07. BLUE INFRASTRUCTURE

Blue infrastructure

07.01 Flood defence strategy

Key principles:

Emerging Avon Riversides 2100

Currently, Western Harbour sits within Flood Risk Zone 3 and experiences regular flooding. The AR2100 flood management strategy has been developed by Bristol City Council and the Environment Agency (EA) to help protect the city and its neighbours from rising river flows and tidal surges.

Key outcomes:

01) Deliver the essential AR2100 infrastructure.

02) Establish a continuous flood protection line along the northern bank of the River Avon, stretching from Cumberland Piazza to east of Vauxhall Bridge.

03) Support the installation of new Entrance Lock Gates and the raising of the Brunel Bridge & Sluice Gate levels.

04) Provide a suitable working corridor along the Knuckle Harbour and basin walls for essential harbour maintenance and operational access.

05) Incorporate sustainable drainage systems (SuDS) to capture and treat water runoff naturally within the landscape.

06) Secure safe and accessible routes during extreme weather events, so that walking, cycling, and public transport connections remain open.

"Protecting the entire area and the rest of the neighbourhood from the risk of flooding. That should be the paramount criterion."

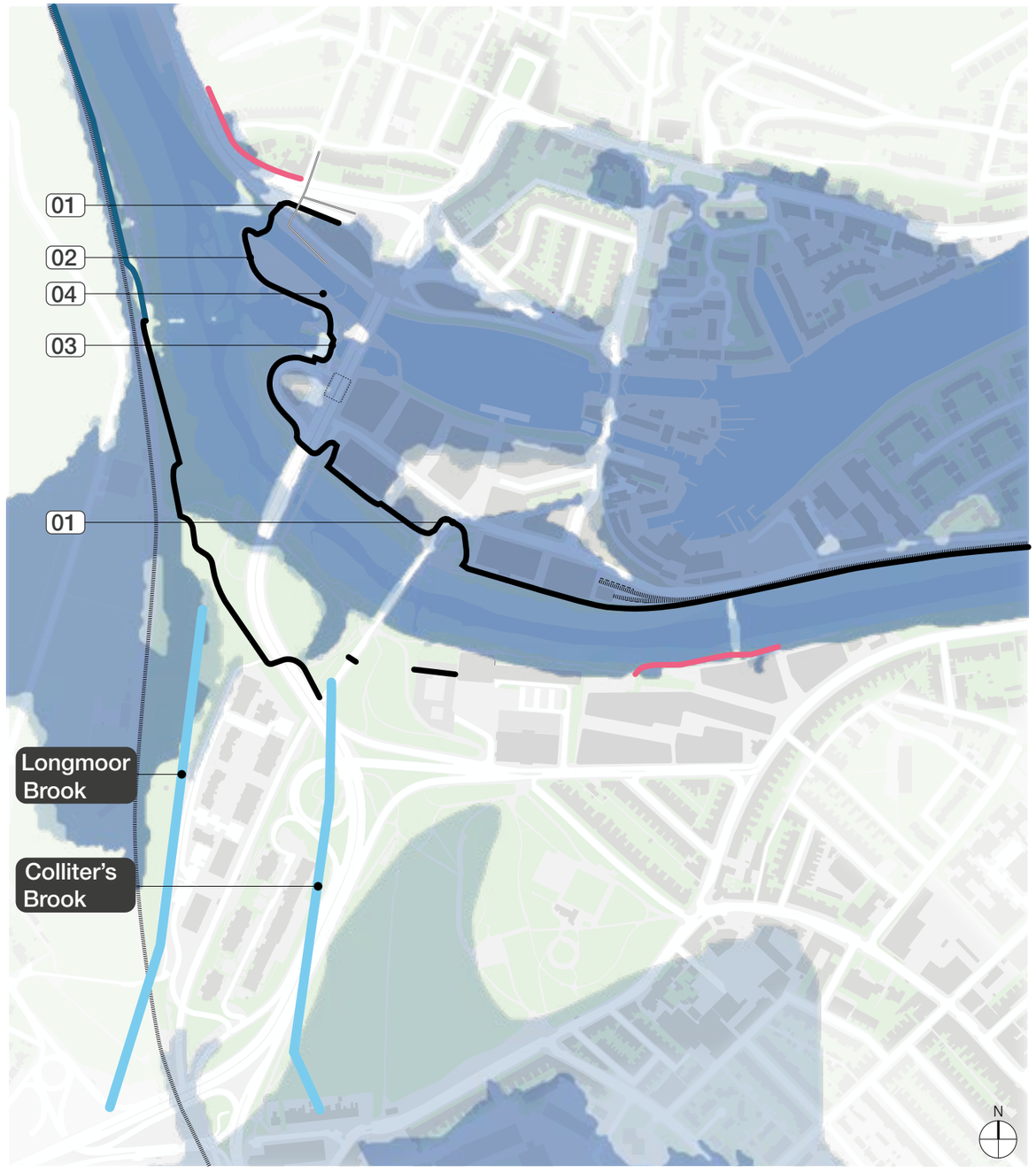


Figure 167: *Diagram showing the location of the proposed AR2100 flood protection*

Key

- AR2100 protection line
- Existing elevated road level
- Existing brook (below ground)
- Flood zone 3
- Flood zone 2

Blue infrastructure

07.01 Flood defence strategy

Flood protection integration

The flood protection infrastructure has been conceived not only as protective engineering but as a defining public realm trail for Western Harbour - an elevated and inclusive waterside route.

