HOMBRE

"Holistic Management of Brownfield Regeneration"

D 6.2 Integrated Framework for systematic evaluation of brownfield regeneration

Due date of deliverable: 30.05.2014
Actual submission date: 27.11.2014

Start date of project: 01.12.2010   Duration: 48 Months

Organisation name of lead contractor for this deliverable:
University of Nottingham, UK

Revision: [final]

Project co-funded by the European Commission within the Seventh Framework Programme (2007-2013)		
Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including Commission Services)	
RE	Restricted to a group specified by the consortium (including Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Document Information

Title	Integrated Framework for systematic evaluation of brownfield regeneration
Lead Author	Matthew Ashmore
Contributors	Paul Nathanail Paul Bardos Peter Storey (MEGZ)
Distribution	
Report Number	D 6-2

Document History

Date	Version	Prepared by	Organisation	Approved by	Notes
22/11/2014	V01	M Ashmore	UNOTT		

Disclaimer

Contents

1 Introduction

Markham Vale is a former colliery site in the East Midlands of England, between the city of Chesterfield and the town of Bolsover. Since the early 2000s a redevelopment scheme has been in progress on the site which seeks to replace the skilled engineering industry lost when the colliery and other surrounding engineering industry closed.

The Brownfield REMIT/RESPONSE tool is a systems-based application which allows a site to be analysed within the context of the urban system within which it resides: examining how the project might affect the system and how the system might affect the project. Thus it allows comparisons between competing plans for a site, or analysis of a plan for bottlenecks or weaknesses.

The application of the tool requires a conceptual model of the site and system to be constructed including information concerning the environmental, economic and social aspects.

The system is broken down into a series of 'component' parts, and the relationships between pairs of components described in order to assess how the relationship, and ultimately system, the will respond to a system perturbation (i.e. redevelopment).

2 The Conceptual Model of the Markham Vale Site and Urban System

2.1 Site History

Markham Colliery produced coal on a large scale from the late 19th century until 1993, closing officially in 1994. Figure 2-1 shows the operational colliery just before it ceased production.

The closure of the colliery resulted in very high levels of unemployment in the Bolsover area and had a knock-on effect on service and supply industries leading to high levels of social deprivation - the northern coalfield was in England's top 20% of the most deprived districts. The site is part of a complex of deprived urban areas and other brownfield areas in the locality.

After closure, ownership was passed from the Coal Authority to Derbyshire County Council though the Coal Authority retains responsibility for the abandoned underground workings.

"Markham Vale" was born out of a Coalfield Task Force Report in 1998[1] which challenged the local authorities to create an employment growth zone centred on the former Markham Colliery. Derbyshire County Council (DCC) led a partnership of other interested bodies in taking up the challenge, which resulted in the formation of the Markham Employment Growth Zone (MEGZ). MEGZ aims to create 5000 jobs (2000 new jobs and 3000 relocated from within the system) to regenerate the local area, as well as providing environmental improvements including establishing short-rotation coppicing on the North heap as well as creating several specific habitats and areas of public open space. MEGZ became known as Markham Vale, with the coppicing project being known as "Markham Willows".

2.2 The Planned Redevelopment

The site includes 127 hectares of the former Markham Colliery site, plus two colliery spoil heaps. The main area of the colliery occupied some 37 hectares; the North Tip occupies 106 Hectares and the South Tip extending to 33 hectares. The total area of the whole redevelopment plan is 360 ha including some agricultural land that was incorporated to make a more economically feasible development platform. Some 205 Ha of the overall Markham Vale scheme has been previously developed. A motorway junction has been completed to improve access to the site and the nearby town of Bolsover.

The Figure 2-2 shows an aerial photograph of Markham Vale shortly after the colliery installations were cleared. This picture shows the development plots which were to be developed in a phased way. Markham Vale is DCC's largest-ever regeneration project and aims to reverse the unemployment and deprivation which followed the colliery closure as well as other industry in the vicinity.

---

[1] Department of Environment Transport and the Regions (1998) Making the Difference. A new start for England's coalfield communities: the Coalfields Task Force Report, DETR, London. June 1998.

Figure 2-1 Markham Colliery before production ceased

Legal issues and the 2008 financial crisis meant that progress was slower than initially envisaged meaning the site is still in the transition phase of land management cycle. New infrastructure has been constructed and development is proceeding in a phased manner across a site master-plan with some phases now complete and occupied, others in development and yet others still at a planning stage. In 2012 Markham Vale was subsumed in a large enterprise zone (Sheffield City Enterprise Zone) providing valuable tax breaks and capital allowances for businesses locating into the area.

The total cost of the project is estimated at £88 million in order to attract a further £150 million of commercial investment. The master-plan foresees 80 hectares for built development creating 265,000 m^2 of commercial premises. 200 ha of surroundings will be environmentally improved. In the region of 10% of the job creation aim has been achieved as of 2014.

Figure 2-2 Markham Vale pre-development including pertinent zones on the site

Figure 2-3 shows a map of the main areas covered by MEGZ. The employment area is divided into 3 zones, with the East, West and North zones in that order of development.

The North tip area was earmarked for several soft reuses including short-rotation coppicing and publically accessible open space including areas of grassland and deciduous woodland. The vegetation of the North Tip was also intended to stabilise and expand the top soil, gradually increasing the soil depth and preventing erosion of the spoil beneath. The ultimate ambition of the SRC was to sell heat energy to the businesses on site rather than selling wood chip fuel, to help off-set landscape management costs.

The South tip was allowed to re-vegetate naturally but closed to the public due to issues with dioxin contamination in the tip[2].

Markham Willows (the North Tip area) was to be linked to an Environment Centre with a view to attracting businesses with a strong sustainability interest along with linking to local education and skill development for environmental technologies.

The Short Rotation Coppice scheme has also been slow to establish, with just the original test planting in place to date. Investigations into the feasibility of the other SRC areas is ongoing due to unforeseen problems of access.

---

[2] Bardos, P. with Nathanail, J. and Nathanail, P. (2004) Risk Management Model Annexed report DOI: 10.13140/2.1.3708.7363, to the Markham Willows Master-planning Report
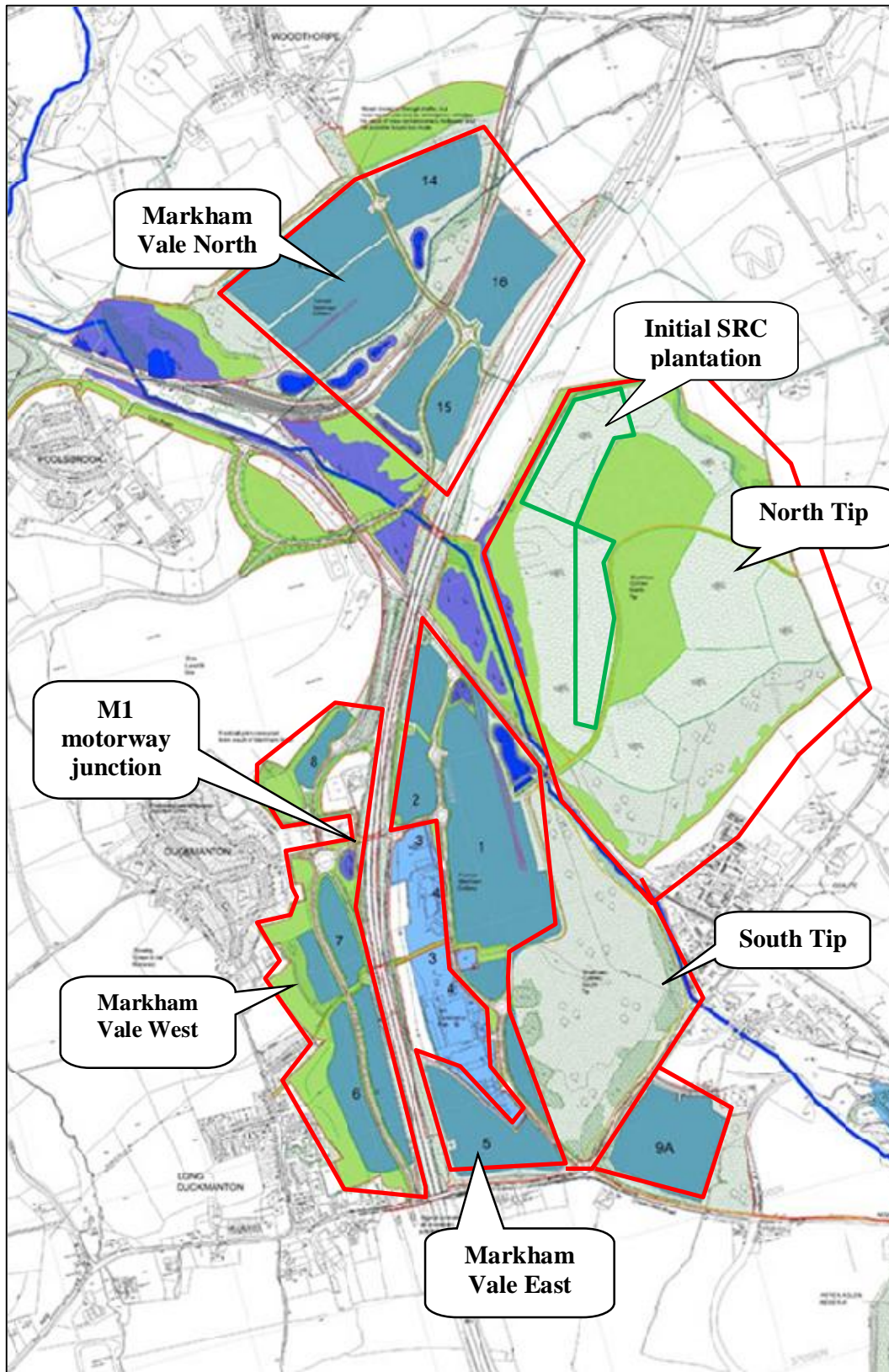
Figure 2-3 Map of the Markham Vale site showing the principle named commercial and tip areas

2.3 The Markham Vale Urban System

In order for a brownfield redevelopment project to be successful it must fit within the wider urban system and become an integral part of it. The MEGZ project must therefore be examined in the light of the local system and the first task therefore is to define the boundaries of that system. This in itself may be no trivial task: different aspects of the project may suggest different potential boundaries. However in this case, three District Councils have an interest in the project for the benefit of their residents. In addition information regarding population is based on these areas; thus the areas covered by these authorities would seem the natural limits to the system.

The site itself rests almost entirely within Chesterfield District, but it also has direct borders with Bolsover and North East Derbyshire Districts (see Figure 2-4).

Within this three-authority system, Bolsover is the most deprived by many indicators, for example.

