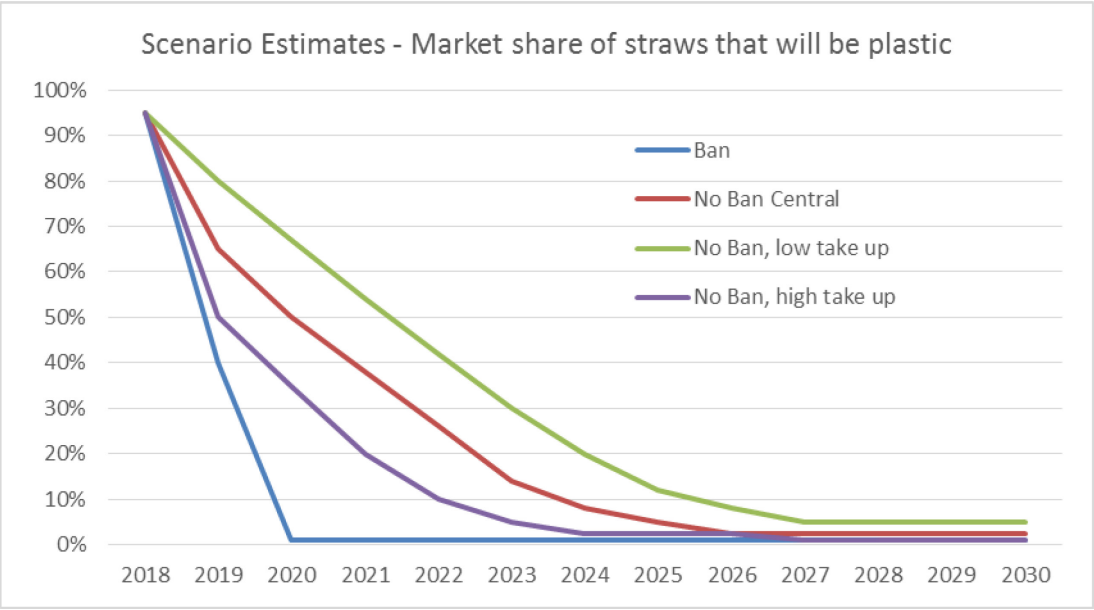
The scale of the costs and benefits of the ban are sensitive to the number and size of businesses that switch away from plastic straws voluntarily, and the time it would take them to switch without the ban in place. A limitation of this impact assessment is that the proportion of straws that are plastic is currently changing and it is very difficult to predict what the market will do if no ban on plastic straws were imposed.

A significant number of businesses have already committed voluntarily to switch to paper straws, including major restaurant chains and supermarkets. It is unclear exactly what proportion of straws being sold today are plastic, but a significant proportion are likely to already be paper, and there is a continuing movement towards paper straws. If we did assume that plastic straw consumption remained high without a ban, this would likely overstate the value of the costs and benefits a ban would bring, and so we have attempted to model what would happen to straws without a ban.

Scenario Analysis

In order to allow for the evidence gap in forecasting what would happen to plastic straws without a ban, we have modelled three scenarios for take up of alternatively made straws in the 'do nothing' (no-ban) scenario and compared these against the 'ban' scenario, all of which are shown in the graph below and in table format in annex 1. They show the percentage of the market share forecast to still be plastic over the next 10 years. All of the 'no ban' scenarios are similar in that they suggest that the vast majority of the market for straws will soon move away from plastic towards paper instead. The counterfactual described in the 'no ban central' scenario has been used to calculate the net present values in table 1.

[16] Estimate based on a quote from McDonald's that they use 1.8m per day in the UK and scaling up to reflect their market share. The estimate is then scaled down using ONS figures for population of England and UK.



We have assumed that in 2018 95% of straws will still be plastic, as modelled in estimates previously made by Resource Futures. The work by Resource Futures[17] provides the basis for our 'no ban, low take up' scenario. Our central scenario estimate ('no can central') is lower than Resource Future's as subsequent to their estimates further commitments have been made to switch to paper straws, most notably by McDonalds[18]. The differences between the three scenarios and the ban scenario start occurring from 2019 as the ban is planned to be enacted October 2019.

In the ban scenario, we assume that 44 million plastic straws, or nearly 1% of current straws, will continue to be consumed as part of the planned exemptions[19]. We are seeking views in the consultation to understand better how many plastic straws are needed for these purposes. Paper is expected to take the market share of plastic. In the 'no ban high' take up of alternatively made straws scenario a near-zero state is reached by 2022. The 'no ban central' and 'no ban low' take up scenarios follow similar paths but each with slightly higher proportions of plastic straws throughout.

The difference between the 'ban' and 'no ban central' scenario assumptions is used to calculate the final 10 year net present value (NPV) estimate in this impact assessment. Table 2 provides a sensitivity analysis to show how the 10 year NPV would change if the low and high 'no ban' scenarios were applied:

Table 2 - Scenarios for plastic take up if there were no ban:	**10 Year NPV estimates, £m:**		
	Low	**Central**	**High**
Central Scenario NPVs	-£111	-£85	-£59
Low take up Scenario NPVs	-£185	-£141	-£98
High take up Scenario NPVs	-£57	-£43	-£30

[17] Resource Futures: Preliminary assessment of the economic, environmental and social impacts of a potential ban on plastic straws, plastic stem cotton buds and plastic drink stirrers.

[18] McDonald's news, June 2018.

[19] Resource Futures: Preliminary assessment of the economic, environmental and social impacts of a potential ban on plastic straws, plastic stem cotton buds and plastic drink stirrers. Based on assumption of 1% of English over 65s population and those with manual dexterity disabilities and Parkinson's disease. Each requiring one straw every day.

