4.3/
Green infrastructure network

4.3.1/ strategic opportunities

The spatial framework is based on the principle that development proposals should prioritise Green Infrastructure (GI) as a key driver, helping to deliver environments that can support sustainable communities. GI is already an integral component of Penrith, representing a town that has developed in harmony with its setting and the natural environment. This can be enhanced by the proposed urban extensions, bringing key benefits to existing and future residents alike;

1. **Stronger, safer communities** - shaping places that people are proud of, and where there is high levels of activity in the public realm
2. **Health improvements** - providing the opportunity for people to take steps to fitness, lowering stress levels, promoting and enabling outdoor interaction, activity and sense of well-being
3. **Improving biodiversity and links with the natural world** – creating linked-up wildlife habitats, corridors and networks
4. **Enterprise development** – providing opportunities and inspiration for business activity, boosting local economies;
5. **Climate change adaptation** - providing the space and terrain needed to allow the impact of urban areas to be managed, e.g. flood alleviation and cooling heat islands
6. **Environmental education** - providing valuable, accessible physical resources
7. **Local food production** - providing space for allotments, private and communal gardens and commercial agriculture.

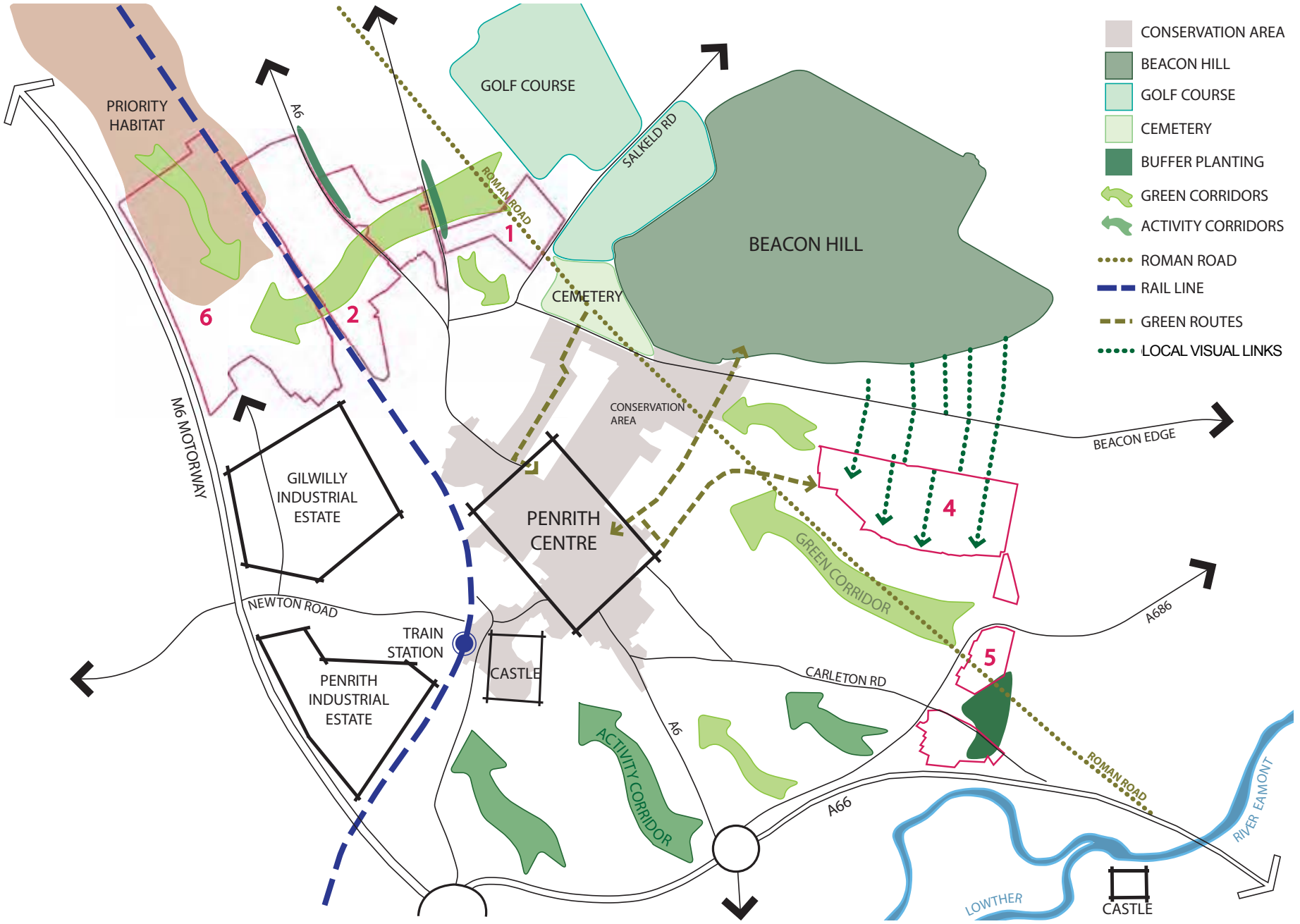
The sketch plan to the right illustrates the potential for urban extensions to help enhance a strong GI network in Penrith. This could play a vital role in coordinating development and growth, ensuring that urban extensions knit into the existing urban fabric. The plan helps to illustrate how key elements of GI can shape urban extension development, their urban form and structure.

GI will;

- **Create a landscape resource** - connections with local landscape, maximising and managing views and landscape impact. New open spaces can increase the landscape resource that is available to communities, both in perception and reality, helping to enhance quality of life.
- **Provide multi-functional spaces** - open spaces that not only complement the landscape setting, but provide recreation opportunities for residents and support wildlife and biotic networks.
- **Enhance biodiversity** - increased biodiversity through habitat creation and ecological improvements such as wetlands, green roofs, environments that attract bees, provides habitats for bats etc.
- **Enable WSUD (Water Sensitive Urban Design)** - GI can integrate appropriate water management techniques and interventions that contribute to climate change mitigation and the potential impacts that the development may have on the local environment. This will be applicable to lower lying sites (e.g. adjacent to Thacka Beck) and higher lying sites, where the rate of surface water run-off must be controlled to prevent flooding downstream.
- **Supporting sustainable transport modes** - legible pedestrian and cyclist routes to key destinations, especially town centre, rail station, schools and employment areas. A particular opportunity would be to establish a ‘green streets’ type public realm initiative - coordinated environmental improvements and signage along key routes, for example;

  To/from the north
  - Beacon Edge
  - Wordsworth Street
  - Graham Street

  To/from the east
  - Brentfield Way
  - (potentially) Carleton Road
  - Pell Lane



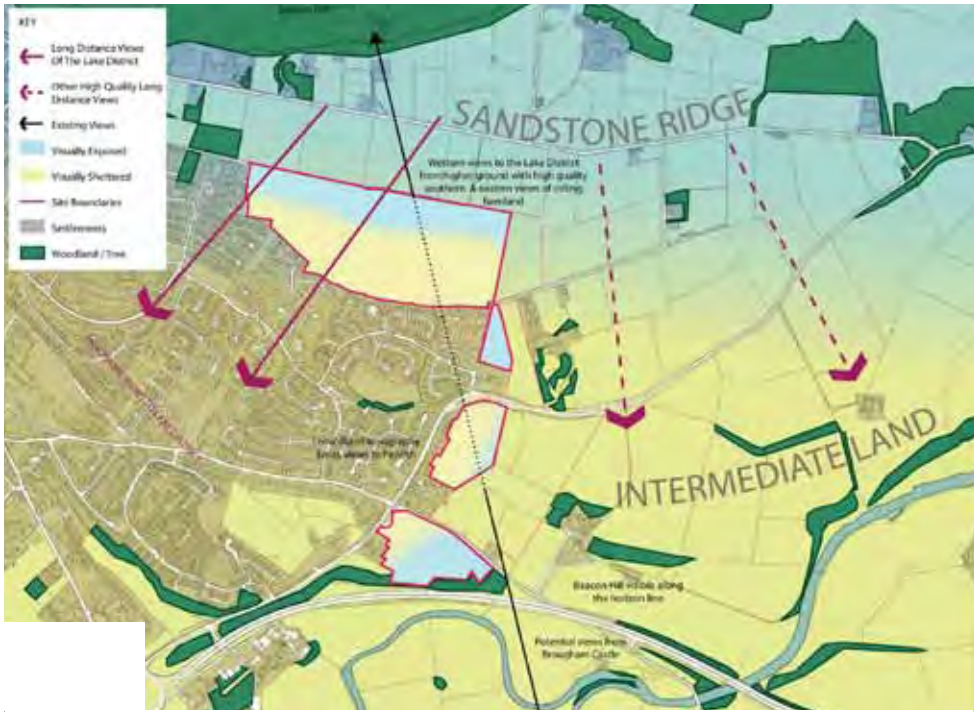
Above: Conceptual plan of potential opportunities to enhance Penrith's strategic Green Infrastructure network through new development and public realm investment initiatives.

4.3.2/ Sites to the east

Integration of GI has been key to shaping the spatial framework and understanding potential development capacity. To the east it is important that development form recognises the sensitive context, yet maximises opportunities where they exist and in particular look to enhance linkages and connectivity, both literally and visually.

