Title: Impact Assessment on the proposal to ban the supply of plastic drinking straws to the end user in England	Impact Assessment (IA)
IA No: N/A	**Date:** 13/02/2020
RPC Reference No: RPC-4316(3)-DEFRA	**Stage:** Final
Lead department or agency: Department for Environment, Food and Rural Affairs (Defra)	**Source of intervention:** Domestic
Other departments or agencies: N/A	**Type of measure:** Secondary legislation
	Contact for enquiries: Dan Quinlan or Tom Murray

Summary: Intervention and Options

RPC Opinion: Green

Cost of Preferred Option (2016 prices, 2017 present value)				
Total Net Present Value	**Business Net Present Value**	**Net cost to business per year**	**Business Impact Target**	**Status**
-£53.7	-£56.9m	£6.6m	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 which generates carbon emissions. These are negative externalities that 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 faster to the plastic-free alternatives that already exist and decompose much quicker, and to ensure the change and environmental benefits are sustained into the future.

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 lower life-cycle impacts on the environment. It may also encourage UK businesses to invest in biodegradable alternatives to plastic straws. 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

Two options are considered. 'Do nothing' (option 0), or a ban with specified exemptions (option 1, preferred). A ban is preferred as it would have the maximum impact in reducing the social costs of plastic drinking straws. The impacts of a ban are proportionate to secure the environmental benefits without major costs given the current trend in the market for straws is to move away from plastic and because straws made from alternate materials are readily available. 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 those who need straws for medical or accessibility reasons, and to allow continued easy access upon request for those who rely on plastic straws in their everyday lives.

Will the policy be reviewed? It will be reviewed. **If applicable, set review date:** 5 years post implementation

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:** 0	**Non-traded:** 0.000895	

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 person REBECCA POW Date: 13 February 2020

Summary: Analysis & Evidence

Policy Option 1M

Description:

FULL ECONOMIC ASSESSMENT

Price Base Year 2017	PV Base Year 2020	Time Period Years 10	Net Benefit (Present Value (PV)) (£m)		
			Low: -£88.7m	**High: -£39.4m**	**Best Estimate: -£60.7m**

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	£1.0		£4.6	**£45.2**
High	£3.1		£9.5	**£91.7**
Best Estimate	£2.1		£6.7	**£65.1**

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

The wholesale price of paper straws, the expected alternative, are greater than plastic straws and so there will be costs to businesses, a portion of which we expect will be passed to consumers. 60% are assumed to be passed to consumers for the NPV calculation, but, for the cost to business calculation all costs are assumed to be absorbed by businesses with no consumer pass-through, following better regulation guidance. We have also monetised a familiariastion cost to businesses that are expected to fall under the proposed exemption to prepare for the new regulation, and an additional cost to small and micro buisnesses who may purchase plastic straws in smaller, quantities at a higher unit price under the exemption. We have monetised the cost of additional emissions expected from paper straws sent to landfill, as plastic emits very few carbon dioxide equivalent (CO_2 e) emissions when placed in landfill relative to paper, as well as additional fuel cost to businesses associated with transporting straws, as paper straws weigh more than plastic straws. Monitoring and enforcement costs to the public sector have also been included.

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.

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	£0		£0.3	**£3.0**
High	£0		£0.6	**£5.7**
Best Estimate	£0		£0.5	**£4.4**

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

Alternatively made straws, expected in this analysis to become paper, are cleaner to incinerate than plastic (incineration is the expected residual waste treatment method for the majority of straws as they are assumed to be picked up by local authorities), 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 and are less costly to clean.

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 by industry, we assume over time 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, for both large and carton straws. We assume 264 million 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: £6.61	**Benefits:** £0	**Net: -**£6.61	

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. Even if they are placed in recycling bins their small size and flexibility means that they are more likely to fall between recycling machinery and are therefore unlikely to be recycled[1].

Littering of plastic drinking straws negatively impacts on wellbeing and generates clean-up costs. It also contributes to the global marine plastic problem, damaging the marine environment and posing a risk to wildlife. 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 entanglement in marine litter in the North Pacific alone; a rate that appears to be increasing[2,3]. Every straw, if not properly disposed of, can contribute towards these costs over a long period of time as it is estimated to take plastic 300 years to decompose[4]. Plastics production also usually depends on finite fossil fuels, and is therefore associated with non-renewable resources use and greenhouse gas emissions.

However, for some of the population, plastic drinking straws are a necessity either for medical purposes or to allow accessibility in everyday life to hot and cold beverages and liquid food. It is therefore vital that those who rely on plastic drinking straws can continue to access them easily and without stigma following a policy intervention to deal with wider environmental and social costs. Businesses should continue to apply their existing obligations under the 2010 equality act to make reasonable adjustments for those with disabilities. Under the proposed exemption, catering businesses and registered pharmacies will be permitted to stock plastic straws behind the counter and to provide these to customers on request. In terms of stigma, this means ensuring there is no requirement for proof of need when anyone requests a plastic drinking straw.

Disposable drinking straws are typically made of a plastic polymer called 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

[1] British Science Association; Which? – How to recycle in the UK; Defra stakeholder conversations with waste management companies

[2] 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.

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

[4] US National Park Service

including cocktail straws and those in sport drink bottles. 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 plastic straws (large and smaller straws attached to beverage carton) are consumed in England each year as a central estimate (see table 2 for range)[5]. A research report on this subject commissioned by Defra to Resource Futures estimated 4.6bn plastic straws per year (large, carton and for medical purposes). For this analysis, this estimate was updated following the latest evidence from McDonalds, who use 1.8 million straws each day, or 657 million per year, which is 14% of the 4.7bn.

Rationale for Intervention

As discussed, plastic drinking straws are not commonly recycled, and therefore most plastic straws are either incinerated for energy or sent to landfill at the end of their life, with the former releasing carbon dioxide emissions. In addition, some plastic straws are disposed of incorrectly as litter. Litter costs the taxpayer money to clean-up and imposes a number of other costs on society including visual pollution and environmental harm. Littered plastic straws also pose a risk to wildlife, and if they enter the water system and/or marine environment they can easily be ingested by, or become entangled with, marine life, captured as marine debris in fishing equipment, or washed up as litter on beaches.
These negative impacts are not accounted for in the market price of plastic drinking straws. This means businesses and end-consumers are not currently incentivised to limit their use and disposal of plastic drinking straws appropriately, or to switch to straws made of less environmentally harmful materials. Intervention is required in order ensure businesses and consumers can make well informed decisions that account for the negative impacts of plastic straw use.

Drinking straws made materials like from paper are readily available alternatives. Paper straws decompose more quickly and therefore cause less environmental damage, and are also cleaner to incinerate than plastic.

Research commissioned by Defra[6] looked at current trends in the straws market. Based on the current rate of businesses switching away from plastic, it estimated that plastic straw usage will decrease regardless of a ban being implemented. If this rate continues, it is estimated that plastic straw usage is likely to reach very low levels by 2025/26 (see Figure 1).

[5] 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.

[6] 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.

However, despite the predicted trend, there is rationale for government to intervene to ban these items ahead of that time. A ban, rather than reliance on voluntary action would stem the flow of plastic straws more quickly, and ensure that the environmental benefits achieved are maintained into the future. The forecasted trend is used for the purpose of this analysis to provide a conservative estimate of the impact of a ban in light of current voluntary action. However, it is important to note that the projected trends are forecasts, and there is no guarantee that, in the absence of a ban, plastic straw usage will decrease by as much as predicted or would not begin to rise again in the future. For example, this might happen if current public awareness and media attention on the issue is not sustained.

Government action to ban the supply to the end user of plastic straws where alternatives are readily available means that the change needed to reduce harmful and unnecessary plastic pollution in our oceans is secured across the market, and that the negative effects these items have on the environment are addressed as soon as possible.

The EU's Single-Use Plastic Directive also requires member states to ban single-use plastic straws by July 2021. The proposed ban is in line with this for plastic carton straws, and goes faster for large plastic straws, by implementing a ban in April 2020.

Consultation support for a ban: The public consultation showed significant support for a ban, with 82% and 81% of members of the public and organisations respectively supporting it based on the environmental impact it has, particularly on marine ecosystems. A small minority of respondents also quoted that alternative materials to plastic straws are available and as such can be easily replaced.

Those who opposed the ban mainly cited plastic straw usage for medical reasons, which we are proposing to be exempt. Other reasons included that plastic straws are a negligible part of a greater environmental problem, alternatives are more costly (costed in this impact assessment) and behaviour change should come first to address littering. The Government is taking these points forward through policies in the both Litter Strategy and the Resources and Waste Strategy, such as consistency in municipal collections, introducing a deposit return scheme and reforming packaging producer responsibility. This impact assessment should be viewed as part of a package of wider measures that seek to maximise the value we extract from waste and minimise its environmental impact.

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[7] to improve the environment has specific commitments to eliminate avoidable plastic waste by the end of 2042 and a target to reduce significantly and where possible prevent all kinds of marine plastic pollution.

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

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

It is also intended that banning the supply of plastic drinking straws to the end user 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.

In addition, it is important to note that a ban on the supply to the end user of plastic straws is not the only government intervention in addressing the environmental impacts of the waste we produce. This measure is part of a wider package of reforms, which use different policy instruments, as detailed in the Resources and Waste Strategy[8]. A ban was chosen as the most appropriate instrument here because single-use straws were deemed as avoidable plastic to most consumers, which cause environmental harm and are easily replaceable.

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. The government recognises that there are a number of vital uses for single-use plastic straws, particularly for the elderly, disabled and those who find it difficult to consume drinks due to the impact of a stroke, injury or other long-term condition. Straws made of alternative materials are not always suitable for the consumption of hot drinks, reusable straws can raise hygiene concerns and metal and glass straws can be dangerous for people with neurological conditions such as Parkinson's. The policy therefore includes exemptions to tackle this objective. This is covered in detail in the Exemptions in Option 1 section below.

Key evidence sought in the consultation

This section provides a list of areas mentioned in the consultation stage impact assessment where we particularly welcomed receiving further evidence in the consultation that closed late 2018:

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

Consultation responses: In the consultation, the majority of respondents (65%) including members of the public and organisations agreed with the proposal to exempt plastic straws for medical-enabling and other specialist uses from any ban. In the consultation impact assessment ban scenario, we assumed that 44 million

[8] Our Waste, Our Resources: A Strategy for England

plastic straws, or around 1% of current straws, will continue to be consumed as part of the planned exemptions.

Data are not readily available on those people who require plastic straws, so this was estimated using a 'bottom-up' method taking into account groups of people more likely to require plastic straws and potential consumption behaviours. Dexterity has several types, and this estimate includes a proportion of both those with manual and severe dexterity disabilities, as well as the 65+ population[9]. This is not an exhaustive list of those groups of people who may require plastic straws, but has been used to estimate the potential scale of the exemption.

We tested this at consultation with the question "do you agree with the government's estimation that 44 million straws (about 1% of existing straws) will still be required for exemptions following a ban?" A total of 663 responses were received, including those from members of the public and charities. 44% of respondents disagreed, with 56% either agreeing or being uncertain. No robust evidence was identified by respondents to support their assumptions, and no evidence of modelling carried out was reported.

