



THE UNIVERSITY OF
SYDNEY

—
Henry Halloran
Research Trust



Biophilic Living Cities

FRAMEWORK FOR NATURE IN THE CITY

Version 1.0 (Beta)

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The climate change is inevitable where cities have the highest impact with rising temperatures. The need for more greener cities is crucial but the solutions should also contribute towards a low carbon future. In this context biophilic design has shown potential to develop greener and cooler cities integrating natural elements. Biophilic cities was a novel concept where city planning is focused on bringing direct nature and natural systems to enhance human nature connectedness in cities. The current biophilic design practice is focused on health and wellbeing potentials where vast opportunity exists for improved sustainable performance through natural processes.

Biophilic living cities is a guiding framework that is focused on sustainable performance allowing to reduce heat gain and support NetZero transition by using nature-based solutions.

The Biophilic Potential

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Introduction

The rapid pace of global urbanization has ushered in unprecedented challenges for the health and well-being of urban dwellers. As cities expand, issues such as the urban heat island effect, increased stress, and a decline in the quality of life have become more pronounced. The loss of natural environments exacerbates these problems, severing the crucial connection between humans and nature. By integrating nature into the built environment, biophilic cities offer a holistic approach to enhance human-nature connectedness, providing not only aesthetic benefits but also sustainable solutions to urgent issues like urban heat.

Biophilic Living Cities is a guiding framework that is focused on sustainable performance allowing to reduce heat gain and support NetZero transition by using nature-based solutions. The framework was premised on a biophilic thinking that embrace the elemental view of nature taking the elements of Earth, Air, Water, Fire and Habitat as higher-level categories. Each category consists of five criteria indicating the experience of natural element thus supporting for the sustainable performance. This broader level framework should be detailed and developed into a more actionable city planning guide considering the climate, community and compliance with the planning policies in place.



Nature Deprivation in Urban Settings

As urban landscapes burgeon, the inherent connection between humans and nature is gradually eroding. The consequences of this disconnection manifest in various ways, affecting physical health, mental well-being, and overall quality of life. One of the most pressing issues is the urban heat island effect, where built environments absorb and retain heat, leading to elevated temperatures. This phenomenon not only poses immediate health risks but also contributes to long-term climate change consequences.

Moreover, the lack of green spaces in urban settings results in increased stress levels among residents. The concrete jungle, with its monotony and lack of natural elements, has been linked to mental health problems such as anxiety and depression. Additionally, poor air quality and limited exposure to sunlight further compound health issues, creating a vicious cycle that undermines the very essence of urban living.





Biophilic Design as a Sensory and Sustainable Solution

Recognizing the detrimental impacts of nature deprivation, biophilic design emerges as a sensory and sustainable solution to transform urban spaces. Traditionally, biophilic design has been viewed primarily as a sensory approach, focusing on aesthetic elements such as natural light, greenery, and water features. While these elements undeniably contribute to the well-being of occupants, the potential of biophilic design extends beyond sensory experiences.

At its core, biophilic design embodies the integration of nature-based solutions that not only enhance the aesthetics of the built environment but also contribute to sustainable performance. Incorporating features like green roofs, vertical gardens, and permeable surfaces, biophilic design addresses the urban heat island effect by promoting natural cooling mechanisms. Through thoughtful architectural planning, biophilic design harnesses the power of nature to mitigate the adverse consequences of climate change, offering a cost-effective and sustainable alternative to conventional urban development.

Biophilic Cities: A Global Evolution

The concept of biophilic cities has gained momentum globally as urban planners and policymakers recognize the urgent need for a paradigm shift in city development. Biophilic cities go beyond individual buildings and embrace a city-wide approach to incorporate nature into every facet of urban life. These cities prioritize the creation and preservation of green spaces, biodiversity, and natural habitats within the urban fabric.

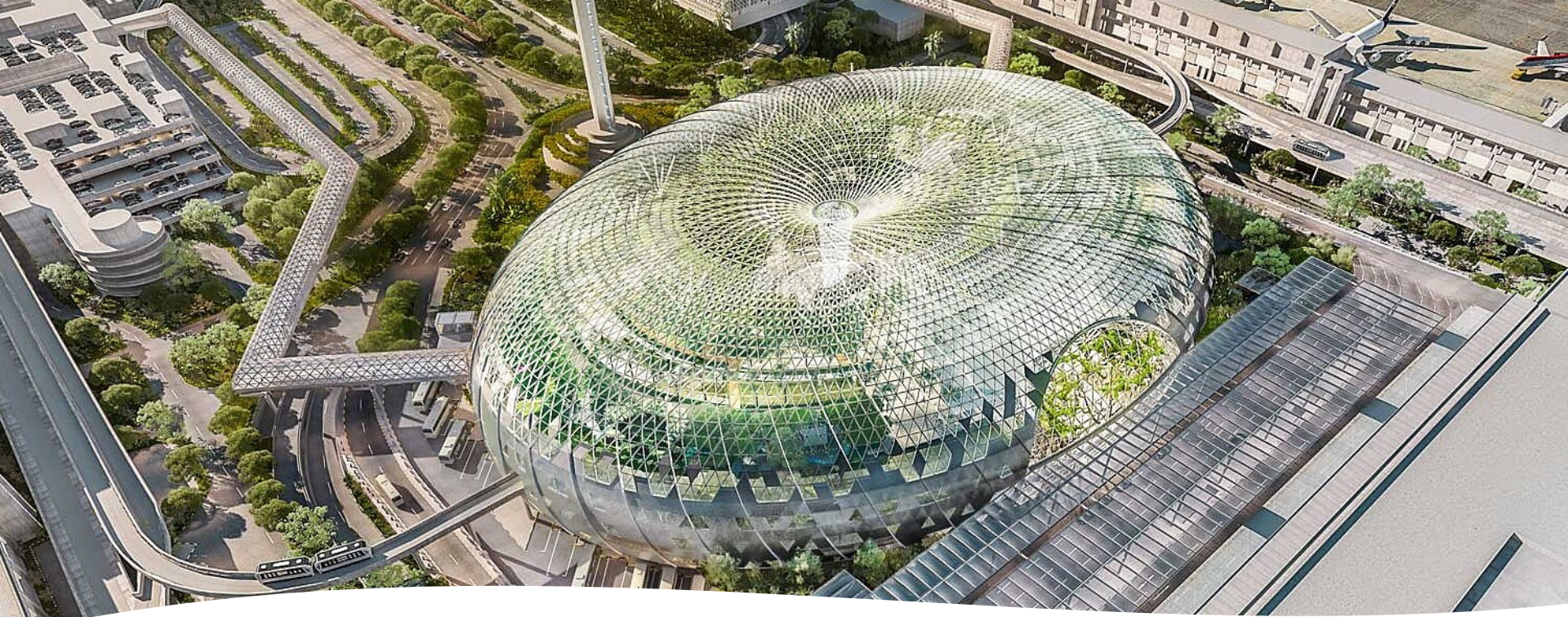
Cities like Singapore have set exemplary standards by integrating green spaces seamlessly into their urban planning. From rooftop gardens to vertical greenery, Singapore showcases how biophilic principles can be embedded in urban development, fostering a harmonious coexistence between nature and the built environment. Other cities, such as Portland and Oslo, have implemented policies and initiatives to enhance urban biodiversity, exemplifying the potential of biophilic design to create sustainable and resilient urban ecosystems.





Benefits Beyond Aesthetics: The Holistic Impact of Biophilic Cities

- The evolution of biophilic cities goes beyond mere aesthetics; it represents a paradigm shift towards holistic urban development. Biophilic cities offer a myriad of benefits that extend to environmental, social, and economic dimensions. Sustainable nature-based solutions not only address immediate challenges like the urban heat island effect but also contribute to long-term climate resilience.
- One of the key advantages of biophilic cities is the positive impact on human well-being. Access to green spaces and natural environments has been proven to reduce stress, improve cognitive function, and enhance overall mental health. By prioritizing the integration of nature into urban planning, biophilic cities create environments that support the physical and psychological well-being of their residents.
- Furthermore, the emphasis on biodiversity in biophilic cities contributes to ecological sustainability. Green corridors, urban forests, and protected natural habitats within the city limits not only provide recreational spaces but also serve as vital ecosystems, supporting diverse flora and fauna. This commitment to biodiversity enhances urban resilience, ensuring cities can adapt to environmental changes and continue to thrive in the face of climate challenges.



Economic Benefits and Community Engagement

Biophilic cities also present economic benefits, challenging the misconception that sustainable development comes at a high cost. Investments in green infrastructure, such as urban parks and green roofs, not only create jobs but also attract businesses and residents seeking a high quality of life. The economic viability of biophilic design lies in its ability to create vibrant, attractive urban spaces that enhance property values and stimulate local economies.

Moreover, biophilic cities foster community engagement by providing spaces for social interaction and recreation. Shared green spaces become focal points for community events, promoting a sense of belonging and connection among residents. This community-centric approach not only enhances the social fabric of cities but also contributes to the overall resilience of urban communities in the face of challenges.



Biophilic design approaches

As the global urbanization trend continues, the imperative to address the adverse impacts on health, well-being, and the environment becomes increasingly urgent. The evolution of biophilic design and the emergence of biophilic cities offer a transformative solution to these challenges. By going beyond sensory experiences and incorporating sustainable nature-based solutions, biophilic design has the potential to mitigate the consequences of climate change, improve human-nature connectedness, and create resilient and vibrant urban spaces.

