

SIMETRICA

Technical Advice Note: Landscape monetisation

June 21, 2019

Helen Dunn, Ricky Lawton

Table of Contents

1	Aims and background to the technical advice ...	3
1.1	Aims and objectives	3
1.2	Background	3
1.3	Relevant research reports	4
2	Methodology and approach	5
3	Review of supplementary guidance on landscape.....	6
4	Review of revised approach on treatment of landscape values.....	11
4.1	Appraisal period	11
4.2	Discount rate.....	12
4.3	Uprating of landscape values over time	13
5	Advice on ecosystem service values.....	15
6	Recommendations and conclusions	18
7	References	20
	Annex 1: Overview of ODPM (2001) value estimates by undeveloped land type	21

1 Aims and background to the technical advice

1.1 Aims and objectives

The purpose of this technical advice is to provide expert advice on the appropriateness of the existing landscape monetisation approach in the supplementary Value for Money (VfM) guidance and peer review of a revised approach developed by the Department for Transport (DfT) and Highways England.

The specific requirements set out by DfT for review are to:

1. Provide a robust assessment on the status of the existing landscape values and the appropriate treatment of these values in appraisal.
2. Comment on the revised approach set out by DfT, suggesting any appropriate modifications.
3. Assess the risks of double counting associated with use of the supplementary VfM guidance values in addition to ecosystem services (ESS) valuations.

1.2 Background

The current DfT's Value for Money Supplementary Guidance on Landscape (Department for Transport, 2016) for monetisation of landscape impacts associated with transport infrastructure is based upon the 2001 report by the Office for Deputy Prime Minister (ODPM) (DCLG, 2006). Given the uncertainty over the values and the recommended approach, the values are used as indicative to inform the VfM rating and the strategic case but are not included in the adjusted benefit-cost ratio¹.

The values provided in the ODPM report are based on a literature review of 47 studies and assesses the values in the context of 6 different land types, reported in per hectare per year units to provide comparable values. In July 2018, Highways England (HE) reviewed the VfM guidance values and raised a number of concerns in relation to the underlying WTP values:

- the ODPM report values are not always on a comparable basis, differing in the scope of land type attributes values and the type of impact being evaluated.
- Some studies considered land type removal while others considered blighting of green land from new roads.

¹ Assessment of landscape impacts associated with transport infrastructure is carried out using a non-monetised qualitative impact assessment. The monetisation is applied when the impacts are deemed moderate or large.

- the ODPM report recommended constant unit values whereas some literature suggests declining marginal willingness to pay (WTP) for landscape.
- within a land type the values are generic per hectare, and do not account for context specific attributes, such as special designations (Sites of Special Scientific Interest (SSSIs), Areas of Outstanding Natural Beauty (AONBs)) or the availability of substitutes.

In addition, the HE Review (and additional views from the Transport Appraisal and Strategic Modelling (TASM) team at DfT) highlighted some technical issues in relation to interpretation of the study results into guidance in relation to the time horizon, discount rates and elasticity of landscape values with respect to changes in real income.

1.3 Relevant research reports

The relevant research reports that link to this peer review.

Valuing the external benefits of undeveloped land (ODPM report published as DCLG, 2006): This study aimed to provide a greater understanding of the economic value of different types of undeveloped land in the UK, reviewing the economic valuation literature to develop valid and transferable estimates of the external benefits of different types of undeveloped land for use in policy appraisal while advising on key evidence gaps.

Valuation of Landscape Impacts of Transport Interventions & Mitigations Using an Ecosystem Services Approach (eftec et al., 2019 forthcoming): The aim of the project is to inform the methodology used by DfT to value landscape impacts in the Transport Appraisal Guidance (TAG²) including the appraisal of the monetary value of landscape impacts using supplementary value for money (VfM) guidance. In particular, the report develops the methodology to value landscape impacts of transport interventions in the context of the ecosystem services (ESS) approach and makes recommendations for specific ecosystem services that could be incorporated into current and future VfM guidance.

This peer review particularly relates to the assessment of the robustness of the values provided by the original report; the assessment of these impacts over the appraisal period; and the impacts being captured by the existing values. In addition, advice is required on what ecosystem service values could be included within the current VfM guidance on landscape which draws on the recent report above (2019, forthcoming).

² Also referred to as WebTAG.

The structure for the technical advice note is set out below:

- Methodology and approach to peer review
- Review of existing supplementary guidance and revised approach
- Review of ESS (ecosystem service) values for inclusion in guidance
- Recommendations and conclusions

2 Methodology and approach

H.M. Treasury Green Book (2018) provides the overarching UK government guidance on appraisal of policies and projects including the approach to the technical issues covered in this advice note on discounting, future values and appropriate time horizon. By extension, the Department for Transport's Transport Appraisal Guidance (TAG) follows the Green Book guidance and approach to economic valuation.

The Green Book (2018) recommends a natural capital³ framework for use in the assessment of environmental impacts. Stocks of natural capital provide flows of 'ecosystem' services. The supplementary guide on accounting for environmental impacts (Green Book Supplementary Guidance: Environment, 2012) highlights that the application of ecosystem services is important to ensure that the full range of environmental impacts are taken into account in appraisal.

There are a range of specific guides for valuing environmental impacts with best practice guidance on economic valuation, such as stated preference and value transfer⁴. In addition, various reports from the Natural Capital Committee on improving cost-benefit analysis and from the ONS on Natural Capital Accounting provide recommendations and key principles for valuing natural capital of relevance to this peer review.