The estimates in Table 2 are calculated by taking the 10 year net present value totals for the low, central and high scenarios, and then multiplying the impacts by the percentage point difference of straws expected to be plastic between the 'ban scenario' and each 'no ban' scenarios. If the scenario analysis were not applied at all, we would be left with a stand still approach where we would be assuming that zero percent of the straw market would switch away from plastic if no ban were enforced. This would give an NPV estimate of -£544m. If we assumed only 50% of the straw market switched away from plastic this would give an NPV estimate of -£272m. These assumptions would not give reasonable estimates of the impacts of the ban as many large restaurant, café and supermarkets chains have already voluntarily committed to switch away from plastic straws.

Benefits

The benefits of a ban on plastic straws include cleaner production and incineration processes from paper alternatives, improvements to marine environments and amenity benefits from litter reduction.

Monetised Benefits

Table 3 shows the value of the benefits we have quantified. In our central total present value (TPV) estimate over 10 years we expect £7.6m of benefits to come from a ban of plastic straws.

Table 3	**10 Year TPV estimates, £m:**		
Total Benefits:	**Low**	**Central**	**High**
Production Emission Savings	£0.0	£0.0	£0.0
Disposal incineration emission benefit	£0.3	£0.4	£0.6
Reduced coastal clean-up costs	£0.5	£0.5	£0.5
Beach well-being benefit	£4.4	£6.7	£8.9
Total Benefits:	**£5.2**	**£7.6**	**£10.0**

The largest benefits are associated with improvements to beach environments which saves clean-up costs and has well-being benefits. Plastic straws are commonly found on beaches, but clean beaches are highly valued by the public. A switch away from plastic straws should see a significant reduction in straws on beaches as plastic takes significantly longer to decompose than paper.

The other quantified benefits are from emission savings which come from paper based alternatives being cleaner to incinerate (each tonne of paper burnt actually saves carbon dioxide equivalent (CO_2 e) emissions through energy conversion) and also cleaner to produce. Each tonne less of CO_2 e produced has an estimated benefit saving to the environment from abatement costs.

Non-monetised Benefits

There are several benefits particularly associated with improvements to marine environments that have not been quantified. Marine litter has a disamenity cost, affecting pristine seascapes and quality of life which impacts those who use marine environments and also impacts those who have a non-use value of marine environments, as people value knowing that there is a pleasant environment available to them and to others. Marine litter impacts marine life as

materials can entangle or be ingested by marine wildlife. Harm to marine wildlife may be a strong public concern and a significant part of the rationale for a ban. Paper straws are less harmful to marine wildlife and quickly biodegrade[20], so a ban on plastic straws will reduce the environmental costs of straws.

Environmental Production Savings

Paper drinking straws are more environmentally friendly to produce than plastic straws as for each tonne of wood produced, less carbon dioxide equivalent (CO_2 e) tonnes are emitted than for each tonne of plastic. We have been able to monetise this benefit:

Monetisation and Assumptions

We have monetised this cost using the following figures and assumptions:

- We estimate that 4.7 billion straws are consumed in England each year[21], which includes an estimate of 1.04 billion smaller beverage carton straws (which is approx. 22% of total straws[22]). We assumed 3.3 billion for our low estimate (which excludes carton straws) and 6.3 billion for our high estimate[23].
- For each tonne of material produced, plastic polypropylene emits 3.08 tonnes of CO_2 e, whereas paper production only emits 0.93t[24].
- Paper straws weigh 1.18g, compared to 0.55g per unit for plastic straws. Smaller carton plastic straws weigh 0.5g[25], and we assume that paper carton straws would increase in weight proportionately to the standard straws, so therefore we assume that paper carton straws weigh 1.07g.
- We assume that the cost of one tonne of CO_2 e in 2020 is £4.56, which increases up to £79.43 in 2030[26].
- This gives an initial annual central estimate benefit of £2,600[27].

Environmental Incineration Emission Savings

A benefit of moving away from plastic based goods is that plastic emits more kilograms of carbon dioxide equivalent (CO_2 e) emissions when it is incinerated (1,343kg of CO2e for each tonne of plastic polypropylene). This contrasts with paper which has actually saves 543kg of CO2e for each tonne incinerated as the energy is recaptured. Given that each tonne of CO2 has an environmental cost associated with it, this causes paper straws to make a positive

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[20] Wessex Water: it's time to switch the stick

[21] Estimate based on a quote from McDonald's that they use 1.8m per day in the UK and scaling up to reflect their market share. The estimate is then scaled down using ONS figures for population of England and UK.

[22] Resource Futures: Preliminary assessment of the economic, environmental and social impacts of a potential ban on plastic straws, plastic stem cotton buds and plastic drink stirrers.

[23] We have adjusted the low and high estimates to reflect that the straw consumption in McDonald's may not be representative of the whole fast food market. We also adjust figures from Resource Futures to estimate a range (from 20-36%) for the portion of straws that are consumed in cartons.

[24] Government conversion factors. Spreadsheet used here, which underpins published government gas reporting figures.

[25] Resource Futures: Preliminary assessment of the economic, environmental and social impacts of a potential ban on plastic straws, plastic stem cotton buds and plastic drink stirrers.

[26] Green Book Supplementary Guidance from BEIS, P3.51, which states to use the traded price of carbon for production emissions overseas.

[27] This annual estimate, starting from 2020, includes adjustment to 2017 prices. It rises each year to £32,000 in 2029 when the traded value of carbon is much higher. It is scaled down in the final Net Present Value calculation to reflect that many retailers are voluntarily switching to paper straws. See section on the counterfactual for more detail on this.

contribute towards the environment relative to plastic straws, given they go to non-recycled waste during disposal.

