The future economic value of the Trent Valley

Final Report

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The Planning Cooperative

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Risk & Policy Analysts

The future economic value of the Trent Valley

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Non-technical Summary

Why is this study needed?

The Trent Valley within Derbyshire is becoming an increasingly fragmented landscape facing significant pressures for change as a result of mineral extraction, urban development, transport infrastructure and agriculture (arable and pastoral). These different land uses compete for space and resources, presenting opportunities and threats to the established landscape character of the area. A map of the study area is given in Figure 1.

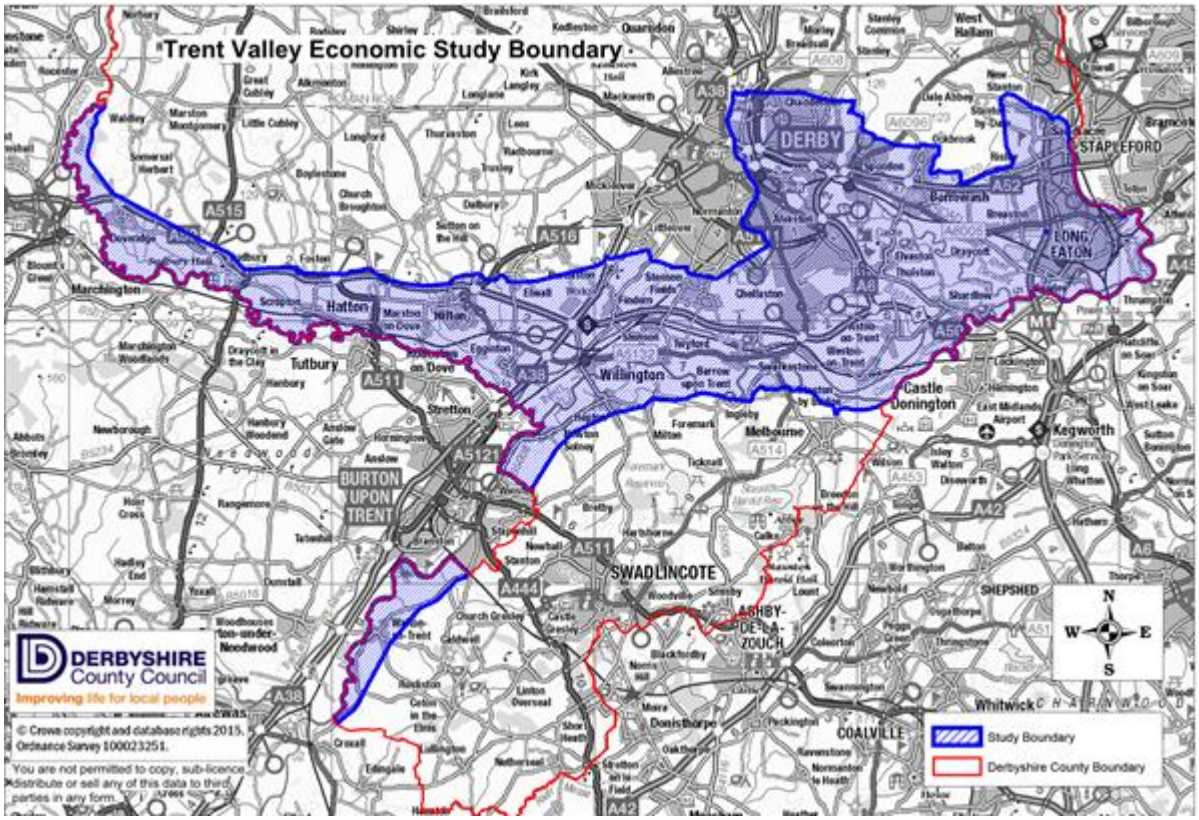

Figure 1: Map of the study area (Source: Derbyshire County Council)

Evidence suggests that the Trent Valley is currently at a pivotal moment, with two possible options for the way forwards:

1.1 Continue to follow **an uncoordinated approach** to the development of the area. Changes will occur in a disjointed, piecemeal fashion with the potential to result in a degraded natural environment; or

1.2 Adopt **a coordinated approach** to the area's development**.** This will involve all sectors working together to establish a long-term vision and strategy for the Trent Valley landscape that can deliver environmental, social and economic benefits.

What are the aims of the study?

Derbyshire County Council commissioned Risk & Policy Analysts Limited (RPA) in association with the Planning Cooperative to undertake this study. The aim is to undertake an economic assessment of the Trent Valley study area to estimate the economic, social and environmental benefits of moving to a coordinated approach as opposed to following an uncoordinated one.

How will the results be used?

The results will provide evidence to help decision makers with future planning, to inform a future strategy for the area and to potentially attract investment to help deliver the coordinated approach.

What are the key findings?

Working together to deliver a long-term vision for the Trent Valley could provide significant economic, social and environmental benefits. In 2050, the coordinated scenario could deliver:

£2.8 billion per year in additional economic benefits (range £800 million to £4.8 billion per year)	**150,000** jobs (range **110,000** to **190,000** jobs)	**£80 million** per year in additional social and environmental benefits (range £44 million to £110 million per year)

In total between 2020 and 2050, the benefits of the coordinated scenario over the uncoordinated scenario are estimated to be:

- **£16 billion** for the economic benefits (range £6.1 billion to £26 billion)
- **£450 million** for the social and environmental benefits (range £300 million to £750 million)

Notes: the total benefits have been discounted using the Treasury Green Book and so are given as present values; all other values are undiscounted and given as annual (per year) values

How were the benefits estimated?

The approach to the study is shown in Figure 2. Further details on each step are provided below.

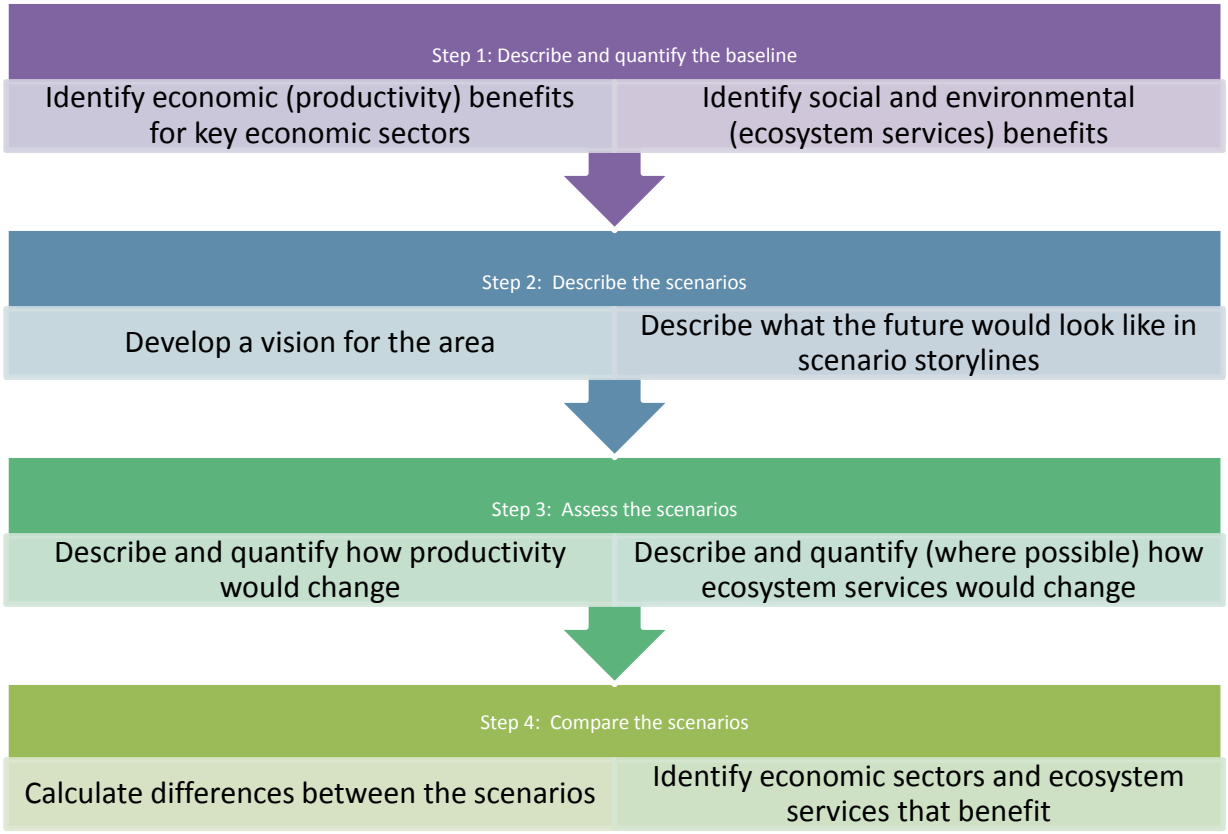

Figure 2: The approach to the study

Step 1: Describe and quantify the baseline

The study combined a review of existing plans, policies and strategies with engagement with key stakeholders to describe the current baseline for the study area. The current economic benefits were described and quantified in terms of productivity and outputs from key sectors. In addition, an ecosystem services (see Box 1) baseline was described to capture the social and environmental benefits.

The study captured the economic benefits to eight key sectors: aggregates, agriculture, construction, energy generation, physical infrastructure, manufacturing and R&D, tourism/recreation and water. This included identifying the current Gross Value Added and number of jobs as well as quantifying the current value of outputs.

Box 1: What are ecosystem services?

These are the goods and services provided by the environment that provide benefits to people. They are divided into four types:

- Provisioning such as freshwater, crops (these are captured as the economic benefits);
- Regulating e.g. carbon sequestration (social and environmental benefits);
- Cultural e.g. opportunities for recreation (social and environmental benefits); and
- Supporting e.g. nutrient cycling. This category underpins the other three types.

This study also included 'biodiversity' as a service so these benefits are explicitly captured within the assessment

The assessment described the current baseline for nine ecosystem services: biodiversity, air quality, climate regulation, water purification, water regulation (flood risk), educational value, cultural heritage, aesthetics and wellbeing. This allowed the identification of changes for three further sectors: health and wellbeing, heritage, and wildlife and biodiversity. Note that it was not possible to estimate the current value of ecosystem services due to data gaps.

Combining the economic benefits with an assessment of social and environmental benefits provided the basis for assessing overall impacts for the wider economy of the Trent Valley study area.

Step 2: Describe the scenarios

The first part of step 2 was to develop an overarching vision for the area, describing how the Trent Valley might look should a coordinated approach to planning and development be followed (see Box 2). Sector specific visions were also developed using existing plans and strategies where possible.

Box 2: Vision for the Trent Valley

The coordinated scenario would promote the creation of an attractive, multifunctional new landscape character within the valley.

This new landscape would be designed and planned to mitigate the adverse effects of mineral extraction and housing growth, and create greater environmental capacity to both absorb and facilitate further development. The landscape framework would also seek to maximise ecosystem services delivery, stimulate and diversify economic activity, and increase social benefits, by providing a multifunctional, multifaceted resource.

By directing sand and gravel extraction towards the least sensitive areas, the most valuable and sensitive areas can be protected, whilst restoration schemes will deliver landscape-scale change through the creation of interlocking water bodies and robust areas of woodland. These will integrate with the best of the existing landscape, including historic and natural assets, to provide a range of recreational and leisure opportunities. This new landscape framework will be an attractive setting for high quality new housing development with direct access to a new and enhanced Green Infrastructure network.

The new landscape will be recognised by residents and businesses alike as an invaluable resource, an attraction and a valued asset, making the valley a desirable location in which to live, work and play.
New waterways will provide additional economic opportunities through their use by pleasure craft, sports and recreational users, and as transport corridors. The newly configured landscape will accommodate new economic activities such as leisure and holiday accommodation and associated services, renewable energy and other diversification opportunities for sectors not previously prevalent in the valley.

Threaded throughout the entire valley will be extensive opportunities for nature conservation not only through the extensive woodland and wetland creation but also through the improved management of existing historic landscape that would be retained as part of the vision

Scenario storylines were then developed for both the uncoordinated and coordinated approaches to describe what the future would look like for each sector at four time points: 2020, 2025, 2030 and 2050:

- For the **uncoordinated approach**, the storylines draw on existing plans and strategies published for individual sectors (where available); and
- For the **coordinated approach**, the storylines reflect the overarching vision taking account of likely interactions between the sectors. Opportunities for synergies between sectors were

taken up (e.g. constructing high quality housing that reflects the nature of the valley was assumed to improve the attractiveness of the area to investors and highly skilled people), whilst mitigating actions were included to deal with any negative feedback between sectors.

Step 3: Assess the scenarios

The scenario storylines provide the basis for developing assumptions that are used to identify how each sector might change (i.e. grow, stabilise or decline) under the uncoordinated and coordinated approaches. The direction and magnitude of change are then used to assess whether there would be benefits (positive impacts) or dis-benefits (negative impacts) at each time point in the future. As well as identifying changes to the sectors individually, feedback between sectors was also considered. For example, aggregates extraction could negatively impact agriculture through affecting water availability/quality and through using land, yet agriculture in turn could benefit the tourism sector if high quality local food was produced and marketed under the Trent Valley brand.

To estimate the changes and value them in monetary terms, two types of assumption were needed: those related to the magnitude of the change, and those related to assigning a monetary value to that change. These two aspects of uncertainty were combined to provide an overall uncertainty rating running from Low to Very High. The ratings were converted to percentages and used to calculate a range (lower and upper bound estimates) for the benefits.

For assumptions on the magnitude of change, the study referred to data from plans or strategies, or existing trends from analysis of historical data, where these were available. Where no such information was available, the assumptions made were validated against data from other areas (e.g. data on visitor numbers from the Norfolk Broads) to verify that they were realistic. In all cases, there was a focus on ensuring that the magnitude of change was realistic.

Box 3: What is a willingness to pay (WTP) value?

This is a value that has typically been identified from a survey where individuals are asked for their willingness to pay for a particular attribute or change. For example, they might be asked how much they would be willing to pay for an improvement in water quality.

There are strict guidelines that need to be followed for these surveys to ensure that the results are as robust and reliable as possible. This study has only used values from studies that follow these guidelines.

When valuing the benefits in monetary terms, market values (e.g. £/tonne, £/ha, average house price) were used for the economic (productivity) benefits. For the social and environmental benefits, where market values are not available, a process called benefits transfer was used. This involves the application of values from one context or situation to another similar one. For example, a study might have identified a 'willingness to pay' value (see Box 3) for an improvement in air quality in a particular location. This value is then applied to the situation in the Trent Valley. The value transferred is applied to the assumptions on magnitude of change. For air quality, this is the number of people benefitting from an improvement in air quality. Benefits transfer is a recognised technique for valuing benefits where market values are not available. The benefits transfer values used in this study have been taken from peer reviewed journals, to ensure that they are as reliable and robust as possible.

Step 4: Compare the scenarios

Step 3 provides a description and monetary estimate of the benefits under the coordinated and uncoordinated scenarios. This information was used in Step 4 to compare the two scenarios at each time point. This enabled the study to identify which sectors would benefit and by how much under the coordinated scenario for each time point.

Differences between the scenarios in terms of economic (productivity) benefits

Figure 3 presents the economic (productivity) benefits for the coordinated and uncoordinated scenarios. It shows that should an uncoordinated approach be followed, the value of the economy in 2020 is estimated as £3.2 billion (central estimate). If a coordinated approach is taken, the value of the economy in 2020 is assumed to be slightly greater at £3.3 billion (central estimate). However, the two approaches diverge over time. Applying the assumptions from the uncoordinated approach results in an economy valued at £3.3 billion in 2050 (central estimate). Should a coordinated approach be applied with sectors working together to implement the vision for the Trent Valley, the value of the economy in 2050 is estimated as £6.2 billion (central estimate), equivalent to an increase of £2.8 billion from 2020 (based on calculated rather than rounded figures). However, it should be acknowledged that uncertainty is greatest for this time point, such that the additional economic benefits of the coordinated scenario could be £800 million per year (low estimate) to £4.8 billion per year (high estimate).

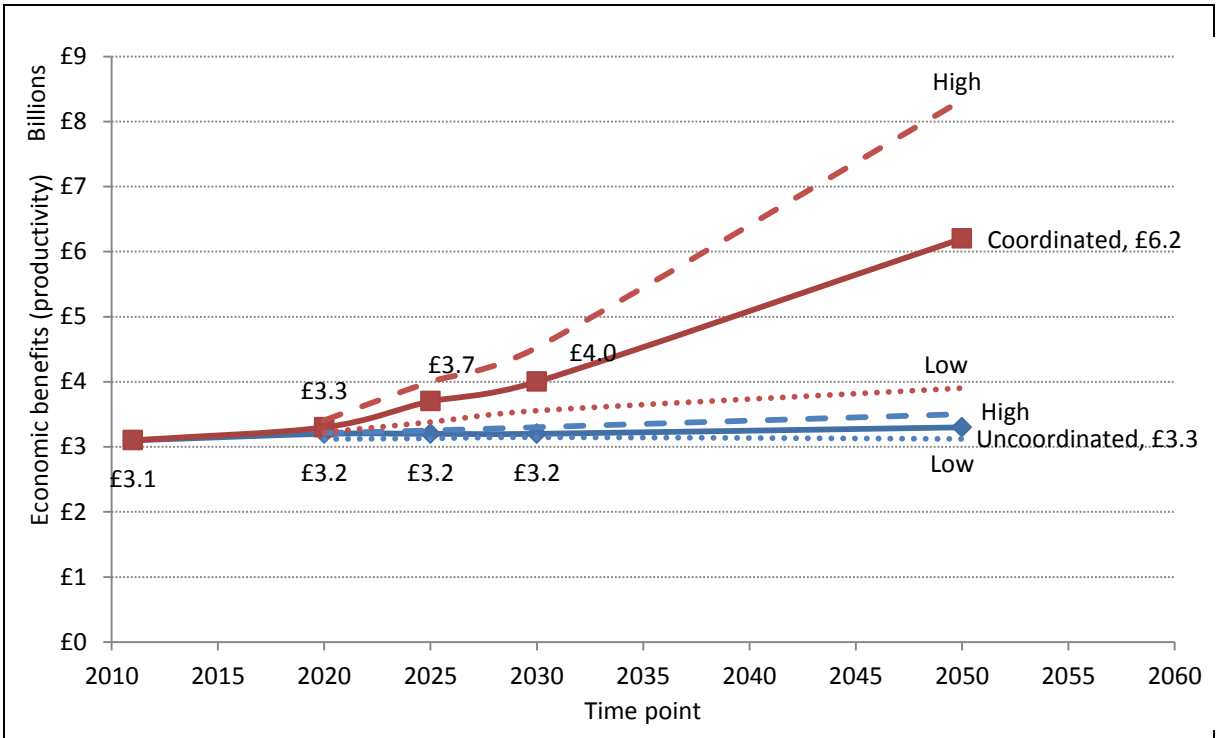

Figure 3: Estimated value of the economic (productivity) benefits for the uncoordinated and coordinated scenarios

Note: the coordinated scenario has much higher uncertainty since the magnitude of change is projected from the scenario storylines; the uncoordinated scenario is based on changes projected in existing plans and strategies (where available)

The sectors that are contributing the most to this increase in value in the economy of the coordinated approach are:

- **Manufacturing, R&D**: grows from £2.8 billion in 2020 to £5.1 billion by 2050 (central estimate, range £3.4 billion to £6.9 million). One of D2N2 LEP's priority sectors, manufacturing is assumed to have a consistently strong growth rate, benefiting from improved infrastructure in the area as well as from the formation of a specific Manufacturing and Research Board. Links to large transport infrastructure projects assist sector growth, and businesses and employees are attracted to the area by the high quality landscape and housing; and
- **Tourism, recreation, retail and leisure**: grows from £150 million in 2020 to £680 million in 2050 (central estimate, range £300 million to £1.1 billion). Another of the LEP's priority sectors, tourism is assumed to grow significantly in response to investment in the Trent Valley brand, the local food offering, the heritage and other attractions of the locality. A major growth area is the development of a network of interconnected waterbodies offering water based activities, wildlife watching and other recreational opportunities including boating day trips and holidays. The Trent Valley is assumed to become well known for its waterways and associated leisure opportunities.

This increase in value is expected to lead to additional jobs in the study area. Using data from the ONS, it is estimated that there were around 93,000 jobs in the Trent Valley in 2011 (based on the estimated GVA of the sectors). Following an uncoordinated approach could result in a slight increase to 104,000 jobs by 2050. However, implementing the coordinated approach could greatly increase the number of jobs, with an estimated 150,000 jobs in 2050.

Differences between the scenarios in terms of social and environmental (ecosystem services) benefits

Figure 4 shows that in 2020, impacts under the uncoordinated scenario are negative in terms of ecosystem services at around £0.6 million less than the baseline (central estimate)[1]. In contrast, for the coordinated scenario, the ecosystem services delivered are worth around £2.4 million more than under the baseline (central estimate). By 2050, the difference between the two scenarios is much greater, with the coordinated scenario delivering around £63 million of social and environmental benefits per year over the baseline, whilst the uncoordinated scenario provides around £13 million fewer benefits than under the baseline (central estimates). Again, there is considerable uncertainty associated with these figures as illustrated by the low and high ranges shown in Figure 4. However, even taking the low and high values into account, there is still a considerable difference between the two scenarios with the coordinated scenario providing significantly more social and environmental benefits than the uncoordinated scenario.

The ecosystem services providing a significant proportion of the benefits under the coordinated scenario are carbon sequestration and value of the landscape and its appearance. This is largely due to the provision of green infrastructure which provides opportunities for carbon sequestration as well as enhancing the appearance of the area. In addition, there are significant additional benefits to health and wellbeing under the coordinated scenario and to biodiversity.

[1] Low and high values for landscape benefits are presented in the report based on the ranges provided in the benefits transfer values used. For presentation purposes, the mid-point has been used in the non-technical summary to give just one low and high estimate for both the coordinated and uncoordinated scenarios.

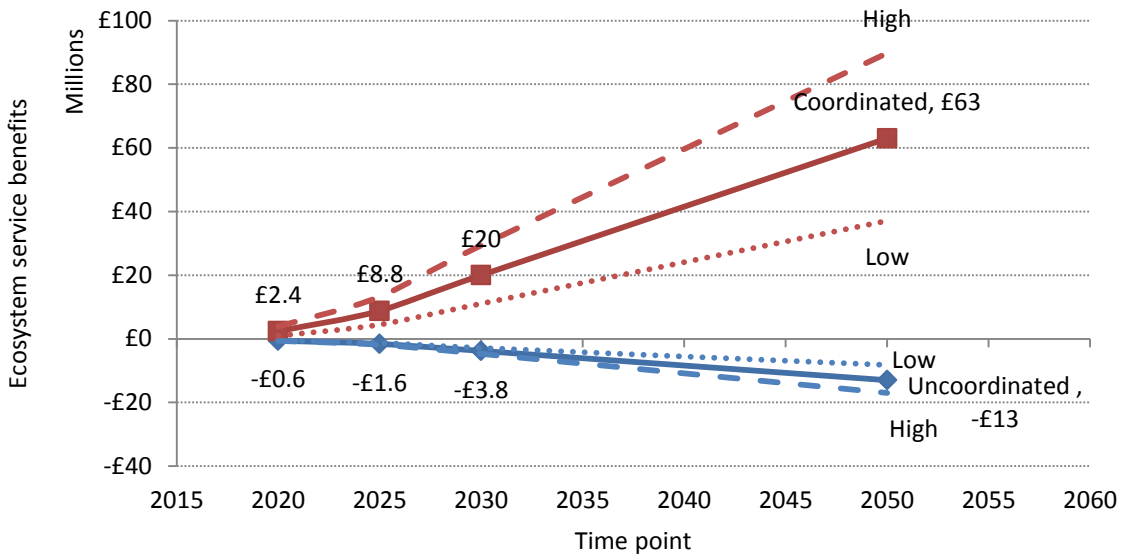

Figure 4: Estimated value of the social and environmental (ecosystem services) benefits for the uncoordinated and coordinated scenarios

Note: *the coordinated scenario has much higher uncertainty since the magnitude of change is projected from the scenario storylines; the uncoordinated scenario is linked to changes projected in existing plans and strategies (where available)*

Under the uncoordinated scenario, the decline in service provision is driven particularly by loss of carbon sequestration (loss of soils to development and aggregates extraction with limited green infrastructure provision), increased risk of flooding linked to higher runoff from existing hard surfaces and a decline in air quality.

The sectors and ecosystem services that benefit from a coordinated approach

Implementation of a coordinated approach to planning and development could therefore lead to considerable benefits for the Trent Valley area over and above those provided by an uncoordinated approach. Following a coordinated approach is likely to bring benefits to key sectors including manufacturing, R&D; and tourism, recreation, retail and leisure. These sectors perform better under the coordinated scenario than the uncoordinated one. Manufacturing and tourism represent key sectors where the Trent Valley has a competitive advantage, should progress be made towards the vision identified by the coordinated scenario.

Similarly, a coordinated approach that follows the Trent Valley vision described in Box 2 could enhance the provision of many ecosystem services and deliver significant social and environmental benefits. A focus on the provision of green infrastructure and careful management of the landscape would lead to carbon sequestration, landscape, health and wellbeing and biodiversity benefits. In contrast, an uncoordinated approach has the potential to decrease the provision of many ecosystem services (air quality, carbon sequestration, water quality) resulting in a reduction in the social and environmental benefits from those currently experienced by people living, working and visiting the Trent Valley.

How can these benefits be realised?

Several changes need to take place to enable progress to be made towards the Trent Valley vision. In addition to sector specific changes, this study has identified two key changes that will require partnership working across the sectors. These changes include:

- **The formation of a coordination board** that is supported by appropriate staff to enable delivery of the coordinated approach; and
- **The development of a business case for the delivery of the coordinated vision**. This will need to identify the structure of the organisation that will be responsible for management, monitoring and evaluation of progress in delivery of the vision. It will also need to update and revise the vision to take account of new developments and approaches to ensure that the vision remains innovative and forward-thinking and retains a focus on delivery of the highest quality outcomes, economically, socially and environmentally. This will require development of a business plan showing how, where and why the coordinated scenario could work and what the benefits and costs of different approaches might be. This will help decision-makers identify the best mechanism for delivery of the vision to 2050 and beyond.

The study has also considered the actions required to implement the coordinated scenario. A key action is the development and promotion of a detailed vision for the Trent Valley. The vision will need to include the key principles underlying the coordinated approach and also the development of a master plan to 2050. Development of the vision will run alongside partnership working and engagement to ensure that there is buy-in from all those who need to be involved with its delivery. Promotion of the vision will help ensure that organisations in the area are inspired to contribute and feed in their ideas. The involvement and commitment of all stakeholders is important due to the linkages between the sectors and the services. Should one aspect of the vision not be taken forwards, this could have knock-on impacts for benefits in several areas. Achievement of the full benefits requires the coordinated vision to be implemented as a whole.

Realisation of the benefits will additionally require funding. This study has identified a range of funding streams that may be able to contribute towards the implementation of the Trent Valley vision. These include both private sources (e.g. payments for carbon offsetting, entrance fees for attractions) and public sources (e.g. the Heritage Lottery Fund, investment leveraged through the LEP). Private companies and individuals may be willing to contribute towards the implementation of a coordinated approach to development should they expect to receive direct benefits, whether these be to a particular economic sector or ecosystem service.

What are the next steps?

This study has shown that significant economic, social and environmental benefits can be realised should a coordinated approach to landscape scale change be implemented in the Trent Valley. If these benefits are to be achieved, the required changes and actions will need to be fully supported and resourced.

Figure 5 summarises the suggested next steps for the Trent Valley.

	**Vision and approach** The delivery of a holistic, multifaceted and coordinated approach to landscape scale change in the Trent Valley will need to follow an agreed master plan, which establishes the key principles, direction of travel and spatial iteration of the aspirations for the valley. This may take some time to plan, develop and agree with stakeholders. In the short term, consideration should be given to producing an outline vision document. The vision should establish key principles for the approach proposed, and include a phased vision visualised as a spatial master plan over a suitable time frame, at least to 2050 as considered here. The vision document will be critical to communicating the proposals to stakeholders, enabling partnership development, facilitating discussion, and exploring resource and funding implications. Development of a vision should be considered a short term priority action and probably the next piece of work required
	**Personnel** A project of this scale cannot be implemented without staff. It is unlikely that current resources within existing organisations could offer sufficient time to deliver this work. Whilst the nature and number of posts required to deliver a coordinated approach cannot be established now, consideration needs to be given to the need for a staff resource (the coordination board) as well as an operational structure
£	**Resources and funding** The body responsible for the direction and operation of activities to enact a fully coordinated approach will require financial resources to operate. This study has identified a range of potential funding sources relevant to different economic sectors and ecosystem services. Whilst the amount of funding and other resources required cannot be quantified at this point, investigations should begin into relevant funding sources
	**Partnership development** To fully coordinate the breadth and depth of activities required to deliver the benefits of the coordinated scenario, it will be necessary to develop a functional partnership with a breadth of support from a wide range of stakeholders. Whilst partnership development will be a long term and ongoing activity, work should commence immediately on partnership and consensus building
	**Business case, operational structure and governance** Consideration will need to be given to the operational structure and governance required to enact the coordinated approach in the longer term (for example, this could be a not-for-profit business or charitable trust). The nature and structure of this organisation will need to develop in response to the emerging strategy and partnership, and so may evolve over time. Meanwhile, thought should be given to developing a business case building on this study, and exploring possible organisational options

Figure 5: Suggested next steps to enable the coordinated scenario to be progressed

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1 Introduction

1.1 Overview of the study

The Trent Valley is predominantly a flat, open landscape. The area's characteristics are strongly defined by the river Trent and periodic inundation; the ecosystem services provided reflect this in that they relate primarily to water (availability, regulation of flow, etc.). The area is greatly influenced by past and present industry, with the landscape experiencing significant forces for change over short timescales from housing, infrastructure, the sand and gravel (extraction) industry, agriculture and others.

The Trent Valley is a fragmented landscape with localised areas of mineral extraction, areas of urban development, agricultural land (both arable and pastoral) and transport infrastructure. These different land uses compete and can present threats and opportunities to the landscape character. Evidence suggests that the Trent Valley is at a pivotal moment and faced with two options:

- Continue to develop with **an uncoordinated approach** where the landscape can continue to change in a disjointed, piecemeal fashion which will perpetuate long-term impacts and potentially lead to a degraded natural environment; a situation with all of the pressures but none, or few, of the benefits; or
- Adopt **a coordinated approach** which will be more forward looking and joined up to establish a long-term vision and strategy for the Trent Valley landscape that can deliver environmental, social and economic benefits.

This study looks to identify the current pressures for change affecting this landscape to allow a comparison between what the potential economic value of the landscape might be with positive coordinated intervention as opposed to a 'business as usual'/uncoordinated scenario. This provides a means of communicating the economic and health benefits of positive environmental planning to allow investment opportunities to be better understood and shared between the various organisations operating within this area (e.g. farmers, mineral extraction organisations, local landowners, etc.). In order to achieve this it is necessary to quantify what difference this change in character will make to the Trent Valley's economy, if it is undertaken in a coordinated manner so as to create a new attractive character.

1.2 Aims and objectives of the study

The aim of this assessment is undertake a robust economic analysis of the Trent Valley as highlighted by the study boundary provided in the specifications (see Figure 1-1).

The specific objectives are to:

1. Establish the current economic baseline;
2. Highlight the value of the transition economy of the Trent Valley, i.e. during sand and gravel extraction and the development of housing, including any efficiencies to the planning process that a vision may facilitate;

3. Clearly set out the difference of the economic potential of the Trent Valley post extraction and development between a coordinated approach and a 'do nothing/business as usual' approach; and
4. Outline the key sectors where the Trent Valley may hold a competitive advantage in the future.

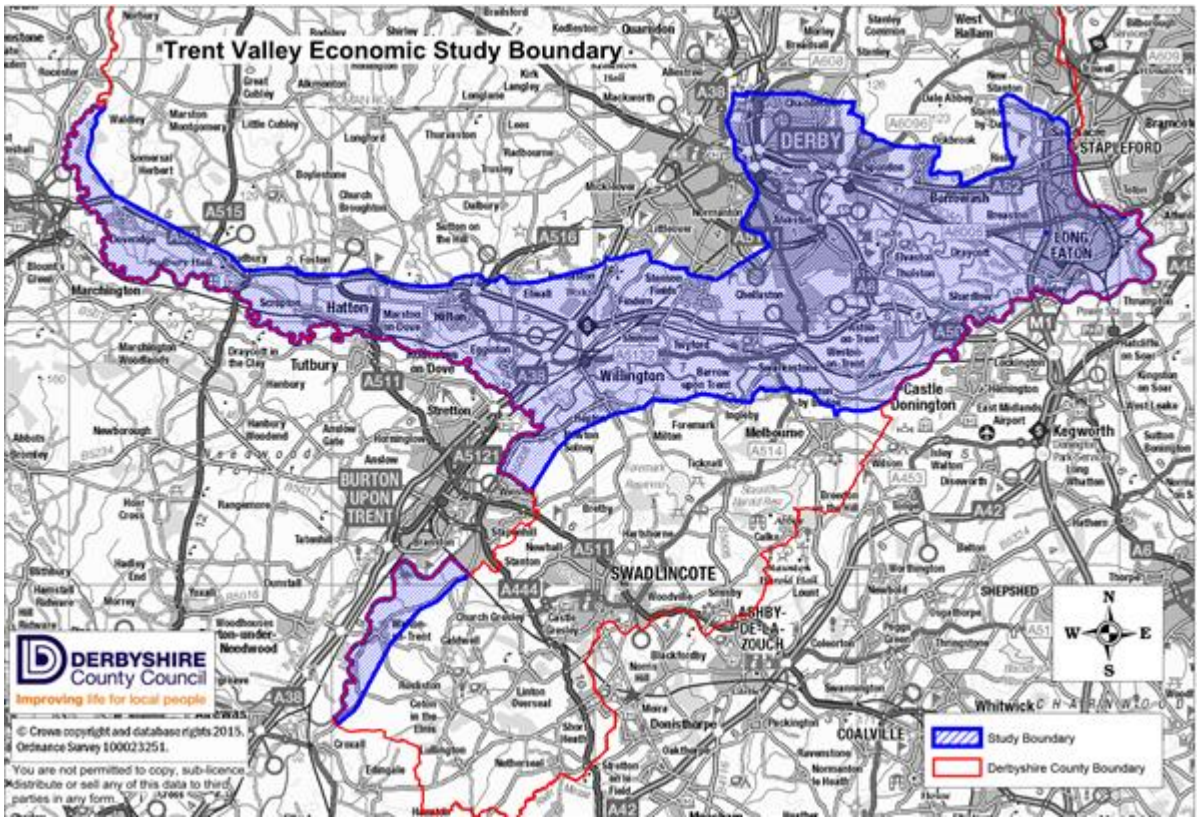

Figure 1-1: Map of the study area (Source: Derbyshire County Council)

1.3 Structure of this report

This Final Report provides details of the methodology followed, as well as the results of the assessment. The remainder of this report is structured as follows:

- Section 2 sets out the methodology used to undertake the tasks;
- Section 3 provides the results for the current economic baseline;
- Section 4 describes the scenarios through the presentation of detailed scenario storylines;
- Section 5 presents the results of applying the scenarios to the current baseline. This enables the identification of the value of the transition economy at several time points;
- Section 6 compares the two scenarios with each other and with the intuitive assessment provided in the study specifications. It presents the difference in the economic potential of the Trent Valley post extraction and development if a coordinated approach is followed

compared to an uncoordinated approach. It also outlines the key sectors where the Trent Valley may hold a competitive advantage in the future;

- Section 7 outlines the key actions that could be carried out to enable the coordinated scenario to be implemented, including identification of potential funding sources;

- Section 8 provides the conclusions and recommendations; and

- Section 9 lists the references reviewed during the study.

2 The methodology

2.1 Overview of approach

The overall approach to the study follows four key tasks:

- Establishing the current economic baseline;
- Developing the scenarios;
- Establishing the outcomes of the scenarios; and
- Comparing the scenarios (with each other and with the intuitive assessment).

This section provides an overview of the methodology that has been used to carry out these tasks.

2.2 Identifying the current economic baseline

2.2.1 Overview

The current economic baseline is intended to provide a snapshot of the current situation, including the economic value of the Trent Valley. Having a robust baseline is important as it is used to measure the overall performance of the scenarios and how and where specific benefits occur (the distribution of benefits).

2.2.2 Data collection and review

The main sources of data are reports, strategies, plans and datasets that have been developed by councils and organisations associated with the sectors that are used as the basis for the economic assessment (see Table 2-1). For a full-list of documents and datasets considered during the data collection and review, see Section 9.

Table 2-1: Sectors considered in the assessment

Sector	Brief description of what each sector includes
Aggregate extraction	Aggregate extraction industry including both existing and planned sites as well as restoration activities
Agriculture	Agricultural industry covering land use and associated activities
Construction	Construction of properties (for homes and businesses) and also larger projects e.g. power stations
Energy generation	Development and operation of power stations and energy generation plants (including renewables), installation of small scale renewables
Health and wellbeing	General health and wellbeing of the population within the study area
Heritage	Heritage assets and attractions within the study area
Physical infrastructure	Transport infrastructure (roads, rail, etc.) as well as green infrastructure (including footpaths, cycle ways, and towpaths), and flood infrastructure. Also includes proposed projects such as the new Trent crossing, and Boulton Moor park and ride
Manufacturing, research and development	Manufacturing sector (including advanced manufacturing), food and drink manufacturing, and research and development

Table 2-1: Sectors considered in the assessment	
Sector	**Brief description of what each sector includes**
Tourism, recreation, retail and leisure	Tourism industry (including expenditure, numbers of tourists), visitor attractions (existing and in development) and informal recreation opportunities (e.g. walking footpaths, towpaths)
Water	Water industry providing public water supply, abstractions for other purposes (e.g. spray irrigation, minerals washing), and water availability and quality (e.g. status of waterbodies as per the Water Framework Directive)
Wider economy	All other economic sectors not considered separately (e.g. financial services), also demographics of the population
Wildlife and biodiversity	Protected areas, landscape character, types and condition of habitat present

2.2.3 Engagement

Email and telephone engagement with individuals representing particular sectors has taken place to fill in gaps within the baseline and ensure that the latest datasets are used. In total, 20 individuals have been contacted representing nine of the sectors including:

- Aggregate extraction;
- Agriculture;
- Health and wellbeing;
- Heritage;
- Physical infrastructure;
- Manufacturing, research and development;
- Tourism, recreation, retail and leisure;
- Water; and
- Wider economy.

For the remaining sectors (construction, energy generation, wildlife and biodiversity) sufficient baseline information was obtained from internet based research and the steering group.

2.2.4 Analysis of data

Analysis of the baseline data has been undertaken using an ecosystem services approach. Ecosystem services are the benefits provided to people from natural processes and the natural environment. They can be broken down into four main types:

- Provisioning services – products obtained from ecosystems, such as food, fibre, fuel;
- Regulating services – benefits from regulation of ecosystem processes, such as clean air, water regulation, climate regulation;
- Cultural services – non-material benefits from ecosystems such as recreation and cultural appreciation; and
- Supporting services – services necessary for the production of all other services such as soil formation and nutrient cycling (these services are not included here since they underpin the other services and their inclusion could result in double counting).

Table 2-2 provides a brief summary of the services used here.