In practice, the assumed number of straws in this impact assessment will not act as a cap or affect the distribution of plastic straws to those who need them for medical purposes. It is purely utilised to enable exemptions to be factored into the economic modelling. However, further stakeholder engagement has been undertaken in order to try and ascertain a better estimate of the number of straws that might be required per person per day. No robust evidence was received, however it was suggested that NHS guidance that adults should consume 6-8 glasses of fluid per day could be used to provide a guide[10]. On this basis, we have therefore increased the number of plastic straws assumed to be used by each person per day to 6, with sensitivity analysis to reflect the uncertainty around this estimate, encompassing a range of 4-8 straws. This increases the number of plastic straws assumed to be used each year under the exemption from 44 million to 264 million in our central scenario.

It should be noted that the impacts of this change are to somewhat reduce the both the costs and benefits associated with the ban, by assuming that fewer straws are switched away from plastic[11].

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[9] 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. The estimate assumes that 1% of each of the following groups will require one straw a day: those with manual dexterity disabilities, those with severe dexterity difficulties (including those with Parkinson's disease and Cerebral Palsy), and the 65+ population (for example, for prescription medicine and/or manual feeding)

[10] NHS Eatwell Guide: https://www.nhs.uk/live-well/eat-well/the-eatwell-guide/. This assumes close to zero plastic straw reuse, which is likely to be a conservative estimate, as any reuse would reduce the number of straws required.

[11] It is assumed that overall consumption of straws (plastic + alternatives) remains constant, however the proportion of plastic vs. alternatives within this changes. As plastic straws are cheaper than paper straws, increasing the proportion of straws assumed to remain as plastic has the effect of reducing the costs to business of the ban more significantly than reducing the environmental benefits.

The impact of the ban and how the exemption is working in practice will be reviewed one year after the ban is implemented as well as the standard five-year post implementation review stage.

- Business costs, including price of alternatives to plastic straws: we welcomed any evidence concerning additional costs or constraints to industry from the proposed ban.

Consultation responses: The responses from members of the public and organisations showed very similar distribution across the response types (yes, no, etc.) The **majority** of responses (59% out of 673 who responded to this question) were unclear or did not give an opinion in agreement or disagreement with the estimate regarding increased costs to industry. These responses mentioned the following themes:

- Some respondents expressed a view that the environmental costs of using plastic straws are greater and more important than the economic costs of the alternatives.
- Some respondents suggested that the costs of alternatives would decrease over time as a result of increased demand and economies of scale.
- A small number of respondents were unsure whether the government's estimation takes into account the overall reduction in the number of plastic straws being manufactured due to decrease in demand.

30% of respondents did not agree with the estimated cost to industry. These responses gave the following reasons:

- Some respondents believed that the costs to industry would be higher, due to the costs associated with alternative materials, investment in new equipment or manufacturing facilities, and product redesign and change.
- Some respondents believed that the costs to industry would be lower, due to the reduction in demand for straws and the economy of scale in producing more straws from alternative materials.
- Several respondents believed that the proposed ban would not considerably affect the industry, as the costs would be passed on to the consumer.
- A large manufacturer stated that they have carried out their own calculations which estimate the cost of finding alternatives for their products which require single-use plastic straws would be four to five times more than their current solution.

- Tetra Pak Limited stated that the government's estimate does not consider:
    - Cost for developing alternatives that can be attached to food or drink cartons
    - Cost for redesigning cartons so that paper straws can be used
    - Cost for the range of paper straws that would be required (e.g. U-shaped straws, telescopic straws)
    - Capital equipment costs for producing the straw and applying it to a carton (estimated that the cost of capital equipment investment could be in the region of tens of millions of pounds over the next five to seven years)
    - The challenge of industrial-scale production of on-pack paper straws, as alternative paper-straw production technologies are currently not suited to high volume production in demanding food-safe environments, and the potentially significant R&D investments of over £30m required to develop alternatives.

A small number of respondents agreed with the government's estimate, providing the following additional information:

- Some of the respondents stated that the increased cost is worth paying to protect the environment.
- Several respondents suggested that overall straw consumption would reduce as a result of a ban on plastic straws, so costs would be further reduced.

The Food and Drink Federation added the following: "We would urge the government to take a holistic view of the wider pressures being faced by industry at the present time along with the attendant risks, before deciding whether to proceed with a ban. These include the proposal to introduce a Deposit Return Scheme, reform of the Packaging Producer Responsibility legislation, a tax on plastic containing less than 30% recycled content plus the wider market uncertainty due to Brexit."

We have taken into account this feedback in the development of this analysis, and included an additional familiarisation cost for businesses. In addition, further engagement since the consultation closed with businesses such as Tetra Pak suggests that technological advances may help to make faster progress with carton straws than initially expected. In July 2019, Tetra Pak announced that they have "developed a paper straw that is fully functional and meets internationally recognised food safety standards" and they are now taking the next steps in field testing paper straws for beverage products in Europe[12]. In addition, the ban for carton straws has been delayed to May 2021 in order to allow industry time to develop alternatives and full scale industrialisation.

[12] Tetra Pak press release July 2019

-Changes to consumer behaviour: we welcomed evidence that can be used to predict how consumers respond to a change in the material of straws. Particularly, whether we should expect straw consumption to decrease, and how well non-plastic alternatives are being received.

Consultation responses: The consultation-stage impact assessment assumes that overall straw usage (plastic + paper) remains unchanged as plastic straws are replaced with paper ones. This was tested at consultation, with half of respondents disagreeing with that assumption, 9% agreeing and 41% answering "unclear". Those who disagreed mainly believed straw usage will decrease over time. A trade association stated in their response that change in behaviour has already been reported in some businesses, including a decline in the use of straws by 63% as a result of moves to supply straws only upon direct request from customers. The respondent stated that they have seen a change in the awareness of the public about what is happening to our environment, which has caused a reduction in the demand for plastic straws.

In response to this, the impact assessment now incorporates a further sensitivity, built into existing high/central/low NPV scenarios, where total straw consumption decreases by 20%, 10% and 0% respectively over the ten-year appraisal period. This is more conservative than some of the reductions predicted in consultation responses, in order to reflect the fact that reductions reported by respondents may not be replicated in all sectors where straws are used/purchased.

In addition to the consultation responses, a number of evidence points have been sourced from research undertaken by the consultancy Resource Futures for Defra. This research was conducted between March and April 2018 to specifically develop understanding of the markets for plastic straws, drinks stirrers and plastic-stemmed cotton buds, and the potential impacts of bans. This included engagement with key stakeholders, an evidence review and preliminary impact modelling. Evidence from this research has been combined with stakeholder engagement (notably with disability groups to structure the exemption), Defra research and consultation responses.

The full set of answers can be viewed in the summary of responses and UK Government response to the consultation.

Changes made to this Impact Assessment following the consultation

- The implementation date for the ban on the supply to the end user of large plastic beverage straws has been moved to April 2020, in line with Government's official response to the consultation. For plastic carton straws, the implementation date assumed is from July 2021.

- Two separate categories of business costs are identified in this impact assessment: direct costs to businesses (purchasing paper straws, which are more expensive than the equivalent plastic straws); and familiarisation costs (moving plastic straws behind the counter and ensuring staff are familiar with the regulation, accruing to those businesses that fall under the proposed exemption).
- Changes to direct costs to businesses: Previously, part of the additional costs to business from moving from plastic to paper straws was partially assumed to fall on consumers. Following Regulatory Policy Committee advice we have allocated all of that as a direct cost to businesses, increasing the equivalent annual net direct cost to businesses (EANDCB) compared to the consultation impact assessment. However, for the Net Present Value calculations, we continue to assume 60% of additional business costs are directly or indirectly passed through to consumers, in line with the consultation-stage IA.
- Changes to familiarisation costs to businesses: The Impact Assessment now incorporates one-off and on-going familiarisation costs for businesses to adjust to the exemption for a ban on plastic straws. This is based on an estimate of a staff time requirement at each outlet of business that may fall under the exemption to undertake activities such as briefing staff and moving plastic straws behind the counter. This was estimated by identifying the types of businesses that will be affected, and was tested with a relevant stakeholder.
- As described above, the assumptions around the number of plastic straws estimated to remain in use under the exemption has been increased. This uses the same bottom-up estimation method to identify members of the public more likely to require plastic straws, but now assumes that each person uses 6 straws per day instead of 1. This has increased the number of plastic straws estimated to be used each year under the exemption from 44 million to 264 million. The groups identified are:
    - Those with manual dexterity disabilities (currently 4.4% of the UK population)[13]
    - Population who is 65 years and over (currently 18.04% of the UK population)[14]
    - Those with severe dexterity difficulties such as Parkinson's Disease and Cerebral Palsy[15]
- As described above, some consultation respondents included evidence that overall straw use (regardless of being paper or plastic) might go down in the future, and in fact has decreased already. The impact assessment now incorporates a further sensitivity, built into existing high/central/low NPV scenarios, where total straw consumption decreases by 20%, 10% and 0% respectively over the ten-year appraisal period.

[13] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/321594/disability-prevalence.pdf

14 https://www.indexmundi.com/united_kingdom/age_structure.html

[15] 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.

- The Impact Assessment now incorporates enforcement costs to authorities, calculated based on the analysis for banning plastic microbeads
- Carbon impacts have been updated to be UK only, using the latest carbon factors. Previously, changes to emissions from producing straws were included (which reduce from switching from paper to plastic), however because we assume that straws are produced abroad, this impact has now been removed.
- Additional fuel costs to businesses, and the associated greenhouse gas emissions, have now been estimated and incorporated into the NPV to account for the fact that paper straws are heavier than plastic straws and therefore may incur additional costs to transport
- Consultation evidence has been incorporated throughout, refining and justifying assumptions
- Further detail on medical exemptions is provided, in line with Government's response to the consultation
- The Small and Micro Business Assessment (SaMBA) has been updated to clearly identify what proportion of the market are SaMBAs, and to illustrate in detail whether they are expected to be impacted disproportionately and to clarify why exemption/mitigations are not thought to be appropriate. Small and micro businesses choosing to continue to purchase a proportion of plastic straws under the exemption may purchase those straws in smaller quantities than they would have previously, and therefore risk losing the benefit of economies of scale. This risk has now been incorporated in the analysis by estimating how many of the 254 million plastic straws purchased under the exemption are purchased by SMBs, and then assuming that they face a higher cost per straw.

Options under consideration

This impact assessment considers two options. **The preferred option is to ban plastic drinking straws without time delay but with exemptions.** This is because

this option will be the most effective in reducing the social and environmental costs associated with plastic straws.

Option 0: Do nothing

The **do nothing** option would allow plastic drinking straws to continue being used with no restriction on supply. The costs and benefits of this option are zero against the baseline. Some businesses are voluntarily moving away from plastic straws and this is factored into the do nothing scenario.