Monetisation and Assumptions

We have monetised this cost using the following figures and assumptions:

- We estimate that 4.7 billion straws are consumed in England each year[28], which includes an estimate of 1.04 billion smaller beverage carton straws (which is approx. 22% of total straws[29]). We assumed 3.3 billion for our low estimate (which excludes carton straws) and 6.3 billion for our high estimate[30].
- Paper straws weigh 1.18g, compared to 0.55g per unit for plastic straws. Smaller carton plastic straws weigh 0.5g[31], and we assume that paper carton straws would increase in weight proportionately to the standard straws, so therefore we assume that paper carton straws weigh 1.07g.
- For each tonne of material given to incineration, plastic polypropylene emits 1.34t of CO_2 e, whereas paper production prevents the emission of 0.54t[32].
- We assume that the cost of one tonne of CO_2 e in 2020 is £68.08, which increases up to £79.43 in 2030[33].
- In our central estimate 99.9% of plastic straws are given to waste or are littered, and then collected by local authorities, with 0.1% ending up in marine environments[34]. We assume zero recycling occurs, which is based on the effort required to segregate them and clean them. This assumption is also to give a conservative estimate, as if any plastic straws were recycled, paper straws would emit fewer carbon equivalent emissions[35], leading to a higher NPV for the policy to ban plastic straws.
- 70% of the 99.9% of straws collected by local authorities are sent for incineration[36]
- When paper is compared against plastic, this gives a saving of £305,000 per year[37].

[28] Estimate based on a quote from McDonald's that they use 1.8m per day in the UK and scaling up to reflect their market share. The estimate is then scaled down using ONS figures for population of England and UK.

[29] Resource Futures: Preliminary assessment of the economic, environmental and social impacts of a potential ban on plastic straws, plastic stem cotton buds and plastic drink stirrers.

[30] We have adjusted the low and high estimates to reflect that the straw consumption in McDonald's may not be representative of the whole fast food market. We also adjust figures from Resource Futures to estimate a range (from 20-36%) for the portion of straws that are consumed in cartons.

[31] Resource Futures: Preliminary assessment of the economic, environmental and social impacts of a potential ban on plastic straws, plastic stem cotton buds and plastic drink stirrers.

[32] Government conversion factors. Spreadsheet used here, which underpins published government gas reporting figures.

[33] Green Book Supplementary Guidance from BEIS: non-traded carbon values are used for emissions from household disposal.

[34] This estimate is based on by Resource Futures that 0.01% of plastic stirrers enter marine environments, which we have taken as our low estimate, with 0.1% as our central estimate and 1% as our high estimate. Resource Future's estimate considers those straws which are littered, not cleaned up and finally find their way into combined sewers and watercourses and the sea; we've raised this to consider the straws consumed and littered directly into marine environments. The overall benefit from incineration emissions is not sensitive to our range given for straws that enter marine environments.

[35] Government conversion factors. Spreadsheet used here, which underpins published government gas reporting figures.

[36] Estimate based on figures by Local Authority collected waste generation from April 2000 to March 2017 (England and regions) and local authority data April 2016 to March 2017

[37] This annual estimate, starting from 2020, includes adjustment to 2017 prices. It is scaled down in the final Net Present Value calculation to reflect that many retailers are voluntarily switching to paper straws, see section on the counterfactual for more detail on this.

Marine Benefits

Summary

Marine litter damages marine life as materials can entangle or be ingested by marine wildlife. Marine litter also has an aesthetic cost, affecting pristine seascapes and quality of life which impacts those who use marine environments and also impacts those who have a non-use value of marine environments, as people value knowing that there is a pleasant environment available to them and to others. There is a market failure as the ocean acts as a free open access resource with no direct private costs to disposal (with only a small chance of being caught and fined). The costs are experienced by all users especially hits groups such as fishermen, water sports enthusiasts, beach goers and animal lovers. As a contributor to marine litter, banning plastic drinking straws will help to reduce these social costs.

Prevalence of Straws in Marine Environments

It is estimated that 1.5 – 4.5% of all global plastics production ends up in the oceans every year[38]. These items are ingested by marine life (with potential knock-on effects further up the food chain), captured as marine debris in fishing equipment and washed up on beaches. The Marine Conservation Society has been monitoring the levels of plastic and polystyrene pieces (0 – 50cm) found on beaches in the UK since 2004. Polystyrene pieces continue to feature in the top ten, ranking first in most common marine litter items in beach clean surveys with an average of 225.3 for every 100m of beach surveyed in 2017[39]. Plastic straws contribute to these pieces as they are made of polystyrene.

Our best estimate for their prevalence comes from an estimate that stirrers and straws together make up 2% of marine litter[40]. We estimate that straws make up 95% of the group of straws and stirrers, based on estimates of the number of straws compared to stirrers[41], so therefore we attribute 1.9% of marine litter to plastic straws.

The ban on plastic straws is expected to reduce the prevalence of marine litter as the ban will help inform consumers of the damages they can cause; fewer straws will reach marine environments, and those that do will stay for less time, as paper straws will decompose quicker than plastic straws. All of these effects will contribute towards an amenity benefit.

Plastic Entanglement Reduction

Entanglement in marine litter is thought to cause the death of 100,000 mammals each year in the North Pacific alone, a rate that appears to be increasing[42,43]. Recording deaths is difficult as many casualties are likely to go unrecorded, either sinking to the ocean floor or being eaten by predators. Entanglement in nets, ropes and other debris poses a significant risk to marine animals and has been recorded in over 130 species of marine animals including 6 sea turtle

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[38] http://www.sciencemag.org/news/2015/02/here-s-how-much-plastic-enters-ocean-each-year

[39] Marine Conservation Society

[40] Report by Eunomia for Seas at Risk, supported by EU funding, 2017, taking the estimate for North Eastern Atlantic.

[41] Resource Futures: Preliminary assessment of the economic, environmental and social impacts of a potential ban on plastic straws, plastic stem cotton buds and plastic drink stirrers. Estimates for the number of stirrers and straws consumed in England vary, and so we have assumed stirrers makeup 2.5% of the total of straws for our high estimate, 5% in our central estimate and 10% for our low estimate for straw prevalence

[42] Thompson, R.C., et al., Plastics, the environment and human health: current consensus and future trends. Philosophical Transactions of the Royal Society B: Biological Sciences, 2009.

[43] Mouat, J., R.L. Lozano, and H. Bateson, Economic Impacts of Marine Litter, 2010.

species, 51 seabird species and 32 marine mammal species[44]. Entanglement causes external cuts and wounds leading to infection, suffocation and drowning, asphyxiation, impaired mobility and fitness.