Table 2-2: Categories of ecosystem services used as the basis against which to assess the change anticipated due to the different scenarios		
Type	**Services**	**Detail**
Provisioning	Biochemicals/genetics	Biodiversity (including habitats and species)
	Ecosystem goods (food/fibre/peat/etc.)	Livestock production
		Crop production
		Ingredients for processing
		Timber and reeds
		Energy production (shale gas, crops for biofuel)*
		Production of compost
		Materials used in pharmaceuticals
		Aggregates*
	Provision of freshwater (and availability of freshwater)	Drinking water (humans and animals)
		Irrigation water for crops
		Process water (for industry)
Regulating	Air quality regulation	Air quality
	Climate regulation (emissions and sequestration of GHGs)	Carbon sequestration
	Pest and disease regulation	Control of invasive species and use of pesticides, herbicides and other control methods
	Pollination	Pollination services (e.g. reducing need for artificial pollination)
	Water purification	Quality of filtered water for habitats
		Quality of filtered water for abstraction
	Water regulation (large-scale)	Risk of flooding and inundation
	Water regulation (small-scale)	Local water regulation and availability (e.g. for wet fences)
	Erosion regulation	Risk of erosion and loss of soil
	Natural hazard regulation	Risk of damage from extreme events e.g. intense rainfall
Cultural	Educational value	Value of educational trips/visits
	Cultural heritage	Value of heritage
	Aesthetics	Intrinsic value of landscape and its appearance
	Recreation and tourism	Recreational activities (e.g. walking, dog walking, jogging)
	Wellbeing	Wellbeing, health and happiness (quality of life)
Economic	Jobs (supply chain)	
	Gross Value Added (GVA) and output (production)	
	Attracting business and investment	
	Attracting employees and skills	
*Notes: *it is acknowledged that energy production and aggregates are not typically included in ecosystem services frameworks. However, they are added in here because they are relevant to the Trent Valley study area and need to be taken into account in the assessment*		

For the purposes of this assessment, biodiversity is included as a separate service to ensure that adequate consideration is given to protected areas and to capture impacts on biodiversity more generally. In addition, the list includes aggregates and energy production (not traditional ecosystem services) as these are key sectors within the Trent Valley. The following economic services are also

included for completeness: jobs; GVA and output; attracting business and investment; and attracting employees and skills.

For each ecosystem service, information is collected in the form of reports, data or maps. Where possible, datasets have been aligned to the Trent Valley study area (see Figure 1-1 above). However, in some cases it is necessary to estimate the extent to which a particular value is relevant to the Trent Valley. For example, for ward level census data from the Office of National Statistics (ONS), an estimate of the population has been determined by considering the proportion of each ward that is within the study area. The estimate focuses on the coverage of buildings as the information collected in the census is about the population of the area.

Table 2-3 shows the proportion of each ward that is considered to be included within the study area and the justification for this level of inclusion.

Table 2-3: Proportion of different wards included within the Trent Valley outline based on GIS outline

Ward	% coverage	Justification/notes
Alvaston	100%	Whole ward within study area
Arboretum	20%	Around 20% of houses, also includes part of an industrial estate
Aston	100%	Whole ward within study area
Boulton	100%	Whole ward within study area
Breaston	100%	Whole ward within study area
Chaddeson	100%	Whole ward within study area
Chellaston	100%	Whole ward within study area
Darley	50%	Covers around half the houses
Derby Road East	100%	Whole ward within study area
Derby Road West	100%	Whole ward within study area
Derwent	100%	Covers almost all of the houses
Doveridge and Sudbury	100%	Includes Doveridge and Sudbury which are the only major villages
Draycott	75%	3 of 4 villages within the outline
Etwall	17%	Eggington 1 of 9 villages (also covers the Toyota factory and part of Etwall)
Hatton	100%	Whole ward within study area
Hilton	33%	Includes the largest of 3 villages and 3 of 4 business parks
Linton	0%	Only includes the Former Drakelow Power Station
Little Eaton and Breadsall	20%	Around 20% of houses
Long Eaton Central	100%	Whole ward within study area
Melbourne	0%	No houses within the study area
Nottingham Road	100%	Whole ward within study area
Oakwood	33%	Covers around a third of the houses
Ockbrook and Borrowash	98%	Covers most of the houses
Repton	22%	2 of 9 villages
Sandiacre North	98%	Covers most of the houses
Sandiacre South	100%	Whole ward within study area
Sawley	100%	Whole ward within study area
Seales	20%	Walton on Trent 1 of 5 villages

Table 2-3: Proportion of different wards included within the Trent Valley outline based on GIS outline		
Ward	**% coverage**	**Justification/notes**
Sinfin	33%	Includes 2 of 4 industrial parks and a shopping centre but most houses are outside the boundary
Spondon	100%	Whole ward within study area
Stenson	100%	Whole ward within study area
West Hallem and Dale Abbey	0%	No houses within the study area
Willington and Findem	100%	Whole ward within study area
Wilsthorpe	100%	Whole ward within study area

Table 2-4 shows the data sources used to collect information on the level of provision for each service, as well as the way in which any change in service provision (as a result of the scenarios) can be measured. Change can also be measured in terms of productivity and outputs by sector (see Table 2-5). Where possible, it is useful to consider outputs by sector since it enables them to be linked to jobs and Gross Value Added (GVA)[2]. However, not all sectors have outputs that can be easily identified. In such cases, ecosystem services can be utilised to ensure that all impacts are adequately covered.

This study therefore uses a combination of ecosystem services and productivity/output approaches to ensure that all changes to the Trent Valley area are taken into consideration during the scenario assessment. To avoid double counting, only one approach is utilised for each type of impact (e.g. agricultural outputs are considered as part of the productivity assessment, and not in ecosystem services).

[2] GVA is a measure in economics of the value of goods and services produced in an area, industry or sector of an economy. In national accounts GVA is output minus intermediate consumption.

Table 2-4: Sources of information on ecosystem service provision used as the basis against which to assess the change anticipated due to the different scenarios			
Ecosystem service		**Data sources for provision of service**	**Aspect which could be measured to show change**
Biochemicals/genetics	Biodiversity (including habitats and species)	Defra (MAGIC map of habitats, species and designations) Environment Agency open source spatial data (maps available to download on land designations) Natural England (status data for designated sites) Lowland Derbyshire Biodiversity Partnership (BAP)	Change in status of designated areas or parts of designated areas (potential to monetise through use of willingness to pay (WTP) values for change in status of protected areas) Change in types of habitat present within the study area
Ecosystem goods (food/fibre/peat/etc.)	Livestock production	Environment Agency open source spatial data (maps available to download on agricultural land classifications) Defra (figures for agricultural production) Office of National Statistics (figures on agricultural income)	Change in area of agricultural land of different classifications (potential to monetise using gross margin figures used to estimate monetary value for crops and livestock, and product values to take into account added value of ingredients for processing)
	Crop production		
	Ingredients for processing	Included under crop and livestock production (no separate data sources identified)	Captured as part of crop and livestock production (see above)
	Timber and reeds	No readily available data sources at the required level – service not taken forwards for assessment	N/A
	Energy production (shale gas, crops for biofuel)	NFU (production of biofuel) Environment Agency open source spatial data (maps available to download on energy crops)	Energy crops: change in area of crops grown (gross margins used to monetise the change) Shale gas: change in volume (cubic feet) of shale gas extracted (market prices used to monetise the change)
	Production of compost	No readily available data sources at the required level – service not taken forwards for assessment	N/A
	Materials used in pharmaceuticals	No readily available data sources at the required level – service not taken forwards for assessment	N/A
	Aggregates	Derbyshire County Council (local aggregate assessment)	Change in volume of aggregates produced (market prices used to monetise the change)

Table 2-4: Sources of information on ecosystem service provision used as the basis against which to assess the change anticipated due to the different scenarios			
Ecosystem service		**Data sources for provision of service**	**Aspect which could be measured to show change**
Provision of freshwater (and availability of freshwater)	Drinking water (humans and animals)	Environment Agency (catchment abstraction management strategies and maps of abstraction sites)	Change in volume of water abstracted (potential to use benefits transfer values to monetise the change)
	Irrigation water for crops		
	Process water (for industry)		
Air quality regulation	Air quality	Environment Agency (maps of pollutant concentrations) Derbyshire Dales DC, South Derbyshire DC, Erewash BC (reports on air quality with maps of exceedance areas)	Change in air quality at monitoring points (potential to monetise using willingness to pay values)
Climate regulation (emissions and sequestration of GHGs)	Carbon sequestration	Natural England (information on change in carbon storage)	Change in area of different types of land use (e.g. agricultural land as opposed to wetland) combined with carbon sequestration figures for different land uses (with potential to monetise the change using the shadow price of carbon)
Pest and disease regulation	Control of invasive species and use of pesticides, herbicides and other control methods	No appropriate dataset available (values exist for costs of invasive species to England, but data cannot realistically be scaled down to the Trent Valley level)	N/A
Pollination	Pollination services (e.g. reducing need for artificial pollination)	No appropriate dataset available (changes in agricultural production and habitat quality picked up elsewhere)	N/A
Water purification	Quality of filtered water for habitats	Environment Agency (maps showing waterbodies and quality status)	Change in status of waterbodies (based on Water Framework Directive status information) (potential to undertake valuation through estimating volume of runoff requiring treatment)
	Quality of filtered water for abstraction		
Water regulation (large-scale)	Risk of flooding and inundation	Environment Agency (maps showing numbers of houses at risk of flooding)	Change in number of properties at particular levels of risk (potential to use weighted annual average damage data to monetise the change)

Table 2-4: Sources of information on ecosystem service provision used as the basis against which to assess the change anticipated due to the different scenarios			
Ecosystem service		**Data sources for provision of service**	**Aspect which could be measured to show change**
Water regulation (small-scale)	Local water regulation and availability (e.g. for wet fences)	No readily available data; there is no Internal Drainage Board (IDB) within the study area boundary	N/A
Erosion regulation	Risk of erosion and loss of soil	No appropriate dataset available for specific service (change in agricultural production picked up elsewhere)	N/A
Natural hazard regulation	Risk of damage from extreme events e.g. intense rainfall	No appropriate dataset available (and flooding impacts are captured elsewhere)	N/A
Educational value	Value of educational trips/visits	Ordnance Survey Open Source data (maps location of schools, colleges and universities)	Change in number of educational establishments (potential to monetise by estimating change in number of apprenticeships)
Cultural heritage	Value of heritage	Historic England (maps of locations of heritage sites)	Change in condition of significant heritage sites (potential to monetise through use of WTP values for visiting heritage assets)
Aesthetics	Intrinsic value of landscape and its appearance	Description of landscape types based on landscape character areas	Change in provision (area) of different landscape types (potential to monetise using benefits transfer values for change in aesthetics but care needs to be taken to avoid double counting with biodiversity, education, cultural heritage, and recreation and tourism)
Recreation and tourism	Recreational activities (e.g. walking, dog walking, jogging)	Ordnance Survey data for footpaths, cycle ways and other green infrastructure	Change in proportion of the population with access to a green space for recreation (potential to monetise using population estimates and WTP values)
Wellbeing	Wellbeing, health and happiness (quality of life)	Office of National Statistics (provides data on population health (self-reported))	Change in levels of population at good/very good health (potential to monetise using WTP values, but care needs to be taken to avoid double counting with recreation and tourism, heritage, etc.)
Jobs (supply chain)		Office of National Statistics (provides number of jobs)	Change in number of jobs (potential to monetise through use of average GVA per head figures)

Table 2-4: Sources of information on ecosystem service provision used as the basis against which to assess the change anticipated due to the different scenarios		
Ecosystem service	**Data sources for provision of service**	**Aspect which could be measured to show change**
Gross Value Added and output (production)	Office of National Statistics (provides GVA at different geographical levels and is broken down into industry sectors) Production statistics are obtained from data specific to each sector, related to number of products and their market value	Change in GVA (potential to estimate change in overall contribution of the sector to the economy) Change in output (potential to monetise change in number or type of products produced taking account of changes in market value for those products)
Attracting business and investment	Office of National Statistics (provides number of jobs) Number of large development/physical infrastructure projects	Change in number and type of jobs (potential to monetise through the use of average GVA per head figures)
Attracting employees and skills	Office of National Statistics (provides data on population and skill levels)	Change in number of people at different skill levels (value captured through change in GVA)
Notes: ** In general, aggregates and energy production are not included in ecosystem services frameworks. However, they are key sectors for the case study area so have been listed here to ensure that potential changes under the scenarios are picked up*		

Table 2-5: Approach and sources of data for estimates of production, market values and output data by sector					
Sector	**Products**	**Production data**	**Market value**	**Output (calculated)**	**Data sources**
Aggregates	Sand and gravel	Volume extracted and sold	£ per tonne of sand/gravel	Sales x £ per tonne	Aggregate production data Permitted volumes (may over-estimate if actual production is lower)
Agriculture	Cereals Arable crops Fruit and vegetables Livestock: cattle Livestock: sheep Livestock: poultry	Typical yield per crop/land use type	Gross margin per crop/land use type	Yield x gross margin	Defra Farm Survey Nix Farm Management Pocketbook

Table 2-5: Approach and sources of data for estimates of production, market values and output data by sector					
Sector	**Products**	**Production data**	**Market value**	**Output (calculated)**	**Data sources**
Construction	Residential premises Commercial premises	Annual housing target	Market value or rental value of property	Annual production (no. or m^2) x market or rental value	Local Plans Property websites Rental values for commercial premises
Energy generation	KWh of energy generated	No. of KWh	£ per KWh	No. of KWh x £ per KWh	Energy production data (by site and by type)
Health and wellbeing	Considered to be a service with no specific output	-	-	-	Captured under ecosystem services
Heritage	Considered to be a service with no specific output (will also support tourism/recreation)	-	-	-	Captured under ecosystem services
Physical infrastructure	Road/rail trips Broadband/digital use	No. trips and time saved per trip No. businesses and households and time saved	Value of time Value of time	No. trips x time saved per trip x value of time No. users x time saved per user x value of time	Road traffic counts Average delays by road type Rail usage data Average delays by operating company
Manufacturing, R&D	Rail sector Automobile sector Aerospace sector Food Drink	No. of products	£ per product	No. of products x £ per product	Economic studies Company data
Tourism, recreation, retail, leisure	Recreational trips	No. of trips	£ per trip (expenditure)	No. of trips x £ per trip (expenditure)	Tourism visitor surveys Day visit surveys (for local recreation)
Water	Water licensed for abstraction	Volume of water abstracted	£/m^3 of water	Volume x £ per m^3	Environment Agency

Table 2-5: Approach and sources of data for estimates of production, market values and output data by sector					
Sector	**Products**	**Production data**	**Market value**	**Output (calculated)**	**Data sources**
Wider economy	Financial sector	No specific products, captured using GVA	-	-	Captured under GVA
Wildlife/biodiversity	Considered to be a service with no specific output (will also support tourism/recreation)	-	-	-	Captured under ecosystem services
Notes: Output is calculated by multiplying the production volumes/items by the market value of each volume/item					

2.3 Developing the scenarios

2.3.1 Overview

The scenarios have been developed based on the following principles:

- Current plans and projections provide the expected change that will occur for the **'uncoordinated' scenario** and that each sector will look to meet those plans and projections without consideration for other sectors unless this is specified within existing plans; and
- Visions from organisations operating in the Trent Valley area provide the ambition across each sector. These visions are combined to look to deliver a future that builds upon the synergies across the visions such that the opportunities for a more sustainable and coordinated approach can be identified through a **'coordinated' scenario**.

2.3.2 Data collection and review

Data collection has focused on identifying visions for each of the sectors identified in Table 2-1. Once all the individual visions had been identified, overarching visions were developed for each of the sectors. Following discussions with and comments from the Steering Group, these visions were developed to encourage synergies between sectors and to ensure that the coordinated scenario was as ambitious as possible. The Steering Group also developed an overall vision for the Trent Valley area.

2.3.3 Engagement

Email and telephone engagement with individuals representing particular sectors has taken place to ensure that key issues and trends relevant to the Trent Valley area are picked up by the scenarios. This engagement was combined with requests for baseline data (see section 2.2.3) to minimise the number of approaches made to consultees.

2.3.4 Developing the scenarios

Uncoordinated scenario

The uncoordinated scenario is based on projections and predicted changes within each of the documents reviewed, focusing on projections specific to each sector. It is assumed that each sector will look to deliver its own projections and that no additional account is taken of the potential for antagonisms or synergies (beyond those identified in the plans and strategies). The scenario storyline therefore reflects assumptions specific to each sector only and no adjustment is made to look to minimise antagonisms or build on synergies.

Coordinated scenario

The overarching vision for the area, as developed by the study steering group, is given in Box 2-1.

The vision for the coordinated scenario has been broken down to sector specific visions, which have been developed further from those identified during data collection. The sectoral visions (provided in Table 2-6) identify the maximum that each sector could achieve through synergies with other sectors.

Box 2-1: Vision for the coordinated scenario

The coordinated scenario would promote the **creation of an attractive, multifunctional new landscape character** within the valley.

This new landscape would be designed and planned to mitigate the adverse effects of mineral extraction and housing growth, and create greater environmental capacity to both absorb and facilitate further development. The landscape framework would also seek to **maximise ecosystem services delivery**, **stimulate and diversify economic activity**, and **increase social benefits**, by providing a multifunctional, multifaceted resource.

By directing sand and gravel extraction towards the least sensitive areas, the most valuable and sensitive areas can be protected, whilst restoration schemes will deliver landscape-scale change through the creation of interlocking waterbodies and robust areas of woodland. These will integrate with the best of the existing landscape, including historic and natural assets, to provide a range of recreational and leisure opportunities. This new landscape framework will be an attractive setting for high quality new housing development with direct access to this new and enhanced **Green Infrastructure network**.

The new landscape will be recognised by residents and businesses alike as an invaluable resource, an attraction, and a valued asset, making the valley a desirable location in which to live, work and play. New waterways will provide additional economic opportunities through their use by pleasure craft, sports and recreational users and as transport corridors. The newly configured landscape will accommodate new economic activities such as leisure and holiday accommodation and associated services, renewable energy, and other diversification opportunities for sectors not previously prevalent in the valley.

Threaded throughout the entire valley will be extensive opportunities for nature conservation not only through the extensive woodland and wetland creation but also through the improved management of existing historic landscape that would be retained as part of the vision.

Table 2-6: Overarching vision for each sector

Sector	Overarching vision
Aggregates	Enable extraction in the least sensitive landscape areas with plans for delivering maximum social, environmental and economic benefits during and post-extraction. Restoration schemes must deliver landscape-scale change that facilitates future social, economic and environmental growth, with interlocking waterbodies and extensive woodland creation. Consideration is also given to the likely locations of future aggregate extraction areas and the desire to transport materials by water rather than road where feasible.
Agriculture	The expansion of aggregate extraction and housing growth is likely to further shrink the agricultural economy. In the most environmentally sensitive areas where farming remains viable it should focus on stewardship of the land, maximising its contribution to ecosystem services such as flood alleviation and biodiversity, and becoming an integrated component of the new attractive landscape character. Elsewhere in the valley where environmental sensitivities are lower, rural diversification should be supported (with land uses including recreation, ecosystem services delivery, or biomass crops), provided that these uses contribute to (or at least do not detract from) the wider Trent Valley vision, and help increase the economic, social or environmental value of the valley.

Table 2-6: Overarching vision for each sector	
Sector	**Overarching vision**
Construction	Promote and enable sustainable land use management with the development of efficient premises to help deliver growth, encouraging awareness of the river including direct access, views and a strong connection with the landscape to generate a unique sense of place. Ensure that the high environmental quality of the valley is recognised as a key asset to drive good quality design, attracting strong inward investment from high value business sectors, particularly where these have synergies with the assets within the Trent Valley.
Energy generation	Increase renewable energy capacity in a way that facilitates future connection to the National Grid as well as a locally distributed energy system. Explore and promote a range of renewable energies sympathetic to the new landscape including biofuels, solar and heat exchange schemes (utilising newly created waterbodies) as part of a wider renewable energy strategy. Ensure that new and existing energy infrastructure does not blight the environmental quality of the valley.
Health and wellbeing	The impact of outdoor environments on health and wellbeing is acknowledged, and the potential for natural environments to improve mental and physical health (and reduce health inequalities) is recognised. Links between the natural environment and health are key considerations in decision making within the Trent Valley. Opportunities are consistently sought to increase access to recreation within the countryside of the valley, promoting healthy lifestyles and helping reduce dependency on the NHS. The health benefits of other ecosystem services (including flood prevention, climate change adaptation and mitigation, reduction of urban heat island effects, improved air and water quality, etc.) are recognised and maximised.
Heritage	Identify, preserve and enhance the historic features of the Trent Valley and encourage development that recognises and utilises these features to help drive growth. Promote the cultural value of the Trent Valley and its role throughout history as a visitor attraction and as part of a wider tourism strategy.
Manufacturing	Recognise the strength of the local area in manufacturing, engineering and life sciences and look to enhance the hi-tech sector through continued development of skills. Create an area of high environmental quality attracting strong inward investment which appeals both to business and their workers, particularly in industries with high value outputs and which have direct synergies to the valley such as the leisure, health and renewable energy sectors. Ensure that the high environmental quality of the valley is recognised as a key asset to drive high quality, sustainable design of products.
Tourism/recreation	Build a tourism and leisure economy focused on an emerging new landscape of interconnecting waterbodies and woodland, whilst also seeking to capitalise on, support and enhance existing tourism, leisure, recreation and heritage assets. Promote the creation of navigable waterways by connecting new waterbodies to the river and canal. Enable creation of new tourism and recreational opportunities through maximising the use of, and enhancing, the natural and historic features of the Trent Valley.

Table 2-6: Overarching vision for each sector	
Sector	**Overarching vision**
Physical infrastructure	Creation of inter-connecting waterbodies to facilitate connectivity and improve transport choices. This includes the development of navigable waterways and the use of green infrastructure to open up new multi-user trails for cycling and walking with connections to key settlements along the valley including new communities. Explore the use of alternative sustainable public transport systems making use of the enhanced GI network and connected waterways (with potential options including water taxis and a monorail). Provision should be made for this new network to extend to Toton to fully exploit the proposed HS2 station. Investigate alternatives to road travel so that existing and new areas of development, employment, recreation and environmental assets can be connected.
Water	Encourage sustainable and efficient use of water and careful land management to reduce pressures on water quality and quantity. Proactively plan for flood alleviation through new 'soft/natural' flood defences (e.g. provision of water storage areas). Maximise the water management potential of ecosystem services instead of hard defences and engineered interventions.
Wider economy	Stimulate a prosperous economy based on sustainable development and diversification. This includes creating an attractive new landscape structure that supports a highly skilled workforce. Overall skill levels of the population are improved. The robust new landscape structure is better able to accommodate new business and support an expanding population.
Wildlife/biodiversity	Conserve and enhance the environment by creating a wildlife artery through the Trent Valley, reconnecting the river to its floodplain and establishing the environment as a key economic and social asset. Biodiversity will be enhanced through creation of new interlocking wetlands and woodlands in and around former extraction sites, the improved environmental quality and permeability of the wider landscape within the valley, and the protection/enhancement of existing environmental assets. Care should be taken to accommodate the aspirations of the RSPB's 'Bigger and Better' Nature after Minerals initiative and other landscape scale wildlife initiatives where these support the overall aims of the Trent Valley vision.

2.4 Establishing the outcomes of the scenarios

2.4.1 Overview

The approach has involved establishing the outcomes of each scenario by determining what changes may occur to the current baseline over time. These changes have been considered in terms of:

- Productivity and outputs under the different sectors;
- Ecosystem services; and
- GVA and jobs.

The assessment has involved looking at how the different sectors and services are likely to be affected under the scenarios, and then quantifying and monetising (where appropriate) the change

expected. To enable the benefits of the transition economy to be highlighted, this process has been carried out for the following time points:

- 2020;
- 2025;
- 2030; and
- 2050.

Consideration of uncertainty has been integrated into the assessment, so that an uncertainty rating of the final value calculated is provided for each sector or ecosystem service assessed. This helps to indicate where sensitivity testing (or checking values with subject experts) can help to improve the robustness of the analysis.

Further details on the approach for each aspect are given below.

2.4.2 Productivity and outputs under different sectors

The same approach has been followed for both scenarios (uncoordinated and coordinated). A spreadsheet was set up including the baseline information on productivity. Several columns were added for each time point to record how the sectors might change according to the scenario storyline. A few sectors (health and wellbeing, heritage and wildlife/biodiversity) were excluded from this part of the assessment since changes in productivity were not deemed to be the best way to measure change over time. Instead, changes to these sectors have been picked up in the ecosystem services assessment described in the next section. This ensures the most appropriate approach is used for each sector. It also avoids any double counting between sectors and ecosystem services. The sector "wider economy" has also been excluded, since it is taken into account in the GVA and jobs assessment.

When assessing the changes to productivity and outputs, the following information was recorded for each time point and sector:

- **Direction of change** from the baseline: increase, decrease, etc.;
- **Productivity in time point year** (e.g. 2020): this may be a volume (e.g. tonnes of aggregates), or a number (e.g. number of properties) and is based on the scenario storylines;
- **Monetary value of productivity** in time point year: where possible, this multiplies the number/volume above by an appropriate value to monetise the productivity;
- **Assumptions**: this ensures that all assumptions used are recorded;
- **Uncertainty over measurement of change**: this enables a rating to be applied to the productivity value. Where values have been taken from published documents or statistics, they are deemed to have low uncertainty. In contrast, where values have been purely based on assumptions (this is particularly the case for the latter years of the assessment), the uncertainty is classed as very high;
- **Uncertainty over valuation**: this enables a rating to be applied to the value used to monetise the productivity figure. A low uncertainty rating is assigned where the value used is specific to the change being measured, is taken from a peer or similarly reviewed document, and is recent and transferable from a similar context. At the opposite end of the scale, values are marked as having very high uncertainty if they are not specific to the type of productivity being measured, they are not peer reviewed, they are not recently dated and they have been taken from a different context;

- **Overall uncertainty**: this column brings together the uncertainty over the measurement of change and the valuation to determine an overall indication of the uncertainty associated with the results for each sector in each time period;
- **Negative impacts from**: this column provides space to record sectors that might negatively affect the sector being assessed; and
- **Positive impacts from**: this column provides space to record sectors that might positively affect the sector being assessed.

To aid with the consideration of knock-on impacts between sectors (recorded in columns "negative impacts from" and "positive impacts from"), a matrix was produced to identify potential pressures/negative feedback from one sector on another; and potential benefits/positive interactions between sectors.

The completed spreadsheet shows the expected productivity of each sector at each time point according to the uncoordinated scenario, and the coordinated scenario. Summing the values for the various sectors therefore provides the expected value of the transition economy at the four time points (2020, 2025, 2030 and 2050) (assuming an approach based on productivity and outputs). The results are presented in Section 5.2.

2.4.3 Ecosystem services

For the assessment of ecosystem services, a similar approach has been followed to that used for productivity and outputs (as described in Section 2.4.2). However, for ecosystem services it was deemed more appropriate to record marginal changes in provision of services against the baseline, rather than the total provision of each service at each time point. This allowed the valuation exercise to focus on the extent of the change in services expected, rather than attempting to quantify and monetise the total service provision. This approach fits better with the values available for monetisation (many benefits transfer values typically represent a change from one condition to another), and also does not required a more detailed baseline than was possible with the available data, or habitat mapping.

The completed assessment spreadsheet for ecosystem services therefore shows the change in service provision for each time point when compared with the baseline. Note that for a few services (e.g. ecosystem goods (food, fibre, peat, etc.)), the assessment was not carried out since changes had already been considered within the sectors given in the productivity and outputs assessment. This approach avoided any double counting.

The changes identified can be added (or subtracted where they are negative changes, i.e. damages) from the values determined in the productivity and outputs assessment to determine the overall value of the transition economy at each of the time points, according to the two scenarios. The results of the ecosystems services assessment are presented in Section 5.3.

2.4.4 GVA and jobs

To determine the anticipated changes in GVA and jobs under the scenarios, the changes identified in the productivity and ecosystem services assessments have been used to identify the sectors where jobs and GVA generated are expected to increase, decrease or stay roughly constant. For example, where there is expected to be an expansion in a particular sector (e.g. in tourism, recreation, retail and leisure), there is assumed to be an associated increase in jobs and GVA generated. Percentages

have been applied to the baseline GVA and job figures to estimate the value of these changes at each time point. Any assumptions made during this process have been recorded in the spreadsheet.

The figures generated during this part of the assessment provide the GVA and job figures for each time point, therefore they provide an indication of the magnitude of the transition economy for the two contrasting scenarios (see Section 5.4 for the results).

2.5 Comparing the scenarios

2.5.1 Overview

This section describes the approach taken to determining the difference in the economic potential of the Trent Valley under the two scenarios. It also introduces the intuitive assessment included within the study specifications, and explains how the results of the scenario assessment are considered against this.

2.5.2 Comparing the uncoordinated and coordinated scenarios with each other

The comparison between the uncoordinated and coordinated scenarios has been carried out at several levels:

- On a sector by sector basis: this involved comparing the particular sectors for which changes in productivity have been calculated;
- At an ecosystem service level: this involved comparing the changes in ecosystem service provision expected to occur at each time point; and
- At the overall impact of the scenario level: this involved comparing the total 'values' of the scenarios as calculated in the various assessments (productivity and outputs; ecosystem services; and GVA and jobs).

The comparison has been undertaken using a series of tables, which has enabled significant differences to be highlighted. Drivers for these differences have then been identified through referencing back to the scenario storyline. Sectors that are performing significantly better under the coordinated scenario than the uncoordinated scenario have been highlighted, since these are likely to indicate the areas where the Trent Valley holds a competitive advantage. The results of the comparison are provided in Section 6.2.

2.5.3 Comparing the scenarios with the intuitive assessment

Table 2-7 presents the intuitive assessment as provided in the study specifications. To carry out the comparison, each outcome from the actual assessment has been rated in terms of low, medium and high, with a justification for the rating also recorded. These ratings are then compared with the ratings given in the intuitive assessment. Where any differences in the ratings between the two assessments are recorded, reasons for these differences are identified. The results are presented in Section 6.3.

Table 2-7: Intuitive assessment of outcomes of the scenarios		
Outcome	**Coordinated scenario**	**Uncoordinated scenario**
The potential to change from an extensively agricultural economy to a mixed economy which is supported by a leisure and recreational landscape	high	low
To meet the demands of an expanding population associated with the Derby Housing Market Area and the requirement for high quality Green Infrastructure as part of a sustainable approach to development	high	low
A landscape that reflects and respects its historic development through the protection of those features (both designated and undesignated) essential to telling the story so far and a new landscape that reflects more recent change associated with mineral workings – a case of not hiding from change but proactively planning for it into the future	high	low
A landscape with a much stronger focus on nature conservation through the development of extensive inter-connected wetland habitats weaved between remnant agricultural areas	high	medium
The potential to attract tourists to the area through new recreational opportunities and improving the local economy – akin to the Norfolk Broads or the Cotswolds Water Park. It is in a central location nationally with an extensive population catchment within a few hours journey time	high	low
New business opportunities attracted by this new landscape and services such as boat builders, holiday lets, marinas, cafes, conservation based events, etc.	high	low
Attracting inward investment on the back of a new and enhanced landscape – business wanting to locate to an attractive area close to an expanding workforce with good communication links	high	low
Connected waterbodies allowing for the use of barges to deliver the extracted minerals to market and reduce the reliance on road haulage with the associated impacts on local communities	medium	low
New multi-user trails connecting to the key settlements along the valley and particularly into new communities as part of the housing growth	high	low
Low key recreational opportunities such as canoeing, cycling, fishing, walking, swimming, etc. – multiple public benefits from the same resource	high	low
Potential to reduce health-care costs through increased use of green infrastructure for both existing and new communities	high	low
Improved trade for existing business such as B&B, shops, pubs and restaurants through the change to a tourist economy – existing communities buy into the overall benefits rather than just perceiving the negatives	high	low
A new landscape structure and changing landscape character based on a strong woodland framework to help link existing features with new habitats and improve the environmental capacity of the area – not a scattering of points of interest but a new attractive and integrated landscape	high	low
The improved management of remnant landscape areas through the use of targeted environmental stewardship to help conserve important landscape, historic and ecological features	high	low

Table 2-7: Intuitive assessment of outcomes of the scenarios		
Outcome	**Coordinated scenario**	**Uncoordinated scenario**
The maintenance of a thriving mineral industry with certainty regarding the available mineral resource, clarity about the constraints and the expectation of helping to deliver the landscape 'vision'	high	low
The need to consider and encourage mineral operators to revisit former extraction areas (possibly restored) to undertake additional work that might further benefit the overall vision e.g. connecting existing waterbodies or providing a link to the river, new access, planting, etc.	high	low
Increasing and enhancing the overall number of ecosystem services provided by the Trent Valley landscape – flood alleviation, water storage, carbon sequestration, habitat creation, pollination, etc.	high	medium/ low
Provide opportunities to naturalise the river and its floodplain, including the realignment of flood defences	high/ medium	low
Provide a higher degree of certainty to local communities, mineral extraction companies, developers and local planning authorities as well as other environmental agencies and groups	high	low
Produce a scarred landscape with poor visual cohesion	low	high
Produce a landscape with limited economic potential	low	high
Source: table extracted from study specifications (Appendix A specification, Q3135 – The future economic value of the Trent Valley)		

2.5.4 Identifying actions/funds to enable the coordinated approach to be progressed

During the development of the coordinated scenario, changes needed to enable the vision to be implemented were also identified. These changes have been categorised by type, to help determine the most appropriate actions required to facilitate the changes and so take forward the coordinated approach. Each of the actions has then been considered in terms of the likely benefits and beneficiaries they will result in, and hence the potential sources of funding that may be relevant. The results are presented in Section 7.

3 The current economic baseline

3.1 Overview

The current economic baseline is composed of the current situation for each of the sectors assessed as well as the current provision of ecosystem services. Where the current economic baseline is not available, such as for carbon sequestration, we have identified approaches to assess potential changes in the provision of the service based on, for example, changing land use regimes. Due to data limitations, the baseline year for calculation of the economic benefits of each sector, including number of jobs, has been set as 2011. This aligns with the census data, as analysed in the Office of National Statistics' Neighbourhood Statistics dataset. It also means that Gross Value Added (GVA) data are available at a more detailed level than if the latest year of data (2013) is used.

3.2 Baseline in terms of productivity and outputs

As well as GVA and jobs, economic information can be presented in terms of production and market value of products. These can then be used to calculate output from each sector. Calculation of this information provides an alternative basis for monetising changes under the scenarios where future production is projected, rather than change in the number of jobs. Table 3-1 presents the production data, market values and output information that have been collected, analysed and calculated to inform the baseline. These data cannot be added to the GVA data as that would result in double counting. Instead, they provide an alternative method for use in the scenarios when changes in production can be projected. The changes in production can then be linked to change in number of jobs, which can then be converted to GVA. Thus, inclusion of approaches based on change in production means that there is potential for more of the benefits of the scenarios to be monetised.

3.3 Baseline in terms of ecosystem services

Table 3-2 provides a summary of the economic baseline identified for each of the ecosystem services included within the assessment. Whilst there is a considerable amount of additional information available on the current situation in the Trent Valley, Table 3-2 focuses on providing the types of data which are directly relevant to the assessment (i.e. the data against which changes under the scenarios can be measured).

It should be noted that for a few services, there is some overlap with the baseline data recorded under the productivity and outputs baseline (see Section 3.2) (for example, ecosystem goods are also captured under agriculture). Whilst such data have been included in both the productivity/outputs and ecosystem services baselines for completeness, it is important to note that they are only assessed using one approach. This avoids double counting when considering the likely changes under the scenarios.

Table 3-1: Production, market values and output data by sector (all data for 2011, unless stated)					
Sector	**Products**	**Production data**	**Market value**	**Output per year (calculated)**	**Data sources**
Aggregates	Sand and gravel	1.1 million tonnes sold	£10.50[1]	£11.6 million	Derbyshire County Council (2014): Local Aggregate Assessment 2014 British Geological Survey (2014): Minerals Yearbook
Agriculture	Cereals Arable crops Fruit and veg	4,144 ha 2,336 ha 38 ha (all data for 2013)	Winter wheat: £615/ha Oilseed rape: £545/ha Field veg: £734/ha (cauliflower)	£2.55 million £1.27 million £0.03 million Total arable: £3.85 million	Defra Farm Survey Nix Farm Management Pocketbook (2011)
	Livestock: cattle Livestock: sheep Livestock: poultry	15,780 cattle (assumed 33% dairy, 67% finishing) 21,657 sheep 106,876 poultry (assumed 50% egg production, 50% table) (all data for 2013)	Dairy cows: £924/cow Grass finishing: £121/cow £30.30 per ewe Egg production: £1.97/bird Table poultry: £7.50 per bird	£4.8 million £1.28 million £0.66 million £0.11 million £0.40 million Total livestock: £7.25 million[2]	Defra Farm Survey Nix Farm Management Pocketbook (2011)
Construction	Residential premises	Annual housing target: 1,298 properties (625 Derby and 673 South Derbyshire)	Average house price: Derby: £136,664 South Derbyshire: £163,520	£85.4 million (Derby) £110 million (South Derbyshire) Total housing: £195 million	Derby City Council (2013): Derby City Local Plan - Part 1: Draft Core Strategy, October 2013
	Commercial premises	Year-on-year average of development of employment land in Derby of 5.28 ha	Rental value of £130/m^2 (2008; no data beyond 2008)	Total benefits of 52,800 m^2 x £130 = £6.86 million	HM Land Registry data Live tables on commercial and industrial floorspace and rateable value statistics (DCLG)

Table 3-1: Production, market values and output data by sector (all data for 2011, unless stated)					
Sector	**Products**	**Production data**	**Market value**	**Output per year (calculated)**	**Data sources**
Energy generation	KWh of energy generated	Closure of Drakelow and Willington power stations means there is limited energy generation in the baseline	£50.82 per MWh (£0.51 per KWh)	No benefits under baseline	Ofgem : Wholesale market indicators (June 2011)
Health and wellbeing	Considered to be a service with no specific output	-	-	-	Captured under ecosystem services
Heritage	Considered to be a service with no specific output (will also support tourism/recreation)	-	-	-	Captured under ecosystem services
Physical infrastructure	Rail trips	Train journeys to/from region: - Derby: 2,212,000 - Derbyshire: 3,767,000 - Total: 5,979,000 Average delays on journeys by train operating companies passing through Derby: 1 minute per journey	Market price of value of time for a rail passenger: £32.22 per hour (2011 values)[3]	**Rail**: 5,979,000 journeys x £32.22÷ 60 x 1 minute average delay = £3.21 million	Office of Rail and Road statistics: NRT Data Portal Transport Appraisal Guidance, WebTAG Databook Nov 2014

Table 3-1: Production, market values and output data by sector (all data for 2011, unless stated)					
Sector	**Products**	**Production data**	**Market value**	**Output per year (calculated)**	**Data sources**
Physical infrastructure (continued)	Road trips	Average road delays: - A38 Birmingham to M1: 1.28 minutes/10 miles - M1 to A38 Birmingham: 1.09 minutes/10 miles - A52/A5111/A6 Derby to Grantham: 1.28 minutes/10 miles - A52/A5111/A6 Grantham to Derby: 1.32 minutes/10 miles Vehicle miles (A50/A38): 86,770,000	Market value for car driver: £27.28 (2011 value)[3]	**Road**: average delay 1.24 minutes (mean of average delays by road type) x £27.28 ÷ 60 x 86,770,000 ÷ 10 miles = £4.89 million	Department for Transport: Interactive tool for route level data on all journeys on inter-urban roads Transport Appraisal Guidance , WebTAG Databook Nov 2014 Department for Transport: Traffic Counts
	Broadband/digital use	No. businesses and households and time saved	Value of time	Digital Derbyshire programme not started until 2014, hence, no benefits from this under baseline	Digital Derbyshire (Light Speed Derby is already working to attract broadband service providers to the city)
Manufacturing, R&D	Aerospace sector Rail sector Automobile sector	No breakdown into number of products found at the local level	No breakdown into product specific data found at the local level	Output (2007): - planes: £3,055 million - trains: £1,542 million - automobiles: £2,382 million	URS (2009): Planes, trains and automobiles, December 2009
	Food Drink	No breakdown into number of products found at the local level	No breakdown into product specific data found at the local level	Total turnover (LEP area): £2,465 million (2012)	ONS Annual Business Survey data

Table 3-1: Production, market values and output data by sector (all data for 2011, unless stated)					
Sector	**Products**	**Production data**	**Market value**	**Output per year (calculated)**	**Data sources**
	Advanced engineering	No breakdown into number of products found at the local level	No breakdown into product specific data found at the local level	Total turnover (LEP area): £9,781 million (2012)	ONS Annual Business Survey data
Tourism, recreation, retail, leisure	Domestic day visits	Annual average of day visits (based on 2011-2013 data): - Derbyshire: 17.6 million - Derby: 6.4 million	Data provided as total expenditure, enabling per trip average to be estimated at: - Derbyshire: £32 - Derby: £27	Total expenditure (annual average based on data from 2011-2013): - Derbyshire: £568 million - Derby: £171 million	ONS: Domestic day visits (includes Derbyshire so will capture the Peak District but only captures domestic day visits)
	Domestic overnight visits	Annual average of overnight nights (based on 2011-2013 data): - Derbyshire: 4.68 million - Derby: 0.81 million	Data provided as total expenditure, enabling per overnight trip average to be estimated at: - Derbyshire: £57 - Derby: £68	Total expenditure - overnight trips (annual average based on data from 2011-2013): - Derbyshire: £267 million - Derby: £55 million	ONS: Domestic overnight visits (includes Derbyshire so will capture the Peak District but only captures overnight visits)
	Tourism expenditure	No breakdown into number of trips	No breakdown into per trip expenditure	Total expenditure (2011): - Derby: £310 million - South and West Derbyshire: £665 million	ONS: Tourism expenditure by area and visit type (covers all types of visits: day and overnight and domestic and inbound visitors)

Table 3-1: Production, market values and output data by sector (all data for 2011, unless stated)					
Sector	**Products**	**Production data**	**Market value**	**Output per year (calculated)**	**Data sources**
Water	Water licensed for abstraction	Estimated 19 licences held by industry (228,154,487 m^3) 14 licences held by agriculture (26,176,815 m^3) (includes licences for amenity purposes) 7 licences held by PWS (150,079,472 m^3) Purposes likely to include spray irrigation, mineral washing, food and drink production, water supply	£/m^3 of water varies by purpose to which the water is put	Volume x £ per m^3	Environment Agency
Wider economy	Financial sector, public administration and defence, education, real estate activities	No specific products, captured using GVA	-	-	Captured under GVA
Wildlife/biodiversity	Considered to be a service with no specific output (will also support tourism/recreation)	-	-	-	Captured under ecosystem services

Notes: Output is calculated by multiplying the production volumes/items by the market value of each volume/item

[1] Calculated from approximate value of sand and gravel produced in the UK (2011): £661 million divided by UK production of sand and gravel (composed of land and marine) (2011): 63,087,000 tonnes. Since production also includes marine sources of sands and gravels the value may be an under-estimate

[2] Total value of output is highly dependent on proportion of cattle that are used for dairying rather than finishing (beef).