The proposed 1km elevated River Avon Trail (see section *04.05)*, which integrates the AR2100 flood protection infrastructure, will vary in height, form, character, and function along its length. The route should connect a sequence of distinctive spaces that foster a balanced relationship between the water, the landscape and urban life.

The Development Framework has identified three locations of particular character and significance:

- **A** The Knuckle
- **B** The Look-Out
- **C** Butterfly Junction Park

Key outcomes:

01) Public realm enhancements that do not compromise the operational or resilience requirements of the AR2100.

02) Continuous public access to the waterside is maintained, making certain that connections are step-free and legible.

03) The flood protection infrastructure includes inclusive and accessible routes to the elevated pathway.

04) Key locations along the route (A, B and C) are celebrated and appropriately integrated.

05) A multifunctional public realm that accommodates informal play, rest points, and opportunities for social interaction.

06) Generous and ecologically rich planting that supports biodiversity while creating a distinctive and legible landscape.

Note: Design and integration of public realm and flood defence to be coordinated with Avon Riversides 2100 project. Separate consultation and engagement on the Avon Riversides 2100 proposals is expected to begin in 2027, when you will have the opportunity to provide feedback on the proposals.

Key

- AR2100 flood protection alignment
- River Avon Trail
- Key location

> *I love the idea of flood defences that embrace the tidal nature of the area and aim to improve it... whilst giving people the opportunity to both appreciate the tides and understand... the tidal ecology.*

Key principles:

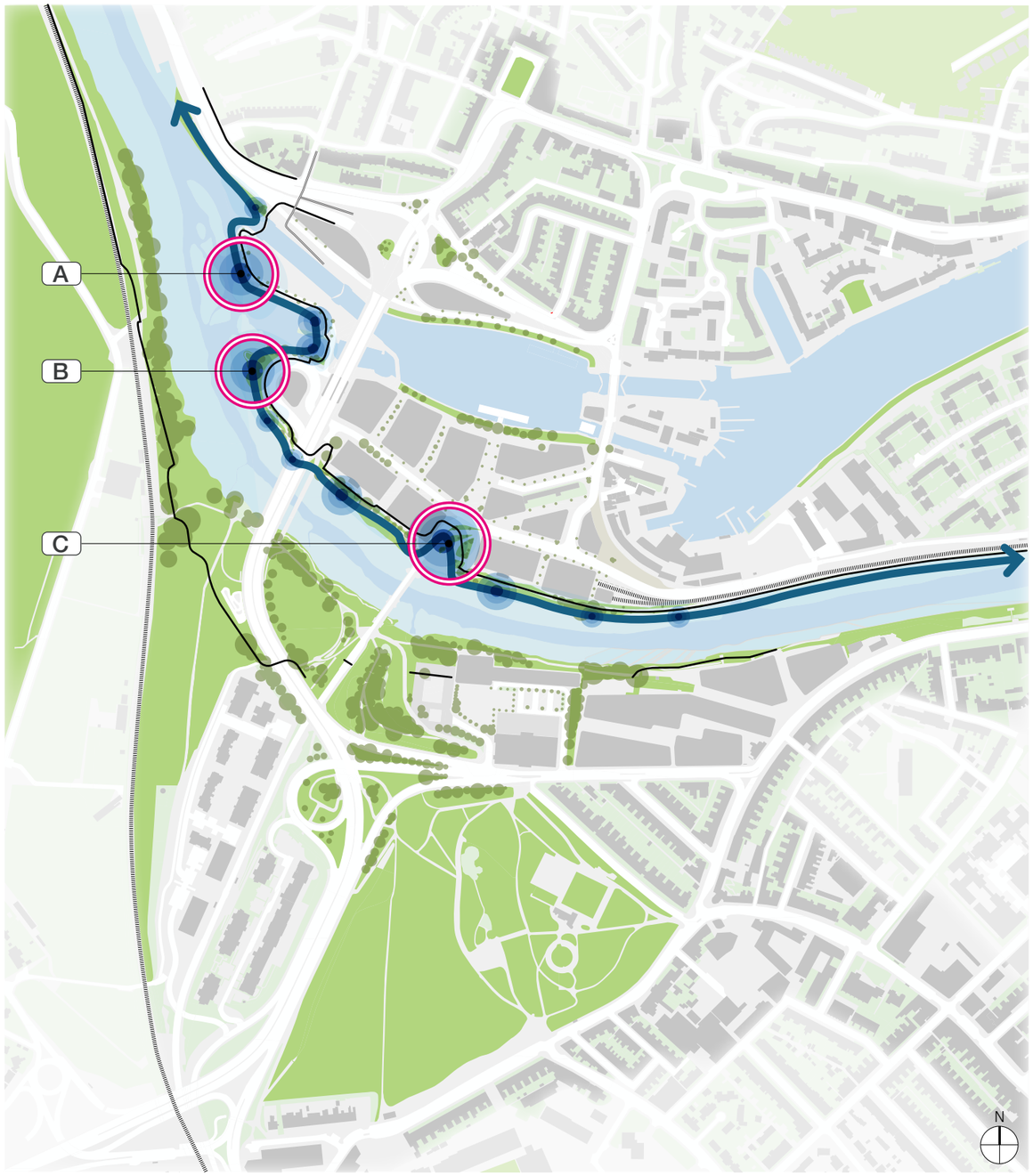


Figure 168: *Illustrative plan of the AR2100 flood protection with key locations identified along the River Avon Trail*