A ban on plastic drinking straws should help reduce the number of cases of entanglement by reducing plastic debris in the seas. This benefit is difficult to quantify particularly due to the difficulties of placing a value on sea life. It has not been possible to evidence how much plastic drinking straws currently contribute to entanglement, though the contribution may be small given that straws are relatively small pieces of debris and make up only a small portion of marine litter. Alternatively made straws may also still contribute in a smaller way to marine litter and entanglement.

Plastic Ingestion Reduction

All plastic items fragment overtime and there is data on the ingestion of 'plastic fragments' for a wide range of organisms. It has been estimated that 50% of marine mammals, 40% of seabirds and all turtle species have been known to ingest plastic[45]. Plastic can be retained in animals' stomachs and can impede dietary habits, either by making them feel full and therefore preventing them from eating, or by impeding their digestion, resulting in malnutrition and eventual starvation[46].

Plastic straws are particularly risky for digestion due to their long thin form. This can cause physical damage to an animal's entire digestive system. If broken, plastic drinking straws can be even more dangerous with ragged and sharp edges. This is a particular concern for plastic carton straws that may have sharp ends for piercing into cartons.

We would expect a reduction in plastic ingestion following a ban in plastic straws, but as we have not been able to monetise the cost of marine life injured or lost to plastic ingestion we have not been able to monetise the benefit of reduced plastic ingestion.

Damage to Fisheries

The European commission[47] estimated that the cost of marine litter to the fishing industry could amount to almost €60 million. We have not quantified the effect the ban would have on reducing these costs as it is not clear the extent to which plastic straws contribute to fishery damage, but even a small contribution by plastic straws could costs thousands or millions of pounds each year, which could be prevented under a ban.

Benefits to Marine users

Marine litter can negatively affect people's quality of life by reducing their enjoyment of the landscape and scenery. Beaches, coasts and seas are used for recreational activities including swimming, diving, boating, recreational fishing and water sports. Accumulations of marine litter can have a strong deterrent effect[48], so there is a disutility cost to people who want to use the marine environment for recreational activities but feel less able to do so, or would enjoy their activities less, as a result of marine litter. As it is not clear how many people are deterred or

[44] Ten Brink, 2009, referenced in Mouat, J., R.L. Lozano, and H. Bateson: Economic Impacts of Marine Litter, 2010

[45] Estimates from Centre for Environment, Fisheries & Aquaculture Science

[46] Cotton bud project

[47] http://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/index_en.htm

[48] Scottish government, referring to multiple publications: Ballance et al 2000; Sheavly and Register 2005

enjoy marine activities less as a result of marine litter, or how much it affects those people, it has not been possible to quantify the utility benefit to marine users of a reduction in plastic litter.

Benefits to Marine non-users

The **non-use value** includes the knowledge of the existence of a desirable coastal environment, the value of bequeathing this to future generations and the altruistic benefits of preserving attractive coastal resources for other users. We have not been able to evidence the scale of non-use values and so therefore we have not been able to quantify the benefit to non-users of marine environments following a reduction in plastic waste.

Coastal Clean-up Cost Reduction

Harbours and marinas have litter cleared in order to ensure that their facilities remain clean, safe and attractive for users. Mouat et al. (2010)[49] estimated that UK municipalities spend approximately £15.8 million each year removing all forms of beach litter, and £2.1 million each year on harbours.

Our central estimate for the prevalence of plastic straws in marine environments is that they make up 1.9% of marine litter[50]. The ban on plastic straws will reduce marine litter clean-up costs on beaches and harbours as the ban will help inform consumers of the damages they can cause, and alternatively made straws (which are expected to be paper) will decompose much more easily, so each straw will be present on beaches for less time and therefore there will be fewer of them. We have estimated that plastics take 300 years[51] to decompose, whereas paper can take just a few weeks[52] to decompose.

Monetisation and Assumptions

It has been possible to monetise the benefits of reduced clean-up costs following a plastic straw ban, using a series of assumptions for our central estimate:

- Our central estimate for the prevalence of plastic straws in marine environments is that they make up 1.9% of marine litter[53].
- Annual litter clean-up costs are £15.8m for beaches and £2.1m for harbour sides (2010 prices). These figures are for the whole of the UK, so are likely to overestimate impacts for England (it was not possible to deduce how much of these costs are attributable to England only).
- We assume that if straws were no longer present on beaches and harbour sides and that there would be a litter clean-up cost saving equivalent to the portion of litter that straws contribute, as the evidence collected by Mouat et al. (2010) suggests that the majority of litter removal costs are variable costs.
- In our central estimate we assume that decomposition for paper straws takes 24 weeks, 0.1% of the time taken for plastic straws which take 300 years. The rate for paper is based on a low estimate of 6 weeks for newspaper to decompose[54]. We have used a range of estimates for decomposition from 6 weeks to 60 weeks for paper and 200 – 400

[49] Mouat, Lozano, Bateson: Economic Impacts of Marine Litter, 2010. Figure based on exchange rate of £1 = EUR 1.14

[50] See earlier section on prevalence.

[51] Based on estimates of 200 years from 4ocean and 400 years from Wessex Water.

[52] US National Park Service

[53] Report by Eunomia for Seas at Risk, supported by EU funding, 2017, taking the estimate for North Eastern Atlantic. We estimate that straws make up 95% of the group of straws and stirrers, based on estimates of the number of straws compared to stirrers, so therefore we attribute 1.9% of marine litter to plastic straws.

[54] US National Park Service

years[55] for plastic to reflect the fact that rates vary according to oxygen, light and moisture levels.
- This gives an annual central estimate of a £360,000 reduction in the clean-up costs of beaches and harbours[56].