[3] Market value is based on value of working (employers' business) time and so may over-estimate costs associated with delays during non-working time

Table 3-2: Ecosystem service provision under the baseline			
Ecosystem service		**Economic baseline**	**Data source**
Biochemicals /genetics	Biodiversity (including habitats and species)	12 Local Nature Reserves within the Trent Valley area: Chellaston Brickworks, Elvaston, Fox Covert, Forbes Hole, Manor Farm (Long Eaton), Stony Clouds, The Sanctuary, Sinfin Moor, Toton Fields, St Chad's Water, West Park Meadow, Elm Wood. 3 SSSIs within/partially within the Trent Valley area: Hilton Gravel Pits SSSI (0.23% favourable, 99.77% unfavourable recovering), Boulton Moor (100% favourable), Attenborough Gravel Pits (mainly in Nottinghamshire, at very edge of study area in east) (14.56% favourable, 79.85% unfavourable recovering, 5.6% unfavourable no change). Other sites include Drakelow Nature Reserve (Derbyshire Wildlife Trust)	Natural England designated sites view (https://designatedsites.naturalengland.org.uk/SiteSearch.aspx) GIS data via the Environment Agency Geostore (http://www.geostore.com/environment-agency/WebStore?xml=environment-agency/xml/ogcDataDownload.xml) Derbyshire Wildlife Trust (http://www.derbyshirewildlifetrust.org.uk/wildlife/reserves)
Ecosystem goods (food/fibre/ peat/etc.)	Livestock production Crop production	Farming within Trent Valley (50% South Derbyshire, 3% Derbyshire Dales, 45% Erewash & Derby) (2013): • Total farmed area 16,202ha; • Total cereals area 4,144ha; • Total arable area (excl. cereals) 2,336ha; • Total fruit & veg area 38ha; • Total grassland area 8,632ha; • Total cattle 15,780; • Total sheep 21,657; and • Total poultry 106,876. It is estimated that of the total case study area, the percentage covered by the different land classifications is as follows: Grade 2 - ~10%; Grade 3a - ~35%; Grade 3b - ~35%; Grade 4 - ~5% Around 85% of land within the Trent Valley area is agricultural land. Of this, 47% is assumed to be used for livestock, with 53% high quality land used for arable	Defra (2014): Agriculture in the United Kingdom 2014 (https://www.gov.uk/government/statistics/agriculture-in-the-united-kingdom-2014) ONS: Regional Gross Value Added (Income Approach) NUTS3 Tables (http://www.ons.gov.uk/ons/datasets-and-tables/index.html) Agricultural land classification GIS data from Natural England overlaid on study area outline and areas estimated (http://www.geostore.com/environment-agency/WebStore?xml=environment-agency/xml/ogcDataDownload.xml)

Table 3-2: Ecosystem service provision under the baseline			
Ecosystem service		**Economic baseline**	**Data source**
	Energy production (shale gas, crops for biofuel)*	Energy crops: no energy crops are currently grown Shale gas: no shale gas is currently extracted	NFU (2013): What farming delivers for Derbyshire (https://www.nfuonline.com/farming-delivers-for-derbyshire-leaflet/) Energy crops GIS file from (http://www.geostore.com/environment-agency/WebStore?xml=environment-agency/xml/ogcDataDownload.xml)
	Aggregates*	Two active operations in Trent Valley (also one at Mercaston on Sherwood Sandstone): • Swarkestone (Lafarge/Tarmac): estimated lifespan 6 years to 2019: 300,000 tonnes permitted output • Willington (Cemex): estimated lifespan 3 years to 2016: 300,000 tonnes permitted output Also: • Shardlow (Hanson): mothballed from Jan 2013; estimated lifespan of remaining reserves of 3 years • Elvaston (Lafarge/Tarmac): not currently being worked; permission granted in 2013 for extension • Potlocks Farm, Willington (Hanson): not currently being worked but current permission would allow it to be worked	Derbyshire County Council (2014): Local Aggregate Assessment 2014
Provision of freshwater (and availability of freshwater)	Drinking water (humans and animals) Irrigation water for crops Process water (for industry)	Abstraction licences estimated to include: • 14 large sized abstractions from surface water sites • 14 medium sized abstraction from surface water sites • 1 small sized abstraction from surface water sites • 4 large sized abstractions from groundwater sites • 4 medium sized abstractions from groundwater sites • 3 small sized abstractions from groundwater sites	Environment Agency backyard maps (http://maps.environment-agency.gov.uk/wiyby/wiybyController?topic=water_abstractions&layerGroups=default&lang=_e&ep=map&scale=8&x=437324.5833333336&y=336526.91666666674#x=442575&y=332955&lg=6,1,3,10,&scale=8)

Table 3-2: Ecosystem service provision under the baseline			
Ecosystem service		**Economic baseline**	**Data source**
Air quality regulation	Air quality	3 Air Quality Monitoring Areas (AQMAs) in the Trent Valley plus several along major roads in Derby City: • 2 areas with 10,000 to 100,000t CO_2; 1 area 10,000t CO_2 or less; 1 area (centre Derby) 100,000t or more CO_2 • 2 areas with 100t or less NOx • 1 area with 10t to 100t particulates All areas have 'very good' compliance rating score	Environment Agency backyard maps (http://maps.environment-agency.gov.uk/wiyby/wiybyController?topic=airpollution&layerGroups=default&lang=_e&ep=map&scale=8&x=437324.5833333336&y=336526.91666666674)
Climate regulation (emissions and sequestration of GHGs)	Carbon sequestration	Current land use types: • Agriculture: around 85% of land within the Trent Valley area is agricultural land. Of this, 47% is assumed to be grassland, with 53% arable farmland • Urban (soils capped by tarmac, properties, etc.) • Wetland (e.g. floodplains of the Dove, Derwent and Trent) • Woodland	Agricultural land classification GIS data from Natural England overlaid on study area outline and areas estimated (http://www.geostore.com/environment-agency/WebStore?xml=environment-agency/xml/ogcDataDownload.xml) Ordnance Survey maps
Water purification	Quality of filtered water for habitats Quality of filtered water for abstraction	Water Framework Directive (WFD) status: • Chaddesden Brook: Good • Cuttle Brook Catchment: Poor Potential (heavily modified) • River Derwent from Bottle Brook to R Trent: Moderate • Trent & Mersey Canal, Alrewas to Shardlow: Moderate potential (artificial) • Erewash Canal: Moderate potential (artificial) • River Trent from River Derwent to River Soar: Moderate potential (heavily modified) • River Trent from R Dove Conf to River Derwent: Moderate • Eggington Brook (lower) trib of R Trent: Moderate • Hilton Brook Lower Catchment (trib of Dove): Moderate • Foston Brook Catchment (trib of Dove): Good • Marston Brook Catchment (trib of Dove): Moderate	Environment Agency backyard maps (http://maps.environment-agency.gov.uk/wiyby/wiybyController?topic=wfd_rivers&layerGroups=default&lang=_e&ep=map&scale=6&x=427978&y=333673)

Table 3-2: Ecosystem service provision under the baseline			
Ecosystem service		**Economic baseline**	**Data source**
Water regulation (large-scale)	Risk of flooding and inundation	Number of locations with numbers of properties at risk of flooding in a 1% annual probability river flood: • 2 locations with <100 properties at risk • 2 locations with 100-250 properties at risk • 2 locations with 250-500 properties at risk • 1 location with 1000-2000 properties at risk Derby, Long Eaton and Hatton are at risk of flooding	Based on EA (2010): River Trent Catchment Flood Management Plan (http://maps.environment-agency.gov.uk/wiyby/wiybyController?topic=fcrmschemes&layerGroups=default&lang=_e&ep=map&scale=6&x=442212.57291666645&y=331020.78124999884#x=427595&y=334824&lg=4,5,6,7,10,&scale=6)
Educational value	Value of educational trips/visits	88 schools 6 higher education facilities	OS OpenSource data overlaid on study area GIS - OS Vector Map District (https://www.ordnancesurvey.co.uk/business-and-government/products/vectormap-district.html)
Cultural heritage	Value of heritage	Nationally designated heritage sites within Trent Valley: • 20 Scheduled Monuments • 4 parks and gardens • 522 listed buildings (support 17 jobs and generate £0.4 million output (GDP)) • 2 archaeology assessment areas The World Heritage Site of Derwent Valley Mills partly overlaps within the study area	Historic England GIS data from Environment Agency Geostore (http://www.geostore.com/environment-agency/WebStore?xml=environment-agency/xml/ogcDataDownload.xml)
		Heritage records for the area include a number of assets (some still existing, others no longer present/visible but preserved as a record only). Examples of records include likely location of a civil war battlefield, cotton mill, manor house (no remains visible), war memorial, site of a settlement (with Neolithic pottery and Bronze Age artefacts found), route of a tramway, an airfield (very little to see now but when it use it was very busy and filled with Australian aircrew), an artificial textile factory (British Celanese, involved in the production of fibres for aircraft during the war), Bobbin Mill, brewery (Navigation Brewery), a cobbler's workshop (dating from the early 20th century), a cricket ground (now part of Repton School), a deer park (destroyed to make way for a power station in the 1960s), knitters cottage (the window outline survives from the 18th century framework knitting workshop), indoor swimming pool (built for Long	Derbyshire County Council

Table 3-2: Ecosystem service provision under the baseline			
Ecosystem service		**Economic baseline**	**Data source**
		Eaton School Board), Lock Keeper's cottage outbuilding (linked to the Erewash Canal), post office, public library (built in 1906 by Gorman and Ross), a public park (the Green), searchlight battery (extent of structures and boundary, visible by earthworks), village hall (an Oddfellows Hall, built for the Stanton Club in 1789), worker's cottage (housing built in 1920s for British Celanese workers)	
Aesthetics	Intrinsic value of landscape and its appearance	Five National Character Areas (NCAs) overlap with the study area (see Derbyshire County Council's (2014) work on the Landscape Character of Derbyshire): • Mease/Sence Lowlands: in the south of the study area around Walton-on-Trent, defined as gently rolling agricultural landscape including scattered villages; • Trent Valley washlands: occurring across the central band of the study area surrounding the Rivers Dove and Trent, as well as by the Trent in the far south; defined as an agricultural landscape with broad open river valleys including urban features; • Melbourne Parklands: defined as an undulating mixed farming landscape with country houses, landscaped parks and estate plantations; feature within the south of the study area e.g. near Willington; • Needwood and South Derbyshire Claylands: features at the northern edge of the study area near Etwall. The claylands are defined as a settled pastoral landscape on gently rolling lowlands; and • Urban: covers Derby and Long Eaton. The study area additionally features four Lowland Derbyshire Biodiversity Action Plan (BAP) Area types including Claylands; Trent and Dove Valleys; National Forest Area (very small patch near to Burton upon Trent); and Derby	Derbyshire County Council (2014): The Landscape Character of Derbyshire Lowland Derbyshire Biodiversity Partnership, Lowland Derbyshire Biodiversity Action Plan, 2011-2020

Table 3-2: Ecosystem service provision under the baseline			
Ecosystem service		**Economic baseline**	**Data source**
Recreation and tourism	Recreational activities (e.g. walking, dog walking, jogging)	Several footpaths and cycle ways exist in the study area including the Derwent Valley Heritage Way (51 miles from Heatherdene (outside the study area) to Shardlow) and the towpath of the Trent and Mersey Canal. The Bonnie Prince Charlie route (Ashbourne to Derby) is mainly outside the study area but finishes in Derby. Other examples of facilities for recreation and tourism (in addition to heritage sites above) include a sailing club (Swarkestone) and Elvaston Castle Country Park	Ordnance Survey map
Wellbeing	Wellbeing, health and happiness (quality of life)	Percentage of population within the study area at different levels of general health: • 40-60% are in very good health • 30-40% are in good health • 10-20% are in fair health • 2-6% are in bad health • 1-2% are in very bad health (Percentages have been adjusted to account for the proportions of the different wards within the study area)	Data on general health from the 2011 census
Jobs (supply chain)		Total number of jobs in the Trent Valley study area is estimated as 93,181 (for 2011)	ONS statistics from 2011 census ONS, NOMIS
Gross Value Added and output (production)		Total GVA for the Trent Valley study area is estimated as £3,778 million (for 2011)	
Attracting business and investment		Total number of jobs in the Trent Valley study area is estimated as 93,181 (for 2011) Median weekly gross pay (full-time, workplace based): - Derby: males £671; females £465 - Derbyshire Dales: males £477; females £320 - Erewash: males £458; females £363 - South Derbyshire: males £538; females £361	

Table 3-2: Ecosystem service provision under the baseline		
Ecosystem service	**Economic baseline**	**Data source**
Attracting employees and skills	Total population for the Trent Valley study area is estimated at 194,395, with 6,462 unemployed in the Trent Valley area in 2011 Proportion of employees who are managers/senior officials, in professional occupations or associate professional and technical operations: - Derby: males 40.2%; females 36% - Derbyshire Dales: males 45.7%; females 28.6% - Erewash: males 38.8%; females 32.9% - South Derbyshire: males 44.8%; females 43.2% Proportion of employees in skilled trades: - Derby: males 16.0%; females 2.1% - Derbyshire Dales: males 25.8%; females 10.5% - Erewash: males 31.5%; females no data - South Derbyshire: males 14.7%; females no data	ONS Neighbourhood Statistics ONS, NOMIS
Notes: ** In general, aggregates and energy production are not included in ecosystem services frameworks. However, they are key sectors for the case study area so have been listed here to ensure that potential changes under the scenarios are picked up*		

3.4 Baseline in terms of GVA and jobs

The **total number of jobs in the Trent Valley in 2011 is estimated at 93,181** with **total GVA in 2011 of £3,778 million** (based on figures for the East Midlands). This is an increase of 12% in terms of number of jobs since 2001 (from 82,979) and 47% in terms of GVA since 2001 (from £2,566 million)[3]. Table 3-3 presents a summary of the key economic and jobs information for 2001 and 2011. Note that GVA figures within the table are presented to the nearest £1 (as per ONS data on 'GVA per workforce job'), but all calculations have been carried out using unrounded numbers.

Figure 3-1 shows the GVA per workforce job by sector in 2001 (dark blue) and 2011 (light blue). The figure shows that GVA per workforce job increases for all sectors, except agriculture (no further information has been identified to explain this decline). GVA per workforce job is greatest for energy generation, water and the wider economy (this is an average across all other sectors, including: financial and insurance activities; real estate activities; professional, scientific and technical activities[4]; public administration and defence, compulsory social security; education; and other service activities).

Figure 3-2 presents the number of jobs in each sector in the Trent Valley (estimated based on the population of each ward considered to be within the study area). Here the number of jobs in 2001 is shown in dark red and the number of jobs in 2011 is shown in light red. The number of jobs has increased in the sectors of construction, health and wellbeing, physical infrastructure, tourism/recreation/retail/leisure, and wider economy. There has been a decrease in number of jobs in the sectors of agriculture and manufacturing/R&D, with energy generation showing only a small change (a slight increase).

Figure 3-3 provides the results of multiplying the GVA per workforce job by the number of jobs. The largest increases between 2001 (dark green) and 2011 (light green) are seen in the sectors of construction (95%), health and wellbeing (93%), tourism/recreation/retail/leisure (80%) and physical infrastructure (84%). Although too small a change to see in Figure 3-3, agriculture shows a reduction of 51%.

The scenario assessment will look to utilise these data to assess if and how the number of jobs and GVA are projected to change.

[3] The comparison of estimated total GVA with 2001 has to be treated with caution as some of the jobs allocated to the wider economy sector were presented in a more aggregated form making it difficult to link the jobs to the specific GVA per workforce job data.

[4] This sector includes research and development and technical construction activities. It has not been possible to break down the GVA so that these activities can be included within the manufacturing and R&D sector or the construction sector. Since the majority of the GVA for professional, scientific and technical activities are outside R&D and construction type activities it has been allocated to wider economy.

Table 3-3: GVA and jobs data by sector for 2001 and 2011 for the Trent Valley						
Sector	2001			2011		
	GVA per workforce job (rounded to nearest £1)	No. jobs	Estimated GVA (rounded to nearest £1 but calculated with unrounded figures)	GVA per workforce job (rounded to nearest £1)	No. jobs	Estimated GVA (rounded to nearest £1 but calculated with unrounded figures)
Aggregates	£31,571	144	£4,546,286	£51,750	96	£4,968,000
Agriculture	£30,792	679	£20,907,542	£25,914	392	£10,158,400
Construction	£27,437	5,335	£146,376,854	£41,073	6,960	£285,867,020
Energy generation	£87,333	729	£63,666,000	£112,833	750	£84,625,000
Health and wellbeing	£17,295	8,252	£142,720,305	£23,661	11,647	£275,574,037
Heritage	Captured under tourism, recreation, retail, leisure and specific activities in wider economy					
Physical infrastructure	£36,521	5,933	£216,681,478	£45,580	8,250	£376,038,227
Manufacturing, R&D	£32,943	20,068	£661,108,075	£50,706	15,103	£765,817,546
Tourism, recreation, retail, leisure	£17,381	18,082	£314,291,436	£23,470	24,165	£567,151,488
Water	£67,111	0	£0	£86,077	906	£77,985,692
Wider economy	£62,883	23,757	£1,493,906,955	£80,072	24,912	£1,994,752,131
Wildlife/ biodiversity	Captured under tourism, recreation, retail, leisure and specific activities in wider economy					

Notes: 'estimated GVA' is based on 'GVA per workforce job' multiplied by 'number of jobs' since these data are available at a level that fits best with the sectors. Figures for 'GVA per workforce job' are sourced from ONS and are calculated by dividing 'workplace based GVA by industry group' by 'jobs by industry group'. The numbers presented for 'GVA per workforce job' given in the above table are rounded to the nearest £1. The calculation of 'estimated GVA' has been undertaken using the unrounded figures. Thus, multiplying the table values for 'GVA per workforce job' by 'number of jobs' will not result in exactly the same figures are presented above under 'estimated GVA'.

The wider economy includes the following sectors: financial and insurance activities; real estate activities; professional, scientific and technical activities; public administration and defence, and compulsory social security; education; and other service activities.

Source: based on Office of National Statistics data for 'GVA per workforce job' and Neighbourhood Statistics for 'number of jobs' (calculated from census data)

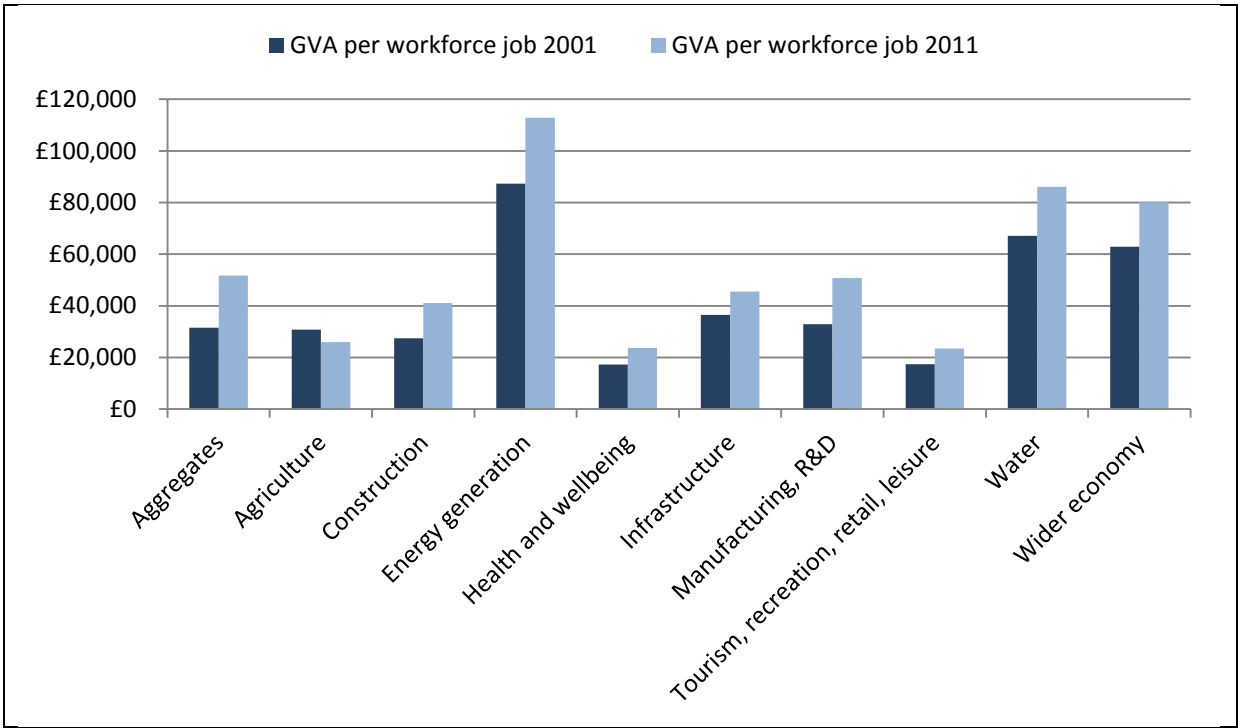

Figure 3-1: GVA per workforce job by sector for 2001 and 2011

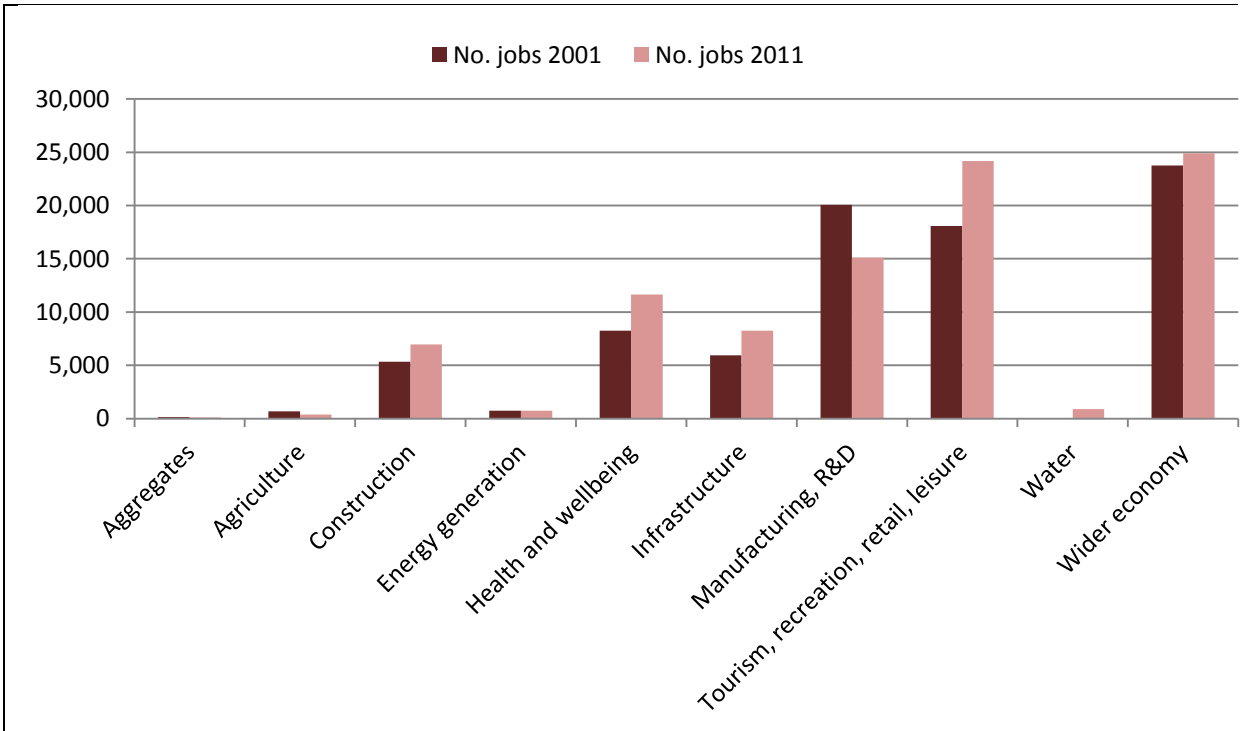

Figure 3-2: Number of jobs by sector for 2001 and 2011
Note: Figures for aggregates are too low to appear on the chart given the scale

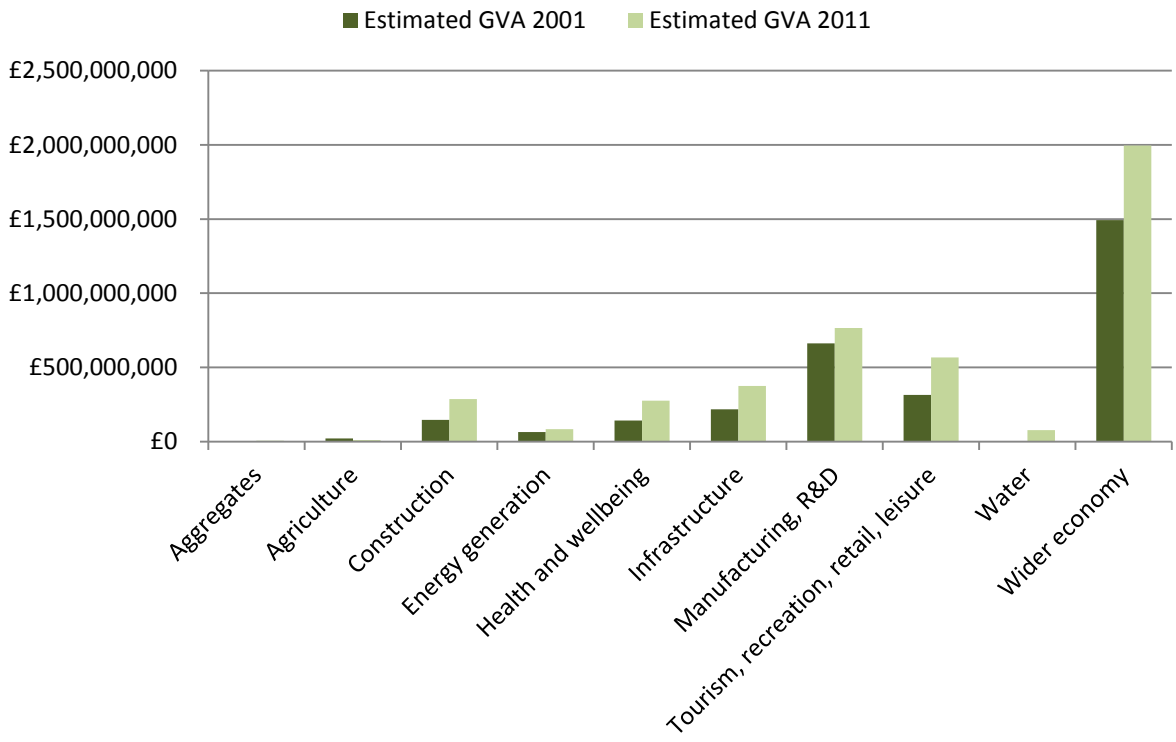

Figure 3-3: Estimated GVA by sector for 2001 and 2011

Note: Figures for aggregates are too low to appear on the chart given the scale

4 The scenario storylines

4.1 Overview

The study involves the development of two scenarios:

1. To continue to develop with an **uncoordinated approach** where the landscape can continue to change in an uncoordinated, piecemeal fashion which will perpetuate long-term impacts and potentially lead to a degraded natural environment; a situation with all of the pressures but none, or few, of the benefits (effectively the 'business as usual/do nothing' scenario projected into the future); and

2. To adopt a **coordinated approach** which will be more forward looking and coordinated to establish a long-term vision and strategy for the Trent Valley landscape that can deliver environmental, social and economic benefits.

The scenario storylines, detailed below, set out the key assumptions upon which the assessment is based. It is important to remember that these are scenarios and, as such, they set out two possible futures out of an infinite number of possibilities. They include assumptions of what could happen but this does not mean that these events would necessarily happen (for example, permission being granted to certain sand and gravel quarries). The aim has been to link the uncoordinated scenario to existing projections (to the extent possible) so this reflects the situation in 2050 of continuing with business as usual. The coordinated scenario looks to identify an overarching vision for 2050, drawing on the visions associated with each sector as an approach to maximising the benefits of the Trent Valley. To turn the coordinated scenario into something that can be appraised, it is necessary to be reasonably specific about what this future would look like and how it would come about.

4.2 Uncoordinated scenario

The projections identified for each sector are summarised in the tables below. This includes consideration of how and where there may be antagonisms and synergies with projections for other sectors. It is these antagonisms in particular that will minimise the extent to which the full benefits identified for each sector can be delivered and where there will be dis-benefits (damages) on the ecosystem services. The titles of each table include highlighted text for the sector; this is intended to make it easier to identify where there is a change to a new sector storyline.

Table 4-1: Uncoordinated scenario storyline: aggregates	
Uncoordinated scenario	**Assumptions**
Projections	Additional 9 million tonnes (mt) permitted reserves needed (to 2030), on top of 9.4 mt already permitted. All sand and gravel extracted from the Plan area is transported to its markets by road (viable alternatives are not currently available but will be explored where possibilities arise). Restoration is undertaken in line with site conditions, with no consideration given to wider benefits (other than those already taken into consideration, e.g. Willington extension that considers the Trent Valley Landscape vision).

Table 4-1: Uncoordinated scenario storyline: aggregates	
Uncoordinated scenario	**Assumptions**
Time point 1: 2020	Swarkestone quarry worked out and final restoration begins. Swarkestone covers 89.7 ha with annual output of 300,000 tonnes. Extension of 34 ha to Willington Quarry permitted prolonging its life until 2025 with 300,000 tpa with further life of 7 years; Readymix operations would continue as present; extension is over 34 ha of agricultural grazing land. Willington covers 45 ha and is outside the East Midlands Airport safeguarding zone, total production of 1.2 mt over 5 years. Elvaston Quarry extension approved, increasing the quarry by 75.6 ha (of mainly agricultural land) of which 57.6 ha would be worked, with total of 1.85 mt produced or 300,000 tpa. Restoration at Swarkestone requires that target bird species are not allowed to breed, roost or establish on site due to potential bird strike issues for East Midlands Airport (since it lies 10 km to the west or within the 13 km safeguarding zone around East Midlands Airport). Restoration is to agricultural land and nature conservation areas, with a variety of different habitats (hedges, reedbeds, rough grassland, wet grassland, trees/woodland and open water). To discourage target bird species, deeper water and steeper sides are proposed for the lake. The number of islands in the lake is also reduced to make them less attractive to geese. The islands will be planted with willow carr, again to discourage geese from nesting. Around 38.4 ha will be restored to agricultural use. In addition 1,916 m of new footpaths will be established, leading from a purpose-designed car park. Swarkestone Quarry is worked dry with dewatering of the current extraction areas (groundwater is pumped to silt settlement points and ultimately to Manor Farm Lake (flooded former sand and gravel workings). Once extraction ceases, pumping is stopped and groundwater levels are allowed to recover, thus flooding the void.
Time point 2: 2025	Willington extension (79 ha, including 2.07 mt extension), Shardlow (including 3.5 mt extension granted in 2014), Elvaston extension (1.85 mt extension) and Potlocks Farm worked out and final restoration begins (7.42 mt of 9 mt additional resources already allocated). New permissions granted at sites in line with applications for new sites or extensions to existing ones, and associated planning requirements. At Willington, dewatering ceases once extraction stops while the restoration offers a reduction in peak water levels with long-term benefits during flooding conditions. Restoration at Willington enhances conservation and biodiversity and is linked to the Trent Valley Landscape Vision. Restoration retains mature hedgerow features, and establishes new water bodies and woodland structure. The newly created woodland and wetlands are connected to adjacent nature reserves once established. A lack of inert fill material means restoration results in lakes (rather than agricultural land), with proposals for the creation of seven lakes surrounded by lowland meadow that would be lightly grazed. Pockets of woodland would be planted along the River Trent and Dove to prevent the lakes from flooding, with reedbed and natural lake margin vegetation. Additional paths are added to enhance the South Derbyshire greenway network. Potlocks Farm extends to 34 ha and extracted around 150,000 tpa over 15 year life of

Table 4-1: Uncoordinated scenario storyline: aggregates	
Uncoordinated scenario	**Assumptions**
	the quarry. Restoration takes account of the Lowland Derbyshire Biodiversity Action plan with the majority of land returned to 3 fields of pasture land (12.8 ha, 10 ha and 5.6 ha in size). Species rich hedgerows and field water supplies will be established. Shardlow Quarry extends to 100 ha and comprises woodland and extensive floodplain farmland that is being restored. 14 ha of floodplain are restored to a mosaic of open water, channels, ponds, reedswamp, fen, wet woodland, wet grassland. There are also 5 ha of new reedbed. Elvaston Quarry is restored to seven lakes of between 4 ha and 7 ha each with fringing woodland, reedbeds, marginal waterside fringe, waterside planning and grassland, and 20 ha of 'best and most versatile' agricultural land. The lakes are used for private, high quality fishing and nature conservation with a small car park. Note: Shardlow and Elvaston both lie within 13 km safeguarding zone for East Midlands Airport.
Time point 3: 2030	Excavation continues to provide the remaining tonnage required within the plan period, with ongoing restoration as phases are completed in line with restoration plans for the sites.
Time point 4: 2050	Aggregates extraction in the area continues, with restoration occurring on a site-by-site basis with no consideration given to potential links with neighbouring restoration areas. Consideration is given to alternatives forms of transport for extracted materials but road remains dominant.
Data sources and references	Cemex UK Operations Ltd (2015): Willington Quarry – Trent – Planning Statement, Planning Application, June 2015, accessed at: http://www.derbyshire.gov.uk/planningdocuments/CM9-0715-63/sup-Planning%20Statement-APP_0_PLANNING%20STATEMENT.pdf Golder Associates (2009): The assessment of the potential hydrogeological and hydrological impacts of continued extraction of sand and gravel at Swarkestone Quarry, Derbyshire, accessed at: http://www.derbyshire.gov.uk/planningdocuments/CM9-1109-166/9.346.12/01-Application-Documents/Environmental%20Statement%20Appendix%204%20-%20Hydrological%20and%20Hydrogeologial%20Assessment.pdf Hanson (2010): Environmental Impact Assessment of the proposed extraction of sand and gravel from land at Potlocks House Farm, Environmental statement, June 2010, accessed at: http://www.derbyshire.gov.uk/planningdocuments/CM9-0610-43/9.922.3/01-Application-Documents/2%20-%20Environmental%20Statement%20Document/Main%20Report/Potlocks%20House%20Farm%20Environmental%20Statement.pdf Lafarge (2011): Bird Hazard Management Plan, Swarkestone Quarry, March 2011, article accessed at: http://www.derbyshire.gov.uk/planningdocuments/CM9-1109-166/9.346.12/01-Application-Documents/Swarkestone%20Bird%20Hazard%20Management%20Plan.pdf Tarmac Limited (2011): Proposed extraction of sand and gravel, with restoration to conditions capable of supporting agriculture, fishing and conservation at Elvaston, Derbyshire, planning application, 16 May 2011, accessed at: http://www.derbyshire.gov.uk/images/2011.05.16%20RP2%20Elvaston_tcm44-162102.pdf

Table 4-2: Uncoordinated scenario storyline: agriculture	
Uncoordinated scenario	**Assumptions**
Projections	Continuation of agricultural land use as at present, with the only changes being associated with revisions under the CAP, especially in relation to greening. Some maize has been grown for a Seven Trent Anaerobic Digester plant but falling Feed in Tariffs are likely to mean limited (if any) future increase in growth of crops for other such plants.
Time point 1: 2020	Areas of grassland and arable land remain roughly constant. However, there is a move away from cereals to other arable crops or energy crops with a greater variety of crops being grown overall. Ecological Focus Areas (EFAs) result in increase in buffer strips and cover/catch crops such that biodiversity may increase.
Time point 2: 2025	Assumed that CAP greening requirements are maintained but greater attention is paid to flood risk from the rivers and intense rainfall events. 38.4 ha is restored to agricultural use from restoration at Swarkestone. The land use will be consistent with the pre-development situation and is assumed to reflect 53% arable and 47% grassland/livestock (in line with the overall pattern of agricultural land use, based on Farm Survey data and Land Use shapefiles). However, there is also some loss to new aggregates areas.
Time point 3: 2030	Assumed that CAP greening requirements are maintained, and land use is managed with flood risk in mind. 28.4 ha restored to pasture land at Potlocks Farm. Although the restoration is to pasture land, this is converted to arable land over time as it is 'best and most versatile' grade 2 and 3a land. In other areas, land is lost to new aggregates extraction sites.
Time point 4: 2050	Agricultural land use and trends remain driven by the CAP. Whilst there is some restoration of aggregates extraction areas to agriculture, ongoing extraction with lack of inert infill material combined with continual housing development leads to a small decline in area of land available for agriculture.
Data sources and references	Defra Farm Survey data Hanson (2010): Environmental Impact Assessment of the proposed extraction of sand and gravel from land at Potlocks House Farm, Environmental statement, June 2010, accessed at: http://www.derbyshire.gov.uk/planningdocuments/CM9-0610-43/9.922.3/01-Application-Documents/2%20-%20Environmental%20Statement%20Document/Main%20Report/Potlocks%20House%20Farm%20Environmental%20Statement.pdf Land Use shapefiles Lafarge (2011): Bird Hazard Management Plan, Swarkestone Quarry, March 2011, article accessed at: http://www.derbyshire.gov.uk/planningdocuments/CM9-1109-166/9.346.12/01-Application-Documents/Swarkestone%20Bird%20Hazard%20Management%20Plan.pdf