Blue infrastructure

07.02 Flood defence integration

The Knuckle

The Knuckle contains several historic assets including the buried Grade II listed grid iron, the Grade II* Brunel Swivel Bridge (B.o.B), the Grade II* listed Brunel Bridge & Sluice Gate, the historic Brunel brick vaults, basin walls and original street furniture. It also serves as an operational hub with various enclosures, storage containers and parking facilities for harbour employees.

Much of the Knuckle is in need of maintenance or replacement, part of which will take place within the AR2100 project. This space will integrate high-quality landscape, ramps and steps to create an accessible and engaging public environment.

The Knuckle - A Future Vision:

01) The elevated walkway will provide protection against future flooding.

02) An elevated platform for people to watch the harbour operations in action.

03) Pockets of landscaping with integrated seating can offer spaces for rest and reflection.

04) Repairing the sluice gates to reveal the historic grid iron.

05) Integrating the restored Brunel Swivel Bridge

06) Informative signage about the engineering history.

07) Fully accessible walkways across the harbour locks.

08) Potential for harbour operations storage under the elevated walkway.

09) Improved sluice operations can increase the depth of the water polo pool, improving safety and flexibility for recreational use.



Figure 169: *The Greek Vessel Panagiotis 9 on the grid iron © Port of Bristol Authority*



Figure 170: *Basin in front of sluice gates clear from silt © Historic England Archive*

> *The area around the lock/knuckle walls, hopefully this can be improved during the flood wall build, as this area is a little tired and should be a jewel in the crown of the area.*

Note: Design and integration of public realm and flood defence to be coordinated with Avon Riversides 2100 project. Separate consultation and engagement on the Avon Riversides 2100 proposals is expected to begin in 2027, when you will have the opportunity to provide feedback on the proposals.