We have modelled this benefit because we believe that as paper decomposes so much quicker than plastic that this will reduce litter on beaches and therefore reduces clean-up and disamenity costs. However, these savings may be overestimated as the savings would be affected by factors such as how frequently and how thorough beach clean ups are. We will continue to assess how switching to biodegradable materials impacts the volume of litter and the implications that has for clean-up costs and disamenity costs.

Amenity benefits of reduced litter on beaches

A ban on plastic drinking straws is expected to have positive amenity benefits. We have monetised the well-being impact of reduced litter in beach environments.

The impacts of litter on amenity well-being:

- 89% of people are concerned by plastic pollution in the ocean[57].
- Initially people may gain a satisfaction from knowing that something is being done to support marine environments (beaches and seas).
- Non-plastic straws that end up in marine environments will decompose faster, leading to fewer straws being found across all environments, and therefore the well-being costs associated with beach litter will be reduced.
- The presence of litter can contribute to a fear of crime and injury, both of which have a negative well-being impact.
- Litter can discourage the use of public spaces and reduce our enjoyment of marine environments.
- There is a negative well-being impact experienced when harm to marine environments and the wildlife in them is observed (this was explored in the marine section).
- Clean environments have a value to people who care for the welfare of wildlife and other people, and littered environments affect people's sense of safety, enjoyment and willingness to use public spaces, and therefore there is a social disamenity cost associated with litter.

Monetisation and Assumptions:

As we have an estimate from Eunomia that beach litter has a disamenity value in England of between £136m to £250m per annum we can estimate the benefit of reduced plastic litter on beaches following the ban with the following assumption and calculations:

- Plastic drinking straws contribute towards 1.9% of marine litter[58].

[55] Based on estimates of 200 years from 4ocean and 400 years from Wessex Water.

[56] This annual estimate, starting from 2020, includes adjustment to 2017 prices. It is scaled down in the final Net Present Value calculation to reflect the market share that plastic straws currently have and how that is expected to change over the appraisal period if there were no ban. See section on 'Counterfactual'.

[57] Populus: Ocean Plastic Survey

[58] Report by Eunomia for Seas at Risk, supported by EU funding, 2017, taking the estimate for North Eastern Atlantic. We estimate that straws make up 95% of the group of straws and stirrers, based on estimates of the number of straws compared to stirrers, so therefore we attribute 1.9% of marine litter to plastic straws.

- The annual well-being loss caused by beach litter is £188m, based on a willing to pay between £6 and £11 per household (in 2002 prices) to see litter free beaches[59].
- We assume a linear relationship between beach litter clean-up and the disamenity experienced by beach users caused by litters. So as we have estimated that straws make up 1.9% of beach litter, we assume that if they were all cleared that this would reduce the litter disamenity costs on beaches by 1.9%. We have assumed a linear relationship as there is an evidence gap describing how litter disamenity is affected by changes in litter. This assumption does not change the overall direction of our net present value estimates, and the uncertainty that there is here is well covered for within the scope of the scenario analysis (see section on counterfactual).
- In our central estimate we assume that decomposition for paper straws takes 24 weeks, 0.1% of the time taken for plastic straws which take 300 years. The rate for paper is based on a low estimate of 6 weeks for newspaper to decompose[60]. We have used a range of estimates for decomposition from 6 weeks to 60 weeks for paper and 200 – 400 years for plastic[61] to reflect the fact that rates vary according to oxygen, light and moisture levels.
- This gives a central estimate of a £380,000 reduction in the annual well-being loss caused by beach litter following a ban on plastic straws[62].

The benefit we have monetised from paper straws decomposing faster than plastic straws is based only on those straws that end up on beaches. We have not quantified the benefit of straws that decompose in other marine settings, yet much of the well-being benefits of there being reduced litter will extend across marine environments beyond beaches. These figures therefore underestimate the well-being benefit of there being reduced litter in marine environments.

We have modelled this benefit because we believe that as paper decomposes so much quicker than plastic that this will reduce litter on beaches and therefore reduces clean-up and disamenity costs. However, these savings may be overestimated as the savings would be affected by factors such as how frequently and how thorough beach clean ups are. We will continue to assess how switching to biodegradable materials impacts the volume of litter and the implications that has for clean-up costs and disamenity costs.

Costs

Costs will be incurred from paper straws being more expensive to produce than plastic straws, which will likely impact businesses and consumers. There are also costs from paper landfill emission costs, enforcement and monitoring costs and a small added fuel cost from paper straws being heavier.

[59] Eunomia, using willingness to pay per household, P65. The estimate for the number of households in England is from ONS.

[60] US National Park Service

[61] Based on estimates of 200 years from 4ocean and 400 years from Wessex Water.

[62] This annual estimate, starting from 2020, includes adjustment to 2017 prices. It is scaled down in the final Net Present Value calculation to reflect the market share that plastic stirrers currently have and how that is expected to change over the appraisal period if there were no ban. See section on 'Counterfactual'.

Monetised Costs

Table 4 shows the monetised costs, with our central total present value (TPV) estimate over 10 years being £93m.

Table 4	10 Year TPV estimates, £m:		
Total Costs:	**Low**	**Central**	**High**
Disposal landfill emission cost	£0	£0	£0
Paper straw costs passed to consumers	-£70	-£55	-£41
Paper straw costs to businesses	-£47	-£37	-£28
Total Costs:	-£117	-£93	-£69

A small cost comes from landfill emissions of paper being greater than plastic. The majority of this comes from the costs incurred from paper straws being more expensive to produce than plastic straws. We expect these costs to be distributed between businesses and consumers, with consumers expected to absorb the majority of the additional costs. These costs are likely to be overestimated given the strong probability that straw consumption will fall, due to wider public understanding of the environmental impacts of straws following this ban; the non-essential nature of straws to most consumers, and; some businesses are likely to choose not to offer straws due to the additional costs of paper straws. We are seeking evidence for future straw consumption levels in the consultation.

Non-monetised Costs

There are likely to be some disutility costs to consumers having to use paper straws when they may have preferred plastic straws. There will be a small added fuel cost from paper straws being heavier than plastic straws, and there will also be enforcement and monitoring costs.