Key criteria important to this peer review of the supplementary value for money guidance on landscape monetisation are:

³ Natural capital includes certain stocks of the elements of nature that have value to society, such as forests, fisheries, rivers, biodiversity, land and minerals. Natural capital includes both the living and non-living aspects of ecosystems.

⁴ See "Economic valuation with stated preference techniques" (Department for Transport, 2002); "Contemporary guidance for stated preference studies" (Johnston et al., 2017); and "Valuing Environmental Impacts: Practical Guidelines for the Use of Value Transfer in Policy and Project Appraisal" (eftec, 2010).

Policy context: the decision context⁵ and the expected significance of the environmental impacts will inform the overall appropriateness of use of valuations.

Relevance and robustness: assessing the ODPM report and application of the 47 valuation studies against the criteria of robustness and relevance⁶:

- relevance refers to whether the attributes covered in the valuation studies reflect the definition of the good being assessed, whether the valuation scenario matches the policy context and whether there are any critical assumptions for translating the values into the appropriate units for use.
- robustness refers to the approach taken to inclusion of valuation studies of landscape impacts in the different land types (e.g. using studies where methodology is considered robust, sample representative of the population).

Consistency of approach: reviewing the current approach and recommendations for consistency with treatment in other contexts, for example in TAG or by ONS for natural capital accounting.

3 Review of supplementary guidance on landscape

This section provides a peer review of the approach and the values that underpin the existing supplementary VfM guidance which are based on the ODPM report (**DCLG, 2006**). In particular, this section reviews the approach to capturing the studies in the literature review and the conversion into per hectare per year units when other units are used by the study.

The ODPM report aimed to provide a greater understanding of the economic value of different types of undeveloped land in the UK. Undeveloped land can provide a number of benefits, such as recreation, landscape, ecology, cultural heritage, hydrology, air quality and climate, tranquillity, accessibility and soil. Key objectives of the study included:

- to produce a typology of undeveloped land and identify for each category of land the associated external benefits;
- to review existing estimated values for the external benefits associated with undeveloped land types in order to identify readily available, valid and transferable estimates; and
- to identify relevant gaps in the literature and advise on the external benefits for which values do not yet exist. The study should also suggest how these values might best be estimated.

⁵ Required accuracy will increase if applied within formal cost-benefit analysis compared to providing indicative estimates.

⁶ Note: it is not the purpose of this peer review to assess individually the 47 valuation studies on robustness and relevance but review the overall approach taken in the ODPM report.

As part of this peer review, we assessed the ODPM report, which incorporated 47 of the most relevant studies for valuing the external benefits of undeveloped land. The studies were selected based on criteria including study subject and study context, methodology, quality of statistical results, and study age.

Table 1 provides a summary of the coverage of external benefits for each undeveloped land use type. **Annex 1** provides a more detailed overview covering the valuation studies that underpin the ODPM value estimates for each land type, the valuation methods and the specific valuation scenarios that were applied.

Table 1: Summary of external benefits by land use type

	External Benefits Included in ODPM (2001)								
	Recreation	Landscape	Ecology	Cultural Heritage	Hydrology	Air Quality and Climate Regulation	Tranquillity	Accessibility	Soil
Urban Core	✓	✓					✓		
Urban Fringe (Greenbelt)	✓	✓	✓						
Urban Fringe (Forested Land)	✓								
Rural Forested Land (Amenity)	✓	✓	✓						
Agricultural Land (Extensive)	✓	✓	✓	✓					
Agricultural Land (Intensive)		✓							
Natural and Semi-Natural Land	✓	✓	✓		✓				

Notes: (1) while tranquillity is included as a benefit for the Urban Core, in practice the supplementary VfM guidance does not incorporate this to avoid double counting with recreation. (2) Soil is identified as a benefit in the ODPM report, but concludes that the values should not be valued separately to avoid double counting because these values are reflected in other benefits (such as ecology).

Specific issues to highlight include:

Are the underlying WTP estimates on a comparable basis including attributes and type of impact being evaluated?

1. The supplementary VfM values provided by the ODPM report were obtained from an extensive literature review of 47 relevant studies from the UK, North America, Europe and Australia dating from 1984 to 2001 (DCLG, 2006). The table above highlights that the external benefits included in the ODPM report were relatively limited focusing on recreation, landscape and to a lesser extent ecology. Moreover, there is an uneven coverage across these core benefits which will affect the comparability of the land use type values.
2. In terms of reliability of the evidence, while the approach in the ODPM report reviewed the valuation literature following credible selection criteria, there are several evidence limitations. First, there have been considerable advancements in the literature in the subsequent 18 years, not only in the conception of amenity and aesthetic values associated with landscapes, but also in the growing area of ecosystem services. While the literature review was extensive, values for

particular undeveloped land types were often drawn from only 1-2 studies at most (apart from the wetlands values), see **Table 2** below. In addition, the age of the studies does not allow for how public preferences may now have changed with regard to these policy scenarios.

Table 2: Number of relevant valuation studies across land type

Land Type	Valuation Studies	Valuation Studies Used	Study Date	Notes
Urban Core	1	Lockwood and Tracy (1995)	1993	
Urban Fringe (Greenbelt)	1	Hanley and Knight (1992)	1991	
Urban Fringe (Forested Land)	5	Tyrvaïnen (2001)	1995-1996	CV survey took place in 1995 in one town (Joensuu) and 1996 in another (Salo)
Rural Forested Land (Amenity)	4	Hanley and Spash (1993)	1990	
Agricultural Land (Extensive)	5	1. Willis et al. (1995) 2. Hanley et al. (1998)	1. 1992 2. 1994-1996	
Agricultural Land (Intensive)	3	Bowker and Diychuck (1994)	1990	
Natural and Semi-Natural Land	9	Woodward and Wui (2001)	N/A	Woodward and Wui's paper was a meta-analysis of 39 wetland studies

Notes: (1) while the review of land type valuations did include 47 studies, "the number of studies providing comparable results is 28" (DCLG, 2006, p53), hence the ODPM report only mentions 28 studies. (2) One study (Paterson et al. (1993)) was considered for both extensive and intensive agricultural land.