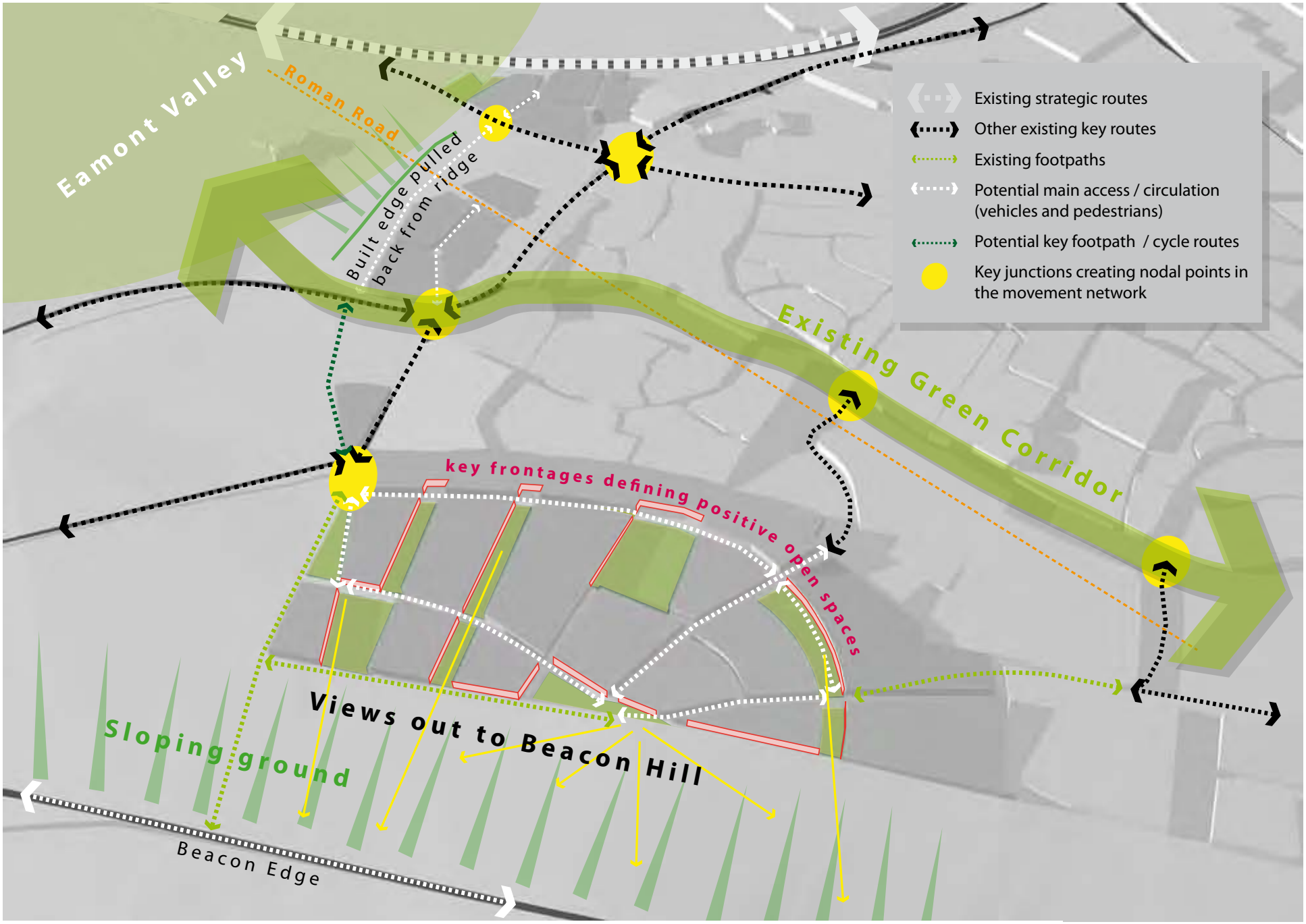
Key issues, constraints and opportunities relating to green infrastructure and landscape are summarised below, the plan to the left mapping existing assets and the plan to the right confirming visual and landscape sensitivities. In response, the plan opposite illustrates an approach to green infrastructure that can help bind the sites, and shape development plots. This is developed further over page, with a summary of design opportunities that arise from this approach. A 'development framework' plan illustrates opportunities and principles shaping extension sites to the east.

Sites E1-E4: relationship with existing open space assets

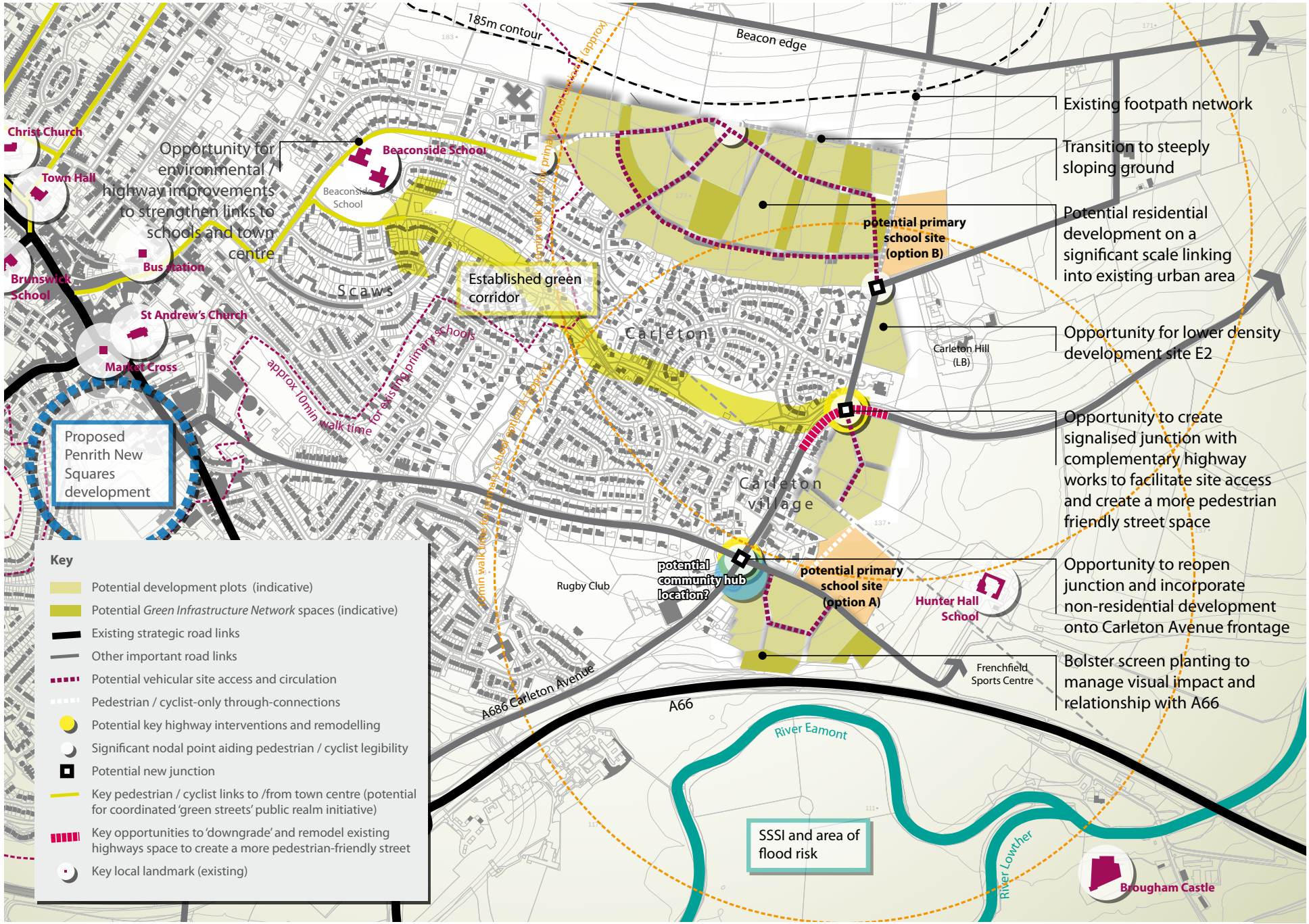


Sites E1-E4: landscape character and views defining visual sensitivity

Sites E1-E4: opportunities for Green Infrastructure to shape the form and layout of urban extension development, creating an integrated plot structures



Sites E1-E4: summary of overarching design opportunities - a summary design framework - as influenced by Green Infrastructure



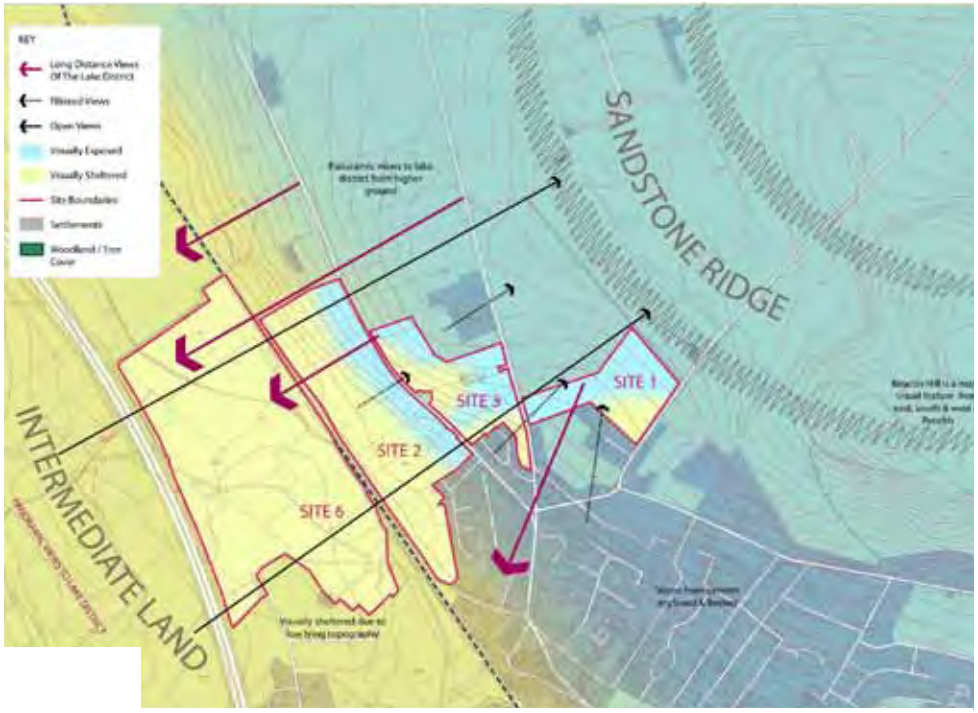
Sites E1-E4: design / development framework and illustrative plot plan shaped by Green Infrastructure