Costs to Businesses and Consumers from Higher Production Costs

Production costs for paper straws are greater than production costs for plastic straws, resulting in costs for businesses which are expected in part to be passed onto consumers. We welcome evidence in the consultation concerning any straw makers that might be directly impacted in England, but we assume in this impact assessment that all straws are imported. Research by Resource Futures indicates that the market for large straws in England is 'dominated by wholesalers supplying imported drinking straws', and that there is also no significant manufacturing base for carton plastic straws either[63].

Monetisation and Assumptions

We have monetised this cost using the following figures and assumptions:

- We estimate that 4.7 billion straws are consumed in England each year[64], which includes an estimate of 1.04 billion smaller beverage carton straws (which is approx. 22% of total

[63] Resource Futures: Preliminary assessment of the economic, environmental and social impacts of a potential ban on plastic straws, plastic stem cotton buds and plastic drink stirrers.

[64] Estimate based on a quote from McDonald's that they use 1.8m per day in the UK and scaling up to reflect their market share. The estimate is then scaled down using ONS figures for population of England and UK.

straws[65]). We assumed 3.3 billion for our low estimate (which excludes carton straws) and 6.3 billion for our high estimate[66].

- For large straws we assume that plastic straws cost 0.65p and paper straws cost 2.5p per unit to produce. For carton straws we assume plastic straws cost 0.06p and paper straws 0.25p per unit to producer[67].
- This means that each paper large straw is 1.83p costlier to produce, and each carton straw is 0.19p costlier to produce.
- When multiplied by the number of straws produced and added together this gives an annual central cost estimate of £69m[68].
- After applying our scenario analysis, where we forecast the percentage of the market that would have switched away from plastic straws voluntarily over the appraisal period, we estimate annual costs in our central scenario to start at £25m, but these fall rapidly to £1m as our forecast is that more and more of the market overtime will switch away from plastic anyway. We assume that businesses that switch voluntarily are doing so regardless of whether plastic straws are banned, and so therefore any costs incurred to these businesses from switching are not counted as an impact of the ban.

Business costs and sensitivities

- Our best evidence is that there is no significant manufacturing base in England, with the straws market being 'dominated by wholesalers supplying imported drinking straws to the hospitality sector'[69]. Wholesalers and hospitality based businesses are likely to be those that are most affected by the increase in straw prices.
- We have assumed in our central estimate that businesses will pass 60% of the production cost increases to consumers. We assume 100% is passed onto consumers in our low cost (to businesses) estimate and 0% is passed on in our high estimate. We have used the widest range possible to show how sensitive business costs are to this assumption, and also as our evidence for how businesses will respond to the cost increases is limited. Our range for the equivalent annual net direct cost to business estimates is shown in table 5.
- We have assumed that the majority of costs (60%) will be passed onto consumers. Evidence from a high street retailer who were contacted by Resource Futures[70] stated that 'any difference in costs would be unlikely to significantly impact sales and profit and the consumer would be willing to pay the extra'. Resource Futures reported that most of their respondents felt that 'costs would be likely passed to consumers and these would go unnoticed', and they therefore modelled a very small cost to businesses in their report. Their evidence certainly implies that businesses will pass the majority, if not all of the costs to consumers. Although we have this evidence we have taken a more

[65] Resource Futures: Preliminary assessment of the economic, environmental and social impacts of a potential ban on plastic straws, plastic stem cotton buds and plastic drink stirrers.

[66] We have adjusted the low and high estimates to reflect that the straw consumption in McDonald's may not be representative of the whole fast food market. We also adjust figures from Resource Futures to estimate a range (from 20-36%) for the portion of straws that are consumed in cartons.

[67] Resource Futures: Preliminary assessment of the economic, environmental and social impacts of a potential ban on plastic straws, plastic stem cotton buds and plastic drink stirrers.

[68] This annual estimate, starting from 2020, includes adjustment to 2017 prices. It is scaled down in the final Net Present Value calculation to reflect that many retailers are voluntarily switching to paper straws, see section on the counterfactual for more detail on this.

[69]

[70] Resource Futures: Preliminary assessment of the economic, environmental and social impacts of a potential ban on plastic straws, plastic stem cotton buds and plastic drink stirrers.

conservative approach by assuming that a small majority (60%) of the costs are passed to consumers.

Table 5 - Business Costs and EANDCB, £m	Low	Central	High
Present Value Net Direct Costs to Business (10 years)	£0	£36,980,909	£93,198,489
Equivalent Annual Net Direct Cost to Business	£0	£4,296,266	£10,827,356

A further area of sensitivity comes from estimating the market share for straws that would switch voluntarily away from plastic regardless of the ban. Our modelling for this is explained in the counterfactual section. Table 6 shows how the equivalent annual net direct costs to businesses (EANDCB) over 10 years change between our low take up (of alternative to plastics) scenario and high take up scenarios:

Table 6 - Scenarios for paper take up if there were no ban:	EANDCB estimates, £m: Low	Central	High
Central Scenario	£0	£4.3	£10.8
Low take up Scenario	£0	£7.1	£17.9
High take up Scenario	£0	£2.2	£5.5

Reasons these costs may be overestimated

The following factors have not been considered in our modelling due to evidence limitations. We welcome responses in the consultation that can address these evidence gaps:

- Economies of scale. As the production of paper straws scales up, the unit cost of each paper straw is likely to go down. Resource Futures reported from their business respondents that prices of paper straws will decline when economies of scale are reached[71].
- Switching materials may create the opportunity for straw production to move to the UK, creating jobs and an opportunity for UK businesses to make profits. This is evidenced by McDonald's recently contracting a Welsh packaging company to supply its paper straws[72].
- Consumption of straws is likely to fall. An increase in the cost of straws is likely to encourage businesses to offer straws less willingly (e.g. they may give them to consumers on request only). Consumers will be less willing to buy straws from retailers if they're more expensive to purchase. These factors depend on the price elasticity of demand i.e. how sensitive demand for straws is to a change in the price of straws. We do not have evidence for the price elasticity of demand for straws, but given that straws are not a necessary item for the majority of consumers, it seems extremely likely that demand for straws will fall. This means costs following a switch in material will be smaller in scale than we have monetised, while the environmental harms caused by straws will be further reduced.