Table 4-3: Uncoordinated scenario storyline: construction (including residential development)	
Uncoordinated scenario	**Assumptions**
Projections	The rapid housing growth in the years prior to the assessment continues, with houses being built across the study area including on the brownfield land of the former power station sites. However, provision of transport infrastructure and services does not keep pace with housing growth, as currently some developments do not have sufficient day-to-day facilities. Many routes in South Derbyshire have issues with congestion due to considerable car use. The urban developed area of the city of Derby extends southwards into South Derbyshire.
Time point 1: 2020	Houses are built in accordance with the plans. Development planning goes to 2028, so taking a proportion of the dwellings for this time period suggests: • Derby city homes: growth in and around the city centre, the Osmaston triangle, land on Boulton Moor at Alvaston, also other greenfield sites. Assume one third of total development (12,500 homes) planned by 2028 is built by 2020, and two thirds is within the study area due to focus on Osmaston and Alvaston. This gives around 2,800 homes; • Derby city employment: assume one third of office space and employment land planned for city by 2028 is developed by 2020. Study area is assumed to include all planned development at Osmaston and Sinfin (100% of 86.8 ha), half of the planned development along the Derwent corridor (50% of 92.7 ha) and half of the city centre office space (50% of 100,000 sqm) so by 2020 it is expected that construction will have resulted in 44 ha of employment land and 17,000 sqm of office space; • Derby city education: a new secondary school is planned and developed for 2020, providing space for up to 2,000 pupils; • South Derbyshire: provision to be made for at least 13,454 net additional dwellings by 2028. Assume 50% of these dwellings are within the study area due to the need for South Derbyshire to provide an urban extension to south of Derby. Assume one third of these are built by 2020 giving around 2,250 houses by 2020; • Derbyshire Dales District: minimal construction within study area due to location of flood plain; and • Erewash Borough: part of Greater Nottingham Growth Point, annual average delivery of houses of 366 for the Borough, according to housing provision figures from the aligned core strategies housing provision position paper. Assume half of these are within the case study area (Long Eaton is a focus point), resulting in 183 per year or 915 houses for 2016 to 2020. Plans are also developed and implemented for housing at Drakelow Park (300 homes expected)
Time point 2: 2025	Construction continues as for the first time period, with one third of houses and business premises planned by 2028 taking place between 2021 and 2025. This results in: • Derby city homes: growth in and around the city centre, the Osmaston triangle, land on Boulton Moor at Alvaston, also other greenfield sites: 2,800 homes; • Derby city employment: 44 ha of employment land and 17,000 sqm of office space developed between 2021 and 2025; • South Derbyshire: 2,250 homes built between 2021 and 2025 (estimated as one third of 50% of homes planned for South Derbyshire);

Table 4-3: Uncoordinated scenario storyline: construction (including residential development)	
Uncoordinated scenario	**Assumptions**
	• Derbyshire Dales District: minimal construction within study area due to location of flood plain; and • Erewash Borough: 915 houses built in study area (mainly in Long Eaton) between 2021 and 2025 (based on 183 per year within case study area). Some services (e.g. schools) are also built as part of developments where they are included as a condition of planning permission.
Time point 3: 2030	Final third of houses and business premises are built as planned by 2028 resulting in: • Derby city homes: growth in and around the city centre, the Osmaston triangle, land on Boulton Moor at Alvaston, also other greenfield sites: 2,800 homes; • Derby city employment: 44 ha of employment land and 17,000 sqm of office space developed between 2025 and 2030; • South Derbyshire: 2,250 homes built between 2026 and 2028 (estimated as one third of 50% of homes planned for South Derbyshire). This is expected to include considerable housing growth in Hatton and Hilton, with associated employment growth in Hatton; • Derbyshire Dales District: minimal construction within study area due to location of flood plain; and • Erewash Borough: 915 houses built between 2026 and 2030, mainly in Long Eaton area (based on 183 per year within case study area). Also during this time period, developers will have started to make improvements to the design of developments to ensure efficient use of energy and water, and to increase access to jobs, services and facilities through considering transport links (including public transport) at the design stage.
Time point 4: 2050	Housing development continues, with some attention paid to water and energy efficiency. The majority of development has been concentrated in South Derbyshire, with the population increasing significantly. Additional services have been provided to cater for the needs of an older and more diverse population. However, transport links and connections between developments are not well established. Whilst it has been acknowledged that developments need to be sited so that they have easy access to jobs, services and facilities, this has not occurred to any great extent with the result that travel into the city of Derby and also between surrounding settlements is generally by car, leading to considerable congestion. This has negative impacts for both air quality and public health.
Data sources and references	South Derbyshire District Council (2013): South Derbyshire Draft Local Plan, September 2013 Derby City Council (2013): Derby City Local Plan - Part 1: Draft Core Strategy, October 2013 (http://www.derby.gov.uk/media/derbycitycouncil/contentassets/documents/policiesandguidance/planning/Full%20doc%20complete%20compressed.pdf) Greater Nottingham Growth Point (http://goss.nottinghamcity.gov.uk/index.aspx?articleid=5768) Erewash Borough Council et al (2011): Greater Nottingham Aligned Core Strategies, Housing Provision Position Paper (http://www.erewash.gov.uk/planning-building-control/planning-policy/core-strategy/housing-provision-and-climate-change.html)

Table 4-4: Uncoordinated scenario storyline: energy generation	
Uncoordinated scenario	**Assumptions**
Projections	Local councils continue to support additional energy generation capacity at the Drakelow and Willington Power Stations (subject to proposals complying with relevant policies in the Local Plans).
Time point 1: 2020	Construction of Willington C gas-fired power station underway (assumed starts 2020) with peak of 2,000 jobs and annual average of 1,000 jobs supported during construction, with many of these contracted locally as per the company's recruitment policy. Construction continues until 2024 after which the power station moves into the operational phase. Drakelow Park Renewable Energy Centre is constructed on the site of the former Drakelow C power station, comprising a combined heat and power gasification plant fuelled by biomass rich fuel to generate up to 15MW of renewable electricity. Construction begins in 2019 and continues to 2020, with around 100 jobs created during the construction phase with initiatives to encourage local companies to tender to help ensure that much of the economic benefits of the proposed development stay in the local area. Derbyshire County Council continues to look for and implement opportunities for renewable energy generation on its own land, especially solar PV on former industrial land. Continued installation of domestic and other small-scale renewables. Oil and shale gas exploration sites established. Energy crops grown in the Trent Valley are exported to power stations outside the study area.
Time point 2: 2025	Willington C gas-fired power station operational phase, supporting 100 full-time equivalent jobs. Drakelow Renewable Energy Centre operational phase, supporting around 10-20 directly employed staff. Shale gas exploration continues. Energy crops grown in the Trent Valley are exported to power stations outside the study area.
Time point 3: 2030	Willington C gas-fired power station operational phase continues, supporting 100 full-time equivalent jobs. Drakelow Renewable Energy Centre operational phase, supporting around 10-20 directly employed staff. Shale gas exploration continues. Energy crops grown in the Trent Valley are exported to power stations outside the study area.
Time point 4: 2050	Drakelow Renewable Energy Centre continues to operate, with an expansion planned to enable renewable energy generation targets to be met. Willington C gas-fired power station is also still in the operational phase, but it is nearing the end of its life (assumed to be around 30 years). There is uncertainty over whether a replacement will be built.
Data sources and references	Cllr Owen J (2014): Renewable energy opportunities for Derbyshire County Council, presentation to Municipal Energy-Local Leaders Forum, 29 October 2014, accessed at: http://www.apse.org.uk/apse/assets/File/Cllr%20John%20Owen.pdf RWE npower (2009): Willington C CGT, Environmental Statement – Non-technical summary, December 2009, accessed at: http://www.rwe.com/web/cms/mediablob/en/359624/data/359620/1/rwe-npower/about-us/our-businesses/new-power-stations/willington-power-station/environmental-statement/Willington-Environmental-Statement-Non-

Table 4-4: Uncoordinated scenario storyline: energy generation	
Uncoordinated scenario	**Assumptions**
	Technical-Summary.pdf TNEI & Future Earth Energy (2015): Drakelow Renewable Energy Centre, Non-Technical Summary, June 2015, accessed at: https://www.derbyshire.gov.uk/planningdocuments/CW9-0615-48/sup-Non%20Technical%20Summary.pdf

Table 4-5: Uncoordinated scenario storyline: health and wellbeing	
Uncoordinated scenario	**Assumptions**
Projections	In Derbyshire, life expectancy at birth is: • 83.2 years for women; and • 79.4 years for men. However, the difference between the healthiest and unhealthiest areas of the county is 7.9 years for men and 5.8 years for females. 'Children in poverty' is lower in Derbyshire than the national and regional average (16.3% for children in poverty under 16s compared with 19.2% (national) and 18.2% (regional)). Derbyshire's population is set to increase by 11.7% from 2012 to 2037, with the population aged 90 and over more than doubling over the same time period. Self-reported scores for low happiness tend to be slightly higher in Derbyshire than nationally and regionally (10.1% compared with 9.7% (national) and 9.3% (regional), although this value is higher in Derby (11.4%). The proportion of people with high anxiety is also slightly higher (20% compared with 19.5% nationally), again Derby scores higher at 24.5%. Self-reported satisfaction is generally higher in Derbyshire with just 5.1% giving a low satisfaction score in Derbyshire compared with 5.8% (regionally) and 5.6% (nationally). Low satisfaction is much higher in Derby, at 7.6%. People in Derbyshire also gave a lower response to having a low worthwhile score (3.5%) compared with 4.3% (regionally) and 4.2% (nationally). Again, people in Derby were more likely to give a low worthwhile score at 5.7%. The percentage of active adults in Derbyshire (56.1%) is higher than Derby (56%) but both are higher than the national (55.6%) and regional (55.7%) averages. The percentage of inactive adults is also lower for Derbyshire (28.4%) than the regional (28.8%) and national (28.9%) figures, but the percentage of inactive adults is higher in Derby (29.1%). There will be increased pressure on housing, health, recreation, and other service providers from the ageing population. The number of retired people will increase significantly placing greater strains on these services.

Table 4-5: Uncoordinated scenario storyline: health and wellbeing	
Uncoordinated scenario	**Assumptions**
Time point 1: 2020	Continuation of health and well-being strategy for Derbyshire with aims to: • Build social capital through building community networks and support, and exploring approaches that help Derbyshire to achieve better health outcomes; • Create healthy communities, with the focus on reducing health inequalities. This involves encouraging regular exercise, healthy lifestyles and balanced diets. Use of the countryside is promoted to encourage outdoor activities that can be undertaken at low cost; • Keep people healthy and independent in their own home; and • Support the emotional health and wellbeing of children and young people. Also continued focus on key priorities given in the South Derbyshire Health and Wellbeing Plan 2013-16: • Supporting health of older people in their own home; and • Supporting individuals and families living in rural areas experiencing inequality (rural isolation, deprivation). (Third priority relates to Swadlincote so is outside case study area) Continued involvement in UK Healthy Cities Network and sharing of good practice to promote health and wellbeing. Continued monitoring of air quality to assess potential impacts on health.
Time point 2: 2025	Implementation of schemes to continue to build social capital and create healthier communities, drawing on existing resources and volunteer organisations, measuring of changes against indicators to reflect how health and wellbeing is changing and revising the strategy in response. Continued monitoring of air quality to assess potential impacts on health.
Time point 3: 2030	Implementation of schemes to continue to build social capital and create healthier communities, drawing on existing resources and volunteer organisations, and adjusting approaches in line with the implications from the measurement of indicators showing how health and wellbeing is changing. Continued monitoring of air quality to assess potential impacts on health.
Time point 4: 2050	Schemes continue to be implemented to achieve the two overarching aims of (1) increased healthy life expectancy and (2) reduced differences between communities in terms of life expectancy and healthy life expectancy. Some progress towards these aims is made. However, continued reliance on the private car as the main means of transport contributes to increasing congestion in and around Derby, with negative impacts for air quality and public health

Table 4-5: Uncoordinated scenario storyline: health and wellbeing	
Uncoordinated scenario	**Assumptions**
Data sources and references	Derbyshire Health and Wellbeing Board (2015): Healthy Derbyshire, Derbyshire Health and Wellbeing Strategy 2015-17, accessed at: http://www.derbyshire.gov.uk/images/Agenda%20item%204%20-%20Draft%20Health%20and%20Wellbeing%20Strategy%20Report_tcm44-270220.pdf Derbyshire Observatory: Public Health Outcomes Framework

Table 4-6: Uncoordinated scenario storyline: heritage	
Uncoordinated scenario	**Assumptions**
Projections	Heritage assets continue to be conserved in line with the requirements of the National Planning Policy Framework (NPPF) (conserve heritage assets in a manner appropriate to their significance, so that they can be enjoyed for their contribution to the quality of life of this and future generations).
Time point 1: 2020	Heritage assets continue to be conserved and maintained, with assessment of heritage assets potentially affected by developments undertaken in line with the NPPF and environment policies of the relevant local plans. Archaeological evaluations are undertaken where ground disturbance would occur.
Time point 2: 2025	Constructive conservation continues, allowing changes to be made to heritage assets where this causes less than substantial harm to the asset and where the public benefits exceed the level of harm.
Time point 3: 2030	Constructive conservation continues as in 2025.
Time point 4: 2050	Conservation of heritage assets continues. Whilst assets are cared for on an individual or site-by-site basis, little effort is put into the bigger picture in terms of joining up and marketing the heritage of the area as a package to attract residents, inward investment and tourists.
Data sources and references	Department for Communities and Local Government (2012): National Planning Policy Framework, accessed at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/ 2116950.pdf

Table 4-7: Uncoordinated scenario storyline: physical infrastructure	
Uncoordinated scenario	**Assumptions**
Projections	D2N2 Infrastructure Investment Board will continue to oversee administration of the Local Growth Fund for schemes across the D2N2 LEP area and will make decisions on individual scheme approval and release of funding. Development of East Midlands Hub through HS2 with construction from 2022 to 2031, and full operation by 2033, with links to existing and improved transport infrastructure building on proximity to East Midlands Airport, key road transport routes (A38/A50/M1 corridor and A52), and rail connections including proposed HS2 development at Toton (East Midlands Hub station). Transport connections to the East Midlands Enterprise Gateway (EMEG) area (in north west Leicestershire but bordering the study area) are also expected to be further developed.

Table 4-7: Uncoordinated scenario storyline: physical infrastructure	
Uncoordinated scenario	**Assumptions**
	Planning and consultation relating to the East Midlands Intermodal Park (EMIP) continues. This will provide an intermodal terminal to move goods between road and rail. Also environmental and landscape infrastructure developments such as the National Forest. Key focus is on addressing the fast growing population, congestion and the availability of suitable sites and premises. Investment by Derbyshire County Council of around £20 million per year in structural maintenance and improvement schemes but local road traffic congestion continues to impact on the economy. Investment in rail transport is also needed (e.g. re-opening of Ivanhoe/National Forest line from Leicester to Burton on Trent for passengers – currently the line only carries freight), alongside local transport schemes and development of the bus network. Investment in high speed broadband with 98% of premises in Derbyshire and Derby City having access to superfast broadband by 2018, and all other premises with a minimum speed of 2 Mbps. Climate change effects will become apparent in the study period, with flooding being perhaps the biggest threat. Investment will be required in flood defences and other related projects where it threatens existing development and infrastructure (such as electricity sub-stations, railways, roads, power stations, etc.). Long Eaton is an example of a growth point that is threatened by flooding in the medium to long-term.
Time point 1: 2020	Short-term physical infrastructure projects include construction of River Trent Crossing & Walton bypass, Drakelow Park; Long Eaton Town Centre Package (to diversify land use in the town centre) as well as wider work to improve resilience of the highway network. Also Woodville-Swadlincote regeneration route and Stanton Employment Land (these are outside the study area but could have benefits for the study area). Beginning of work on the South Derby Integrated Transport Link Phase 1 and Boulton Moor park and ride scheme (on outskirts of Derby). Continuation and completion of rollout of Digital Derbyshire programme, with 200,000 premises (of which more than 10,000 are business premises) having access to fibre broadband that would not have been available without the programme. Overall programme is expected to have resulted in expenditure of almost £35 million. Beginning of work on EMIP to provide intermodal terminal for freight.
Time point 2: 2025	Construction of Swarkestone Causeway bypass and proposed HS2 station and interchange at Toton, as well as the HS2 Skills Academy and maintenance depot at Staveley. Finalisation of work to construct EMIP. Continued focus on investment in strategic sites. Significant investment required in flood defences.
Time point 3: 2030	Continued focus on investment in strategic sites and final construction stages of HS2.

Table 4-7: Uncoordinated scenario storyline: physical infrastructure	
Uncoordinated scenario	**Assumptions**
Time point 4: 2050	Construction of HS2 has been completed. Investment continues in flood defences and also at strategic sites. In line with forecasts, growth in passenger numbers and freight at East Midlands Airport has occurred, adding to the traffic on the roads within the study area.
Data sources and references	D2N2 (2015): D2N2 Infrastructure and Investment Board, Terms of Reference, May 2015, accessed at: http://www.derbyshire.gov.uk/images/2015-05-28%20Derby%20Derbyshire%20Nottingham%20Notts%20IIB_tcm44-265134.pdf D2N2 and Derbyshire County Council (2015): Derbyshire Broadband, D2N2 Infrastructure and Investment Board, 10 August 2015, accessed at: http://www.derbyshire.gov.uk/images/Derbyshire%20Broadband%20IIB%20report_tcm44-268933.pdf Derby City Council (2010): Local Economic Assessment, Development, Economic Infrastructure and Connectivity, Chapter 6 http://www.derby.gov.uk/media/derbycitycouncil/contentassets/documents/economicassessment/DerbyCityCouncil-Economic-Assessment-Chapter6-Development-Infrastructure-Connectivity.pdf Derbyshire Economic Partnership (2014?): Derbyshire Economic Strategy Statement http://www.derbyshireeconomicpartnership.org.uk/derbyshire-economic-partnership/derbyshire-economic-strategy-statement/ East Midlands Intermodal Park (EMIP), accessed at: http://www.emipark.co.uk/ HS2 (2013): East Midlands Hub Station, July 2013, accessed at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/381963/HS2_Phase_Two_East_Midlands_Hub_station_factsheet.pdf

Table 4-8: Uncoordinated scenario storyline: manufacturing and research & development	
Uncoordinated scenario	**Assumptions**
Projections	Concern over potential continued trend of loss of manufacturing jobs in the area, with this being at around a reduction of 15% over the 10 years to 2011, and loss of 3,500 manufacturing jobs in 2014-2015. The advanced manufacturing sector has seen a growth, though, of 2,300 jobs in the period between 2008 and 2010. GVA of manufacturing in South and West Derbyshire of £2,045 million and in Derby of £1,790 million (2012). There was rapid growth in manufacturing GVA to 2006 in South and West Derbyshire followed by a significant decrease before recovery occurred in 2010. In Derby, there was a decline from 2000 before consistent growth began in 2010. Growth between 2000 and 2012 was around £35 million per year in South and West Derbyshire (averaged over the whole period) and around £16 million per year in Derby. Since 2009, growth in both areas has been much more rapid at around £129 million per year in South and West Derbyshire and £117 million per year in Derby. Manufacturing supported 16% of all jobs as main or second job in Derbyshire and 20.6% of all jobs in Derby (2011-2013).
Time point 1: 2020	Continued specialisation in Derby of 'planes, trains and automobiles' and continued recognition of importance of Toyota at Burnaston with a focus on high quality manufacturing and high skill level of workers, through ongoing development of the manufacturing growth corridor along the A38/A50/M1 and A52. Encouragement for manufacturing companies to move towards higher value manufacturing and services.

Table 4-8: Uncoordinated scenario storyline: manufacturing and research & development	
Uncoordinated scenario	**Assumptions**
	Continued investment in Infinity Park at Derby (focused on advanced engineering, including automotive, rail and aerospace industries and their supply chain), Growth Hub (offering incentives and support to SMEs) and investments in development (both commercial and residential) such as the 'Our City Our River' programme in Derby and Woodville/Swadlincote Regeneration Route & Drakelow Park. Continued investment in transport equipment manufacturing sector, maintaining its high level of productivity (40% more productive in the D2N2 area than elsewhere in the UK) and importance in terms of exports (where machinery and transport goods make up 65% of exports); other manufacturing also makes a significant contribution to exports. Initial development in response to construction of HS2 and the East Midlands Hub. Also facilitation of research and development as a high-skilled sector, with ongoing encouragement of better education-industry links to improve access to high level skills training and apprenticeships.
Time point 2: 2025	Continued investment in advanced manufacturing sector to maintain Derby and Derbyshire's role as a hub with a source of highly skilled workers associated with training opportunities at local colleges and universities, as well as through apprenticeships, with increased focus on exports to key markets such as Asia and Oceania, as well as the EU. Continued construction of HS2.
Time point 3: 2030	Continued investment in advanced manufacturing sector to maintain Derby and Derbyshire's role as a hub with a source of highly skilled workers associated with training opportunities at local colleges and universities, as well as through apprenticeships, with continued focus on exports. Continued construction of HS2 with employment and economic benefits from the HS2 skills academy and maintenance depot.
Time point 4: 2050	Construction of HS2 has been completed. Focus on advanced manufacturing is retained, with transport being a specialist area (strongly linked to HS2 and the maintenance depot).
Data sources and references	D2N2 Local Enterprise Partnership (2014): Strategic Economic Plan, March 2014, accessed at: http://www.d2n2lep.org/write/Documents/D2N2_SEP_March_31st.pdf D2N2 Local Enterprise Partnership (2015): State of the D2N2 Economy 2015, Summary Report, accessed at: http://www.d2n2lep.org/write/Annual%20Conference/D2N2_State_of_the_Economy_summary_report_080715.pdf Derby City Council (2011): Derby's Economic Strategy 2011-2016: Driving wealth creation in Derby, accessed at: http://www.derby.gov.uk/media/derbycitycouncil/contentassets/documents/strategies/ DerbyCityCouncil-Derbys-Economic-Strategy-2011-2016.pdf Derbyshire Economic Partnership (2014): Derbyshire Economic Strategy Statement, accessed at: http://www.derbyshireeconomicpartnership.org.uk/derbyshire-economic-partnership/derbyshire-economic-strategy-statement/ HS2 (2013): East Midlands Hub Station, July 2013, accessed at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/381963/HS2_Phase_Two_East_Midlands_Hub_station_factsheet.pdf

Table 4-8: Uncoordinated scenario storyline: manufacturing and research & development	
Uncoordinated scenario	**Assumptions**
	Neighbourhood statistics: Regional Gross Value Added, NUTS3 local areas, 1997-2013, accessed at: http://www.neighbourhood.statistics.gov.uk/HTMLDocs/NUTS3GVAbyindustry/NUTS3MotionChart.html Neighbourhood Statistics: Atlas of Tourism, accessed at: http://www.neighbourhood.statistics.gov.uk/HTMLDocs/Tourism/atlas.html

Table 4-9: Uncoordinated scenario storyline: tourism, recreation, retail and leisure	
Uncoordinated scenario	**Assumptions**
Projections	The visitor economy is the largest of D2N2's priority sectors, so increasing footfall and expenditure is the key aim. For informal recreation and leisure, opportunities identified by stakeholders and to be followed up include using the strategic river corridors, canal corridors and other waterways; increasing connectivity through using multifunctional green infrastructure; making use of urban fringe land; utilising long distance routes including the National Forest Way (crossing the Trent below Burton upon Trent) and the Erewash Valley Trail walking and cycling route (following the Erewash to the east of Long Eaton).
Time point 1: 2020	Publicity occurs around D2N2's key tourist attractions including the heritage area of Derby linking to Derwent Valley Mills World Heritage Site, the Derwent Valley Way and the retail opportunities in the city of Derby. Campaigns are also launched to encourage outdoor leisure activities including walking the various footpaths available. These include the Trent and Mersey Canal towpath, where plans are developed and implemented to upgrade the route to greenway standard. The Tourism Investment Assessment commissioned by the LEP helps inform development and marketing opportunities for so called 'anchor attractions' across the LEP's area.
Time point 2: 2025	The heritage of the area, and retail and leisure opportunities continue to be publicised, with a focus on particular sites (anchor attractions). Building on increasing tourist numbers, the opportunity (identified in the LEP's growth strategy) to link food sourcing and local tourism is taken up, with marketing of food produced in Derbyshire (building on the significant food and drink manufacturing sector). Efforts are also put into marketing outdoor leisure and tourism, including activities on the various waterways.
Time point 3: 2030	The visitor economy continues to grow, combining the city based attractions in Derby with the more rural landscape along the Trent and Dove river valleys. The long distance routes crossing the area (National Forest Way, Erewash Valley Trail, Derwent Valley Way) are all advertised as offering significant outdoor recreation opportunities, in conjunction with accommodation providers in Derby and the surrounding area. Several successful local food and drink offerings have become well established in the study area.
Time point 4: 2050	D2N2's inclusion of the visitor economy as one of its priority sectors has resulted in investment and growth in tourism and leisure within the area. Visitor numbers remain buoyant, being attracted by the combination of heritage, outdoor recreation and city based attractions.
Data sources and references	6Cs green infrastructure (2010): Green infrastructure strategy, volume 3, Baseline information review and strategic GI audit, accessed at:

Table 4-9: Uncoordinated scenario storyline: tourism, recreation, retail and leisure	
Uncoordinated scenario	**Assumptions**
	http://www.derby.gov.uk/media/derbycitycouncil/contentassets/documents/policiesandguidance/planning/Volume%203_Final_06-10.pdf D2N2 Local Enterprise Partnership: Strategy for growth 2013-2023, accessed at: http://www.d2n2lep.org/growth

Table 4-10: Uncoordinated scenario storyline: water	
Uncoordinated scenario	**Assumptions**
Projections	The water sector follows existing strategies (e.g. Severn Trent's Strategic Direction Statement: Focus on Water), targets (e.g. South Staffs Water's leakage targets) and plans (e.g. River Basin Management Plans), with various organisations dealing with water quality, water availability and flood risk. Demand for potable water is increased due to housing and population growth. Water resources continue to face a range of pressures including agricultural pollution, phosphates, non-native species and physical modification. Improving water quality is an overarching objective as per the Water Framework Directive.
Time point 1: 2020	In line with the increase in homes and business premises (see construction) there is increased demand for potable water. This leads to higher levels of abstraction and subsequently discharge of effluent, adding to the large amounts of treated water which are already discharged to the catchment from sewage treatment works. Most of the water for the Derby Housing Market Area (HMA) comes from reservoirs in the Derbyshire Derwent catchment, transfers from Rutland Water and river abstraction. Derby is already considered an area of moderate water stress. Despite attempts to reduce demand through the installation of meters, promotion of water efficiency programmes and an education programme, overall demand does increase. However, the 2019 target for leakage of 275 Ml/d in the strategic grid water resource zone is met. Agricultural abstractions remain at a similar level given that the existing split between arable and grassland is retained (additional abstractions from the Derbyshire Derwent would likely be limited anyway due to status of 'restricted water available for licensing' even at high flows).
Time point 2: 2025	As property development continues, demand for potable water also rises, with Derby still viewed as being an area of moderate water stress. Levels of agricultural abstraction fall slightly, due to restrictions and changes in cropping patterns. Severn Trent's proposed sustainable economic level of leakage target of 269 Ml/day for 2025 is met.
Time point 3: 2030	Demand for water increases still further as more properties are built. Increased tourism in Derby and the surrounding area in response to promotion of the city's attractions and the local food and drink offer also put pressure on resources. Derby becomes an area of water stress.
Time point 4: 2050	Water stress remains a key issue. Lack of available water starts to affect agricultural production (spray irrigation is restricted) as well as sectors such as construction and tourism (e.g. meters are introduced where there is a change of use or owner). There is a movement towards universal water metering to make users more aware of their consumption.

Table 4-10: Uncoordinated scenario storyline: water	
Uncoordinated scenario	**Assumptions**
Data sources and references	Severn Trent Water (2007): Focus on water, Strategic direction statement, 2010-2035, accessed at: https://www.stwater.co.uk/about-us/our-business-and-strategy/our-25-year-plan/ Natural England (nd): NCA profile: 69 Trent Valley Washlands (NE475), accessed at: http://publications.naturalengland.org.uk/publication/5447860266991616?category=587130 URS (2013): Derby City Local Plan, Draft, October 2013, accessed at: http://www.derby.gov.uk/media/derbycitycouncil/contentassets/documents/policiesandguidance/planning/Derby%20City%20HRA%20Oct%202013%20FINAL%20ISSUE.pdf EA (2013): Derbyshire Derwent Abstraction Licensing Strategy February 2013, accessed at: http://maps.environment-agency.gov.uk/wiyby/wiybyController?topic=airpollution&layerGroups=default&lang=_e&ep=map&scale=9&x=435500&y=335500#x=427978&y=333673&lg=1,2,3,4,5,7,9,10,&scale=6

Table 4-11: Uncoordinated scenario storyline: wider economy	
Uncoordinated scenario	**Assumptions**
Projections	***GVA*** GVA per head for 2012 varies as follows: • Derby £27,849 (for Derby, current GVA levels and average earnings are the highest for any city outside of London); • East Derbyshire £16,170; and • South and West Derbyshire £16,986. The top three industries by GVA for 2012 were manufacturing, wholesale and retail trade, and real estate activities. GVA is expected to increase by 144% between 2013 and 2030 in Derbyshire, with GVA for the ICT sector forecast to increase by £655 million between 2013 and 2030. ***Sectoral make-up of economy*** Of those employed, approximately 70% are in full time employment and 30% in part time employment (averaging Derby and Derbyshire). The employment rate of the working age population is around 73%. The strong manufacturing base has been retained in recent years, even though it suffered a decline greater than the national average. The public sector is significant, employing around 28% of workers (based on 2011 census data). The local economy is dominated by larger companies rather than SMEs (low business density) including Bombardier, Rolls Royce and Citi bank (Egg). ***Areas for growth and development*** Areas for economic focus/priority sectors for the D2N2 LEP include: • Transport, equipment, manufacturing; • Medicine/bioscience;

Table 4-11: Uncoordinated scenario storyline: wider economy	
Uncoordinated scenario	**Assumptions**
	• Construction; • Food and drink manufacturing; • Visitor economy; and • Low carbon goods and services. All these sectors are assumed to develop during the study. Visitor spend has shown an increasing trend in recent years. In 2011 it was £1.72 billion (this represented an increase of 20% since 2008) (note that these data relate to a much larger area than that covered by this study). ***Population*** Current population for the study area is estimated at around 200,000. Population growth is expected, with Derby's population anticipated to increase by 16,000 working age people by 2023, and 19.5% in total by 2030.
Time point 1: 2020	Overall GVA levels are maintained, although there are changes in the balance between the various sectors. For instance, some public sector jobs are lost (estimated at 3,000 across Derby so 1,500 for the study area), but the visitor economy continues to grow as in previous years. Efforts are made to develop the priority sectors as advocated by the LEP's Growth Strategy. The decline in manufacturing is slowed through support to high growth sectors, advanced manufacturing and growth in the area's export intensive industries. Supply chain opportunities linked to major employers are built upon, with R&D projects being developed, and collaboration between business and educational institutions taken up in the sectors of transport equipment and medical/biosciences. Efforts are also put into the development of rural microbusinesses as per the LEP's strategy for growth. In addition, more support and training are provided to increase the number of new businesses and the business survival rate. Promotional campaigns are also run to retain more graduates within the D2N2 area to build on existing research strengths. Attempts are made to enhance the private sector employment base (partly to counter the decline in public sector employment) through developing the service sectors (e.g. visitor economy) and knowledge intensive industries. The population of the study area increases slightly, with main areas of growth being south of Derby itself, as well as in the Osmaston triangle and Alvaston (as per the housing growth described in the construction sector).
Time point 2: 2025	GVA for the case study area increases on average in line with the projection for Derbyshire (144% by 2030). A proactive approach is taken to ensure investment in high growth sectors including business and financial services, digital and creative industries, and transport and logistics. Additional jobs are generated in priority sectors including transport equipment manufacturing, medicine/bioscience, construction, food and drink manufacturing, visitor economy, and low carbon goods and services (D2N2 strategy for growth intends for 55,000 extra jobs in the LEP area by 2023; around 25% of these are assumed to be in the study area).

Table 4-11: Uncoordinated scenario storyline: wider economy	
Uncoordinated scenario	**Assumptions**
	The population continues to increase, with the Derby part of the case study area gaining around 8,000 working age people. This has implications for service provision and travel with congestion increasing.
Time point 3: 2030	GVA has increased in line with the projections for Derbyshire (144% by 2030). The priority sectors supported by D2N2 have continued to develop. The tourism industry in particular has grown, building on the combination of city and countryside provided by the Trent Valley. New plans and strategies are formed for the individual sectors to encourage growth to continue. The population of the study area has increased by around 29% from the start of the assessment (based on projected increase in South Derbyshire from 95,000 to 123,000). The population has also become older and more diverse. This causes issues in terms of service provision, since new housing developments have not necessarily been built with sufficient day-to-day services nearby.
Time point 4: 2050	GVA has increased, with much of this growth being in the D2N2 priority sectors. Efforts continue to be put into the development of plans and strategies for these sectors. Further population growth occurs, with people attracted to the area by the buoyant economy. However, service provision and availability/access to public transport remain problematic.
Data sources and references	Derby City Council (2010): Derby Enterprise Growth Strategy, December 2010, accessed at: http://www.derby.gov.uk/media/derbycitycouncil/contentassets/documents/reports/DerbyCityCouncil-Derby-Enterprise-Growth-Strategy.pdf Nottingham Business School: Economic strategy research bureau (2011): D2N2 Strategic priorities and areas of economic focus, accessed at: http://www.d2n2lep.org/write/documents/d2n2_strategic_priorities_and_areas_of_economic_focus.pdf Derbyshire Observatory (2011): 2011 Census: Summary Profile. Policy and Research Division, DCC, accessed at: http://observatory.derbyshire.gov.uk/IAS/ Derby City Council (2011): Derby's Economic Strategy 2011-2016: Driving wealth creation in Derby, accessed at: http://www.derby.gov.uk/media/derbycitycouncil/contentassets/documents/strategies/DerbyCityCouncil-Derbys-Economic-Strategy-2011-2016.pdf ONS: Regional Gross Value Added (Income Approach) NUTS3 Tables, accessed at: http://www.ons.gov.uk/ons/datasets-and-tables/index.html Derbyshire Economic Partnership (2014): Derbyshire Economic Strategy Statement, accessed at: http://www.derbyshireeconomicpartnership.org.uk/derbyshire-economic-partnership/derbyshire-economic-strategy-statement/ Derby City Council (2010): Local Economic Assessment, Executive Summary, accessed at: http://www.derby.gov.uk/media/derbycitycouncil/contentassets/documents/economicassessment/DerbyCityCouncil-Economic-Assessment-Executive-Summary.pdf ONS neighbourhood statistics, accessed at: http://www.neighbourhood.statistics.gov.uk/dissemination/LeadHome.do%3Fa%3D3%26i%3D1001%26m%3D0%26r%3D1%26s%3D1298463767007%26enc%3D1%26extendedList%3Dtrue%26nav%3DA

Table 4-11: Uncoordinated scenario storyline: wider economy	
Uncoordinated scenario	**Assumptions**
	South Derbyshire District Council (2013): South Derbyshire Draft Local Plan, September 2013, accessed at: http://www.south-derbys.gov.uk/planning_and_building_control/planning_policy/local_plan/local_plan_part1/draftlocalplan_part/default.asp?VD=localplan

Table 4-12: Uncoordinated scenario storyline: wildlife and biodiversity	
Uncoordinated scenario	**Assumptions**
Projections	Trent and Dove Valleys local wildlife sites: 35% (29) are in favourable or recovering condition with the main reasons for unfavourable condition being presence of non-native species in woodlands and lack of appropriate management in grasslands. The total area of the Trent and Dove Valleys region is 12,211 ha, of which 4.7% contained priority biodiversity habitat features in 2011. Trent and Dove Valley targets for UK BAP priority habitats priority features are (with 'continue to maintain' the minimum action required to ensure no net loss of biodiversity): • Lowland meadow: continue to maintain 6 ha, further manage 6 ha, restore 30 ha, expand 14 ha (83% already under management in 2011, 33% already under restoration in 2011); • Field margins: manage/restore/expand 30 ha (no current measure of achievement of target); • Reedbed: continue to maintain 46 ha, further manage 35 ha, expand 15 ha (37% currently under management); • Wet woodland: continue to maintain 61 ha, further manage 55 ha, expand 8 ha (69% already under management in 2011); • Lakes and canals: continue to maintain 31, further manage 28 (75% of target currently under management); • Ponds: continue to maintain >150 ponds, further manage 60 ponds, restore 20 ponds, expand 25 ponds (50% of target currently under management); and • Floodplain grazing marsh: continue to maintain 132 ha, further manage 95 ha, expand 30 ha (no current measure of achievement of target). Claylands local wildlife sites: 29% (39) are in favourable or recovering condition with main reasons for unfavourable condition being unmanaged grassland, presence of non-native species in woodlands and pollution incidents. The total area of Claylands is 34,825 ha of which 4.8% contained priority biodiversity resource in 2011. Claylands targets for UK BAP priority habitats priority features are (with 'continue to maintain' the minimum action required to ensure no net loss of biodiversity): • Lowland meadows: continue to maintain 42 ha, further manage 40 ha, restore 165 ha, expand 45 ha (83% already under management in 2011); • Wood-pasture and parkland: continue to maintain 16 sites, further manage 9 sites (67% already under management in 2011); • Hedgerows: manage additional 10 km, expand by 7 km (no current measure of achievement of target); and • Ponds: continue to maintain >500 ponds, further manage 40 ponds, restore 15

Table 4-12: Uncoordinated scenario storyline: wildlife and biodiversity	
Uncoordinated scenario	**Assumptions**
	ponds, expand number of ponds (60% already under management in 2011). Derby Area local wildlife sites: 69% (43) are in favourable or recovering condition. The total area of the Derby region is 7,803 ha of which 5.9% contains priority biodiversity resources in 2011. Targets for UK BAP priority habitats priority features are (with 'continue to maintain' the minimum required to ensure no net loss of biodiversity): • Floodplain grazing marsh: continue to maintain 99 ha, further manage 99 ha and expand 9 ha (no specific measures of target given); • Lowland mixed deciduous woodland: continue to maintain 100 ha, further manage 90 ha, expand 1 ha (90% already under management in 2011); • Wood-pasture and parkland: continue to manage 3 sites, further manage 3 sites (100% already under management in 2011); and • Ponds: continue to maintain >90 ponds, further manage 65 ponds, restore 15 ponds and expand 20 ponds (31% already under management in 2011). National Forest area local wildlife sites: 43% in favourable or recovering condition in 2011. Total area of National Forest of 15,283 ha of which 18.2% contains priority biodiversity habitat features in 2011. Only a very small area of the National Forest lies within the Trent Valley study area but the targets are: • Lowland meadow: continue to maintain 12 ha, further manage 12 ha, restore 150 ha, expand 20 ha (92% already under management in 2011 with 58% of target under restoration); • Hedgerows: further manage additional 10 km, expand 7 km (no specific measures of target given); • Lowland mixed deciduous woodland: continue to maintain 2,194 ha, further manage 2,000 ha, expand 150 ha (76% already under management in 2011); • Wet woodland: continue to maintain 23 ha, further manage 15 ha, expand 8 ha (66% already under management in 2011); • Wood-pasture and parkland: continue to maintain 4 sites, further manage 4 sites, expand 1 site (no specific measures of target given); • Lakes and canals: continue to manage 3 lakes (66% already under management in 2011); and • Ponds: continue to manage >200 ponds, further manage 100 ponds, restore 20 ponds, expand 25 ponds (30% already under management in 2011).
Time point 1: 2020	Actions set out in Local Derbyshire Biodiversity Action Plan continue to be implemented on a site-by-site basis as and when opportunities to incorporate habitat management or enhancement arise and where funds are available. These activities include: providing survey and monitoring data, protecting priority habitats and species, promoting conservation, restoration and creation through the planning system, providing land management advice, raising awareness of biodiversity and developing and implementing projects to achieve LBAP targets. Species Action Plans continue to be developed. Biodiversity is considered within the objective of other sectors where possible including the potential for habitat expansion. Opportunities exist to improve the condition of sites through development proposals, project work and providing advice to owners, and looking to work closely with

Table 4-12: Uncoordinated scenario storyline: wildlife and biodiversity	
Uncoordinated scenario	**Assumptions**
	landowners to encourage land use that helps to meet the targets associated with priority habitats and wildlife and biodiversity more generally.
Time point 2: 2025	Continuation of approach to expand wildlife/biodiversity sites as and where opportunities arise.
Time point 3: 2030	Continuation of approach to expand wildlife/biodiversity sites as and where opportunities arise.
Time point 4: 2050	Existing approach to wildlife/biodiversity sites continues, with actions implemented on a site-by-site basis as opportunities arise.
Data sources and references	Lowland Derbyshire Biodiversity Partnership (2011): Lowland Derbyshire Biodiversity Action Plan 2011 to 2020, accessed at: http://derbyshirebiodiversity.org.uk/news/files/Lowland_Derbyshire_Biodiversity_Action_Plan_2011-2020.pdf

4.3 Coordinated scenario

The vision identified for each sector is given below with a description of what each sector would look like at the key time points through the appraisal. This is supported by the assumptions that underlie the scenario and which therefore set out the scenario storyline.