The problem associated with this option is although there is currently a concerted voluntary reduction in plastic straw use, there will still be many plastic straws that continue to be used and disposed of over the coming years. Furthermore, there is no guarantee that the current voluntary action will be sustained into the future, for example if current media and public attention on the issue does not persist. This means the environmental costs associated with plastic straws, such as risks to wildlife and the marine environment, will continue into the future.

Option 1: Implement a regulatory ban on the supply of beverage plastic straws to the end user, with exemptions for medical, disability and accessibility reasons from April 2020, and plastic straws from drinks cartons from July 2021 (preferred option)

This is the preferred option. As described in the rationale for intervention section, plastic drinking straws impose environmental and social costs on society and banning the supply of them to the end user will reduce these significantly after April 2020. This intervention will secure the change and associated environmental benefits quickly, and ensure that these are sustained into the future. The exemptions to the ban will ensure that people who require plastic straws are still able to access them easily and without stigma.

Businesses will be encouraged to source straws from non-plastic materials, or to stock stocking straws altogether. This is expected to incur some costs, but some of these will be mitigated given the current trend in the market to move away from plastic straws and the availability of non-plastic alternatives. There will also be some familiarisation costs to business in preparation for the change in legislation.

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. It is also expected to increase wellbeing from reduced presence of litter and to reduce the costs of cleaning up litter.

Exemptions in option 1

The government recognises that there are a number of vital uses for single-use plastic straws, where alternative materials are not suitable. Questions in the consultation invited views on: what steps the government could take to ensure particular groups are not disadvantaged or stigmatised; whether exemptions from the ban should be allowed; whether straws made of alternative materials are suitable for use by particular groups; and whether straws should be supplied in pharmacies and catering establishments. Defra has also engaged with a number of stakeholder groups representing people who may be affected by the government's proposals.

The majority of consultation respondents (65%) including members of the public and organisations, agreed with the proposal to exempt plastic straws for medical or accessibility purposes and other specialist uses from any ban. As a result, the government proposes a ban on the supply of single-use plastic straws to the end user with the following exemptions:

- **Plastic straws that are used as medical devices**. These include those that have pre-dosed granular medicines.
- **Plastic straws that are defined as packaging** under EU Directive 93/42/EEC.
- **Single use plastic straws supplied in registered pharmacies** (online and in store) to anyone that wants them. There would be no need to prove, or state, disability or accessibility requirement. Where straws are supplied in store, they would be kept behind the counter rather than displayed on the shop floor.
- **Single use plastic straws supplied in catering establishments**; these establishments would be divided into two categories. In all cases these establishments are not *required* to stock straws by this proposal.
    i. **For commercial use**. Plastic straws would be given out on demand only to anyone that requests them, and stored behind the counter.
    ii. **For use in a care, educational or health setting**. Plastic straws would be given out at the discretion of the staff and according to need.

Several options for how this exemption will work in practice were tested during the consultation period. We have proposed relatively broad exemptions to the ban in order to provide the most effective balance between maintaining the environmental benefits and ensuring that people with disability and/or medical requirements can still access plastic straws.

As is currently the case, it will not be a legal requirement for pharmacies and catering establishments to stock straws of any material. This is at the discretion of the establishment. However, these businesses have obligations under the Equality Act 2010 to make reasonable adjustments to ensure their facilities are accessible to disabled people. This legislation will continue to apply when making decisions on whether to stock plastic drinking straws. If they do choose to stock plastic straws on this basis, they must be stored behind the counter and provided to customers on request, with no requirement for proof of accessibility need. Expected costs from this reasonable adjustment are covered in the familiarisation costs section. This is expected to comprise activities such as staff moving plastic straws behind the

counter and becoming familiar with the new regulations, and has now been calculated on an annual basis to allow for staff turnover. A further cost to businesses has also now been accounted for in this analysis, to take into account the risk that small and micro businesses may purchase plastic straws in smaller quantities under the exemption than they would have previously, whereas large businesses may be more likely to continue to purchase in bulk and therefore benefit from economies of scale.

However, in general, plastic straws are less expensive to purchase than those made of alternative materials, therefore businesses that continue to maintain a proportion of their stock of straws as plastic are actually expected to face lower business purchasing costs as a result of the ban than those that do not.

Storing plastic straws behind the counter in pharmacies and catering establishments will reduce the visibility of plastic straws for sale to those who do not need them (i.e. where alternative materials are suitable or straws are not necessary at all), but also allow easy access to those who do require them. No proof of accessibility will be required in order to protect the rights and dignities of the people who need plastic straws, and to allow friends/family/carers to purchase or request straws on someone else's behalf. This approach also ensures that staff do not have to determine whether an individual is eligible for a plastic straw or not.

In care, educational or health settings, plastic straws would be permitted to be given out at the discretion of the staff and according to need, for example to ingest medicine. It is noted that straws used in this capacity are unlikely to be littered.

The government believes this strikes the right balance between maintaining the environmental benefits while protecting the rights of people with medical/accessibility needs and disabilities. In addition it does also not require significant burdens on business other than familiarisation with the new legislation and exemptions. A communications strategy will be put in place by Government to ensure that consumers and businesses are aware of the changes.

We consider that with these exemptions, the overall environmental benefit of our proposals will be positive – as we estimate that annual plastic straw usage in England will drop from 4.7 billion down to around 264 million. While the breadth of the exemptions means that it will be still possible for people to obtain a plastic straw even without having medical or accessibility reasons for doing so, we think this extra margin is likely to be relatively small, and is outweighed by the privacy concerns expressed by advocacy groups for people with disabilities. We do not anticipate businesses purchasing and stockpiling additional quantities of straws compared to a no-ban scenario, but to substitute plastic ones for paper, while still purchasing some plastic straws.

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.

Furthermore, a ban would ensure that the environmental benefits are sustained in to the future.

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. 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 in all settings e.g. available only if a customer specifically asks for one, but the impacts in reducing usage would be smaller, 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 although this would likely be effective in reducing consumption, it would not be as effective as a ban where suitable alternatives are available. Another risk with a charge instead of a ban is that effectiveness reduces over time without further intervention. For example, in Ireland, plastic bag usage initially fell with the introduction of the first levy in 2002, but rose again five years post levy, requiring the charge to be increased[16]. A ban avoids this risk and ensures that the desired impact is sustained.

In addition, it is important to note that a ban on the supply to the end user of plastic straws is not the only Government intervention in addressing the environmental impacts of the waste we produce, and this measure should be viewed as part of a wider package of reforms, which use different policy instruments, in the Resources and Waste Strategy[17]. A ban was chosen as the most appropriate instrument here because single use plastic straws, with the exception of those needed for medical purposes, were deemed as avoidable plastic, which cause environmental harm and is easily replaceable. The consultation responses agreed with that rationale.

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[18]. Commitments have been made by major chains to switch away from

[16] Institute for European Environmental Policy

[17] Our Waste, Our Resources: A Strategy for England

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

plastic straws including by McDonald's and Wetherspoons[19,20], Starbucks[21] and Costa, Pret and Leon[22], mostly towards paper.

A similar trend has started in supermarkets. Waitrose stopped selling packs of plastic straws in 2018 , and also replaced 600,000 plastic straws with paper straws in their cafes[23], while Morrisons 'no longer buys plastic drinking straws'[24].

Commitments have also been made by companies that use small straws with cartons, including Tetra Pak, who stated in July 2019 that they "have developed a paper straw that is fully functional and meets recognised food safety standards" and are now taking the next steps in field testing paper straws for beverage products in Europe. ''[25].

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[26]. 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. Other alternative materials such as metal or glass make up a smaller proportion of the market and are often re-used, therefore they are not expected to primarily replace single-use plastic straws. We therefore assume in this analysis that paper will be the primary alternative material for both large and carton straws. This leads to a conservative comparison, as we expect that as technology develops, further alternative materials that perform better than paper in terms of functionality and environmental harm may start to appear within the 10 year appraisal period of this impact assessment.

[19] McDonald's
[20] Businessgreen
[21] BBC
[22] The Grocer
[23] Waitrose
[24] Morrisons corporate
[25] Tetra Pak press release July 2019
[26] Bon appetit

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). This is estimated over a ten year appraisal period. The central estimate is -£61m. The largest positive contributions come from a wellbeing 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 purchase, which we have modelled as being shared between consumers and businesses for the NPV. However, for the annual net direct cost to business metric we have attributed costs fully to businesses, as per Regulatory Policy Committee guidance.

	Table 1 – Summary	**10 Year NPV estimates (£m):**		
		Low	**Central**	**High**
Benefits	Disposal incineration emission benefit	£0.1	£0.2	£0.2
	Reduced coastal clean-up costs	£0.3	£0.3	£0.3
	Beach well-being benefit	£2.6	£3.9	£5.2
Costs	Disposal landfill emission cost	-£0.1	-£0.1	-£0.1
	Paper straw costs passed to consumers	£0.0	-£32.6	-£40.4
	Paper straw costs to businesses	-£68.4	-£21.7	£0.0
	SaMB plastic straw cost	-£5.2	-£3.2	-£1.7
	Familiarisation costs for businesses	-£17.0	-£6.7	-£2.3
	Enforcement costs	-£0.8	-£0.7	-£0.6
	Fuel costs to businesses	£0.0	£0.0	£0.0
	Fuel emissions cost	£0.0	£0.0	£0.0
	Total (£m)	**-£88.7**	**-£60.7**	**-£39.4**

Further detail on Table 1 can be found in the benefits and costs sections below. All figures are in 2017 prices.

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 and the associated societal wellbeing benefits that we would expect following a plastic straw ban. Although it has not been possible to monetise these benefits, they are analysed in detail as non-monetised benefits below. Another consideration is that the monetised costs may fall significantly if the price of non-plastic alternative straws fall, which is possible as their scale of production increases.

Low/Central/High Scenarios

The range between the low, central and high estimates reflects mainly the estimate ranges for the number of straws consumed in England (see table 2 below). The low NPV scenario uses the low estimate for the total number of straws used (large +

carton straws), and applies the high costs and low benefits estimates to them. The high NPV scenario uses the largest estimate for number of straws used (large + carton), and applies the high benefits and low costs estimates.

In addition, sensitivities on: how long each straw would take to decompose; the proportion that end up on beaches; differing values in the literature placed on having cleaner beaches; and how many plastic straws that will continue to be consumed under the exemption are incorporated into the NPV scenarios. The consumer/business cost pass-through figures assume 100% pass-through in the low cost (to businesses) scenario, 60% pass-through in the central scenario, and 0% pass-through in the high cost scenario.

Table 2 shows the range of plastic straws used in England, with the low scenario using 75% of the central estimate and the high using scenario 125%. Carton straw use was estimated by the Resource Futures report. For example, in the central scenario, the Resource Futures report estimates that 22% of total plastic straws in England are carton straws, therefore that percentage is used in this impact assessment. No new evidence or modelling was provided by consultation respondents who answered the questions about banning carton straws, so this has been kept consistent with the consultation impact assessment.

