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Reframing Development with Living Infrastructure: A Case Study of the South Essex Green and Blue Infrastructure (SEGBI) Strategy

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Abstract:

We are headed towards a global crisis: climate change, ecological collapse, and population expansion are threatening planetary boundaries as never before. We must urgently tackle these issues together. Entire ecosystems must be regenerated rather than trying to tackle issues in isolation. We were tasked with creating a green and blue infrastructure strategy in the 70,000-hectare region of South Essex - a place threatened with sea-level rise, flooding, and significant growth pressures. A 'land-based' methodology was applied, and a co-design approach was undertaken with community stakeholders to create a spatial framework based on living biophysical systems and ecological infrastructures that can reshape and drive future planning and development. The resulting *SEGBI Study* provided a ground-breaking model for the delivery of sustainable growth. It demonstrated how the application of living infrastructure has the capacity to address climate change and ecological collapse while also supporting sustainable housing, resilient communities, and regenerative infrastructures.

Keywords: Landscape; Living infrastructure; Green blue; Climate change; Ecological collapse; Regenerative design; Sustainable growth

1. Introduction

Our world is crying out for change. Scientists predict we have ten years to restore our world to a level of balance and health, or we will have set ourselves on a course spiralling out of control. The Intergovernmental Panel on Climate Change (IPCC) *Sixth Assessment Report* (2021)¹ warns of increasingly extreme heatwaves, droughts and flooding, and a surpassed key temperature limit in just over a decade. Together with the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES),² they warn that climate change and biodiversity decline must be tackled urgently together, or we face imminent ecological collapse. Entire ecosystems must be regenerated rather than trying to tackle issues in isolation. But how can we bring such integrated and wide-scale transformation in our increasingly populated urban centres, fragmented and disconnected from nature?

Until now, the dominant thinking in urban development has been an anthropocentric view that exploits and dominates nature. Current design and planning approaches often ignore and isolate living communities: development parcels and political precincts often have no appreciation of the natural systems on which they are built (Amen & Nia, 2020, Amen, 2021, Aziz Amen, 2022, Amen et al., 2023).

. This thinking must be replaced by an eco-centric perspective that embraces an intelligent humility of our place in this world, with an understanding that we are part of nature and not separate from it. Now is the time to pioneer a living infrastructure approach that considers all of life - not only human - within the development process. Such a critical reorientation will lead us to integrate natural systems, built environment and social equity and restore health and balance to our cities and our planet.

The South Essex Green and Blue Infrastructure Study (SEGBI)³ demonstrates how this radical paradigm shift can be transferred to the planning and development process. It shows that the application of landscape-led strategic thinking, comprehensive analysis, bold vision, and long-term stewardship will manifest healthy communities and restore our planet. By putting all of nature back in the frame and adjusting our focus to the land, an integrated, holistic, and inclusive outcome naturally comes about. Moreover, the study reveals that this landscape-based methodology effectively creates conditions required for all life to thrive and for development not merely to be sustainable but restorative.

2. Project Brief

The *SEGBI* was prepared on behalf of the Association of South Essex Local Authorities (ASELA). ASELA is a strategic partnership of neighbouring councils that have come together to promote growth and prosperity across the 70,000-hectare region and includes the councils of Basildon; Brentwood; Castle Point; Rochford; Southend-on-Sea; Thurrock and Essex County.

South Essex faces real and imminent challenges: sea-level rising and flooding in the Thames Estuary due to climate change; internationally important nature sites under threat and intense biodiversity losses; significant pressures for

growth and development; inadequate infrastructure; lack of open space, especially for deprived communities; and, poorly managed agricultural lands, amongst others.

In order to address these challenges and to deliver the *South Essex 2050* vision, the South Essex authorities are preparing a statutory Joint Strategic Framework that will focus on key spatial planning priorities, including the *SEGBI*. The study will describe an inspired vision, provide high-level objectives, strategic opportunities, and policies, and drive a coordinated approach that will steer, and be supported by, individual Local Plans. It will assist the strategic and local plan-making processes by informing the management and delivery of visionary, exemplary, high-quality green and blue infrastructure across South Essex.

ASELA recognises the opportunity and need for a cross-boundary approach to strategic planning and growth, a shared vision of place, and a strong commitment to collaboration and delivery. With joined-up thinking and a joined-up region, a much more significant and impactful plan for South Essex can be developed, leading to many environmental, social, and economic benefits and synergies across the boroughs.