Table 2-1 shows data from the 2014 area profiles of the three districts along with figures for Derbyshire as a whole and England for comparison (DCC 2014). This is largely 2012 data: after the planning stages of Markham Vale, but still informative given the current state of the project. Bolsover is ranked lowest in Derbyshire for six of the indicators, including overall depravation and child poverty, as well as being the least academically qualified district according to the measures shown. Also apparent is that, while long-term unemployment in Bolsover is relatively low, youth unemployment and out of work benefit claimants were high. When combined with the levels Educational attainment in Bolsover (the lowest in the county) it may be assumed that jobs in the area may be low-paid, low-skilled and potentially short-term and high turnover.
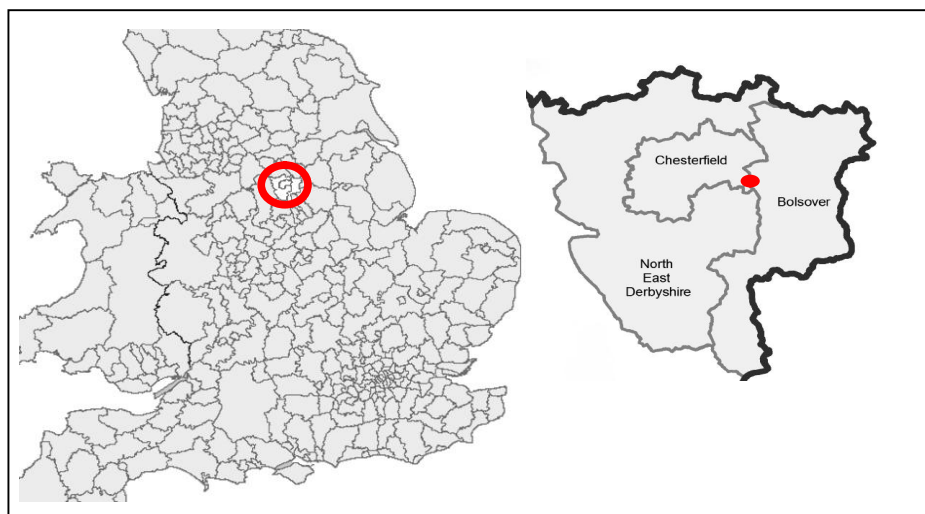
Figure 2-4 District Council Boundaries. The red circle shows the position of the three Districts. The red dot shows the approximate location of Markham Vale

While NE Derbyshire shows less depravation overall, Figure 2-5 shows that the most deprived parts of the district are in vicinity of the Markham Vale site. Adult education attainment again appears to be a problem.

Chesterfield's statistics are in a similar vein to Bolsover's, with overall unemployment and out of work benefit claimants rates being the worst in Derbyshire.

Table 2-1 Population, depravation, employment and education in the three districts, Derbyshire and England in 2012

	BOLSOVER	North East DERBYSHIRE	CHESTERFIELD	DERBYSHIRE COUNTY	ENGLAND
POPULATION	76,500	99,325	103,782	~750,000	~53.5m
Depravation	33.2[a]	25.8	28.8	25.2	24.8
Children in poverty	20.9[a]	13.6	19.0	15.0	18.2
Unemployment rate (overall)	2.7	2.2	3.0[a]	2.2	2.8
Economically active (available to work)	66.9[a]	68.0	67.9	69.9	69.9
Out of work benefit claimants	12.9	9.9	13.5[a]	9.8	10.6
Youth Unemployment	5.1	4.2	5.7	4.0	3.8
Long-term unemployed	24.1	30.0	31.3	27.6	29.3
Adults with no qualifications	32.9[a]	26.9	27.6	25.7	22.5
GCSEs (5+ A*)	48.2[a]	60.6	59.8	59.1	60.6
Adults with a degree %	15.8[a]	22.2	21.0	23.7	27.4

[a] = the lowest rank in Derbyshire County
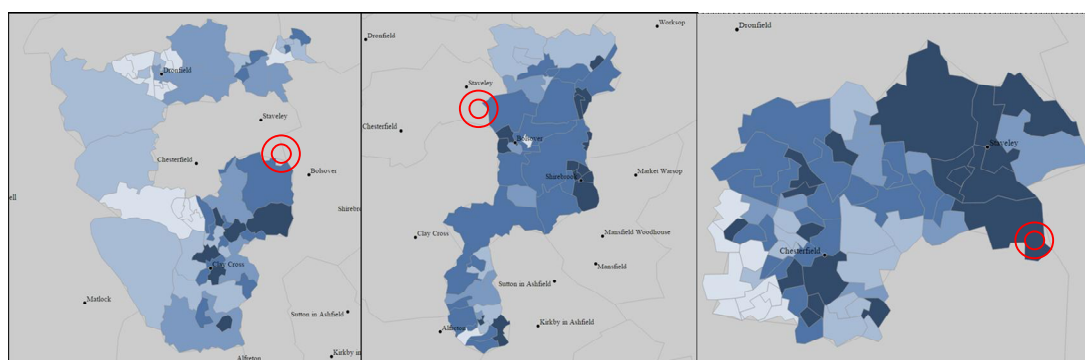
Figure 2-5 *from:* Atlas of the Indices of Deprivation 2010 for England: from left to right - NE Derbyshire, Bolsover and Chesterfield respectively. The red circle indicates the approximate location of the Markham Vale site. The depth of blue indicates the area's position in the ranking of all 32,000 LSOA, grouped into quintiles, with the deepest blue representing the most deprived
Graphic by ONS Data Visualisation Centre. Contains Ordnance Survey data © Crown copyright and database right 2011

3 The REMIT/RESPONSE technique

3.1 Interaction Matrices

In order to examine how the system functions as a whole, it is broken down into individual components. This may be done in a system-specific way, through an analysis of the project objectives, the nature of the redevelopment project and the urban system or, as in the case of the BR2 tool, by using generic system components which simplifies and standardises the process.

Once the components are selected, they are assembled into a matrix with each component placed on the main diagonal. For example, Figure 3-1 represents a 4-component system, each of the components (A to D) are inserted into the main diagonal cells. The relationships between the components are the described in the off-diagonal intersections. By convention, relationships are coded in a clock-wise manner, so in the figure the influence of A over D is represented in the top-right cell, while the influence of D over A is in the bottom-left. Note that relationships may be unsymmetrical, for example A may exert an greater influence over D, than D over A, or there may be effectively no relationship in one (or indeed either) direction.

A			A-D
	B		
		C	
D-A			D

Figure 3-1 Example 4-Component Interaction Matrix

The changes to the site and urban system brought about by the redevelopment are described as a system 'perturbation' and the object is to assess how the system as a whole responds to the perturbation. This may be achieved in one of several ways, in the BR2 tool this is done by using before- and after- matrices for comparison.

3.2 Relationship Coding

The relationships may be coded or scored in one of a number of ways:

- Binary

- Expert Semi-Quantitative

- Simple Gradient relationship

- Numerical solutions via partial differential equations

- Numerical analysis of interaction mechanism

In the case of an urban system, quantitative relationships are not generally available, hence only binary and expert semi-quantitative coding is utilised in BR2. Binary coding simply assigns a '1' to relationships where there is an influence and '0' where there is no, or negligible, interaction.

Expert semi-quantitative (ESQ) scoring schemes attempt to assign a weighting to a relationship to give an impression of importance where explicit mathematical relationships are unavailable (Jiao and Hudson, 1995).

Here again a zero may be assigned to relationships which are non-existent or are deemed to be negligible. The remaining relationships are then assigned a value according to their relative importance in the system. The actual values are arbitrary; any scale may be chosen though the scales available in the BR2 tool are often seen in the used the literature. Two ESQ scoring systems are included:

Firstly a range from 0 to 4 relationship strength (the '0-4ESQ' system) where 0=no relationship, 1=weak, 2=medium, 3=strong, 4=critical to the system.

The second ESQ system (the '±2ESQ' system) allows the relationships to be scored according to whether they are positive or negative: -2=major negative, -1=minor negative, 0=no influence, +1=minor positive, +2=major positive.

3.3 Generic Urban System Components

In the current BR2 tool, 10 leading diagonal components are included, shown in Table 3-1. In fact, each of these components is better described as an 'aggregate' component, with each heading chosen to represent a range of sub-system components. Table 3-2 indicates the types of individual sub-components which should be considered within each aggregate component, depending of course on which are present at the site and system. Each aggregate component has a dedicated spreadsheet within BR2 where its effects on the other components are encoded together with justification. Figure 3-2 shows a snapshot of the biodiversity sheet in BR2.

Table 3-1 Main Diagonal System Components in the BR2 generic matrix

1	BIODIVERSITY	Bio	
2	NATURAL ENVIRONMENT	NE	ENVIRONMENTAL
3	BUILT ENVIRONMENT	BE	
4	DEMOGRAPHICS	Dem	SOCIAL
5	QUALITY OF LIFE	QoL	
6	PUBLIC ECONOMIC	PuE	
7	PRIVATE ECONOMIC	PrE	ECONOMIC
8	INDIVIDUAL ECONOMICS	IE	
9	LOCAL INSTITUTIONAL CONTROLS	LIC	POLICY/

10	CENTRAL/EU INSTITUTIONAL CONTROLS	CIC	REGULATION

Table 3-2 sub-components to be considered within each generic component

Generic Component	Example sub-component
BIODIVERSITY	Protected species
	Habitats
NATURAL ENVIRONMENT	Topology
	Geology
	Geotechnics
	Contamination
	Hydrogeology
	Hydrology / Flood risk
	Air Quality
	Noise
BUILT ENVIRONMENT	Former Use
	Current Use
	Existing Buildings
	Site Access
	Within-Site Access
	Site Size
	Site Location
	Site Boundaries
DEMOGRAPHICS	Population
	Ethnicity, Religion
	Age
	Gender, Sexuality, Marital Status
	Employment Status, Income
	Socio-economic Status
	Ownership
	Mobility
	Education
QUALITY OF LIFE / DEPRAVATION	Cost of living
	Culture
	Education
	Service Provision
	Health
	Recreation/Free time
PUBLIC ECONOMIC	Tax receipts
	Benefits Claims
	Investment
	Other income
	Transport Infrastructure
PRIVATE ECONOMIC	Labour availability
	Retail
	Potential Markets
	Incentives
INDIVIDUAL ECONOMICS	Jobs created/wage levels
	Commuting
	Leisure/recreation
LOCAL INSTITUTIONAL CONTROLS	Planning policy
	Environmental regulation
	Built environment regulation
	Social Policy

CENTRAL/EU INSTITUTIONAL CONTROLS	National regulatory regimes
	National planning policies
	Regional Development Initiatives

The banner across the top of each component's spreadsheet shows a summary of the information and values entered further down the sheet (A). Each individual relationship is shown down the left hand side, for example the first is the (potential) influence of the Biodiversity component on the Natural Environment (B). Across this row are cells to enter coding values for the three scoring systems and justification for the selection (C).

Scrolling down the sheet, the effect of Biodiversity on each of the nine other components may be entered, and each value is subsequently copied in the summary at the top.

Once entered in the spreadsheet, the codings are automatically entered into appropriate matrices (located in BR2 on spreadsheets after the 10 coding sheets).
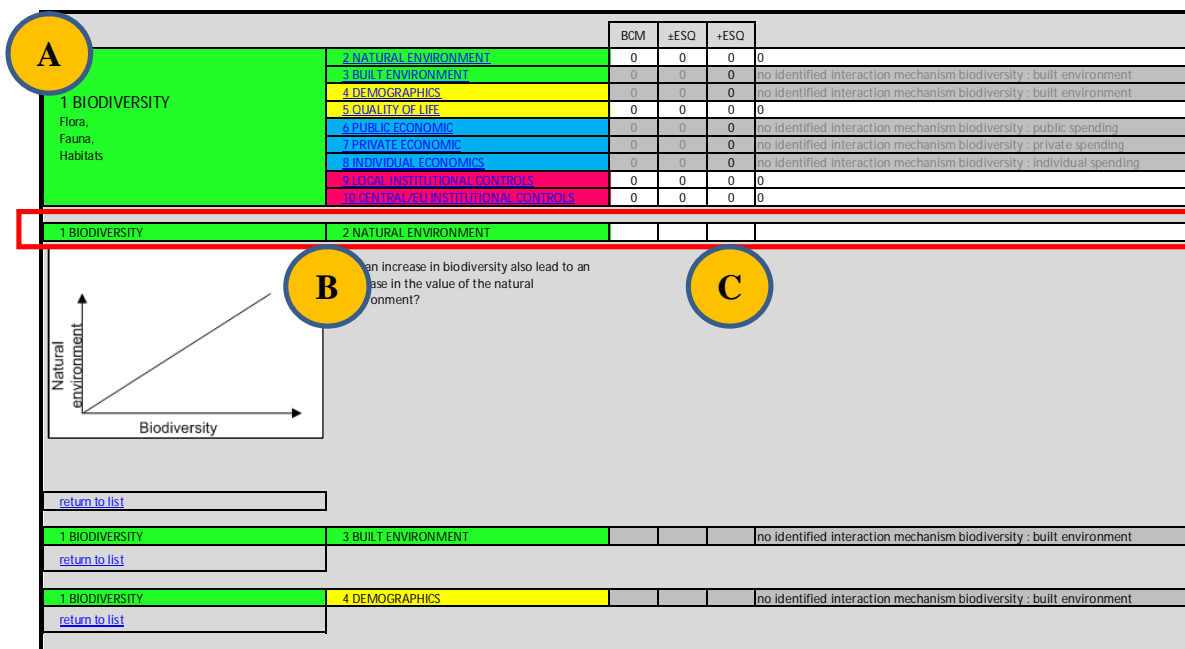
Figure 3-2 example BR2 coding spreadsheet for the influence of Biodiversity on the other generic components A: summary banner, B: Relationship to be coded, in this case Biodiversity's influence on Natural Environment, C: cells for coding and justification

3.4 Cause-Effect Plots

Once each relationship has been coded, the completed matrix is ready for analysis. There are several techniques for analysing the matrix, the main one being the cause-effect (C:E plot). Due to the clockwise coding method, the sum of each row of the matrix represents that component's effect on the system, termed CAUSE, whereas the sum of each column represents the system's effect on the component, termed EFFECT (see Figure 3-3). These component values are then plotted to give the C:E diagram (Figure 3-4).