Table 4-13: Coordinated scenario storyline: aggregates	
Coordinated scenario	**Assumptions**
Time point 1: 2020	Aggregates extraction continues in some areas, focusing on those which are less environmentally sensitive. Final restoration begins on worked out pits and where extraction has stopped. Restoration is undertaken with consideration given to the wider landscape, in line with the vision. In particular: • Current restoration plans are revised to increase the provision of lakes for water-based recreation. Aggregates companies work with existing marinas and sailing clubs to create lakes that provide for a wider range of water-based recreation activities than at present. Thought is given to the development of a watersports venue to enable kayaking/canoeing, windsurfing, sailing, cable skiing and a rowing course. Activities (e.g. water skiing) that have a higher risk of causing disturbance are thoughtfully located away from sensitive receptors. Low impact recreational boating (of the kind seen in the Norfolk Broads) is seen as a way of encouraging economic activity and visitor spend in a way compatible with the natural environment, and site restorations are coordinated to facilitate access to such boats; • Restoration has regard to the East Midlands Safeguarding Zone, with certain locations restored in ways which minimise their attractiveness to nesting/roosting birds. In other areas, the new water based recreation provides some level of disturbance which reduces the occurrence of certain nesting birds; • New footpaths and cycle ways are added to join up with existing routes and provide circular walks. The heritage of the area for quarrying is used as an attraction with interpretation boards explaining the process and impacts of restoration; and

Table 4-13: Coordinated scenario storyline: aggregates	
Coordinated scenario	**Assumptions**
	• Restoration plans are revised to include the potential for woodland planting including withies/willow on wetter areas. The willow provides a break in the landscape such that the 'holes' are screened, and also generates a resource in its own right (as timber linked to construction needs to fit with landscape, and as biomass/biofuels).
Time point 2: 2025	Final restoration begins at worked out pits. New permissions are granted in line with the location of demand for materials, drawing on coordinated developments and physical infrastructure projects, to maintain a supply of 1.09 mt per year. Environmental restoration and land use look to match the 'flow' of the valley and the linkages to adjacent areas, with increasing importance of woodland. Transport links are also considered including the potential to move some of the extracted material by water. Investigations are carried out into opportunities to develop additional marinas, linking with the canal as well as the previously restored gravel workings. These enhanced facilities are intended to deliver tourism and recreation benefits without causing bird strike issues for East Midlands Airport. A wide range of water-based recreation occurs on different lakes, with different offerings on each lake with more motorised sports available on lakes nearer to roads (to minimise off-site noise issues) or at key hubs, and quieter activities on other lakes. The potential for increased recreational opportunities is explored, especially where there may be opportunities to add a quarrying aspect to the Derwent Valley Heritage Way, joining up with the long distance footpath and adding to the existing recreation/tourism offerings, e.g. high quality fisheries with links to existing campsites. Footpaths and cycle ways provide the opportunity to view the water sports activities as well as biodiversity.
Time point 3: 2030	Excavation continues to provide the remaining tonnage required within the plan period, with ongoing restoration as phases are completed. Restoration is tailored according to the needs of the wider landscape and may include provision of interconnected lakes, willow/withy planting, heritage trails, etc. The restoration activities will take account of the habitat needs for wildlife/biodiversity, reflect the heritage of the area and provide additional tourism/recreation opportunities linking to the wider strategy for a long distance Trent and Dove valley footpath, as well as more local recreational needs.
Time point: 2050	Sand and gravel extraction continues to be directed towards less sensitive areas and to those areas with the greatest potential to deliver environmental gains upon restoration, with full consideration given to site restoration and links with neighbouring areas prior to extraction. Restoration schemes are considered at the landscape level to maximise delivery of ecosystem services including opportunities for nature based recreation. Woodland is fully developed as a habitat in its own right and as a resource, with the aim being to provide resources for high end uses, such as local construction materials that further fit with the theme of linking to the natural environment. Woodland is also used as a smooth transition to neighbouring areas, especially the National Forest (located outside the study area).

Table 4-13: Coordinated scenario storyline: aggregates	
Coordinated scenario	**Assumptions**
Changes needed to enable vision to be implemented	• Review of restoration plans with quarry companies to agree different end goals • Identify organisations that can take over (or share) responsibility for managing restored sites in line with their purpose of restoration • Identify funding sources to support organisations that take over (or share) responsibility for the sites • Establish appropriate policy wording in emerging Local Plans including the Minerals Local Plan and district/borough plans, ensuring each plan recognises and supports the aims of the others

Table 4-14: Coordinated scenario storyline: agriculture	
Coordinated scenario	**Assumptions**
Time point 1: 2020	Traditional agricultural economy declines slightly as less sensitive land is used for aggregates extraction and housing development. Where agriculture remains, stewardship of the land to maximise ecosystem service provision is important, along with the provision of high quality local products. Local products are promoted e.g. through continuation of Derbyshire County Council's Made in Derbyshire campaign, with emphasis on food and drink from traditional land use and processing of products on farms to provide added value. Local products are either sold on the farms themselves or at farm shops, and in local markets/outlets. Development occurs of more sustainable, niche products that reduce resource use (water, fertiliser, pesticides, etc.). Land use change is predominantly driven by the need for sustainable products and diversification (e.g. to biomass crops where environmental sensitivities are lower) rather than CAP greening (although this does have a role).
Time point 2: 2025	Careful stewardship of sensitive areas continues, with diversification occurring in other locations. Continued development of local produce with exploration into new markets including online and to supermarkets through cooperative working amongst farmers.
Time point 3: 2030	Established trends continue, with ongoing marketing of the Made/Grown in Derbyshire brand, linking up with tourism/recreation promoting local products. The storyline becomes nationally and internationally recognised for the way it integrates the natural and built environment. Links are made between the heritage of the area (sand and gravel quarrying) and the food produced. Trails around the restored lakes provide recreational opportunities, as well as attracting customers to farm gates to buy products.
Time point: 2050	Agricultural economy continues to shrink as aggregates extraction and housing growth utilise more land. Whilst significant diversification has occurred in some locations (e.g. to biomass crops, fishing lakes, recreational trails), the focus of agriculture in the environmentally sensitive areas is land stewardship involving the production of high quality food whilst maintaining provision of ecosystem services.
Changes needed to enable vision to be implemented	• Identify funding sources to enable farms to invest in technology and equipment, and development of new skills to help them process their produce • Awareness campaign on emerging/new/potential products (including energy crops) • Targeting of Countryside Stewardship funding to assist in the sensitive management of areas of historic landscape

Table 4-15: Coordinated scenario storyline: construction (including residential development)	
Coordinated scenario	**Assumptions**
Time point 1: 2020	Housing and business property development occurs across the study area with around 6,000 houses built focusing in on the city and the surrounding area. There is also the development of 44ha of employment land and 17,000 sqm of office space. There is a new secondary school in South Derby, providing space for up to 2,000 pupils. This is linked to key housing areas by footpaths and cycle ways, providing alternatives to car travel. Developments within Derby itself focus on brownfield sites where possible. For the business premises, covered cycle racks are provided and thought is given to how workers will travel (with access to the bus network a key consideration when looking at site locations). For the greenfield areas that are needed, developments are carefully planned to allow opportunities for walking and cycling, for example: • Footpaths link the development to the Derwent Valley Heritage Way; • Cycle ways to enable residents to access services in larger settlements (e.g. Derby and Burton upon Trent) without using cars; and • Where services are not within walking distance, housing developments include the provision of green spaces, schools and basic amenities to minimise the need for car travel for everyday activities, and 'wild areas' for children to play. Developments include sustainable urban drainage systems (SUDS) to attenuate flows and avoid increasing the amount of runoff entering the sewerage system, as well as to create wetland habitats. Consideration is also given to the need for design coding (a set of rules/requirements for development) to encourage high quality housing to fit with the high quality environment being created, and to reflect the flow of the landscape and the connections between the river, its floodplain and the river terraces.
Time point 2: 2025	Construction continues with another 6,000 homes, 44 ha of employment land and 17,000 sqm of office space. Focus is on development of brownfield sites which are on bus routes, or close to main roads where supply/distribution of materials and goods is likely to be required. Hotspots of high end design encourage interest from other developers and investors in moving into the valley. Several new developments are linked to the new combined heat and power plant in the area, which meets all their electricity requirements. The plant also provides heating for up to 5,000 homes in total. All housing developments are built with pedestrians and cyclists in mind, with wide footpaths/cycle paths and green spaces to encourage walking/cycling. Housing built around the city is positioned to enable easy access to the centre via bus routes, with additional local amenities also built as required. In addition to the use of SUDS, careful consideration is given to the siting of buildings to avoid locating them in flood risk areas, or adding significantly to the volume of water in the sewers through using permeable paving materials. Through design coding, high quality construction is promoted, with properties built to

Table 4-15: Coordinated scenario storyline: construction (including residential development)	
Coordinated scenario	**Assumptions**
	be energy efficient. Developers recognise the value of linkages to/from the natural environment and to other areas in raising the value of their properties. Strong links with the landscape are encouraged, with river views meaning the high quality homes attract buyers who are willing to pay to live in such an attractive area.
Time point 3: 2030	More construction occurs, with the aim of creating communities with easily accessible services, outdoor spaces and links to other areas to improve social infrastructure. Green infrastructure is an overarching objective to which all aspects of the development of the area contribute wherever possible, helping to create uniqueness of place. Properties built include another 6,000 homes, 44 ha of employment land and 17,000 sqm of office space. The development which is linked to the new combined heat and power plant is expanded. The homes are complemented by a new school, doctors' surgery and shopping area, all of which are linked to the heat and power plant. Access roads to the north and south are improved, with cycle routes and footpaths a key part of the expanding development. Access to areas of green space (including nature reserves) is enhanced, increasing the opportunities available for residents to undertake outdoor based recreation. Careful siting of properties, the use of SUDS and permeable paving, and the increased level of green infrastructure incorporated into new developments helps to minimise any flood risk. Design coding also ensures water and energy efficiency.
Time point: 2050	Developers continue to build high quality, efficient homes according to the design coding established for the area. Demand for the properties is high due to the attractiveness of the area as a place to live. Business premises are also built in line with high standards, taking into account employee needs with regard to transport and green space provision.
Changes needed to enable vision to be implemented	• Changes to conditions applied to planning permissions to ensure that large developments must incorporate green spaces, footpaths and cycle ways with due consideration given to access to services • Establish planning policy in support of the Trent Valley vision

Table 4-16: Coordinated scenario storyline: energy generation	
Coordinated scenario	**Assumptions**
Time point 1: 2020	Support is provided for a local renewable energy park. Energy generation at property and community levels is also promoted as and where appropriate e.g. use of solar PV panels. This helps to mitigate the increase in energy demand resulting from servers and other digital technologies within the Trent Valley. Care is taken to have the right balance between energy crops and food production, linked to sustainability and environmental benefits as well as economic output. Careful siting and screening of new and existing energy infrastructure ensures it does not blight the valley.

Table 4-16: Coordinated scenario storyline: energy generation	
Coordinated scenario	**Assumptions**
Time point 2: 2025	Support for renewables appropriate for the area continues. Aggregates restoration at lakes includes floating solar panels or water-source heat pumps encouraging sustainable energy use with this used as an additional attraction/point of interest at the newly developed water sports park. It also enables local developments to generate the electricity that they need.
Time point 3: 2030	Continued support for local energy generation taking account of opportunities for generation at the property/community scale as developments are proposed to improve overall level of local generation within the Trent Valley, including when aggregate extraction sites are being restored.
Time point: 2050	Work continues to increase renewable energy generation capacity, including the use of solar panels on restored lakes, and innovative schemes at new developments. Some woodland created earlier during aggregates extraction may also start to provide a viable source for small scale energy generation. All electricity generation devices are implemented so that they can be connected to the national grid as well as to a local distribution system.
Changes needed to enable vision to be implemented	• Changes to planning to encourage consideration of potential for energy generation at an appropriate scale within all developments and restorations

Table 4-17: Coordinated scenario storyline: health and wellbeing	
Coordinated scenario	**Assumptions**
Time point 1: 2020	The health and wellbeing strategy is implemented as per the uncoordinated scenario. It is also linked to aims to improve general quality of life through: • Improving access to recreation; • Promoting a stronger sense of place (local food/drink production, heritage, wildlife and links to key economic sectors); and • Increasing investment in and retention of highly skilled employment opportunities. Health and wellbeing aspects are included in the development of infrastructure and economic strategies, thus ensuring a high quality Trent Valley for those living, working and visiting the area. Links between environment and health start to be taken into account in development planning. Policies are developed to encourage the provision of appropriate accommodation for an ageing population, also the necessary social infrastructure in the form of medical and health services. In addition, opportunities for recreation to support health and wellbeing are promoted. There is continued monitoring of air quality to assess the potential impacts on health.
Time point 2: 2025	Focus is on enhancing quality of life through, for example: • Development of a water sports park and more local recreation opportunities at restored sand and gravel extraction sites; • Continued construction of high quality homes where they are needed to help reduce commuting times and congestion; • Strong development of sense of place through schemes such as Made in

Table 4-17: Coordinated scenario storyline: health and wellbeing	
Coordinated scenario	**Assumptions**
	Derbyshire promoting the industrial (aggregates extraction, manufacturing, R&D) and agricultural heritage of the Trent Valley with greater recreational offerings that bring together heritage and wildlife/biodiversity with greater access to outdoor activities, improving attractiveness of the area to investors, skilled employees and visitors; and • Monitoring air quality and taking action where limits are approached or breached. Consideration is also given to other ecosystem services that are directly relevant to health.
Time point 3: 2030	Focus on enhancing quality of life continues. Air quality is monitored along with the provision of other ecosystem services relevant to health outcomes. Green infrastructure (including trees) forms a critical part of new developments. Green spaces are enhanced with tree planting where possible to provide shade (protection from UV radiation and heat), reduce the heat island effect, contribute towards improved air quality and add to the amenity of the area. There is a continued emphasis on health and wellbeing as part of manufacturing/R&D and physical infrastructure strategies, further building in green infrastructure, recreational opportunities and links to the wildlife/biodiversity value of the area.
Time point: 2050	Health and wellbeing are strongly linked to the environment in which people live such that the high quality housing, opportunities for easily accessible skilled employment and plentiful nature based recreation contribute to improved health outcomes for the area.
Changes needed to enable vision to be implemented	• Include health and wellbeing of residents, workers and visitors within decisions made about changes to the Trent Valley, especially when developing future visions so quality of life becomes a key factor • Establish planning policies in Local Plans that promote design quality to encourage the very best environments

Table 4-18: Coordinated scenario storyline: heritage	
Coordinated scenario	**Assumptions**
Time point 1: 2020	The profile of the area in terms of its heritage is raised. This is carried out by developing heritage trails and stronger linkages with industrial heritage such as aggregate extraction, power generation, engineering and manufacturing. For example, the heritage profile could reflect the historical importance of the Trent for transport, water power and food. It could also encompass the many mills and fisheries, including evidence such as the discovery of possible remnants of a fish weir in the abandoned river channels at Hemington. Continued constructive conservation occurs but with an emphasis on raising the profile of the area's heritage as a tourist attraction and providing a stronger sense of place for communities. The heritage, culture and history of the valley are also connected to the natural environment to provide a wealth of recreational and visitor attractions. These are linked to the Trent Valley 'Storyline' that provides a narrative and a brand looking to bring together the built and natural environment in a way that provides the tale of the Trent Valley. As a Conservation Area, the Trent and Mersey Canal is a key feature of this storyline.

Table 4-18: Coordinated scenario storyline: heritage	
Coordinated scenario	**Assumptions**
Time point 2: 2025	Further and ongoing development of the heritage offer occurs, including branding such as 'Made in Derbyshire' bringing in current production. There is also the development of heritage aspects of aggregates restoration, e.g. Bronze Age boats at Shardlow and links to Derwent Valley Heritage Way at Elvaston. There is significant potential for footpaths and cycle ways to be incorporated providing a range of walks around the restored gravel pits, linking to the towpath walk along the Trent and Mersey Canal but also directly linking to historic towns such as Repton. Historic and heritage aspects are included in the range of walks, such as links to the location of the Bronze Age boat finds and then to Derby Museum to see one of the boats.
Time point 3: 2030	Constructive conservation continues with further development of opportunities to link aggregates and manufacturing history with tourism/recreation and sense of place. The importance of historic towns like Repton and the Trent Valley storyline continue to be used to bring together the heritage, culture and history of the area to attract visitors.
Time point: 2050	Work to conserve historic features continues, ensuring that they are viewed as part of the bigger Trent Valley storyline. This facilitates green infrastructure links between features to promote environmentally friendly tourism and informal recreation by residents. The storyline is also used to encourage visitors to come to the area, and hence grow the expanding heritage tourism industry.
Changes needed to enable vision to be implemented	• Identify funding sources to raise profile of heritage assets as part of the tourism offer, including working with landowners to identify industrial heritage of previous and current land uses and how this can be highlighted

Table 4-19: Coordinated scenario storyline: physical infrastructure	
Coordinated scenario	**Assumptions**
Time point 1: 2020	D2N2 Infrastructure Investment Board (IIB) is involved in developing a long-term infrastructure plan for the Trent Valley (and wider D2N2 area) taking account of the Landscape Vision and the potential wider benefits of the coordinated scenario. This incorporates a wide range of physical infrastructure needs and the extent to which physical infrastructure underpins the requirements for other sectors to meet their potential. The IIB covers all physical infrastructure necessary to ensure that the vision of the coordinated scenario can be met, covering transport, green infrastructure, flood risk management, services and social infrastructure, waste, interactions between sectors, broadband/communications, and the natural infrastructure (rivers, canals, nature reserves, wildlife corridors) bringing these all into account to inform the future of the Trent Valley (and wider D2N2 area). This involves reconsideration and potential redesign of short and longer term proposals for physical infrastructure improvements (e.g. River Trent Crossing and Walton Bypass, and Long Eaton Town Centre Package) to ensure that these fit with the landscape vision while still supporting economic growth and addressing disparities in terms of economic and social well-being. Opportunities are taken to begin transforming the landscape in line with the vision through design and implementation of new transport and wider infrastructure developments. Projects that involve work on linear transport assets within the valley are undertaken to fit with the vision and to link with the Trent Valley 'Storyline' and

Table 4-19: Coordinated scenario storyline: physical infrastructure	
Coordinated scenario	**Assumptions**
	brand. This includes opening up access for recreation and tourism along the river, through footpaths and cycle ways for short, local trips, through public transport for longer journeys, linking to existing public transport networks and identifying opportunities to fill gaps through a public transport strategy that is focused on developing inter-connectedness and widening transport choices within and between communities, recreational sites and employment sites. Particular emphasis is placed on encouraging local firms to bid for work to design, plan and implement physical infrastructure projects.
Time point 2: 2025	Implementation of the D2N2 IIB's long-term strategic infrastructure and services plan with funding from the Government's Local Growth Fund targeted at where physical infrastructure investments could deliver the greatest overall benefit (taking account of economic, social and environmental benefits) to improve quality of life through sustainable economic growth. Again this reconsiders proposed improvements such as the Swarkestone Causeway to ensure that it fits within the landscape vision and is designed to deliver social and environmental benefits as well as economic benefits. Transport infrastructure investment moves to public transport, building on the public transport strategy, with opportunities for water taxis exploited by private operators, drawing on increased demand from local residents as well as from visitors. Investment is attracted for the development of a monorail that will link to existing visitor attractions and new developments to provide easy access, again taking advantage of the demand for environmentally friendly modes of transport. The transport modes are linked to the Trent Valley 'Storyline' with existing companies also buying into this as a brand and providing their own inputs to support it (e.g. story of manufacturing, history of aggregates, etc.). This provides private funding to assist with the connectivity of the 'Storyline' such that it begins to become a linear feature in its own right.
Time point 3: 2030	Continued implementation of the D2N2 IIB's long-term strategic infrastructure and services plan with funding priorities reflecting the later priorities, such as linkages with HS2. The public transport strategy is fully developed, encouraging use of footpaths and cycle ways for short, local journeys, linked to water taxis, buses, and the monorail for journeys around the Trent Valley, then linked to the rail network and HS2 for journeys outside of the Valley. The high quality road links are also maintained with the focus being on their use where public transport links to locations outside of the Trent Valley are less developed.
Time point: 2050	The Trent Valley becomes a demonstration project showing how a well-managed and designed transport network can reduce reliance on cars, encourage local trips to be made using footpaths and cycle ways, and longer trips through a well-connected public transport system. The linear transport features are designed to fit within the 'flow' of the Trent Valley so they form an integral part of the landscape and the opportunities that the Valley offers for homes, businesses, employment, services, recreation and visitors.
Changes needed to enable vision to be implemented	• Revision of role of D2N2 IIB to give it a longer-term focus (looking to 2030 and beyond) • Changes to planning approaches to enable longer-term projects to be brought into the planning system and considered at an early stage (e.g. to link with HS2 and

Table 4-19: Coordinated scenario storyline: physical infrastructure	
Coordinated scenario	**Assumptions**
	associated developments) • Changes to industry planning timeframes and associated funding systems (e.g. Ofwat) so that future projects can secure funding at a much earlier stage providing the basis for a more coordinated approach to development taking account of needed changes to physical infrastructure to underpin other developments

Table 4-20: Coordinated scenario storyline: manufacturing and research & development	
Coordinated scenario	**Assumptions**
Time point 1: 2020	Development of a manufacturing strategy in response to the construction of HS2 and the East Midlands Hub, with identification of proposals for encouraging manufacturers within the area to bid for contracts as well as the potential for further enhancing the manufacturing strengths of the area through tailored development. Recognition of the historic importance of manufacturing to the area and use of this to help promote the visitor economy. Strategy brings together all the aims and priorities in existing plans and looks to provide a coordinated approach, taking account of how manufacturing and R&D fit into the Trent Valley economically, socially and environmentally. The strategy also identifies future projects and funding opportunities to realise these projects. Involvement of D2N2 Infrastructure and Investment Board and establishment of a specific Manufacturing and Research Board involving a mix of councillors and representatives from large and small R&D companies, chamber of commerce, etc. to develop a long-term strategy for manufacturing taking account of how manufacturing fits into the Trent Valley and wider D2N2 area, skills, attracting investment, etc. This builds upon the current D2N2 action plan looking to identify projects and schemes to implement the action plan through consideration of how manufacturing fits within the Trent Valley and with the Trent Valley Landscape vision. The strategy identifies manufacturing and R&D needs, research priorities and forges stronger links between academic institutions and businesses to encourage innovation. This enables the sector to continue to flourish in the Trent Valley as well as attracting wider investments that may be required to exploit opportunities and address weaknesses. This could include, for example, research into agricultural technologies and new, more sustainable products. Investments into Infinity Park, Growth Hub, etc. continue but are reconsidered and potentially redesigned to ensure that they fit with the landscape vision and that they deliver social and environmental benefits as well as economic benefits.
Time point 2: 2025	Implementation of the strategic plans of the Manufacturing and Research Board linking with the ongoing construction of HS2, with focus on the East Midlands Hub station at Toton. Use of HS2 and other physical infrastructure and construction developments to highlight potential of the area for investment, with focus on skills base and quality of the environment as attraction for investment and retention of highly skilled workers.
Time point 3: 2030	Continued implementation of the Manufacturing and Research Board's strategy linking with continued construction of HS2 with continued emphasis on the strength of the Trent Valley to encourage expansion of existing manufacturing centres and further investment to increase the 'hub' element of the advanced manufacturing economy.

Table 4-20: Coordinated scenario storyline: manufacturing and research & development	
Coordinated scenario	**Assumptions**
	The growing reputation of the Trent Valley as an area of high environmental quality is recognised as a key asset by manufacturing companies and drives investment into high quality, sustainable products.
Time point: 2050	The maturation of the landscape into an internationally recognised area of beauty enables manufacturers to attract highly skilled employees, helps to retain skills and hence allows manufacturers to invest with confidence. The strong public transport links also allows manufacturers to move their products efficiently and effectively within the local area, as well as enabling visiting companies or representatives to easily reach them. Synergies within the valley grow ever stronger, further encouraging inward investment and development of the local skills base.
Changes needed to enable vision to be implemented	• Establishment of the Manufacturing and Research Board with powers to develop strategic plans, identify funding sources and allocate funds to projects that provide the greatest economic, environmental and social benefits taking account of not just the needs of manufacturing/R&D but also the wider needs of the Trent Valley and improvement of quality of life • Long-term planning to enable masterplanning associated with HS2 and inter-linkages between construction, physical infrastructure and the advanced manufacturing sector • Identification of funding sources to promote historic importance of manufacturing and links between manufacturing and the visitor economy

Table 4-21: Coordinated scenario storyline: tourism, recreation, retail and leisure	
Coordinated scenario	**Assumptions**
Time point 1: 2020	The visitor economy is one of the priority sectors of the LEP, so considerable effort is put into providing advertising for both city based activities and those of a more outdoor nature, e.g. canoeing associated with river conditions, scenery and weirs. The World Heritage Site at Derwent Valley Mills is a big attraction, and is linked to the Derwent Valley Way to encourage visitors to stay longer and explore more of the area. Other long distance routes in the area are also marketed, with additional routes providing links between the city and the surrounding landscape. Projects that involve work within the valley are undertaken to fit with the vision and to begin to fill gaps such that the 'flow' of the valley from the river, through the floodplain and onto the river terraces begins to develop. This includes opening up access for recreation and tourism along the river, through footpaths, cycle ways, access for angling, links to heritage/history and the future changes that will happen. Potential is explored for linking sections of footpath along the Rivers Trent and Dove to provide the basis for a new long distance footpath. The heritage and history of the valley are emphasised and linked to the natural environment to provide a wealth of recreational and visitor attractions, connected to the Trent Valley 'Storyline' that provides a narrative and a brand looking to bring together the built and natural environment in a way that provides the tale of the Trent Valley. Work also begins on promotion of the Trent Valley as an area for boating holidays and day trips. This initiative builds on the success of sites such as Mercia Marina, which provides mooring for narrow boats along with shops, restaurants, and opportunities to watch wildlife.

Table 4-21: Coordinated scenario storyline: tourism, recreation, retail and leisure	
Coordinated scenario	**Assumptions**
	Local leisure and tourism businesses work with aggregates extractors, to enhance existing facilities, with the aim of developing further the boating and water sports opportunities. This necessitates revision of existing restoration plans, but provides the potential for activities such as water skiing, kayaking/canoeing, windsurfing, rowing, cable skiing, family boating areas, open water swimming, etc. Footpaths and cycle routes are built into the restoration plan from the beginning, to increase the amount of green infrastructure and enable people to easily access the sites for informal recreation. Much is made of the quarrying heritage of the area, with circular walks developed and interpretation boards put at strategic points.
Time point 2: 2025	The tourism offer of the area is marketed in a joined up way, with much being made of locally produced food and drink (building on the strong food and drink manufacturing sector) and the area's key heritage attraction, the Derwent Valley Mills. Farms located in the south of the area develop their own distinct brands, with 'food and drink trails' added to the list of activities and things to do. The waterways are marketed as tourist attractions (e.g. Trent and Mersey Canal for its heritage), but also as places for local people to undertake informal recreation. New property developments and restoration plans for aggregates extraction sites pay greater attention to accessibility by foot and bike, so access to green spaces for informal recreation is far easier than previously. Public transport expands through opportunities for water taxis exploited by private operators, drawing on increased demand from local residents as well as from visitors. A monorail is developed that links existing visitor attractions and new developments to provide easy access, again taking advantage of the demand for environmentally friendly modes of transport as well as becoming an attraction in its own right. The transport modes are linked to the Trent Valley 'Storyline', which describes the history of the valley (including the Saxons, and the Viking army at Repton) up to the present day. Existing companies also buy into this as a brand and develop their own inputs to support and further build the storyline (e.g. story of manufacturing, history of aggregates) to provide a valley-wide tourism experience. At former extraction sites, plans are developed for marinas to link with the canal network, to provide additional tourist attractions and recreational opportunities through the restoration of lakes to offer watersports opportunities, development of high quality fishing opportunities, and use of interpretation boards to explain about the area's heritage. Various activities are available on the different lakes including motorised sports as well as quieter activities such as rowing and sailing. Further work is put into marketing the area as a place to explore by boat (with the waterways branded as the 'Trent Valley Broads'), with boating day trips and holidays being offered.
Time point 3: 2030	The number of tourists visiting the area increases, as does the amount of informal recreation undertaken by locals, due in part to the improved links between different areas (due to more and better connected footpaths, cycle ways, public transport) and the joined-up nature of the activities available. The restored aggregate extraction sites provide a wide range of watersports opportunities and fishing. In addition, the 'Trent Valley Broads' brand is further promoted, with increasing numbers of people taking up boating holidays and day trips on the wetlands. The long distance Trent and Dove valley footpath/cycleway continues to be a priority with further work to fill gaps and improve the attraction of the walk though links with

Table 4-21: Coordinated scenario storyline: tourism, recreation, retail and leisure	
Coordinated scenario	**Assumptions**
	the heritage and wildlife value of the valleys. The route is identified to maximise links with existing attractions, villages and services, as well as to/from the natural environment and public transport. Retail opportunities are enhanced by a number of local food and drink companies which are associated with particular farms in the south of the study area. Food and drink trails are also a popular feature. Woodland begins to be developed as a resource for timber of specialist trades (e.g. coppicing for heritage and craft uses). The focus is on the provision of high quality accommodation, with plenty of information available on Trent Valley and the attractions of the wider region. The Trent Valley 'Storyline' brand becomes nationally and internationally recognised for the way it integrates the natural and built environment, and the current landscape with the historic one such that visitor numbers increase, providing further incentive for private investors to continue to develop new attractions and ensure the overall connectivity of the recreation/tourism/heritage/wildlife offering.
Time point: 2050	The landscape matures into an area that is recognised internationally for its quality as a tourism destination, as well as nationally and locally for the range and quality of the recreational opportunities. In particular, the Trent Valley becomes well known as a place to explore by boat, with both boating holidays and day trips popular with visitors. Accommodation is linked to the natural environment both in design and physically, and public transport and green infrastructure enable people to move around the area making maximum use of the visitor attractions and trails such that the Trent Valley experience is highly valued.
Changes needed to enable vision to be implemented	• Changes to restoration plans for aggregates extraction • More joined up approach when planning and implementing new footpaths and cycle ways to ensure locations are better connected, with an overall vision of creating a long distance footpath along the Trent and Dove valleys • Themed visitor development around water bodies, footpaths and cycle ways involving active holidays, bird watching, cycling, heritage trails, etc. with non-vehicle links to other areas • Promote and look to create and enhance recreational opportunities such as angling, swimming, etc. • Create strong links between planning for transport and the needs of visitors to the area and those looking to utilise recreational opportunities

Table 4-22: Coordinated scenario storyline: water	
Coordinated scenario	**Assumptions**
Time point 1: 2020	Despite increases in the number of properties, the demand for water increases only slightly, in response to the significant effort put into encouraging water efficiency and minimising waste. Both water companies within the area significantly overachieve on their leakage targets. The relationship between the river and its tributaries and water use/efficiency begins to be reinforced in the local consciousness. New developments include sustainable urban drainage systems (SUDS) to attenuate

Table 4-22: Coordinated scenario storyline: water	
Coordinated scenario	**Assumptions**
	flows and avoid increasing the amount of runoff entering the sewerage system, with additional benefits for water quality. Consideration is given to adjusting flood risk management to work with natural processes and capture green or soft approaches. This potentially includes setting back defences to enable development of natural flood management through floodplain meadows.
Time point 2: 2025	Whilst the Valley remains an area of moderate water stress, water resource is considered during the design and construction of the residential and business properties being built. In addition to the use of SUDS, careful consideration is given to the siting of buildings to avoid locating them in flood risk areas or adding to the volume of water in the sewers through using permeable paving materials. Water recycling is encouraged where possible, with water butts being fitted as standard. Education campaigns continue to be run by both water companies operating in the area. These help to further develop links through green infrastructure creating an ever stronger sense of place that is driven by the presence of and interaction with the river. The plans for the restoration of aggregates extraction areas are changed, so there is minimal increase in the area of agricultural land (and no rise in agricultural abstractions). Woodland and wet woodland are used to provide natural flood management measures. Further consideration is given to opportunities to use soft defences in place of hard defences to help naturalise the look of the river and work with natural processes to attenuate high flows and minimise the flood risk to properties and other assets.
Time point 3: 2030	Further increases in housing and business premises increase the number of people requiring potable water, but demand is carefully managed through educational programmes. Water butts and other efficiency measures are fitted to all new residential properties, with older properties also being offered certain measures. Meters are installed on all new builds and where there is a change of owner to further encourage awareness of water use. Careful siting of properties, the use of SUDS and permeable paving, and the increased level of green infrastructure incorporated into all new developments help to minimise any flood risk and improve water quality. Natural flood management is further utilised to the extent possible, making use of woodland, wet woodland and floodplains where soft measures can replace hard defences. Demand for abstracted water from the agricultural sector stays constant or even decreases slightly as farmers change their practices to minimise water use.
Time point: 2050	SUDS and green infrastructure become commonplace within all developments with woodland and use of soft defences supporting natural flood management. Movement towards restoring the connection between the river and its floodplain continues. The landscape as a whole matures into one that respects nature's demand for water, and the importance of water as part of the visual appeal of the area. This strong linkage with the valley further encourages consideration of water use by residents, visitors and businesses.
Changes needed to enable vision to be	• Need to increase education about water use and efficiency to reduce demand for potable water

Table 4-22: Coordinated scenario storyline: water	
Coordinated scenario	**Assumptions**
implemented	• More emphasis on comprehensive measures to improve water quality and the link between water quality and the beauty of the landscape, richness of biodiversity and water-based recreation

Table 4-23: Coordinated scenario storyline: wider economy	
Coordinated scenario	**Assumptions**
Time point 1: 2020	GVA levels are maintained since decreases in sectors such as public services are counteracted by increases in other areas. Sectors doing well include the priority sectors of food and drink manufacturing, and the visitor/leisure economy. The visitor economy in particular is boosted by changes in aggregate restoration plans which result in the development of a significant water sports area. Considerable efforts are put in to linking up different sectors to ensure that any benefits are shared around and provide more opportunities e.g. production of local food and drink subsequently being marketed to visitors. The Trent Valley 'Storyline' provides a narrative and a brand looking to bring together the built and natural environment in a way that provides the tale of the Trent Valley and helps to encourage new business opportunities through diversification. As per the LEP's Strategy for Growth, various activities are carried out to support businesses, e.g. support to high growth sectors, take-up of opportunities linked to the supply chain, collaboration between businesses and educational institutions, and support to new businesses. Other activities include encouragement of "seed-bed" enterprises at small scale through Local and Neighbourhood Plans. Efforts are made to link various sectors and initiatives, rather than them being developed separately. For example, new developments and investments provide opportunities for the growth of the advanced manufacturing sector, as well as R&D. Opportunities are taken to utilise local colleges and universities to increase the overall skill level of the population, with companies encouraged to take on and train apprentices. The population of the study area increases slightly. Within Derby, growth areas are mainly located in older areas where brownfield sites are used for construction of houses and new business premises. New communities are formed elsewhere where they reflect the 'flow' of the landscape and the connections between the river, its floodplain and the environment of the river terraces. This better enables new businesses to be accommodated within a more robust and resilient landscape.
Time point 2: 2025	The GVA for the area continues to increase in line with projections. Jobs are generated in the LEP's priority sectors including transport equipment manufacturing, medicine/bioscience, construction, food and drink manufacturing, visitor economy, and low carbon goods and services (D2N2 strategy for growth intends to create 55,000 extra jobs in the LEP area by 2023; around 25% of these are assumed to be in the study area). The different sectors continue to work together to develop additional opportunities and further upskill the local populations. For example, training programmes at local colleges are geared specifically towards the manufacturing and knowledge needs of R&D and advanced manufacturing. Hotspots of high end design encourage interest from other developers and investors in

Table 4-23: Coordinated scenario storyline: wider economy	
Coordinated scenario	**Assumptions**
	moving into the valley. They also attract private sector funding that helps to not only fill more of the funding gaps but to regenerate existing areas such that they can become part of the 'flow' of the Valley. Again, this encourages ever stronger links with the landscape, reinforcing the style and design of business development land and buildings. The population continues to increase. The location of the new developments, along with the provision of footpaths and cycle ways, means that the area can absorb the extra population without significant extra traffic being generated and without this affecting the quality of the environment or the visual appeal of the area. In addition, new housing areas are equipped with services and social infrastructure to avoid the need for people to travel by car for everyday needs. Regeneration occurs in pre-existing developments on the back of rising land values and the area becomes more attractive to highly skilled people.
Time point 3: 2030	GVA has increased in line with the projections for Derbyshire (144% by 2030). Advanced manufacturing is seen as a hub sector for the area. The tourism/leisure sector has also grown significantly, with the offer of local food and drink complementing the many new facilities/attractions available. The local population is also well catered for with easily accessible areas of green infrastructure (e.g. better connectivity of habitats, green infrastructure and transport along the Trent Valley providing linkages to/from the natural environment). Cross sector initiatives become common as different sectors work together in particular locations e.g. construction sector working with tourism/recreation and energy generation to ensure that the new developments are high quality, sustainable in terms of energy use and impact on water resources, and have access to green spaces. Regeneration continues and the area becomes increasingly attractive to highly skilled people. The developments continue to be in harmony with the local landscape such that there are synergies between development and the environmental, social and economic quality of the area. Significant changes in the population size and make up (the population has grown, and become older and more diverse), mean that demand for particular services has changed over time. However, joined up thinking between sectors means that service and social infrastructure provision has been taken into account during property development. As a result, local people benefit strongly from an improved environment, increased social value and growing economy.
Time point: 2050	The landscape matures into an internationally recognised area of beauty, further attracting investment and highly skilled people for both the job opportunities and the quality of life. The area becomes a demonstration project showing how economic growth can be achieved, investment secured and skilled people attracted while maintaining and enhancing environmental and social value.
Changes needed to enable vision to be implemented	• Encourage different business sectors to develop their plans together to take advantage of opportunities and benefit each other (e.g. construction and manufacturing) • Encourage approaches to design quality that will mirror the natural beauty of the area and encourage investment into the area

Table 4-24: Coordinated scenario storyline: wildlife and biodiversity	
Coordinated scenario	**Assumptions**
Time point 1: 2020	Work begins to transform the landscape by expanding wildlife and biodiversity habitats through consideration of the potential to increase connectivity between habitats, create wildlife corridors and to fit with the natural habitats of the river, floodplain and terraces. This includes encouraging developers to consult habitat maps when designing their developments to help ensure that proposed wildlife/habitat areas link with existing/surrounding habitats, with a focus on the priority habitats for the LBAP area, including floodplain grazing marsh, reedbeds, wet woodland, lowland meadow, woodland, and lakes/river/canals and ponds. Developments include wildlife corridors as part of green infrastructure with emphasis on connectivity of habitats for movement of species as well as transport routes for movement of people. Links are also made with habitats outside the Trent Valley, especially in terms of woodland areas. Opportunities to link the river to its floodplain are taken where possible, to enable development of wet pasture, growing of biofuels (such as willow) and wet woodland. This also improves connectivity of habitats along the river valley. Restoration of aggregates extraction sites takes into consideration the need to restore and expand priority habitats. This includes extending areas of wet woodland and reedbeds to supplement the large areas of lakes that already exist, taking account of the requirements of the East Midlands Airport Safeguarding Zone within 13km of the airport.
Time point 2: 2025	Further development of wildlife corridors and ongoing improved connectivity of habitats through concentration on development and land use that is consistent with existing land uses and the 'flow' of the valley while also looking to enhance and restore habitats where possible. This includes strong links between developments and adjacent nature reserves, and wider habitats. Restoration at aggregates excavation sites focuses on extending existing habitats (where these do not conflict with the East Midlands Airport Safeguarding Zone). In restored areas where water based recreation is encouraged, zoning is used to ensure that high noise high speed activities are located away from quieter areas which are more wildlife focused. Reedbeds are used to help protect lake margins (e.g. from boatwash from watersports activities) and wet woodland is created to supplement lake habitats. Woodland continues to expand, linked to work to screen those features that do not fit with the 'flow' of the valley but also to create a smooth transition from the National Forest, again emphasising the concept of 'flow' across and within the valley and outwards to neighbouring areas.
Time point 3: 2030	Continued focus on the connectivity of habitats and restoration of priority habitats to improve the links between the river and its floodplain, and with adjacent areas such as the National Forest through ongoing expansion of woodland. Woodland provides structure to the landscape and is carefully located to ensure that it does not interrupt the 'flow'. The environment is a key component of developments such that the quality of the environment is seen as an integral part of the economic development of the area. Restoration plans for aggregates extraction sites include reference to the priority habitats and potential to improve connectivity, as well as to help meet the overall vision of reconnecting the river to its floodplain and establishing the wildlife corridor. Other mechanisms such as agri-environment schemes are used to improve the environmental quality and ecological permeability of the wider landscape, further

Table 4-24: Coordinated scenario storyline: wildlife and biodiversity	
Coordinated scenario	**Assumptions**
	enhancing the value of the valley. Improvements to existing habitats combined with the creation of new habitats result in a high quality network supporting a range of species. The Trent Valley becomes nationally and internationally recognised for the way it integrates the natural and built environment.
Time point: 2050	The landscape matures into an internationally recognised area of beauty, attracting designations that reflect the 'flow' of the landscape. The area becomes a demonstration project showing how economic growth can be achieved while maintaining and enhancing environmental value. The landscape provides a smooth transition through habitat types with the built environment fitting within the 'flow' of the landscape. As such the area becomes much more interconnected with species and habitats, reducing fragmentation. Woodland is fully developed as a habitat it its own right. Woodland is also used as a smooth transition to neighbouring areas, especially the National Forest.
Changes needed to enable vision to be implemented	• Development of a strategic approach to identifying areas of greatest potential to deliver new biodiversity and/or link existing sites • Identification of funds to assist with ongoing management of wildlife and biodiversity habitats and enhancement through projects that reconnect habitats, creating corridors and recreating floodplain meadows • Planning needs strong links with approaches to other sectors, especially tourism/recreation and heritage to enable links, corridors and connectivity to be taken into account more widely and deliver added value • Continue to improve provision and quality of habitat to encourage iconic species such as bittern and otter, thus adding to the attractiveness of the Trent Valley as a place to visit

5 Establishing the outcomes of the scenarios: the transition economy

5.1 Overview

This section presents the results of the scenario assessment, identifying how the baseline situation might change over time under the uncoordinated and coordinated scenarios. This provides the value of the transition economy at each of the four time points considered (2020, 2025, 2030 and 2050). Each scenario is considered separately, with the outcomes assessed in three ways as per the baseline:

- Scenario outcomes in terms of productivity and outputs;
- Scenario outcomes in terms of ecosystem services; and
- Scenario outcomes in terms of GVA and jobs.