3. The definition of the change in good is an important driver of value, and it is important to ensure homogeneity in the change in provision of goods. However, within the studies included in the ODPM report, some considered valuation scenarios linked to avoiding loss or deterioration: preserving greenbelt land and preventing urban development or more specific WTP scenarios to avoid a transport scheme (by-pass) through an ancient woodland. Other valuation scenarios were focused on WTP for improvements: quality improvements through agri-environment schemes or for management of a city park. There are a number of challenges with the application of these values:
 - i. Generally, the studies found that people were willing to pay more to maintain quality and avoid deterioration than they are to improve quality. This is in line with wider findings in the SP literature that show that people value a loss greater than a gain (despite the underlying economic theory suggesting that the welfare impacts should be equal). Although debate still exists as to the driver of these differences, the divergence is commonly put down to the endowment effect and loss aversion, whereby respondents have a cognitive bias towards losing something which they already have, over any hypothetical gains they could enjoy (Brown and Gregory, 1999; Ericson and Fuster, 2014; Tunçel and Hammitt, 2014). It is therefore important to consider the policy context carefully and ensure the valuation studies match as otherwise there is likely to be either an under or over-estimate of the value of this change.

- ii. As the valuation scenarios differ, these policy changes are likely to involve considerable differences in the welfare change experienced by those on whom they impact, and it would not be appropriate to combine different policy changes into a single value.
- iii. It is also problematic to present one set of values for one type of policy change for one environmental category and another set of values for a different policy change for another category, as this may have implications for the ways that these values should be applied and the relevant adjustments that must be made to them in subsequent appraisals.

Issues with use of constant unit values

- 4. Within the ODPM report, the WTP estimates are presented in three different units: WTP per visit - to a site (from 'recreational' studies); per household; and per hectare per year. For the purpose of advising land-use planning, the ODPM report considers the per-hectare values to be the appropriate choice but is unable to provide reliable per hectare estimates based on the literature reviewed. The ODPM report acknowledges that “there are a number of issues that affect the valuation estimates” (DCLG, 2006, p11). These include:
 - i. Distinguishing between users and non-users in the local population. We note that it is best practice to separate out and estimate independently the use and non-use values held by user and non-user populations, but this is not attempted in the ODPM report, which concludes that “None captured the total economic value” (DCLG, 2006, p14).
 - ii. While some of the land use type categories map to specific habitat types such as forest, for others there is not an exact mapping. This is an issue as different habitats will have different combinations of ecosystem services present.
 - iii. With the exception of the wetlands value, the values presented in the ODPM report do not include any indirect-use values, such as hydrology, air quality and climate and soil functions.
 - iv. The issue of diminishing returns: The ODPM report acknowledges that many studies show that as the area of land to be maintained increases (decreases), WTP for each extra hectare of land decreases (increases), which is also affected by assumptions about how people's WTP is likely to change over time. This issue of diminishing returns per hectare is not addressed in the ODPM values, which is likely to lead to an overestimate of values for larger land cover areas.
- 5. These limitations mean that it was not possible for the ODPM report to provide an estimate for a 'typical' hectare of land (other than for wetlands). Therefore, these per hectare valuation estimates from ODPM are not directly comparable with each other, and indeed the ODPM report states that they should provide only “a useful 'quick summary' of the most relevant literature” (DCLG, 2006, p12). However - and given that “None of the literature reviewed [in the ODPM report] sought to explain how per hectare values change as the absolute size of the site in question and the relative proportion of the site under threat changes” (DCLG, 2006, p14) - it is our interpretation of this that the per hectare values

provided by the ODPM report should not be used within the formal adjusted value for money metrics.

6. It is important to note that the landscape values derived from the ODPM report do not account for context specific attributes, such as special designations (SSSIs, AONBs) or the availability of substitutes. Yet, hedonic price studies have shown that increasing distance to natural amenities such as rivers, National Parks and National Trust sites is unambiguously associated with a fall in house prices, as a strong indicator of the higher amenity values associated with such designations⁷. This is an area that requires additional research in order to develop adjustments that are able to account for these differing factors. In the absence of such evidence, the values obtained are likely to be an underestimate when applied to designated areas.

Methodological

7. Within the ODPM report the value of landscape is conceptualised as a bundle which includes “benefits, such as recreation, landscape, ecology, cultural heritage, hydrology, air quality and climate, tranquillity, accessibility and soil” (DCLG, 2006, p7). Landscape is defined as “the fabric of the land into which development is placed, along with a constantly evolving entity fashioned by that development” (DCLG, 2006, p9). An extensive body of research exists which shows that landscape values commonly include the aesthetic or visual amenity value of landscape. This was central to landscape evaluations in the UK National Ecosystem Assessment (2011) and subsequent academic research, but is not included in the ODPM report.
8. At the core of non-market valuation techniques is an assumption that individuals have a maximum willingness to pay (WTP) for or willingness to accept (WTA) compensation for a change in the provision of a non-market good, in this case local environmental goods and services. When combining WTP/WTA values obtained over multiple studies, best practice in the field of stated preference value transfer would require testing of ‘transfer error’ (i.e., the error introduced by site-specific difference between the observed ‘study’ site and the ‘policy’ site of interest which would be expected to drive unobserved difference in value) as an assessment of the robustness of the values when applied to different land use contexts⁸ (see e.g. Johnston et al., 2015). However, there is no testing of transfer error in the ODPM report. This means that it is impossible to assess whether the average values obtained for each category are based on similar ‘policy change’.
9. Finally, there are specific issues relating to the methodology developed in the VfM supplementary guide of relevance:

⁷ See for instance “The Amenity Value of English Nature: A Hedonic Price Approach” (Gibbons et al., 2014)

⁸ See for instance Johnston et al. (2015)

- i. The bundling of the external benefits in terms of an overall value per hectare does not provide allowance for policy contexts where some ecosystem services are affected and others are not;
- ii. The approach to assessing landscape impacts assume a transport scheme affects undeveloped land (and in turn the external benefits) a specific distance either side of the scheme. However, as highlighted in the eftec report, for some benefit categories, particularly landscape amenity and recreation, there is a case for considering the viewshed of the scheme⁹.

4 Review of revised approach on treatment of landscape values

This section reviews the revised approach as set out by DfT on the treatment of the landscape values over a shorter appraisal period, in line with Defra/Green book supplementary guidance and the assessment of the growth in impacts. **Table 3** below provides a summary of the current position on these technical issues taken in the supplementary VfM guidance on landscape monetisation and DfT’s proposed changes.

Table 3: Summary of key technical issues for landscape monetisation

Technical issue	Current guidance	Proposed changes to guidance
Appraisal period	Landscape impacts are assumed to exist in perpetuity.	Move to a 100-year appraisal period, providing 60 and 250-year values as a sensitivity range.
Discount rate	Applies a 3.5% flat discount rate	Apply Green Book declining discount rates. ¹⁰
% increase in landscape values	Assumes a 3% rate of increase in annual per hectare values (2.5% income growth and an income elasticity of 1.2)	Use an elasticity of growth in impact with respect to real income growth of 1.

Each of these technical issues is reviewed below with the peer review recommendations.

4.1 Appraisal period

The Green Book recommends an appraisal period of 60 years where “significant assets” are involved, such as infrastructure, but also highlights that an appraisal period greater than 60 years is

⁹ Even for other types of external benefits this assumption of impacts a certain distance from the scheme is arbitrary and requires further consideration.

¹⁰ 3.5% for the first 30 years of a project or programme, and a schedule of declining discount rates thereafter.

sometimes more appropriate for interventions likely to have significant costs or benefits beyond 60 years (H.M. Treasury, 2018, p13).

DfT's TAG guidance (Department for Transport, 2018) highlights that the costs and benefits of a transport project or policy will typically occur over a long time period and recommends the use of a standard 60-year appraisal which also allows better comparison between options and schemes.

For landscape impacts, the justification for applying an appraisal period that is longer than the default 60 years for transport schemes is that these impacts might be assumed to last well beyond the lifetime of the scheme itself and therefore this could undervalue the true impact.

A 100-year appraisal period is in line with the Natural Capital Accounts as set out in the ONS Natural Capital Accounting Principles paper (Office for National Statistics, 2017). Ecosystem assets can supply flows of services indefinitely if managed sustainably. The ONS paper highlights that discounting at Green Book rates at constant prices over 50 years would give approximately 76% of the net present value (NPV) based on infinite flows whereas a 100-year period captures over 92% of the NPV value. This led to the recommendation to adopt a 100-year asset life to better reflect the longevity of renewable natural assets. This captures most of the theoretical value in perpetuity and is preferred to the use of the infinite time horizon for practical purposes and to aid transparency.

Peer review conclusion: we agree with the recommendation to adopt a 100-year appraisal period, providing 60 and 250-year values as a sensitivity range. The Treasury Green Book recommends that the time horizon for appraisal of impacts “may be extended where there is evidence a longer time period is required for the full effects of an intervention to materialise” (H.M. Treasury, 2018, p110). Landscape impacts can last well beyond the 60-year appraisal period adopted as the default appraisal period for transport schemes in TAG. The choice of a 100-year appraisal period (with sensitivity analysis of 60 years and 250 years) is in line with ONS natural capital accounting principles and provides a practical and transparent approach.

4.2 Discount rate

The supplementary VfM guidance on landscape monetisation currently applies a discount rate of 3.5% that does not change over time¹¹. The proposed changes are to implement the Green Book

¹¹ This choice was originally to offset the assumption of an infinite time horizon coupled with increases of landscape values over time which would mean that the overall present value of landscape values would tend to infinity.

(2018) recommended discount rates: 3.5% to apply for the first 30 years of a project, 3% from 31 – 75 years, 2.5% from 76 – 125 years, 2% from 126 – 200 years and 1.5% from 201 to 250 years¹².