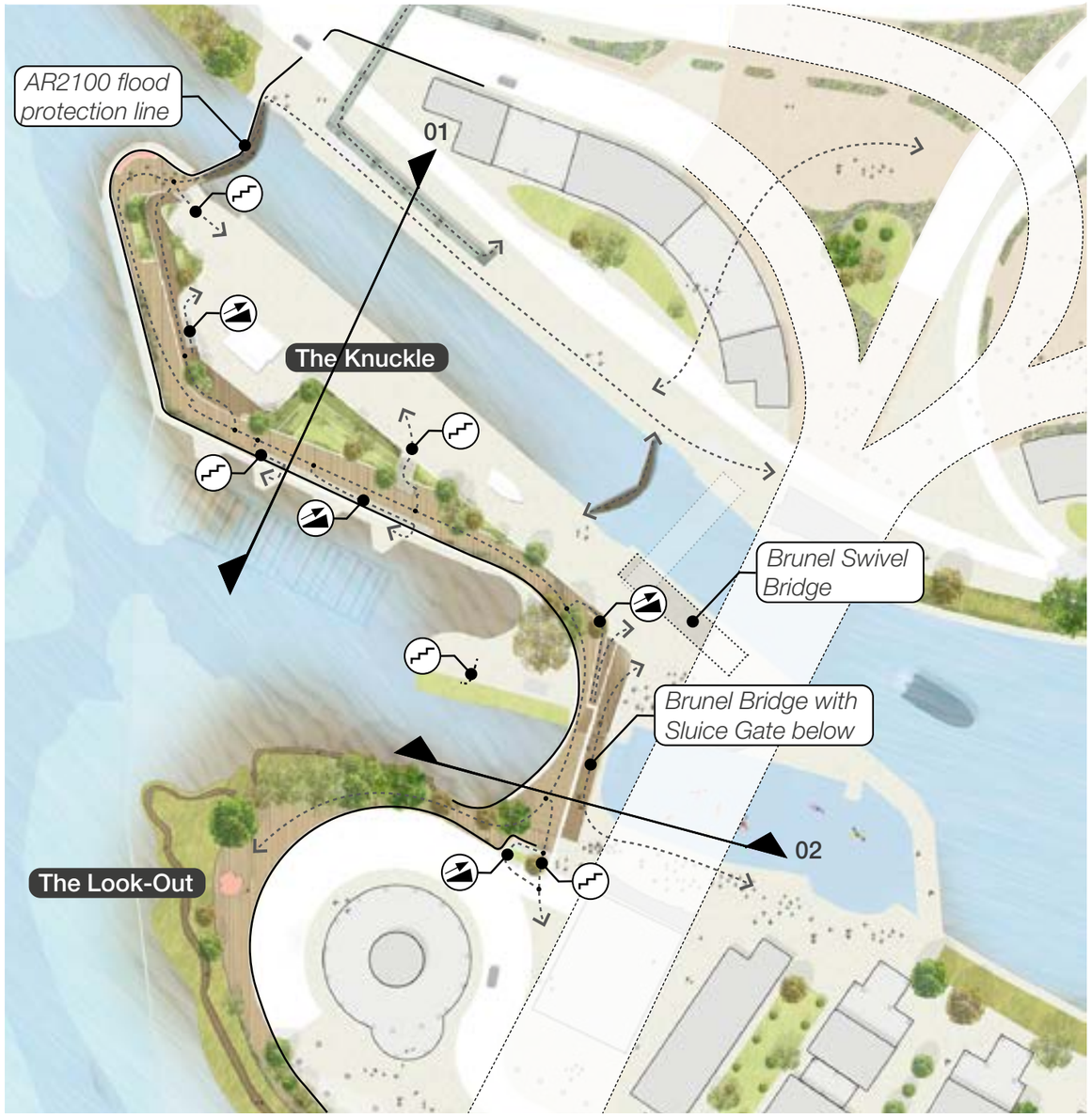


Figure 171: *Illustrative plan of The Knuckle and sluice gate connection to The Look-Out*

Blue infrastructure

07.02 Flood defence integration

Note: Design and integration of public realm and flood defence to be coordinated with Avon Riversides 2100 project. Separate consultation and engagement on the Avon Riversides 2100 proposals is expected to begin in 2027, when you will have the opportunity to provide feedback on the proposals.

> *Any building on the Knuckle needs to allow sufficient space for people to walk / cycle / run / wheelchair or pram around it safely in flood.*

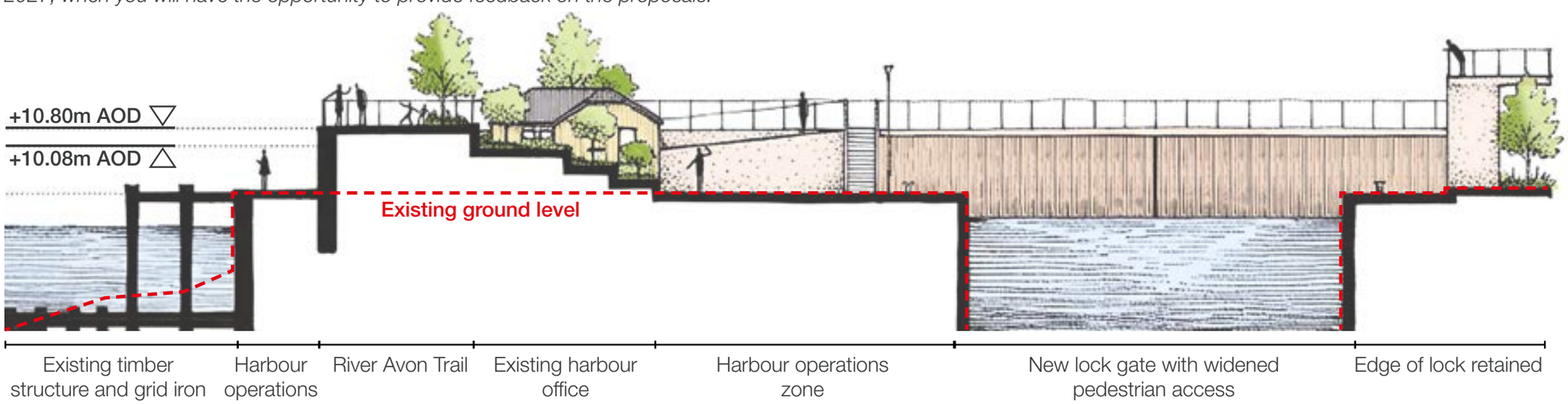


Figure 172: *Section 01 through The Knuckle illustrating the River Avon Trail raised park*