In the BR2 tool, C:E plots are constructed automatically as each matrix is populated.
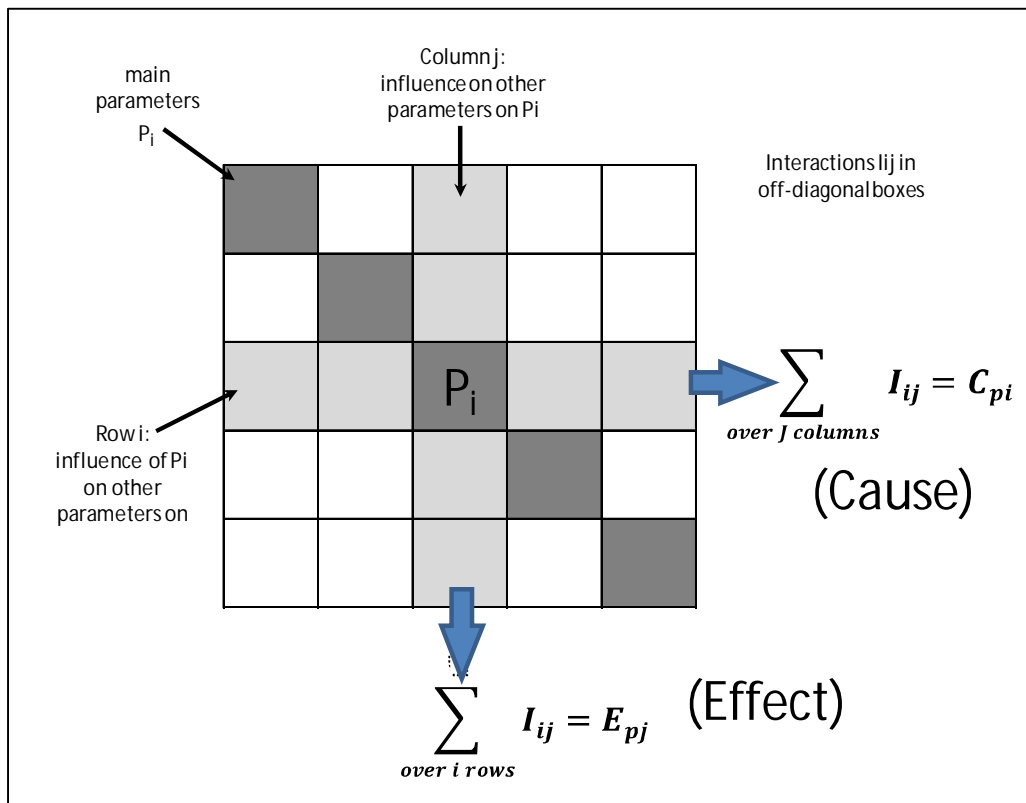
Figure 3-3 Generation of the cause and effect co-ordinates (after Hudson, 1992)
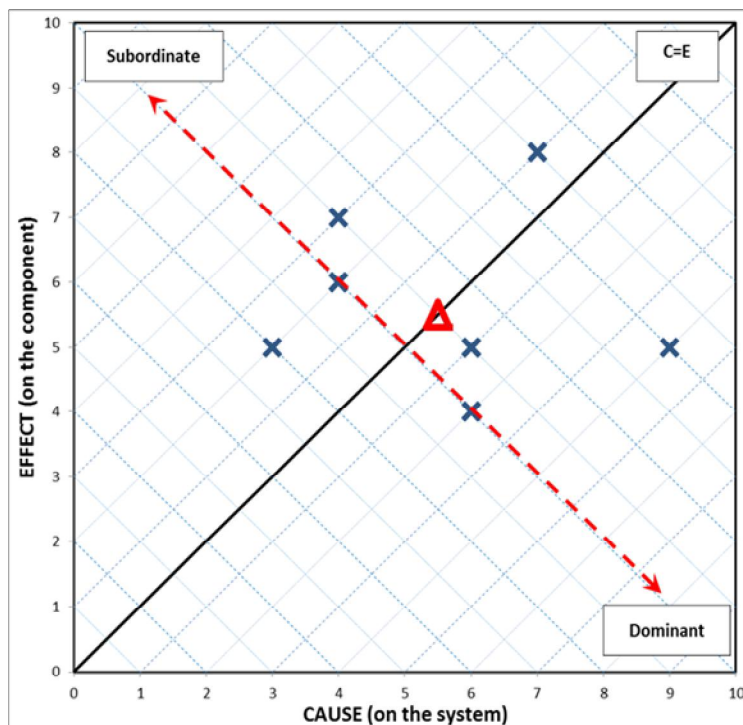
Figure 3-4 example binary C-E plot. On an actual C-E plot, each component's data point is labelled so that each system component is easily identifiable. The red triangle on each plot denotes the mean C-E value

3.5 Interpreting the C:E Plot

The position of each data point on the plot, and the 'constellation' of points as a whole, can be analysed to give information about the system. In general, the further along the C=E line a component lies, the more interactive it is i.e. the more connections to other components in the system. The further beneath the C=E line a point plots (parallel to it) the more dominant it is in the system, i.e. it has influence over more components than influence it and, conversely, the further above C=E line a component plots, the more subordinate to the system it is. In addition, information about the system as a whole can be determined by the position of the mean C+E value. This information may also be displayed in tabular or histogram form: in tables the C+E gives the interactivity of the component C-E gives the dominance: the more positive the value, the more dominant; more negative means more sub-ordinate.

Systems displaying a high degree of interactivity may in general be considered more robust, better functioning system, though care must be taken as this also implies that a particular component has the ability to disrupt large parts of the system. Dominant components by definition affect proportionally more of the system and so need to be monitored carefully, though vulnerabilities may be magnified if these are in turn influenced by highly subordinate components.

4 Application of the Brownfield REMIT/RESPONSE tool

The Brownfield REMIT/RESPONSE tool was applied with the help of the MEGZ team in several stages: initially at a meeting with Peter Storey of MEGZ, the situation at Markham Vale pre-development was discussed; the reasons why the project was instigated, the long term aims of the of the site and the geographical and social context that the site resided in. Next, the BR2 tool was presented along with a précis of the general Interaction Matrix technique: i.e. the formation of a matrix, scoring systems, and the production and interpretation of C:E diagrams. A first-pass at populating a spreadsheet for the initial Markham Vale plan, given the surrounding system pre-development, was carried out. The tool was then left with the MEGZ team for several weeks to refine the relationships. The completed tool was them returned to UNOTT to check the inputs and begin to interpret the outputs. In addition, for comparison, a sheet for a second, hypothetical redevelopment scenario was completed in which it was assumed that the site was addressed as per the original plan except that the tip areas, especially the north tip, were not addressed. i.e. only the private commercial aspects were pursued which the biomass and public amenity aspects being omitted.

4.1 Application of the BR2 to Markham Vale pre-development

4.1.1 Binary Interaction Matrix

Figure 4-1 depicts the binary relationships between components for the Markham Vale site pre-development and the resulting C:E diagram. The detailed decisions for each relationship are reproduced in Annex I. It can be seen from the matrix that biodiversity (habitats, species) affects little in the system (horizontal), and is little affected in return (vertical), whereas Private Economic affects five other components, but is itself only affected by Local Institutional Controls.
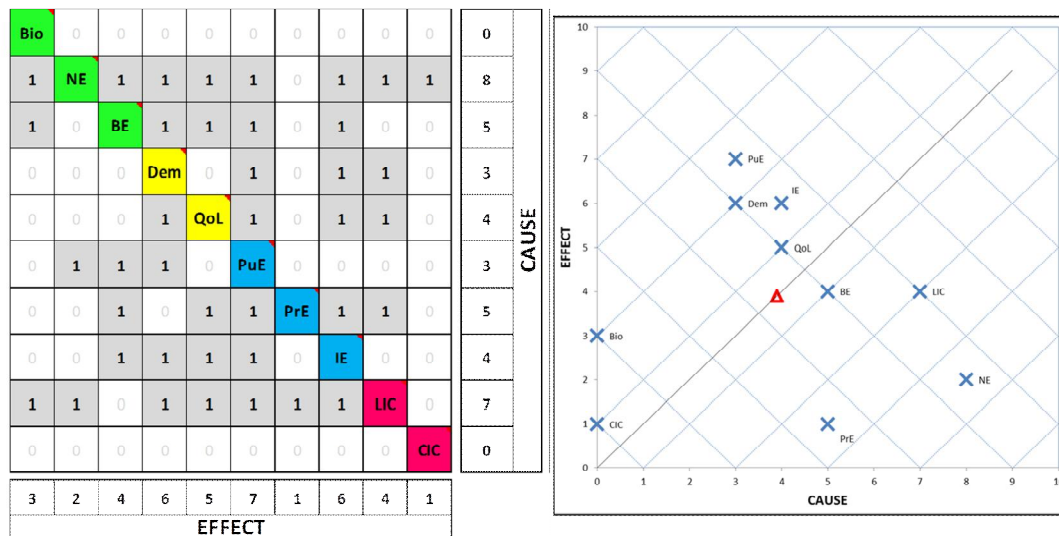
Figure 4-1 binary interaction matrix and C:E diagram for the Markham Vale site pre-development

Table 4-1 The dominance (C-E) and interactivity (C+E) binary interaction matrix scores for pre-development Markham Vale

	C-E	C+E
Biodiversity	-3	3
Natural Environment	6	10
Built Environment	1	9
Demographics	-3	9
Quality of Life	-1	9
Public Economic	-4	10
Private Economic	4	6
Individual Economic	-2	10
Local Institutional Controls	3	11
Central Institutional Controls	-1	1

The C:E chart shows this clearly: Biodiversity and Central Institutional Controls are relatively divorced from the system. Only one component is more than 50% interactive (Local Institutional Controls with a C+E of 11 from a maximum of 18). The average interactivity is 3.9. The most dominant components (greatest C-E values) are the Natural Environment and Private Economic with LIC also dominant, whilst the most subordinate components (most negative C-E values) are the Public Economic, Demographics, Biodiversity and Individual Economics.

Table 4-1 displays the same information in another form, C-E gives the dominance of the component (positive = dominant, negative = sub-ordinate) while C+E gives the interactivity.

4.1.2 ±2 Expert Semi-Quantitative (ESQ) Matrix

Figure 4-2 shows the ±2 ESQ matrix and C:E chart for the pre-development scenario (see Annex 1 for justification of scoring). The matrix shows 24 relationships judged to be negative, with one a major negative relationship (LIC:PuE), and 20 positive relationships including 3 judged to be major positive.

Following on from the binary matrix which showed LIC to be the most interactive component as well as one of the most dominant, the ±2ESQ matrix reinforces this, with all of the 3 major positive influences and 1 major negative influence all due to this component. It can also be seen that, generally, environmental and social aspects have negative influences over finances and governance.