4.3.3/ Sites to the north

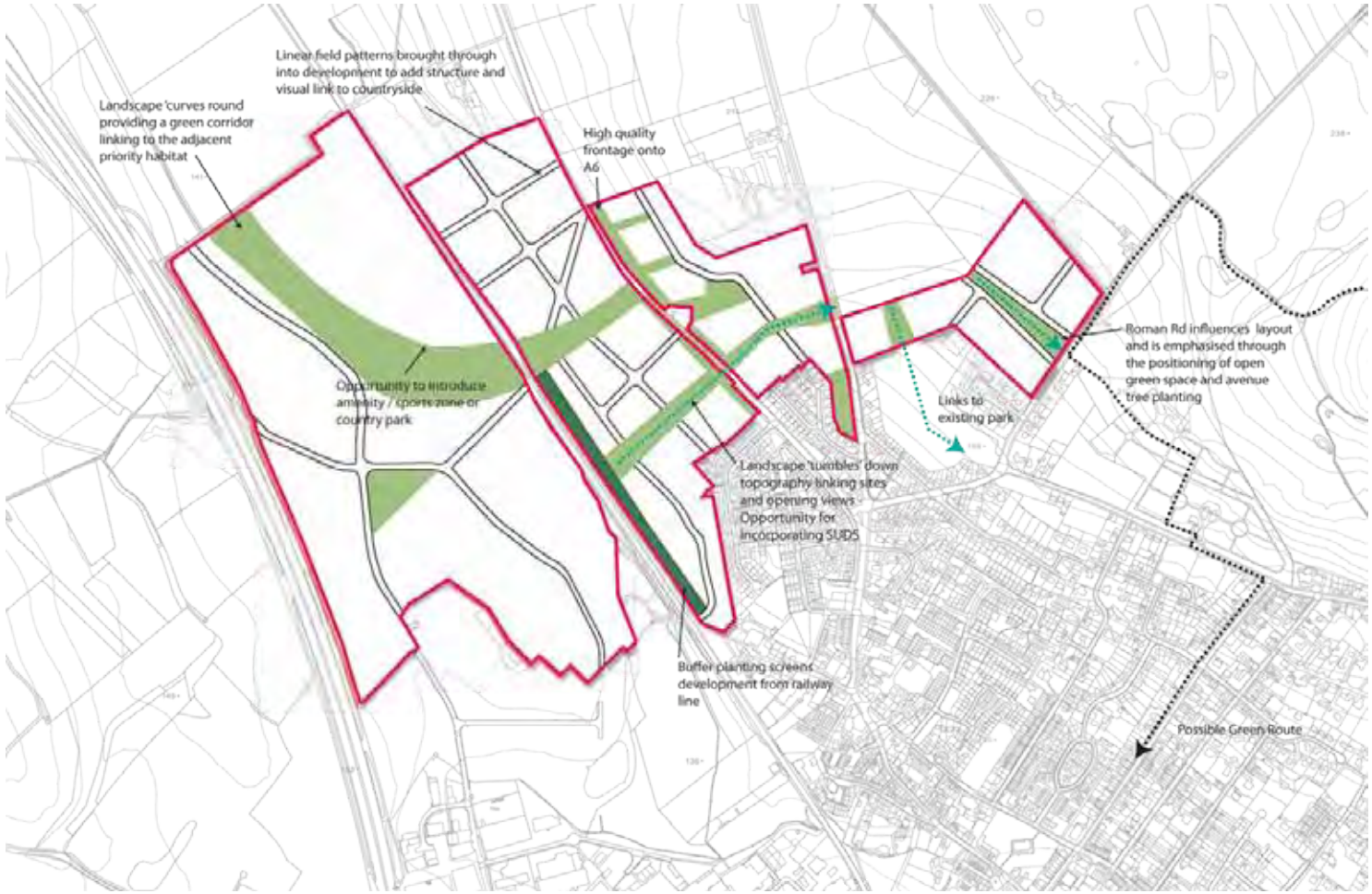
To the north it is important that development form is approached comprehensively, the objective being to bring sites together as a collective whole, despite the constraint of strong north-south movement corridors (A6, WCML, Inglewood Road) and dramatic changes in ground level. Green Infrastructure can play a key role here, enhancing linkages and connectivity, both literally and visually.

Key issues, constraints and opportunities relating to green infrastructure and landscape are summarised below, the plan to the left mapping existing assets and the plan to the right confirming visual and landscape sensitivities. In response, the plan opposite illustrates an approach to green infrastructure that can help shape development plots. This is developed further over page, with a summary of design opportunities that arise from this approach. A 'development framework' plan illustrates opportunities and principles for extension sites to the north.

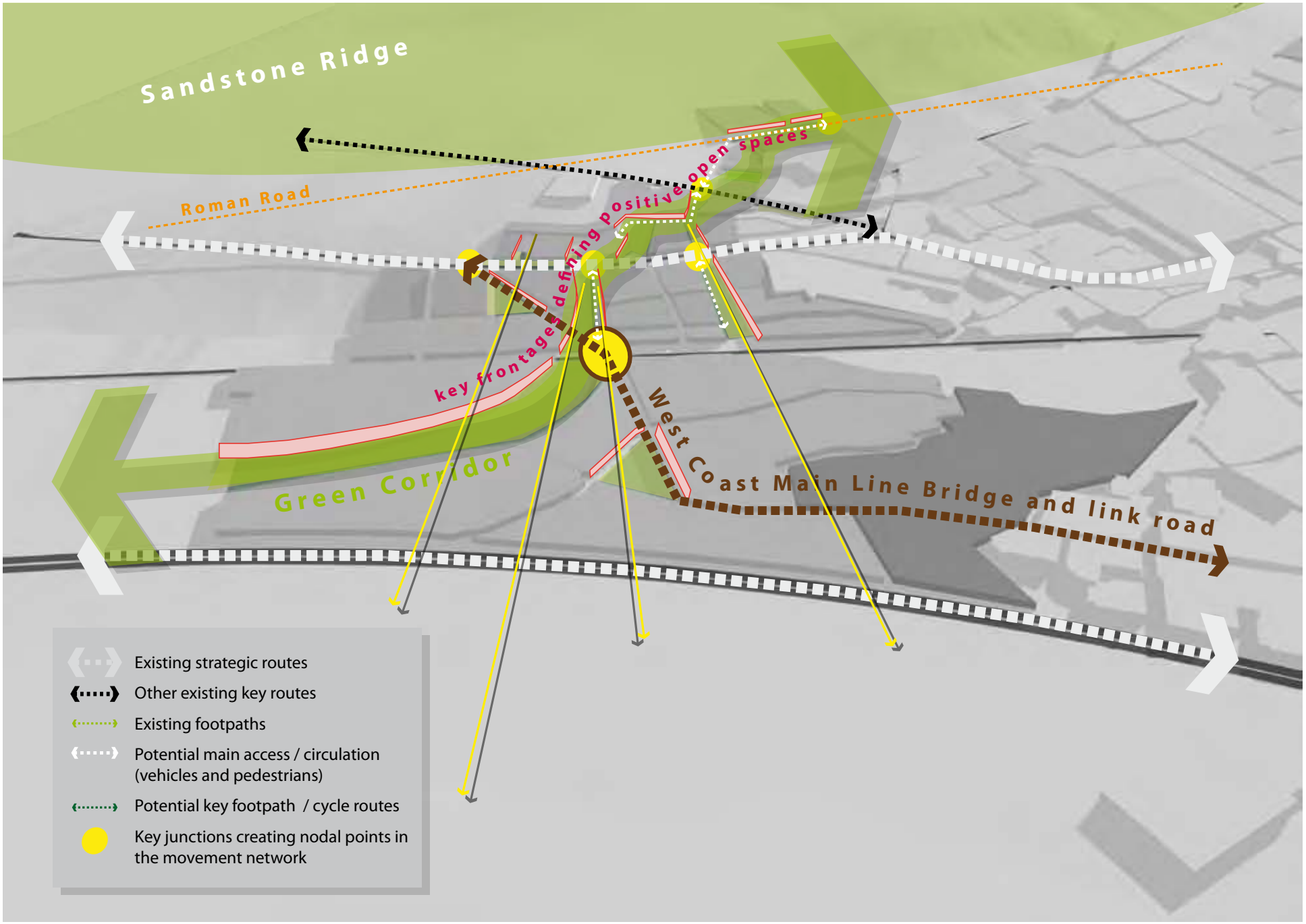
Sites N1-N6: relationship with existing open space assets