The journey towards biophilic cities with enhanced sustainable performance requires a collaborative effort from urban planners, policymakers, architects, and the community. Environmentally sustainable design as it is practised with green building rating tools takes a performance-based approach. The outcomes are technologically sophisticated built environmental solutions that lack opportunities for enhanced human nature connectedness. Biophilic design on the other hand is a sensory place-making approach reconnecting human to nature. Thus, a wholistic approach may be required at the intersect of these two approaches.

By prioritizing the integration of nature into the urban fabric in a wholistic manner, cities can not only enhance the well-being of their residents but also contribute to a sustainable and regenerative future. As biophilic design continues to evolve and gain traction, it stands as a beacon of hope for cities seeking to balance the demands of urbanization with the preservation of our essential connection to the natural world.

Biophilic Living Cities framework

The aim of the Biophilic Living Cities framework is to facilitate designers to bridge between sensory place-making approach in biophilic design and environmental performance-based approach in sustainable design. This framework development adopted Process Bridging Technique, that demonstrated how criteria can be developed contributing to both biophilic and sustainable design by using natural processes (Wijesooriya et al., 2022).

Process Bridging Technique required a sustainability perception that can categorise both biophilic criteria and sustainability criteria in a common understanding introducing the Biophilic Thought based on elemental view of nature.

In par with biophilic thought biophilic living cities framework consists of five categories representing the elements of nature: Earth, Air, Water, Fire and Habitat (Refer Figure 1).

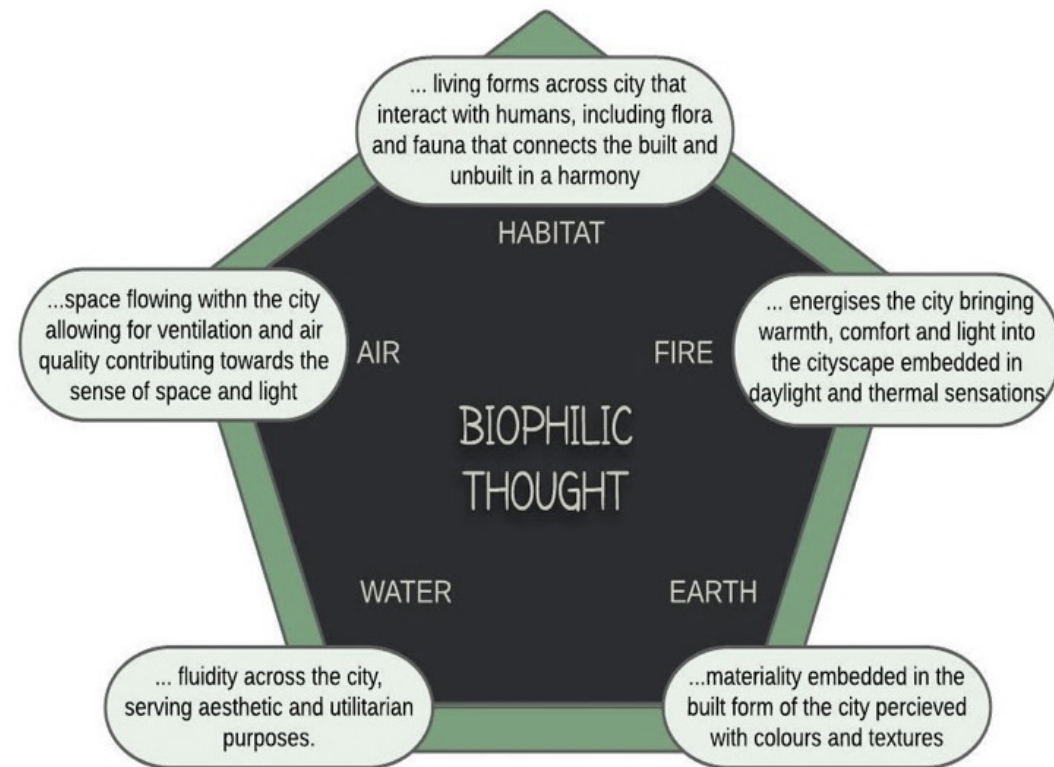


Figure 1. Biophilic Thought

Structure and Terminology

The structure of the frameworks consists of four levels. Five categories are the highest level (see Figure 2) expanded with criteria that support the urban design to bring the elemental experience into the city. Urban design strategies are given for each criterion, further elaborated with typical urban components that could adopt the strategy at the next level. Urban level design strategies and urban components are proposed as a guidance.

However, this framework should be contextualised and developed into a planning guide taking into consideration the climate, community, capacity and compliance.

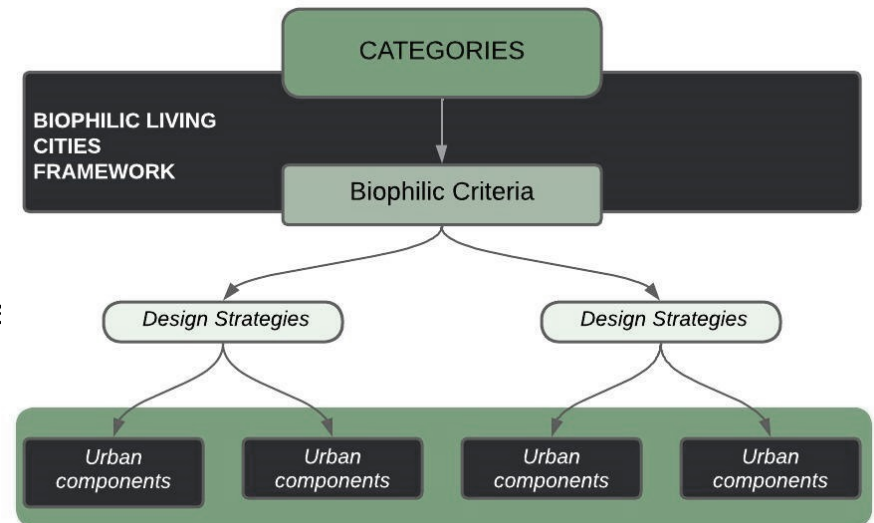


Figure 2. Structure of Biophilic Living Cities framework



Earth

Earth represents materiality embedded in the built form of the city that brings it into existence with colours and textures.

Air

Air is the space flowing in between the built forms in the city allowing for ventilation and air quality performance contributing towards the sense of space and light.

Fire

Fire energises the city bringing warmth, comfort and light into the cityscape. Visual attributes of daylight and perceived thermal sensations are depicted by Fire.

Water

Water is the fluidity across the city, serving aesthetic and utilitarian purposes.

Habitat

Habitat is the living forms across city that interact with humans, including flora and fauna that connects the built and unbuilt in a harmonised manner.

Categories

Categories in this design framework categorise the criteria into design aspects. Use of categories are found in both biophilic design frameworks and sustainable design frameworks. Following Table 1 outlines the definitions for each Category.



Criteria

Criteria are given under each category outlining what are expected to achieve through design strategies for each category. For example, under the Category Water, using Water for thermal comfort is given as a Criteria.



Design Strategy

How a certain criterion can be strategically achieved through design is given by a Design strategy. For example, under the criteria, Water for thermal comfort, use of Water in vertical structures is one Design strategy.

Urban Component

Urban component is the final elements that is included into the city designs. For example, to achieve the design strategy Water in vertical structures, a public square can have Water walls as an art installation used as an Urban component.



Contextualisation

Implementing sustainability initiatives at cities may have to consider four additional aspects that will shape the city design: Climate, Community, Capability and Compliance. Shaping by these four aspects can take place across designing process as shown in Figure 3.

However, these aspects are not included into the Biophilic Living Cities framework allowing the designers to integrate them if they were to develop specific design guides. These aspects were also not considered explicitly in evaluations for credits at this framework level