Figure 4-2 ±2 ESQ Matrix for Markham Vale pre-development

In general, C:E diagrams are inappropriate for ±2 ESQ matrices as positive and negative influences can cancel one another out leading to spurious conclusions. However, in this case, the overall negativity of the system is illustrated well as most components cluster around or below the origin of the C:E plot.

4.1.3 0-4 Expert Semi-Quantitative Matrix

The 0-4 ESQ matrix again reiterates the importance of the LIC and PuE, both are among the most interactive components and their dominance and sub ordinance has been magnified by the weighting of the coding scores. NE is also interactive and dominant as it presents problems that need to be addressed whether or not the site is redeveloped.

Figure 4-3 0-4 ESQ Markham Vale site - before redevelopment

Table 4-2 the dominance and interactivity displayed in the 0-4ESQ matrix for the pre-development scenario

	C-E	C+E
Biodiversity	-3	3
Natural Environment	11	21
Built Environment	3	11
Demographics	-9	17
Quality of Life	1	15
Public Economic	-10	20
Private Economic	1	9
Individual Economic	-4	14
Local Institutional Controls	11	27
Central Institutional Controls	-1	1

4.2 Application to Markham Vale Scenario A:The redevelopment as planned

4.2.1 Scenario A Binary Interaction Matrix

The completed development as originally planned is analysed in the following section (see Annex II for justification of coding values). Figure 4-4 shows the Binary Interaction Matrix for the scheme-as planned. Unsurprisingly, there are many more connections in the system compared with the pre-development system, and it is immediately apparent that the system is much more interactive as evidenced by the mean interactivity of 7.5 against the pre-redevelopment interactivity of 3.9. The interactivity of this system in turn means that most of the components do not display overt dominance or sub-ordinance, with only biodiversity plotting appreciably away from the C=E line.

HOMBRE
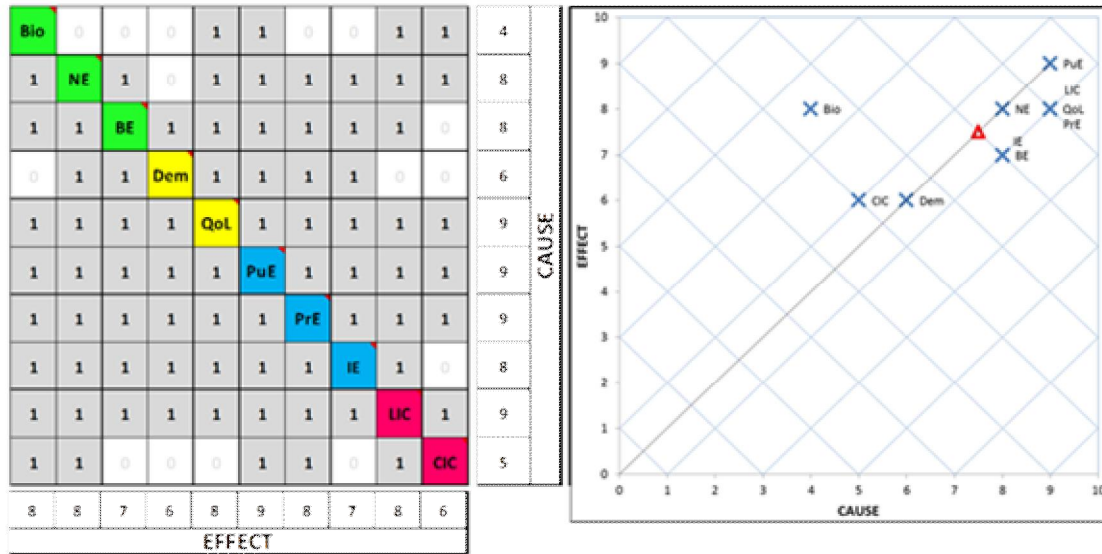
Figure 4-4 binary Interaction Matrix for Scenario A: the redevelopment completed as per the actual plan

Among the most interactive components are the Local Institutional Controls and Public Economics, in part because these instigate and control the redevelopment. Similarly, Private Economic is interactive and slightly dominant as private investment is needed to make the completed project a success.

The natural environment is also interactive and neither dominant nor sub-ordinate. NE affects the system in potentially negative respects such as reductions in air quality, while it also could reduce flooding potential, soil, groundwater and surface water contamination. Improvements in quality of life and the knock on effects to public health provided by the public open space, and even just in the improved views, are also positive.

4.2.2   Scenario A ±2 ESQ Interaction Matrix

Figure 4-5 shows the ±2 ESQ Interaction Matrix and C:E plot for scenario A. From the completed matrix it can be seen that there are 13 negative influences, including 4 major negative influences while there are 62 positive influences including 21 major positive influences and, while the ratings aren't strictly additive (i.e. not quantitatively based), there appear to be many more positive influences in the new system.

										CAUSE
Bio	0	0	0	1	-1	0	0	1	1	2
2	NE	2	0	1	-1	-1	1	-1	-1	2
1	2	BE	1	2	-2	2	2	-2	0	6
0	-1	1	Dem	1	1	1	2	0	0	5
1	1	1	1	QoL	2	1	2	1	1	11
2	2	2	1	2	PuE	2	1	-1	1	12
-1	-2	1	1	1	1	PrE	2	1	1	5
1	-1	1	1	1	2	1	IE	1	0	7
2	2	2	1	1	-2	2	1	LIC	2	11
1	1	0	0	0	1	1	0	1	CIC	5
9	4	10	6	10	1	9	11	1	5	
				EFFECT						
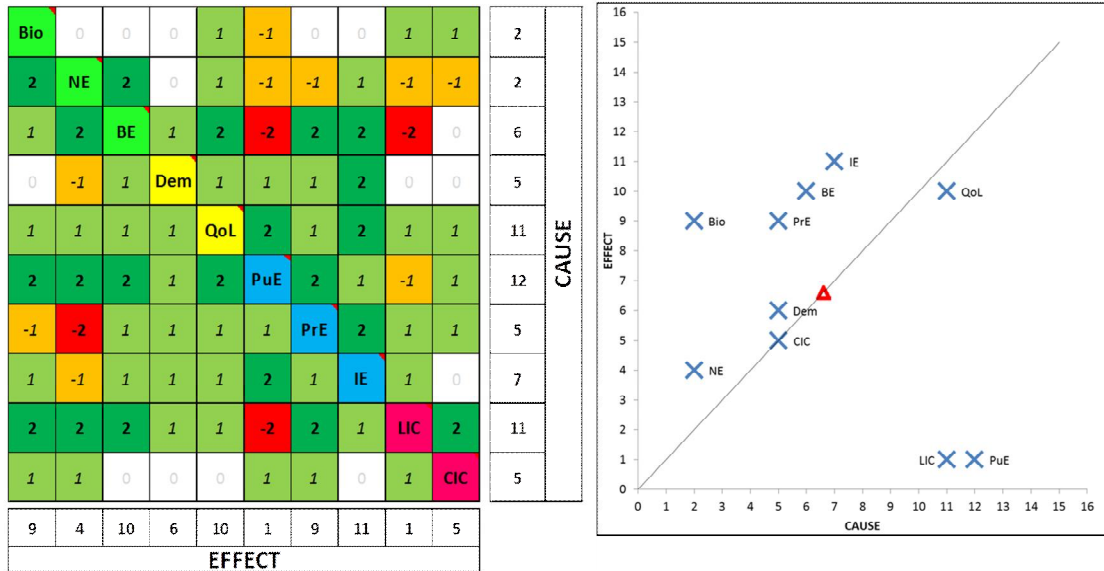
Figure 4-5 the ±2 ESQ for scenario A

In this assessment, the Built Environment has major negative influences over the resultant system, both over the public realm in terms of the work, time and cost of realising the redevelopment. LIC also has a major negative effect on the public finances in that, for example, environmental laws and policies will dictate some expenditure on site, so BE may affect the public finances both directly and indirectly in this case. The other major negative effect coded is that of private economic over NE: there must be strict controls on those Natural Environment aspect which are affected by PrE, for example soil sealing and drainage, maintenance of drainage ponds and other flood mitigation factors.

4.2.3   Scenario A 0-4 ESQ Interaction Matrix

Figure 4-6 shows the 0-4 ESQ interaction matrix and C:E plot for scenario A. Immediately apparent from the matrix is that the most dominant components are appear to be LIC, PuE and BE, and this is borne out by the C:E diagram, though also apparent here is that, while dominant, they are also relatively interactive. No components are particularly isolated in the system, comparing Table 4-3 with Table 4-2 (the dominance and interactivity of 0-4ESQ matrix pre-development), 7 components have an interactivity of less than 20 with 3 in single figures, whereas the lowest value in scenario A is 17 showing a much more interactive system overall. Only one other component is dominant in the C:E plot (in Figure 4-6): Central Institutional Controls, though this is also the least interactive component. Biodiversity again is the most sub-ordinate component, relying on other aspects of the plan for its creation. Education is recognised as being important: the conceptual model shows that the system may be lacking in skilled or educated workers, and this is addressed in the project by the inclusion of apprenticeships and other training opportunities, though it must be recognised that it will take time to ensure a local skilled workforce and so in the shorter term perhaps a degree of inward migration and commuting needs to be factored into plans.
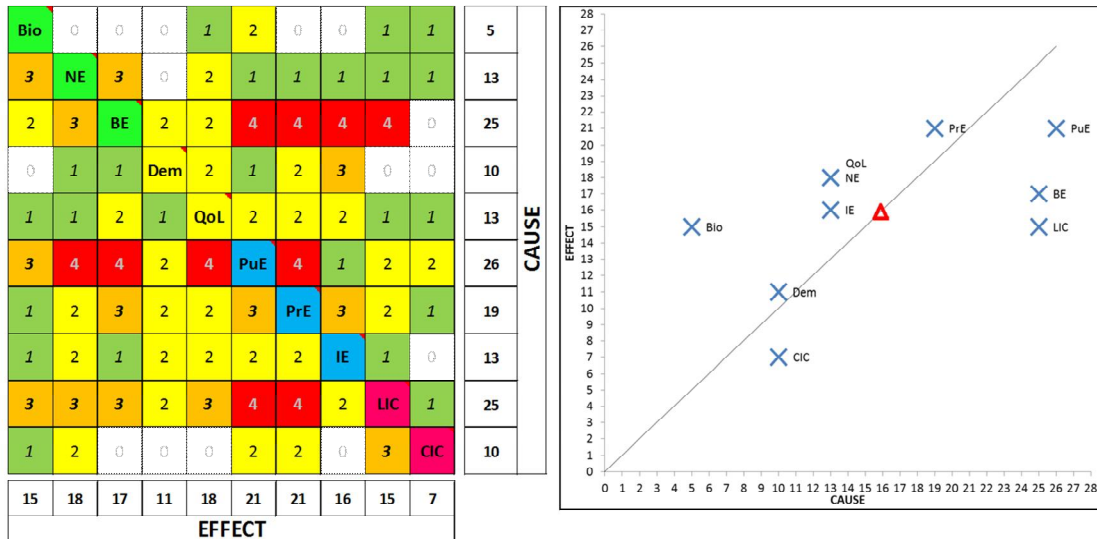
Figure 4-6 0-4 ESQ interaction matrix and C-E plot for scenario A

Table 4-3 the dominance and interactivity displayed in the 0-4ESQ matrix for scenario A

	C-E	C+E
Biodiversity	-10	20
Natural Environment	-5	31
Built Environment	8	42
Demographics	-1	21
Quality of Life	-5	31
Public Economic	5	47
Private Economic	-2	40
Individual Economic	-3	29
Local Institutional Controls	10	40
Central Institutional Controls	3	17

4.3 Application to Markham Vale Scenario B: The planned redevelopment minus the North Tip plans

In this scenario, the North tip especially is not considered to be part of the development; however as it is still part of the urban system and the effects of not addressing problems that it presents, as they are addressed in scenario A, must be included in the assessment.