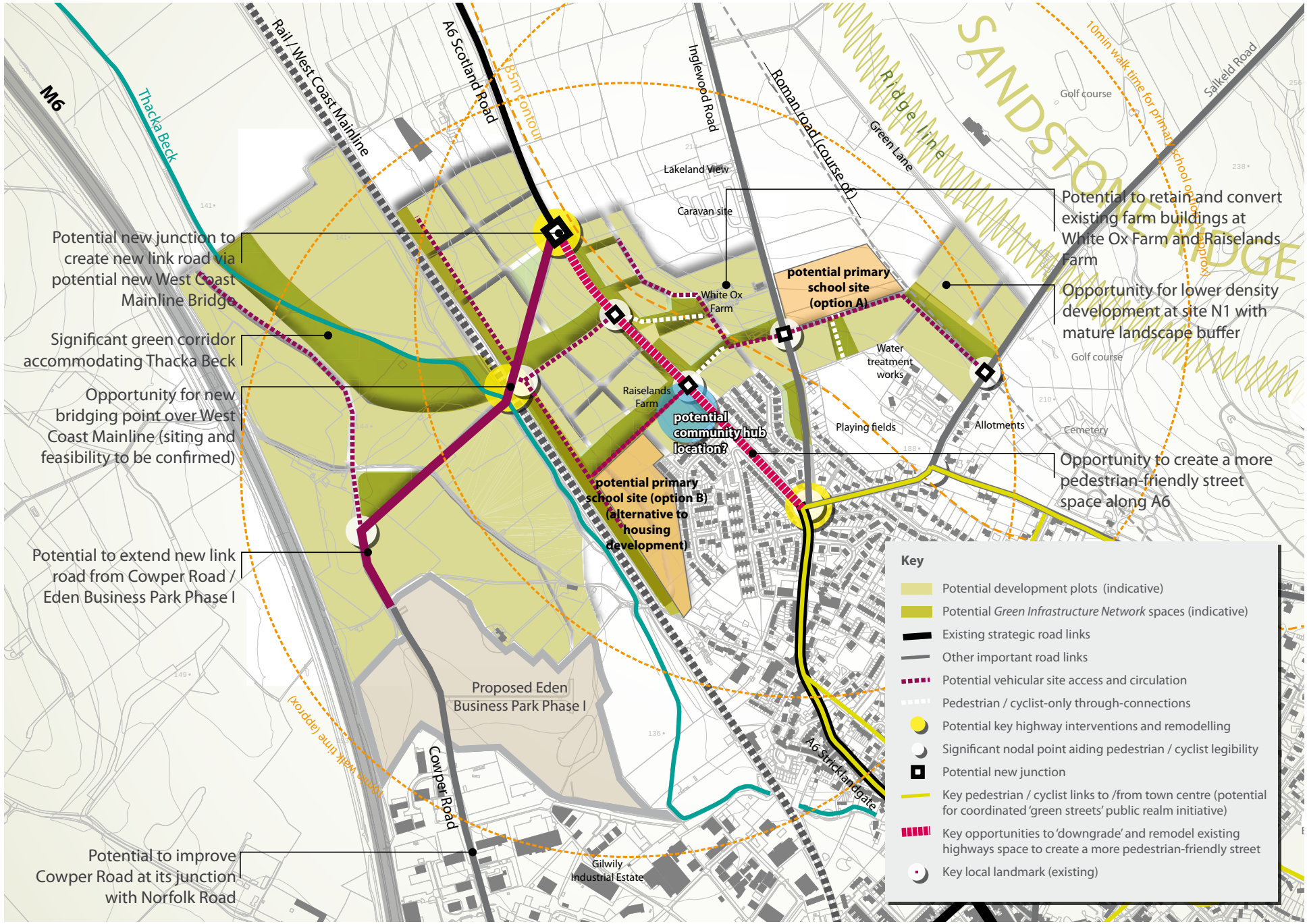
Sites N1-N6: landscape character and views defining visual sensitivity



Sites N1-N6: opportunities for Green Infrastructure to shape the form and layout of urban extension development, creating an integrated plot structures



Sites E1-E4: summary of overarching design opportunities - a summary design framework - as influenced by Green Infrastructure



Sites N1-N6: design / development framework and illustrative plot plan shaped by Green Infrastructure

4.4/

Sites and capacity

4.4.1/ Key assumptions

The plan to the right confirms the potential urban extension sites; N1 - N6 (to the north) and E1-E4 (to the east). The following predominant land uses are assumed.

Residential
- North: N1 - N4
- East: E1 - E4

Strategic employment land
- North: N5 and N6
- East: not applicable

The plans opposite, and schedule of estimated capacity below, confirm how the sites have evolved from the initial Option Areas considered at the outset of the masterplan project.
The inset plan to the right illustrates the proposed urban extension sites N1-N6 and E1-E4 relative to the original Option Area boundaries.

Understanding of capacity has been shaped by consideration of different growth scenarios - examining how key issues and influences could shape the location and extent of development.

The table below shows an estimate of potential capacity for purposes of understanding likely yield of urban extension development. This represents a more certain estimate compared to that available through the SHLAA.

As described at 4.3, a key factor taken into account in these capacity estimates is a commitment to a strong Green Infrastructure Network as part of a coordinating landscape strategy.

The total estimated capacity of sites illustrated within our development framework can be summarised as;

Residential units
from ca. 1550 (at 30dph)
to ca. 2070 (at 40dph)

Strategic employment land
ca. 36.4 ha net developable subject to flood risk and ecological mitigation

			North							East					Totals
Predominant land use			Residential				Strategic employment land		Sub totals	Residential				Sub totals	
Original Option Area ref			1	3	2	n/a	6 (parcel 65)	n/a		4		5	n/a		
Original Option Area site area (approx)			23.7	10.2	11.4	n/a	25.1	n/a	70.4	26.9		14.2	n/a	41.1	111.5
New reference			**N1**	**N2**	**N3**	**N4**	**N5**	**N6**		**E1**	**E2**	**E3**	**E4**		0.0
Total Site Area			**7.0**	**8.8**	**11.4**	**10.1**	**25.1**	**19.5**	**81.9**	**21.1**	**1.1**	**3.6**	**4.6**	**30.4**	112.3
Estimated non-developable (strategic green space and principal access roads) (ha)			1.7	2.5	2.4	1.6	4.3	3.9	16.4	6.1	0.0	0.5	1.0	27.9	44.3
Estimated non-developable (strategic green space and principal access roads) (% total)			24.3	28.4	21.1	15.8	17.1	20.0	n/a	28.9	0.0	13.9	21.7	n/a	n/a
Net development area			**5.3**	**6.3**	**9.0**	**8.5**	**20.8**	**15.6**	**65.5**	**15.0**	**1.1**	**3.1**	**3.6**	**22.8**	88.3
Potential residential capacity	30	DPH	159	189	270	255	0	0	**873**	450	33	93	108	**684**	1557
	35	DPH	186	221	315	298	0	0	**1019**	525	39	109	126	**798**	1817
	40	DPH	212	252	360	340	0	0	**1164**	600	44	124	144	**912**	2076

NB capacity estimates have been calculated **without** allowance for provision of new school(s) and/or other non-residential development within the site boundaries

Inset: sites relative to original Option Area boundaries

Above (main plan): confirmation of site areas and derivation of urban extensions N1-N6 and E1-F4 (inclusive of potential / indicative open spaces that have been factored into capacity assumptions)

4.4.2/ Further extension

Residential

Ongoing research and evidence base material being produced to plan, monitor and manage the LDF suggest that it is unlikely for the residential development capacity of brownfield sites within the existing urban area of Penrith to exceed about 300 units. With Core Strategy policy objectives signposting the need to cater for up to 2600 new dwellings in Penrith before 2025, this creates - in effect - a need for urban extension sites to create capacity for at least **2300 units**.

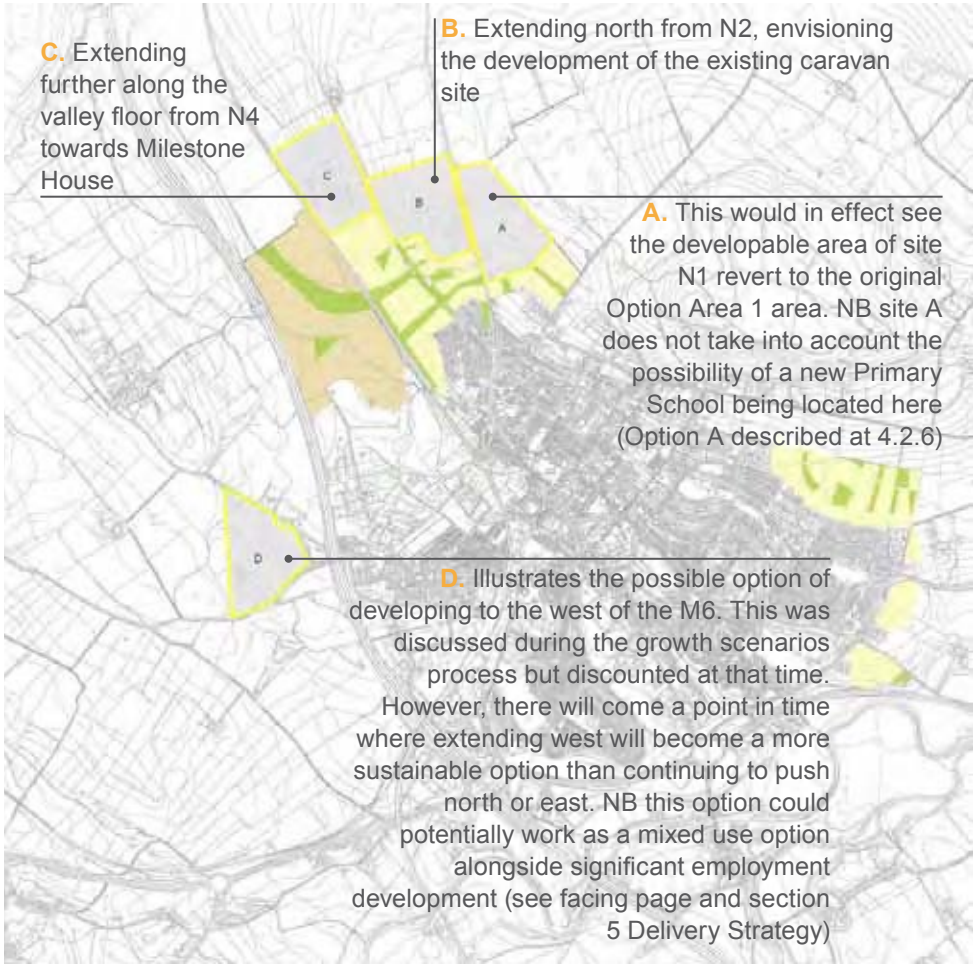
Initial estimates of capacity set out at 4.4.1 show that sites N1-N4 and E1-E4 would fall below this target capacity, unless assumptions relating to key variables such as net developable area and development density are adjusted.