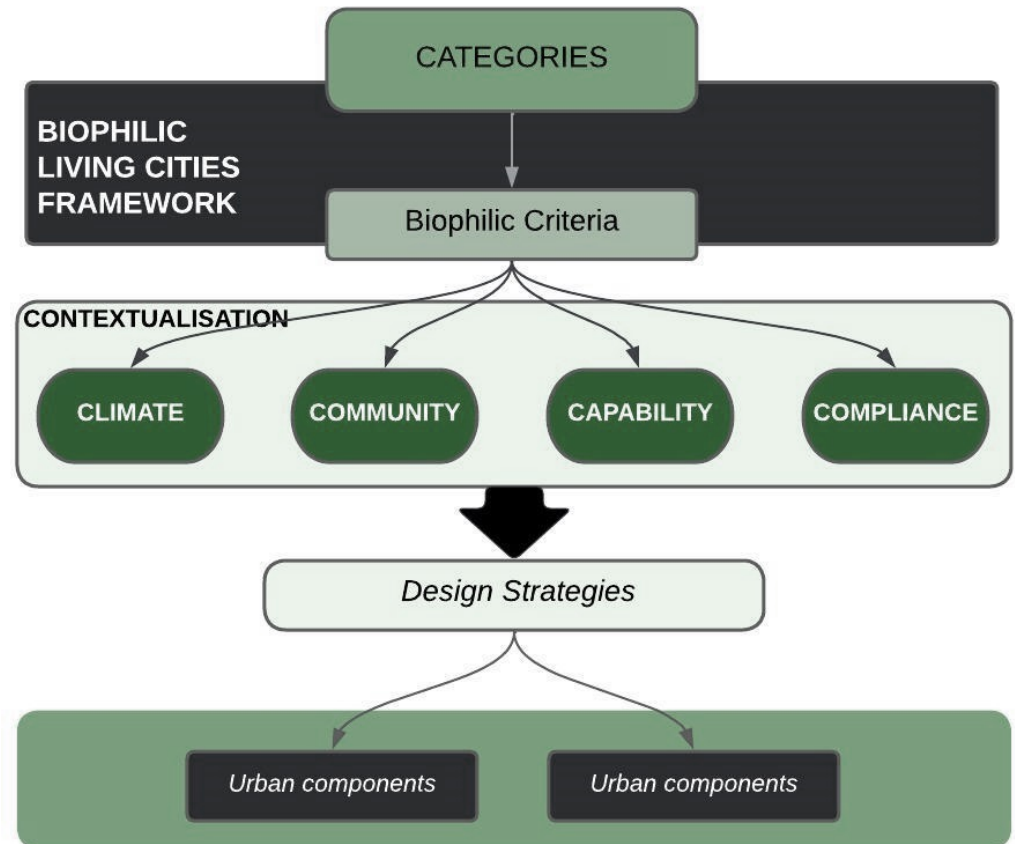


Figure 3. Contextualisation of Biophilic Living Cities framework

Climate

The climate plays a major role in shaping how cities are designed and built. The local climate conditions, including temperature, rainfall, humidity, and seasonal variations, influence the types of natural elements that can be integrated with design strategies needed to create sustainable and resilient biophilic environments. By considering the local climate conditions and incorporating climate-responsive design strategies, biophilic cities can create resilient, sustainable, and enjoyable environments that promote human well-being and ecological sustainability in the face of climate change.





Community

Incorporating the community into biophilic design is crucial for creating inclusive, engaging, and responsive urban environments, that can create spaces not only aesthetically pleasing and environmentally friendly but also socially inclusive and meaningful to the people who inhabit them. Engaging the community ensures that biophilic design reflects the unique needs and aspirations of the local residents, fostering a sense of ownership, pride, and well-being.



Compliance

Urban policy and regulations play a critical role in shaping the development and implementation of biophilic cities. They provide a framework for integrating nature into urban environments, promoting sustainable practices, and ensuring the long-term viability of biophilic initiatives.

Capacity

While biophilic cities offer numerous environmental and social benefits, the design should also consider the economic capacity of the city to implement the initiatives. It is crucial to demonstrate the long-term economic benefits, cost-effectiveness, and resilience advantages of biophilic cities to attract investments and overcome any economic barriers.



Biophilic Design Thinking Model

It is recommended to use this design guide in a design thinking process rather a checklist to obtain the credits. Considering the typical design thinking process used in building design following biophilic design thinking model is proposed.

This is an integrated model that will allow the biophilic design aspects to be integrated at five strategic points within the design thinking process (Wijesooriya et al, 2022).

They are: category, criteria, process, overlay and conceptual. Following Figure 4 shows an integrated process of these five models that can be applied in developing the city design.