4.3.1 Scenario B Binary Interaction Matrix

Figure 4-7 shows the binary interaction matrix and C:E plot for scenario B. the system again is more interactive overall than the pre-development system, with a mean interactivity of 5.6 against 3.9 pre-development (and 7.5 for scenario A). In this scenario, biodiversity has little influence over other components, though has the same sub-ordinance as in scenario A. Comparing the constellation of points in the C:E diagram with Figure 4-4, interactivity is lower overall, and particular components assert dominance, notably QoL, demographics and IE. The lack of public open space in the scheme is clearly detrimental compared to scenario A.

										CAUSE
Bio	0	0	0	0	0	0	0	0	0	0
1	NE	0	0	0	1	0	0	1	1	4
1	1	BE	0	1	1	1	1	1	0	7
0	1	0	Dem	1	1	1	1	0	0	5
0	0	1	1	QoL	1	1	1	1	1	7
0	1	1	1	1	PuE	1	0	1	1	7
1	1	1	1	1	1	PrE	1	1	1	9
1	1	1	1	1	1	1	IE	1	0	8
0	1	1	0	0	1	1	1	LIC	1	6
0	0	0	0	0	1	1	0	1	CIC	3
4	6	5	4	5	8	7	5	7	5	EFFECT

Figure 4-7 Binary Interaction Matrix for the Markham Vale site, scenario B

4.3.2 Scenario B ±2 ESQ Interaction Matrix

Figure 4-8 shows the ±2 ESQ Interaction Matrix for this scenario. Again, the detail of the C:E plot may be disregarded; overall the components plot much closer to the origin than in Figure 4-5 but this is, in part a consequence of the negative scores rather than a general lower interactivity.

Again, there is a potential loop implying that the built environment may have a negative influence over Public finances (i.e. cost public money) both directly and indirectly and so these relationships need to be clearly monitored: the built environment aspects which public money is financing need to be off-set by expected gains in business rates, plus BE's effect on LIC is to reduce deprivation in the area in which case, ideally more and higher-skilled jobs need to be created though a mechanism need to be in place to ensure that local workers have avenues into these jobs so that positions are not merely filled by commuters from, for

example, Sheffield, Derby or Nottingham.

Figure 4-8 ±2 ESQ for the scenario without soft end-use

In this scenario, there are fewer negative interactions than in scenario A – 11 including 2 major negative (cf 13 negative including 4 major negative for scenario A), however there is also a reduction of positive relationships – 45 including 6 major positives (cf 62 positive including 21 major positives in scenario A).

4.3.3   Scenario B 0-4 ESQ Interaction Matrix

Figure 4-9 shows the 0-4 ESQ Matrix and C:E plot for scenario B. it can be seen from the C:E chart that, again, the system is much less interactive largely due to the loss of the SRC and public open space in the this plan. Table 4-4 shows the dominance and interaction of each parameter more clearly and these are lower than scenario A, with 5 component interactivities below 20. Demographics, quality of life and individual economic components are amongst the least interactive of the components, meaning they are relatively divorced for the system, and the latter two are slightly dominant. Thus, there is some evidence that the social aspect of sustainability may be lacking in comparison to scenario A. The built environment becomes much less important in this scenario, less interactive but more dominant.
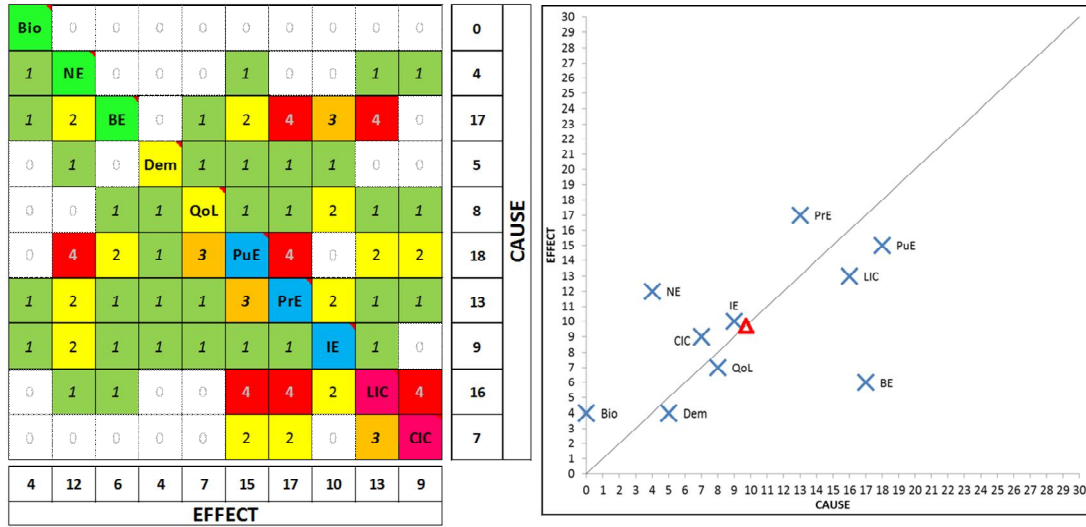
Figure 4-9 0-4 ESQ Matrix and C-E plot for scenario B

Table 4-4 dominance (C-E) and interactivity (C+E) for the components in scenario B

	C-E	C+E
Biodiversity	-4	4
Natural Environment	-8	16
Built Environment	11	23
Demographics	1	9
Quality of Life	1	15
Public Economic	3	33
Private Economic	-4	30
Individual Economic	-1	19
Local Institutional Controls	3	29
Central Institutional Controls	-2	16

5 Discussion

The Markham Vale site represented an excellent opportunity to test the BR2 tool for several reasons: it is a varied site which encompasses many possible features of the sustainable redevelopment of a long-term brownfield site and, as the site is still in transition, it allows the testing of BR2 with some degree of hindsight.

The fact that BR2 suggests that the chosen redevelopment strategy is an appropriate one is positive. It shows that a systematic appraisal by stakeholders may produce similar results to a long-term planning exercise by Derbyshire County Council which could reinforce support for, or at least tolerance of, the project by helping to structure and demystify it.

The analysis of the site suggests that the selected redevelopment was an appropriate one compared to the situation before redevelopment and the alternative scheme suggested herein given the urban system. Neither of the main bottlenecks retarding progress on the site was predictable: the financial crisis and a legal challenge form a local resident. While the SRC project has not been successful as yet, many of the other North Tip benefits are in progress; the habitats and public open space, and indeed the natural revegetation of the areas earmarked for SRC will provide some of the environmental benefits, and could arguably be more beneficial for biodiversity than SRC.

Unsurprisingly, Local Institutional Control and Public finances are generally amongst the most interactive in both redevelopment scenarios, as they instigate and drive the process.

Biodiversity is isolated in the systems, though more involved in Scenario A. Should the redevelopment scenario B be the preferred option then, in order to improve the sustainability of the overall system, then the biodiversity aspect may need to be addressed, for example by setting aside particular areas for habitat creation, stipulating green roofs or introducing particular species into constructed drainage wetlands. Built Environment could potentially have both direct and systemic effects on Public finances in scenario A and so needs to be carefully controlled and monitored, the risk seems less in scenario B, but the potential mechanism is still present. With respect to Private economic aspects, attracting businesses to the site will positively affect the demographics and quality of life of local residents provided the jobs created are sufficiently skilled and well paid. However, this creates a paradox of sorts in that the businesses will have to encourage relocation of sufficiently skilled staff, or attract commuters thereby not employing/up-skilling local workers. In order to attract businesses which are considered acceptable, it must therefore be accepted that there will probably be possibly a high proportion of such outside workers and, given the mobility of many modern workers, will remain that way to some extent. This was anticipated in the original redevelopment plan in that part of the total jobs target was for relocation (and possible expansion) of local businesses and apprenticeships and training opportunities were implemented via Derbyshire Chamber of Commerce as well as other providers. These initiatives will clearly need to be maintained beyond full site occupancy.

The main benefits of the North Tip remediation are in the biodiversity (habitat creation) and to the quality of life. The continued lack of short rotation coppicing in the scheme may perhaps affect the public financial aspects to a small degree, though perhaps more-so private economics as this may necessitate increased site maintenance fees, but some of the

main benefits it was intended to provide: stabilisation of the waste, some habitat creation and improvement of views are equally (if not better in some cases) served by natural re-vegetation of the tip.

The MEGZ feedback on the tool was positive, it was felt that in addition to constructive additions to the options appraisal process the analysis offered, potentially greater positives lie in the use of BR2 as a communication and process aid:

The structured way of considering components of the site and regeneration plans was thought to be beneficial in options appraisal stage and as a communication tool to inform/consult stakeholders. The tool gives transparency to the process, making it easier to see the reasons why a particular decision was made and could act as a focal point for the various investigations and modelling in the planning stages. The systems analysis results help to reinforce conclusions and decisions.The MEGZ team envisaged BR2 being used to communicate decisions to local stakeholders for smaller sites, the simple structure allows easy interrogation of a completed spreadsheet even if the user was not involved in populating it. The structure also suggests aspects to be considered and allows a relatively simple check for omissions from a plan.

In addition, the manner in which decisions are encoded and justified means that the tool also acts as a record of those decisions and an index to the evidence on which those decisions have been made.

In terms of the tool itself, the exercise has highlighted aspects which may be improved. With regard to the 3 coding systems, the ±2ESQ system presents problems in scoring: should effects be scored as if they work perfectly, or according to the risks of failure or under performance? It perhaps may be useful to give opportunities to record both, perhaps with ideal case as the main justification with an added section for potential risks.

Though the exercise can easily be carried out on paper, the tool aids the process, initially by helping to suggest considerations when assessing relationships and also in re-displaying the data to allow easier analysis. This could be taken further by redisplaying each component to show the all 'causes' and 'effects' associated with it together with the reasoning thus helping to assess where chains of relationships may indeed produce systemic effects. It may also help to plot C:E diagrams for each individual component for all scenarios considered for better comparison.

As well as analysing and recording the simple perturbation: the redevelopment, for a site on the scale of Markham Vale taking a number of years, or distinct phases, could be analysed by stage or by annual progress in order to allow monitoring over the redevelopment period.

References

DCC (2014) Derbyshire County Council Community area profiles
http://www.derbyshire.gov.uk/community/about_your_county/community_profiles/default.asp

Jiao, Y. and Hudson, J. A. (1995). The fully-coupled model for rock engineering systems, *International Journal of Rock Mechanics, Mineral Science and Geomechanic Abstracts,* **32,** 491-512.

Hudson, J. A. (1992). *Rock Engineering Systems: theory and practice,* Ellis Horwood, Chichester.

ONS (2013) ONS Statistical Bulletin. Annual Mid-year Population Estimates for England and Wales, 2012

Annex I pre-development relationships for Markham Vale

1 BIODIVERSITY Flora, Fauna, Habitats	2 NATURAL ENVIRONMENT	0	0	0	biodiversity had no initial effect on natural environment
	3 BUILT ENVIRONMENT	0	0	0	biodiversity had no initial effect on the built environment
	4 DEMOGRAPHICS	0	0	0	no identified interaction mechanism biodiversity : built environment
	5 QUALITY OF LIFE	0	0	0	any biodiversity/habitats before regeneration were not generally aesthetic therefore unlikely to improve QoL
	6 PUBLIC ECONOMIC	0	0	0	the initial biodiversity did not need protection
	7 PRIVATE ECONOMIC	0	0	0	no identified interaction mechanism biodiversity : private spending
	8 INDIVIDUAL ECONOMICS	0	0	0	no identified interaction mechanism biodiversity : individual spending
	9 LOCAL INSTITUTIONAL CONTROLS	0	0	0	no biodiversity to protect at the time
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	0	0	0	would eg natural england or EA be involved, or merely as consultees to local IC?