Table 2: Plastic straw use in England

	Large Straws	Carton Straws	Total
Low	2,778,600,000	555,720,000	**3,334,320,000**
Central	3,704,800,000	1,037,344,000	**4,742,144,000**
High	4,631,000,000	1,667,160,000	**6,298,160,000**

Source: Resource Futures and McDonald's estimate

Counterfactual

In order to assess the costs and benefits of the preferred option, 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 in the central NPV scenario that 4.7 billion straws are currently consumed in England each year[27], and until recently almost all of these would likely have been plastic. 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[28]. 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, therefore we have attempted to model what would happen to straws without a ban.

[27] 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.

[28] See evidence in 'Alternatives to plastic drinks straws' section

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.

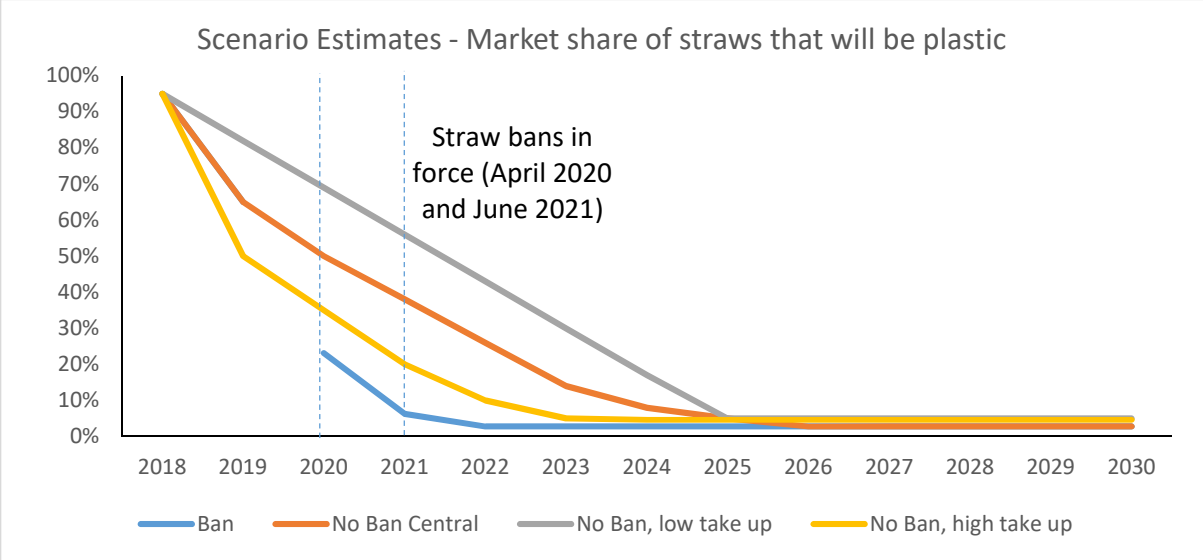
A significant number of businesses have already committed voluntarily to switch to paper straws, including major restaurant chains and supermarkets. It is unclear exactly what proportion of straws being sold today are plastic, but a significant proportion are likely to already be paper, and there is a continuing movement towards paper straws. Paper has therefore been assessed as the most likely alternative material, and the modelling assumes that all switching is from plastic to paper for both large and carton straws. This decision represents the most likely alternative at the time of writing, but it is possible that other materials will be preferred in the future as technology develops.

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 Figure 1 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 'no ban scenario' counterfactual has been used to calculate the net present values in Table 1.

Figure 1: Scenario estimates of plastic straw share out of all straws



Source: Resource Futures and Defra modelling

We have assumed that in 2018, 95% of straws were plastic, as modelled in estimates previously made by Resource Futures. In all the no-ban scenarios, we forecast a significant reduction in plastic straw use.

The work by Resource Futures[29] provides the basis for our 'no ban, low take up' scenario. Their research found that the market for plastic straws was dominated by large retailers and hospitality businesses, and that frequent public announcements were being made indicating switching to plastic-free alternatives at the time the research was conducted[30]. Resource Futures also undertook a number of stakeholder interviews as part of their research, including questions on commitments to avoid plastic use[31]. In addition to public announcements, a number of interviewees confirmed their intentions to switch and wholesalers stated that they were experiencing an increase in demand for paper-based alternatives.

It is on this basis the current observed trends are projected to continue, with the assumption that this decrease would be in a linear fashion. This is recognised as a simplified representation of the market, and in reality it is likely that switching would occur in a non-linear fashion, for example peaking or falling in response to public interest and media attention. However it is difficult to provide a robust forecast of this. These scenarios have therefore been utilised for modelling purposes in order to provide a comparison for the "ban" scenario, where change is implemented earlier and faster, to avoid overstating the impacts of the regulation.

The assumption that the number of straws made of plastic will fall gradually from 95% to 3% without a ban was tested at consultation. Many respondents were unclear, unsure, or disagreed with the estimate. Some respondents stated that the government has a responsibility to act and that plastic straw use would not fall this low without intervention. However, no robust statistical evidence was identified by respondents to support their assumptions, and no evidence of modelling carried out was reported.

We have therefore continued to use these projections in order to provide a comparison for the "ban" scenario. The forecasts are recognised as being inevitably uncertain, and therefore sensitivity analysis around the central scenario has been undertaken to explore this risk. We will review the policy after the ban has been in place for a year, to assess its effectiveness in cutting the number of straws, its impact on those with disabilities, and whether the policy needs to be revised.

Our central scenario estimate ('no ban central') forecasts a larger reduction in plastic straw use than Resource Futures. This is because subsequent to their research conclusions, further commitments were made to switch to paper straws, most notably by McDonalds[32]. McDonalds alone is estimated to account for around 14% of England's straw use[33].

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[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] See 'alternatives to plastic drinking straws' section for examples of some of the key public announcements

[31] This included a variety of stakeholders, including the British Retail Consortium, Foodservice Packaging Association and UK Hospitality.

[32] McDonald's news, June 2018.

[33] McDonald's straw use based on an estimate of 1.4m straws per day, or 657m per year. This is 14% of the total 4.5bn straws consumption estimate.

The ‘high uptake’ scenario is provided as further sensitivity analysis in order to explore the impacts if the market moves away from plastic at a faster rate than expected.

The differences between the three scenarios and the ban scenario start occurring from 2020 as the plastic beverage straws ban is planned to commence in April 2020, with plastic straws from cartons being banned by 2021.

The difference between the ‘ban’ and ‘no ban central’ scenario assumptions is used to calculate the best estimate 10 year net present value (NPV) estimate in this impact assessment. Table 3 provides a sensitivity analysis to show how the 10 year NPV would change if the low and high ‘no ban’ scenarios were applied:

Table 3 - Scenarios for plastic take up if there were no ban:	**10 Year NPV estimates, £m:**		
	Low	**Central**	**High**
Central Scenario NPVs	-£88.7	-£60.7	-£39.4
Low take up Scenario NPVs	--£165.4	-£119.3	-£80.1
High take up Scenario NPVs	-£38.1	-£22.2	-£12.6

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.

Straws disposal assumptions

Most of the costs/benefits considered in this analysis are based on how plastic straws behave when disposed of, in comparison to straws made of an alternative material. In order to assess this, we have therefore had to make assumptions around how straws tend to be disposed of. For the purpose of this analysis, the alternative material for both large and carton straws is assumed to be paper.

Plastic straws tend not to be recycled even though they are recyclable, due to the effort required to segregate and clean them. If they are placed in a recycling bin, often the straw is not detached from the cap/drink and therefore the opportunity to separate the material is impaired. However, even if they are separated, their small size means that they are likely to fall out at the front of recycling plants. This means that most plastic straws will not get recycled in the current systems, even if they are technically recyclable[34]. Therefore, for the purpose of this analysis we have assumed that zero straws recycling occurs for either plastic or paper straws. This assumption

[34] Confirmed via Defra discussion with recycling and recovery industry stakeholder, responsible for significant share of the waste management market.

provides a conservative estimate because if any straws were recycled, paper would emit fewer carbon equivalent emissions than plastic[35].

We therefore assume that 100% of plastic straws are either given to residual waste (and therefore sent to landfill or incinerated) or littered. We assume that 99.9% of total straws are eventually treated as residual waste (including straws that are littered and then collected by Local Authorities). However, some litter is unable to be cleared, for example if it enters a waterway. We assume that 0.1% of total straws consumed end up in marine environments[36].

The costs/benefits of paper in comparison to plastic in each of these disposal options (landfill, incineration, marine litter) are considered in this impact assessment. We expect that both plastic and paper straws are likely to be disposed of in the same way, and therefore have kept these assumptions are consistent across both material types.

Monetised Benefits

The monetised benefits of a ban on plastic straws relate to differences between paper and plastic at the end-of-life.

If straws are sent to incineration, paper is cleaner to incinerate than plastic (each tonne of paper burnt actually saves carbon dioxide equivalent (CO_2 e) emissions through energy conversion). Each tonne less of CO_2 e produced has an estimated benefit saving to the environment from abatement costs.

If straws are littered, paper decomposes significantly faster than plastic (taking weeks in comparison to hundreds of years). Therefore this is expected to reduce straws litter on beaches once the paper starts decomposing, even if the same total number of straws are littered. This is expected to reduce coastal clean-up costs and generate well-being benefits to society because plastic straws are commonly found on beaches[37], but clean beaches are highly valued by the public.

There are also key non-monetised benefits due to paper decomposing so much faster than plastic, in particular improvements to marine environments and reduced choking and entanglement risks to wildlife.

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

[36] 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.

[37] Report by Eunomia for Seas at Risk, supported by EU funding, 2017, taking the beach litter clean-up estimate for North Eastern Atlantic estimates that plastic straws comprise 1.9% of beach litter (by item count). We estimate that straws make up 95% of the group of straws and stirrers recorded in beach clean-ups, based on estimates of the number of straws compared to stirrers.

Table 4 shows the value of the benefits we have quantified. In our central total present value (TPV) estimate over 10 years we expect £4.4m of monetised benefits to come from a ban of plastic straws.

Table 4	**10 Year TPV estimates, £m:**		
Total Benefits:	**Low**	**Central**	**High**
Disposal incineration emission benefit	0.1	0.2	0.2
Reduced coastal clean-up costs	0.3	0.3	0.3
Beach well-being benefit	2.6	3.9	5.2
Total Benefits:	**3.0**	**4.4**	**5.7**

Disposal Incineration Emission Benefit

When incinerated, plastic based goods emit more kilograms of carbon dioxide equivalent (CO_2 e) emissions than paper. 819kg of CO2e is emitted for each tonne of plastic polypropylene, in comparison, incinerating paper actually saves 331kg of CO2e for each tonne. While the process of incineration is the same for both materials, the respective emissions factors are very different because the CO2 released from burning paper is biogenic, meaning it is considered as part of the natural carbon cycle and therefore the CO2 released is not counted as additional[38].

Monetisation and Assumptions

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

- As in Table 2, we estimate that 4.7 billion straws are consumed in England each year in the central estimate, with 3.3bn in the low estimate and 6.3bn in the high estimate. All estimates include a proportion of large and carton straws.
- Paper straws weigh 1.18g, compared to 0.55g per unit for plastic straws. Smaller carton plastic straws weigh 0.5g[39], 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 0.82t of CO_2 e, whereas paper incineration prevents the emission of 0.33t in the UK (see table A2-1 in Annex 2).