The proposed changes would put the approach in line with H.M. Treasury Green Book and TAG cost benefit guidance that applies the Green Book recommended discount rates. In addition, the ONS Natural Capital Accounting Principles paper reviews the appropriate discount rate and recommends, on the basis of a 100-year asset life, the use of the declining discount rates as set out by the Green Book (2018). A comprehensive assessment of social discounting for the purposes of natural capital accounting is set out in Freeman and Groom (2016). In particular, in the context of using natural capital valuation in policy appraisal, consistency across government departments should be the chief organising principle. This organising principle supports the case for use of the Green Book recommended discount rates¹³. The paper also discusses the issue of “dual” discount rates relating to the use of different discount rates for different goods such as environmental goods. However, the conclusion of the paper is that an equivalent and preferable approach would be to reflect the increased relative scarcity of natural capital and its lack of substitutability with other consumption goods by inflating the estimated costs and benefits of the environmental goods: *“In terms of implementation, our preference would be, wherever possible, to reflect these changes in relative prices in the valuation of environmental goods, rather than taking the dual discounting approach. This has the benefit of not necessitating a large departure from the Green Book discounting guidelines and follows the Green Book guidance on accounting for relative price changes”* (Freeman and Groom, 2016, p12). The issue of future values for environmental goods is discussed further in the next section.

Peer review conclusion: we agree with the recommendation to apply Green Book (2018) recommended discount rates which will then provide a consistent approach with TAG.

4.3 Uprating of landscape values over time

The DfT supplementary VfM guidance on landscape monetisation currently applies a 3% appreciation of landscape valuation over time, which is made up of an assumption of real income growth of 2.5% per annum and income elasticity of WTP for landscape impacts of 1.2. However, in July 2018, Highways England reviewed the DfT’s Value for Money guidance values and said this figure was “set entirely arbitrarily”. **DfT’s proposed revised approach is to use an income**

¹² Green Book recommended health discount rates are 1.5% for the first 30 years with a declining schedule. This is relevant to impacts that are associated with health-related costs and benefits such as air quality. However, see section 4.3 which recognises that applying an uprating of future value of health effects (as recognised in air quality values) can provide an equivalent approach to using a lower health discount rate.

¹³ The paper recognises a distinction between use of natural capital valuation to enter into the ONS National Accounts where in principle it would be possible to use either observable market rates or the Green Book’s Social Rate of Time Preference. However, even in this context they recommend using Green Book rates, unless good reason can be provided to deviate.

elasticity of WTP for landscape impacts of 1, implying that WTP for landscape impacts grows in direct proportion to real income.

The current approach is set out in the ODPM report, where the change in real income over time was assumed to be 2.5% and the income elasticity of WTP was given three values – 1, 1.2 and 1.4. This gave three values of the rate of appreciation of WTP – 2.5%, 3% and 3.5%. As 3.5% would give infinite benefits, and as they assumed the income elasticity of environmental goods would be greater than 1, they used 3% as the rate of appreciation.

Freeman and Groom (2016) note that the increased relative scarcity of natural capital and its lack of substitutability with other consumption goods justify inflating the estimated costs and benefits within environmental accounts. The trajectory of this increase in shadow prices will depend on three factors: (1) the rate of growth of the environmental goods in question and scarcity over time; 2) the substitutability of these environmental goods with typical consumption goods; and 3) growth in income and consumption. A paper for the Natural Capital Committee on improving cost benefit analysis (Maddison and Day, 2015) concludes that the ‘default’ approach that assumes that values for environmental goods will remain constant over time has serious limitations. The paper highlights that future values for environmental goods depend on their future supply and demand. They note that the supply of environmental goods is diminishing while there is considerable evidence that the demand for environmental goods responds to increases in income. They suggest various methods to obtain future values (e.g. modelling changes in the demand and supply for environmental goods) although they acknowledge there is a lack of empirical evidence. The report also notes that projecting values into the future based on combining information on expected changes in per capita GDP with information on the income elasticity of WTP is one approach but does not take into account changes in the supply of environmental goods. The Principles of Natural Capital Accounting paper (2017) notes that unit values are likely to change over time. They argue that it is preferable to capture the implications of the future projections of unit prices of environmental goods and services on an individual asset or service basis.

In terms of DfT’s proposed revised approach to use an income elasticity of WTP for landscape impacts of 1, this would imply that with an assumption of 2% real GDP per capita growth that landscape values would be increased in real terms by 2% per annum. This assumption for the elasticity of landscape values with respect to real incomes of 1 is in line with the treatment of other environmental and health impacts in TAG. For example, air quality damage costs are uplifted by 2% per annum to reflect the assumption that willingness to pay for health outcomes will rise in line with real GDP per capita growth.

Peer review conclusion: There are good reasons implied by the supply and demand for environmental goods to expect future values for landscape impacts to increase in real terms over time, perhaps substantially in some cases. However, there is recognition that the current assumptions in the VfM supplementary guidance of an income elasticity of 1.2 are not well-evidenced and may be both arbitrary and counter to good practice guidance. We acknowledge that the use of an income elasticity of 1 for landscape values would bring this into line with other health

and environmental impacts and therefore would make sense as the central assumption (using income elasticity of 1.2 for sensitivity analysis purposes). As DfT extend the ecosystem services approach to valuing landscape impacts it will be important to assess the evidence from the uprating of WIP in the context of each specific service.

5 Advice on ecosystem service values

This section, building on Section 4, considers which ecosystem services/benefits are included, implicitly or explicitly, in the current VfM supplementary guidance on landscape. We then provide an assessment of which of these services can be used in addition to the current supplementary VfM values without leading to double counting issues.

This will help to inform the extent to which valuations derived using the ecosystem services approach (as set out in eftec et al. (2019 forthcoming)) are additional to the current values. DfT have asked to give a particular focus to climate regulation and air pollutant removal, noting that these appear to have a low risk of double counting but also to comment on the other services too.

It should also be noted that the discussion of double counting of ecosystem services (ESS) refers to two specific aspects:

- whether the ESS fit into the landscape module as currently defined or should be captured in principle as part of a different module (e.g. under biodiversity, water environment)
- where the ESS are relevant for the landscape module, are these ESS currently included in the landscape values in the VfM supplementary landscape guide and therefore there would be double counting if new ESS values were introduced?