This suggests a possible need to identify **further extensions** to address the shortfall should policy targets fail to be met within the plan period.
The plan to the right identifies potential 'Further Extension' sites for residential development, referenced A-D. These are largely clustered to the north (with one option to the west) in response to feedback received during the growth scenarios process (see 4.1).

Each of the sites illustrated in this plan are based on a hypothetical area of **17ha**. This has been calculated as the area required to address the potential shortfall in capacity of sites N1-N4 and E1-E4 (assuming the average development density of 35dph).

Therefore it is important to stress that only **one** of four sites illustrated (or a combination of smaller sites) would be sufficient to address the shortfall, in the event that sites N1-N4 and E1-E4 delivered between them ca. 1800 units i.e. as the potential number of units possible at 35dph.

The further extension sites and their implications are reviewed further at section 5 (Delivery Strategy).



Strategic employment land

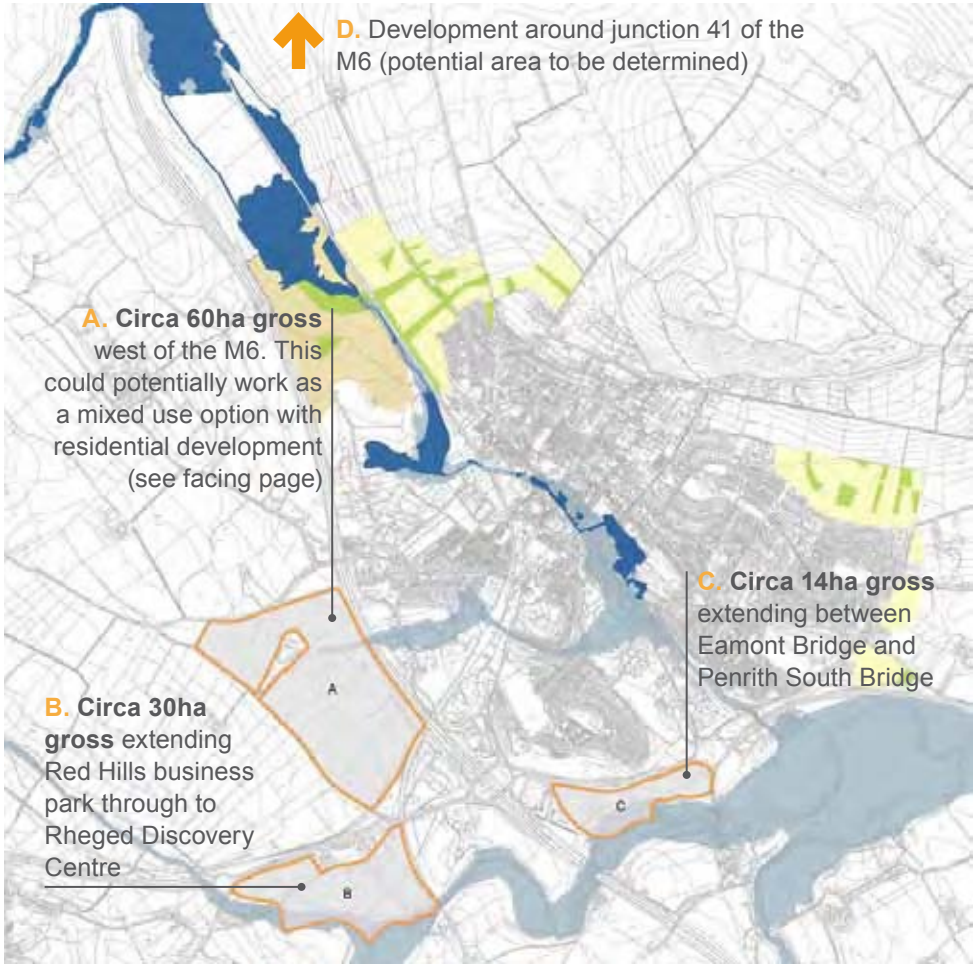
Sites N5 and N6 are proposed as a means by which to deliver the Core Strategy target of 30ha of strategic employment land. Although these sites could potentially release circa 36ha net developable area, baseline research confirms that delivery of this would be complicated by environmental constraints in the form of sensitive ecological / habitat assets and risk of fluvial flood from Thacka Beck.

It is also assumed in the spatial framework that these sites would be delivered in conjunction with a new road bridge over the WCML. Should a bridge scheme not prove viable or feasible then the implication is that this could significantly curtail development potential at N5 and N6, given that these would then be reliant on existing (limited) road infrastructure for access to the strategic network.

In the event that these constraints proved insurmountable then clearly alternative, 'fallback' sites would be required to deliver 30ha of strategic employment land. These alternative / fallback sites have been considered and filtered as part of this strategic masterplan process, and possible options are illustrated to the right.

These are illustrated relative to flood risk mapping, given that flood risk could be a major constraint to N5 and N6, and could clearly constrain options such as B and C. The plan illustrates that option A would be the only site that could deliver 30ha net strategic employment land entirely by itself.

The merits of the alternative, fallback strategic employment land sites illustrated here are reviewed at section 5 Delivery Strategy.



Potential mixed use alternative west of the M6

Should the following scenarios arise, then a potential option could be to plan for a major mixed use urban extension to the west of the M6;

(i) Land and site(s) west of the M6 become favoured strategically over time;

And/or

(ii) Potential residential development sites N1-N4 and E1-E4 fail to deliver anticipated yield;

And/or

(iii) N5 (Parcel 65) and N6 (proposed additional employment land to the north) prove to be not feasible.

Although areas west of the M6 were not identified as a 'preferred option' development location during consultation (and it is noted that potential development land here was rejected through the SHLAA), it is arguable that development at this location is likely to have moderate impact on some of the sensitivities described at section 3 (e.g. topography, visual and landscape impact, ecology, flood risk).

Indeed, it could be argued that allowing Penrith to expand west would be a more 'natural' or 'organic' direction of growth compared to north or east. Such an argument could be founded on the notion that the M6 represents an artificial edge to the settlement that is artificially 'pushing' development to north and east.

Development to the west of the M6 would;

1. Be in very close proximity to existing major employment areas and therefore help promote trips to work by sustainable modes
2. Be in relatively close proximity to rail station and town centre (e.g. closer than many urban extension options to north and east)
3. Have the potential to help better integrate and connect Newton Rigg campus with the town centre
4. Offer the potential to help alleviate road transport and highways issues, for example;
   - Development here would help support an upgraded link road to the A65 west of Jct 40
   - Vehicles wishing to reach the M6 would be more likely to bypass Penrith town centre, so reducing traffic pressures in the centre
   - Walking and cycling into the centre would be a viable option, without reliance on the A6 for example
   - Development here could provide a good basis for a circular bus route, connecting the site with the town centre and employment land behind Gilwilly.

Notwithstanding these potential benefits, it is recognised that development potential here would not only be contingent on other, preferred sites failing to deliver, but require focussed feasibility studies.

Right: Potential future development locations, possibly involving both residential and strategic employment land

4.5/

Movement and Transport

Key strengths and weaknesses of the spatial framework from the perspective of transport and movement summarised in the table to the right.

Capacity assumptions at 4.4 describe a split in growth expectations of 56% of new houses located in the north, and 44% to the east. The implications of this on the local transport network has been carefully considered and modelled. In overall terms, the balance of residential development between the north and the east will provide a balanced trip distribution across the town - e.g. new trips would not be generated by / approached from a single development cluster.

There are a number of strategic locations where improvement and intervention could support wider aims for growth and development.

4.5.1/ Strategic locations

Strengths
• Development would be fairly balanced between north and east, spreading the distribution of new trips into and through the town centre • A new road bridge over WCML would help to create an orbital loop, reducing traffic entering the town centre, removing / redirecting through traffic and better serving pedestrianisation • The bridge will also allow better service of northern sites especially N3-N6 by public transport • Proposals would support better use of M6 junction 41 • Presents opportunity for good linkages to employment areas from new and existing residential areas • Development could facilitate access by public transport linking residential, town centre and employment areas • Development could support key strategic improvement to the transport network
Weaknesses
• New development would be remote from existing key transport hubs, presenting challenges for connectivity to main network • Sites to the east add little, strategically, to the transport network • Funding a new road bridge over WCML from developer contributions may be problematic, given that not all development would be specific to this location and it is uncertain whether growth is on a scale sufficient to fund such a substantial project without other sources of funding • Development would still require some improvements to the southern junctions (M6, A66, A6) as trips from eastern sites would be significant • With a new road bridge over WCML the employment sites (N5, N6) would have a weak access arrangements, essentially creating a long cul-de-sac.