[38] [38] IPCC protocol for incineration and open burning of waste https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/5_Volume5/V5_5_Ch5_IOB.pdf

[39] 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.

- Carbon emissions have been priced according to Green Book guidance, and we assume that the cost of one tonne of CO_2e in 2020 is £68.08, which increases up to £79.43 in 2030[40].
- 70% of the 99.9% of straws collected by Local Authorities are sent for incineration[41]
- When comparing the tonnage of paper assumed to be incinerated each year under the ban scenario to the central no ban scenario (where the proportion of plastic straws on the market declines due to voluntary action), the ban provides £152,439 net present value discounted over ten years in incineration emissions benefits

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)[42] 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 the marine litter found on beaches, by item count[43].

The ban on plastic straws is predicted to reduce marine litter clean-up costs on beaches and harbours by reducing the number of straws that need to be picked up. It is assumed that significantly reducing the number of plastic straws in circulation (and particularly those being used in outdoor settings where they may be more likely to be littered), will directly reduce the littering incidence of these items and therefore the numbers of plastic straws found on UK beaches[44].

The ban will help to inform consumers of the environmental damages that straws can cause and therefore may reduce straws littering incidence overall (of any material). However, as this effect is uncertain, for the purpose of this analysis, we assume that the overall level of straw littering remains constant, with the difference being that the vast majority of straws are now assumed to be paper. The litter cost reduction arises because paper decomposes much more easily and quickly than plastic, so each straw will be present on beaches for less time. This means that we assume that there will be fewer straws needing to be cleared up over time (based on the proportional difference in biodegradability rates), even if the total number of straws

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

[41] 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

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

[43] 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 recorded in beach clean-ups, based on estimates of the number of straws compared to stirrers. Therefore it is estimated that 1.9% of marine litter (by item count) is plastic straws. The European Commission IA on 'Reducing Marine Litter' (pg. 8/9) states that "beach litter item counts are internationally accepted as a reasonable indicator of the composition of marine litter".

[44] As plastic moves around the oceans, a UK ban on plastic straws will not directly result in zero plastic straws on UK beaches. However, international progress in this area (such as the EU's Single Use Plastic Directive, which requires EU member states to ban plastic straws) is likely to contribute towards this goal.

being littered remains consistent. We have estimated that plastics take 300 years[45] to decompose, whereas paper can take just a few weeks[46].

Monetisation and Assumptions

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

- Our central estimate for the prevalence of plastic straws in marine environments is that they make up 1.9% of marine litter by item count[47].
- 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 (however, 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 there would be a litter clean-up cost saving equivalent to the portion of litter that straws contribute[48]. We take this approach based on the evidence collected by Mouat et al. (2010) who found that the majority of litter removal costs are variable costs[49].
- In our central estimate we assume that decomposition for paper straws takes 24 weeks, 0.15% 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[50]. We have used a range of estimates for decomposition from 6 weeks to 60 weeks for paper and 200 – 400 years[51] for plastic to reflect the fact that rates vary according to oxygen, light and moisture levels.
- We therefore estimate that paper straws are associated with 0.15% of the cleaning cost of plastic straws, reflecting that there will be proportionately less of them on beaches over time as they biodegrade When comparing the ban scenario to the baseline, the ban provides a net present benefit of £301,011 over ten years.

We have modelled this benefit because we believe that as paper decomposes so much quicker than plastic this will reduce litter on beaches and therefore reduce clean-up and disamenity costs.

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

[46] US National Park Service

[47] Litter by item count was chosen here as the most relevant indicator for litter clean-up benefits, in comparison to other indicators such as volume or weight. The European Commission IA on 'Reducing Marine Litter' (pg. 8/9) states that "beach litter item counts are internationally accepted as a reasonable indicator of the composition of marine litter", and that "[this] is the best indicator for the overall environmental, social and economic impacts".

[48] This relationship is assumed to be linear for the purpose of this analysis, assuming that having less items to pick up on the beach will correspond to a reduction in effort/cost.

[49] Mouat, Lozano, Bateson: Economic Impacts of Marine Litter, 2010. Study found that many municipalities operate variable cleansing regimes according to the beach and the season; that the majority of municipalities remove marine litter manually; and that around two thirds of total clean-up costs are spent on labour.

[50] US National Park Service; National Oceanic and Atmospheric Administration and Woods Hole Sea Grant

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

It is assumed that because most litter clean-up costs are variable and beach cleaning is usually carried out manually in the UK[52], a reduction in the number of items will linearly reduce costs. In practice, the relationship will likely depend on a number of factors that will vary between locations, such as how frequent and thorough beach clean-ups are[53]. It is also possible that some fixed costs (such as hourly/daily contracts) could mean that cost reductions manifest in terms of workers having more time to spend picking up other items of litter on the beach, therefore increasing the overall efficiency of the clean-up, rather than reducing the amount of cleaning time overall.

Although plastic straws make up just 1.9% of marine litter by item count, when viewed in tandem with policies to ban plastic drinks stirrers and cotton buds, the cumulative impact of the bans is highlighted as it is estimated that all three items together contribute around 5.7%. Furthermore, single-use plastic bans should be seen as part of the overall program of reform announced in government's Resources and Waste Strategy, which aims to maximise the value we extract from resources and minimise its environmental impact of waste. This includes other measures such as consistency in municipal waste collections, introducing a deposit return scheme and reforming packaging producer responsibility. Measures such as a deposit return scheme for drinks containers would also aim to reduce the littering incidence of these materials, and therefore their contribution to marine litter.

Amenity benefits of reduced litter on beaches

89% of people are concerned by plastic pollution in the ocean[54]. The presence of litter can contribute to a fear of crime and injury, both of which have a negative well-being impact. Litter can also 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. 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. Therefore there is a social disamenity cost associated with litter.

A ban on plastic drinking straws is expected to have positive amenity benefits by reducing the amount of single-use plastic in circulation and littered. As discussed above, non-plastic straws that end up in marine environments will decompose faster and do not break down into micro-plastics, leading to fewer straws being found across all environments. This amenity benefit is generated because people may gain a satisfaction from knowing that something is being done to support marine environments (beaches and seas), and is based on people being willing to pay to achieve this benefit.

[52] Mouat, Lozano, Bateson: Economic Impacts of Marine Litter, 2010.

[53] Mouat, Lozano, Bateson: Economic Impacts of Marine Litter, 2010 found that average marine litter removal costs were variable between municipalities, with higher costs tending to occur in those with responsibility for large areas of coastline or popular tourist beaches, which are generally more expensive to keep free of litter and are likely to require a higher frequency of clean-up.

[54] Populus: Ocean Plastic Survey

Monetisation and Assumptions

We have monetised the benefit of reduced plastic litter on beaches due a ban using the following figures and assumptions:

- Eunomia estimate that beach litter has a disamenity value in England of between £136m to £250m per annum
- As above, based on beach litter count data, we estimate that plastic drinking straws contribute towards 1.9% of marine litter, by item count[55].
- The annual well-being loss caused by beach litter is £192m, based on a willing to pay between £6 and £11 per household (in 2002 prices) to see litter free beaches[56].
- We assume a linear relationship between beach litter clean-up and the disamenity experienced by beach users caused by litters. Therefore, because we estimate that straws make up 1.9% of beach litter, we assume that if all straws were all cleared that this would reduce the litter disamenity costs on beaches by 1.9% of the total.
- 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).
- As above, in our central estimate we assume that decomposition for paper straws takes 24 weeks, 0.15% of the time taken for plastic straws which take 300 years. Therefore, we assume that littered paper straws on beaches are associated with 0.15% of the litter disamenity of plastic straws.
- In comparison to the baseline scenario, the ban provides £3.9m net present benefit discounted over ten years.

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 are therefore likely to underestimate the well-being benefit of there being reduced litter in marine environments.

We have modelled this benefit because the ban will significantly reduce the amount of plastic straws in circulation, and therefore the amount of plastic straws reaching the marine environment and beaches. Based on the evidence that paper decomposes so much quicker than plastic, we estimate that paper straws being littered will be significantly less harmful than plastic and survive intact for a small

[55] Report by Eunomia for Seas at Risk, supported by EU funding, 2017, taking the estimate for North Eastern Atlantic. Data on the volume of litter that plastic cotton buds comprise was not readily available so litter count has been used to estimate the visual impact. The European Commission IA on 'Reducing Marine Litter' (pg. 8/9) states that "[this] is the best indicator for the overall environmental, social and economic impacts".

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

proportion of the time. Therefore, we estimate that this will generate lower litter clean-up and amenity costs.

Non-monetised Benefits

There are several benefits particularly associated with improvements to marine environments that have not been quantified. As described above, 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 also 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 drinking straws are also more environmentally friendly to produce than plastic straws as for each tonne of paper produced, less carbon dioxide equivalent (CO_2 e) tonnes are emitted than for each tonne of plastic. These production benefits were previously monetised in this analysis, but they have been removed as the evidence shows that most straws are produced in other countries[57], and therefore the emissions benefits are not thought to accrue in the UK. However, they are still important to take into consideration when considering benefits on a global scale, and are therefore highlighted here as a non-monetised benefit.

Marine Benefits

Summary

It is estimated that 1.5 – 4.5% of all global plastics production ends up in the oceans every year[58]. 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.

Our best estimate for their prevalence comes from an estimate that stirrers and straws together make up 2% of marine litter[59]. 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[60], so therefore we attribute 1.9% of marine litter to plastic straws.

Plastic Entanglement Reduction

[57] 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.

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

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

[60] 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

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[61,62]. 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 species, 51 seabird species and 32 marine mammal species[63]. 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[64]. 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[65].

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[66] estimated that the cost of marine litter to the EU fishing industry could amount to almost €60 million. We have not quantified the effect the

[61] 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.

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

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

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

[65] Cotton bud project

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

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 cost 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[67], 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 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.

Monetised Costs

Introducing a ban on the supply of plastic straws to the end user is expected to incur a number of costs. The largest cost is expected to arise from the fact that currently paper straws are more expensive to purchase than plastic straws, which is expected to impact businesses and consumers. A familiarisation cost is also accounted for as businesses that fall under the proposed exemption make any changes to prepare for the introduction of the legislation. We have also now estimated a cost to small and micro businesses that may purchase plastic straws in smaller quantities under the exemption, assuming that they therefore may no longer benefit from economies of scale and face a higher per-unit cost. If paper is disposed of in landfill, it releases more greenhouse gas emissions that plastic. There are also emissions costs in terms of the additional fuel that may be required to transport heavier paper straws than plastic. This also incurs a small additional fuel purchasing cost to businesses that transport straws. Finally, there is an estimated cost to Local Authorities Trading Standards Agencies to enforce the ban.

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

Table 5 shows the monetised costs, with our central total present value (TPV) estimate over 10 years being £65.1m.