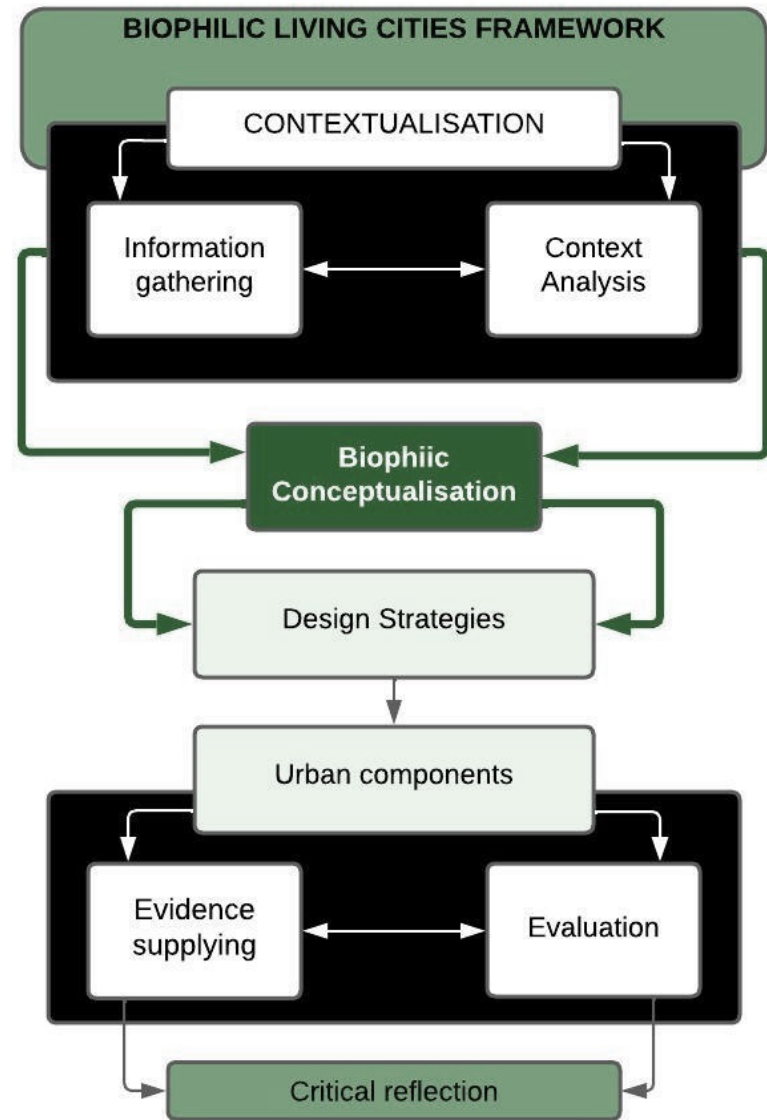


Figure 4. Biophilic Design Thinking process

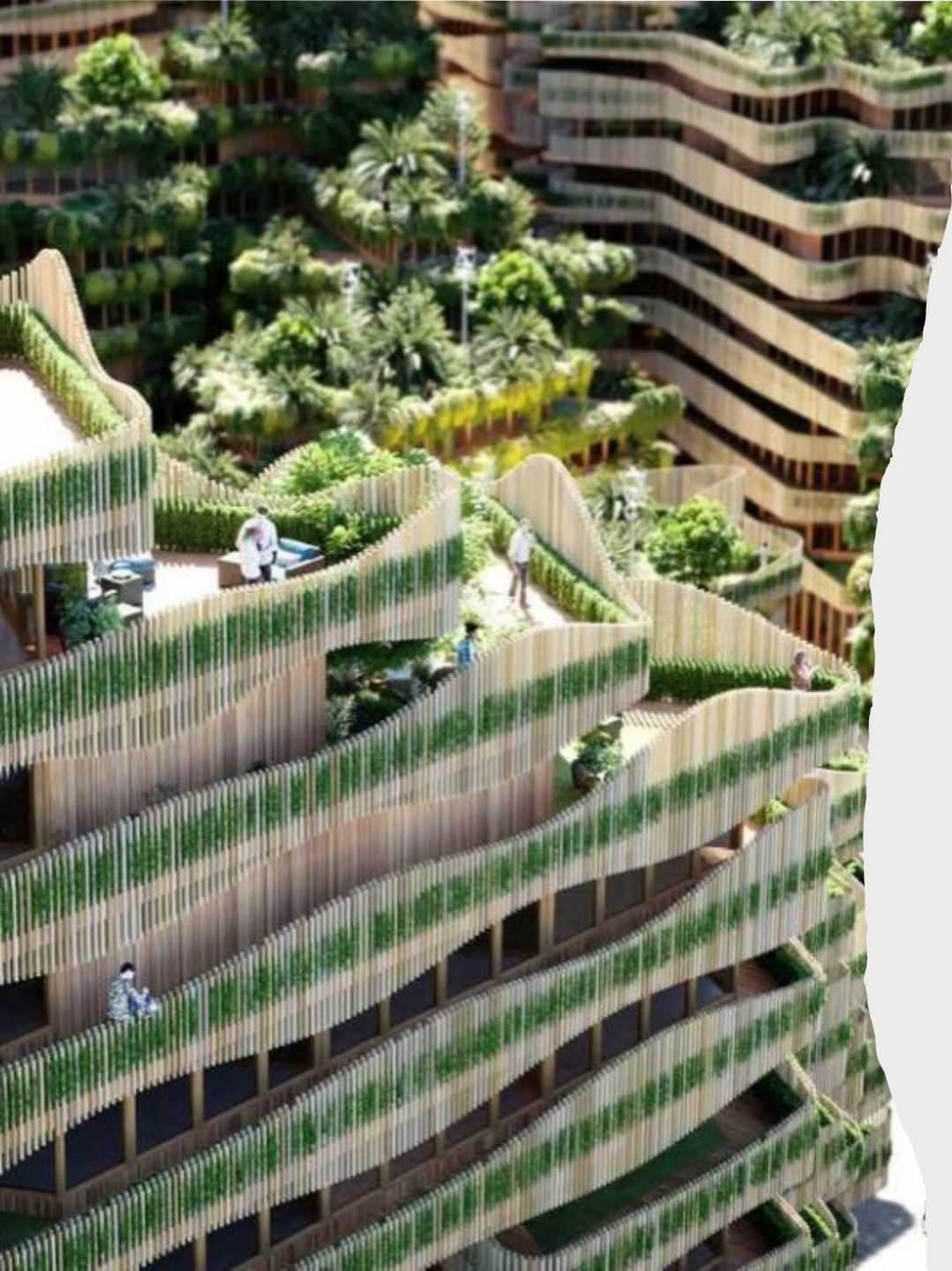
Biophilic Living Cities Credit Summary

Category	Criteria	Credits	Total	%
Earth	E1 Exposed materiality	4	23	19%
	E2 Low energy	4		
	E3 Recycled natural materials	3		
	E4 Sustainable finishing	4		
	E5 Circular use	3		
Air	Management credits	5	23	19%
	A1 Natural processes for air quality management	3		
	A2 Natural ventilation	4		
	A3 Sensory air flow variation	4		
	A4 Natural elements for carbon offset	3		
	A5 Low-emitting natural materials and finishes	3		
Water	Management credits	6	24	20%
	W1 Nature for water quality management	4		
	W2 Water for thermal comfort	4		
	W3 Enhanced water area	3		
	W4 Water saving in landscaping	4		
	W5 Water elements for restoration	4		
Fire	Management credits	5	21	18%
	F1 Passive solar heating	3		
	F2 Circadian lighting design	4		
	F3 Sensory thermal variation	3		
	F4 Visually appealing renewable energy use	3		
	F5 Natural elements for heat reduction	3		
Habitat	Management credits	5	26	24%
	H1 Restore natural habitat	4		
	H2 Restorative natural habitats	4		
	H3 Bio-diversity	4		
	H4 Experience direct nature	4		
	H5 Inter-species connectivity	4		
	Management credits	6		

Earth: Criteria and Credits

Total Credits: 23

E1	Exposed natural materials	4
E2	Low energy materials	4
E3	Recycled natural materials	3
E4	Sustainable finishing for enhanced natural quality	4
E5	Circular resource use	3
EMC	Earth Management credits	5



EARTH

Earth represents materiality embedded in the built form of the city that brings it into existence with colours and textures contributing to the sensory experience.

Earth is emphasised using natural materials depicting its natural colours, textures and form. The criteria can be enhanced and supported using natural topography and environmental features of the context.

Earth category consists of five criteria that can obtain 47 credits.

Prerequisite: At least 50% of the built form in the city should depict the natural material quality. Green tree cover can be included into this 50%.



E1: Exposed materiality

E1: Exposed Materiality

Total Credits: 4

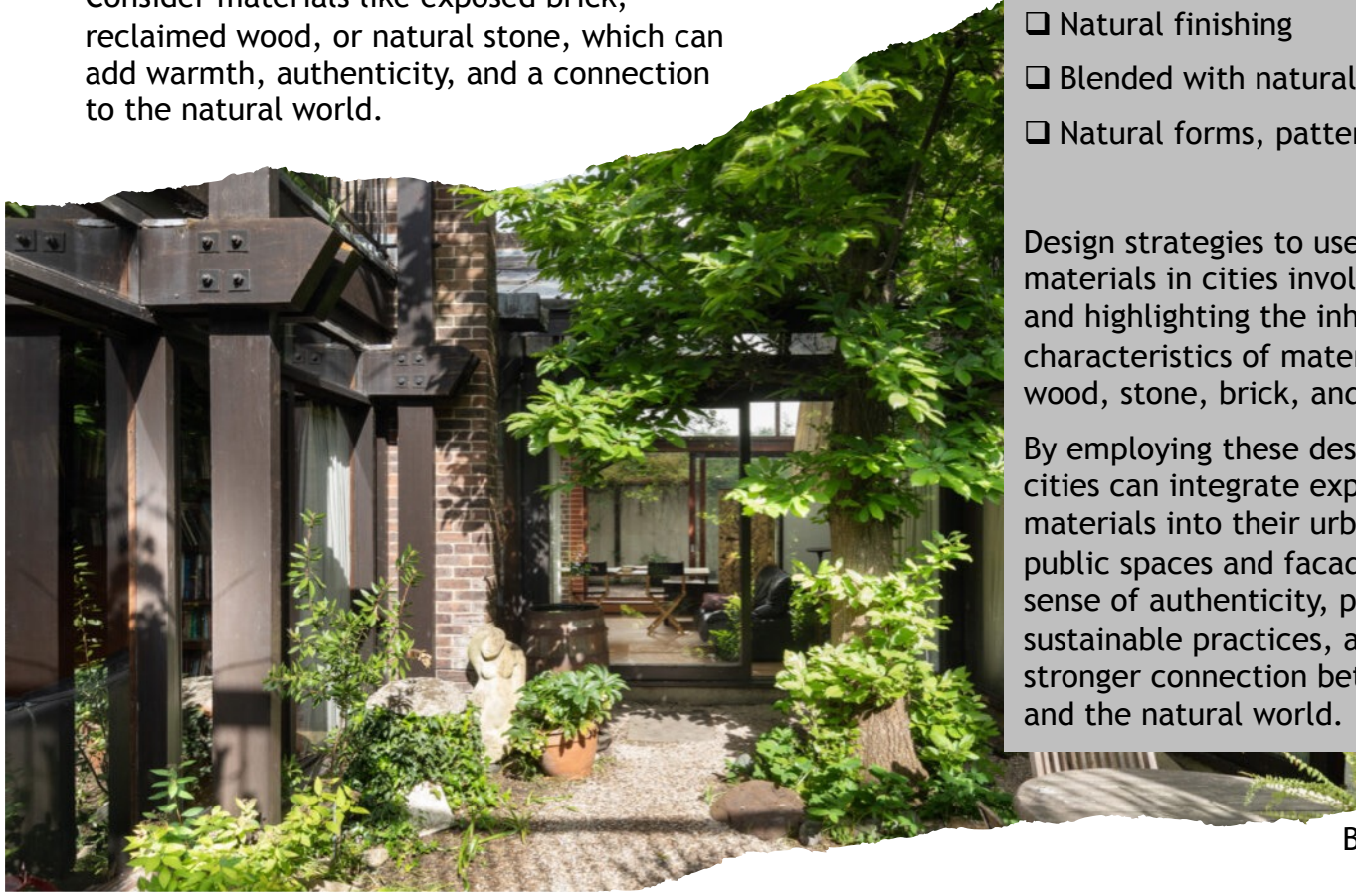
Choose natural materials with distinctive textures, patterns, and colours that create visual interest and enhance the overall aesthetics of the urban environment. Consider materials like exposed brick, reclaimed wood, or natural stone, which can add warmth, authenticity, and a connection to the natural world.

DESIGN STRATEGIES

- ❑ Enhanced tactile experience
- ❑ Natural finishing
- ❑ Blended with natural landscape
- ❑ Natural forms, patterns and shapes

Design strategies to use exposed natural materials in cities involve showcasing and highlighting the inherent beauty and characteristics of materials such as wood, stone, brick, and concrete

By employing these design strategies, cities can integrate exposed natural materials into their urban fabric through public spaces and facades creating a sense of authenticity, promoting sustainable practices, and fostering a stronger connection between residents and the natural world.



E2: Low energy materials

Total Credits: 4

Prerequisite: The design should indicate embedded energy of all the materials used or recommended to get evaluated in this criterion.

Choose natural materials that have a low embodied energy, meaning the energy consumed during their production and transportation is minimal. Examples include locally sourced wood, stone, bamboo, and rammed earth. These materials often require less energy-intensive processing compared to synthetic materials like concrete or steel.

DESIGN STRATEGIES

- ☐ Natural materials
- ☐ Locally sources
- ☐ Rapidly renewable
- ☐ Durability

Use low embedded energy natural materials for infrastructure in cities focus on selecting materials that have a low energy footprint throughout their lifecycle, from extraction to production, transportation, and maintenance.

E3: Recycled Natural Materials

Total Credits: 3

Prerequisite: The design should include at least 20% recycled of all the materials used or recommended to get evaluated in this criterion.

DESIGN STRATEGIES

- ☐ Composites
- ☐ Retaining natural form and exposure
- ☐ Decorative elements

Use recycled natural materials in cities involve incorporating materials derived from natural sources that have undergone recycling or repurposing processes. These strategies focus on reducing waste, conserving resources, and promoting sustainable practices.

These materials can come from salvaged, reclaimed, or repurposed sources, offering a more environmentally friendly alternative to virgin resources.

E4: Sustainable Finishing

Total Credits: 4

In a biophilic city, using naturally looking sustainable finishes for urban components can contribute to a more harmonious and nature-inspired environment. These finishes emulate the textures, colors, and patterns found in the natural world while being environmentally friendly.



DESIGN STRATEGIES

- ☐ Natural techniques
- ☐ Natural stains, dyes and chemicals
- ☐ Allowing for aging and patina
- ☐ Non-Toxic finishes

Choose non-toxic finishes and coatings for materials such as wood, metal, or concrete. Avoid paints, varnishes, or sealants that contain harmful volatile organic compounds (VOCs) that can contribute to indoor air pollution and environmental degradation. Opt for water-based, low VOC, or natural oil-based finishes that provide protection without compromising air quality.