A6, town centre

The A6 runs through the heart of the town, currently bisecting the main shopping and business district. Additional traffic onto this route will exacerbate congestion in the town as well as making crossing difficult for pedestrians and affecting overall perceptions of character and quality of place.

As part of the wider growth / urban extension programme, Penrith town centre must be protected and strengthened as an attractive retail environment and service centre.

The pedestrianisation of a section of the A6 (with traffic being diverted round the existing gyratory, e.g. via Castlegate and Brunswick Road) would remove traffic from the main retail area. As part of this, Castlegate could be remodelled as a two-way street, although at this stage such a proposal remains aspirational and subject to detailed feasibility (see p.85).

Such intervention would not only allow

for pedestrianisation / enhance quality of place, but also allow those wishing travel towards the east from the A592 and B5288 to bypass the town centre and the existing gyratory. This may be a key intervention in light of the new Sainsbury's development further south on the A6.

Towards the north, the junction of the A6, Inglewood Road and Salkend Road would need to be assessed as the current junction configuration is not efficient enough to cope with the large amounts of additional trips that would arise from urban extension development envisaged in this locality (especially given that further additional trips could pass through this junction from the east - people using Beacon Edge to link on to the A6). A possible option here would be to signalise the junction.

Pedestrian and cyclist links

For the northern sites, there are good, direct pedestrian and cycle routes into the town centre. This suggests that these could be sustainable locations in terms of transport and movement, and initiatives such as the 'green streets' public realm improvements described at 4.3 could consolidate accessibility by sustainable modes.

In terms of the urban extension sites to the east, although there are routes suitable for cycling and walking to the town centre, these are currently not particularly legible and/or convenient, and hence less attractive. Public realm improvement and wayfinding initiatives could help address this.

M6 junction 41

The use of junction 41 of the M6 should be promoted and well signed to encourage better utilisation by residents and businesses. This would relieve pressure on junction 40, which is currently taking the majority of northbound and southbound trips. This junction acts as the main point of access for the industrial estates and links traffic on to the A66.

Beacon Edge

The A6 as it passes through the town centre

It is realistic to assume that Beacon Edge would become more intensively used as a consequence of the proposed scale of development. The road at present is fairly wide in places but does not currently serve large amounts of traffic. This route would need to be assessed to ensure new trips are able to be accommodated safely and that it is also suitable for pedestrians and cyclists. Improvements could include street lighting, surfacing and new footways.

4.5.2/ Aspirational interventions

As well as strategic locations for improvement, the masterplan has considered two specific interventions that - although aspirational at this stage (i.e. not tested for feasibility) - could bring significant benefits as part of the future programme of growth and development

West Coast Main Line Link

A new road link over the West Coast Main Line (WCML) is envisaged within the spatial framework. This would help to create a relief link for the town centre with strategic traffic movement and commercial traffic accessing the main industrial areas being able to circumnavigate around Penrith, avoiding the town centre. This would then provide a greater opportunity for continued public realm intervention within the heart of the town, particularly associated with the A6.

Although as part of the current modelling work it has not been possible to obtain accurate base trip figures for Gilwilly Road, it is possible given the characteristics of the local network that this road may reach capacity in the near future. Clearly, introducing a new WCML bridge that connected through to Gilwily Road will introduce a need for improvement in any case.

Funding contributions from new residential developments are unlikely to be of a level to support high intervention transport improvements such as a WCML bridge. However, local improvements will be required to integrate the sites with the network, and any such improvement works must be mindful of the potential need to integrate with a WCML bridge. In all cases, development should not preclude future strategic transport improvements.

The concept of bridging of the WCML in a location suggested by the spatial framework would provide important linkages not only strategically but locally.

The bridge could act as an orbital relief road for the town centre removing through traffic and better serving pedestrianisation and public transport improvements.

The bridge would also allow better service of northern sites by public transport as a loop will effectively be created and the ability to link several key areas, i.e. residential areas and employment/business area would be attractive and more financially feasible for bus operators than closed loop one way circuits. N.B. The eventual alignment of the bridge would need to be carefully assessed in engineering terms against existing topographical, hydrological and ecological conditions

It has not been possible as part of the strategic masterplan project to accurately predict the number of base flow trips that could be reassigned to a

new link should it be implemented. This would not be possible without undertaking dynamic modelling with a package such as SATURN.

However, it is anticipated at this stage that the proportion of traffic diverting would be significant enough to relieve the pressure upon the current town centre gyratory system (the actual proportion of traffic diverting would depend on the nature of its connection to the A6 at the northern end of the link).

Castlegate two way conversion

The conversion of Castlegate to a two-way link is promoted as an aspirational intervention within this strategic masterplan report, given that it could release significant benefits for the town centre and the functionality of the wider transport network. It would enable the removal of traffic from the main retail area and support pedestrianisation / creation of shared surface along a section of the A6. This will not only support a better pedestrian experience in the town centre but would also allow those wishing to go towards the east of the town from the A592 and B5288 to bypass the town centre and the existing gyratory.

Nevertheless, it is a scheme that requires further investigation prior to commitment - it is recognised that, if the scheme was viewed purely in terms of highway engineering then constraints along the route (width, speed, pedestrian facilities) could prevent it from becoming a standard two-way street.

However, there could be a range of urban design options and traffic management interventions which could be applied to make the link work. Such options and interventions need to be understood and tested (e.g. in terms of safety and impact on / benefit for the wider transport network) to inform decisions on whether to pursue such a scheme.

A review of the possible traffic management interventions and the exact impact that this change would have upon the network would probably require specific modelling of the route and theoretical application of the interventions.

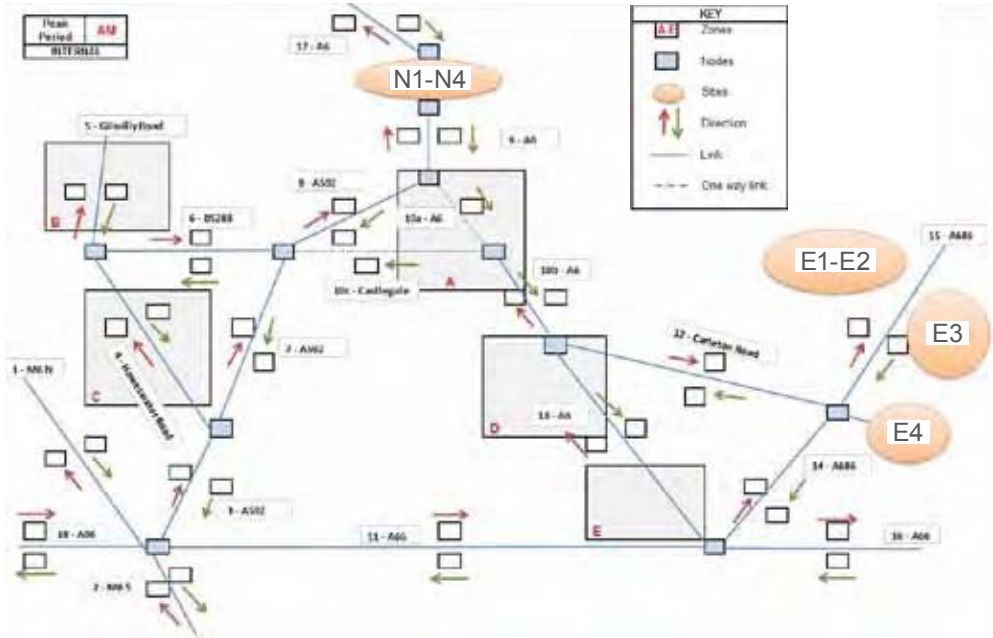
4.5.3/ Traffic modelling

A traffic model has been created to assess the impact of new trips from the sites on the existing transport network. A review of the modelling work is

appended, but in summary it relies on the links identified in the diagram to the right - an abstract representation of Penrith's road transport network. Key outputs from the model are summarised over page.

The traffic model has been designed to offer a flexible tool which can tolerate future refinement and changes to development proposals - e.g. adjustments to assumed capacity - or actual capacity - altering the number of trips generated. This will allow interventions and initiatives to be monitored and managed over time.

Alternative density assumptions have been tested through the model and these are illustrated in later tables. The lower density assumption (30dph) allows us to assess the 'low level' interventions needed - basic improvements and mitigation relative to proposals for urban extension.



Above: Traffic model diagram

By reviewing the projected changes in traffic volumes along the key links in the model, a number of specific 'low level' interventions become apparent. Is is therefore fully justifiable to regard these as an integral part of the development proposals. These interventions are described and illustrated in plan on the facing page.

It should be noted that estimated costings associated with such 'low level' interventions have been considered as part of the delivery strategy outlined at section 5. It is important to stress that estimated costs are generic costs for basic schemes.

Should the urban extension developments proceed without improvements to the transport network it is certain that the additional traffic on the network will cause considerable congestion, in particular around the centre of Penrith. It is anticipated that the following links would be taken above or close to full capacity;

- A66 Westbound
- A66 between the M6 and A686
- B5288

The implementation of the 'low level' interventions would help relieve such expected pressure and ensure that traffic to, from and through Penrith remains moving during busy peak hours.