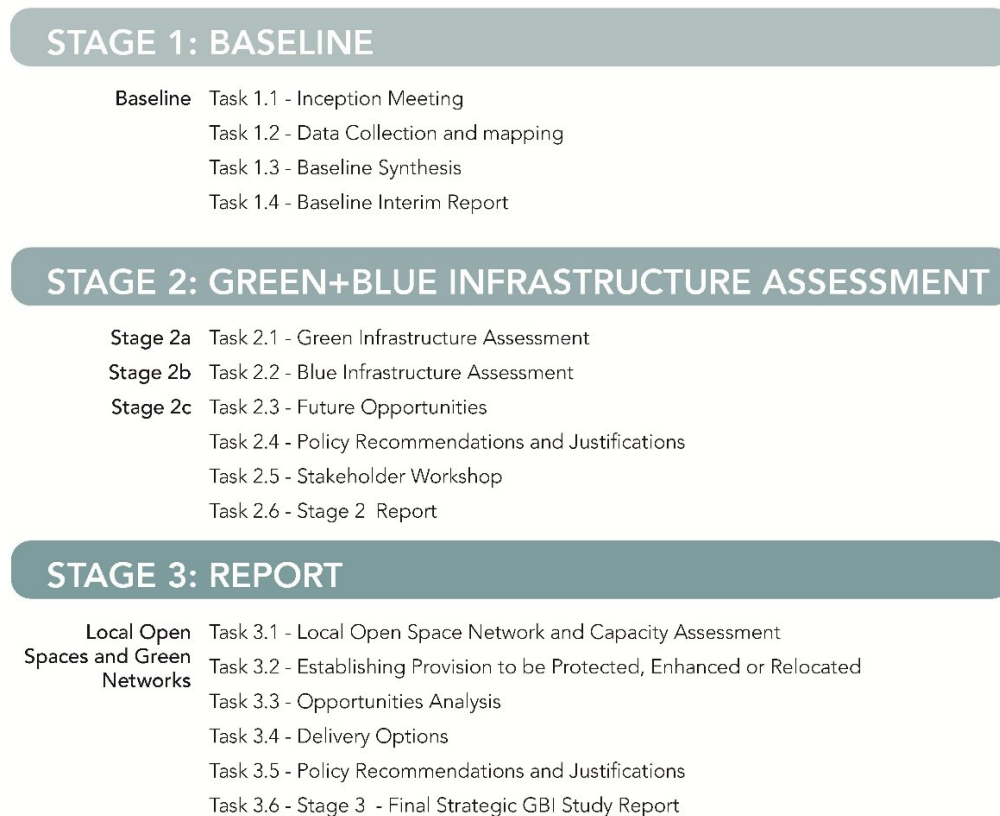
3. Method

Through the *SEGBI*, the team sought to answer the questions: How can we unlock the intelligence of nature to create a new sustainable planning and development model? And how can green and blue infrastructure create thriving places for the whole community of life?

A land-based methodology was employed to explore these questions. The *SEGBI* looked to scholarly research in the area of landscape and ecological planning and landscape infrastructure, including works by academics such as Pierre Belanger, "*Landscape as Infrastructure*",⁴ Carl Steinitz, "*A Framework for Geodesign*",⁵ and Ian McHarg's classic, "*Design with Nature*".⁶ This research provided a robust grounding and made clear that, when allowed, living biophysical systems provide ecological frameworks that can reshape and drive future planning and development. This land-based methodology was complemented by a co-design approach undertaken with ASELA and numerous community stakeholders, adding richness and complexity to the *SEGBI*.

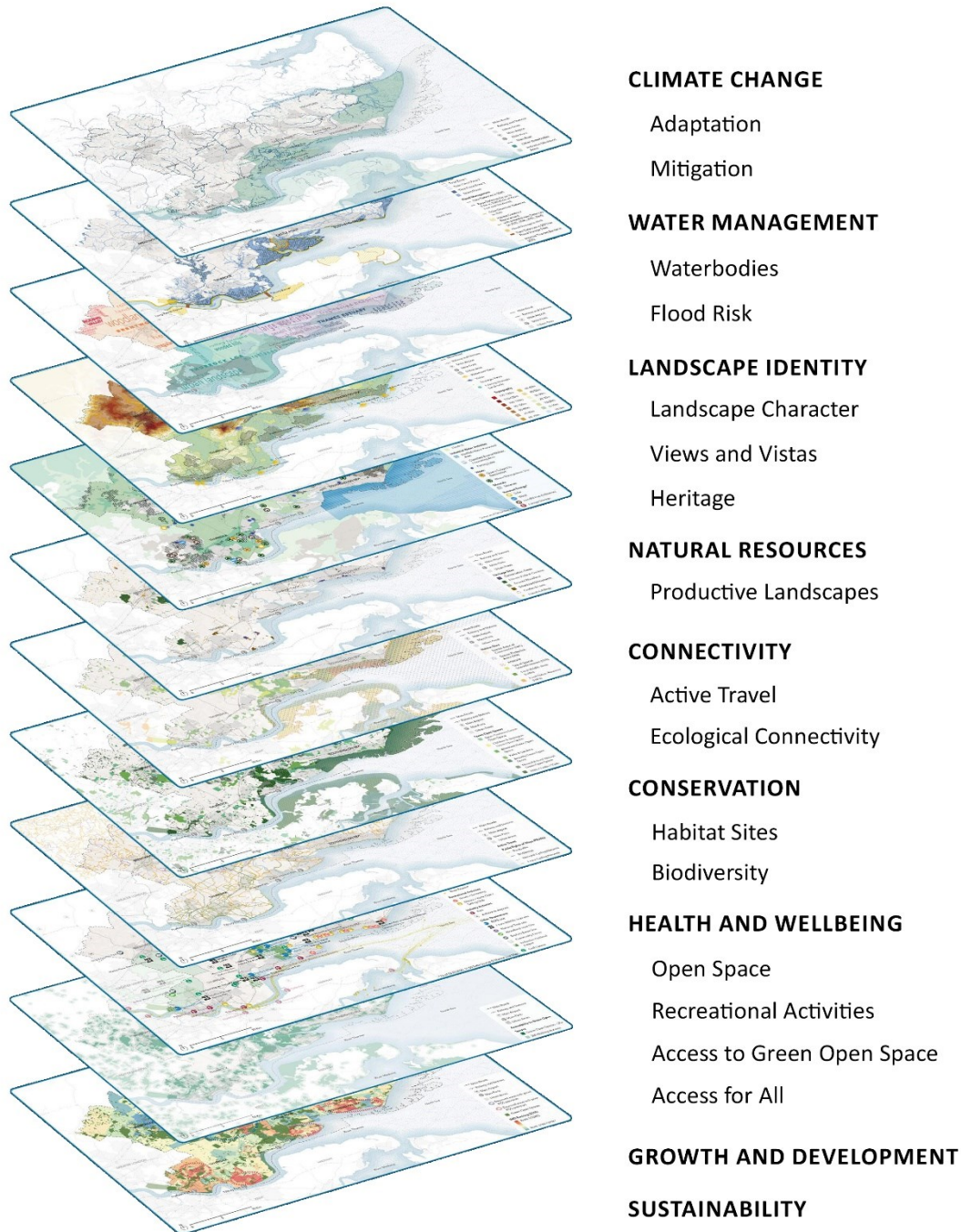
The project comprised three key stages: Baseline Review, Green and Blue Infrastructure Assessment, and the final Green and Blue Infrastructure Report.