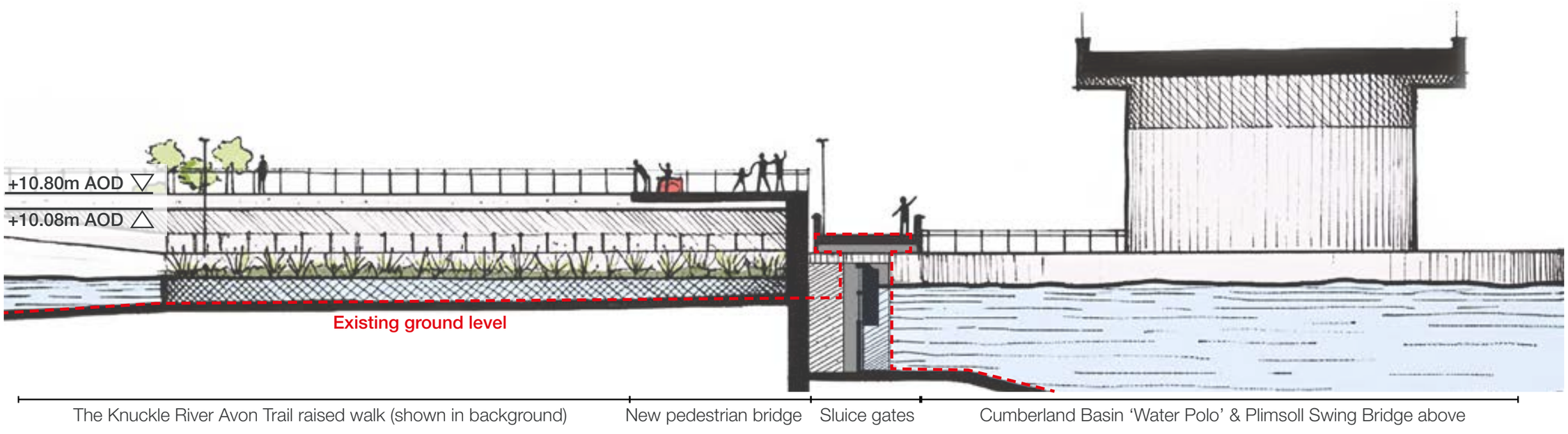


Figure 173: *Section 02 through The Knuckle illustrating the aspiration for a new pedestrian bridge that would provide a connection between the Knuckle and the Look-Out along the River Avon Trail*

Blue infrastructure

07.02 Flood defence integration

I think it important to de-silt the old lock and grid iron. There could then be an information board explaining that the lock gates were installed by John Armstrong, who later went on to supervise Isambard Brunel on the Thames Tunnel, and after that became Bristol City Engineer.

Key principles:

The Knuckle: Brunel Bridge & Sluice Gates

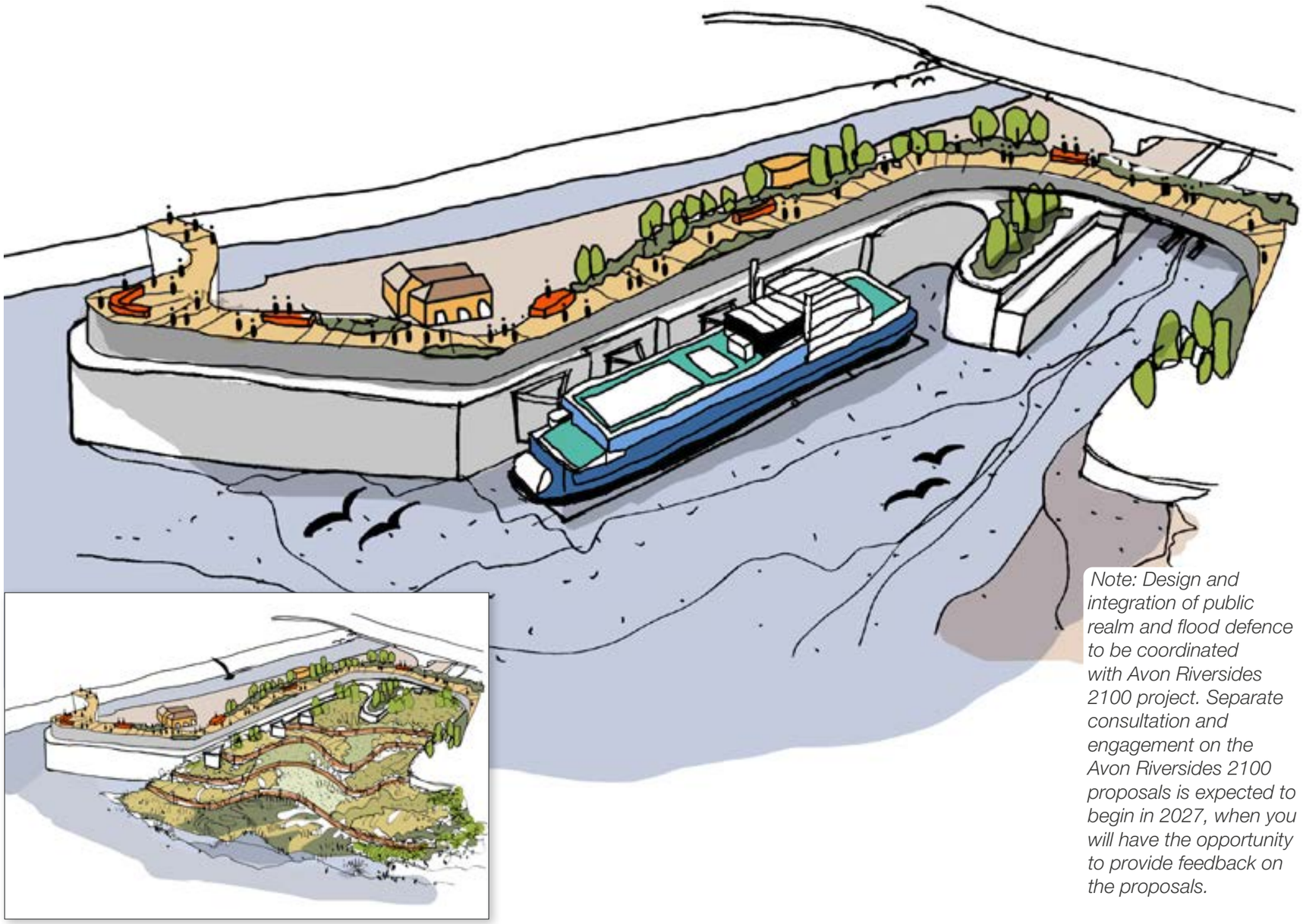
The area around the Knuckle presents a variety of options, including the reinstatement of the Brunel Bridge & Sluice Gate to reveal the historic grid iron, or helping the space become an ecological habitat. Any options will need to integrate the AR2100 flood protection strategy.