Table 5	**10 Year TPV estimates (£m):**		
Total Costs:	**Low scenario (high cost)**	**Central**	**High scenario (low cost)**
Disposal landfill emissions	-£0.1	-£0.1	-£0.1
Paper straw costs passed to consumers	£0.0	£32.6	-£40.4
Paper straw costs to businesses	-£68.4	£21.7	£0.0
SaMB plastic straw cost	-£5.2	-£3.2	-£1.7
Business familiarisation	-£17.0	-£6.7	-£2.3
Enforcement costs	-£0.8	-£0.7	-£1.7
Fuel costs to businesses*	£0.0	£0.0	£0.0
Fuel emissions*	£0.0	£0.0	£0.0
Total Costs (£m):	**-£91.5**	**-£65.1**	**-£45.2**

*Not zero, but small enough that they are not shown due to rounding. Details on calculations and magnitude can be found in section below.

Costs to Businesses

Purchasing Costs

Paper straws are more expensive on average than plastic straws, resulting in costs for businesses, which are expected in part to be passed onto consumers. Consumers expected to absorb the majority (60%) of the additional costs via higher prices. The uncertainty around this estimate is accounted for in sensitivity analysis, with the low and high cost scenarios (to businesses) assuming 100% and 0% of costs are passed through to consumers. As per RPC guidance, 0% of costs are assumed to be passed through to consumers in the EANDCB calculation.

Retailers that sell straws are expected to pass costs onto consumers in the higher prices charged for paper straws, and hospitality businesses that choose to provide straws free of charge alongside purchase of a drink are expected to pass through these variable costs to consumers via general pricing structures, for example by slightly increasing the price of drinks.

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[68]. Therefore, we assume that all straws are purchased and imported.

Under the ban scenario, it is assumed that the majority of plastic straws switch to paper following the April 2020 and June 2021 ban implementation dates. However, a proportion of straws are assumed to remain as plastic under the proposed exemption

[68] 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.

(264 million straws per year). These straws are included within the total number of straws consumed each year.

Monetisation and Assumptions

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

- As shown in Table 2, we estimate that 4.7 billion straws are consumed in England each year in the central estimate, with 3.3bn in the low estimate and 6.3bn in the high estimate. All estimates include a proportion of large and carton straws[69].For large straws we assume that the wholesale price of plastic straws is 0.65p, and paper straws are modelled as roughly four times the price, at 2.5p per unit. For carton straws we assume plastic straws cost 0.06p and paper straws 0.25p per unit[70].
- This means that each paper large straw is 1.83p more expensive, and each carton straw is 0.19p more expensive.
- When multiplied by the number of straws on the market and added together this gives an annual central cost estimate of £70m[71] if all plastic straws were to be switched to paper straws at once.
- We assume businesses that switch voluntarily are doing so regardless of whether plastic straws are banned, and therefore any costs incurred to these businesses from switching are not counted as an impact of the ban.
- Therefore, in comparison to the central baseline scenario, the ban generates £54m in net present costs, discounted over ten years

Fuel Costs

Paper straws weigh approximately double plastic straws (0.18g in comparison to 0.55g for large straws). For businesses that transport straws, this could potentially be reflected in an increase in transport fuel costs, and additional fuel being used would also result in greenhouse gas emission costs.

A number of important factors are unknown, which makes it difficult to form a reliable estimate of these costs:

- The average distance travelled by each straw in England
- The number of straws carried on average in a truck

[69] 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 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.

[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. Typical unit prices (which include VAT) were compiled from online research (spot values from wholesale and retail websites) and verified by Defra. The price used is the wholesale market price, which therefore takes into account any mark-up made by manufacturers. This is the cost expected to be incurred by English businesses purchasing straws.

[71] 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.

- The mode or modes of transport used to transport straws 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

At consultation, respondents were asked about any potential environmental risks that alternatives to plastic straws might have. There was a lack of clear consensus here, but a small number of respondents did mention the potential risk of increased transportation required for heavier paper straws. A number of respondents also noted that it is likely that fewer straws will be manufactured as a result of the ban, which would reduce this environmental impact.

We have estimated this cost using the information available:

- Large paper straws are assumed to weigh 1.18g in comparison to 0.55g for plastic, and carton paper straws are assumed to weigh 1.07g in comparison to 0.5g for plastic
- Applying this weight difference to all straws placed on the market (4.7bn) would mean that there would be an additional weight of 2,928 tonnes per year if all straws were paper in comparison to plastic
- In comparison to the baseline scenario where some businesses are assumed to switch voluntarily, and taking into account the 10% projected reduction in consumption over the appraisal period, we estimate that the ban would result in an additional 3,335 tonnes to be transported over the 10 year appraisal period
- A Massachusetts Institute of Technology (MIT) study estimated that removing 10kg of weight from a truck can save 80L of fuel over 200,000km[72]
- This would imply that adding 10kg weight to a truck would require an additional 0.04L of fuel over 100km, costing 5p at fuel prices of £1.30/L diesel[73]. As the type of vehicle and weight already being transported are important variables here, this should be taken as an indicative estimate rather than a definite costing
- This would suggest that adding 3,335 tonnes would require an additional 13,340L of fuel over a distance of 100km
- Therefore, assuming the average travel distance of a paper straw is 100km, there would be a discounted net cost of £16,000 across all businesses over 10 years

Due to the uncertainty surrounding a number of the inputs to this estimate, we have included this figure as the high scenario estimate, and doubled it to provide a conservative central scenario estimate (£32,000). For the low scenario estimate, the estimated fuel costs have been tripled to reflect the uncertainty and to account for the extreme end of the scale (£48,000).

[72] http://www.nrcan.gc.ca/node/16755

[73] 1L diesel = £1.30, average annual estimate in 2018, https://www.gov.uk/government/statistical-data-sets/oil-and-petroleum-products-monthly-statistics

These numbers illustrate that any additional fuel costs from the ban are expected to be relatively small, particularly considering that the impact would be experienced across a number of companies, with many likely to be transporting a small number of straws at a time within each truckload. These assumptions were tested with a representative of the British Retail Consortium[74], who reported that retailers such as supermarkets are expecting sales of all straws to drop as a response to the ban and therefore expect additional fuel costs to be minimal. It was highlighted that businesses most likely to experience these costs would be the large fast food chains who would be more likely to continue to provide straws at the same rate. The range of estimates provided was confirmed to be reasonable in representing these costs.

In addition to the fuel costs to businesses (which have been included in the NPV and EANDCB calculations), the use of additional fuel would also incur additional greenhouse gas emissions. Using an average of 2.4 kg CO_2 equivalent per litre of diesel burned[75], we would expect an additional 65 tonnes CO_2e from the 26,680 litres of diesel required over the ten year appraisal period in the central scenario. Using Green Book non-traded carbon prices[76], this would be worth £4,593 discounted over 10 years.

Familiarisation costs

One-off and annual familiarisation costs have been calculated for businesses that are likely to fall under the proposed exemption, and that therefore may spend some time preparing for the new regulation. The exemption will not legally require exempt businesses (registered pharmacies and catering establishments) to stock plastic straws, as is currently the case. However, business will continue to have a duty under the Equality Act 2010 to make reasonable adjustments to ensure their facilities are accessible to disabled people. It is therefore assumed these businesses are likely to continue to stock some plastic straws as a reasonable adjustment for customers who require them.

On this basis, businesses that choose to stock plastic straws under the exemption must store them behind the counter, and to provide them to customers on request, with no requirement for proof of accessibility need. This means that staff will not be expected to decide whether someone "qualifies" as having a disability, and therefore no associated training will be required.

Government will clearly communicate to consumers and businesses the details of the policy, so communication costs to businesses are not expected.

Businesses that change a stock order from plastic to paper are expected to do so as part of usual business stocking activity. The ban confirmation in May 2019 with an April 2020 commencement date provides just under a year lead-in time for stock

[74] Stakeholder discussion with the British Retail Consortium, August 2019. 70% of the UK retail industry, by turnover, are members of the BRC: www.brc.org.uk.

[75] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/696677/Data_tables_1-19_supporting_the_toolkit_and_the_guidance_2017__180403_.xlsx

[76] Green Book Supplementary Guidance from BEIS, which recommends that non-traded sector carbon prices should be used for direct fuel use in non-aviation transport.

changes, and this is not expected to incur any additional costs to the purchasing costs detailed above, as alternatives to plastic straws are readily available.

The familiarisation cost that has been calculated therefore covers the staff time cost associated with exempt businesses preparing for the ban and making reasonable adjustments for customers that require plastic straws. In the purchasing cost estimate above, a proportion of straws are assumed to remain as plastic under the exemption (246 million) For example, familiarising staff with the ban and exemption by explaining that plastic straws need to be kept behind the counter and provided on request, and physically moving boxes of plastic straws behind the counter.

Monetisation and Assumptions

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

- Categories of businesses likely to be included in the exemption were identified using Standard Industrialisation Codes (SIC) (see Annex 3 for a full list of SIC codes and local business unit numbers).
- Local business units was used as the most relevant metric, on the assumption that the time requirement would be for staff in each outlet. This gave an estimate of 264,200 outlets that may be impacted.
- It was estimated that in year 1, half an hour of staff time would be required in each outlet to prepare for the new regulation, with 15 minutes as the low estimate and 1 hour as the high estimate to account for uncertainty. This was costed at the average hourly wage for each category[77] + 30% on-costs.
- According to RPC guidance, a higher hourly wage has been used for small and micro outlets (see Annex 3 for a full list of hourly wages used)[78]
- The UK average staff turnover is estimated to be around 15%[79], which suggests that new staff joining each year may also need to be made familiar with the regulation and exemption. Therefore, an annual familiarisation cost has also now been estimated, assuming 15% of staff will be new each year and therefore require familiarisation time (at 15% of the year 1 staff time cost, and then doubled to account for the current member of staff that giving the training). This rate varies across sectors, and is estimated to be higher in the catering industry (up to 30%[80]) and lower in the retail industry (8.3%[81]), therefore these have been used as high and low sensitivity estimates.

These assumptions were tested with a representative of the British Retail Consortium and confirmed to be a reasonable estimate of the familiarisation costs likely to be faced by businesses[82]. A concern was raised by the BRC in terms of cafes within larger premises (e.g. supermarkets) potentially being unaccounted for within SIC categories. Given this uncertainty a 10% uplift to the number of affected

[77] Office for National Statistics 'Earnings and hours worked', gross hourly pay 2018.

[78] The median hourly wage has been used for medium and large businesses, and the higher mean hourly wage for small and micro businesses.

[79] Employee turnover rates, Monster

[80] Deputy Staff Retention report 2018: 'Retaining Britain's Hospitality Workers'

[81] Employee turnover rates by industry comparison, e-days

[82] Stakeholder discussion with the British Retail Consortium, August 2019. 70% of the UK retail industry, by turnover, are members of the BRC: www.brc.org.uk.

outlets was agreed and has been applied to account for this uncertainty, increasing the number to 290,620.

This gives an overall one-off cost of £2.1min the central scenario, and an on-going annual cost of £617,877 across all businesses. Over the ten year reporting period this relates to £6.7m net present cost.