2. NATURAL ENVIRONMENT Green Infrastucture : green open space Lithosphere : Contamination, Geotechnics, Geology; Hydrosphere : Hydrogeology, Hydrology, Flooding; Atmosphere : Air quality	1 BIODIVERSITY	1	1	1	open space supports biodiversity, such as it is,
	3 BUILT ENVIRONMENT	1	1	1	biodiversity enhanced by dereliction of the site (mosaic habitats)
	4 DEMOGRAPHICS	1	-1	2	no public open space, view of spoil heaps, derelict buildings etc
	5 QUALITY OF LIFE	1	-1	2	views of spoil heaps, derelict buildings etc
	6 PUBLIC ECONOMIC	1	-1	3	will require public finding to remediate contamination and tip stability, maintain roads around the site
	7 PRIVATE ECONOMIC	0	0	0	no affect on provate economics
	8 INDIVIDUAL ECONOMICS	1	-1	2	will affect property values of owners in the area
	9 LOCAL INSTITUTIONAL CONTROLS	1	-1	4	contamination, flood defences, groundwater, air quality will all need regulation
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	1	-1	1	flood protection measures require consultation with EA.

HOMBRE

3. BUILT ENVIRONMENT Land use: Former uses, Current uses, Existing buildings Infrastructure: Access to site, Access within the site General site characteristics: Size, Location, Site boundaries	1 BIODIVERSITY	1	1	1	any biodiversity is there as a consequence of the state of the built environment, redevlopment will have to take this into account
	2 NATURAL ENVIRONMENT	0	0	0	the built environment doesn't really affect natural environment before redevelopment
	4 DEMOGRAPHICS	1	-1	2	built environment (dereliction, existing roads) means demographics unlikely to change
	5 QUALITY OF LIFE	1	-1	2	built environment (dereliction, existing roads) means QoL unlikely to change
	6 PUBLIC ECONOMIC	1	-1	1	roads etc will still need to be maintained whether development takes place or not
	7 PRIVATE ECONOMIC	0	0	0	before development, little opportunity of PrE to benefit
	8 INDIVIDUAL ECONOMICS	1	-1	1	built environment likeily to depress property values for local owners
	9 LOCAL INSTITUTIONAL CONTROLS	0	0	0	0
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	0	0	0	0

		BCM	±ESQ	+ESQ	
4. DEMOGRAPHICS	1 BIODIVERSITY	0	0	0	0
	2 NATURAL ENVIRONMENT	0	0	0	0
	3 BUILT ENVIRONMENT	0	0	0	0
	5 QUALITY OF LIFE	0	0	0	0
	6 PUBLIC ECONOMIC	1	-1	2	population will continue to require benefits, JSA etc
	7 PRIVATE ECONOMIC	0	0	0	0
	8 INDIVIDUAL ECONOMICS	1	-1	1	demographics help to depress property values
	9 LOCAL INSTITUTIONAL CONTROLS	1	-1	1	level of depravation will remain, interventions will be unaffected
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	0	0	0	no identified interaction mechanism demographics:central inst. Controls

HOMBRE

		BCM	±ESQ	+ESQ	
QUALITY OF LIFE Cost of living, Education, Culture, Provision of services, Access to services, Health, Social, Recreation / free time	1 BIODIVERSITY	0	0	0	0
	2 NATURAL ENVIRONMENT	0	0	0	0
	3 BUILT ENVIRONMENT	0	0	0	0
	4 DEMOGRAPHICS	1	-1	2	demographics will remain transient
	6 PUBLIC ECONOMIC	1	-1	2	health, education will continue to imact public finance to same degree
	7 PRIVATE ECONOMIC	0	0	0	no change
	8 INDIVIDUAL ECONOMICS	1	-1	2	QoLwill continue to depress IE
	9 LOCAL INSTITUTIONAL CONTROLS	1	-1	2	QoL will help to ensure level of interventions unchanged
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	0	0	0	0

		BCM	±ESQ	+ESQ	
6 PUBLIC ECONOMIC	1 BIODIVERSITY	0	0	0	no current spending
	2 NATURAL ENVIRONMENT	1	1	2	improves contamination, stability, flooding issues
	3 BUILT ENVIRONMENT	1	1	1	maintain the roads
	4 DEMOGRAPHICS	1	-1	2	benefits etc will ensure the demographics will not change
	5 QUALITY OF LIFE	0	0	0	no change
	7 PRIVATE ECONOMIC	0	0	0	no change
	8 INDIVIDUAL ECONOMICS	0	0	0	no change
	9 LOCAL INSTITUTIONAL CONTROLS	0	0	0	0
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	0	0	0	0

HOMBRE

7 PRIVATE ECONOMIC		BCM	±ESQ	+ESQ	
	1 BIODIVERSITY	0	0	0	0
	2 NATURAL ENVIRONMENT	0	0	0	0
	3 BUILT ENVIRONMENT	1	1	1	currently maintains BE, minus roads
	4 DEMOGRAPHICS	0	0	0	no effect
	5 QUALITY OF LIFE	1	1	1	PrE minor factor in QoL
	6 PUBLIC ECONOMIC	1	1	1	helps with maintaining status quo
	8 INDIVIDUAL ECONOMICS	1	1	1	maintains levels of emloyment
	9 LOCAL INSTITUTIONAL CONTROLS	1	1	1	status quo
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	0	0	0	0

8 INDIVIDUAL ECONOMICS		BCM	±ESQ	+ESQ	
	1 BIODIVERSITY	0	0	0	no identified interaction mechanism individual economic : biodiversity
	2 NATURAL ENVIRONMENT	0	0	0	increased IE may mean more car journeys
	3 BUILT ENVIRONMENT	1	1	1	Agree
	4 DEMOGRAPHICS	1	1	1	IE important factor in demographics, little change means little change in demographics
	5 QUALITY OF LIFE	1	1	1	QoL little changed
	6 PUBLIC ECONOMIC	1	-1	2	on-going benefits etc
	7 PRIVATE ECONOMIC	0	0	0	no change
	9 LOCAL INSTITUTIONAL CONTROLS	0	0	0	no identified interaction mechanism individual economic : LIC
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	0	0	0	no identified interaction mechanism individual economic : CIC

HOMBRE

		BCM	±ESQ	+ESQ	
9 LOCAL INSTITUTIONAL CONTROLS	1 BIODIVERSITY	1	-1	1	there may be species/habitats to protect, eg mosaic habitats, colonisation of derelict mine buildings
	2 NATURAL ENVIRONMENT	1	2	3	LIC will still need to protect eg groundwater quality, provide flood mitigation, soil contamination/stability issues where spoil heaps are being used
	3 BUILT ENVIRONMENT	0	0	0	though will be increasing pressure to act
	4 DEMOGRAPHICS	1	2	4	LIC will be responsible for attraching employment opportunities
	5 QUALITY OF LIFE	1	1	1	decisions of LIC will directly affect QoL for many residents
	6 PUBLIC ECONOMIC	1	-2	4	local policies and interventions dictate public spending
	7 PRIVATE ECONOMIC	1	2	4	no policy, no development
	8 INDIVIDUAL ECONOMICS	1	1	2	potentially policy redudces unemploment
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	0	0	0	0

		BCM	±ESQ	+ESQ	
10 CENTRAL/EU INSTITUTIONAL CONTROLS	1 BIODIVERSITY	0	0	0	0
	2 NATURAL ENVIRONMENT	0	0	0	0
	3 BUILT ENVIRONMENT	0	0	0	0
	4 DEMOGRAPHICS	0	0	0	no identified interaction mechanism CIC : demographics
	5 QUALITY OF LIFE	0	0	0	no identified interaction mechanism CIC : QoL
	6 PUBLIC ECONOMIC	0	0	0	0
	7 PRIVATE ECONOMIC	0	0	0	0
	8 INDIVIDUAL ECONOMICS	0	0	0	0
	9 LOCAL INSTITUTIONAL CONTROLS	0	0	0	0

Annex II Scenario A Relationships for Markham Vale

1 BIODIVERSITY Flora, Fauna, Habitats		BCM	±2ESQ	+4ESQ	
	2 NATURAL ENVIRONMENT	0	0	0	changes to the natural environment will enable changes to biodiversity, not vice-versa
	3 BUILT ENVIRONMENT	0	0	0	considering biodiversity may affect the type of drainage, but not the need for it
	4 DEMOGRAPHICS	0	0	0	no identified interaction mechanism biodiversity : built environment
	5 QUALITY OF LIFE	1	1	1	Improved environment + landscape = increased desire to access landscaped areas = healthier lifestyles. Greater pride and local ownership of surroundings
	6 PUBLIC ECONOMIC	1	-1	2	Establishing some biodiversity will require some public expenditure which is currently at risk of being cut
	7 PRIVATE ECONOMIC	0	0	0	no identified interaction mechanism biodiversity : private spending
	8 INDIVIDUAL ECONOMICS	0	0	0	no identified interaction mechanism biodiversity : individual spending
	9 LOCAL INSTITUTIONAL CONTROLS	1	1	1	Our restoration work is already showing some postives, ie cleaner water = presence of otters, improved habitats = increased GCN which benefits biodiversity but results in need for greater control measures for DCC and also private companies
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	1	1	1	would eg natural england or EA be involved, or merely as consultees to local IC?

2. NATURAL ENVIRONMENT Green Infrastucture : green open space Lithosphere : Contamination, Geotechnics, Geology; Hydrosphere : Hydrogeology, Hydrology, Flooding; Atmosphere : Air quality		BCM	±ESQ	+ESQ	
	1 BIODIVERSITY	1	2	3	SRC, surface water and open space areas inc. biodiversity
	3 BUILT ENVIRONMENT	1	2	3	open space in plan has no effect on built environment
	4 DEMOGRAPHICS	0	0	0	no change on site
	5 QUALITY OF LIFE	1	1	2	more public open space increases QoL
	6 PUBLIC ECONOMIC	1	-1	1	will require public funding for new public open space (how much?) In the short to medium term quite a lot but long term it will be self financing through a Site Facilities Charge
	7 PRIVATE ECONOMIC	1	-1	1	SRT provides low carbon fuel but businesses have to pay a Site facilities Charges per acre they occupy to meet Environmental Costs
	8 INDIVIDUAL ECONOMICS	1	1	1	some jobs in SRT & open space maintenance. Closer open space for local populace [NB fewer jobs than in the past, but more than as BF/under-utilised]
	9 LOCAL INSTITUTIONAL CONTROLS	1	-1	1	soil contamination remediation required (rel. low level for industrial uses). created habitats may need protection. Increased traffic = incr air pollution . We are creating 5,000 jobs in a Sustainable Environment which includes Travel to Work Plans, new walking/cycling routes, cycle racks etc
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	1	-1	1	flood protection measures require consultation with EA. Increased traffic = incr air pollution

		BCM	+ESQ	+ESQ	
3. BUILT ENVIRONMENT Land use: Former uses, Current uses, Existing buildings Infrastructure: Access to site, Access within the site General site characteristics: Size, Location, Site boundaries	1 BIODIVERSITY	1	1	2	while total 'undeveloped area reduced, the quality and management habitats in the plan is better - is remediation of large areas of brownfield land +ve or -ve? The costs of which are being met by the built development
	2 NATURAL ENVIRONMENT	1	2	3	air pollution for extra traffic?. Is potential flooding mitigated. Without the development, there would be no protection to existing natural environment and no environmental improvements. The site benefits from SUDS type draiange. The costs of providing all this is being met from the business development. the ongoing management and maintenance
	4 DEMOGRAPHICS	1	1	2	will 5000 jobs require inward migration to chesterfield/bolsover? Housing strategy mentions this, but there is no direct link. Will extra jobs impact on depravation. The local communities see MV as an opportunity for new jobs for their local young people and for them to stay in the area rather than move to jobs elsewhere. Equally, there is a need for more
	5 QUALITY OF LIFE	1	2	2	Removal of dereliction, improved landscape, greater access to woodlands etc plud new employment opportunities for local communities will all positively contribute to the Quality of Life for local communities.
	6 PUBLIC ECONOMIC	1	-2	4	extra road building. extra road maintenance and services - how does this compare with extra tax revenue. Extra road building costs are being met through the development with grant aid. Maintenance costs of highways are additional burden but maintenance of other public realm areas are being financed through the Site Facilities charge on each
	7 PRIVATE ECONOMIC	1	2	4	Our objective at MV is to create 5,000 jobs -3,000 of which are safeguarded and 2,000 are NEW. Safeguarded means retaining businesses/jobs in the area that would otherwise move elsewhere. We have already achieved a mix of new/existing businesses/jobs
	8 INDIVIDUAL ECONOMICS	1	2	4	The expectation of MV is to create new jobs which in turn is help improve on the existing Poverty Indices in this locality which are amongst the worse in Derbyshire and the East Midlands
	9 LOCAL INSTITUTIONAL CONTROLS	1	-2	4	The MV development forms part of all three LA Local Plans and Local Economic Plans. The Planning Authorities have an increase in workload dealing with all the various Planning Applications that we are submitting for each phase of the development.
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	0	0	0	0