Table 4 overleaf provides an assessment across the key ESS/benefits from natural capital covering both these aspects. On this basis, clean water, flood regulation and wildlife are ESS/benefits that should in principle be covered in other TAG modules (water environment and biodiversity respectively). Where the ESS/benefits are considered relevant to the landscape module, the eftec report suggests that we can currently monetise five ESS¹⁴ and value their impacts:

- climate regulation (carbon sequestration);
- air pollutant removal;
- recreation;
- landscape aesthetics/visual quality; and
- noise.

¹⁴ The report also covers urban cooling but notes this is “mainly an urban impact and unclear whether is materially affected by a transport scheme” (eftec et al., 2019 forthcoming, p6).

Peer review conclusion:

We agree with the assessment that both **regulation of air quality** and **climate regulation** are ESS benefits that can be incorporated into the current VfM supplementary guidance on landscape. These values would be additional to the existing landscape values and there would be no risk of double counting. In addition, with some further work, there is a practical method available to apply these values to transport appraisal.

While **noise regulation** is an ESS benefit that would also be additional to the existing landscape values, further research is likely to be required and arguably it would be better integrated as part of the overall noise assessment process.

For **recreation** benefits, there would be double counting of benefits if these were incorporated directly alongside the existing landscape values. However, the use of recreational valuation tools such as OrVAL would be an important improvement over the existing values as they reflect specific characteristics of the recreation site that affect the value, including spatial factors and substitute sites. Therefore, our advice would be to consider its use as part of sensitivity analysis within the current landscape guidance.

For **visual amenity** benefits, there would be double counting of benefits if these were incorporated directly alongside the existing landscape values. There is currently a research gap in the availability of monetised values for the landscape amenity associated with different types of landscapes, which means that no robust values exist for transferring benefits for the purposes of appraisal. We therefore recommend that new primary research be undertaken to provide a set of fit for purpose values that capture the benefits associated with landscape visual amenity.

Table 4: Coverage of benefits from natural capital in current TAG

Benefits	Assessment from Temple/Eftec study (2019, forthcoming)		Commentary on potential for inclusion of ESS benefit in addition to landscape values	Other comments	Can values be suitably presented on a per hectare basis?
	In supplementary	Priority for WebTAG			
Aesthetics	Yes	Yes	No. All undeveloped land types in ODFM study include landscape aesthetic values (with the exception of urban fringe (forest)). For landscape aesthetics / visual quality, important to recognise that impacts can arise some distance from the transport scheme and therefore, the use of fixed distances is arbitrary. Temple/Eftec (2019)	Temple/Eftec (2019 forthcoming) emphasise that the impacts of transport infrastructure on landscape aesthetics / visual amenity requires primary research.	
Clean air (regulation of air quality)	No	Yes	Yes. Based on recent work for Defra/ONS, (Jones et al. 2017) potential to assess air pollutant removal by vegetation based on the area and type of habitat damaged by scheme (or gained through mitigation). Air quality impacts of vehicles are also appraised in WebTAG but no risk of double-counting as this relates to separate air pollutant removal of vegetation.	Further work may be required: in progress, ongoing work (eftec, CEH) to develop look-up tables for the value of air quality regulation in different land types and parts of the UK but may require further work to adapt to transport context (e.g. to include roadside trees). The marginal values for air pollution removal by vegetation are based on avoided health costs.	Yes, feasible to provide. The modelling can be disaggregated to show average value (£) per hectare for woodland and non-woodland habitats in urban and non-urban areas.
Clean Water	Yes	No, overlap and very local context dependent benefits	No. Arguably, any water related values should be incorporated in the water environment section of WebTAG. Currently only natural and semi-natural land types include any water related values based on values for wetlands. Because it is very local context specific, values per hectare may not be appropriate for general use.	Publicly available values for use in England & Wales are based National Water Environment Benefits Survey (NWEBS): values by different river catchment area are reported on an annual per km basis for changes in water quality status (e.g. poor, moderate, good).	
Climate regulation	No	Yes	Yes. Carbon sequestration: Government-recommended values (e.g. BEIS non-traded price of carbon) can be applied in standardised manner although uncertainties remain in the quantification of carbon storage and sequestration in some habitats. Impacts of carbon emissions from vehicles are also appraised in WebTAG but no risk of double-counting as this relates to separate carbon sequestration benefits of different land types.	Some work may be required to develop look-up values for WebTAG on the value of carbon lost as a result of loss of habitats with high carbon storage and/or sequestration (including woodland, peatland and saltmarsh). Uncertainties remain in the quantification of carbon storage and sequestration in some habitats and understanding assumptions about impact on habitat and therefore carbon sequestration/storage.	Yes, based on different habitat types. However for the undeveloped land types in the supplementary guide the values per ha may vary according to the mix of habitats.
Hazard protection (flooding)	Yes	No, overlap and very local context dependent benefits	No. Arguably, any water related values should be incorporated in the water environment section of WebTAG. Currently only natural and semi-natural land types include any flood related values based on values for wetlands. Because it is very local context specific, values per hectare may not be appropriate for general use.		No, very local context specific
Recreation	Yes	Yes	No. Recreation values are already included in the current landscape values across all undeveloped land types so this would be double-counting. However, new tools such as the (DrVAL) recreation valuation tool now provide a preferred spatially specific approach to valuing loss of recreational sites and could be used for sensitivity analysis. DrVAL tool works best for more typical and smaller sites. However, further work to investigate marginal impact of transport schemes on the recreation value of sites impacted.	Potential to explore addition of health benefits which are not incorporated and of similar magnitude to recreation, linked to physical activity of recreational visits	No, values are likely to vary significantly dependent on a range of factors including population affected and number of substitute sites. In addition, for recreational values, Temple/Eftec (2019) highlight impacts can arise some distance of the transport project according to its visibility so important to apply the viewshed of the scheme.
Noise regulation	No	Yes	No. Further research required to ensure this service is incorporated in the longer term. Research as part of the UK natural capital accounts (eftec, 2018) looked at the role of noise regulation but highlighted there is significant uncertainty in the physical measurement of this ecosystem service leading to significant uncertainty in its monetary valuation. Noise regulation services only impacted when habitat is lost and so are only relevant to the footprint of the scheme.	It should be noted that the health impacts of noise on households are appraised elsewhere in WebTAG. Temple/Eftec report (2019) recommend integrating role of trees lost in a scheme into the existing appraisal of noise impacts elsewhere in WebTAG to estimate the net change in noise.	
Wildlife	Yes, under ecology	No, overlap and very challenging to value	No. In principle should be covered under biodiversity part of WebTAG. The landscape values already incorporate various ecology values in most of the land types (exceptions: urban fringe forest and intensive agriculture). So not appropriate to consider adding as could double count. Some biodiversity values are captured in valuations for other final goods and services. In addition, overlap with biodiversity category of WebTAG.	For example, for wildlife there may be existing targets and regulations for the conservation of certain species and habitats. A simple approach is to ensure that proposed investments do not have effects which run counter to those existing targets and regulations, and instead secure them or improve their status.	