Figure 1. The approach taken for the *SEGBI Study* involved 3 main stages of work



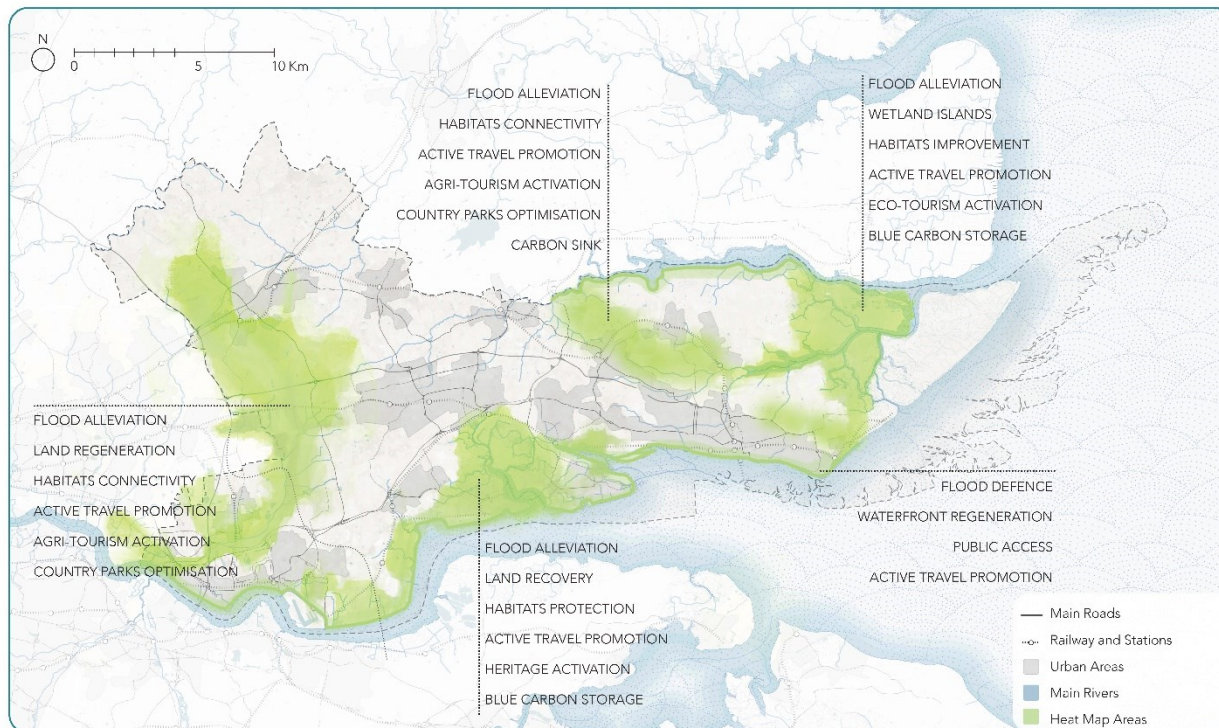
First, the Baseline Review for this vast area was a complex undertaking with numerous considerations. The team understood the importance of providing a comprehensive database of the region and that this baseline would drive all outcomes. The analysis included assessing numerous layers of GIS data, reviewing policy (including local guidance, but also national, such as the Environment Bill, and international, such as UN Sustainable Goals), best practices and standards, reports, relevant strategies, initiatives, and case studies, while also undertaking site visits and engaging with the client team and stakeholders. Information was synthesised into a series of tables, matrices, and composite maps to organise, assess, and reveal important relationships between things. This comprehensive analysis of the landscape was essential and provided a robust foundation upon which to build.