		BCM	+ESQ	+ESQ	
4. DEMOGRAPHICS	1 BIODIVERSITY	0	0	0	no change in population on-site, are popn changes expected off-site? - Slight increase expected in off-site population
	2 NATURAL ENVIRONMENT	1	-1	1	possible extra traffic due to extra popn imapcts air quality
	3 BUILT ENVIRONMENT	1	1	1	increased employment/wages may allow improvements to properties and construction of higher value housing
	5 QUALITY OF LIFE	1	1	2	will in-migration stress health and education provision? An increase in working population with a reduction in unemployemt will help to increases in training. education achievement levels, and aspirations
	6 PUBLIC ECONOMIC	1	1	1	Increased levels of employment will increase National Tax payments and reduce state aid dependancies both locally and nationally
	7 PRIVATE ECONOMIC	1	1	2	New jobs = increased levels of employment = increased levels in perosnal and disposable income therby benefitting local businesses.
	8 INDIVIDUAL ECONOMICS	1	2	3	Local people in employment = increased levels in personal income
	9 LOCAL INSTITUTIONAL CONTROLS	0	0	0	no identified interaction mechanism demographics:local inst. Controls
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	0	0	0	no identified interaction mechanism demographics:central inst. Controls

HOMBRE

QUALITY OF LIFE Cost of living, Education, Culture, Provision of services, Access to services, Health, Social, Recreation / free time		BCM	±ESQ	+ESQ	
	1 BIODIVERSITY	1	1	1	better QoL (free time) may increase volunteering eg nature conservation, gardening, increasing biodiversity
	2 NATURAL ENVIRONMENT	1	1	1	Agree with comments provided
	3 BUILT ENVIRONMENT	1	1	2	Greater QoL should lead to greater pride in area and surroundings
	4 DEMOGRAPHICS	1	1	1	Agree with comments - this is one of the aspirations of our Regeneration work at MV
	6 PUBLIC ECONOMIC	1	2	2	One of the main reasons of MEGZ is to create jobs and improve the economy in an area with high levels of deprivation and state dependancy
	7 PRIVATE ECONOMIC	1	1	2	Increase in leisure pursuits due to cycle ways and improved access to woodlands and open countryside etc. Retail restricted to new pub/restaurant, McDonalds, KFC and Starbucks (to date). Our work at Styaveley Basin and the adjoining canal restoration is making the area more attractive for visitors to the area.
	8 INDIVIDUAL ECONOMICS	1	2	2	As part of our work to get people into employment, we work with training and education bodies - JobCentre Plus, Chesterfield College, Apprenticeship schemes etc
	9 LOCAL INSTITUTIONAL CONTROLS	1	1	1	improving QoL reduces required interventions
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	1	1	1	as per 9, ie EU funding is linked to deprivation levels. If Improved QoL reduces deprivation then less need for EU intervention

6 PUBLIC ECONOMIC		BCM	±ESQ	+ESQ	
	1 BIODIVERSITY	1	2	3	public spending provides new habitats
	2 NATURAL ENVIRONMENT	1	2	4	public spending increases flood mitigation (is this needed beforehand? - yes) and reduces contamination risks, BUT decreases air quality due to increase in traffic. Improvements to landscape, network of cycle routes helps to mitigate any increase in traffic. canal restoration at Staveley is +ve
	3 BUILT ENVIRONMENT	1	2	4	encourages the redevlopment of the site
	4 DEMOGRAPHICS	1	1	2	arguably another +2, +4 response as will not happen otherwise. Agree - but +1 for increase in population but +2 for changing make-up of population
	5 QUALITY OF LIFE	1	2	4	The big reason for public investment is to improve the quality of life for locals through a variety of factors - jobs, training, education, environment, income, aspirations etc
	7 PRIVATE ECONOMIC	1	2	4	that's the plan - Yes £88m of public sector investment to attract over £200m of private sector investment
	8 INDIVIDUAL ECONOMICS	1	1	1	only indirectly leads to an increase in income, apart from some employment in SRC etc
	9 LOCAL INSTITUTIONAL CONTROLS	1	-1	2	Planning, Environmnetal Controls, Flood Prevention, Highways, Financial Control of Public expenditure, Project Mgt.
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	1	1	2	as above + Plus central Govt and EU funding

HOMBRE

7 PRIVATE ECONOMIC		BCM	±ESQ	+ESQ	
	1 BIODIVERSITY	1	-1	1	Yes if not managed properly, hence the need for strict planning controls. Look at other business sites (or the adjoining one) without as strict controls
	2 NATURAL ENVIRONMENT	1	-2	2	Yes if not managed properly, hence the need for strict planning controls. Look at other business sites (or the adjoining one) without as strict controls. Private funding (through the Site Facilities Charge) is paying for mgt of landscape and water bodies, and ongoing treatment of leachate from Sout Tip
	3 BUILT ENVIRONMENT	1	1	3	Compare the design and quality of new build with that of existing/adjoining industrial area.
	4 DEMOGRAPHICS	1	1	2	The area currently has high levels of unemployment so Labour Rates are relatively low. As more people gain jobs, then wage levels are likely to increase. As the labour market shrinks, then local population may increase with increase at lower age brackets. Local desire for more private sector housing as currently high percentage of starter homes and
	5 QUALITY OF LIFE	1	1	2	the retail part on plot 7 is being used by local community. MV has a planning requirement to replace a fottball pitch that has been developed for industry
	6 PUBLIC ECONOMIC	1	1	3	Business rates will increase - some discussion about Council's borrowing Capital for investment projects against future business rates uplift. Businesses investing in the area have anticipation of public infrastructure being maintained at high quality standard - if not it will deteriorate over years and the site quality will suffer and businesses may suffer.
	8 INDIVIDUAL ECONOMICS	1	2	3	High levels of unemployment in area results in low wage rates. The MV project, whilst using this as an attraction for business investment, aims to reverse this. We are selective about the types of businesses investing at MV - we want high quality/skilled jobs and higher job densities per area. Whilst we do not always say not to warehouse/distribution
	9 LOCAL INSTITUTIONAL CONTROLS	1	1	2	improving employment, reducing interventions
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	1	1	1	improving employment

8 INDIVIDUAL ECONOMICS		BCM	±ESQ	+ESQ	
	1 BIODIVERSITY	1	1	1	improving IE may result in more pride and volunteering in nature conservation
	2 NATURAL ENVIRONMENT	1	-1	2	increased IE may mean more car journeys
	3 BUILT ENVIRONMENT	1	1	1	Agree
	4 DEMOGRAPHICS	1	1	2	decreases depravation - Local councils are working towards increasing the quality of housing by more providing more private sector housing and more for 2nd/3rd time buyers
	5 QUALITY OF LIFE	1	1	2	Increase income to better employment opportunities should also raise health levels of population through improved diet and fitness levels
	6 PUBLIC ECONOMIC	1	2	2	Agree with comments but change to scoring
	7 PRIVATE ECONOMIC	1	1	2	Agree
	9 LOCAL INSTITUTIONAL CONTROLS	1	1	1	better indicvidual economics means less likely social/health interventions
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	0	0	0	no identified interaction mechanism individual economic : CIC

HOMBRE

9 LOCAL INSTITUTIONAL CONTROLS		BCM	±ESQ	±ESQ	
	1 BIODIVERSITY	1	2	3	The MEGZ mssion statement is to 'create 5,000 jobs in a sustainable environment' The MEGZ project is covered by a comprehensive Planning pemission from 3 LA's (CBC, NEDDC and Bolsover) as well as other DCC Highways etc. The conditions cover widely Biodiversity from surveys, protection, mitigation and enhancements
	2 NATURAL ENVIRONMENT	1	2	3	See 'Biodiversity' above. reduces contaminated soil/GW risks (yes)
	3 BUILT ENVIRONMENT	1	2	3	The MV Planning permission includes a detailed Design Framework covering the design and appearance of buildings, their BREEAM rating, environmental credentials, Travel to Work, etc. No historical buildins on site other than restoration of Chesterfield canal. Planning Conditions stipulate need for Archaeological Surveys
	4 DEMOGRAPHICS	1	1	2	DCC requirements are to encourage local employment in permanent jobs and in construction jobs - but cannot enforce
	5 QUALITY OF LIFE	1	1	3	Planning controls require improved landscape, comprehensive cycle routes/fottways around and to/from site. Need to encouraging local employment and training - these figures are collated and reported. Planning stipulates that we spend £x000,000 on Public Art (including community festivals) around the site. Our planning obligations include
	6 PUBLIC ECONOMIC	1	-2	4	planning policy leads spending local budget
	7 PRIVATE ECONOMIC	1	2	4	no policy, no development
	8 INDIVIDUAL ECONOMICS	1	1	2	potentially policy redudces unemploment
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	1	2	1	no identified interaction mechanism LIC : CIC - Without Local Plans and Local Policies we would have difficulty securing national and Europena Control for Funding, M1 Motorway Junction, for Enterprise Zone etc

10 CENTRAL/EU INSTITUTIONAL CONTROLS		BCM	±ESQ	±ESQ	
	1 BIODIVERSITY	1	1	1	increase in low carbon energy policies increase attractiveness of biomass crops. Improved landscape is increasing biodiversity including European protected species
	2 NATURAL ENVIRONMENT	1	1	2	see above
	3 BUILT ENVIRONMENT	0	0	0	No connection
	4 DEMOGRAPHICS	0	0	0	no identified interaction mechanism CIC : demographics
	5 QUALITY OF LIFE	0	0	0	no identified interaction mechanism CIC : QoL
	6 PUBLIC ECONOMIC	1	1	2	Enterprise Zone designation increases the funding opportunities availabel from central Government and Local Economic Partnerships
	7 PRIVATE ECONOMIC	1	1	2	Enterprize zone policy
	8 INDIVIDUAL ECONOMICS	0	0	0	no identified interaction mechanism CIC : individual economics
	9 LOCAL INSTITUTIONAL CONTROLS	1	1	3	Central Govt designation of Enterprise Zone status has strengthened links with the two Local Economic Partnerships as well as with the three District Councils (who granted Planning Approval) as they sit on the Sheffield City Region (whose Enterprise Zone MV is in)

HOMBRE

Annex III Scenario B Relationships for Markham Vale

		BCM	±ESQ	+ESQ	
1 BIODIVERSITY Flora, Fauna, Habitats	2 NATURAL ENVIRONMENT	0	0	0	biodiversity/habitats have no effect on natural environment
	3 BUILT ENVIRONMENT	0	0	0	biodiversity/habitats have no effect on built environment
	4 DEMOGRAPHICS	0	0	0	no identified interaction mechanism biodiversity : built environment
	5 QUALITY OF LIFE	0	0	0	not enough biodiversity established to affect QoL
	6 PUBLIC ECONOMIC	0	0	0	no extra biodiversity beyond SUDS etc, no extra expense
	7 PRIVATE ECONOMIC	0	0	0	no extra biodiversity beyond SUDS etc, no extra expense
	8 INDIVIDUAL ECONOMICS	0	0	0	no identified interaction mechanism biodiversity : individual spending
	9 LOCAL INSTITUTIONAL CONTROLS	0	0	0	no effect unless BF habitats are deemed 'mosaic habitats', which may render them -ve
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	0	0	0	no effect unless BF habitats are deemed 'mosaic habitats', which may render them -ve