6 Recommendations and conclusions

The purpose of this review has been to provide technical advice on the appropriateness of the existing landscape monetisation approach in the supplementary Value for Money (VfM) guidance and peer review of a revised approach developed by the Department for Transport (DfT).

Specific recommendations and conclusions are highlighted below:

- 1. Provide a robust assessment on the status of the existing landscape values and the appropriate treatment of these values in appraisal.**

As part of the review, we assessed the ODPM report that underpins the external benefit of undeveloped land estimates. This has highlighted some key challenges to the existing landscape values relating to the coverage of external benefits across land types and the different valuation scenarios that underpin the estimates which make comparability an issue. Moreover, there have been significant advancements in the subsequent 18 years in the conception of amenity and aesthetic values associated with landscapes and in the growing area of ecosystem services. The use of constant values per hectare does not account for diminishing marginal returns, the added value of special designations e.g. SSSIs, national parks, and does not allow other factors which affect the values including substitutes to be appropriately reflected.

- 2. Comment on the revised approach set out by DfT, suggesting any appropriate modifications.**

In general, our review of the key technical issues supported the revised approach set out by DfT with a few specific caveats:

- we agree with the recommendation to adopt a 100-year appraisal period, providing 60 and 250-year values as a sensitivity range. Landscape impacts can last well beyond the 60-year appraisal period adopted as the default appraisal period for transport schemes in TAG. The choice of a 100-year appraisal period provides a practical and transparent approach.
- applying Green Book (2018) recommended discount rates will provide a consistent approach with TAG.
- there is recognition that the current assumptions in the VfM supplementary guidance are not well evidenced. The use of an income elasticity of 1 for landscape values would bring this into line with other health and environmental impacts. However, as DfT extend the ecosystem services approach to valuing landscape impacts it will be important to assess the evidence from the uprating of WTP in the context of each specific service.

3. Assess the risks of double counting associated with use of the supplementary VfM guidance values in addition to ecosystem services (ESS) valuations.

We agree with the assessment that both **regulation of air quality** and **climate regulation** are ESS benefits that can be incorporated into the current VfM supplementary guidance on landscape. These values would be additional to the existing landscape values and there would be no risk of double counting. In addition, with some further work, there is a practical method available to apply these values to transport appraisal.

While **noise regulation** is an ESS benefit that would also be additional to the existing landscape values, further research is likely to be required.

For **recreation** benefits, there would be double counting of benefits if these were incorporated directly alongside the existing landscape values. However, the use of recreational valuation tools such as OrVAL would be an improvement over the existing values and our advice would be to consider its use as part of sensitivity analysis within the current landscape guidance.

As highlighted in the VfM supplementary guidance, the landscape values are expected to be used only indicatively and not presented formally within the cost-benefit analysis while there is an emphasis on the use of the qualitative landscape assessment process in the appraisal process. However, given that the focus for use of the landscape values is likely to be where moderate or significant environmental impacts occur, we would argue that the level of robustness of these estimates may not meet the requirements for indicative decision making. The technical revisions outlined in Section 4 seek to adjust the ODPM values in a way that is in line with standard Government guidance and natural capital accounting principles. This would reduce the overall values in a way that is more realistic, producing more conservative estimates of landscape value, which the reviewers would recommend in light of the limitations of the evidence that underlies the landscape values (as outlined in Section 3). However, we note that the evidence limitations identified in the ODPM report persist even after the adjustments outlined. While there are specific additions to ESS in section 5 that can be introduced without any issues of double-counting, these do not directly address the limitations of the ODPM landscape values. However, to fully address these limitations would require new primary research which will take longer to produce. As such, the approach outlined in Sections 4 and 5 would help to adjust the existing approach in the right direction, until such time as a full suite of ESS impacts can be valued.