Figure 2. A layered approach to South Essex mapping and analysis reveals an integrated approach to planning GBI



Second, the Green and Blue Infrastructure Assessment expanded on the Baseline Review, gathered meaningful information from stakeholders, and layered their knowledge onto the baseline mapping. Ultimately, the assessment revealed the greatest areas of challenge and opportunity, and a number of themes were identified that informed and drove the objectives for the *SEGBI*.

Figure 3. Heat Map - by overlaying dozens of analysis maps, large-scale areas of potential GBI are revealed, creating a vast network of Nature Recovery Sites



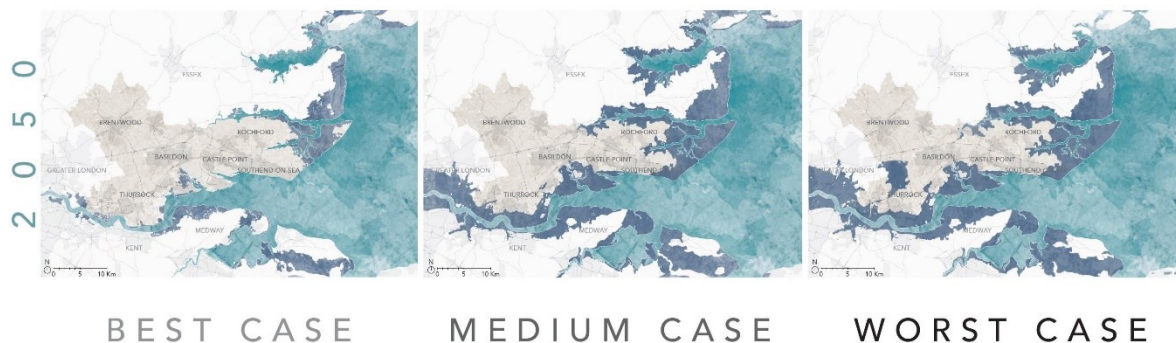
Considering limitations and constraints was a major driver of this study. The *SEGBI* sought to, as a minimum, limit harm to human and wildlife communities and ecosystems but also, more importantly, identify the areas of greatest opportunity and impact for GBI.

Some of the key challenges, in no particular order, included:

- **Nature Conservation under Threat:** There are scores of important ecological sites at risk of flooding in the Thames Estuary, many protected by national and international designations. For example, one of the very few ancient landscapes remaining in South Essex is at Rainham Marshes, acquired by the RSPB in 2000. This significant site for nature and visitors is under threat of flooding. 'Coastal squeeze' is a key issue, especially in the Rochford and Southend-on-Sea areas where realignment is required.
- **The Thames Floodplain:** The Thames Gateway is the UK's largest regeneration programme, stretching 60 kilometres from the London Docklands to Southend-On-Sea. The government has committed £9 billion to create thousands of new homes and jobs in the area. The Thames tidal floodplain cuts right through the Gateway, putting new homes and businesses at risk from flooding.
- **Lack of Access to Open Space:** Deficient provision and distribution of open space, along with poor access to quality green open spaces within urban areas, require special attention by Local Authorities to improve the situation.
- **Lack of Connectivity:** Routes for people and wildlife suffer from fragmentation and severance. Major regional transportation infrastructure, including the A13 trunk road and the London, Tilbury, and Southend railway lines, are major barriers. Greenways, cycleways, and bridleways are fragmented, and public ways are often not registered or maintained for public access.
- **New Development:** Several sites are under development in the area, but not all of them are being planned and designed with green and blue infrastructure in mind. For example, the A13 widening could have achieved many benefits if landscape architects and ecologists had been involved in the redesign for a small upfront cost and significant benefits in the long term.
- **An Abundance of Agricultural Land:** A large area of South Essex lies within the Green Belt, with the majority as agricultural land. Development proposals must be sensitively knit into this green environment.

Furthermore, while some of the agricultural lands are in the Stewardship programme, more could be done to optimise this land for biodiversity net gain. Innovative agricultural practices can be used to activate tourism and the economy of South Essex.

Figure 4. The projected flooding map reveals large areas of land that will be susceptible to sea level rise and pluvial flooding in the coming decades.