The following sections provide the results of the different aspects of the assessment.

5.2 Value of the transition economy in terms of productivity and outputs

Table 5-1 provides the central estimates of the value of the transition economy for the uncoordinated scenario, whilst Table 5-2 presents the same information for the coordinated scenario. The tables focus on the sectors considered in the productivity assessment, namely:

- Aggregates;
- Agriculture;
- Construction;
- Energy generation;
- Physical infrastructure;
- Manufacturing (including food and drink manufacturing), R&D;
- Tourism, recreation, retail and leisure; and
- Water for abstraction (water quality is dealt with under ecosystem services).

Health and wellbeing, heritage and wildlife/biodiversity are considered in detail in the ecosystem services assessment, whilst wider economy is picked up in the GVA/jobs section.

The tables provide the estimated total value of the sectors (based on the components assessed) at each of the four time points. The direction of change indicator provides the change from the baseline year (2011) rather than change between assessment years (e.g. 2020 to 2025). All the monetary values are presented to two significant figures and are undiscounted (discounting is generally used when assessing the costs and benefits of an intervention over a specified time period. It takes account of time preference and the assumption that individuals prefer to receive benefits sooner rather than later). Note that the key points for each sector are summarised after the tables.

Table 5-1: Uncoordinated scenario: value of the transition economy in terms of productivity and outputs (undiscounted monetary values in £ millions)												
Sector	2020			2025			2030			2050		
	Direction of change	Monetary Value	Uncertainty	Direction of change	Monetary Value	Uncertainty	Direction of change	Monetary Value	Uncertainty	Direction of change	Monetary Value	Uncertainty
Aggregates	No Change	£11	ML	No change	£11	ML	No change	£11	M	No change	£11	H
Agriculture	Slight decrease	£11	ML	Slight decrease	£11	M	Slight decrease	£11	M	Slight decrease	£11	M
Construction	Increase	£200	M	Increase	£190	M	Increase	£190	M	Increase	£190	H
Energy generation	Increase	£0.02	M	Increase	£0.15	M	Increase	£0.15	M	Increase	£0.15	M
Health & wellbeing	Considered in ecosystem services assessment											
Heritage	Considered in ecosystem services assessment											
Physical infrastructure	Increase	£33	MH	Increase	£33	MH	Increase	£33	MH	Increase	£33	H
Manufacturing, R&D	No Change	£2,700	M	Slight increase	£2,700	MH	Increase	£2,800	MH	Increase	£2,800	H
Tourism, recreation, retail, leisure	No Change	£130	M	Increase	£140	MH	Increase	£150	MH	Increase	£150	H
Water	No change	£71	M	No change	£71	MH	No change	£71	MH	No change	£71	H
Wider economy	Considered in GVA and jobs assessment											
Wildlife/ biodiversity	Considered in ecosystem services assessment											

Table 5-1: Uncoordinated scenario: value of the transition economy in terms of productivity and outputs (undiscounted monetary values in £ millions)												
Sector	2020			2025			2030			2050		
	Direction of change	Monetary Value	Uncertainty	Direction of change	Monetary Value	Uncertainty	Direction of change	Monetary Value	Uncertainty	Direction of change	Monetary Value	Uncertainty
Notes: key to uncertainty ratings: L = low, ML = medium low, M = medium, MH = medium high, H = high. Direction of change refers to change from the baseline not change between the time points. It has been determined through comparing the number/area/volume of a good at a time point with that at the baseline. Presentation of the monetary values to two significant figures masks some of the changes in the underlying numbers (e.g. there is growth in manufacturing and R&D between 2020 and 2025, but when the values are presented to two significant figures, both years are given as £2,700)												

Table 5-2: Coordinated scenario: value of the transition economy in terms of productivity and outputs (undiscounted monetary values in £ millions)												
Sector	2020			2025			2030			2050		
	Direction of change	Monetary Value	Uncertainty	Direction of change	Monetary Value	Uncertainty	Direction of change	Monetary Value	Uncertainty	Direction of change	Monetary Value	Uncertainty
Aggregates	No change	£11	ML	No change	£11	ML	No change	£11	M	No change	£11	H
Agriculture	Slight decrease	£11	M	Slight decrease	£11	M	Slight decrease	£11	M	Slight decrease	£11	M
Construction	Increase	£200	M	Increase	£190	M	Increase	£190	M	Increase	£190	H
Energy generation	Increase	£0.05	M	Increase	£0.22	M	Increase	£0.24	M	Increase	£0.26	M
Health & wellbeing	Considered in ecosystem services assessment											
Heritage	Considered in ecosystem services assessment											

Table 5-2: Coordinated scenario: value of the transition economy in terms of productivity and outputs (undiscounted monetary values in £ millions)												
Sector	2020			2025			2030			2050		
	Direction of change	Monetary Value	Uncertainty	Direction of change	Monetary Value	Uncertainty	Direction of change	Monetary Value	Uncertainty	Direction of change	Monetary Value	Uncertainty
Physical infrastructure	Increase	£35	MH	Increase	£34	MH	Increase	£35	MH	Increase	£36	H
Manufacturing, R&D	Increase	£2,800	MH	Increase	£3,200	H	Increase	£3,500	H	Increase	£5,100	H
Tourism, recreation, retail, leisure	Increase	£150	M	Increase	£230	H	Increase	£260	MH	Increase	£680	H
Water	No change	£71	M	Slight decrease	£71	MH	Slight decrease	£71	MH	Slight decrease	£71	H
Wider economy	Considered in GVA and jobs assessment											
Wildlife/ biodiversity	Considered in ecosystem services assessment											
Notes: key to uncertainty ratings: L = low, ML = medium low, M = medium, MH = medium high, H = high. Direction of change refers to change from the baseline not change between the time points. It has been determined through comparing the number/area/volume of a good at a time point with that at the baseline. Presentation of monetary values to two significant figures may mask some changes (e.g. volume of water abstracted is assumed to decline over time, but this decline is not sufficient to be visible when the monetary values are presented to two significant figures)												

For the uncoordinated scenario, the key points for each sector are as follows:

- **Aggregates extraction** is not expected to change. Extraction is assumed to continue at the same rate as at present throughout the time period of the assessment;
- **Agriculture** is anticipated to decline very slightly. However, this small decline is not visible in the monetary values when these are presented to two significant figures;
- **Construction** increases against the baseline when existing house building plans are implemented. The peak in the value of construction in 2020 reflects the development of Drakelow Park in addition to other planned housing;
- **Energy generation** increases markedly between 2020 and 2025 due to Willington C gas-fired power station and Drakelow Park Renewable Energy Centre becoming operational;
- **Physical infrastructure** increases from the baseline mainly due to the implementation of the Digital Derbyshire (broadband) programme. Improvements to transport infrastructure are assumed to decrease delays, but increases in the number of journeys carried out means that overall the cost of the remaining delay is the same as that under the baseline;
- The **manufacturing and R&D** sector shows some growth over time due to investment in the sector;
- The **tourism, recreation, retail, leisure** sector also shows gradual growth (this is a D2N2 priority sector); and
- The **water** sector does not show any changes with licensed volumes remaining constant. Any water efficiency measures are assumed to be balanced out by additional demand for potable water from newly built properties.

For the coordinated scenario, the key points for each sector include:

- The situation for the **aggregates** sector mirrors that of the uncoordinated scenario, with no change in amounts extracted over time;
- For **agriculture**, production is expected to decline slightly over time when compared with the baseline, but this small decline is not visible in the monetary values which are presented to two significant figures;
- The **construction** sector performs as per the uncoordinated scenario, with house building and business premises developed as planned. The relatively high value of the sector in 2020 reflects the construction of Drakelow Park;
- **Energy generation** grows markedly between 2020 and 2025 as Willington C gas-fired power station and Drakelow Renewable Energy Centre become operational. Additional increases over time are assumed to be due to development of small scale renewables;
- **Physical infrastructure** increases when compared with the baseline due to the implementation of the Digital Derbyshire (broadband) programme (as per the uncoordinated scenario). Further benefits are experienced by the sector due to improvements to transport infrastructure decreasing the length of any delays. An increase in the number of journeys being made (due to a growing population) means that the benefits in 2025 are slightly less than in 2020. However, continual investment over time results in a better integrated and improved transport system which utilises novel transport methods (e.g. the monorail). This results in higher benefits for the sector in 2030 and 2050 as the length of any delay declines still further;
- The **manufacturing and R&D** sector is assumed to increase (at a rate of 5% for the first few years then 2% thereafter) due to investment and the activities of the newly established Manufacturing and Research Board, as well as improvements to transport infrastructure;

- The **tourism, recreation, retail and leisure** sector is also expected to grow significantly with joined up marketing of the area combined with the local food and drink offer (visitor numbers are assumed to grow at a rate of 5% each year between 2030 and 2050). This growth is partly due to the landscape maturing into an area that is internationally recognised, with many visitors making repeat trips and taking advantage of the boating holidays and day trips available in the Trent Valley; and
- Demand for **water** declines slightly over time (although this is not visible in the monetary values presented to two significant figures) as water recycling is encouraged, water meters are installed on new builds to encourage awareness of water use and linkages with the valley encourage careful consideration of water use by residents and businesses.

Table 5-3 provides the direction of change for the uncoordinated and coordinated scenarios against the 2011 baseline. The direction of change has been determined by comparing the number/area/other output of a sector (rather than the monetised value) with that of the baseline. The table shows that there are very few apparent differences between the two scenarios based on direction of change alone.

Table 5-3: Direction of change from baseline (productivity and outputs)

Service	Uncoordinated				Coordinated			
	2020	2025	2030	2050	2020	2025	2030	2050
Aggregates	—	—	—	—	—	—	—	—
Agriculture	↘	↘	↘	↘	↘	↘	↘	↘
Construction	↑	↑	↑	↑	↑	↑	↑	↑
Energy generation	↑	↑	↑	↑	↑	↑	↑	↑
Physical infrastructure	↑	↑	↑	↑	↑	↑	↑	↑
Manufacturing, R&D	—	↗	↑	↑	↑	↑	↑	↑
Tourism, recreation, retail, leisure	—	↑	↑	↑	↑	↑	↑	↑
Water	—	—	—	—	—	↘	↘	↘

Key to symbols:

— *= no change* ↓ *= decrease* ↑ *= increase* ↗ *= slight increase* ↘ *= slight decrease*

The direction of change has been determined by considering the number/area/output of a sector at each time point against that at the baseline. This ensures that slight increases and decreases are picked up. Such small variations may not necesssarily be apparent in the monetary values which are presented to two significant figures (e.g. see values for water in Table 5-2)

Tables 5-4 and 5-5 take account of the uncertainty ratings to provide sensitivity values for each of the sectors at each of the time points. As mentioned in Section 2.4.2, the uncertainty ratings reflect two aspects of uncertainty:

- **Uncertainty over the measurement of change**: this relates to whether the productivity value (e.g. the ha of crop, tonnes of aggregates) is based on a published document/plan, historical trends, or assumptions. Where published documents are used, uncertainty is assumed to be low. For values based purely on assumptions, uncertainty is assumed to be very high (note that attempts have been made to validate such assumptions through comparisons with other areas, e.g. statistics for tourism in the Norfolk Broads); and
- **Uncertainty over valuation**: this relates to the monetary figure used to monetise the productivity value (e.g. the £/ha figure used to convert a number of ha into a monetary value). Values are marked as having low uncertainty if they are specific to the change being measured, have been taken from a peer or similarly reviewed document, and are recent and transferable from a similar context. Alternatively, values are deemed to have very high uncertainty if they are not specific to the type of change being measured, are not peer reviewed, are not recently dated and have been taken from a different context.

These two aspects of uncertainty have been combined to create an overall uncertainty rating for each sector for each time point. The uncertainty ratings have been converted to percentages as follows:

- Low uncertainty = 10%
- Medium low uncertainty = 20%
- Medium uncertainty = 30%
- Medium-high uncertainty = 50%
- High uncertainty = 70%
- Very high uncertainty = 90%

The low and high sensitivity values have then been calculated through multiplying the difference between the baseline and the central estimate by the uncertainty percentage, and subtracting this figure from the central estimate to obtain the low sensitivity value, or adding it to the central estimate to obtain the high sensitivity value. This means that if the productivity of a sector is not expected to change from that under the baseline (e.g. for aggregates, extraction is expected to continue at the same rate as under the baseline), then the low and high sensitivity values are the same as the central estimate for each time point.

Whilst the central estimates can be viewed as the 'best' estimates based on currently available evidence, the low and high sensitivity values provide a range that reflects the level of uncertainty in the data and the assumptions.

Table 5-4: Sensitivity based on uncertainties (£ million) for uncoordinated scenario																
Sector	2020				2025				2030				2050			
	Lower estimate	Central estimate	Upper estimate	Uncertainty	Lower estimate	Central estimate	Upper estimate	Uncertainty	Lower estimate	Central estimate	Upper estimate	Uncertainty	Lower estimate	Central estimate	Upper estimate	Uncertainty
Aggregates	£11	£11	£11	20%	£11	£11	£11	20%	£11	£11	£11	30%	£11	£11	£11	70%
Agriculture	£11	£11	£11	20%	£11	£11	£11	30%	£11	£11	£11	30%	£11	£11	£11	30%
Construction	£180	£200	£230	30%	£170	£190	£210	30%	£170	£190	£210	30%	£140	£190	£240	70%
Energy generation	£0.01	£0.02	£0.03	30%	£0.11	£0.15	£0.20	30%	£0.11	£0.15	£0.20	30%	£0.11	£0.15	£0.20	30%
Health and wellbeing	Considered in ecosystem services assessment															
Heritage	Considered in ecosystem services assessment															
Physical infrastructure	£13	£33	£54	50%	£13	£33	£54	50%	£13	£33	£54	50%	£4.3	£33	£62	70%
Manufacturing, R&D	£2,700	£2,700	£2,700	30%	£2,700	£2,700	£2,700	50%	£2,700	£2,800	£2,800	50%	£2,700	£2,800	£2,900	70%
Tourism, recreation, retail, leisure	£130	£130	£130	30%	£140	£140	£140	50%	£140	£150	£150	50%	£140	£150	£170	70%
Water	£71	£71	£71	30%	£71	£71	£71	50%	£71	£71	£71	50%	£71	£71	£71	70%
Wider economy	Considered in GVA and jobs assessment															
Wildlife/ biodiversity	Considered in ecosystem services assessment															

Table 5-5: Sensitivity based on uncertainties (£ million) for coordinated scenario																
Sector	2025								2030				2050			
	Lower estimate	Central estimate	Upper estimate	Uncertainty	Lower estimate	Central estimate	Upper estimate	Uncertainty	Lower estimate	Central estimate	Upper estimate	Uncertainty	Lower estimate	Central estimate	Upper estimate	Uncertainty
Aggregates	£11	£11	£11	20%	£11	£11	£11	20%	£11	£11	£11	30%	£11	£11	£11	70%
Agriculture	£11	£11	£11	20%	£11	£11	£11	30%	£11	£11	£11	30%	£11	£11	£11	30%
Construction	£180	£200	£230	30%	£170	£190	£210	30%	£170	£190	£210	30%	£140	£190	£240	70%
Energy generation	£0.03	£0.05	£0.06	30%	£0.15	£0.22	£0.29	30%	£0.17	£0.24	£0.31	30%	£0.18	£0.26	£0.34	30%
Health and wellbeing	Considered in ecosystem services assessment															
Heritage	Considered in ecosystem services assessment															
Physical infrastructure	£13	£35	£56	50%	£13	£34	£56	50%	£13	£35	£56	50%	£5.1	£36	£67	70%
Manufacturing, R&D	£2,800	£2,800	£2,800	30%	£2,900	£3,100	£3,400	50%	£3,000	£3,500	£3,800	50%	£3,400	£5,100	£6,900	70%
Tourism, recreation, retail, leisure	£140	£150	£150	30%	£180	£230	£290	50%	£190	£260	£320	50%	£300	£680	£1,100	70%
Water	£71	£71	£71	30%	£71	£71	£71	50%	£71	£71	£71	50%	£71	£71	£71	70%
Wider economy	Considered in GVA and jobs assessment															
Wildlife/ biodiversity	Considered in ecosystem services assessment															

Table 5-6 presents the total estimated value of the transition economy in terms of productivity and outputs. It includes the central estimate for each time point, as well as the low and high sensitivity estimates calculated using the uncertainty percentages. Figure 5-1 presents these results in a graph.

Table 5-6: Value of the transitional economy in terms of productivity and outputs (£ millions)				
Scenario	**Time point**			
	2020	**2025**	**2030**	**2050**
Sensitivity - low				
Uncoordinated	£3,100	£3,100	£3,100	£3,100
Coordinated	£3,200	£3,400	£3,600	£3,900
Central estimate				
Uncoordinated	£3,200	£3,200	£3,200	£3,300
Coordinated	£3,300	£3,700	£4,000	£6,200
Sensitivity - high				
Uncoordinated	£3,200	£3,300	£3,300	£3,500
Coordinated	£3,400	£4,000	£4,500	£8,300
Notes: values are undiscounted and are based on the estimation of productivity and outputs under eight sectors including aggregates, agriculture, construction, energy generation, physical infrastructure, manufacturing and R&D, tourism/recreation, and water				

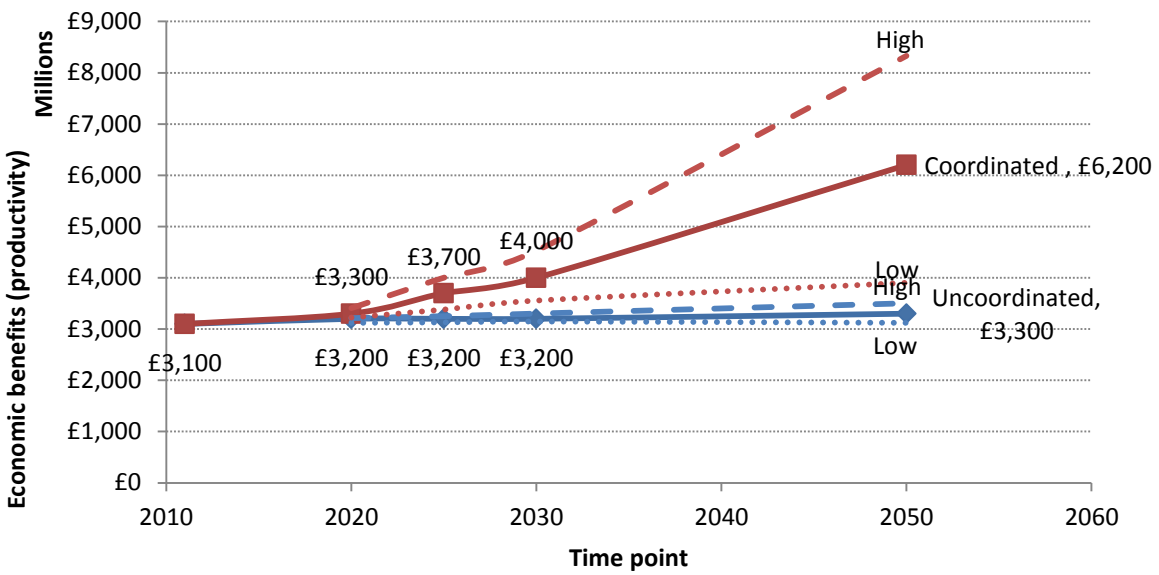

Figure 5-1: Value of the transition economy in terms of productivity and outputs

Red lines show the coordinated scenario whilst blue lines indicate the uncoordinated scenario. Solid lines represent the central estimate for each scenario and dashed lines represent the high and low sensitivity values

The table and figure indicate that in 2020, the value of the uncoordinated scenario is £3,200 million (range of £3,100 million to £3,200 million), whilst the value of the coordinated scenario is estimated

as £3,300 million (range of £3,200 million to £3,400 million). By 2050, the two scenarios have diverged significantly, with the central estimate for the uncoordinated scenario being £3,300 million (low to high sensitivity range of £3,100 million to £3,500 million) and that for the coordinated scenario is estimated as £6,200 million (low to high sensitivity range of £3,900 million to £8,300 million).

5.3 Changes over time in terms of ecosystem service provision

Tables 5-7 and 5-8 provide an indication of the change in ecosystem service provision under the two scenarios at the four time points. The monetary values are central estimates and represent change from the baseline rather than the total provision of ecosystem services within the Trent Valley.

Note that for water regulation (capturing risk of flooding and inundation), positive values represent a decrease in damages from flooding, whilst negative numbers indicate an increase in damages expected from flooding.

For the uncoordinated scenario, key points to note for each ecosystem service are as follows:

- **Biodiversity**: there is some loss of habitat to aggregates extraction, construction sites, infrastructure and fragmentation. However, work is undertaken to restore and expand designated sites, so the net change for each of the time points is a relatively modest positive;
- **Air quality**: this shows a decline from the baseline at each of the time points, with the extent of the decline increasing over time. This is due to an increasing proportion of the Trent Valley population assumed to be at risk from air quality impacts (9% of the population in 2020 to 27% in 2050);
- **Carbon sequestration**: there is a negative change in the carbon sequestration potential of soils in the Trent Valley, as more agricultural land is used for aggregates, construction and infrastructure over time;
- **Quality of filtered water for habitats and abstraction**: this shows a negative change from the baseline as increases in hard surfaces increase the amount of runoff requiring treatment;
- **Water regulation (capturing risk of flooding and inundation)**: this shows a growing negative change over time as the number of properties at risk of flooding increases due to changing rainfall and climate patterns as well as the increase in hard surfaces. In 2020, 2,800 properties are assumed to have a 1% risk of flooding. By 2050, flood risk is assumed to have increased so that 2,800 properties have a 4% risk, another 2,800 have a 2% risk, another 2,800 have a 1% risk and a final 2,800 have a 0.5% risk;
- **Value of educational trips/visits**: no change is expected, with continual use of existing assets as per the baseline;
- **Value of heritage**: for this service no change in provision from the baseline is expected under the uncoordinated scenario;
- **Intrinsic value of the landscape and its appearance**: this service shows a decreasing value over time due to greater fragmentation of the landscape, including new aggregate extraction sites and more construction with limited mitigation in terms of green infrastructure and landscaping. Note that the low and high figures represent the use of different monetary values to monetise the impacts; and
- **Wellbeing, health and happiness**: overall, provision of this service improves over time despite decreases in some areas of environmental quality (and negative impacts on health from increased congestion). The improvement is due to the implementation of existing

health and wellbeing strategies improving social capital and life satisfaction. Note that valuation is based on improvements in life satisfaction.

For the coordinated scenario, key points to note for each ecosystem service are as follows:

- **Biodiversity**: this shows positive change from the baseline due to habitat restoration and expansion, as well as efforts to reduce fragmentation. Concentration of aggregates sites in less sensitive areas in addition to the use of woodland to screen and provide a smooth transition to neighbouring habitats also benefits biodiversity by improving connectivity between habitats;
- **Air quality**: this does not change from the baseline in 2020, but improves slightly throughout the rest of the assessment. Key factors include the provision of a green infrastructure network which provides traffic free routes that help reduce the number of people exposed to higher emission levels. Cycle routes and footpaths are also used to link together developments for recreation and commuting purposes;
- **Carbon sequestration**: this shows a significant increase from the baseline over time. There is the loss of some carbon sequestration potential due to agricultural land being used for aggregates extraction, construction and infrastructure development. However, the creation of extensive amounts of green infrastructure as well as a reduction in fragmentation means that the net carbon sequestration potential of the area increases (note that monetisation is based on the value of CO_2 used by the UK Government in policy appraisal. The carbon content of urban soils has been determined as greater than that of agricultural land, thus a change from agriculture to green infrastructure could provide carbon sequestration benefits, based on measurements undertaken in Leicester);
- **Quality of filtered water for habitats and abstraction**: this shows a positive change from the baseline. Whilst some areas experience increased runoff due to the creation of hard surfaces from construction and infrastructure, overall defragmentation results in benefits for water quality;
- **Water regulation (capturing risk of flooding and inundation)**: this shows very slight benefits over time, as use of green infrastructure and natural flood management measures helps to decrease flood risk to some properties;
- **Value of educational trips/visits**: benefits are experienced above the baseline since the development of the Trent Valley storyline brings opportunities for formal as well as informal education;
- **Value of heritage**: this shows positive change from the baseline as visitor numbers for heritage attractions increase in response to greater publicity about the area's heritage and the history of the Trent Valley;
- **Intrinsic value of the landscape and its appearance**: this service increases significantly over time due to reduced fragmentation of landscape, greater screening of new aggregate extraction sites and construction that fits into landscape (the low and high figures represent the use of different monetary values to monetise the impacts); and
- **Wellbeing, health and happiness**: overall, provision of this service improves over time due to the continued implementation of existing health and wellbeing strategies that focus on improving social capital. Investment in green infrastructure and the promotion of recreation also help to encourage more active communities with benefits for health. Monetisation of the benefits is based on assumed improvements in life satisfaction.

Table 5-7: Uncoordinated scenario: marginal value of ecosystem services over time (undiscounted monetary values; £ millions)												
Services	2020			2025			2030			2050		
	Direction of change	Central estimate (£m)	Uncertainty	Direction of change	Central estimate (£m)	Uncertainty	Direction of change	Central estimate (£m)	Uncertainty	Direction of change	Central estimate (£m)	Uncertainty
Biodiversity	Slight increase	£0.13	ML	Slight increase	£0.13	ML	Slight increase	£0.13	ML	Slight increase	£0.14	MH
Livestock and crop production	Impacts captured under productivity assessment											
Energy production	Impacts captured under productivity assessment											
Aggregates	Impacts captured under productivity assessment											
Drinking water	Impacts captured under productivity assessment											
Air quality	Slight decrease	-£0.19	H	Decrease	-£0.39	H	Decrease	-£0.77	H	Decrease	-£2.3	H
Carbon sequestration	Decrease	-£0.58	M	Decrease	-£1.8	M	Decrease	-£3.2	M	Decrease	-£8.6	M
Quality of filtered water for habitats and abstraction	Slight decrease	-£0.01	M	Slight decrease	-£0.07	M	Slight decrease	-£0.12	M	Decrease	-£0.35	M
Water regulation (capturing risk of flooding and inundation)	Decrease	-£0.22	M	Decrease	-£0.33	M	Decrease	-£1.2	M	Decrease	-£3.3	M
Value of educational trips/visits	-	-	MH	-	-	MH	No change	-	MH	No change	-	MH

Table 5-7: Uncoordinated scenario: marginal value of ecosystem services over time (undiscounted monetary values; £ millions)												
Services	**2020**			**2025**			**2030**			**2050**		
	Direction of change	**Central estimate (£m)**	**Uncertainty**	**Direction of change**	**Central estimate (£m)**	**Uncertainty**	**Direction of change**	**Central estimate (£m)**	**Uncertainty**	**Direction of change**	**Central estimate (£m)**	**Uncertainty**
Value of heritage	-	-	MH	No change	-	MH	No change	-	MH	No change	-	MH
Intrinsic value of landscape and its appearance	Slight decrease	-£0.02 to -£0.08	MH	Slight decrease	-£0.09 to -£0.40	MH	Decrease	-£0.15 to -£0.69	MH	Decrease	-£0.42 to -£1.9	MH
Recreational activities	Impacts captured under productivity											
Wellbeing, health and happiness	Increase	£0.36	H	Increase	£1.1	H	Increase	£1.8	H	Increase	£2.9	H
Jobs	Impacts captured under GVA and jobs assessment											
Gross value added	Impacts captured under GVA and jobs assessment											
Attracting business and investment	Impacts captured under GVA and jobs assessment											
Attracting employees and skills	Impacts captured under GVA and jobs assessment											
Notes: key to uncertainty ratings: L = low, ML = medium low, M = medium, MH = medium high, H = high. Direction of change refers to change from baseline rather than change between time points												

Table 5-8: Coordinated scenario: marginal value of ecosystem services over time (undiscounted monetary values; £ millions)												
Service	2020			2025			2030			2050		
	Direction of change	Central estimate (£m)	Uncertainty	Direction of change	Central estimate (£m)	Uncertainty	Direction of change	Central estimate (£m)	Uncertainty	Direction of change	Central estimate (£m)	Uncertainty
Biodiversity	Increase	£0.42	MH	Increase	£0.70	MH	Increase	£0.97	MH	Increase	£1.5	MH
Livestock and crop production	Impacts captured under productivity assessment											
Energy production	Impacts captured under productivity assessment											
Aggregates	Impacts captured under productivity assessment											
Drinking water	Impacts captured under productivity assessment											
Air quality	No change	£0	H	Slight increase	£0.04	VH	Slight increase	£0.06	VH	Increase	£0.21	VH
Carbon sequestration	Slight increase	£0.20	M	Increase	£3.4	M	Increase	£9.9	M	Increase	£35	M
Quality of filtered water for habitats and abstraction	Slight increase	£0.002	M	Slight increase	£0.03	M	Slight increase	£0.10	M	Increase	£0.64	M
Water regulation (capturing risk of flooding and inundation)	Slight increase	£0.001	M	Slight increase	£0.002	M	Slight increase	£0.003	M	Slight increase	£0.006	M
Value of educational trips/visits	Increase	£0.47	H	Increase	£0.56	H	Increase	£0.66	H	Increase	£0.94	H

Table 5-8: Coordinated scenario: marginal value of ecosystem services over time (undiscounted monetary values; £ millions)												
Service	2020			2025			2030			2050		
	Direction of change	Central estimate (£m)	Uncertainty	Direction of change	Central estimate (£m)	Uncertainty	Direction of change	Central estimate (£m)	Uncertainty	Direction of change	Central estimate (£m)	Uncertainty
Value of heritage	Slight increase	£0.003	VH	Slight increase	£0.007	VH	Slight increase	£0.01	VH	Slight increase	£0.02	VH
Intrinsic value of landscape and its appearance	Slight increase	£0.19 to £0.27	MH	Increase	£1.3 to £1.9	MH	Increase	£3.5 to £4.9	MH	Increase	£16 to £22	MH
Recreational activities	Impacts captured under productivity											
Wellbeing, health and happiness	Increase	£1.1	H	Increase	£2.6	H	Increase	£4.4	H	Increase	£6.9	H
Jobs	Impacts captured under GVA and jobs assessment											
Gross value added	Impacts captured under GVA and jobs assessment											
Attracting business and investment	Impacts captured under GVA and jobs assessment											
Attracting employees and skills	Impacts captured under GVA and jobs assessment											
Notes: key to uncertainty ratings: L = low, ML = medium low, M = medium, MH = medium high, H = high, VH = very high. Direction of change refers to change from baseline rather than change between time points												

Table 5-9 provides the direction of change for the uncoordinated and coordinated scenario against the 2011 baseline for ecosystem services. The table shows that the differences between the two scenarios are much greater when presented for ecosystem services than was seen for productivity and outputs. This reflects the potential for much greater benefits for ecosystem services through a coordinated approach than would be seen from an uncoordinated approach.

Table 5-9: Direction of change from baseline (ecosystem services)

Service	Uncoordinated				Coordinated			
	2020	2025	2030	2050	2020	2025	2030	2050
Biodiversity	↗	↗	↗	↗	↑	↑	↑	↑
Air quality	↘	↓	↓	↓	—	↗	↗	↑
Carbon sequestration	↓	↓	↓	↓	↗	↑	↑	↑
Quality of filtered water for habitats and abstraction	↘	↘	↘	↓	↗	↗	↗	↑
Water regulation (capturing risk of flooding and inundation)	↓	↓	↓	↓	↗	↗	↗	↗
Value of educational trips/visits	—	—	—	—	↑	↑	↑	↑
Value of heritage	—	—	—	—	↗	↗	↗	↗
Intrinsic value of landscape and its appearance	↘	↘	↓	↓	↗	↑	↑	↑
Wellbeing, health and happiness	↑	↑	↑	↑	↑	↑	↑	↑

Key to symbols:

— *= no change* ↓ *= decrease* ↑ *= increase* ↗ *= slight increase* ↘ *= slight decrease*

The direction of change has been determined by considering the number/area/output of a sector at each time point against that at the baseline. This ensures that slight increases and decreases are picked up. Such small variations may not be apparent in the monetary values which are presented to two significant figures

Tables 5-10 and 5-11 take account of the uncertainty ratings to provide sensitivity values for each of the sectors at each of the time points. As per the calculation of the sensitivity values for the productivity and outputs assessment, the sensitivity values for ecosystem services have been estimated by applying the uncertainty rating as a percentage. The uncertainty percentage for each ecosystem service and time point has been multiplied by the ecosystem service value in each case (note the that the ecosystem service values represent the change between the baseline and each time point, and are not the absolute value of the service at any particular time point). The resultant value has then been added to the central estimate to estimate the high sensitivity value, and subtracted from the central estimate to determine the low sensitivity value. Table 5-10 presents the full range of values for the uncoordinated scenario, whilst Table 5-11 does the same for the coordinated scenario. The central estimates can be viewed as the 'best estimate' for each service at each time point. The low and high sensitivity values illustrate the likely range either side of the central values given the level of uncertainty in the data and assumptions.

Table 5-10: Sensitivities for uncoordinated scenario: marginal value of ecosystem services over time (undiscounted monetary values; £ millions)																
Service	2020				2025				2030				2050			
	Lower estimate	Central estimate	Upper estimate	Uncertainty	Lower estimate	Central estimate	Upper estimate	Uncertainty	Lower estimate	Central estimate	Upper estimate	Uncertainty	Lower estimate	Central estimate	Upper estimate	Uncertainty
Biodiversity	£0.07	£0.13	£0.20	50%	£0.07	£0.13	£0.20	50%	£0.07	£0.13	£0.20	50%	£0.07	£0.14	£0.21	50%
Livestock and crop production	Impacts captured under productivity assessment															
Energy production	Impacts captured under productivity assessment															
Aggregates	Impacts captured under productivity assessment															
Drinking water	Impacts captured under productivity assessment															
Air quality	-£0.06	-£0.19	-£0.32	70%	-£0.04	-£0.39	-£0.74	90%	-£0.08	-£0.77	-£1.5	90%	-£0.23	-£2.3	-£4.4	90%
Carbon sequestration	-£0.41	-£0.58	-£0.75	30%	-£1.2	-£1.8	-£2.3	30%	-£2.3	-£3.2	-£4.2	30%	-£6.0	-£8.6	-£11	30%
Quality of filtered water for habitats and abstraction	-£0.01	-£0.01	-£0.01	30%	-£0.05	-£0.07	-£0.09	30%	-£0.08	-£0.12	-£0.16	30%	-£0.25	-£0.35	-£0.46	30%
Water regulation (capturing risk of flooding and inundation)	-£0.15	-£0.22	-£0.29	30%	-£0.23	-£0.33	-£0.43	30%	-£0.85	-£1.2	-£1.6	30%	-£2.3	-£3.3	-£4.3	30%
Value of educational trips/visits	£0.00	£0.00	£0.00	70%	£0.00	£0.00	£0.00	70%	£0.00	£0.00	£0.00	70%	£0.00	£0.00	£0.00	70%
Value of heritage	£0.00	£0.00	£0.00	90%	£0.00	£0.00	£0.00	90%	£0.00	£0.00	£0.00	90%	£0.00	£0.00	£0.00	90%

Table 5-10: Sensitivities for uncoordinated scenario: marginal value of ecosystem services over time (undiscounted monetary values; £ millions)																
Service	2020				2025				2030				2050			
	Lower estimate	Central estimate	Upper estimate	Uncertainty	Lower estimate	Central estimate	Upper estimate	Uncertainty	Lower estimate	Central estimate	Upper estimate	Uncertainty	Lower estimate	Central estimate	Upper estimate	Uncertainty
Landscape low	-£0.01	-£0.02	-£0.03	50%	-£0.04	-£0.09	-£0.13	50%	-£0.08	-£0.15	-£0.23	50%	-£0.21	-£0.42	-£0.63	50%
Landscape high	-£0.04	-£0.08	-£0.12		-£0.20	-£0.40	-£0.60		-£0.35	-£0.69	-£1.0		-£0.56	-£1.9	-£3.2	
Recreational activities	Impacts captured under productivity															
Wellbeing, health and happiness	£0.11	£0.36	£0.61	70%	£0.32	£1.1	£1.8	70%	£0.54	£1.8	£3.1	70%	£0.87	£2.9	£5.0	70%
Jobs	Impacts captured under GVA and jobs assessment															
Gross value added	Impacts captured under GVA and jobs assessment															
Attracting business and investment	Impacts captured under GVA and jobs assessment															
Attracting employees and skills	Impacts captured under GVA and jobs assessment															

Table 5-11: Sensitivities for coordinated scenario: marginal value of ecosystem services over time (undiscounted monetary values; £ millions)																
Service	2020				2025				2030				2050			
	Lower estimate	Central estimate	Upper estimate	Uncertainty	Lower estimate	Central estimate	Upper estimate	Uncertainty	Lower estimate	Central estimate	Upper estimate	Uncertainty	Lower estimate	Central estimate	Upper estimate	Uncertainty
Biodiversity	£0.21	£0.42	£0.63	50%	£0.35	£0.70	£1.1	50%	£0.49	£0.97	£1.5	50%	£0.76	£1.5	£2.3	50%
Livestock and crop production	Impacts captured under productivity assessment															
Energy production	Impacts captured under productivity assessment															
Aggregates	Impacts captured under productivity assessment															
Drinking water	Impacts captured under productivity assessment															
Air quality	£0.00	£0.00	£0.00	70%	£0.00	£0.04	£0.08	90%	£0.01	£0.06	£0.12	90%	£0.02	£0.21	£0.40	90%
Carbon sequestration	£0.14	£0.20	£0.26	30%	£2.4	£3.4	£4.4	30%	£6.9	£9.9	£13	30%	£24	£35	£45	30%
Quality of filtered water for habitats and abstraction	£0.002	£0.002	£0.003	30%	£0.02	£0.03	£0.03	30%	£0.07	£0.10	£0.13	30%	£0.45	£0.64	£0.83	30%
Water regulation (capturing risk of flooding and inundation)	£0.001	£0.001	£0.001	30%	£0.002	£0.002	£0.003	30%	£0.002	£0.003	£0.004	30%	£0.004	£0.006	£0.007	30%
Value of educational trips/visits	£0.14	£0.47	£0.80	70%	£0.17	£0.56	£0.95	70%	£0.20	£0.66	£1.1	70%	£0.28	£0.94	£1.6	70%
Value of heritage	£0.00	£0.003	£0.01	90%	£0.001	£0.007	£0.01	90%	£0.001	£0.0097	£0.02	90%	£0.002	£0.016	£0.030	90%

Table 5-11: Sensitivities for coordinated scenario: marginal value of ecosystem services over time (undiscounted monetary values; £ millions)																
Service	2020				2025				2030				2050			
	Lower estimate	Central estimate	Upper estimate	Uncertainty	Lower estimate	Central estimate	Upper estimate	Uncertainty	Lower estimate	Central estimate	Upper estimate	Uncertainty	Lower estimate	Central estimate	Upper estimate	Uncertainty
Landscape low	£0.10	£0.19	£0.29	50%	£0.67	£1.3	£2.00	50%	£1.7	£3.5	£5.2	50%	£7.8	£16	£23	50%
Landscape high	£0.14	£0.27	£0.41		£0.94	£1.9	£2.8		£2.4	£4.9	£7.3		£11	£22	£33	
Recreational activities	Impacts captured under productivity															
Wellbeing, health and happiness	£0.32	£1.1	£1.8	70%	£0.77	£2.6	£4.3	70%	£1.3	£4.4	£7.5	70%	£2.1	£6.9	£12	70%
Jobs	Impacts captured under GVA and jobs assessment															
Gross value added	Impacts captured under GVA and jobs assessment															
Attracting business and investment	Impacts captured under GVA and jobs assessment															
Attracting employees and skills	Impacts captured under GVA and jobs assessment															

Table 5-12 provides a summary of the marginal value of the transition economy in terms of ecosystem services. It presents the central estimates for each time point as well as the high and low sensitivity values. Note that the range within each cell is due to the use of low and high values for aesthetics. Figure 5-2 illustrates the change in provision of ecosystem services over time.