Delivery of this flood protection infrastructure is essential to protect the city centre and unlock development. Its integration with the River Avon Trail creates a continuous and accessible route punctuated by areas for rest, planting and informal gathering.

Brunel Bridge & Sluice Gate historically managed water levels within Cumberland Basin. Following a technical failure the sluices are no longer operational. Sediment has now accumulated enabling the expansion of intertidal mudflats that now form part of a Strategic Nature Area.

Alternatively, should the sluices not be reinstated, the retained sediment could be shaped to form a series of intertidal terraces. Brushwood fascines secured with chestnut posts could be used to stabilise material, diversify habitat conditions and support ecological function, while maintaining the environmental integrity of the river corridor.

% Over 70% of respondents felt that The Draft Masterplan did a reasonable job, or better, of integrating the raised flood defences with a river walk to better connect to the waters edge



Note: Design and integration of public realm and flood defence to be coordinated with Avon Riversides 2100 project. Separate consultation and engagement on the Avon Riversides 2100 proposals is expected to begin in 2027, when you will have the opportunity to provide feedback on the proposals.

Figure 174: *Illustrative sketches show the revealing of the grid iron or creation of intertidal terraces*

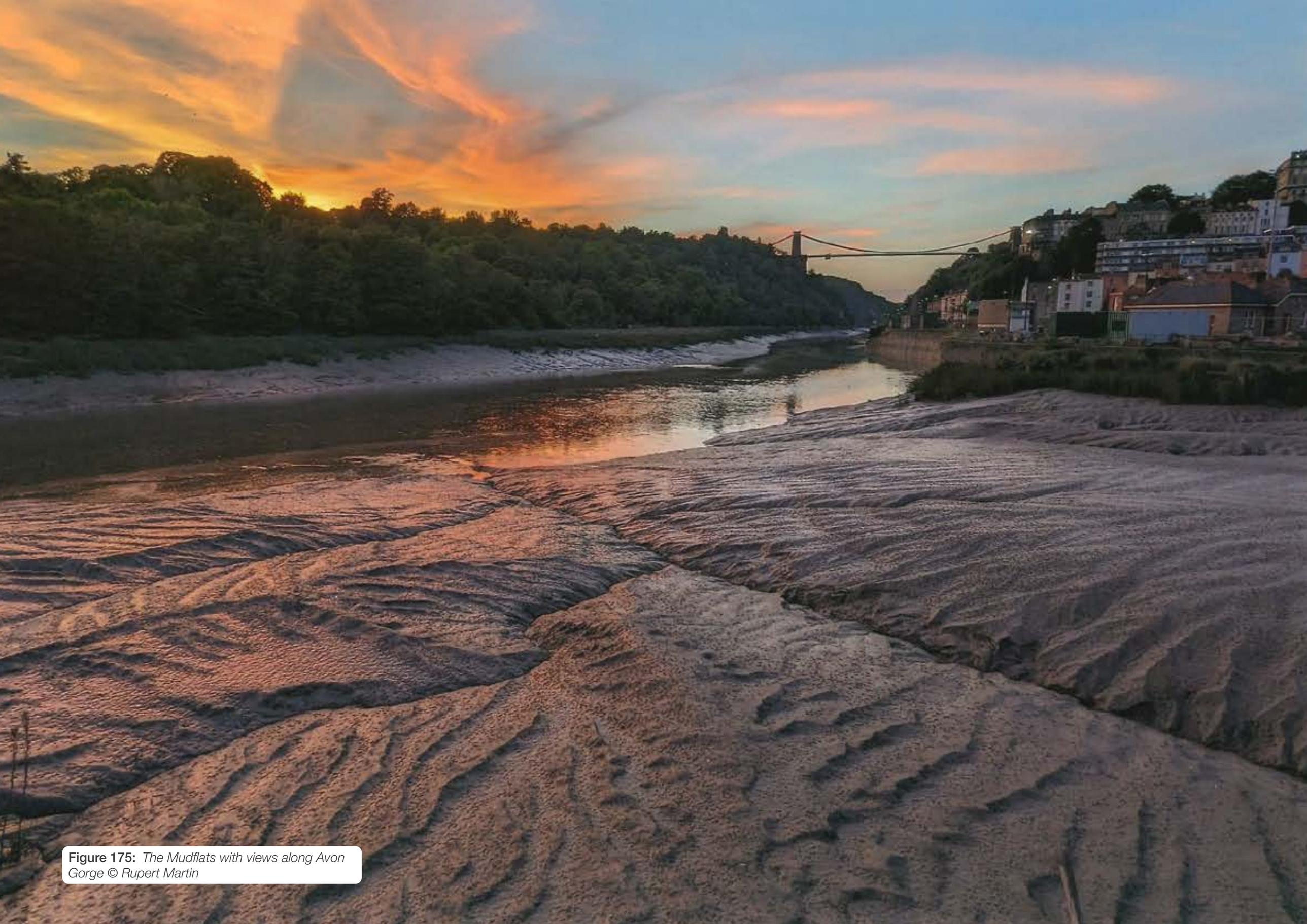


Figure 175: *The Mudflats with views along Avon Gorge © Rupert Martin*

Blue infrastructure

07.02 Flood defence integration

Western tip of Spike Island

This celebrated viewpoint of the Clifton Suspension Bridge and Avon Gorge is marked by Dame Sylvia Crowe's Look-Out point.