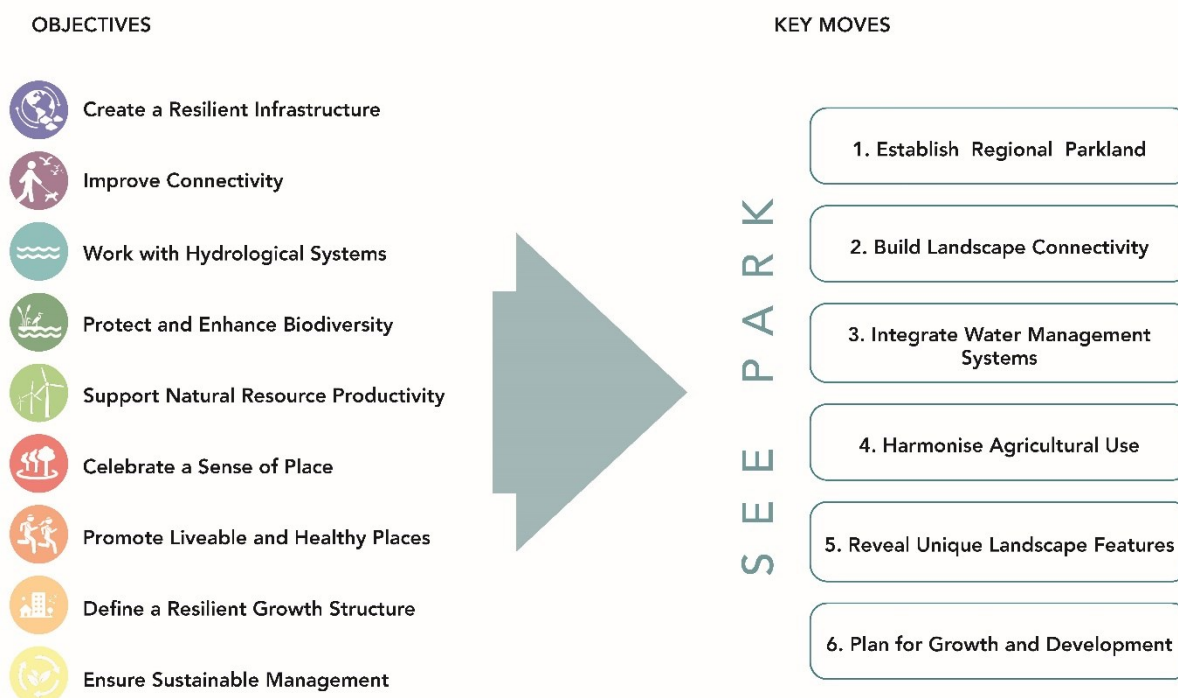


Understanding these challenges, opportunities and relationships between things was essential to identifying important themes of the South Essex region to be addressed, such as climate change, water management, connectivity, sustainability, identity, health and well-being and growth. Recognising these important elements prepared the way for the development of clear objectives and a profound regional landscape strategy.

Third, the Green and Blue Infrastructure Report set out a vision, spatial strategy, key moves and policy recommendations. The spatial strategy was developed directly from an analysis of the land and works to maximise social, environmental, and economic benefits.

Fundamental to this stage was developing a clear strategic framework and bold vision for South Essex that anyone reviewing the final report could communicate clearly and understand.

Figure 5. After mapping out the objectives and opportunities, a series of key moves have established the GBI framework and provided a comprehensive strategy of how to embed South Essex within a sustainable and extraordinary parkland setting.



4. Results

The *SEGBI* became known as South Essex Estuary Park (SEEPARK), arising out of the study's vision to create an extraordinary parkland setting that provides an attractive offer for modern living, supports residents, businesses, industry, tourism, leisure activities, and all of nature, right on the doorstep of one of the world's greatest cities. SEEPARK provides a scaled response to the ASELA requirements and offers a revolutionary and resilient framework for South Essex. Moreover, the *SEGBI* complements the *Thames Estuary Growth Board Green Growth* ambitions,⁷ addresses the Government's *Ten Point Plan for a Green Industrial Revolution*,⁸ and anticipates the *Environment Act 2021*.⁹

This single park system, framing all South Essex, holistically addresses 21st-century challenges through its green and blue spaces, including:

- improving health, well-being, and air quality.
- restoring biodiversity and ecosystems.
- mitigating climate change and flooding.
- transitioning to net zero carbon, providing carbon offsetting for local businesses.
- eco-tourism and green tech job creation and recovery.

Indeed, the SEEPARK vision provides a means to re-frame growth, development and planning in the region, providing an innovative, joined-up and attractive model of adaptability and resilience that will be a pioneer for sustainable development and environmental net gain.

Figure 6. SEEPARK provides a scaled response to the ASELA requirements and offers a resilient and nature-based vision for South Essex.