Table 5-12: Value of the transition economy in terms of ecosystem services over and above the baseline (£ millions)

Scenario	Time point			
	2020	2025	2030	2050
Sensitivity – low				
Uncoordinated	-£0.46 to -£0.49	-£1.2 to -£1.4	-£2.7 to -£3.0	-£8.1 to -£8.4
Coordinated	£0.91 to £0.95	£4.3 to £4.6	£11 (low and high aesthetics)	£36 to £39
Central estimate				
Uncoordinated	-£0.53 to -£0.60	-£1.4 to -£1.7	-£3.5 to -£4.1	-£12 to -£13
Coordinated	£2.4 (low and high aesthetics)	£8.6 to £9.1	£19 to £21	£60 to £67
Sensitivity – high				
Uncoordinated	-£0.60 to -£0.70	-£1.6 to -£2.0	-£4.3 to -£5.1	-£16 to -£18
Coordinated	£3.8 to £3.9	£13 to £14	£28 to £30	£85 to £94

Notes: values are undiscounted and are based on the estimation of impacts on ecosystem services. Ranges represent low and high aesthetics values

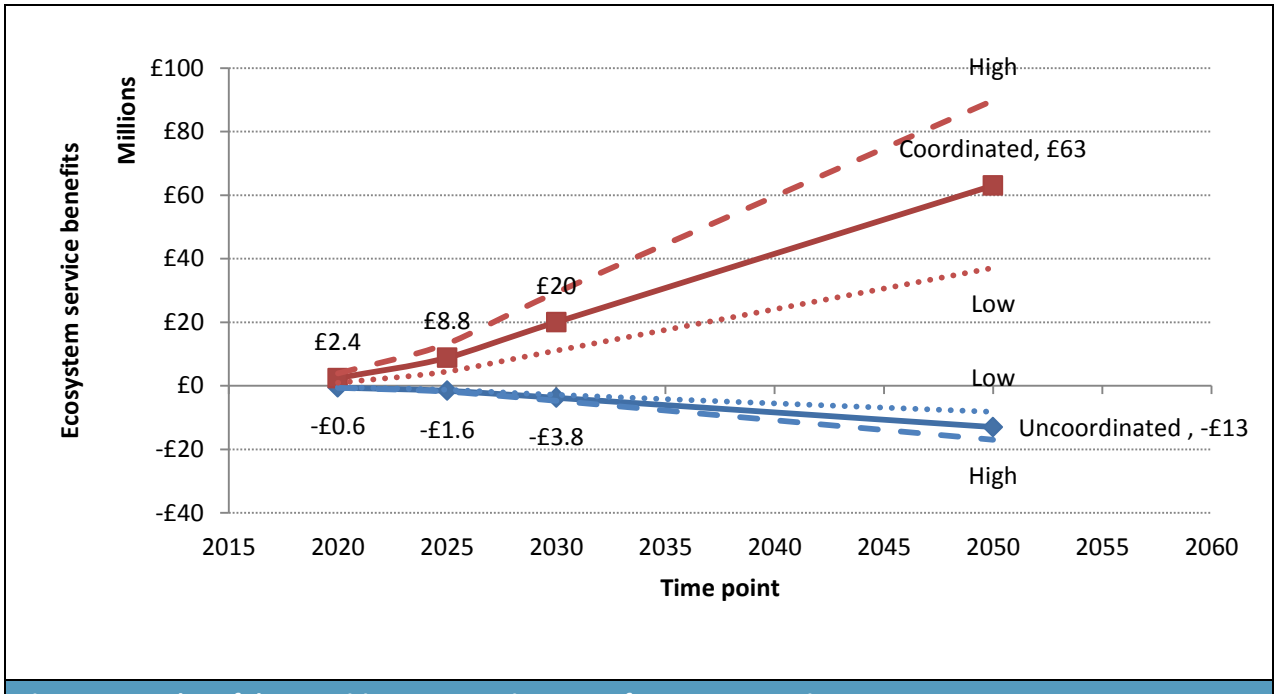

Figure 5-2: Value of the transition economy in terms of ecosystem service

Red lines show the coordinated scenario whilst blue lines indicate the uncoordinated scenario. Solid lines represent the central estimate for each scenario and dashed lines represent the high and low sensitivity values

The results of the assessment indicate that in 2020:

- For the uncoordinated scenario, the impacts are negative in terms of ecosystem services at around £500,000 less than the baseline (with a range of -£460,000 to -£700,000); and
- For the coordinated scenario, the ecosystem services delivered are worth around £2.4 million more than under the baseline (with a range of £910,000 to £3.9 million).

By 2050:

- For the uncoordinated scenario, ecosystem service provision is more significantly negative at £12 to £13 million less than under the baseline (with a range of -£8.1 million to -£18 million); and
- For the coordinated scenario, ecosystem service provision is between £60 and £67 million more than under the baseline (with a range of £36 million to £94 million).

5.4 Value of the transition economy in terms of GVA and jobs

Table 5-13 presents the estimates of GVA and jobs for the four time points under the uncoordinated scenario, whilst Table 5-14 provides the same information for the coordinated scenario. The direction of change relates to change from the baseline, rather than from one time point to the next. It should be acknowledged that the values given draw heavily on the assumptions made in the productivity and outputs sector, and the resultant percentage changes between the time points. Also, the values generated are based on the assumptions made in the scenario storylines and do not take account of background growth in GVA.

Particular points to note for both the uncoordinated and coordinated scenarios include the peak in construction jobs in 2020; this is due to the development of Drakelow Renewable Energy Park and Willington C gas-fired power station. Jobs in energy generation also increase significantly in 2025 onwards to account for the operation of the power stations.

For the coordinated scenario, jobs in infrastructure increase more than under the uncoordinated scenario due to the need to maintain the green infrastructure developed throughout the Trent Valley. The coordinated scenario additionally gains many more jobs in manufacturing and R&D, and in tourism, recreation, retail and leisure than the uncoordinated scenario. The increases for manufacturing are mainly due to the development of a manufacturing strategy, the formation of a Manufacturing and Research Board and improvements to transport infrastructure, whilst those for tourism are predominantly due to the marketing of the area as a place for boating holidays and day trips.

Table 5-13: Uncoordinated scenario: value of the transition economy in terms of jobs and GVA (undiscounted monetary values; £millions)												
Sector	2020			2025			2030			2050		
	Direction of change	Number of jobs	GVA	Direction of change	Number of jobs	GVA	Direction of change	Number of jobs	GVA	Direction of change	Number of jobs	GVA
Aggregates	No change	96	£5.0	No change	96	£5.0	No change	96	£5.0	No change	96	£5.0
Agriculture	Slight decrease	327	£8.5	Slight decrease	327	£8.5	Slight decrease	330	£9.0	Slight decrease	320	£8.3
Construction	Increase	13,148	£540	Increase	11,462	£470	Increase	11,462	£470	Increase	11,462	£470
Energy generation	None	750	£85	Increase	865	£98	Increase	865	£98	Increase	865	£98
Health and wellbeing	Very slight increase	11,763	£280	Very slight increase	11,880	£280	Very slight increase	11,996	£280	Slight increase	12,113	£290
Physical infrastructure	Slight increase	8,663	£390	Increase	9,075	£410	Increase	9,488	£430	Increase	9,075	£410
Manufacturing, R&D	None	15,103	£770	Very slight increase	15,254	£770	Very slight increase	15,407	£780	Increase	15,858	£800
Tourism, recreation, retail, leisure	No change	24,165	£570	Increase	25,373	£600	Increase	26,582	£620	Increase	27,790	£650
Water	No change	906	£78	No change	906	£78	No change	906	£78	No change	906	£78
Wider economy	Slight increase	25,161	£2,000	Slight increase	25,410	£2,000	Slight increase	25,659	£2,100	Slight increase	25,908	£2,100
Note: Heritage and wildlife and biodiversity are assumed to be captured within tourism. Direction of change relates to change from the baseline rather than change between the time points												

Table 5-14: Coordinated scenario: value of the transition economy in terms of jobs and GVA (undiscounted monetary values; £ s)												
Sector	2020			2025			2030			2050		
	Direction of change	Number of jobs	GVA	Direction of change	Number of jobs	GVA	Direction of change	Number of jobs	GVA	Direction of change	Number of jobs	GVA
Aggregates	No change	96	£5.0	No change	96	£5.0	No change	96	£5.0	No change	96	£5.0
Agriculture	Slight decrease	326	£8.5	Slight decrease	325	£8.4	Slight decrease	323	£8.4	Slight decrease	320	£8.3
Construction	Increase	13,148	£540	Increase	11,462	£470	Increase	11,462	£470	Increase	11,462	£470
Energy generation	None	750	£85	Increase	865	£98	Increase	865	£98	Increase	865	£98
Health and wellbeing	Very slight increase	11,763	£280	Very slight increase	11,880	£280	Very slight increase	11,996	£280	Slight increase	12,113	£290
Physical infrastructure	Slight increase	8,663	£390	Increase	9,075	£410	Increase	9,488	£430	Increase	9,900	£450
Manufacturing, R&D	Increase	15,858	£800	Increase	17,509	£890	Increase	19,331	£980	Increase	28,725	£1,500
Tourism, recreation, retail, leisure	Increase	26,582	£620	Increase	42,810	£1,000	Increase	47,091	£1,100	Increase	62,473	£1,500
Water	Slight increase	915	£79	Slight increase	924	£80	Slight increase	924	£80	Slight increase	924	£80
Wider economy	Slight increase	25,161	£2,000	Slight increase	25,410	£2,000	Slight increase	25,659	£2,100	Slight increase	25,908	£2,100
Note: Heritage and wildlife and biodiversity are assumed to be captured within tourism. Direction of change relates to change from the baseline rather than change between the time points												

The central estimates given in Tables 5-13 and 5-14 represent the 'best estimate' of jobs and GVA for each sector. However, it is prudent to also consider the likely range of the values. Given that the figures are based on the assumptions made during the assessment of productivity and outputs, and the likely level of growth given the scenario storylines, a high level of uncertainty is assumed.

Tables 5-15 and 5-16 therefore present the full range of estimated values for the GVA of the Trent Valley, whilst Tables 5-17 and 5-18 provide the same for the number of jobs. These values have been determined assuming a 70% uncertainty rating. To calculate the low sensitivity values, we have identified 70% of the difference between the baseline value and the value for each time point, and subtracted the resultant figure from the central estimate. For the high sensitivity values, we have performed the same calculation with the exception that we have added the 70% of the difference value to the central estimate.

Table 5-15: Uncoordinated scenario: value of the transition economy in terms of GVA (low, high and central estimates; £ millions)												
Sector	2020			2025			2030			2050		
	Low estimate	Central estimate	High estimate	Low estimate	Central estimate	High estimate	Low estimate	Central estimate	High estimate	Low estimate	Central estimate	High estimate
Aggregates	£5.0	£5.0	£5.0	£5.0	£5.0	£5.0	£5.0	£5.0	£5.0	£5.0	£5.0	£5.0
Agriculture	£7.3	£8.5	£9.7	£7.3	£8.5	£9.7	£7.3	£9.0	£9.7	£7.0	£8.3	£9.6
Construction	£360	£540	£720	£340	£470	£600	£340	£470	£600	£340	£470	£600
Energy generation	£85	£85	£85	£89	£98	£107	£89	£98	£110	£89	£98	£110
Health and wellbeing	£280	£280	£280	£280	£280	£280	£280	£280	£290	£280	£290	£290
Physical infrastructure	£380	£390	£410	£390	£410	£440	£390	£430	£470	£390	£410	£440
Manufacturing, R&D	£770	£770	£770	£770	£770	£780	£770	£780	£790	£780	£800	£830
Tourism, recreation, retail, leisure	£570	£570	£570	£580	£600	£620	£580	£620	£660	£590	£650	£710
Water	£78	£78	£78	£78	£78	£78	£78	£78	£78	£78	£78	£78
Wider economy	£2,000	£2,000	£2,000	£2,000	£2,000	£2,100	£2,000	£2,100	£2,100	£2,000	£2,100	£2,100
Note: Heritage and wildlife and biodiversity are assumed to be captured within tourism												

Table 5-16: Coordinated scenario: value of the transition economy in terms of GVA (low, high and central estimates; £ millions)												
Sector	2020			2025			2030			2050		
	Low estimate	Central estimate	High estimate	Low estimate	Central estimate	High estimate	Low estimate	Central estimate	High estimate	Low estimate	Central estimate	High estimate
Aggregates	£5.0	£5.0	£5.0	£5.0	£5.0	£5.0	£5.0	£5.0	£5.0	£5.0	£5.0	£5.0
Agriculture	£7.3	£8.5	£9.6	£7.2	£8.4	£9.6	£7.1	£8.4	£9.6	£7.0	£8.3	£9.6
Construction	£360	£540	£720	£340	£470	£600	£340	£470	£600	£340	£470	£600
Energy generation	£85	£85	£85	£89	£98	£110	£89	£98	£110	£89	£98	£110
Health and wellbeing	£280	£280	£280	£280	£280	£280	£280	£280	£290	£280	£290	£290
Physical infrastructure	£380	£390	£410	£390	£410	£440	£390	£430	£470	£400	£450	£500
Manufacturing, R&D	£780	£800	£830	£800	£890	£970	£830	£980	£1,100	£970	£1,500	£1,900
Tourism, recreation, retail, leisure	£580	£620	£660	£700	£1,000	£1,300	£730	£1,100	£1,500	£840	£1,500	£2,100
Water	£78	£79	£79	£78	£80	£81	£78	£80	£81	£78	£80	£81
Wider economy	£2,000	£2,000	£2,000	£2,000	£2,000	£2,100	£2,000	£2,100	£2,100	£2,000	£2,100	£2,100
Note: Heritage and wildlife and biodiversity are assumed to be captured within tourism												

Table 5-17: Uncoordinated scenario: value of the transition economy in terms of number of jobs (low, high and central estimates)												
Sector	2020			2025			2030			2050		
	Low estimate	Central estimate	High estimate	Low estimate	Central estimate	High estimate	Low estimate	Central estimate	High estimate	Low estimate	Central estimate	High estimate
Aggregates	96	96	96	96	96	96	96	96	96	96	96	96
Agriculture	281	327	372	281	327	372	281	330	372	269	320	370
Construction	8,816	13,148	17,479	8,310	11,462	14,613	8,310	11,462	14,613	8,310	11,462	14,613
Energy generation	750	750	750	785	865	946	785	865	946	785	865	946
Health and wellbeing	11,682	11,763	11,845	11,717	11,880	12,043	11,752	11,996	12,241	11,787	12,113	12,439
Physical infrastructure	8,374	8,663	8,951	8,498	9,075	9,653	8,621	9,488	10,354	8,498	9,075	9,653
Manufacturing, R&D	15,103	15,103	15,103	15,148	15,254	15,360	15,194	15,407	15,619	15,330	15,858	16,387
Tourism, recreation, retail, leisure	24,165	24,165	24,165	24,527	25,373	26,219	24,890	26,582	28,273	25,252	27,790	30,327
Water	906	906	906	906	906	906	906	906	906	906	906	906
Wider economy	24,987	25,161	25,336	25,061	25,410	25,759	25,136	25,659	26,183	25,211	25,908	26,606
Note: Heritage and wildlife and biodiversity are assumed to be captured within tourism												

Table 5-18: Coordinated scenario: value of the transition economy in terms of number of jobs (low, high and central estimates)												
Sector	2020			2025			2030			2050		
	Low estimate	Central estimate	High estimate	Low estimate	Central estimate	High estimate	Low estimate	Central estimate	High estimate	Low estimate	Central estimate	High estimate
Aggregates	96	96	96	96	96	96	96	96	96	96	96	96
Agriculture	280	326	372	278	325	372	275	323	371	269	320	370
Construction	8,816	13,148	17,479	8,310	11,462	14,613	8,310	11,462	14,613	8,310	11,462	14,613
Energy generation	750	750	750	785	865	946	785	865	946	785	865	946
Health and wellbeing	11,682	11,763	11,845	11,717	11,880	12,043	11,752	11,996	12,241	11,787	12,113	12,439
Physical infrastructure	8,374	8,663	8,951	8,498	9,075	9,653	8,621	9,488	10,354	8,745	9,900	11,055
Manufacturing, R&D	15,330	15,858	16,387	15,825	17,509	19,193	16,371	19,331	22,291	19,190	28,725	38,260
Tourism, recreation, retail, leisure	24,890	26,582	28,273	29,758	42,810	55,861	31,043	47,091	63,139	35,657	62,473	89,288
Water	909	915	921	911	924	937	911	924	937	911	924	937
Wider economy	24,987	25,161	25,336	25,061	25,410	25,759	25,136	25,659	26,183	25,211	25,908	26,606
Note: Heritage and wildlife and biodiversity are assumed to be captured within tourism												

Table 5-19 provides a summary of the total value of the transition economy in terms of GVA and jobs. In 2020, both scenarios provide a similar level of GVA (when reported to two significant figures). However, by 2050 there is expected to be a large difference between the scenarios, with the uncoordinated scenario providing a GVA of £4,900 million and the coordinated scenario resulting in a GVA of £6,400 million.

Table 5-19: Value of the transition economy in terms of GVA (£ millions) and jobs

Scenario	Category	Time point			
		2020	2025	2030	2050
Low sensitivity					
Uncoordinated	GVA	£4,500	£4,500	£4,600	£4,600
	Jobs	95,163	95,335	95,977	96,449
Coordinated	GVA	£4,500	£4,700	£4,800	£5,000
	Jobs	96,113	101,239	103,301	110,961
Central estimates					
Uncoordinated	GVA	£4,800	£4,800	£4,900	£4,900
	Jobs	100,091	100,666	102,805	104,411
Coordinated	GVA	£4,800	£5,300	£5,500	£6,400
	Jobs	103,262	120,355	127,235	152,786
High sensitivity					
Uncoordinated	GVA	£4,900	£5,000	£5,100	£5,200
	Jobs	105,018	105,997	109,633	112,373
Coordinated	GVA	£5,100	£5,900	£6,300	£7,800
	Jobs	110,410	139,471	151,169	194,610

Notes: values are derived from 2011 data on GVA and jobs combined with the assumptions used to estimate productivity and outputs for each of the economic sectors. All monetary values are presented to two significant figures. Values do not take background growth in GVA into account; instead they focus on the likely changes under the scenarios to enable comparisons between the coordinated and uncoordinated scenarios to be made

Figures 5-3 and 5-4 present the same information in chart format, with Figure 5-3 showing GVA (including the 2011 baseline of £4,400 million in GVA) and Figure 5-4 showing jobs (including the 2011 baseline of 93,181 jobs).

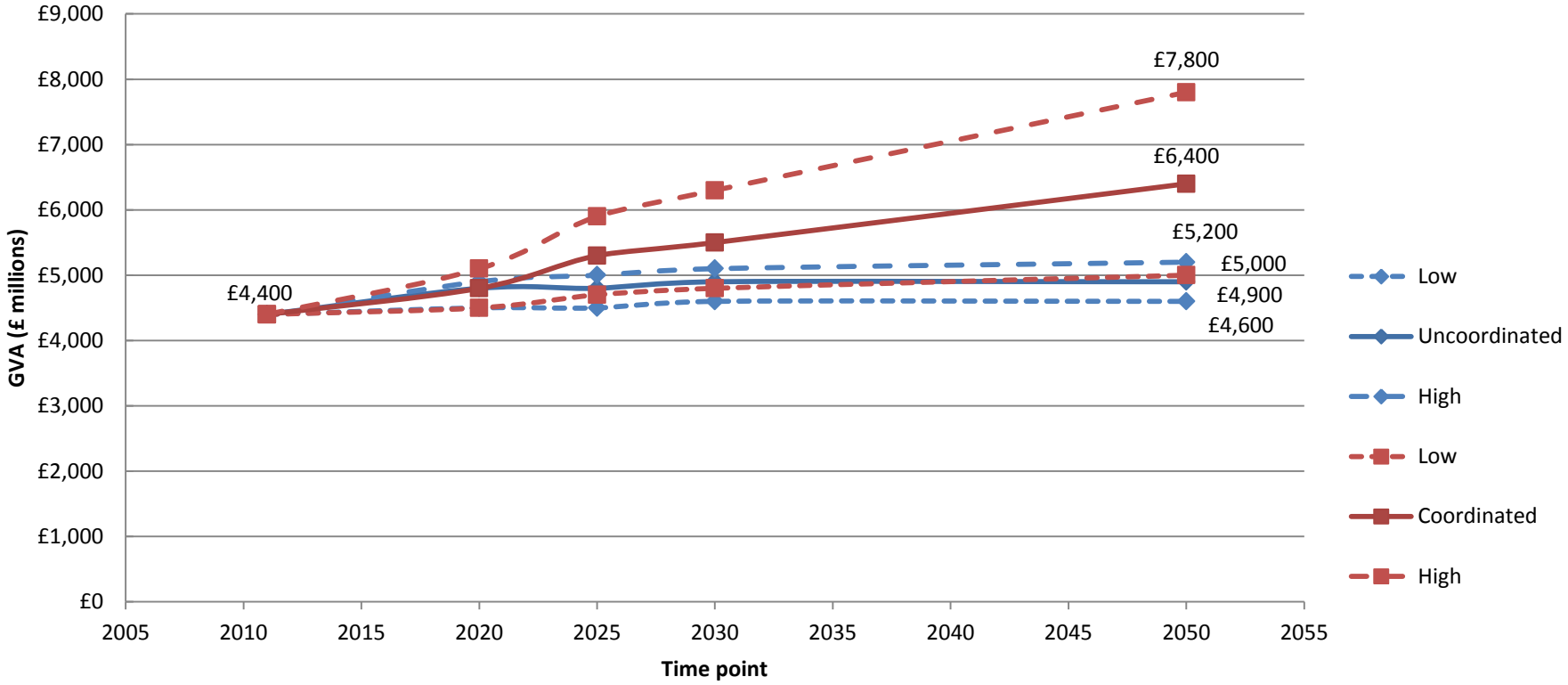

Figure 5-3: Value of the transition economy in terms of GVA

Figures are derived from 2011 data on GVA and jobs combined with assumptions for each of the economic sectors as used for the assessment of productivity and outputs. Red lines show the coordinated scenario whilst blue lines indicate the uncoordinated scenario. Solid lines represent the central estimate for each scenario and dashed lines represent the high and low sensitivity values

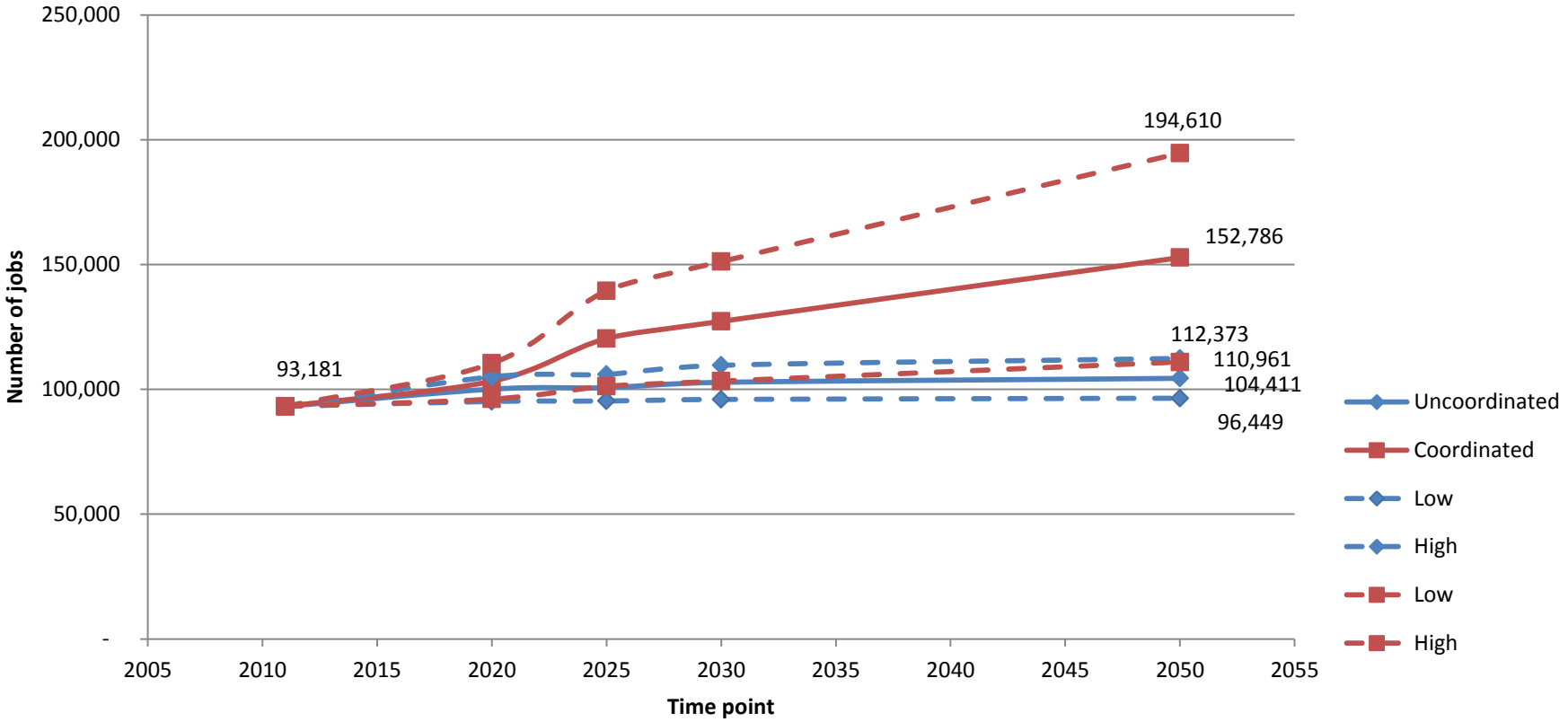

Figure 5-4: Expected number of jobs at each time point for the uncoordinated and coordinated scenarios

Figures are derived from 2011 data on jobs combined with assumptions for each of the economic sectors as used for the assessment of productivity and outputs. Red lines show the coordinated scenario whilst blue lines indicate the uncoordinated scenario. Solid lines represent the central estimate for each scenario and dashed lines represent the high and low sensitivity values

6 Comparing the scenarios

6.1 Overview

This section presents the results of comparing the scenarios with each other, as well as with the intuitive assessment provided in the specifications.

6.2 Comparing the uncoordinated and coordinated scenarios

6.2.1 Comparison of the time points

Table 6-1 shows the difference between the two scenarios in terms of productivity and outputs, whilst Table 6-2 presents the difference in ecosystem service provision. Table 6-3 compares the GVA and jobs of the two scenarios. Note that comparisons in all three tables use the central estimates.

Table 6-1: Productivity benefits of coordinated over uncoordinated scenario (£ millions)

Sector	2020	2025	2030	2050
Aggregates	£0	£0	£0	£0
Agriculture	-£0.020	-£0.075	-£0.13	-£0.009
Construction	£0	£0	£0	£0
Energy generation	£0.029	£0.068	£0.087	£0.11
Health and wellbeing	Captured under ecosystem services			
Heritage	Captured under ecosystem services			
Physical infrastructure	£1.2	£1.2	£1.5	£2.7
Manufacturing, R&D	£140	£400	£700	£2,300
Tourism, recreation, retail, leisure	£13	£95	£110	£530
Water	£0	£0	£0	£0
Wider economy	Captured under ecosystem services			
Wildlife/biodiversity	Captured under ecosystem services			
TOTAL	**£150**	**£500**	**£820**	**£2,800**

Note: values are undiscounted and presented to two significant figures. Totals may not be the exact sum of the sectors due to rounding

Table 6-2: Ecosystem service benefits of coordinated over uncoordinated scenario (£ millions)

Service	2020	2025	2030	2050
Biodiversity	£0.30	£0.57	£0.84	£1.4
Livestock and crop production	Captured under productivity			
Energy production	Captured under productivity			
Aggregates	Captured under productivity			
Drinking water	Captured under productivity			
Air quality	£0.19	£0.43	£0.83	£2.5
Carbon sequestration	£0.78	£5.1	£13	£43

Table 6-2: Ecosystem service benefits of coordinated over uncoordinated scenario (£ millions)				
Service	**2020**	**2025**	**2030**	**2050**
Quality of filtered water for habitats and abstraction	£0.014	£0.094	£0.33	£1.2
Water regulation (capturing risk of flooding and inundation)	£0.22	£0.33	£1.2	£3.3
Value of educational trips/visits	£0.47	£0.56	£0.66	£0.94
Value of heritage	£0.003	£0.006	£0.0097	£0.0016
Intrinsic value of landscape and its appearance	£0.35	£2.3	£5.6	£24
Recreational activities	Captured under productivity			
Wellbeing, health and happiness	£0.72	£1.5	£2.6	£4.0
Jobs	Captured under jobs and GVA			
Gross value added	Captured under jobs and GVA			
Attracting business and investment	Captured under jobs and GVA			
Attracting employees and skills	Captured under jobs and GVA			
TOTAL	**£3.0**	**£11**	**£25**	**£80**
Note: values are undiscounted and presented to two significant figures. Totals may not be the exact sum of the sectors due to rounding				

Table 6-3: Comparison of GVA (£ millions) and jobs between the scenarios				
Measurement	**Time point**			
	2020	**2025**	**2030**	**2050**
GVA benefits of coordinated scenario over uncoordinated	£96	£530	£680	£1,500
Number of jobs provided by the coordinated scenario over uncoordinated	3,171	19,689	24,430	48,375
Note: monetary values are undiscounted and presented to two significant figures.				

The tables indicate that in general, the two scenarios diverge over time, with the greatest difference in value apparent in 2050.

- Sectors:
  - **Manufacturing, R&D**: stronger growth is assumed under the coordinated scenario due to better physical infrastructure (road/rail connections), the development of a manufacturing strategy and the formation of a specific Manufacturing and Research Board;

- **Tourism, recreation, retail, leisure**: under the coordinated scenario, this sector has significantly stronger growth due to the formation of the Trent Valley Brand, the development of a joined-up marketing strategy, links to local food and drink offers, and the restoration of aggregates areas to provide a landscape suited to boat trips and holidays (similar to the experience offered by the Norfolk Broads);

- Services:

  - **Carbon sequestration** (emissions and sequestration of greenhouse gases): the coordinated scenario provides increased carbon sequestration over the uncoordinated scenario due to a greater amount of green infrastructure, and also a reduction in habitat fragmentation (due to land use management and planning being considered at the landscape scale rather than the individual site level);

  - **Aesthetics**: the coordinated scenario provides an improved landscape when compared with the uncoordinated scenario. This is due to wider implementation of green infrastructure and defragmentation of the landscape to provide greater flow along the valley and from valley through floodplain to river terraces; and

  - **Health and well-being**: the improvement of the landscape together with greater opportunities to enjoy outdoor recreation offer significant benefits for mental health under the coordinated scenario, which exceed the benefits offered just through implementation of the health strategy under the uncoordinated scenario (physical health benefits are captured under other services, such as air quality).

6.2.2 Sectors where the Trent Valley may have a competitive advantage

The analysis of sector benefits through the assessment of changes in productivity highlights that implementation of the coordinated scenario could result in significant benefits for two sectors, namely manufacturing and R&D, and tourism and recreation. In terms of ecosystem services, the presence of a significant amount of green infrastructure benefits the provision of numerous ecosystem services, as well as contributing to the creation of a more attractive landscape where people want to live.

The focus of the coordinated scenario is in emphasising the environmental, locational and social (including skills) advantages that currently exist and looking to build upon these to 2050. This highlights the ongoing importance of advanced manufacturing and R&D. Real opportunities arise with improvements to the landscape and the development of the Trent Valley 'Storyline'. As well as offering opportunities to develop new recreational facilities and link together tourist attractions to provide an enhanced experience, the high quality landscape should encourage investment into the area and attract highly skilled people by enabling a high quality of life. This has iterative benefits with the construction sector by presenting opportunities for high quality, high value housing and employment sites that reflect the landscape. These opportunities should attract innovative design and could provide the environment in which R&D companies can flourish.

6.2.3 Overall comparison

To compare the two scenarios over the whole assessment period (i.e. from 2020 to 2050), it is first necessary to interpolate the values for the years in between the time points. This results in an

estimated value for each sector and service, for every year, for both scenarios. The benefits of the coordinated scenario over the uncoordinated scenario can then be determined for each year through subtracting the values for the uncoordinated scenario from those for the coordinated scenario. Summing the difference between the scenarios in every year provides the overall benefits of the coordinated scenario[5].

Following this process means that the benefits of the coordinated scenario over the uncoordinated scenario are:

- **£16 billion** in terms of productivity and outputs (value given in present value format to two significant figures); and
- **£450 million** in terms of ecosystem services (value given in present value format to two significant figures).

In other words, should all aspects of the coordinated scenario be implemented according to the overall vision and the sectoral visions, the Trent Valley study area has the potential to deliver £16 billion more in terms of productivity and outputs, and £450 million more in ecosystem service benefits than if the existing approach continued.

6.3 Comparing the scenarios with the intuitive assessment

Table 6-4 identifies how the assessment carried out for this study can be used to identify the extent to which each outcome proposed in the intuitive assessment in the specifications could be met. A comparison is provided with the intuitive assessment, with justifications drawn from the scenario description and the assessment of economic benefits. Consideration is given to whether the economic assessment of the scenarios suggests that the outcomes may be the same (i.e. have the same high, medium or low rating) or vary (higher or lower) than the intuitive assessment.

[5] When summing costs and benefits occurring in different years, it is necessary to discount values to take account of time preference, i.e. the preference for benefits to be felt this year rather than next year or in 10 years' time. The Treasury Green Book (HM Treasury, 2011) specifies a discount rate of 3.5% declining. This rate is applied to this assessment.