[71] Resource Futures: Preliminary assessment of the economic, environmental and social impacts of a potential ban on plastic straws, plastic stem cotton buds and plastic drink stirrers.

[72] Walesonline

Reasons these costs may be underestimated:

- Prices of paper straws may rise following an upturn in demand at the time of the plastic straw ban, but our scenario analysis shows that there is already a significant trend away from plastic straws, with commitments having been made by multiple major chains.
- There may be implementation, menu costs and switching costs we have not considered. Some businesses may have stocks of plastic straws they may be unable to shift. We welcome evidence in our consultation for any concerns businesses may have about the direct costs of switching material.

Fuel Costs

There will be an increase in fuel costs for transporting paper straws as paper straws weigh more than plastic straws (approximately double), so this will add to transportation costs (both the fuel cost to businesses and associated environmental costs of emissions) when the travel from production line to consumer is considered.

We have not been able to monetise the additional fuel cost as a number of factors are unclear:

- The average distance travelled by each straw from production to consumption.
- The mode or modes of transport used to import straw and the vehicles used.
- The fuel cost of the additional weight per mile, which will depend on the mode of transport and the weight a vehicle is already transporting.
- Whether the added weight will require additional journeys, and if so how many will be required.

Samba - Small and Medium sized Business Assessment

There will be costs to businesses resulting from additional fuel costs, but predominantly the additional costs will come from the production costs, and our expectation is that the majority of these costs will be passed onto consumers. Of the costs that are absorbed by businesses, we have no evidence to suggest that small and medium sized businesses would be impacted disproportionately to larger businesses, but we have little evidence of the size of the wholesaler businesses that dominate the straw market in England with imported straws. We welcome evidence in the consultation concerning any costs that might particularly hit small and medium sized businesses.

Disutility from using a different product

Paper straws may not be a perfect substitute for plastic straws. Some users have reported that they go ‘soggy’ and degrade while in the drink, and that they can affect the taste of the drink[73]. Some alternatives to plastic straws are unsuitable for consuming hot drinks and reusable plastic straws can raise hygiene concerns.

However, there is evidence to suggest that any disutility costs from non-plastic straws being inferior are not as big a concern as environmental considerations, as a YouGov poll found that 77% of the public supports banning plastic drinking straws[74].

[73] Bon appetit

[74] You Gov

Furthermore, any disutility costs may be short lived as non-plastic straws that are higher quality than paper may soon become available. There is a developing market for bio-based (polylactic acid, PLA) materials to replace polypropylene plastic, and some suppliers believe it is possible to have a 'material for straws that achieves the expected performance attributes, is renewably-sourced and manufactured cleanly – yet still provides desired after-use options such as compostability'[75], and have been advertised as able to break down in under 12 weeks[76].

We welcome evidence in our consultation concerning cases where non-plastic straws are not suitable substitutes, particularly in cases not considered in the planned exemptions.

Environmental Landfill Emission Cost

A cost of moving away from plastic based goods is that plastic emits very few kilograms of carbon dioxide equivalent (CO_2 e) emissions when placed in landfill (just 0.005 tonnes of CO2e for each tonne of plastic polypropylene). This contrasts with paper which emits 1.033t of CO2e for each tonne left to landfill. This means that paper based alternatives have an element of environmental cost.

Monetisation and Assumptions

We have monetised this cost using the following figures and assumptions:

- We estimate that 4.7 billion straws are consumed in England each year[77], which includes an estimate of 1.04 billion smaller beverage carton straws (which is approx. 22% of total straws[78]). We assumed 3.3 billion for our low estimate (which excludes carton straws) and 6.3 billion for our high estimate[79].
- Paper straws weigh 1.18g, compared to 0.55g per unit for plastic straws. Smaller carton plastic straws weigh 0.5g[80], and we assume that paper carton straws would increase in weight proportionately to the standard straws, so therefore we assume that paper carton straws weigh 1.07g.
- For each tonne of material placed in landfill, plastic polypropylene emits 0.005kg of CO_2 e, whereas paper production emits 1.033kg[81]. It is possible that there are impacts of plastic landfill disposal that are not included within the 0.005kg estimate as plastic has not been around for as long as its own estimated decomposition rate, but this would only serve to reduce the emission cost of switching materials.
- We assume that the cost of one tonne of CO_2 e in 2020 is £68.08, which increases up to £79.43 in 2030[82].
- In our central estimate 99.9% of plastic straws are given to waste or are littered, and then collected by local authorities, with 0.1% ending up in marine environments[83]. We assume

[75] Bio-based news

[76] Plastico

[77] Estimate based on a quote from McDonald's that they use 1.8m per day in the UK and scaling up to reflect their market share. The estimate is then scaled down using ONS figures for population of England and UK.

[78] Resource Futures: Preliminary assessment of the economic, environmental and social impacts of a potential ban on plastic straws, plastic stem cotton buds and plastic drink stirrers.

[79] We have adjusted the low and high estimates to reflect that the straw consumption in McDonald's may not be representative of the whole fast food market. We also adjust figures from Resource Futures to estimate a range (from 20-36%) for the portion of straws that are consumed in cartons.

[80] Resource Futures: Preliminary assessment of the economic, environmental and social impacts of a potential ban on plastic straws, plastic stem cotton buds and plastic drink stirrers.

[81] Government conversion factors. Spreadsheet used here, which underpins published government gas reporting figures.

[82] Green Book Supplementary Guidance from BEIS, which states that emissions for landfill should use non-traded values.