4. Key Moves

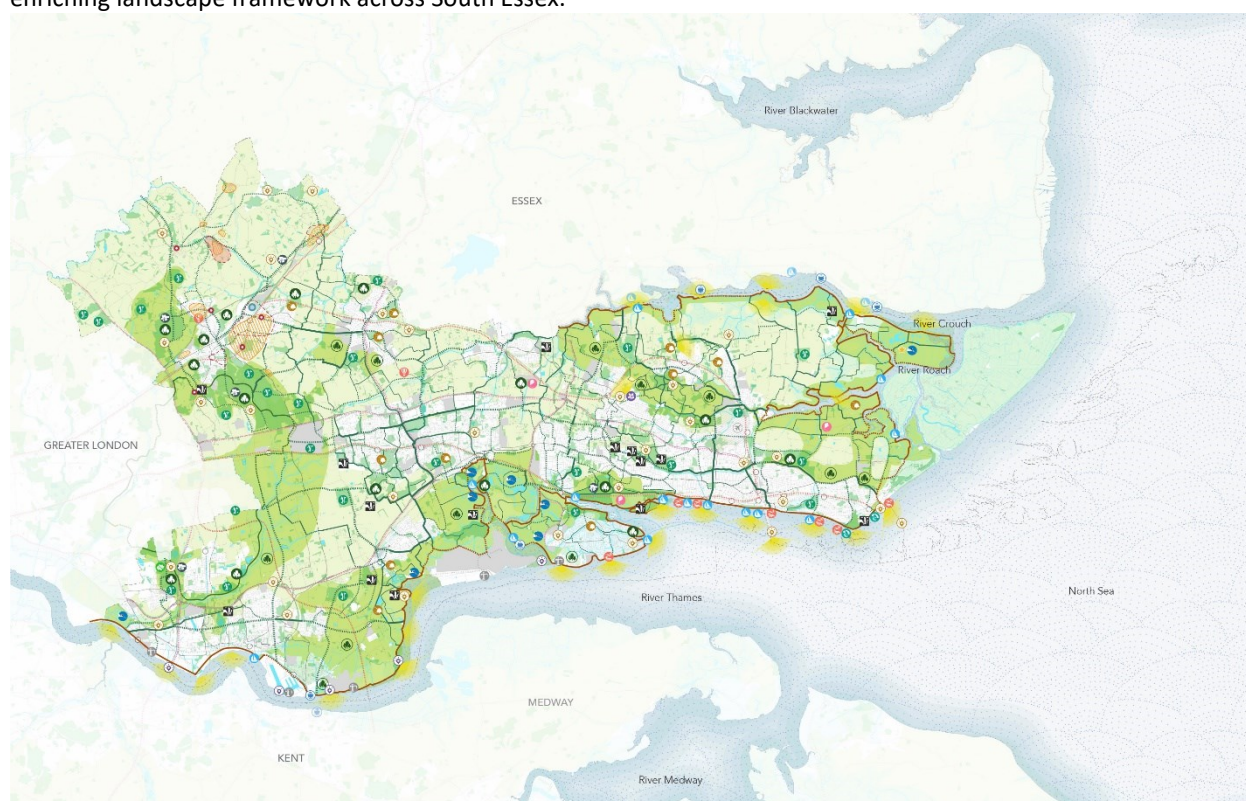
Six key moves were identified that provide a framework for development and provide significant tools to address climate change, ecological collapse and community health and well-being needs while also providing appropriate locations for development. They are:

1. Establish Regional Parkland –24,000 hectares of the overall 70,000 hectares in South Essex are identified as regional parkland, comprising the most challenging sites that offer maximum social, economic, and

environmental opportunities. As the main natural carbon sinks are plants, soil and the ocean, the protection, restoration and creation of ecosystems and habitats throughout the region will provide a vital role in preventing carbon levels from rising. Five major sites include:

- 'Island Wetlands' provides wide-scale restoration of intertidal habitats and salt marshes (important blue carbon sinks), extending important shoreline realignment work already undertaken at Wallasea Island. This wetland park will protect people and properties, enhance habitat sites, and provide many public health and recreational benefits.
 - 'Central Marshlands' extends the important habitats and marshlands already existing and accommodates rising sea levels whilst replacing habitats that will be lost due to climate change and rising sea levels.
 - 'Central Woodland Arc' greatly increases the existing woodland and habitats, connects the River Roach to the River Crouch in a wide arc, and provides large areas of flood attenuation.
 - 'Mardyke Valley' and 'Brentwood Parklands' (forming the eastern part of the Thames Community Forest) connect Rainham Marshes through the Mardyke Valley to Brentwood as a strategic resource for recreation, active travel, connecting habitats and providing flood attenuation while being easily accessed by adjacent communities.
2. Build Landscape Connectivity – A complete landscape network of green and blue corridors encourages the healthy connectivity of people and struggling wildlife throughout the region. The Connectors have been categorised as follows:
- Public Connectors - Creating an accessible, safe, legible, and connected network of routes for people.
 - Wildlife Connectors - Supporting the movement of wildlife through a range of locally appropriate habitats and allowing species to migrate and commute between islands of the highest quality habitat.
 - Transport Connectors – Focus on supporting people and wildlife movement.
3. Integrate Water Management Systems – South Essex's blue assets provide incredible benefits to be celebrated: its shoreline, watercourses, and waterbodies comprise a significant part of the character and heritage of the area. However, they continue to be under considerable pressure, especially from rising sea levels, flooding, industry, pollution, and other human-imposed negative conditions. The *SEGBI* considers:
- Shoreline realignment, coastal access, and marine conservation.
 - Restoration of rivers, creeks, and ponds.
 - Provision of flood storage, especially in marsh areas, farmland, and parkland.
 - Urban surface water attenuation, harvesting and recycling.
4. Harmonise Agricultural Use – Approximately 70% of South Essex's land is comprised of agricultural land. Agriculture is known to be responsible for 25% of greenhouse gas emissions globally. How we manage the land for climate change, biodiversity, water, and life, whilst still growing food and respecting the history of the land is a key challenge. The *SEGBI* proposes the following:
- Promotes the interdependence of agriculture and nature conservation, supported by the Countryside Stewardship program, the new Environment Act, and other financial incentives becoming more available.
 - Plans for flooding large farmland areas, both pluvial and tidal, especially with rising sea levels.
 - Encourages agri-tourism to create an additional source of income and employment opportunities for farmers whilst also inviting people to learn about healthy relationships with the land and food production.
5. Reveal Unique Landscape Features – South Essex possesses some wonderful heritage features, landscapes, and iconic landmarks. Though these features are isolated, they punctuate the landscape providing special moments in the larger experience of place. In general, these features will be protected and enhanced to celebrate the unique quality they bring. Access, connectivity, setting, supporting facilities, and programming will be a focus.
6. Plan for Growth and Development – To support new modes of living and quality of life, South Essex wants to invest in green and blue infrastructure, not as a 'nice to have' but rather core to all project work moving forwards. The *SEGBI*, along with the mapping and design guidance being developed by Defra and Natural England, will help South Essex and the Thames Estuary to become an exemplar of good green infrastructure delivery, benefitting the economy, people and the environment of the region and helping to deliver biodiversity net gain and net zero carbon.

Figure 7. The *SEGBI* spatial strategy integrates all six key moves to create a robust, comprehensive, unifying and life-enriching landscape framework across South Essex.



The *SEGBI* will play a key role in shaping and informing the spatial contents of various documents, including local plans and masterplans, and will contribute to standards and policies across South Essex for the provision of green and blue infrastructure. The *SEGBI* defines a spatial arrangement, articulates key moves, and describes why these are important for ongoing investment, conservation, management, and development.

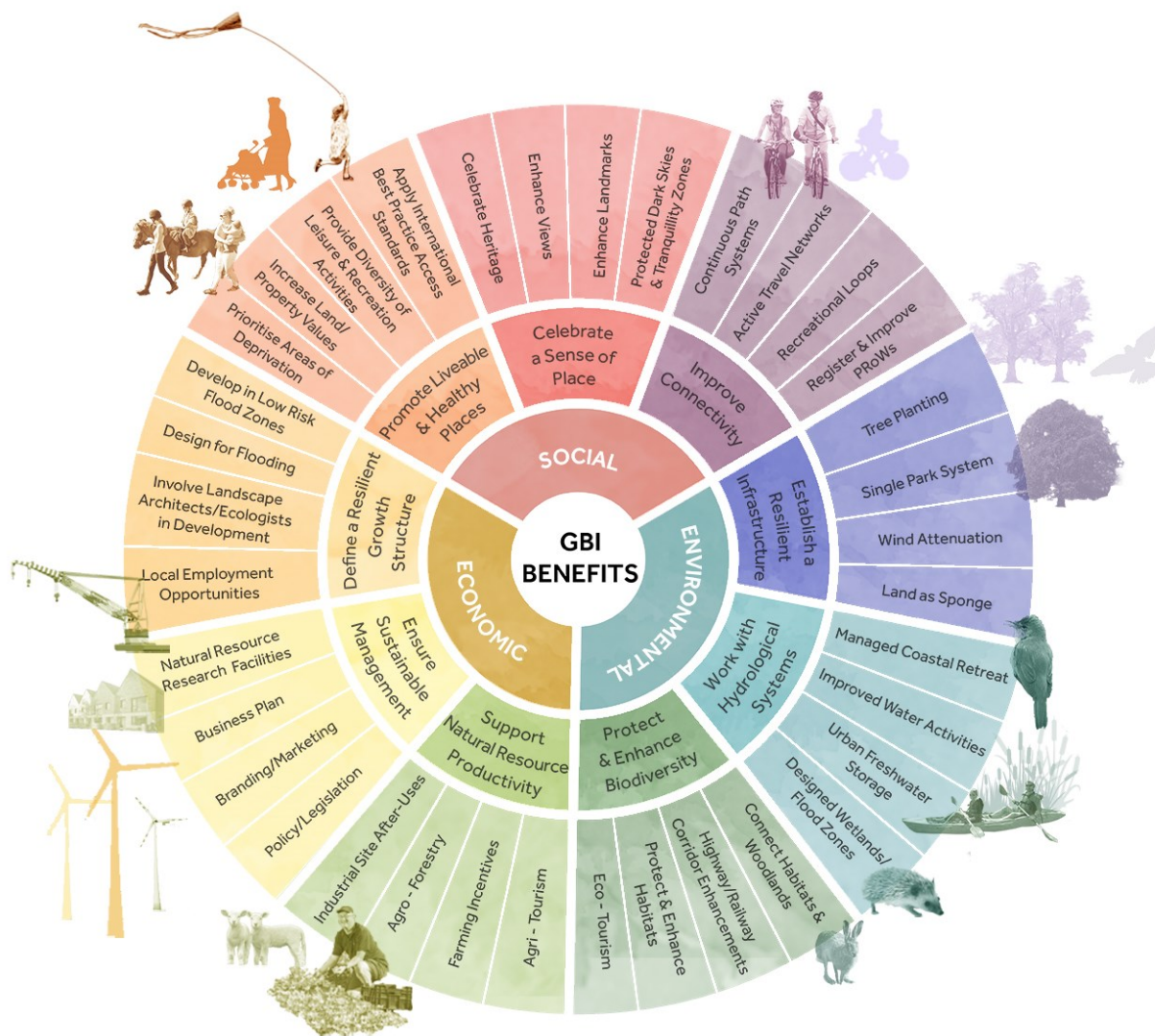
Stewardship and governance are key to the success of any strategy, particularly in the case of living infrastructure that must be cultivated and managed carefully. This is a major challenge to a land-based approach, as systems are not currently in place to take on such stewardship. However, they are rising, and the Government, through the Environment Act, is now bringing about large-scale stewardship programs.