Refurbishment of The Look-Out sculpture, with potential for new seating and climate resilient planting.

The Lookout - A Future Vision:

01) During a high flood event the tip of Western Harbour will be temporarily flooded with an alternative dry further inland.

02) New seating could be provided to take in the iconic views.

03) A new footbridge parallel to Avon Fixed Bridge could provide a new connection to Ashton meadows.

04) Stairs and ramps provided where required to accommodate level accessibility across the level changes.

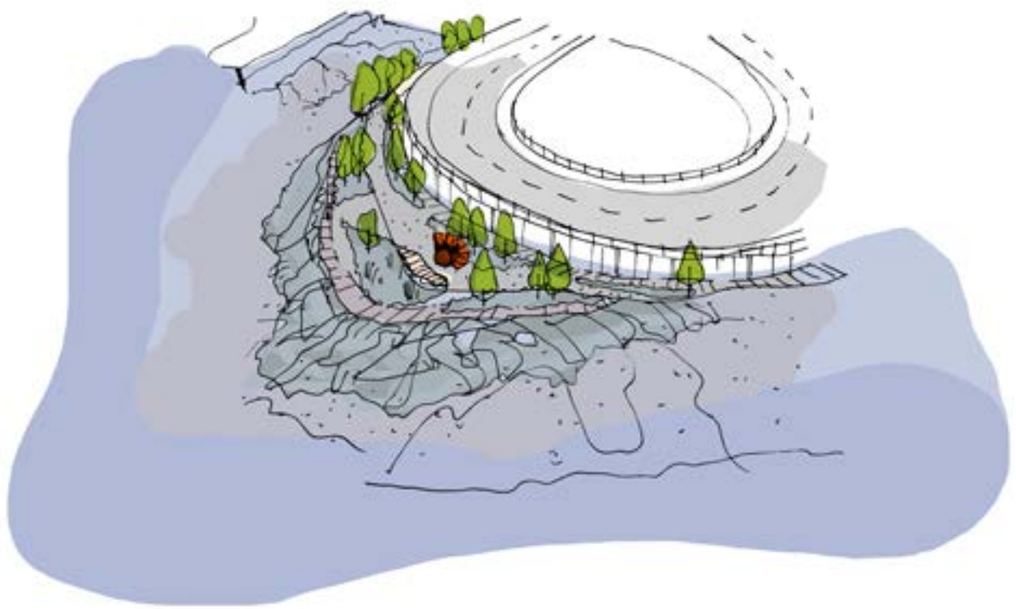


Figure 176: *Illustration of The Look-Out during a high flood event*

"The proposed new footbridge would be very helpful, the concept of the flood defences is great, and the idea of a public rooftop terrace for the new large round building looking up the gorge towards the suspension bridge is brilliant."

Note: Design and integration of public realm and flood defence to be coordinated with Avon Riversides 2100 project. Separate consultation and engagement on the Avon Riversides 2100 proposals is expected to begin in 2027, when you will have the opportunity to provide feedback on the proposals.