E5: Circularity in Waste management

Total Credits: 3

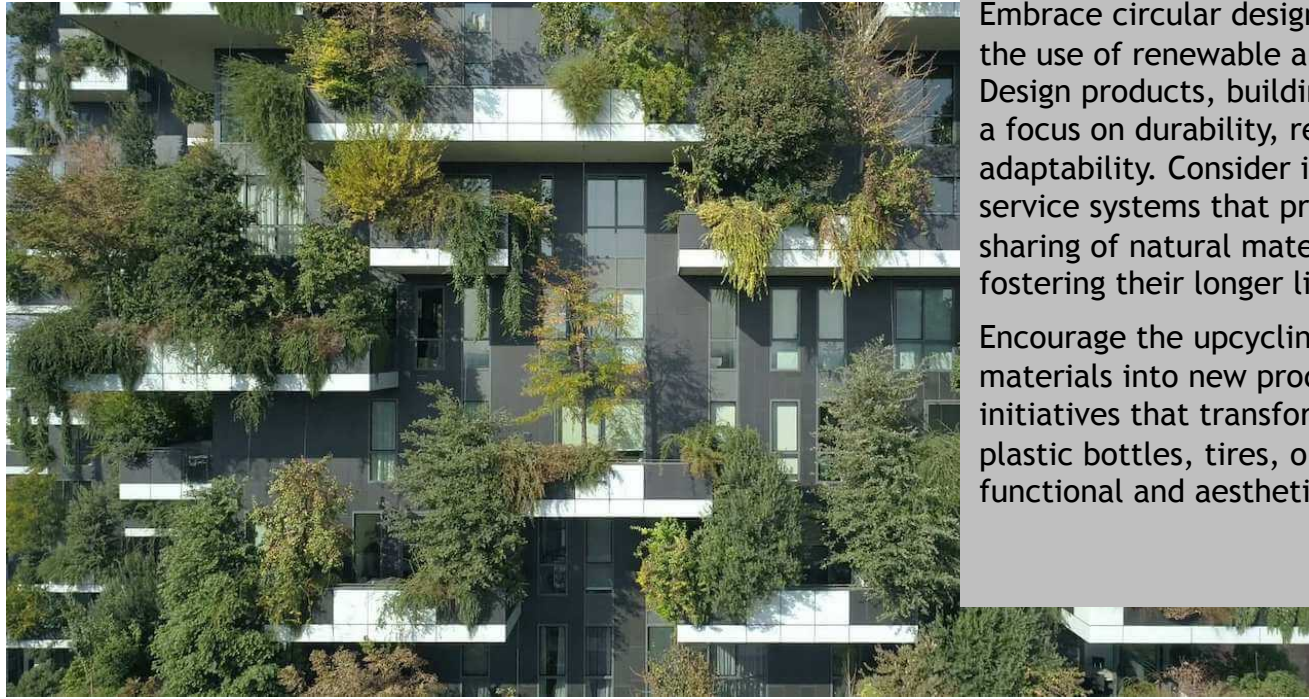
Restore natural materials through waste management in cities involve utilizing waste as a resource for creating new products, materials, and ecosystem restoration initiatives. These strategies aim to reduce waste, conserve natural resources, and promote circular economy principles.

DESIGN STRATEGIES

- ☐ Landscape design for composting
- ☐ Elements and fixtures for waste management
- ☐ Designed for circular use

Embrace circular design principles that prioritize the use of renewable and recyclable materials. Design products, buildings, and infrastructure with a focus on durability, repairability, and adaptability. Consider implementing product-service systems that promote the leasing or sharing of natural material-based products, fostering their longer lifespan and multiple uses.

Encourage the upcycling and repurposing of waste materials into new products or materials. Support initiatives that transform waste materials, such as plastic bottles, tires, or reclaimed wood, into functional and aesthetically pleasing products.



E6: Earth Management credits

Total Credits: 5

Establish material recovery facilities (MRFs) where waste is sorted, processed, and recycled. These facilities employ advanced sorting technologies to separate recyclable materials from the waste stream. By recovering materials such as paper, plastic, glass, and metal, cities can redirect them back into the production cycle, reducing the need for virgin resources.



STRATEGIES

- ☐ Partnerships
- ☐ Education and awareness
- ☐ Public engagement
- ☐ Monitoring and evaluation
- ☐ Establishment of governance and organisations

Foster partnerships with waste management companies, recycling facilities, research institutions, and community organizations to promote innovative waste management practices. Collaborate on projects that demonstrate the potential of waste as a resource for restoring natural materials and ecosystems in the city.

Educate the public about the benefits of natural materials and the importance of the circular economy. Raise awareness about sustainable consumption practices, encouraging residents to choose products and materials made from renewable resources or recycled content. Promote initiatives that empower consumers to make informed decisions and actively participate in the circular economy.



Air: Categories and credits

A1	Natural processes for air quality management	3
A2	Natural ventilation	4
A3	Sensory air flow variation	4
A4	Natural elements for carbon offset	3
A5	Low-emitting natural materials and finishes	3
AMC	AIR Management Credits	6

Total Credits: 23

An aerial photograph of a modern building with a distinctive facade featuring a series of rectangular openings. Adjacent to the building is a lush vertical garden with various green plants. A swimming pool with a blue tiled bottom and white curved edges is visible next to the garden. The surrounding area includes a road with white lane markings and other greenery.

AIR

Air is the space flowing in between the built forms in the city allowing for ventilation and air quality performance contributing towards the sense of space and light

This category focuses on design strategies and urban components designed to act as natural processes for air quality management, promoting cleaner and healthier environments. By incorporating natural elements and systems, these components can help filter and purify the air, reducing pollution levels and improving overall air quality.

This category entails criteria to obtain 24 credits.

Prerequisite: The city form allows for natural ventilation avoiding any stagnant spaces for habitable purposes

A1: Natural processes for air quality

Total Credits: 3

Natural processes for air quality management involves integrating various elements and strategies that leverage the power of nature to improve air quality.



DESIGN STRATEGIES

- ☐ Plants for air purification
- ☐ Direct sunlight to avoid stagnant spaces
- ☐ Water features for moisture management

By incorporating these natural processes for air quality management into the urban fabric, biophilic cities can create healthier, more sustainable environments that prioritize the well-being of their residents and visitors. Additionally, these initiatives can contribute to mitigating the impacts of climate change and promote overall environmental resilience.

A2: Natural ventilation across the city

Total Credits: 4

Designing for natural ventilation in a biophilic city involves creating strategies that facilitate the flow of fresh air throughout the urban environment.



DESIGN STRATEGIES

- ☐ Building orientation and layout
- ☐ Building design and form
- ☐ Access to outdoor for fresh air
- ☐ Urban morphology and street design

In a biophilic city, several urban components can be designed to support natural air flow, allowing for improved ventilation and air circulation. By leveraging natural air movements, cities can enhance air quality, reduce reliance on mechanical ventilation systems, and create a more comfortable and healthier living environment.

A3: Sensory air flow variation

Total Credits: 4

In a biophilic city, several urban components can be designed to support natural air flow, allowing for improved ventilation and air circulation. By leveraging natural air movements, cities can enhance air quality, reduce reliance on mechanical ventilation systems, and create a more comfortable and healthier living environment.

DESIGN STRATEGIES

- ☐ Wind-responsive design
- ☐ Landscape responding to natural breeze
- ☐ Public spaces across ventilation corridors
- ☐ Sensorial planting

Designing for sensory airflow variation in biophilic cities involves creating diverse and dynamic airflow patterns that engage and stimulate the senses.

Designate specific areas as ventilation corridors to facilitate airflow and create sensory variations. These corridors can be wide pathways or open spaces strategically located to channel and direct natural breezes throughout the city. By enhancing airflow, these corridors create subtle changes in temperature, humidity, and air movement that can be sensed by individuals as they move through the urban environment.

A4: Natural elements for carbon offset

Total Credits: 3

Incorporating urban components with natural materials in a biophilic city can contribute to carbon offset and help mitigate the impacts of climate change. By utilizing natural materials, you can reduce the carbon footprint associated with construction and infrastructure development while promoting sustainable practices.

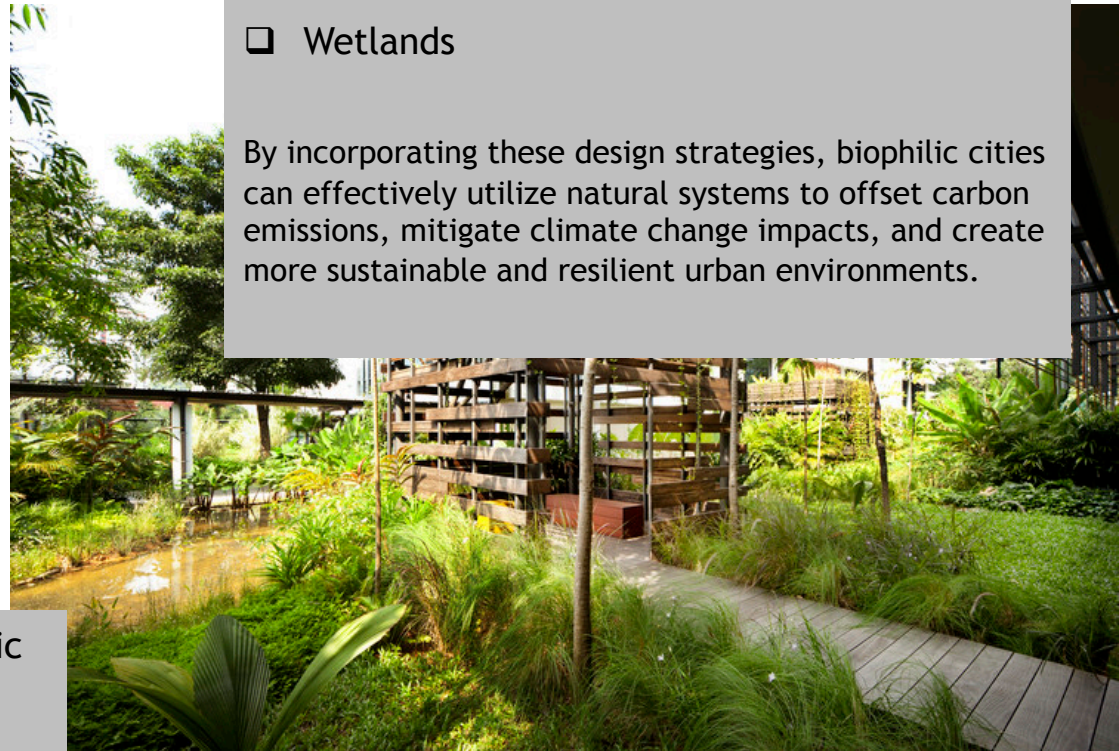
Urban components may include green walls, green roofs, green paths, walkways, wetlands and timber fixtures.