5. Conclusions

There is no time to waste. Scientists worldwide agree that we have this decade to turn things around. Small, incremental change is not enough. Landscape-scale, regional strategies must be rolled out quickly to meet the challenges we face with climate change, ecological collapse, growth pressures and attacks on health and well-being. The *SEGBI* study demonstrates how by working cross-boundary and shifting our focus to the land, the intelligence of nature is liberated to lead the way to a future of sustainable development. By considering natural systems and processes as the first step in strategic plans and by studying the soils, water, air, flora and fauna, so much is made clear and sustainable solutions become obvious.

The *SEGBI* provides an exemplary model of how a landscape framework encompassing all of South Essex brings tremendous environmental, social, and economic value to the regional offer. Covering one-third of South Essex, SEEPARK's proposed large-scale multi-functional landscapes align with the Government's aim of protecting 30% of England's countryside by 2030.¹⁰ Moreover, through this study, South Essex has the opportunity to create an infrastructure model of adaptability and resilience, not only for South Essex but also for London and other estuary communities around the world (twenty-two of the world's largest thirty-two cities are located in estuaries) which are particularly fragile and at risk.

Figure 8. The *SEGBI* Opportunity Wheel demonstrates the significant benefits delivered through regional living infrastructure, with absolutely no disbenefits.



Not only is providing a clear framework fundamental but also having a bold vision to capture the people's imagination and inspire change. The SEEPARK vision was big. It presents a new language of adaptable, resilient infrastructure, where human life is understood as part of nature rather than separate. It is an integrated landscape-scale plan with vast transformation areas that have a significant impact. It shows how we can protect South Essex and all of London and provide an attractive offer for modern living that supports residents, businesses, industry, tourism, and all of nature, right on the doorstep of one of the world's greatest cities.

This project offers the following solutions to the creation of healthy cities:

- Flooding – natural management with absorptive landscapes (12,500 hectares of restored marshlands) that protect: local communities; important infrastructure; significant coastal habitat sites; and London, with a long-term solution to managing the impacts of sea-level rise.
- Biodiversity net gain - safeguarding and restoring 24,000 hectares of natural habitats and ecosystems (including floodplains and woodlands) as part of a Nature Recovery Network.
- Active Travel - an efficient network of routes promoting health and well-being across 200km of continuous waterfront paths and 550km of greenways.
- Targets & Standards - exemplary urban open space standards and strategies for sustainable growth and development, including high-quality green space within 300m of new developments.
- Community - facilities within nature areas and links to schools to support green learning opportunities for children.

- Regeneration - Transforming sensitive industrial sites/structures and heritage assets into thriving nature, recreation and visitor destinations.
- Climate Change and Net Zero Carbon - Accelerating the transition to net zero carbon and providing large-scale carbon-offsetting opportunities.
- Collaboration – coordinating across seven authorities, linking in with other initiatives, including Thames Estuary Growth Board, Creative Estuary, Thames Chase Forest, etc.
- Economy - Promoting eco-tourism, green job creation and recovery.
- Investment - Presenting a scalable and replicable green investment model to create a high-value investment proposition. A preliminary natural capital account that estimates a total value of £ 7.2 billion has been prepared.

The benefits are endless. By implementing a living infrastructure approach and rehabilitating our relationship with the land and nature, new sustainable planning and development models emerge that point the way to a brighter, greener and healthier future for all.

Acknowledgements

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Conflict of Interests

The authors declare no conflict of interest.

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