Table 6-4: Comparison of intuitive assessment with the coordinated and uncoordinated scenarios						
Outcome	Intuitive assessment from study specifications		Assessment carried out for this study			
	Coordinated scenario	Uncoordinated scenario	Coordinated scenario	Justification	Uncoordinated scenario	Justification
The potential to change from an extensively agricultural economy to a mixed economy which is supported by a leisure and recreational landscape	high	low	high (same)	Agriculture estimated to support around 320 jobs in 2050 while tourism and recreation grows rapidly to support around 62,000 jobs	low (same)	Agriculture supports around 380 jobs in 2050 while tourism and recreation grows slightly to support 28,000 jobs
To meet the demands of an expanding population associated with the Derby Housing Market Area and the requirement for high quality Green Infrastructure as part of a sustainable approach to development	high	low	high (same)	Provision of high quality housing that fits with landscape and uses green infrastructure to link living and working spaces. Additional benefits over the uncoordinated scenario to water purification of £0.98 million per year by 2050 (undiscounted) and to water regulation (flooding) of £3.3 million per year by 2050 (undiscounted)	low (same)	Lower emphasis on green infrastructure *between* developments means benefits are limited to within developments only

Table 6-4: Comparison of intuitive assessment with the coordinated and uncoordinated scenarios						
Outcome	Intuitive assessment from study specifications		Assessment carried out for this study			
	Coordinated scenario	Uncoordinated scenario	Coordinated scenario	Justification	Uncoordinated scenario	Justification
A landscape that reflects and respects its historic development through the protection of those features (both designated and undesignated) essential to telling the story so far and a new landscape that reflects more recent change associated with mineral workings – a case of not hiding from change but proactively planning for it into the future	high	low	high (same)	Development of a Trent Valley brand and storyline that embraces historic and industrial change and how this has shaped the valley. Additional landscape (aesthetic) benefits over the uncoordinated scenario of around £24 million per year by 2050 (undiscounted) (assuming high value for aesthetics)	low (same)	No specific actions to bring together the historic, industrial and current land uses such that there is no mechanism for reflecting this in the landscape
A landscape with a much stronger focus on nature conservation through the development of extensive inter-connected wetland habitats weaved between remnant agricultural areas	high	medium	high (same)	Focus on defragmentation of landscape and habitats, including restored aggregate extraction sites. Additional biodiversity benefits over the uncoordinated scenario of around £1.4 million per year by 2050 (undiscounted)	low (lower)	Focus for nature conservation is on designated areas with limited opportunities on an ad hoc basis outside these areas

Table 6-4: Comparison of intuitive assessment with the coordinated and uncoordinated scenarios						
Outcome	Intuitive assessment from study specifications		Assessment carried out for this study			
	Coordinated scenario	Uncoordinated scenario	Coordinated scenario	Justification	Uncoordinated scenario	Justification
The potential to attract tourists to the area through new recreational opportunities and improving the local economy – akin to the Norfolk Broads or the Cotswolds Water Park. It is in a central location nationally with an extensive population catchment within a few hours journey time	high	low	high (same)	Ambition is to combine existing assets with new assets, linking to new (and existing) developments to identify and develop new opportunities through the Trent Valley brand and storyline, including development of a nationally important water park. Additional benefits over the uncoordinated scenario of around £530 million per year (undiscounted) by 2050 for tourism, recreation, retail and leisure	low (same)	Tourism (visitor economy) is one of the LEP's priority sectors but focus is on publicity for key (anchor) attractions and existing tourism/ recreation assets
New business opportunities attracted by this new landscape and services such as boat builders, holiday lets, marinas, cafes, conservation based events, etc.	high	low	high (same)	The provision of green infrastructure is expected to increase the attractiveness of the Trent Valley as a place to live and work, with tourism related businesses thriving (tourism has additional benefits of around £530 million (undiscounted) over the uncoordinated scenario)	low (same)	Tourism is one of D2N2's priority sectors, but whilst it does increase slightly, the lack of landscape scale planning means that businesses are not attracted to the area to the same extent as under the coordinated scenario

Table 6-4: Comparison of intuitive assessment with the coordinated and uncoordinated scenarios						
Outcome	Intuitive assessment from study specifications		Assessment carried out for this study			
	Coordinated scenario	Uncoordinated scenario	Coordinated scenario	Justification	Uncoordinated scenario	Justification
Attracting inward investment on the back of a new and enhanced landscape – businesses wanting to locate to an attractive area close to an expanding workforce with good communication links	high	low	high (same)	Focus on improving workforce skills and linking the skills and key economic sectors to the Trent Valley brand so it has a clear identity for marketing purposes	medium (higher than in intuitive assessment)	LEP priority sectors and work to develop these through the growth strategy, including actions to attract and retain high skilled workers; an issue may be increased congestion which could reduce attractiveness
Connected waterbodies allowing for the use of barges to deliver the extracted minerals to market and reduce the reliance on road haulage with the associated impacts on local communities	medium	low	medium (same)	Opportunities for moving aggregates by water are investigated where possible to minimise impacts on road traffic	low (same)	Some consideration is given to alternative transport opportunities but this is limited by, for example, the lack of inter-connected water bodies
New multi-user trails connecting to the key settlements along the valley and particularly into new communities as part of the housing growth	high	low	high (same)	Promotion of green infrastructure as an integrated form of transport as well as recreational trails and opportunities	medium (higher than in intuitive assessment)	Includes opportunities along strategic corridors and use of long distance routes but does not specifically aim to connect to new communities

Table 6-4: Comparison of intuitive assessment with the coordinated and uncoordinated scenarios						
Outcome	Intuitive assessment from study specifications		Assessment carried out for this study			
	Coordinated scenario	Uncoordinated scenario	Coordinated scenario	Justification	Uncoordinated scenario	Justification
Low key recreational opportunities such as canoeing, cycling, fishing, walking, swimming, etc. – multiple public benefits from the same resource	high	low	high (same)	Linkages between different recreational opportunities to maximise use, and between communities and developments to maximise access; also zoning of activities to enable a wide range of activities to be offered throughout the valley	low (same)	Focus is on key attractions and publicity to improve visitor numbers rather than a focus on low key recreational opportunities
Potential to reduce health-care costs through increased use of green infrastructure for both existing and new communities	high	low	high (same)	Use of green infrastructure to help improve people's quality of life. Additional wellbeing benefits over the uncoordinated scenario of £4.0 million per year by 2050 (undiscounted)	medium (higher than in intuitive assessment)	Health and wellbeing strategy already aims to tackle issues such as social capital and creation of healthy communities including through exercise and promotion of outdoor activities
Improved trade for existing business such as B&Bs, shops, pubs and restaurants through the change to a tourist economy – existing communities buy into the overall benefits rather than just perceiving the negatives	high	low	high	Marketing of the Trent Valley storyline, along with the development of the area as a place for boating holidays and boat trips leads to a significant increase in GVA within the tourism and leisure sector	medium (higher than in intuitive assessment)	Tourism is one of D2N2's priority sectors, so significant investment means that even under the uncoordinated scenario, the tourism economy benefits

Table 6-4: Comparison of intuitive assessment with the coordinated and uncoordinated scenarios						
Outcome	Intuitive assessment from study specifications		Assessment carried out for this study			
	Coordinated scenario	Uncoordinated scenario	Coordinated scenario	Justification	Uncoordinated scenario	Justification
A new landscape structure and changing landscape character based on a strong woodland framework to help link existing features with new habitats and improve the environmental capacity of the area – not a scattering of points of interest but a new attractive and integrated landscape	high	low	high (same)	Defragmentation is a key aspect of improving the aesthetics of the landscape with woodland used as an important habitat and screening around features that do not fit with the Trent Valley storyline	low (same)	Landscape is likely to become more fragmented as there is no coordinated action to manage the landscape at the valley scale

Table 6-4: Comparison of intuitive assessment with the coordinated and uncoordinated scenarios						
Outcome	Intuitive assessment from study specifications		Assessment carried out for this study			
	Coordinated scenario	Uncoordinated scenario	Coordinated scenario	Justification	Uncoordinated scenario	Justification
The improved management of remnant landscape areas through the use of targeted environmental stewardship to help conserve important landscape, historic and ecological features	high	low	high (same)	BAP habitat plans are implemented (as in the uncoordinated scenario) but much more work is also undertaken to reduce fragmentation and increase connectivity for ecological features. Historic assets are also publicised more widely and brought into the Trent Valley storyline to help illustrate the changes and development of the valley. Additional benefits to biodiversity and cultural heritage over the uncoordinated scenario of £1.4 million per year to 2050 (undiscounted)	medium (higher than under intuitive assessment)	BAP habitat plans are implemented encouraging continued and expanded management of designated and high value conservation areas

Table 6-4: Comparison of intuitive assessment with the coordinated and uncoordinated scenarios						
Outcome	Intuitive assessment from study specifications		Assessment carried out for this study			
	Coordinated scenario	Uncoordinated scenario	Coordinated scenario	Justification	Uncoordinated scenario	Justification
The maintenance of a thriving mineral industry with certainty regarding the available mineral resource, clarity about the constraints and the expectation of helping to deliver the landscape 'vision'	high	low	high (same)	Maintenance of GVA and jobs in aggregates sector throughout assessment period. Clear role in terms of restoration requirements within strategy for the Trent Valley as a whole	low (same)	No difference between uncoordinated and coordinated scenarios in terms of GVA and jobs for minerals industry, but restoration is carried out on site-by-site basis rather than fitting with the Trent Valley vision
The need to consider and encourage mineral operators to revisit former extraction areas (possibly restored) to undertake additional work that might further benefit the overall vision e.g. connecting existing waterbodies or providing a link to the river, new access, planting, etc.	high	low	high (same)	Restoration of aggregate extraction sites is identified as a key opportunity to initiate defragmentation of habitats and recreational sites (taking account of the East Midlands Airport safeguarding zone). This turns the vision into a plan that could be implemented through enhanced working with aggregates companies	low (same)	No specific aim to review restoration plans

Table 6-4: Comparison of intuitive assessment with the coordinated and uncoordinated scenarios						
Outcome	Intuitive assessment from study specifications		Assessment carried out for this study			
	Coordinated scenario	Uncoordinated scenario	Coordinated scenario	Justification	Uncoordinated scenario	Justification
Increasing and enhancing the overall number of Ecosystem Services provided by the Trent Valley landscape – flood alleviation, water storage, carbon sequestration, habitat creation, pollination, etc.	high	medium/ low	high (same)	Benefits are seen to biodiversity, air quality regulation, carbon sequestration, water purification, water regulation, educational value, cultural heritage, aesthetics, and wellbeing ecosystem services (with further benefits to provisioning services). Total benefits of £80 million per year in 2050 (undiscounted)	medium/ low for benefits (same) low (lower across all ecosystem services taking account of dis-benefits)	Benefits are seen to biodiversity and wellbeing. Benefits to these services of £3 million per year by 2050 (but note there are also dis-benefits of £15-16 million to the other ecosystem services such that the benefits of the coordinated over the uncoordinated scenario are greater)
Provide opportunities to naturalise the river and its floodplain, including the realignment of flood defences	high/ medium	low	high/ medium (same)	Potential to use natural flood management measures, defragmentation and realignment of defences to reduce flood risk	low (same)	Focus is on providing flood defences, this could include natural measures but this is not specified

Table 6-4: Comparison of intuitive assessment with the coordinated and uncoordinated scenarios						
Outcome	Intuitive assessment from study specifications		Assessment carried out for this study			
	Coordinated scenario	Uncoordinated scenario	Coordinated scenario	Justification	Uncoordinated scenario	Justification
Provide a higher degree of certainty to local communities, mineral extraction companies, developers and local planning authorities as well as other environmental agencies and groups	high	low	high (same)	Vision provides the basis for planning towards the goals that need to be achieved. These cut across sectors better enabling partnership working, allowing all parties to get involved with developing a better future for their businesses, employees and for their quality of life	low (same)	Uncoordinated plans means that there is potential for conflicts between different objectives and/or no mechanisms to better enable partnership working. Decisions may be delayed due to conflicts and objections as a result
Produce a scarred landscape with poor visual cohesion	low	high	low (same)	Objective is to work against this outcome, delivering a less fragmented landscape and encourage greater cohesion	high (same)	Existing plans could help reduce potential impacts individually but there is no overall vision so greater fragmentation is likely
Produce a landscape with limited economic potential	low	high	low (same)	Objective is to identify opportunities to enhance the landscape such that it better enables sustainable economic growth. Potential to significantly increase GVA associated with tourism and recreation, but also for other sectors such as manufacturing and construction	high (same)	Conflicts between plans and limited opportunities for partnership working mean that win-win situations are missed. The LEP growth strategy may help reduce this risk but this is not targeted at the landscape
Source: outcomes and intuitive assessment extracted from study specifications (Appendix A specification, Q3135 – The future economic value of the Trent Valley)						

7 Actions and funding sources

7.1 Overview

This section discusses the actions and funding sources which could be used to enable progression towards the coordinated scenario.

7.2 Identification of changes required

Table 7-1 brings together the changes likely to be required to enable the coordinated scenario to be taken forwards. These changes (identified during the development of the scenario storylines in Section 4) have been categorised as follows:

- Changes/strengthening of plans and initiatives of all relevant organisations;
- Education;
- Funding;
- Partnership working;
- Planning system/policies;
- Publicity; and
- Staffing.

Note that two additional cross sectoral changes have been added to those identified as part of development of the scenarios. These changes are overarching ones that require the different sectors to work together to enable the Trent Valley vision to be implemented.

Table 7-1: Changes required to take forward a coordinated approach

Sector	Change required	Type of change
Aggregates	Review restoration plans with quarry companies to agree different end goals	Partnership working
	Identify organisations that can take over (or share) responsibility for managing restored sites in line with their purpose of restoration	Partnership working
	Identify funding sources to support organisations that take over (or share) responsibility for the sites	Funding
	Establish appropriate policy wording in emerging Local Plans including the Minerals Local Plan and district/borough plans, ensuring each plan recognises and supports the aims of the others	Changes/strengthening of plans and initiatives of all relevant organisations; Partnership working
Agriculture	Identify funding sources to enable farms to invest in technology and equipment, and the development of new skills to help them process their produce	Funding
	Awareness campaign on emerging/new/potential products (including energy crops)	Publicity
	Target Countryside Stewardship funding to assist in the sensitive management of areas of historic landscape	Funding

Table 7-1: Changes required to take forward a coordinated approach		
Sector	**Change required**	**Type of change**
Construction (including residential development)	Changes to conditions applied to planning permissions to ensure that large developments must incorporate green spaces, footpaths and cycle ways with due consideration given to access to services	Planning system/policies
	Establish planning policy in support of the Trent Valley vision	Planning system/policies
Energy generation	Change planning to encourage consideration of potential for energy generation at an appropriate scale within all developments and restorations	Planning system; Partnership working
Health and wellbeing	Include health and wellbeing of residents, workers and visitors within decisions made about changes to the Trent Valley, especially when developing future visions so quality of life becomes a key factor	Changes/strengthening of plans and initiatives of all relevant organisations; Partnership working
	Establish planning policies in Local Plans that promote design quality to encourage the very best environments	Planning system/policies
Heritage	Identify funding sources to raise the profile of heritage assets as part of tourism offer, including working with landowners to identify industrial heritage of previous and current land uses and how this can be highlighted	Funding; Partnership working
Physical infrastructure	Revise the role of D2N2 Infrastructure Investment Board (IIB) to give it a longer-term focus (looking to 2030 and beyond)	Partnership working
	Change planning approaches to enable longer-term projects to be brought into the planning system and considered at an early stage (e.g. to link with HS2 and associated developments)	Planning system/policies
	Change industry planning timeframes and associated funding systems (e.g. Ofwat) so that future projects can secure funding at a much earlier stage providing the basis for a more coordinated approach to development taking account of needed changes to physical infrastructure to underpin other developments	Funding
Manufacturing and research & development	Establish a Manufacturing and Research Board with powers to develop strategic plans, identify funding sources and allocate funds to projects that provide the greatest economic, environmental and social benefits taking account of not just the needs of manufacturing/R&D but also the wider needs of the Trent Valley and improvement of quality of life	Partnership working; Funding
	Undertake long-term planning to enable masterplanning associated with HS2 and inter-linkages between construction, physical infrastructure and the advanced manufacturing sector	Planning system/policies
	Identify funding sources to promote the historic importance of manufacturing and links between manufacturing and the visitor economy	Funding

Table 7-1: Changes required to take forward a coordinated approach		
Sector	**Change required**	**Type of change**
Tourism, recreation, retail and leisure	Change restoration plans for aggregates extraction	Changes/strengthening of plans and initiatives of all relevant organisations
	Develop more joined up approach when planning and implementing new footpaths and cycle ways to ensure locations are better connected, with an overall vision of creating a long distance footpath along the Trent and Dove valleys	Planning system/policies; Partnership working
	Promote and look to create themed visitor development around water bodies, footpaths and cycle ways involving active holidays, bird watching, cycling, heritage trails, etc. with non- vehicle links to other areas	Partnership working; Publicity; Education
	Promote and look to create and enhance recreational opportunities such as angling, swimming, etc.	Publicity
	Create strong links between planning for transport and the needs of visitors to the area and those looking to utilise recreational opportunities	Partnership working
Water	Increase education about water use and efficiency to reduce demand for potable water	Education; Publicity
	Emphasise comprehensive measures to improve water quality and the link between water quality and the beauty of the landscape, richness of biodiversity and water-based recreation	Changes/strengthening of plans and initiatives of all relevant organisations; Partnership working
Wider economy	Encourage different business sectors to develop their plans together to take advantage of opportunities and benefit each other (e.g. construction and manufacturing)	Partnership working; Changes/strengthening of plans and initiatives of all relevant organisations
	Encourage approaches to design quality that will mirror the natural beauty of the area and encourage investment into the area	Planning system/policies; Changes/strengthening of plans and initiatives of all relevant organisations; Funding

Table 7-1: Changes required to take forward a coordinated approach		
Sector	**Change required**	**Type of change**
Wildlife and biodiversity	Develop a strategic approach to identifying areas of greatest potential to deliver new biodiversity and/or link existing sites	Planning system/policies
	Identify funds to assist with ongoing management of wildlife and biodiversity habitats and enhancement through projects that reconnect habitats, create corridors and re-create floodplain meadows	Funding
	Enable strong planning links to approaches in other sectors, especially tourism/recreation and heritage to enable links, corridors and connectivity to be taken into account more widely and deliver added value	Planning system/policies; Partnership working
	Continue to improve provision and quality of habitat to encourage iconic species such as bittern and otter, thus adding to the attractiveness of the Trent Valley as a place to visit	Partnership working; Publicity; Education
Overarching/ cross-sectoral changes	Form a coordination board supported by appropriate staff to enable delivery of the coordinated approach	Partnership working
	Develop a business case for the delivery of the coordinated vision. This will need to identify the structure of the organisation that will be responsible for management, monitoring and evaluation of progress in delivery of the vision. It will also need to update and revise the vision to take account of new developments and approaches to ensure that the vision remains innovative and forward-thinking and retains a focus on delivery of the highest quality outcomes, economically, socially and environmentally. This will require development of a business plan showing how, where and why the coordinated scenario could work and what the benefits and costs of different approaches might be. This will help decision-makers identify the best mechanism for delivery of the vision to 2050 and beyond	Partnership working

7.3 Identification of actions

The next step is to identify actions which could help enable these types of changes to be made. Table 7-2 draws upon the coordinated scenario description, as well as the changes required to implement the scenario (given above) to suggest specific actions. These actions are then linked to the economic sectors and ecosystem services that they could benefit.

A critical action under 'partnership working' is the development of the detailed vision which provides the context for all the other actions. This vision needs to include the key principles of the coordinated approach. It also needs to be produced in such a way that it obtains the support and buy-in of the different stakeholders who are going to need to work together to ensure its implementation.

Table 7-2: Potential actions along with economic sectors and ecosystem services that would benefit from those actions		
Type of change	**Specific actions related to type of change**	**Economic sectors and ecosystem services with potential to benefit from the action**
Changes/strengthening of plans and initiatives of all relevant organisations	Set up a cross-departmental working group within the council (similar to the Coastal Officers' Working Group developed by East Riding of Yorkshire Council) that can meet on a regular basis (e.g. quarterly or biannually) to discuss issues and opportunities in relation to the Trent Valley vision (such as appropriate policy wording in emerging Local Plans)	All sectors and services
	Influence policies and aspirations in other relevant strategies	All sectors and services
Education	Produce Learning Packs for local schools and further and higher education institutions alongside offering free talks on a range of related topics	Tourism, recreation, retail and leisure; Value of educational trips/visits
	Run local competitions to encourage community participation and involvement in the Trent Valley vision	Tourism, recreation, retail and leisure; Recreational activities; Wellbeing, health and happiness;
	Utilise the information produced by Seven Trent Water (such as the Seven Trent saving water guide, free water saving products[6], etc.) to educate the community, residents, and businesses about water efficiency	Water sector; Drinking water; Quality of filtered water for habitats and abstraction
Funding	Investigate funding sources related to development of heritage trails	Tourism, recreation, retail and leisure; Value of heritage; Recreational activities
	Investigate funding sources related to maintenance and improvement of wildlife and biodiversity habitats, such as funding for green infrastructure and natural flood management	Tourism, recreation, retail and leisure; Biodiversity; Quality of filtered water for habitats and abstraction; Risk of flooding and inundation; Intrinsic value of the landscape and its appearance; Recreational activities
	Investigate options and opportunities for private sector funding, such as Payment for Ecosystem Services (PES)	Tourism, recreation, retail and leisure (e.g. through visitor payback schemes); Potentially all services, but most likely to be those where there is a measurable benefit to an individual or business (e.g. risk of flooding and inundation)

[6] See Seven Trent Water's 'Save water save money' website, accessed at: https://www.savewatersavemoney.co.uk/severntrent/free-water-saving-products on 4th March 2016.

Table 7-2: Potential actions along with economic sectors and ecosystem services that would benefit from those actions		
Type of change	**Specific actions related to type of change**	**Economic sectors and ecosystem services with potential to benefit from the action**
	Identify funding sources to enable the coordinated board and its associate staff to operate. The administrative costs could be reduced by seconding staff with specific expertise from existing organisations. However, this could lead to staffing gaps at existing organisations, so it is likely that the coordination board would need to employ some new staff members directly or through temporary contracts with existing organisations	All sectors and services
Partnership working	Develop a detailed vision for the Trent Valley, building upon the potential benefits identified in this report from the scenario assessment. The vision will need to include the key principles underlying the coordinated approach and development of a master plan to 2050. Development of the vision will run alongside partnership working and engagement to ensure that there is buy-in from all those who need to be involved with its delivery	All sectors and services
	Investigate the use of "ethical brokers" or intermediaries to encourage partnership working, provide guidance and support, and identify funding (e.g. liaise with Trent Rivers Trust joint bids for funding to maximise the value of their initiatives, etc.)	All sectors and services
	Investigate the possibility of setting up a quarterly or biannual sector meeting between the council and relevant organisations, businesses and land owners	All sectors and services
	Engage major aggregates companies at this concept stage to secure their buy-in and ownership of the project. A similar approach can be adopted for communities and local business	Aggregate extraction sector; All services
	Develop partnerships: as well as directly employing or seconding staff to work with the coordination board, there is a need to establish strong partnerships with organisations, businesses and local communities throughout the Trent Valley. This is likely to require	All sectors and services

Table 7-2: Potential actions along with economic sectors and ecosystem services that would benefit from those actions		
Type of change	**Specific actions related to type of change**	**Economic sectors and ecosystem services with potential to benefit from the action**
	development of a partnership engagement plan to identify how partnership approaches should be developed and which activities are likely to be needed to enable partnership working to develop	
Planning system/policies	Secure commitment from Local Planning Authorities in the study area to use the Trent Valley vision project as an overarching/coordinating strategy to help steer individual initiatives and schemes	All sectors and services
Publicity	Promote the idea of the Trent Valley vision so that organisations are inspired to help shape it through feeding in their ideas	All sectors (particularly those which manage significant areas of land e.g. aggregates extraction, agriculture) All services
	Develop the Trent Valley storyline as a brand (with a simple clear relevant logo) and encourage tourist/heritage/ recreation attractions to use this as part of their marketing material	Tourism, recreation, retail and leisure; Value of educational trips/visits; Value of heritage; Recreational activities
	Investigate the potential for a dedicated Trent Valley website (and other social media outlets) to raise the profile of the area, disseminate changes/actions within the area, and encourage participation from the community	All sectors and services
	Organise and run regular community and business events to keep people engaged in the vision for the area	All sectors; All services (but website could focus on particular subset dependent on target audience e.g. Wellbeing, health and happiness, Recreational activities)

7.4 Funding sources

Funding is required to enable the actions to be implemented. This section considers the possible sources of funding that could enable the actions given in Table 7-2 to be implemented. As well as public funding, there may be also be opportunities to obtain funding from the private sector. For some economic sectors (e.g. tourism, recreation, retail and leisure), private individuals are likely to be willing to invest in assets they own if they think that they are going to benefit directly from their investment. Delivery of some ecosystem services can also result in direct benefits to organisations and companies; for example, helping them to meet their corporate social responsibility linked to suitability and biodiversity. Where such benefits exist, organisations may be willing to pay for or contribute towards the costs of delivering those services.

Table 7-3 provides a summary of possible funding sources for the economic sectors, whilst Table 7-4 provides the same information for the ecosystem services. Note that the monetary values included are in present value (PV) format and have been discounted at the Treasury Green Book rate of 3.5%. Discounting allows values from different years to be summed and ensures that time preference is taken into account. Discounting is required in assessments and appraisals when comparing future benefits and costs (or in this case, potential funding available).

Both tables highlight where there may be opportunities to lever in private funds and where public funds could be sourced. The sources of public funds are limited to organisations that manage funds.

For the economic sectors (Table 7-3), there are three sectors (aggregates, construction and water) where the coordinated scenario is not expected to result in benefits over and above the uncoordinated scenario. This does not mean that there are no benefits for the sector; instead the sectors are expected to perform the same (in terms of productivity and outputs) under the two scenarios. For agriculture, a negative value is given in Table 7-3. This means that there are more benefits under the uncoordinated scenario than the coordinated one, primarily due to a shrinking of the agricultural sector. However, under the coordinated scenario, the remaining agricultural land produces high quality outputs (linked to the increased marketing of local food) with a focus on stewardship of the land and environmental quality. Thus, whilst the net benefits in terms of productivity and outputs are lower than under the uncoordinated scenario, the agricultural sector is still contributing to the overall economy and ecosystem services) of the area. In addition, local diversification may mean that some farmers and landowners would benefit from the coordinated scenario.

For all ecosystem services (see Table 7-4), the coordinated scenario provides benefits over the uncoordinated scenario. There is a large number of smaller funds that could be targeted; these would need to be identified once the specific details of projects have been developed to begin delivering the vision. Such funds are therefore not included in the table below. These could include funds such as the East Midlands Airport Community Fund for community and/or environmental benefit.

Following the development of the Trent Valley vision, further investigation of these funding streams will need to occur to identify which funds are actually applicable once additional details are known.

Table 7-3: Potential funding sources by economic sector				
Service	**Present Value benefits of coordinated scenario over uncoordinated scenario[1]**	**Private funding possible?[2]**	**Potential level of private funding[3]**	**Public funding sources[4]**
Aggregates	£0 (no difference between the scenarios. Aggregates sector continues to produce at existing levels under both scenarios)	Not specifically for scenario, but some aggregates companies may be willing to invest more in restoration for the purposes of corporate social responsibility	Dependent on individual aggregates extraction areas	None specific to the coordinated scenario because no benefits over and above the uncoordinated scenario
Agriculture	-£930 million (due to change in land use to other land types. Farmers retaining land benefit through premium for locally produced and marketed food, as well as funding for maintaining high nature value farmland)	Not specifically for scenario, but some landowners may be willing to engage in activities that provide additional ecological benefit based on their own values	Dependent on individual farming businesses	None specific to the coordinated scenario because no overall benefits over and above the uncoordinated scenario (but note that the coordinated scenario is expected to result in improved environmental stewardship as there is a focus on nature and high quality outputs)
Construction	£0 (no difference between the scenarios in terms of value of productivity and outputs for the construction sector)	Not specifically for scenario, but some construction companies may be willing to invest more in sustainable construction processes where this could result in higher value housing or reduced planning constraints	Dependent on individual construction companies	None specific to the coordinated scenario because no benefits over and above the uncoordinated scenario

Table 7-3: Potential funding sources by economic sector				
Service	**Present Value benefits of coordinated scenario over uncoordinated scenario[1]**	**Private funding possible?[2]**	**Potential level of private funding[3]**	**Public funding sources[4]**
Energy generation	£1.1 million	Individual small scale generators (to take advantage of feed in tariff and decreased energy bills) Households (to take advantage of feed in tariff) Energy generation companies	£0.22 million	Central government (through provision of feed-in tariff)
Health and wellbeing	Considered to be a service with no specific output (see Table 7-4 for wellbeing, health and happiness)			
Heritage	Considered to be a service with no specific output (see Table 7-4 for heritage)			
Physical infrastructure	£24 million	Businesses	£4.8 million	Regional Growth Fund (indirectly through Regional Growth Fund programmes) County and local councils LEP
Manufacturing, R&D	£13,000 million	Manufacturing businesses	£2,600 million	LEP Regional Growth Fund (indirectly through Regional Growth Fund programmes)
Tourism, recreation, retail, leisure	£2,700 million	Tourism, recreation, retail and leisure businesses	£540 million	Allocation of Community Infrastructure Levy (CIL) Funds for Historic Buildings Groundwork Green Investment Bank Horizon 2020 (European Commission) Heritage Lottery Fund Historic England Heritage Alliance

Table 7-3: Potential funding sources by economic sector				
Service	**Present Value benefits of coordinated scenario over uncoordinated scenario[1]**	**Private funding possible?[2]**	**Potential level of private funding[3]**	**Public funding sources[4]**
				LEP/LNP Tourism cooperation grants (via the Growth Programme funded by the EAFRD) - potential to access through formation of a Destination Management Organisation
Water	£0 (no difference between the scenarios in terms of value of productivity and outputs for the water sector)	Not specifically for scenario, but water companies may be interested in investing where this could reduce their costs, for example, reducing runoff from heavy rain meaning they have to deal with less wastewater or lower pollutant levels, or where groundwater recharge is increased	Dependent on water companies operating in the area	None specific to the coordinated scenario because no benefits over and above the uncoordinated scenario
Wider economy	No specific products, captured by GVA assessment			
Wildlife/biodiversity	Considered to be a service with no specific output (see Table 7-4 for biodiversity)			

Notes:

[1] Present Value benefits are the sum of the annual discounted benefits from 2020 to 2050. The benefits for years 2021 to 2024, 2026 to 2029, and 2031 to 2049 are based on interpolations between the estimated benefits for the time points 2020, 2025, 2030 and 2050. The figures given are the central estimates and represent the benefits of the coordinated scenario over the uncoordinated scenario

[2] Private funding is assumed possible where benefits can be attributed directly to a beneficiary such that they may be willing to pay for those benefits

[3] It is assumed that a private funder would require a return on their investment of 5 to 1 to make their investment worthwhile

[4] Where private funding is unlikely, potential public funding sources are identified. These are suggestions of possible sources only; further investigation would be needed to ensure that the ecosystem benefits that would be delivered fit with the specific funding criteria of the various sources as well as specific funds

Table 7-4: Potential funding sources by ecosystem service				
Service	**Present Value benefits of coordinated scenario over uncoordinated scenario[1]**	**Private funding possible?[2]**	**Potential level of private funding[3]**	**Public funding sources[4]**
Biodiversity	£12 million	Wildlife organisations (RSPB, wildlife trusts, Trent Rivers Trust, etc.) Aggregates companies Developers (as part of planning conditions)	£2.3 million	LNP, LEP Natural England (through NELMS: new environment land management scheme) Heritage Lottery Fund Groundwork
Livestock and crop production	Captured under productivity (benefits to producer)			
Energy production	Captured under productivity (benefits to producer)			
Aggregates	Captured under productivity (benefits to producer)			
Drinking water	Captured under productivity (benefits to producer)			
Air quality	£15 million	Developers (to obtain higher land/property values, as part of planning conditions)	£3.0 million	LEP (through investments in infrastructure)
Carbon sequestration	£230 million	Private companies (carbon offsetting) National Forest Company (Woodland Carbon Code)	£47 million	Forestry Commission Horizon 2020 (European Commission)
Quality of filtered water for habitats and abstraction	£5.4 million	Water companies	£1.2 million	Natural England (through NELMS: new environment land management scheme)
Risk of flooding and inundation	£19 million	Landowners, private companies (to reduce their own risks)	£3. 9 million (may contribute to publically funded projects)	Environment Agency/Defra (as part of flood risk management scheme)
Value of educational trips/visits	£9.4 million	Private companies (employers)	£1.9 million	Skills Funding Agency LEP

Table 7-4: Potential funding sources by ecosystem service				
Service	**Present Value benefits of coordinated scenario over uncoordinated scenario[1]**	**Private funding possible?[2]**	**Potential level of private funding[3]**	**Public funding sources[4]**
Value of heritage	£0.13 million	Owners of heritage attractions Visitors (through entrance fees)	£0.03 million	Heritage Lottery Fund Historic England Funds for Historic Buildings Heritage Alliance Tourism cooperation grants (via the Growth Programme funded by the EAFRD) - potential to access through formation of a Destination Management Organisation
Intrinsic value of landscape and its appearance	£120 million	Developers (to obtain higher land/property values)	£6.7 million (may contribute to publically funded projects)	NERC, universities Allocation of Community Infrastructure Levy (CIL) Groundwork Green Investment Bank Horizon 2020 (European Commission)
Recreational activities	Captured under productivity			
Wellbeing, health and happiness	£33 million	Private companies (to help attract and retain skilled employees)	£6.7 million (may contribute to publically funded projects)	LEP Big Lottery Fund Groundwork
Jobs	Captured under jobs and GVA			
Gross value added	Captured under jobs and GVA			
Attracting business and investment	Captured under jobs and GVA			
Attracting employees and skills	Captured under jobs and GVA			

Table 7-4: Potential funding sources by ecosystem service				
Service	**Present Value benefits of coordinated scenario over uncoordinated scenario[1]**	**Private funding possible?[2]**	**Potential level of private funding[3]**	**Public funding sources[4]**

Notes:

[1] Present Value benefits are the sum of the annual discounted benefits from 2020 to 2050. The benefits for years 2021 to 2024, 2026 to 2029, and 2031 to 2049 are based on interpolations between the estimated benefits for the time points 2020, 2025, 2030 and 2050. The figures given are the central estimates and represent the benefits of the coordinated scenario over the uncoordinated scenario

[2] Private funding is assumed possible where benefits can be attributed directly to a beneficiary such that they may be willing to pay for those benefits

[3] It is assumed that a private funder would require a return on their investment of 5 to 1 to make their investment worthwhile

[4] Where private funding is unlikely, potential public funding sources are identified. These are suggestions of possible sources only; further investigation would be needed to ensure that the ecosystem benefits that would be delivered fit with the specific funding criteria of the various sources as well as specific funds

8 Conclusions and recommendations

8.1 Conclusions

This study has carried out an economic assessment of the Trent Valley to identify the benefits of following a coordinated approach to planning and development of the landscape. The study has assessed two scenarios over a 30 year time period (from 2020 to 2050). These include:

- An uncoordinated approach to development of the area whereby changes occur in a disjointed piecemeal fashion with the potential to result in a degraded natural environment; and
- A coordinated approach to the area's development, that involves all sectors working together to establish a long-term vision and strategy for the Trent Valley landscape to deliver environmental, social and economic benefits.

The assessment and comparison of the two scenarios has indicated that the coordinated scenario offers significant benefits over the uncoordinated scenario for the lifetime of the assessment. Looking at the annual values, there is only a small difference between the scenarios in 2020, which was the first time point assessed. However, by the final time point at 2050, the coordinated scenario could provide:

- £2,800 million per year in economic benefits over and above the uncoordinated scenario;
- £80 million per year in additional social and environmental benefits; and
- 150,000 more jobs than the uncoordinated scenario.

Summing the difference between the scenarios in each year provides an estimate of the total additional benefits of the coordinated scenario over the uncoordinated one. Over the 30 year study period, the coordinated scenario results in:

- £16,000 million more benefits in terms of productivity and outputs (value given in present value format[7] to two significant figures); and
- £450 million more ecosystem service benefits than the uncoordinated scenario (value given in present value format to two significant figures).

The figures given above are all central estimates. Table 8-1 provides the central estimates along with the high and low sensitivity values. Whilst the central estimates represent the best estimates given the available data, the sensitivity values illustrate the likely range either side of the central values given the level of uncertainty in the data and assumptions.

[7] This indicates that the numbers have been discounted using the Treasury Green book rate of 3.5% declining. When summing costs and benefits occurring in different years, it is necessary to discount values to take account of time preference, i.e. the preference for benefits to be felt this year rather than next year or in 10 years' time.

Table 8-1: Benefits of the coordinated scenario over and above the uncoordinated scenario			
Type of benefit	**Benefit estimates (present values)**		
	Low sensitivity	**Central estimate**	**High sensitivity**
Productivity and output benefits	£6,100 million	£16,000 million	£26,000 million
Ecosystem service benefits	£300 million	£450 million	£750 million
Notes: all values have been discounted and are presented to two significant figures. Discounting takes account of time preference and enables values from different years (i.e. 2020 to 2050 in this case) to be summed. Discounting is required when benefits are to be compared with costs			

The high and low sensitivity values have been determined by applying an uncertainty rating to each economic sector and ecosystem service dependent on the type of value used for monetisation and the data or assumption used to determine the magnitude of the change for a particular time point. For example, where the magnitude of change is based on an existing plan or strategy, and the change has been monetised using a value from a peer reviewed source, a low uncertainty rating is applied. In contrast, if the magnitude of the change has been assumed on the basis of the scenario storyline and monetisation has taken place using a value from a different context, a high uncertainty rating is applied. The uncertainty ratings have been converted to percentages and multiplied by the central estimates to determine the potential range (i.e. the low and high sensitivity values) either side of the central estimate.

Table 8-2 provides an overview of the uncertainty ratings for the productivity and outputs assessment. It indicates that as expected, uncertainty increases over time, with more sectors being assigned a 'high uncertainty' rating in 2050 than at any of the other time points.

Table 8-2: Summary of uncertainty rankings for assessment of productivity and outputs				
Type of uncertainty ranking	**Number of sectors per time point**			
	2020	**2025**	**2030**	**2050**
Uncoordinated scenario				
Sectors with low uncertainty	0	0	0	0
Sectors with medium low uncertainty	2	1	0	0
Sectors with medium uncertainty	5	3	4	2
Sectors with medium high uncertainty	1	4	4	0
Sectors with high uncertainty	0	0	0	6
Sectors with very high uncertainty	0	0	0	0
Coordinated scenario				
Sectors with low uncertainty	0	0	0	0
Sectors with medium low uncertainty	1	1	0	0
Sectors with medium uncertainty	5	3	4	2
Sectors with medium high uncertainty	2	2	1	0
Sectors with high uncertainty	0	2	3	6
Sectors with very high uncertainty	0	0	0	0
Notes: the productivity and outputs assessment considered eight sectors. Health and wellbeing, heritage and wildlife/biodiversity were considered in the ecosystem services assessment whilst wider economy was considered in the GVA/jobs assessment				

Table 8-3 presents a summary of the uncertainty ratings for the ecosystem services assessment. Again, higher uncertainty ratings feature more in the later time points than the earlier ones. Also, there is greater uncertainty associated with the coordinated scenario than the uncoordinated one. This is predominantly because many of the anticipated changes under the coordinated scenario rely on assumptions developed from the storyline as opposed to numbers from plans and strategies. The ranges calculated for the coordinated scenario are therefore much greater than those calculated for the uncoordinated scenario. However, even considering the low sensitivity values, the coordinated scenario still provides significant benefits over the uncoordinated one (see Table 8-1). Thus, implementation of a coordinated approach is expected to result in benefits that would not occur should the current uncoordinated approach continue.

Table 8-3: Summary of uncertainty rankings for assessment of ecosystem services

Type of uncertainty ranking	Number of services with each ranking per time point			
	2020	2025	2030	2050
Uncoordinated scenario				
Services with low uncertainty	0	0	0	0
Services with medium low uncertainty	1	1	1	0
Services with medium uncertainty	3	3	3	3
Services with medium high uncertainty	3	3	3	4
Services with high uncertainty	2	2	2	2
Services with very high uncertainty	0	0	0	0
Coordinated scenario				
Services with low uncertainty	0	0	0	0
Services with medium low uncertainty	0	0	0	0
Services with medium uncertainty	2	3	3	3
Services with medium high uncertainty	3	2	2	2
Services with high uncertainty	3	2	2	2
Services with very high uncertainty	1	2	2	2

Notes: the ecosystem services assessment considered nine services. Livestock and crop production, energy production, aggregates and drinking water were included in the productivity and outputs assessment whilst jobs, GVA, attracting business and investment, and attracting employees and skills were considered in the GVA/jobs assessment

Furthermore, it is important to note that where a coordinated approach is not followed, additional costs could be incurred should retrospective attempts be made to create a joined-up landscape. For example, should there be a need for land restoration (e.g. from old aggregates areas to woodland) sometime in the future, further costs may be incurred. Research undertaken for this study suggests that these costs vary widely dependent on the starting condition of the land, the area covered (there are economies of scale for larger sites), and the requirement for long term site management, etc. Typical capital costs for establishing a woodland on a soil surface that is left in a suitable condition for tree planting are around £11,000 per ha (for a small site of <10ha), with this figure including weeding, replacement of dead trees, etc. in years 1 to 3 (pers. comm.[8]). If site management over the longer term is also considered, the costs could be around £32,000 per ha (including capital works and revenue expenditure assuming management and maintenance of the woodland for a 75 year

[8] Information provided to RPA by email from the Forestry Commission (14th January 2015).

period) (ibid). Therefore, a lack of coordinated planning over a large area could easily result in significant additional costs being incurred.

In conclusion, the coordinated scenario presents an ambitious vision for the area. The full benefits of the scenario will only be delivered should there be a commitment to that vision. Due to the interactions between the economic sectors and ecosystem services, all aspects of the coordinated scenario need to be implemented together to ensure the benefits are realised. Partial implementation of the vision in one sector would have knock-on impacts for other sectors and also the level of environmental benefits that would be delivered. The following section therefore provides some recommendations to facilitate the implementation of a coordinated approach to the development of the Trent Valley area.

8.2 Recommendations

This report has demonstrated the highly significant economic, social and environmental benefits that can be realised if a holistic, multifaceted and coordinated approach to landscape scale change in the Trent Valley is planned and implemented. However, it must be recognised that the achievement of these benefits will require action that will need to be fully supported and resourced. It is therefore recommended that the following requirements are recognised and planned for to enable project delivery:

- **Personnel**: it should be recognised that a project of this scale cannot be implemented without staff, as it is unlikely that current resources within existing organisations could offer sufficient time to deliver this work. For example, the National Forest Company is delivering landscape-scale change and environmental enhancement across 200 square miles (520 km^2) of land. The current implementation phase of the project requires a team equivalent to 16 full time members of staff and is supported by a board of seven non-executive directors[9]. Whilst the nature and number of posts required to deliver a coordinated approach cannot be established now (and indeed will vary through time) the need for a staff resource (as well as an operational structure) should be recognised.

- **Resources and funding**: the body responsible for the direction and operation of activities to enact a fully coordinated approach will require financial resources to operate. Whilst the amount of funding and other resources cannot be quantified at this point, it should again be recognised that the National Forest Company operates on an annual budget of around £3 million.

- **Partnership development**: to fully coordinate the breadth and depth of activities required to deliver the benefits outlined in this report, it will be necessary to develop a functional partnership with a breadth of support from a wide range of stakeholders. Whilst partnership development will be a long term and ongoing activity, work should commence immediately on partnership and consensus building, if the economic benefits are to be maximised.

- **Vision and approach**: by definition, the delivery of a holistic, multifaceted and coordinated approach to landscape scale change in the Trent Valley will need to follow an agreed masterplan, which establishes the key principles, direction of travel and spatial iteration of

[9] See National Forest internet site, accessed at: http://www.nationalforest.org/about_us/about_us.php on 10th March 2016.

the aspirations for the valley. This may take some time to plan, develop and agree with stakeholders, and so in the short term, consideration should be given to producing an outline vision document. The vision should establish key principles for the approach proposed, and include a phased vision visualised as a spatial master plan over a suitable time frame, at least to 2050 as considered in this report. The vision document will be critical to communicating the proposals to stakeholders, enabling partnership development, facilitating discussion, and exploring resource and funding implications. Thus, development of a vision should be considered a short term priority action and probably the next piece of work required.

- **Business case, operational structure and governance**: in due course, consideration will need to be given to the operational structure and governance required to enact the coordinated approach in the longer term (for example, this could be a not-for-profit business or charitable trust). The nature and structure of this organisation will need to develop in response to the emerging strategy and partnership, and so may evolve over time. Meanwhile, thought should be given to developing a business case building on this study, and exploring possible organisational options.

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