Designing for natural carbon offset in biophilic cities involves implementing strategies that utilize natural systems to absorb and store carbon dioxide (CO₂) emissions.

DESIGN STRATEGIES

- ☐ Urban forests
- ☐ Green skins
- ☐ Wetlands

By incorporating these design strategies, biophilic cities can effectively utilize natural systems to offset carbon emissions, mitigate climate change impacts, and create more sustainable and resilient urban environments.



A5: Emission control

Total Credits: 3

Using urban components made from low-emitting natural materials is a great approach to promote healthier indoor and outdoor environments in a biophilic city. Low-emitting materials release fewer harmful chemicals and pollutants, improving air quality and the overall well-being of city inhabitants.

These may include green infrastructure, natural paving, biodegrade street furniture and fixtures.

Designing for emission control in biophilic cities involves selecting and utilizing building materials that have minimal or no emissions of volatile organic compounds (VOCs) and other harmful pollutants.

DESIGN STRATEGIES

- ☐ Low emitting finishes
- ☐ Low emitting materials
- ☐ Ventilation strategies

Prioritize the use of natural materials that have low VOC emissions. Examples include sustainably sourced wood, natural stone, cork, bamboo, clay-based materials, and natural fibers like wool or cotton. These materials often have lower chemical content and emit fewer pollutants compared to synthetic materials.



AIR Management Credits

Total Credits: 6

STRATEGIES

- ☐ Partnerships
- ☐ Sustainable transportation policy
- ☐ Education and awareness
- ☐ Technology promotion
- ☐ Testing, Monitoring and evaluation
- ☐ Establishment of governance and organisations

Raise awareness among architects, designers, contractors, and building occupants about the importance of low-emitting natural materials for air quality. Promote knowledge about healthy material choices and their impact on indoor environments. Provide resources and guidelines to help stakeholders make informed decisions when selecting building materials.

Explore the integration of smart technologies that monitor and regulate natural ventilation systems. Sensor-based systems can detect air quality, temperature, and humidity levels, adjusting ventilation rates accordingly. This helps optimize natural ventilation while maintaining indoor air quality and thermal comfort.

Water: Categories and credits

W1	Nature for water quality management	4
W2	Water for thermal comfort	4
W3	Enhanced water area	3
W4	Water saving in landscaping	4
W5	Water elements for restoration	4
WM C	Management credits	5

Total Credits: 24

Water

Water is the fluidity across the city, serving aesthetic and utilitarian purposes.

Water is an integral component of the built form that serve utilitarian , aesthetic and emotional purposes.

The biophilic and sustainable approach is premised upon the use of natural processes and elements to enhance the sustainability performance. These may include the use of natural water quality management, designing cooler cities in an aesthetically pleasing expression.

The community will harness the benefits of enhanced human nature connectedness with opportunities for interacting with water.



Prerequisites:

The City form should allow for more than 30% visual water bodies. The water quality could differ including wetlands and similar elements used for water purification.

W1: Natural processes for water quality

Total Credits: 4

DESIGN STRATEGIES

- ☐ Water Purification with plants
- ☐ Exposed natural filtration
- ☐ Water elements for solar purification
- ☐ Natural protection techniques

Designing with natural processes for water quality management in biophilic cities involves incorporating strategies that mimic and utilize the natural hydrological cycle to enhance water quality.

Designing urban components in a biophilic city to serve as natural processes for water quality management is a smart and sustainable approach. By incorporating natural elements and strategies it can improve water quality, reduce stormwater runoff, and enhance the overall ecological health of the city.

Restoring or creating wetland habitats within the city as an urban component can act as natural water purifiers. They help filter pollutants, trap sediments, and provide habitat for diverse plant and animal species.

Other components may include bioswales, rain gardens, water filtration infrastructure and rain water harvesting elements.

W2: Water for thermal comfort

Total Credits: 4

By incorporating urban components that utilize water for thermal comfort, biophilic cities can create more comfortable and enjoyable environments, enhance the well-being of residents, and promote sustainable and resilient urban design practices.

These may include misting systems, fountains, ponds, water walls, water roofs and aquatic planting.

DESIGN STRATEGIES

- ☐ Water features
- ☐ Water based structures
- ☐ Sensory experience for thermal sensation
- ☐ Permeable finishes

Design strategies to use water for thermal comfort in biophilic cities involve incorporating water features and elements that provide cooling and create a more comfortable microclimate.

W3: Enhanced water area

Total Credits: 3

By incorporating urban components for enhanced water in biophilic cities, the waterfront areas can be transformed into vibrant and inclusive spaces that promote community engagement, connection with nature, and a sense of place.



DESIGN STRATEGIES

- ☐ Water elements in landscaping
- ☐ Visual connection to water
- ☐ Water based leisure

Design strategies to enhance water areas in biophilic cities focus on maximizing the benefits and functionality of water bodies.

Design spaces that encourage active water uses, such as kayaking, paddleboarding, or swimming. Provide access points, rental facilities, or designated areas for these activities to foster community engagement and enjoyment of the water.

Prioritize the development of waterfront areas, such as riversides, lakeshores, or coastlines. Create accessible pathways, seating areas, and recreational spaces that allow people to connect with the water and enjoy the views.

W4: Water saving in landscaping

Total Credits: 4

By incorporating urban components to save water consumption in landscaping can be minimized, promoting sustainable water management practices, and preserving water resources for the benefit of the environment and community.

The components may include rainwater harvesting systems, drip irrigation systems, smart controls, permeable paving, mulching and water saving landscapes.

DESIGN STRATEGIES

- ❑ Low maintenance plants and trees
- ❑ Indigenous plants and techniques
- ❑ Hydroponics and aquaponics
- ❑ Water retaining elements and techniques

Design strategies to save water in landscaping in biophilic cities focus on efficient water use, sustainable practices, and choosing water-wise plantings.

By implementing these design strategies, biophilic cities can create beautiful and sustainable landscapes while significantly reducing water consumption. Conserving water in landscaping not only benefits the environment but also promotes resilience in water resources and encourages responsible stewardship of natural resources

W5: Water elements for restoration

Total Credits: 4

Water in urban components can be used as a sensory experience in biophilic cities to engage people's senses and create a deeper connection with nature.

These may include artistic sensory installations, water features, water falls, moving water bodies and water performance areas.

Water pathways or bridges that cross over or run alongside water bodies, allowing people to feel the presence of water as they walk or move through the environment. The proximity to water enhances the overall sensory experience of the journey.

Opportunities for tactile experiences with water. This can include shallow pools or fountains with smooth pebbles or textured surfaces that people can touch and interact with, providing a sensory connection to water.

DESIGN STRATEGIES

- ☐ Low maintenance plants and trees
- ☐ Indigenous plants and techniques
- ☐ Hydroponics and aquaponics
- ☐ Water retaining elements and techniques

Design strategies to use water for mental restoration in biophilic cities aim to create calming and rejuvenating environments that promote mental well-being

By incorporating these design strategies, biophilic cities can harness the power of water to create environments that support mental restoration, reduce stress, and enhance overall well-being. The presence of water elements in urban settings provides a connection to nature, fostering a sense of calm and serenity amidst the hustle and bustle of city life.

Water Management credits

Total Credits: 5

STRATEGIES

- ☐ Maintenance
- ☐ Education and awareness
- ☐ Technology promotion
- ☐ Monitoring and auditing

Regularly inspect irrigation systems for leaks, broken sprinkler heads, or other issues that may lead to water waste. Ensure proper maintenance of plants, including pruning, fertilizing, and monitoring for pests and diseases, to optimize water uptake and plant health.

Promote water conservation practices and educate the community about the importance of responsible water use in landscaping. Provide resources and guidelines on efficient irrigation techniques, plant selection, and water-wise gardening practices.

Regularly monitor water usage in landscaped areas and conduct water audits to identify areas of inefficiency and potential water-saving opportunities. This data can inform future landscape design decisions and enable ongoing improvement in water conservation efforts.



Fire: Categories and credits

F1	Passive solar heating	3
F2	Circadian lighting design	4
F3	Sensory thermal variation	3
F4	Visually appealing renewable energy use	3
F5	Natural elements for heat reduction	3
FMC	Fire Management credits	5

Total Credits: 21

An aerial photograph of a city landscape. A winding asphalt road curves through a dense forest of green trees. To the left of the road, there are modern buildings with red-tiled roofs. In the background, several tall, multi-story apartment buildings are visible. The overall scene depicts a mix of urban development and natural green space.