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'[83]. Wholesalers and hospitality-based businesses are therefore likely to be those that are most affected by the increase in straw prices in England.
- It is expected that retailers will pass the majority of costs onto consumers in the prices charged for paper straws. Similarly hospitality businesses that provide straws free of charge alongside purchase of a drink are expected to pass through some of the costs to consumers via general pricing structures. In these circumstances the cost of straws are a variable cost that are embedded into the price of a drink, with the cost of the straw itself being hidden[84].
- Given hospitality is a competitive environment, the NPV analysis assumes that 60% of costs are passed through to consumers, with 40% absorbed by businesses. This was supported by Resource Futures stakeholder discussions[85] and consultation responses, where several respondents noted that costs would be likely to be passed onto the consumer.
- For the EANDCB calculation, 100% of costs are modelled as falling on businesses, as per Regulatory Policy Committee guidance.

An 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 7 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. That is, the highest cost to business (£19.9m) from banning plastic straws would occur under the high cost scenario, and lowest voluntary movement from businesses. To note that for the EANDCB calculation, we assume no cost pass-through to consumers, with all direct costs falling on businesses.

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[83] 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.

[84] This kind of pricing structure is also demonstrated in the Impact Assessment for the 5p plastic carrier bags charge. Prior to the charge, the cost of plastic carrier bags was identified as being hidden in the price of goods. This is because revenue from customers must cover not only the cost of goods, but all operational costs such as labour costs, rent of premises, and items provided for free, such as plastic carrier bags or straws.

[85] Resources Futures conducted stakeholder discussions, and found that "most respondents felt costs would be likely passed to consumers and these would go unnoticed (a few pence in the price of a drink, or a pack of large party straws, etc.) and that even buyers in large hospitality businesses would not regard it as a significant cost, relative to other costs" (pg. 27, Resource Futures: Preliminary assessment)

Table 7 - Scenarios for paper take up if there were no ban:	EANDCB estimates, £m: Low cost	Central cost	High cost
Central take up Scenario	£7.3	£7.5	£8.4
Low take up Scenario	£12.8	£14.8	£17.7
High take up Scenario	£3.7	£2.2	£1.5

- A new sensitivity is that following consultation, this impact assessment now incorporates a 0%, 10% and 20% decrease in overall straws consumption assumption over the appraisal period.

Reasons these costs may be overestimated

The following factors have not been considered in our modelling due to evidence limitations:

- 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[86].
- 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[87].

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 evidence shows that there is already a significant trend away from plastic straws, with commitments having been made by multiple major chains.
- There may be further implementation or development costs to businesses that this analysis does not consider. For example, as stated in the 'Business costs – consultation responses' section above, respondents to the consultation such as Tetra Pak Limited raised concerns around costs for developing alternatives to small beverage carton straws and the associated capital costs that would be required

  We have not been able to incorporate these costs into the analysis, and given the counterfactual scenarios that predict markets shifting away from plastic it is likely that some of this investment would have taken place regardless of the ban, in response to voluntary switches and public pressure. Engagement with businesses such as Tetra Pak following the consultation period also suggests

[86] 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.
[87] Walesonline

that technological advances may help to make faster progress than initially expected. In July 2019, Tetra Pak announced that they have "developed a paper straw that is fully functional and meets internationally recognised food safety standards"[88]. In addition, the ban for carton straws has been delayed to May 2021 in order to allow industry more time to develop alternatives. The assumed alternative to plastic straws, i.e. paper straws, are well-established products, with the impact of moving to them from plastic being costed in our analysis as far as possible.

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:

- As shown in Table 2, we estimate that 4.7 billion straws are consumed in England each year in the central estimate, with 3.3bn in the low estimate and 6.3bn in the high estimate. All estimates include a proportion of large and carton straws[89]
- Paper straws weigh 1.18g, compared to 0.55g per unit for plastic straws. Smaller carton plastic straws weigh 0.5g[90], 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 0.009kg of CO_2 e, whereas paper production emits 1.042kg (see table A2-1 in Annex 2). It is possible that there are impacts of plastic landfill disposal that are not included within the 0.009kg 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.
- Greenhouse gas emissions have been priced according to Green Book guidance. 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[91].

[88] Tetra Pak

[89] 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 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.

[90] 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.

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

- As described in the Straws Disposal Assumptions section, in the central estimate we assume that 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[92].
- 30% of the 99.9% of drinking straws collected by local authorities are sent to landfill[93].
- In comparison to the baseline scenario, this generates £90,223 in net present costs discounted over ten years.

Enforcement costs

There will be costs associated with inspection and law enforcement services to support the ban. The ban will be enforced through civil sanctions set out in part 3 of the Regulatory Enforcement and Sanctions Act 2008.

Many respondents to the consultation proposed that Trading Standards authorities would be best placed to enforce the ban. We will work closely with Local Authorities to establish the most effective and efficient way of enforcement.

Local Authorities spending data shows that Local Authorities in England spent £113m on trading standards in 2017/18[94]. We have allowed for around 3 days of enforcement at 190 trading standards authorities per year, costed at £130/day[95], and applied this annually over the 10 year period. This gives an overall net present cost estimate of £732,921. This approach is based on the analysis for banning plastic microbeads[96], where 2 days of staff time were allowed in year 1 for enforcement familiarisation. Due to the relatively high-profile of the plastic straws ban and the larger number of businesses involved, we have increased this and extended it to an annual basis in order to provide a conservative estimate, allowing for familiarisation and active enforcement if required.

Non-monetised Costs

Disutility from using a different material

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[97]. Some alternatives to plastic straws are unsuitable for consuming hot drinks and reusable plastic straws can raise hygiene concerns.

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[92] 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.

[93] 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

[94] https://www.gov.uk/government/statistics/local-authority-revenue-expenditure-and-financing-england-2017-to-2018-individual-local-authority-data-outturn (Table RO5)

[95] Based on ONS wage for local government staff at £12.48/hour + 30% on-costs

[96] https://www.legislation.gov.uk/ukia/2017/160/pdfs/ukia_20170160_en.pdf

[97] Bon appetit

Therefore, there are likely to be some disutility costs to consumers using paper straws when they would have preferred to use a plastic straw.

In addition, there is a potential risk of increased costs to businesses that serve particularly thick drinks, such as milkshakes or slushies, where paper straws may perform comparably worse. Businesses may therefore face costs in compensating for this, for example by offering customers two paper straws in the place of one plastic straw. However, it has not been possible to identify what proportion of businesses are likely to serve these drinks, or in what quantities, nor the likelihood that they would offer two straws in replacement. Therefore, it has not been possible to monetise this potential cost.

However, there is evidence to suggest that any disutility costs from non-plastic straws being inferior are of less concern than environmental considerations, as a YouGov poll found that 77% of the public supports banning plastic drinking straws[98]. The consultation confirms that with 82% of respondents agreeing to the ban

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'[99], and have been advertised as able to break down in under 12 weeks[100]. In addition, there is evidence that the market is responding to issues such as paper straws for thicker drinks. For example, by developing paper spoon straws, which suggests that this issue may not persist into the future[101]. Other alternative materials to paper are also already available, such as reusable bamboo straws.

The consultation did not yield additional evidence on this matter therefore this continues to be a non-monetised cost.

SaMBA - Small and Micro Businesses Assessment

Small and micro businesses (SaMBs) that currently sell or offer plastic straws for free will be impacted by this regulation. In order to ascertain whether they will be disproportionately impacted, we consider each of the identified business costs in turn and identify how it will fall on SaMBs. It should be noted that questions were asked in the public consultation on whether additional costs or constraints to industry should be expected from this proposed ban, and whether respondents agreed with government's initial estimates of business costs. Disproportionate costs on SaMBs were not raised as a concern by respondents to the consultation.

[98] You Gov

[99] Bio-based news

[100] Plastico

[101] https://www.polarkrush.co.uk/world-first-paper-spoon-straw/

Purchasing costs

The largest costs to businesses from this regulation are due to the higher price of paper straws in comparison to plastic. SaMBs retailers/hospitality businesses are likely to source straws from wholesalers, and could therefore experience higher costs, as accounted for in the 'paper straws cost to businesses'. However, they are not expected to be impacted disproportionately as it is predicted that the majority of these costs are likely to be absorbed and reflected in overall pricing structures for the hospitality sector (where straws are often provided for free).

In addition, Defra discussion with the British Retail Consortium (BRC) highlighted that large fast food establishments are more likely than SaMBs to supply straws with drinks, and are also more likely to maintain their overall straw consumption when switching to paper, and hence face a higher proportion of these costs.

Transport costs

Businesses that transport straws are also expected to face small additional fuel costs due to the fact that paper straws generally weigh more than plastic. However, as with the purchasing cost, this is expected to fall on all businesses. Larger businesses such as fast food chains are more likely to transport a higher number of straws, and therefore experience a higher proportion of these costs. This assumption was tested and verified in discussion with the BRC.

Costs associated with exemptions to the ban

Businesses that fall under the proposed exemption (registered pharmacies and catering establishments) may choose to continue to stock plastic straws as a reasonable adjustment for customers that need them, in accordance with the Equality Act 2010. We have therefore assumed that businesses will choose to do so, and estimated a familiarisation cost for them to make these adjustments.

In order to establish the proportion of exempt businesses categorised as small or micro (i.e. with less than 50 employees) we use ONS 2018 data split by the relevant SIC codes. This data is only available by four-digit SIC code at the UK level, therefore we have applied the proportion of local business units that are in England for each code to the UK-wide data. This provides the following split of the 254,200 identified local business units in England by employment size:

Table 8: Estimated breakdown of Standard Industrial Classification (SIC) local business units in England by employment size-bands[102]

	0-4	5-9	10-19	20-49	50-99	100-249	250+	Total	Proportion of UK units in England[103]
4711 : Retail sale in non-specialised stores with food;	18,281	6,844	6,956	4,969	650	1,197	803	**39,700**	83%

[102] Office of National Statistics, UK Business: Activity, Size and Location 2018, Table 19

[103] Office of National Statistics, UK Business: Activity, Size and Location 2018, Table 17 – total England local business units as a proportion of total UK local business units for each SIC code. These percentages have been applied to the UK-level data to provide the information in this table. This assumes that the proportion of UK local units in England is consistent across all employee size categories.