		BCM	±ESQ	+ESQ	
2. NATURAL ENVIRONMENT Green Infrastucture : green open space Lithosphere : Contamination, Geotechnics, Geology; Hydrosphere : Hydrogeology, Hydrology, Flooding; Atmosphere : Air quality	1 BIODIVERSITY	1	1	1	biodiversity may change due to SUDs drainage ponds (though remediation of contamination, site clearance etc may destroy mosaic habitats)
	3 BUILT ENVIRONMENT	0	0	0	open space in plan has no effect on built environment
	4 DEMOGRAPHICS	0	0	0	no change on site
	5 QUALITY OF LIFE	0	0	0	QoL largely unaffected
	6 PUBLIC ECONOMIC	1	-1	1	will require public funding for roads and infrastructure. Tip areas will still need to be investigated
	7 PRIVATE ECONOMIC	0	0	0	change in natural environment not really affecting PrE. Who pays for remediation/flood mitigation?
	8 INDIVIDUAL ECONOMICS	0	0	0	no real implications for IE from NE as no SRT, public open space etc
	9 LOCAL INSTITUTIONAL CONTROLS	1	-1	1	soil contamination remediation required (rel. low level for industrial uses). Increased traffic = incr air pollution . Without the moderating effects of SRT and open space
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	1	-1	1	flood protection measures require consultation with EA. Increased traffic = incr air pollution

HOMBRE

		BCM	±ESQ	+ESQ	
3. BUILT ENVIRONMENT Land use: Former uses, Current uses, Existing buildings Infrastructure: Access to site, Access within the site General site characteristics: Size, Location, Site boundaries	1 BIODIVERSITY	1	1	1	some biodiversity benefits from eg SUDs but may be mitigated in the short term by reduction in mosaic habitats
	2 NATURAL ENVIRONMENT	1	2	2	air pollution for extra traffic?. Is potential flooding mitigated. Without the development, there would be no protection to existing natural environment and no environmental improvements. The site benefits from SUDS type drainage. [IS THIS -VE FOR LOWER AIR QUALITY, OR +VE FOR Con Land/Flooding]
	4 DEMOGRAPHICS	0	0	0	demographics may be largely unaffected if jobs provided are low pay/low skilled.
	5 QUALITY OF LIFE	1	1	1	some improvement in QoL for those in the new jobs
	6 PUBLIC ECONOMIC	1	-1	2	extra road building. extra road maintenance and services - how does this compare with extra tax revenue. Extra road building costs are being met through the development with grant aid. Maintenance costs of highways are additional burden. The Businesses will generate extra Business rates to benefit local council finance.The new businesses will
	7 PRIVATE ECONOMIC	1	2	4	Our objective at MV is to create 5,000 jobs - 3,000 of which are safeguarded and 2,000 are NEW.
	8 INDIVIDUAL ECONOMICS	1	1	3	The expectation of MV is to create new jobs which in turn is help improve on the existing Poverty Indices in this locality which are amongst the worse in Derbyshire and the East Midlands
	9 LOCAL INSTITUTIONAL CONTROLS	1	-2	4	The MV development forms part of all three LA Local Plans and Local Economic Plans. The Planning Authorities have an increase in workload dealing with all the various Planning Applications that we are submitting for each phase of the development.
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	0	0	0	0

		BCM	±ESQ	+ESQ	
4. DEMOGRAPHICS	1 BIODIVERSITY	0	0	0	no change in population on-site, are popn changes expected off-site? - Slight increase expected in off-site population
	2 NATURAL ENVIRONMENT	1	-1	1	possible extra traffic due to extra popn imapcts air quality
	3 BUILT ENVIRONMENT	0	0	0	little change
	5 QUALITY OF LIFE	1	1	1	improvement for those with new jobs, but perhaps not highly paid/stable/great prospects
	6 PUBLIC ECONOMIC	1	1	1	Increased levels of employment will increase National Tax payments and reduce state aid dependancies both locally and nationally
	7 PRIVATE ECONOMIC	1	1	1	New jobs = increased levels of employment = increased levels in perosnal and disposable income therby benefitting local businesses.
	8 INDIVIDUAL ECONOMICS	1	1	1	Local people in employment = increased levels in personal income
	9 LOCAL INSTITUTIONAL CONTROLS	0	0	0	no identified interaction mechanism demographics:local inst. Controls
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	0	0	0	no identified interaction mechanism demographics:central inst. Controls

HOMBRE

		BCM	±ESQ	+ESQ	
QUALITY OF LIFE Cost of living, Education, Culture, Provision of services, Access to services, Health, Social, Recreation / free time	1 BIODIVERSITY	0	0	0	better QoL (free time) may increase volunteering eg nature conservation, gardening, increasing biodiversity, though no extra opportunity without open space etc
	2 NATURAL ENVIRONMENT	0	0	0	without the openspace in the plan, less opportunity for volunteering
	3 BUILT ENVIRONMENT	1	1	1	Greater employment levels should lead to greater pride in area and surroundings, though effect may be marginal
	4 DEMOGRAPHICS	1	1	1	some increase in QoL may alter demographics, though debatable
	6 PUBLIC ECONOMIC	1	1	1	One of the main reasons of MEGZ is to create jobs and improve the economy in an area with high levels of deprivation and state dependancy
	7 PRIVATE ECONOMIC	1	1	1	Increase in disposable income and leisure pursuits due to higher emploment
	8 INDIVIDUAL ECONOMICS	1	1	2	just low-skilled, low wage jobs will limit impact on individual economics
	9 LOCAL INSTITUTIONAL CONTROLS	1	1	1	increase in QoL may reduce required social interventions, antisocial behaviour, crime etc
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	1	1	1	as per 9, ie EU funding is linked to deprivation levels. If Improved QoL reduces deprivation then less need for EU intervention

		BCM	±ESQ	+ESQ	
6 PUBLIC ECONOMIC	1 BIODIVERSITY	0	0	0	possibly, but also may be -ve if mosaic habitats present on BF
	2 NATURAL ENVIRONMENT	1	2	4	public spending increases flood mitigation (is this needed beforehand? - yes) and reduces contamination risks, BUT decreases air quality due to increase in traffic.
	3 BUILT ENVIRONMENT	1	1	2	encourages the redevlopment of the site
	4 DEMOGRAPHICS	1	1	1	possible effect, but weak
	5 QUALITY OF LIFE	1	1	3	The big reason for public investment is to improve the quality of life for locals through a variety of factors - jobs,
	7 PRIVATE ECONOMIC	1	2	4	that's the plan - Yes £88m of public sector investment to attract over £200m of private sector investment
	8 INDIVIDUAL ECONOMICS	0	0	0	without actual employment in eg SRC, PuE affects IE only indirectly
	9 LOCAL INSTITUTIONAL CONTROLS	1	-1	2	Planning, Environmnetal Controls, Flood Prevention, Highways, Financial Control of Public expenditure, Project Mgt. potentially a reduction in social interventions
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	1	1	2	as above + Plus central Govt and EU funding

HOMBRE

7 PRIVATE ECONOMIC		BCM	±ESQ	+ESQ	
	1 BIODIVERSITY	1	-1	1	no real private economic relationship with biodiversity, though possibly negative simply by building on brownfield if mosaic habitats present
	2 NATURAL ENVIRONMENT	1	-1	2	poorer air quality from increased traffic, soil sealing from carparks, hard standing etc, though may mitigate contamination or flooding problems
	3 BUILT ENVIRONMENT	1	1	1	better simply because it's new and maintained
	4 DEMOGRAPHICS	1	1	1	may result in lower migration, and increase in household income
	5 QUALITY OF LIFE	1	1	1	apart from some increases in household income, no other real benefits
	6 PUBLIC ECONOMIC	1	1	3	Business rates will increase, but areas of LA responsibility will also increase (eg roads). will lower benefits to some extent.
	8 INDIVIDUAL ECONOMICS	1	1	2	High levels of unemployment in area results in low wage rates. No accounting for increasing the job quality will result in mainly more of the same, increasing wages for some but generally little effect
	9 LOCAL INSTITUTIONAL CONTROLS	1	1	1	some improvement employment, triggers con land, flooding, habitat/biodiv assessments
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	1	1	1	some improvement employment, triggers con land, flooding, habitat/biodiv assessments

8 INDIVIDUAL ECONOMICS		BCM	±ESQ	+ESQ	
	1 BIODIVERSITY	1	1	1	improving IE may result in more pride and volunteering in nature conservation
	2 NATURAL ENVIRONMENT	1	-1	2	increased IE may mean more car journeys
	3 BUILT ENVIRONMENT	1	1	1	Agree
	4 DEMOGRAPHICS	1	1	1	some changes as more may be in work, but no increase in higher status jobs, education etc
	5 QUALITY OF LIFE	1	1	1	Increase income to better employment opportunities should also raise health levels of population through improved diet and fitness levels, perhaps marginally
	6 PUBLIC ECONOMIC	1	1	1	Agree with comments but change to scoring
	7 PRIVATE ECONOMIC	1	1	1	Agree
	9 LOCAL INSTITUTIONAL CONTROLS	1	1	1	better indicvidual economics means less likely social/health interventions
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	0	0	0	no identified interaction mechanism individual economic : CIC

		BCM	±ESQ	+ESQ	
9 LOCAL INSTITUTIONAL CONTROLS	1 BIODIVERSITY	0	0	0	potentially a slight bioD increase due to SUDs eg drainage ponds, but will this offset loss of BF mosaic habitats?
	2 NATURAL ENVIRONMENT	1	1	1	air quality will need protection due to increased traffic, flood mitigation and con land remediation should score this +ve
	3 BUILT ENVIRONMENT	1	1	1	built environment may improve marginally due to current building regs, planning etc
	4 DEMOGRAPHICS	0	0	0	little change to demographics if LA etc does not insist on the jobs outlined in actual MEGZ plan
	5 QUALITY OF LIFE	0	0	0	no effect
	6 PUBLIC ECONOMIC	1	-2	4	planning policy leads spending local budget, though less upfront cost than actual plan
	7 PRIVATE ECONOMIC	1	2	4	no policy, no development
	8 INDIVIDUAL ECONOMICS	1	1	2	potentially policy redudces unemploment
	10 CENTRAL/EU INSTITUTIONAL CONTROLS	1	2	4	no identified interaction mechanism LIC : CIC - Without Local Plans and Local Policies we would have difficulty securing national and Europena Control for Funding, M1 Motorway Junction, for Enterprise Zone etc

		BCM	±ESQ	+ESQ	
10 CENTRAL/EU INSTITUTIONAL CONTROLS	1 BIODIVERSITY	0	0	0	0
	2 NATURAL ENVIRONMENT	0	0	0	see above
	3 BUILT ENVIRONMENT	0	0	0	No connection
	4 DEMOGRAPHICS	0	0	0	no identified interaction mechanism CIC : demographics
	5 QUALITY OF LIFE	0	0	0	no identified interaction mechanism CIC : QoL
	6 PUBLIC ECONOMIC	1	1	2	Enterprise Zone designation increases the funding opportunities availabel from central Government and Local Economic Partnerships
	7 PRIVATE ECONOMIC	1	1	2	Enterprize zone policy
	8 INDIVIDUAL ECONOMICS	0	0	0	no identified interaction mechanism CIC : individual economics
	9 LOCAL INSTITUTIONAL CONTROLS	1	1	3	Central Govt designation of Enterprise Zone status has strengthened links with the two Local Economic Partnerships as well as with the three District Councils (who granted Planning Approval) as they sit on the Sheffield City Region (whose Enterprise Zone MV is in)