Fire

Fire energises the city bringing warmth, comfort and light into the cityscape. Visual attributes of daylight and perceived thermal sensations are depicted by Fire.

Fire category focuses on passive solar design for thermal performance across the city while maximizing the daylight use enhancing circadian lighting rhythms. The varying sensory experience with natural processes will bring the biophilic benefits to the occupants while providing comfortable spaces.

Prerequisites:

The City form should allow for more than 50% access natural sunlight. Building guidelines should be in place for mandatory passive solar heating.

F1:Passive solar heating

Total Credits: 3

In biophilic cities, various urban components can be used for passive solar heating and cooling to harness the natural energy of the sun and create comfortable and energy-efficient environments.

These may include solar shading, glazed areas, solar panels, reflective surfaces and thermal insulation creating sustainable and climate-responsive environments.



DESIGN STRATEGIES

- ☐ Daylighting
- ☐ Enhanced solar heating
- ☐ Thermal mass

Passive solar design strategies in biophilic cities utilize the natural energy of the sun to heat, cool, and illuminate buildings, creating comfortable and sustainable living environments.

Incorporate materials with high thermal mass, such as concrete or stone, on interior walls and floors to absorb and store heat from sunlight. This stored heat can be released gradually, helping to regulate indoor temperatures and reducing the need for mechanical heating systems.

By implementing these passive solar design strategies, biophilic cities can reduce energy consumption, enhance occupant comfort, and promote sustainable living. Passive solar design not only integrates harmoniously with nature but also contributes to the overall well-being of residents while minimizing the environmental impact of buildings.

F2:Circadian lighting design

Total Credits: 4

Incorporating circadian lighting in biophilic cities involves using various urban elements to create lighting environments that align with the natural rhythms of the human body.

These may include smart lighting systems, daylight public pathways, circadian lighting systems and biophilic lighting installations,

DESIGN STRATEGIES

- ❑ Natural lighting for public spaces
- ❑ Elements to enhance circadian rhythm
- ❑ Materials to amplify natural light
- ❑ experience lighting rhythm

Design strategies to incorporate circadian lighting in biophilic cities involve creating lighting environments that align with the natural rhythm of the human body, promoting well-being and supporting the body's circadian system

F3: Sensory thermal variation

Total Credits: 3

URBAN COMPONENTS

Urban Components will include shading and open spaces, wind corridors, water features, seating, walkways.

Urban components that consider for seasonal changes in temperature and design urban spaces that can adapt to these variations. For instance, incorporate movable shading devices or adaptable infrastructure that can be adjusted to different seasons, providing different thermal experiences throughout the year.

DESIGN STRATEGIES

- ❑ Thermal variability in city
- ❑ Natural shading
- ❑ Climate sensitive elements

Design strategies to achieve sensory thermal variation within biophilic cities aim to create diverse microclimates and thermal experiences that engage the senses and enhance the overall biophilic experience.

To achieve sensory thermal variation within biophilic cities involve creating diverse thermal experiences throughout urban spaces, allowing individuals to perceive and interact with different temperature conditions

F4: Visually appealing Renewable energy use

Total Credits: 3

DESIGN STRATEGIES

- ☐ Visible Solar power elements
- ☐ Wind power with sensory experience
- ☐ Bioenergy elements in landscape design

Incorporating visual renewable energy elements in biophilic cities not only promotes sustainability but also enhances the aesthetic appeal and quality of the urban environment.

Integrating solar panels and solar arrays into the design of buildings, structures, and public spaces. Visually appealing solar panel designs, such as transparent or colored panels, that blend harmoniously with the surroundings and create an aesthetically pleasing visual element.

Wind miles can be designed for both performance and aesthetic enhancement.

URBAN COMPONENTS

The integration of urban components for biophilic design strategies helps establish a strong connection between humans, nature, and renewable energy sources, enhancing the overall quality and aesthetic appeal of the cityscape.

These components may include smart lighting systems, lighting pathways, biophilic lighting installations, artistic installations with renewable energy sources,

F5:Natural elements for heat reduction

DESIGN STRATEGIES

- ☐ Increased canopy cover for shading
- ☐ Water features
- ☐ Reflective and cooling materials

In biophilic cities, design strategies that utilize natural elements for heat reduction play a crucial role in creating comfortable and sustainable urban environments.

biophilic cities can effectively utilize natural elements to reduce heat, create more comfortable microclimates, and enhance the overall well-being of residents while promoting sustainability and connection with nature.

Total Credits: 3

URBAN COMPONENTS

In biophilic cities, several natural urban elements can effectively support heat reduction and create cooler, more comfortable environments.

These components may include :

- ☐ Green Roofs
- ☐ Green Walls:
- ☐ Green Spaces
- ☐ Parks
- ☐ Shading Structures
- ☐ Tree Canopies
- ☐ Community Gardens
- ☐ Green Corridors
- ☐ Vegetated Streetscapes

FIRE Management Credits

Total Credits: 5

Promote community engagement and education on the importance of heat reduction strategies. Encourage residents to participate in tree planting programs, community gardens, and green initiatives. Educate the community about the benefits of biophilic design and the role they can play in reducing urban heat.

STRATEGIES

- ☐ Community engagement and education
- ☐ Urban planning for thermal performance
- ☐ Lighting wellness programs
- ☐ Monitoring and user controls
- ☐ Research and evaluation


Divide spaces in urban planning into different lighting and thermal zones to accommodate various activities and circadian needs. For example, areas for relaxation and winding down can have softer, warmer lighting, while areas for concentration and productivity can have brighter, cooler lighting.

Implement lighting wellness programs that educate occupants about the importance of circadian lighting and encourage healthy lighting practices. This may include guidelines for adjusting lighting settings, scheduling lighting changes, and promoting awareness of the impact of lighting on well-being.

Stay informed about the latest research and advancements in circadian lighting design and thermal performance . Continuously evaluate and update lighting and thermal comfort strategies to incorporate new findings and technologies that enhance the circadian experience in biophilic cities.



Habitat: Categories and Credits



H1	Restore natural habitat	4
H2	Restorative natural habitats	4
H3	Bio-diversity	4
H4	Direct Nature Experience	4
H5	Inter-species connectivity	4
HMC	Management credits	6

Total Credits: 26



Habitat

Habitat is the living forms across city that interact with humans, including flora and fauna that connects the built and unbuilt in a harmonised manner.

These allows for continued habitation for animals, enhanced biodiversity and enhanced human nature connectedness.

Prerequisites:

The City form should allow for more than 30% natural habitat cover, with guidelines in place for continuation and safe management.

H1:Restore natural habitat

Total Credits: 4

DESIGN STRATEGIES

- ☐ Reduces built areas in the city
- ☐ Natural landscaping blended to city
- ☐ Indigenous plants in landscaping
- ☐ Recreating continuous habitat

Design strategies to restore natural habitats in biophilic cities aim to re-establish and enhance natural ecosystems within the urban environment. These strategies focus on promoting biodiversity, preserving native flora and fauna, and creating spaces that mimic natural habitats.

By implementing these design strategies, biophilic cities can actively restore natural habitats, promote biodiversity, and support the coexistence of urban environments with thriving ecosystems. These efforts not only benefit wildlife but also enhance the overall well-being and quality of life for city residents by fostering a stronger connection to nature.

URBAN COMPONENTS

Urban components provide opportunities for creating suitable habitats for native flora and fauna within the urban environment. These components may include :

- ☐ Living walls and vertical gardens
- ☐ Green Roofs and Rooftop Gardens
- ☐ Urban forests and Tree Canopies
- ☐ Green Spaces and parks
- ☐ Habitat-Friendly Lighting fixtures
- ☐ Ponds, Lakes, and Water Features
- ☐ Urban wetlands
- ☐ Insect Hotels and Pollinator Gardens
- ☐ Wildlife Crossings and Green Corridors
- ☐ Rain Gardens with native plants

H2: Restorative natural habitats

DESIGN STRATEGIES

- ☐ Direct nature experience
- ☐ Enhanced sensory experience
- ☐ Simulated nature
- ☐ Nature views

Design strategies to create restorative natural habitats in biophilic cities focuses on enhancing the sensory connection to natural elements and representations.

By implementing these design strategies, biophilic cities can create sensory restorative habitats that engage multiple senses and enhance the overall well-being of residents.

These sensory experiences foster a deeper connection to nature and provide opportunities for relaxation, rejuvenation, and a sense of tranquility within the urban environment.

Total Credits: 4

URBAN COMPONENTS

Biophilic cities can create sensory restorative habitats that appeal to multiple senses, enhance mental well-being, and foster a deeper connection with nature amidst the urban environment. These components may include :

- ☐ Green Spaces and Urban Parks
- ☐ Sensory water features
- ☐ Fragrant Gardens, Aromatic Trees and Shrubs
- ☐ Natural Soundscape Design
- ☐ Themed Sensory Gardens
- ☐ Urban Forests, Tree Canopies and Wildflower Meadows
- ☐ Natural Art Installations
- ☐ Edible Landscapes
- ☐ Tactile Trails
- ☐ Bird Feeders and Nesting Boxes
- ☐ Living Walls

H3:Bio-Diversity

Total Credits: 4

DESIGN STRATEGIES

- ❑ Plant, Habitat diversity and continuity
- ❑ Habitat-Focused Architecture
- ❑ Elements for species conservation
- ❑ Wild-life friendly infrastructure

Enhancing biodiversity in biophilic cities involves a holistic approach that incorporates various strategies to create a thriving and balanced ecosystem within the urban environment.