beverages or tobacco predominating									
4719 : Other retail sale in non-specialised stores	4,602	1,797	2,116	2,247	752	176	55	**11,745**	84%
4725 : Retail sale of beverages in specialised stores	3,550	1,008	226	48	9	4	0	**4,845**	87%
4773 : Dispensing chemist in specialised stores	2,259	4,777	2,295	309	28	8	4	**9,680**	81%
4774 : Retail sale of medical and orthopaedic goods in specialised stores	1,340	229	71	22	4	4	0	**1,670**	88%
4781 : Retail sale via stalls and markets of food; beverages and tobacco products	865	179	37	5	0	0	0	**1,085**	92%
4791 : Retail sale via mail order houses or via Internet	26,240	1,548	756	321	100	50	45	**29,060**	91%
5510 : Hotels and similar accommodation	2,303	1,476	2,085	2,597	949	455	80	**9,945**	77%
5520 : Holiday and other short-stay accommodation	2,573	575	254	136	32	29	11	**3,610**	71%
5530 : Camping grounds; recreational vehicle parks and trailer parks	1,232	386	184	117	64	42	11	**2,035**	71%
5590 : Other accommodation	735	228	118	42	8	4	4	**1,140**	84%
5610 : Restaurants and mobile food service activities	38,607	22,936	14,144	8,385	1,401	579	34	**86,085**	84%
5621 : Event catering activities	7,404	2,903	1,621	740	216	84	53	**13,020**	88%
5629 : Other food service activities	5,979	3,026	1,430	652	166	72	40	**11,365**	90%
5630 : Beverage serving activities	12,994	10,279	9,177	6,216	494	51	4	**39,215**	84%
Total	128,963	58,191	41,469	26,805	4,873	2,755	1,144	**264,200**	

Table 9: Proportion of local units that fall under each employee size band

	Micro	**Small**	**Medium**	**Large**
Number of local units in size band	187,154	68,274	7,628	1,144

Proportion of total units	70.8%	25.8%	2.9%	0.4%

As the tables show, small and micro business units make up around 97% of those affected. However, while they represent a large proportion of the sector, we do not expect familiarisation costs to fall on them disproportionately. This is because the same familiarisation time cost is expected for each outlet to undertake adjustments such as moving plastic straws behind the counter. We have calculated this cost on an average basis across all businesses, but rather than SaMBs being affected disproportionately it is more likely that a unit with more employees would face a higher cost in ensuring all staff have been made familiar with the requirement for plastic straws to be kept behind the counter and provided on request. Larger businesses are also likely to own more outlets/stores, and therefore likely to face higher per business costs than SaMBs.

In order to provide a conservative estimate of this cost, we have also used a higher staff time cost for small and micro business units in calculating the total familiarisation cost, as per Regulatory Policy Committee advice. The median wage per SIC code has been used for medium and large businesses, and the higher mean wage per SIC code has been used for small and micro businesses[104].
It is possible that the opportunity cost of understanding and complying with the ban could be higher for SaMBs as they may have fewer staff to devote to understanding the regulations. However, the exemption has been kept simple (for example, staff are not required to request proof of accessibility or make a decision on who should be allowed a plastic straw) and Government will also have a communications strategy to ensure that consumers and businesses are aware of the changes. This will mitigate additional burdens on SaMBs.

There is also a risk that SaMBs that choose to purchase a proportion of their total stock of straws as plastic under the exemption may face a higher per-unit cost for plastic straws than they would have previously, due to making purchases in a smaller quantity and therefore no longer benefiting from economies of scale. This may impact SaMBs disproportionately as a larger business would be more likely to continue to order in bulk.

Data on the number of straws purchased by different sized businesses are not readily available, therefore in order to estimate this cost we have identified that SaMBs are responsible for around 29% of total turnover in the UK[105]. We have made an assumption that sales turnover is likely to be proportional to costs, including the number of straws purchased. Based on this assumption, we estimate that SaMBs will purchase 29% of the plastic straws under the exemption, which is 76 million straws (29% of the 264 million plastic straws in the central estimate). We assume that they will be likely to purchase plastic straws in smaller boxes. Boxes of 100 or less straws are not widely offered by online wholesalers, therefore we have used an average cost for boxes of 500 or less plastic straws. Online research provides an average unit price of around £0.011 per straw, in comparison to the average £0.0065

[104] Earnings and hours worked, industry by four-digit SIC: ASHE Table 16, see annex 3 for a summary of codes and wages used

[105] Office of National Statistics, Employment by employment size band, 2018 – total turnover for partial SIC range, which includes the relevant codes in question

used in this impact assessment. This provides an additional cost of £0.005 per plastic straw, which relates to £381,817 per year across all SaMBs. This cost has been included in the NPV estimate.

This is likely to be a conservatively high estimate, as many plastic straws will be purchased by individuals from pharmacies for use at home.

Distorted competition

As the ban and exemption are to be applied uniformly across England, we do not expect there to be competition issues with consumers switching to go to a different retailer/hospitality business to purchase or request a plastic straw.

People who require plastic straws under the exemption will need to purchase them from registered pharmacies (rather than a convenience store, for example) however as the exemption is expected to cover only around 6% of the market for straws this is not expected to have a significant or disproportionate sales impact on SaMBs retailers selling straws made from alternative materials such as paper.

SaMB exemption/mitigation

We have identified that there may be some small, specific costs that fall disproportionately on SaMBs from this policy. As per RPC guidance, we therefore consider whether it would be appropriate for SaMBs to either be exempted or mitigated from the regulation. Our conclusion is that no exemption or mitigation approach is necessary.

Given the high proportion of hospitality and retail units that are small and micro (97%, based on table 9), if consumers were able to freely access plastic straws from these outlets, as well as from SaMB retailers, the environmental benefits of the policy could be at risk. For example, these plastic straws would be likely to be used in the outdoor environment and therefore risk being littered and reaching the marine environment. Comparison is drawn here to the single-use plastic bag carrier charge, which exempted small businesses when implemented in 2015. However, in 2017 alone, small businesses were estimated to circulate 3.6 billion single-use carrier bags, with the associated negative environmental impacts[106]. Therefore, exemption is not thought to be appropriate here because of the risk to the intended benefits of the policy, and because the disproportionate costs outlined above are small.

We also considered whether SaMBs should be allowed an extended transition period in implementing the ban. This would give them more time to become familiar with the regulation and to make any necessary preparations. However, proposals for the ban were announced in October 2018[107] and the government response in July 2019, sufficient time ahead of the regulation coming actually into force. It is also a well-known topic that has received significant media interest. The consultation was announced in October 2018 by the Secretary of State and received significant media attention. In addition, the initial proposed date of the ban of October 2019 has

[106] https://consult.defra.gov.uk/environmental-quality/extending-the-single-use-bags-charge/supporting_documents/carrierbagsconsultia.pdf

[107] https://www.gov.uk/government/news/government-launches-plan-to-ban-plastic-straws-cotton-buds-and-stirrers; https://www.theguardian.com/environment/2018/oct/22/ban-on-plastic-straws-stirrers-and-cotton-buds-pollution-could-come-into-force-by-2019

already been extended to April 2020 for large straws, and May 2021 for carton straws. This lead-in time, the public and media attention on this issue, the availability of alternatives and the low staff time requirement imposed by the exemptions to the ban, means that mitigation is not thought to be necessary for this regulation.

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.
- **Stockpiling of plastic straws:** There is a risk that some members of the public may stockpile plastic straws in response to the ban, which could increase sales and mean that the number of plastic straws being consumed after the ban is underestimated. However, because the exemption means that plastic straws will be readily available to those who require them (via registered pharmacies or behind the counter in hospitality venues), the risk of stockpiling is unlikely. In addition, because the ban is on the supply of plastic straws to the end-user, rather than on stopping plastic straws coming onto the market, there is a low risk of retailers stockpiling plastic straws for later sale, as they would be in breach of the law to do so.

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.
- **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[108] 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 9 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, to the UK, and whether the emissions count as traded or non-traded emissions.

Table 9 - Carbon emissions (CO2e tonnes)	UK emissions	Traded	Non-traded
Production emission savings	0	Y	
Incineration emissions savings	2,352		Y
Landfill emission costs	-1,392		Y
Fuel emission costs	-65		Y
Total net saving:	895		

Emissions from production count as traded emissions (covered under the European Emissions Trade Scheme), whereas emissions released in disposal (incineration and landfill) are counted as non-traded emissions[109].

Savings from production emissions are counted as zero in the UK 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 the emission reduction impact via energy conversion when it is incinerated.

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

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

Annex 1 Ban and no ban plastic straw pathways

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.

Table A1- 1	Plastic market share difference to ban scenario			
	Central Ban	Low Take up	Central	High Take up
2020	26%	69%	50%	35%
2021	9%	56%	38%	20%
2022	6%	43%	26%	10%
2023	6%	30%	14%	7%
2024	6%	17%	8%	7%
2025	6%	6%%	6%	7%
2026	6%	6%%	6%	7%
2027	6%	6%%	6%	7%
2028	6%	6%%	6%	7%
2029	6%	6%%	6%	7%

*With the ban coming into force in April 2020 and June 2021, the share of plastic straws used in 2020 and 2021 are higher than for later years post-ban.

Annex 2: Environmental carbon factors used

Table A2-1: UK only GHG emissions for polypropylene and paper, in kg CO2e per tonne of material

Waste Streams	**Production Emissions*** (kg CO_2 eq per tonne material)	**Energy Recovery (combustion)** (kg CO2 eq per tonne material)	**Landfill** (kg CO2 eq per tonne material)
Plastics: PP	1,876	819	9
Paper	354	-331	1,042

*This impact assessment assumes all straws are imported, therefore the production emissions savings from producing plastic instead of paper is 0, as GHG savings don't accrue to the UK.

Source: WRAP data

Annex 3: SIC codes assumed to be affected by the ban

Table A3-1: SIC codes estimated to be impacted by the proposed exemption, with median and mean hourly wage[110]

SIC code	Total local business units in England	Median hourly wage	Inc. 30% on-costs	Mean hourly wage	Inc. 30% on-costs
4711 : Retail sale in non-specialised stores with food; beverages or tobacco predominating	39700	8.87	11.53	11.21	14.57
4719 : Other retail sale in non-specialised stores	11745	8.04	10.45	11.12	14.46
4725 : Retail sale of beverages in specialised stores	4845	8.50	11.05	11.31	14.70
4773 : Dispensing chemist in specialised stores	9680	8.54	11.10	12.00	15.60
4774 : Retail sale of medical and orthopaedic goods in specialised stores	1670	10.71	13.92	14.63	19.02

[110] Earnings and hours worked, industry by four-digit SIC: ASHE Table 16 – median wage is used for medium and large businesses, and higher mean wage is used for small and micro businesses; Office of National Statistics, UK Business: Activity, Size and Location 2018, Table 17

4781 : Retail sale via stalls and markets of food; beverages and tobacco products	1085	7.83	10.18	7.97	10.36
4791 : Retail sale via mail order houses or via Internet	29060	11.21	14.57	16.34	21.24
5510 : Hotels and similar accommodation	9945	8.51	11.06	10.86	14.12
5520 : Holiday and other short-stay accommodation	3610	9.00	11.70	10.30	13.39
5530 : Camping grounds; recreational vehicle parks and trailer parks	2035	8.48	11.02	10.62	13.81
5590 : Other accommodation	1140	10.76	13.99	15.44	20.07
5610 : Restaurants and mobile food service activities	86085	8.00	10.40	9.78	12.71
5621 : Event catering activities	13020	8.87	11.53	11.39	14.81
5629 : Other food service activities	11365	8.87	11.53	11.09	14.42
5630 : Beverage serving activities	39215	8.00	10.40	9.77	12.70
Total	**264,200**				