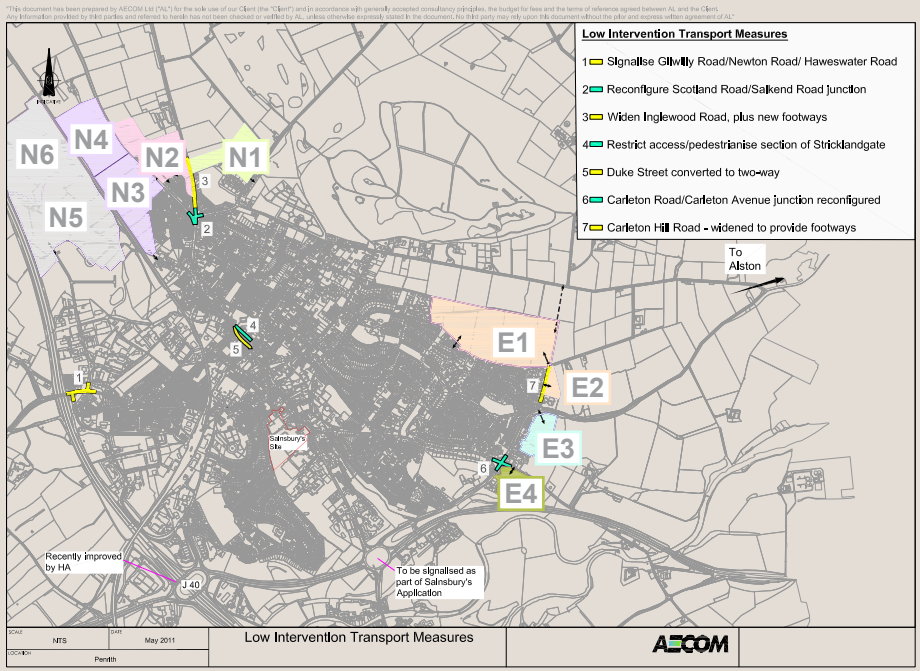
- Signalisation of Gilwilly Road/ B5288/Haweswater Road staggered junction – This would help traffic to enter and exit the industrial estate more easily as well as regulating traffic coming from Haweswater Road trying to cut into the town centre.

- Reconfigure Salkend Road/ Scotland Road junction – This would be necessary to integrate the flow of traffic from the development sites onto the A6, and to ensure that traffic flows smoothly into and out of the town centre, to prevent queues building up, especially to the south.

- Widen Inglewood Road and add new footways – the extent of traffic from the northern development sites would require this link to be improved.

- Carleton Road/Carleton Avenue junction improvements. To ensure access to the sites to the east via Carleton Road the junction would need simplifying to allow traffic to cross more directly from the proposed site towards the town centre.

- Carleton Hill Road, widen to add footways – This would be necessary due to the increase in traffic along this route and it being a primary route for accessing the main easterly site.



Above: Summary of potential 'low level' interventions needed as part of the proposed urban extension developments, to help manage traffic flows through the network

Model outputs

For the purposes of the traffic modelling work, the number of dwellings on each site was based on the industry standard assumption of 30 dwellings per hectare. The dwelling distribution and resultant assumed trip numbers can be seen in the table below, drawn from the capacity assumptions at 4.4.
This analysis allows an estimate of the number of trips to and from each of the development sites, based on the potential number of dwellings and the existing / likely distribution of trips to various locations within Penrith (internal movement) and externally to other areas.

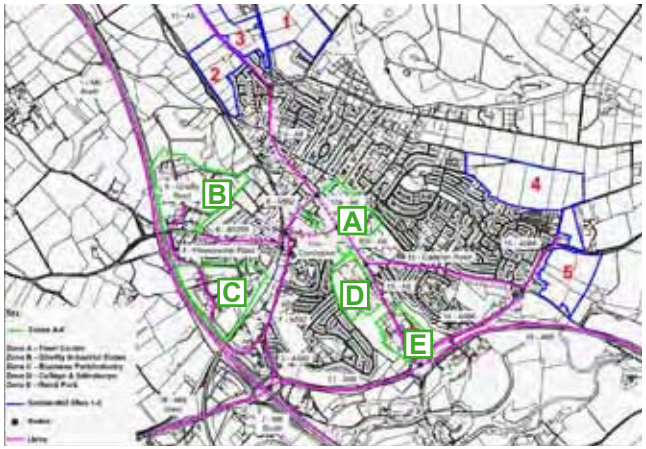
In order to apportion trips onto the network, the routes that trips are likely to utilise were determined using a common sense approach – based on which routes would be the most direct and intuitive from each of the sites to the zones identified within the traffic model, as illustrated in the diagram below (determined in collaboration with the project steering group).

It was possible to use these routes to assign trips from the potential development sites to areas outside of Penrith, based on the percentage of trips were assumed were going to each zone (20%) and the number of trips which stay internal to Penrith (48.5% of new trips to be generated).

The following tables summarise assumptions arising relating to internal and external movement.

Site	Area (ha)	No. dwellings	AM Arrival to site (0.15)	AM Departure from site (0.43)	PM Arrival to site (0.40)	PM Departure from site (0.23)
N1	5.3	159	24	68	64	37
N3	9	270	41	116	108	62
N4	8.5	255	38	110	102	59
N2	6.3	189	28	81	76	43
E1	15	450	68	194	180	104
E2	1.1	33	5	14	13	8
E3	3.1	93	14	40	37	21
E4	3.6	108	16	46	43	25
Total	51.9	1,557	234	669	623	359

Table 1: Trip numbers to/from the proposed urban extension development sites (based on 30dph)



Above: Zones in the traffic model (shown relative to the original option areas)

Site	Roads to get TO Zone A	Roads to get FROM Zone A
1	A6 Southbound	Castlegate, A592 north bound, A6 north bound
2	A6 Southbound	Castlegate, A592 north bound, A6 north bound
3	A6 Southbound	Castlegate, A592 north bound, A6 north bound
4	A686, Carleton Road, A6 north Castlegate, A592 north bound, A6 south (round gyratory)	A6 southbound, Carleton Road, A686
5	A686, Carleton Road, A6 north Castlegate, A592 north bound, A6 south (round gyratory)	A6 southbound, Carleton Road, A686
Site	**Roads to get TO Zone B**	**Roads to get FROM Zone B**
1	A6, A592, B5288,Gilwilly Road	Gilwilly Road, B5288, A592, A6
2	A6, A592, B5288,Gilwilly Road	Gilwilly Road, B5288, A592, A6
3	A6, A592, B5288,Gilwilly Road	Gilwilly Road, B5288, A592, A6
4	A686, A66, A592, Haweswater Road, Gilwilly Road	Gilwilly Road, Haweswater Road, A592, A66, A686
5	A686, A66, A592, Haweswater Road, Gilwilly Road	Gilwilly Road, Haweswater Road, A592, A66, A686
Site	**Roads to get TO Zone C**	**Roads to get FROM Zone C**
1	A6, A592, B5288, Haweswater Road	Haweswater Road, B5288, A592, A6
2	A6, A592, B5288, Haweswater Road	Haweswater Road, B5288, A592, A6
3	A6, A592, B5288, Haweswater Road	Haweswater Road, B5288, A592, A6
4	A686, A66, A592, Haweswater Road	Haweswater Road, A592, A66, A686
5	A686, A66, A592, Haweswater Road	Haweswater Road, A592, A66, A686

Site	Roads to get TO Zone D	Roads to get FROM Zone D
1	A6 Southbound	A6 northbound, Castlegate, A592 north bound, A6 north bound
2	A6 Southbound	A6 northbound, Castlegate, A592 north bound, A6 north bound
3	A6 Southbound	A6 northbound, Castlegate, A592 north bound, A6 north bound
4	A686, Carleton Road, A6	A6, Carleton Road, A686
5	A686, Carleton Road, A6	A6, Carleton Road, A686
Site	**Roads to get TO Zone E**	**Roads to get FROM Zone E**
1	A6 Southbound	A6 northbound, Castlegate, A592 north bound, A6 north bound
2	A6 Southbound	A6 northbound, Castlegate, A592 north bound, A6 north bound
3	A6 Southbound	A6 northbound, Castlegate, A592 north bound, A6 north bound
4	A686, A6	A6, A686
5	A686, A6	A6, A686

Table 2: Routes used to get between option area sites and internal zones

Site	Roads to get TO Zone A	Roads to get FROM Zone A
1	A6, A592, M6	M6, A592, A6
2	A6, A592, M6	M6, A592, A6
3	A6, A592, M6	M6, A592, A6
4	A686, A66, M6	A6, Carleton Road, A686
5	A686, A66, M6	A6, Carleton Road, A686
Site	**Roads to get TO Zone B**	**Roads to get FROM Zone B**
1	A6	A6
2	A6	A6
3	A6	A6
4	A686, Carleton Road, A6, Castlegate, A592, A6 northbound	A6, Carleton Road, A686
5	A686, Carleton Road, A6, Castlegate, A592, A6 northbound	A6, Carleton Road, A686
Site	**Roads to get TO Zone C**	**Roads to get FROM Zone C**
1	A6, A592, A66	A66, A592, A6
2	A6, A592, A66	A66, A592, A6
3	A6, A592, A66	A66, A592, A6
4	A686, A66 W	A66 E, A686
5	A686, A66 W	A66 E, A686

Site	Roads to get TO Zone D	Roads to get FROM Zone D
1	A6, A592, M6	M6, A592, A6
2	A6, A592, M6	M6, A592, A6
3	A6, A592, M6	M6, A592, A6
4	A686, A66, M6	A6, Carleton Road, A686
5	A686, A66, M6	A6, Carleton Road, A686
Site	**Roads to get TO Zone E**	**Roads to get FROM Zone E**
1	A6, A592, A66	A66, A592, A6
2	A6, A592, A66	A66, A592, A6
3	A6, A592, A66	A66, A592, A6
4	A686, A66 E	A66 W, A686
5	A686, A66 E	A66 W, A686

Table 3: Routes used to get between option area sites and internal zones

Internal and external trips can be added together to arrive at the number of 'new' trips expected on the network by link as a result of the residential developments. The detailed tables below(4 and 5) illustrate the totals for development at 30dph. Tables over page (6 - 9) summarise outputs for development at 35dph and 40dph.