Design buildings and infrastructure with features that promote biodiversity, such as green roofs, bird-friendly glass, and wildlife-friendly construction materials.

Focusing on conserving and enhancing populations of specific species that are of particular ecological or cultural importance may involve targeted conservation efforts, such as providing nesting sites for endangered birds or protecting critical habitats for threatened species.

URBAN COMPONENTS

Biophilic cities can create sensory restorative habitats that appeal to multiple senses, enhance mental well-being, and foster a deeper connection with nature amidst the urban environment. These components may include :

- ❑ Native Planting and Habitat Restoration
- ❑ Urban Forests and Green Spaces
- ❑ Pollinator Gardens and Beekeeping
- ❑ Water Features and Wetlands
- ❑ Green roofs and Living Walls
- ❑ Wildlife-Friendly Lighting
- ❑ Wildlife Corridors and Connectivity
- ❑ Birdhouses, Nesting Boxes, and Bat Boxes
- ❑ Urban Agriculture and Community Gardens
- ❑ Community Gardens and Allotments

H4: Direct Nature Experience

DESIGN STRATEGIES

- ☐ Direct access to nature
- ☐ Vertical greening and green roofs
- ☐ Nature in access ways
- ☐ Nature in public spaces
- ☐ Nature-based activities

Supporting direct nature experiences in biophilic cities is essential for fostering a strong connection between individuals and the natural environment.

By implementing these strategies, biophilic cities can create opportunities for residents and visitors to directly engage with nature, fostering a sense of wonder, appreciation, and environmental stewardship.

These experiences have numerous benefits for individual well-being, community cohesion, and the overall sustainability and liveability of the city.

Total Credits: 4

URBAN COMPONENTS

Nature-based Urban components facilitates direct nature experience that can harness Biophilic well-being potentials in sustainable urban context. These components may include :

- ☐ Accessible Green Spaces
- ☐ Nature Trails and Walkways
- ☐ Urban spaces for Waterfront access
- ☐ Outdoor Recreation Spaces
- ☐ Nature Play Areas
- ☐ Community Gardens
- ☐ Green Rooftops and Terraces
- ☐ Urban Farms and Food Forests
- ☐ Ecological Restoration Sites
- ☐ Nature educational spaces and signage

H5: Inter-species connectivity

DESIGN STRATEGIES

- ☐ Animal friendly public spaces in city
- ☐ Animal abodes
- ☐ Animal representations using patterns, forms and textures in the city scape
- ☐ Aquaponics in the landscape

Designing animal-friendly urban elements in biophilic cities involves creating spaces and structures that consider the needs and well-being of various animal species.

By incorporating these design strategies, biophilic cities can create urban elements that consider the needs and well-being of various animal species.

This fosters coexistence between humans and wildlife, supports biodiversity, and contributes to a thriving and harmonious urban ecosystem.

Total Credits: 4

URBAN COMPONENTS

Animal-friendly urban elements in cities are designed to accommodate and support the needs of various animal species. These components may include :

- ☐ Green Spaces and Habitats
- ☐ Animal shelters and nesting spaces
- ☐ Wildlife-friendly Buildings
- ☐ Water Sources
- ☐ Animal Crossings and Wildlife Passages
- ☐ Urban forests and Tree Canopies
- ☐ Vegetated Corridors
- ☐ Urban Agriculture
- ☐ Sensitive Lighting fixtures and controls
- ☐ Nature-based Stormwater infrastructure
- ☐ Bat Roosting Spaces

Habitat Management credits

Total Credits: 6

Engage the local community in biodiversity enhancement efforts through educational programs, citizen science initiatives, and volunteer opportunities. Encourage residents to participate in habitat restoration, wildlife monitoring, and conservation projects.



STRATEGIES

- ☐ Community engagement and education
- ☐ Ecological and sustainable land use planning
- ☐ Restoration, Protection and Conservations programs
- ☐ Long-term Monitoring, evaluation and control
- ☐ Research and citizen science programs
- ☐ Collaboration and Partnerships

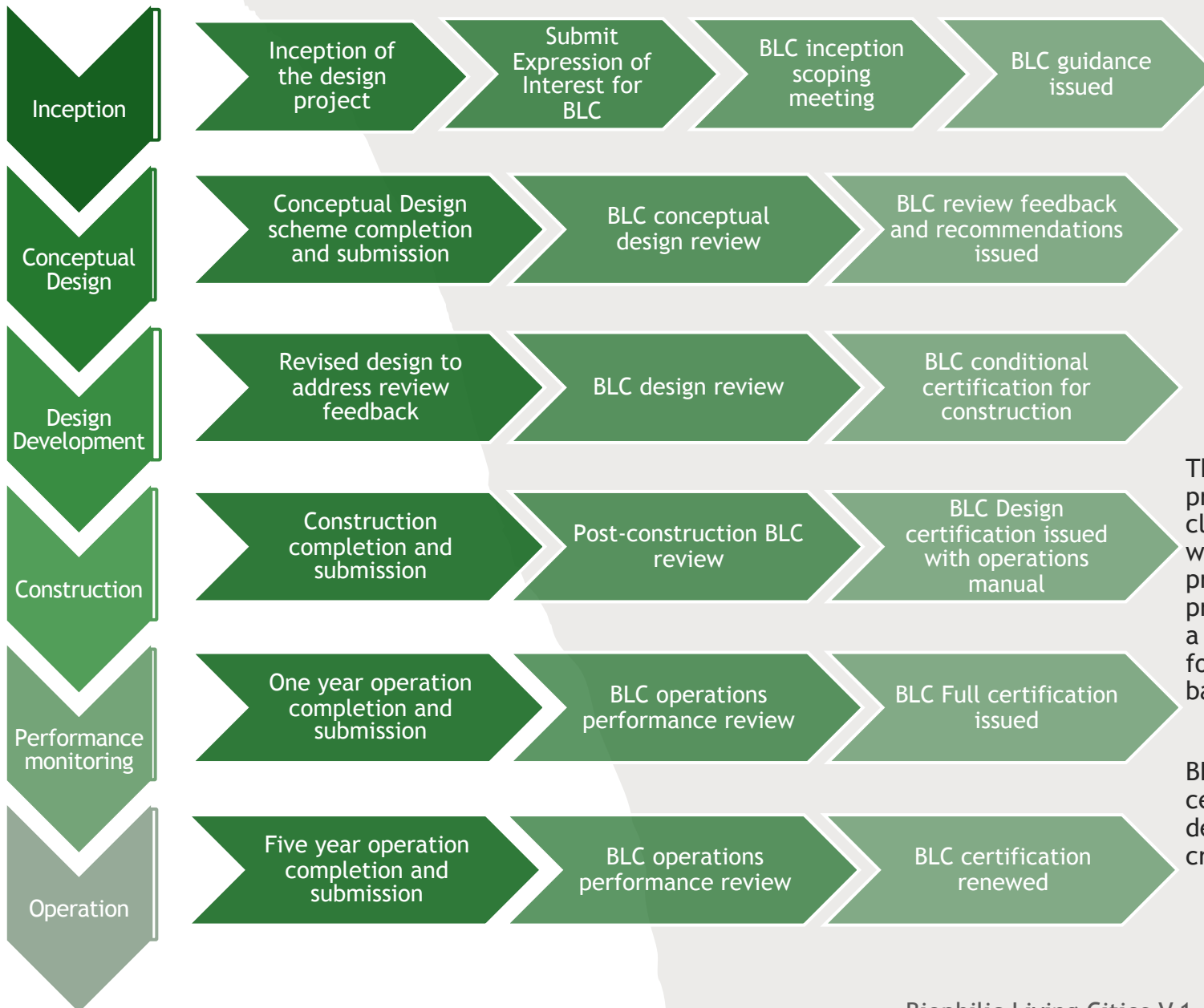
Raise awareness about the importance of biodiversity and its connection to human well-being through public outreach and educational campaigns. Assess the existing natural features and identify areas for restoration or enhancement based on their ecological potential.

Establish monitoring programs to assess the success of habitat restoration efforts and make necessary adjustments to management practices. Engage residents in citizen science programs to monitor and conserve local biodiversity. Community involvement is essential for the long-term success of habitat restoration efforts.

Foster collaboration between government agencies, NGOs, community groups, and academic institutions to leverage resources, expertise, and knowledge for effective biodiversity conservation.

Certification process

PHASES







This is certification process is a self-claiming procedure where it is expected the project team to prepare a report with a self-assessed claim for the certification band.

BLC offer four certification bands depending on the credits obtained.

Credit Bands

This certification process is a self-claiming procedure where we expect the project team to prepare a report with a self-assessed claim for the certification band.

Rating	Credit required	Conditions
7 Leaves 	85%-100%	A least 50% in each category At least 80% in management credits
6 Leaves 	75% - 84%	A least 50% in each category At least 70% in management credits
5 Leaves 	65% - 74%	A least 50% in 3 categories At least 60% in management credits
4 Leaves 	50 % - 64%	A least 50% in 2 categories At least 50% in management credits

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