Overall, we agree with the key conclusion from the efttec report that: “the current monetary values in the supplementary VfM guidance for TAG are no longer fit for purpose. An improved approach, although still with weaknesses, would be to value ecosystem services separately” (efttec et al., 2019 forthcoming, p6).

7 References

Department for Communities and Local Government (2006) “Valuing the external benefits of undeveloped land: main document” [pdf]. Available at:
<https://webarchive.nationalarchives.gov.uk/20120920043019/http://www.communities.gov.uk/documents/planningandbuilding/pdf/158136.pdf>

Department for Transport (2016) “Value for Money Supplementary Guidance on Landscape” [pdf].
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/627487/value-for-money-supplementary-guidance-on-landscape.pdf

Freeman, M. and Groom, B. (2016) “Discounting for Environmental Accounts” Office for National Statistics [pdf]. Available at:
<https://www.ons.gov.uk/file?uri=/economy/nationalaccounts/uksectoraccounts/methodologies/naturalcapital/discountingforenvironmentalaccounts.pdf>

H.M. Treasury (2018) “The Green Book” H.M. Treasury [pdf]. Available at:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/685903/The_Green_Book.pdf

H.M. Treasury Green Book Supplementary Guidance (2012) “Accounting for environmental impacts” [pdf]. Available at:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/191500/Accounting_for_environmental_impacts.pdf

Maddison, D. and Day, B. (2015) “Improving Cost Benefit Analysis Guidance” [pdf]. Available at:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/517027/ncc-research-improving-cost-benefit-guidance-final-report.pdf

Office for National Statistics (2017) “Principles of Natural Capital Accounting” [pdf]. Available at:
<https://www.ons.gov.uk/economy/environmentalaccounts/methodologies/principlesofnaturalcapitalaccounting/pdf>

eftec et al. (2019 forthcoming) “Valuation of Landscape Impacts of Transport Interventions & Mitigations Using an Ecosystem Services Approach” [pdf]

Annex 1: Overview of ODPM (2001) value estimates by undeveloped land type

Land Type	Description	Original (2001) £/ha/yr	Current (2010) £/ha/yr	Valuation Study	Attributes Covered	Valuation method	Valuation scenario	Source for £/ha/yr Value estimate in ODPM study
Urban Core	Central urban area e.g. public spaces and city parks.	54,000	75,153	Lockwood and Tracy (1995)	Recreation, Landscape, Tranquillity	Contingent Valuation and Travel-Cost Method	Local residents of a park in Sydney, Australia. WTP for management of a park through a Trust Fund.	The ODPM study used a rounded down version of the valuation calculated by Lockwood and Tracy.
Urban Fringe (Greenbelt)	Areas of transition where urban areas meet countryside.	889	1,237	Hanley and Knight (1992)	Recreation, Landscape, Ecology	Open-Ended Contingent Valuation	Asked local residents their WTP to preserve greenbelt land in Cheshire, UK.	Hanley and Knight's valuation was used.
Urban Fringe (Forested Land)	Forested land on urban fringes; more valuable than typical urban fringe.	2,700	3758	Tyrvaïnen (2001)	Recreation	Contingent Valuation (Payment Card)	Asked local residents their WTP to prevent urban development in multiple urban forest parks.	Tyrvaïnen's study most relevant since it focused on urban forest parks; the ODPM study calculated an average of the range of valuations from this study, rounded down to get £2,700 ha/yr.
Rural Forested Land (Amenity)	This value represents the range of forests in the UK, including both commercial and amenity forests.	6,626	9,222	Hanley and Spash (1993)	Recreation, Landscape, Ecology	Contingent Valuation	Asked local residents their WTP to avoid a bypass through an ancient woodland.	As Hanley and Spash's study was the only one that values all three attributes, the ODPM study uses their valuation of £6,626 ha/yr.
Agricultural Land (Extensive)	Areas of rough grassland where extensive agricultural practices such as sheep farming dominate. May include farm buildings forming part of the agricultural holdings.	3,150	4,384	1. Willis et al. (1995) 2. Hanley et al. (1998)	1. Recreation, Landscape, Ecology, Cultural Heritage 2. Recreation, Landscape, Ecology	1. Contingent Valuation (Dichotomous Choice) 2. Open-Ended Contingent Valuation	1. Obtained the public's WTP (via taxes) to maintain the Environmentally Sensitive Areas (ESA) programme. 2. Asked residents, visitors and the public their WTP for environmental improvements at an ESA.	As both the Willis et al. (1995) and the Hanley et al. (1998) study aggregated across the UK population and found similar results (£3,170 and £3,110 respectively), the ODPM study used a valuation between both of these (£3,150 ha/yr).
Agricultural Land (Intensive)	This type of land is usually in farmland under intensive agriculture (usually land under food production). May include farm buildings forming a part of the agricultural holdings.	103	143	Bowker and Diychuck (1994)	Landscape	Contingent Valuation (Payment Card)	Asked residents their WTP to save farmland that is under threat from urban development.	Bowker and Diychuck's study used as most relevant because calculated WTP to avoid agricultural land being developed for urban uses. ODPM study took the valuation of intensive agricultural land at the higher end of the study's results range, justified as land more scarce in the UK than in Canada (where the study took place).
Natural and Semi-Natural Land	This includes uncultivated areas, wetlands and areas with nature conservation designations.	6,616	9,208	Woodward and Wui (2001)	Recreation, Landscape, Ecology, Hydrology	Meta-Analysis	The meta-analysis was based on 39 wetland studies.	The ODPM study uses Woodward and Wui's findings of £6,616 ha/yr because this study included the most attributes.