Table 4: New trips generated by residential development (AM)

Link no.	Description	Direction on link		% change from base flows	
		N or E	S or W	N or E	S or W
1	J40 M6 North	45	18	12%	1%
2	J40 M6 South	23	59	4%	9%
3	A592	118	138	15%	13%
4	Haweswater Road	87	49	11%	9%
5	Gilwilly Road	60	28	20%	28%
6	B5288	32	48	7%	9%
7	A592	47	114	19%	35%
8	A592	133	162	15%	42%
9	A6	133	251	46%	34%
10a	A6 (one way)	N/A	77	N/A	10%
10b	A6	74	75	10%	16%
10c	A592 (one way)	N/A	54	N/A	7%
11	A66 East	51	147	4%	11%
12	Carleton Road	20	57	9%	22%
13	A6	54	58	7%	11%
14	A686	68	194	13%	45%
15	A686	87	251	38%	64%
16	A66	51	39	7%	5%
17	A6 North	17	7	10%	3%
18	A66 West	33	85	4%	7%

Table 5: New trips generated by residential development (PM)

Link no.	Description	Direction on link		% change from base flows	
		N or E	S or W	N or E	S or W
1	J40 M6 North	24	47	5%	5%
2	J40 M6 South	61	31	7%	4%
3	A592	126	127	19%	9%
4	Haweswater Road	42	97	8%	13%
5	Gilwilly Road	30	75	30%	25%
6	B5288	84	61	9%	14%
7	A592	126	61	25%	10%
8	A592	340	121	47%	29%
9	A6	340	209	63%	49%
10a	A6 (one way)	N/A	90	N/A	14%
10b	A6	88	84	15%	18%
10c	A592 (one way)	N/A	131	N/A	16%
11	A66 East	137	41	8%	3%
12	Carleton Road	53	4	21%	1%
13	A6	88	52	18%	9%
14	A686	181	54	26%	10%
15	A686	233	58	59%	26%
16	A66	80	21	8%	2%
17	A6 North	9	17	3%	6%
18	A66 West	88	46	9%	2%

Table 6: Expected trip generation based on 35 DPH

Site	Area (ha)	No. dwellings	AM Departure from site (0.43)	PM Arrival to site (0.40)
N1	5.3	186	122	114
N3	9	315	135	126
N4	8.5	298	128	119
N2	6.3	221	95	88
E1	15	525	226	210
E2	1.1	39	17	16
E3	3.1	109	47	43
E4	3.6	126	54	50
Total	**51.9**	**1,817**	**824**	**766**

Table 7: New trips generated by residential development based on 35 DPH

Link no.	AM				PM			
	Direction on link		% change from base flows		Direction on link		% change from base flows	
	N or E	S or W	N or E	S or W	N or E	S or W	N or E	S or W
1	35	18	9%	1%	18	48	4%	5%
2	23	45	4%	6%	62	24	7%	3%
3	125	111	16%	11%	147	111	22%	8%
4	89	49	11%	9%	49	105	10%	14%
5	60	31	20%	31%	40	82	40%	27%
6	37	50	8%	9%	99	81	11%	18%
7	55	86	22%	26%	147	46	29%	8%
8	153	136	17%	36%	397	127	55%	30%
9	153	217	53%	29%	397	228	73%	53%
10a	N/A	68	N/A	9%	N/A	93	N/A	14%
10b	77	66	11%	15%	102	89	17%	19%
10c	N/A	61	N/A	8%	N/A	151	N/A	19%
11	45	128	3%	10%	119	31	7%	2%
12	19	54	9%	21%	50	3	20%	1%
13	58	49	8%	9%	99	53	20%	9%
14	59	168	11%	39%	156	41	23%	8%
15	78	222	33%	57%	207	44	52%	20%
16	45	29	6%	3%	79	16	8%	1%
17	13	7	7%	3%	7	18	2%	6%
18	34	65	4%	5%	90	35	9%	2%

Table 8: Expected trip generation based on 40 DPH

Site	Area (ha)	No. dwellings	AM Departure from site (0.43)	PM Arrival to site (0.40)
N1	5.3	212	91	85
N3	9	360	155	144
N4	8.5	340	146	136
N2	6.3	252	108	101
E1	15	600	258	240
E2	1.1	44	19	18
E3	3.1	124	53	50
E4	3.6	144	62	58
Total	**51.9**	**2076**	**892**	**832**

Table 9: New trips generated by residential development based on 40 DPH

Link no.	AM				PM			
	Direction on link		% change from base flows		Direction on link		% change from base flows	
	N or E	S or W	N or E	S or W	N or E	S or W	N or E	S or W
1	39	21	11%	2%	21	55	4%	6%
2	27	51	5%	7%	71	27	8%	4%
3	143	127	18%	12%	168	127	26%	9%
4	101	56	13%	10%	56	121	11%	16%
5	68	35	23%	35%	46	94	46%	31%
6	42	57	9%	10%	113	92	12%	21%
7	63	99	26%	30%	168	53	34%	9%
8	175	155	19%	41%	454	145	63%	34%
9	175	248	61%	34%	454	261	84%	61%
10a	N/A	78	N/A	10%	N/A	107	N/A	17%
10b	88	76	12%	17%	117	101	20%	22%
10c	N/A	70	N/A	9%	N/A	173	N/A	22%
11	51	146	4%	11%	136	35	8%	2%
12	22	62	10%	24%	58	3	23%	1%
13	66	56	9%	11%	113	60	23%	10%
14	67	192	13%	45%	179	47	26%	9%
15	89	254	38%	65%	236	50	60%	23%
16	52	34	7%	4%	90	18	9%	1%
17	15	8	8%	4%	8	20	2%	7%
18	39	74	4%	6%	103	40	11%	2%

4.6/

Sustainability challenges

Eden District's Sustainable Community Strategy highlights the importance of the maintaining a high quality environment, but recognises that improving knowledge and information is key. It also sets out aspiration to support the development of a green economy and plug the gap in environmental services; particularly in conjunction with the local community.

The adopted Core Strategy sets out the spatial approach to managing environmental assets and the potential impact of development on the environment. Policy CS16 Principles for the Natural Environment requires in essence that new development does not have an adverse impact on the environment by avoiding the most productive agricultural land and contributing positively to biodiversity through habitat restoration and creation. Development that also improves access to greenspace and enhances character will also be encouraged.

The Core Strategy also sets out policy on the design of new development. The use of sustainable construction techniques should be optimised, with energy efficiency through siting and design, on site renewable energy generation, sustainable drainage systems, water efficiency, recycling and conservation methods and the minimisation, re-use and recycling of waste particularly highlighted in policy CS18. In addition, development should utilise local materials and protect the rural distinctiveness of the district. Policy CS19 Energy Conservation, Efficiency and Production in New Developments also reiterates the importance of reducing energy requirements through design, construction, layout, orientation, massing, internal design, materials used, insulation and heat recovery (combined heat and power).

Specifically in relation to the sustainability performance of buildings, the Core Strategy policy CS7 encourages 'the use of the Code for Sustainable Homes and the Lifetime Homes Standards where possible' but does not set out minimum requirements beyond building regulations.

The Cumbria Climate Change Strategy 2008-2012 and subsequent action plan 2010-2014 highlight the importance of reducing carbon emission and adapting to inevitable climate change, recognising the importance of planning in achieving change.

Overarching opportunities

Low Carbon Communities

Cumbria County Council is developing a Renewable Energy Strategy. Data is being collected with wider information on issues affecting the deployment of renewable energy sources. This work will provide greater detail on the potential for low carbon energy generation near to or within Penrith.

In addition, the establishment of a Cumbria Community Energy Trust (proposed in 2010) could help facilitate community scale renewable and low carbon energy projects. This would ensure that local communities will benefit from investment in low carbon technology by promoting community ownership. This may also help secure funding and reduce planning risk.

Flood and water management

According to the Environment Agency, none of the proposed residential urban extensions are located in areas that are at risk of fluvial or tidal flooding (flood risk zones 2 or 3). The north-western portion of sites to the east does contain a large area of marshy land. This is a most telling indication of the need for improved surface water management.

Penrith's topography highlights the need for new development will need to be planned with water sensitive design principles, ensuring that new development does not negatively impact the volume and rate of stormwater runoff.

The SHLAA also notes that some sites to the north especially are sensitive to sewer overflow issues are require further investigation.

Landscape, ecology and environment assets

The current Landscape and Visual Impact Assessment indicates that sites to the north score relatively well with respect to the potential impact of new development on sensitive landscape. The lack of landscape features suggest they are capable of adapting to change, and tree shelter belts could help to diffuse views.

As has been illustrated through baseline research, some sensitive ecological areas may be affected by the proposed urban extension locations. Robust habitat investigation must take place as sites come forward for development.

Sites to the east are more sensitive than the sites to the north due to their general rural character, proximity to Beacon Hill and the Eamont Valley. Some of the sites contain significant hedgerows, and tree stands. The landscape character is especially important moving down towards the Eamont Valley, and this needs a sensitive design response.

While the countryside has a distinct landscape character, the agricultural land is of lower grade (Grades 4 to the north, Grade 3 elsewhere). The majority of productive land is located to the south of Penrith, below the A66 Route. The land being considered for development is located on less productive land, with a reduced capacity to produce crops.

However, the Core Strategy does note the importance of creating green links and ecological corridors capable of supporting and improving local biodiversity. In this respect, the Core Strategy Sustainability Appraisal recommends ecological surveys be undertaken to establish the environmental impacts of developing specific sites.