[83] This estimate is based on by Resource Futures that 0.01% of plastic stirrers enter marine environments, which we have taken as our low estimate, with 0.1% as our central estimate and 1% as our high estimate. Resource Future's estimate considers those straws which are littered, not cleaned up and finally find their way into combined sewers and watercourses and the sea; we've raised this to consider the straws

zero recycling occurs, which is based on the effort required to segregate them and clean them. This assumption is also to give a conservative estimate, as if any plastic straws were recycled, paper straws would emit fewer carbon equivalent emissions[84], leading to a higher NPV for the policy to ban plastic straws.
- 30% of the 99.9% of drinking straws collected by local authorities are sent to landfill[85].
- This gives an initial cost estimate of £115,000 per year[86].

Monitoring and Enforcement Costs

There will be costs associated with inspection and law enforcement services to support the ban. It has been proposed that the ban will be enforced through civil sanctions set out in part 3 of the Regulatory Enforcement and Sanctions Act 2008 (though this would require the creation of an offence punishable by a fine, to facilitate the use of the 2008 Act). As part of the consultation, we are seeking views on how such civil enforcement can most effectively and proportionately be carried out. Although the costs of enforcement have yet to be specified, it is not expected that these costs will be large in size compared to other impacts in this assessment.

Risks

Risks of imposing a ban

- **Increase in littering:** There is a risk that a change in material may encourage consumers to believe that the consequences of not disposing of straws correctly will be reduced and that therefore consumers will litter more or not recycle straws as frequently. However we expect that the ban will raise people's awareness of the environmental damage straws can cause, and that consumers will therefore dispose of them correctly and reduce their use of straws.
  Increase in prices: Some suppliers may be forced to increase prices of paper straws in the short term due to excess demand around the ban. There may also be an incentive to use the forced change in material following the ban as an opportunity to impose price rises on consumers.
  Inadequate provision of exemptions: This would impose welfare costs on those who rely on using plastic straws in their everyday lives.

Risks of not imposing a ban

- **Environmental costs get worse**: If we don't place a ban the environmental impacts including harm to marine wildlife may worsen and possibly at an increasing rate.

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consumed and littered directly into marine environments. The overall benefit from incineration emissions is not sensitive to our range given for straws that enter marine environments.

[84] Government conversion factors. Spreadsheet used here, which underpins published government gas reporting figures.

[85] Estimate based on figures by Local Authority collected waste generation from April 2000 to March 2017 (England and regions) and local authority data April 2016 to March 2017

[86] This annual estimate, starting from 2020, includes adjustment to 2017 prices. It is scaled down in the final Net Present Value calculation to reflect that many retailers are voluntarily switching to paper straws, see section on the counterfactual for more detail on this.

- **Commitments not met:** The ban forces retailers to adhere to the voluntary commitments many retailers have already made towards switching to paper straws. If a ban is not imposed retailers may fall back on or delay commitments they have made.
- **Consumers keep choosing plastic:** Even though paper straws are increasingly being made available to consumers, and there is strong consumer support to move away from plastic products[87] there is a risk that consumers will still opt for plastic straws without a ban. They could do so inadvertently if products are not well labelled, or consumers may find that they prefer plastic straws. It may be that there is a time inconsistency problem where consumers state that they should not use plastic straws because of their associated environmental harms, but upon purchase they discount future and indirect environmental costs too strongly in favour of a plastic product that they may prefer to use now.

Carbon Impact

Banning plastic straws will reduce carbon emissions. These are picked up in the monetised sections on production and disposal emissions. Table 7 provides an estimate of the net CO_2 equivalent change in greenhouse gas emissions over the next 10 years as a result of the preferred option, globally and to England, and whether the emissions count as traded or non-traded emissions.

Table 7 - Carbon emissions (CO2e tonnes)	Global Emissions	Emissions in England	Traded	Non-traded
Production emission savings	796	0	Y	
Incineration emissions savings	6,452	6,452		Y
Landfill emission savings	-2,314	-2,314		Y
Total net saving:	4,934	4,138	796	4,138

Emissions from production count as traded emissions, whereas emissions released in disposal (incineration and landfill) count as non-traded emissions[88].

Savings from production emissions are counted as zero in England as we have assumed that straws are all imported. Globally, paper straws will add emissions compared to plastic through being heavier and through emitting more emissions when placed in landfill. However there is a net saving due to paper being significantly cleaner to produce than plastic, and through having an emission reduction impact through energy conversion when it is incinerated.

Key evidence sought in the consultation

This section provides a list of areas mentioned across the impact assessment that we would particularly welcome receiving further evidence around in the consultation:

- **Exemptions:** views and evidence on how best to maintain access to plastic drinking straws for specific groups of people who need them.

[87] YouGov finds overwhelming support for banning 'problem plastics'.

[88] For guidance on this, see Green Book Supplementary Guidance from BEIS.

- **Business costs:** we welcome any evidence concerning additional costs or constraints to industry from the proposed ban.
- **Prices of paper straws:** we welcome further evidence for the price per unit of non-plastic straws, and evidence to suggest how the price of non-plastic straws will change as the scale of production increases
- **Changes to consumer behaviour:** we welcome evidence that can be used to predict how consumers respond to a change in the material of straws. Particularly, should we expect straw consumption decrease, and how well are non-plastic alternatives being received.

The full set of questions we would appreciate responses for are in the consultation document.

Annex 1

Annex 1 shows the scenario analysis described in the counterfactual section. The table shows the percentage of the market share forecast to still be plastic over the next 10 years. The counterfactual described in the 'no ban central' scenario has been used to calculate the net present values in table 1.

Annex 1	**Plastic market share difference to ban scenario**			
	Ban	**Low Take up**	**Central**	**High Take up**
2020	0.9%	67%	50%	35%
2021	0.9%	54%	38%	20%
2022	0.9%	42%	26%	10%
2023	0.9%	30%	14%	5%
2024	0.9%	20%	8%	3%
2025	0.9%	12%	5%	3%
2026	0.9%	8%	3%	3%
2027	0.9%	5%	3%	1%
2028	0.9%	5%	3%	1%
2029	0.9%	5%	3%	1%