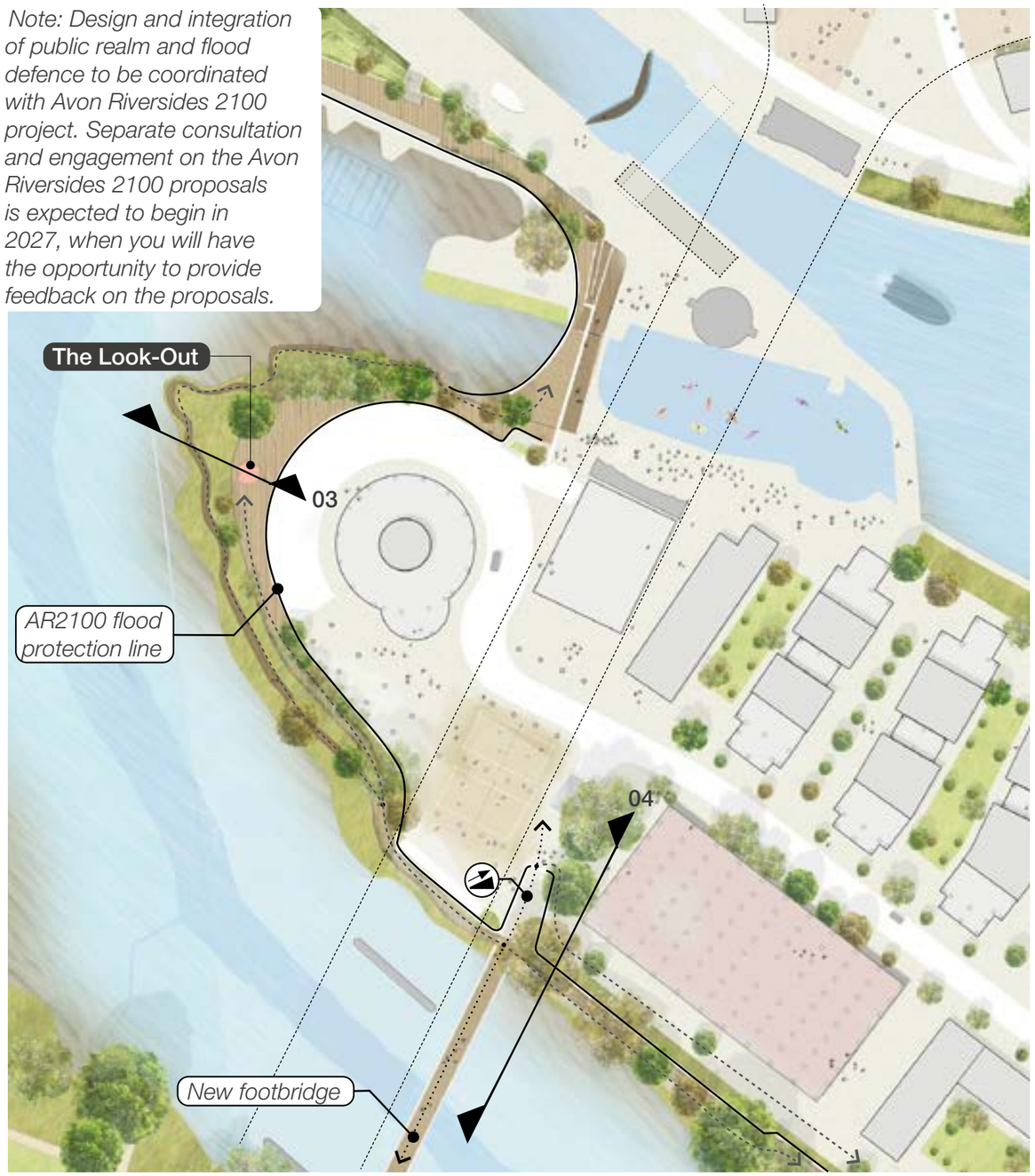


Figure 177: *Illustrative plan of the Look-Out and the adjacent bonded warehouses*

Blue infrastructure

07.02 Flood defence integration

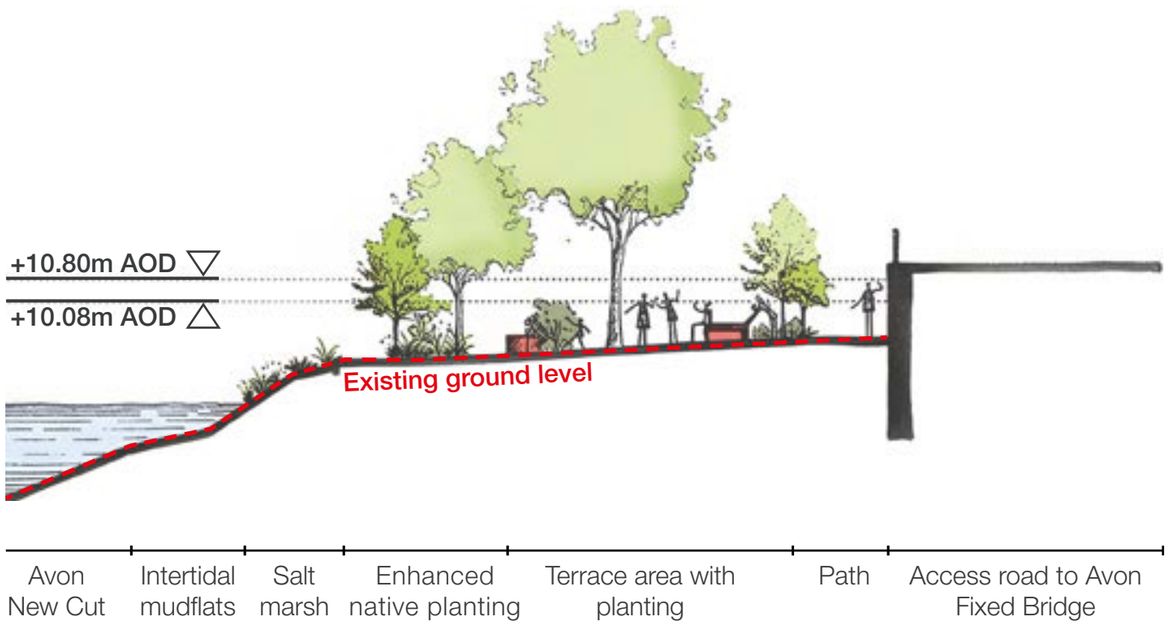


Figure 178: *Section 03 through The Look-Out illustrating a point to celebrate the views toward Clifton Suspension Bridge and Avon Gorge*

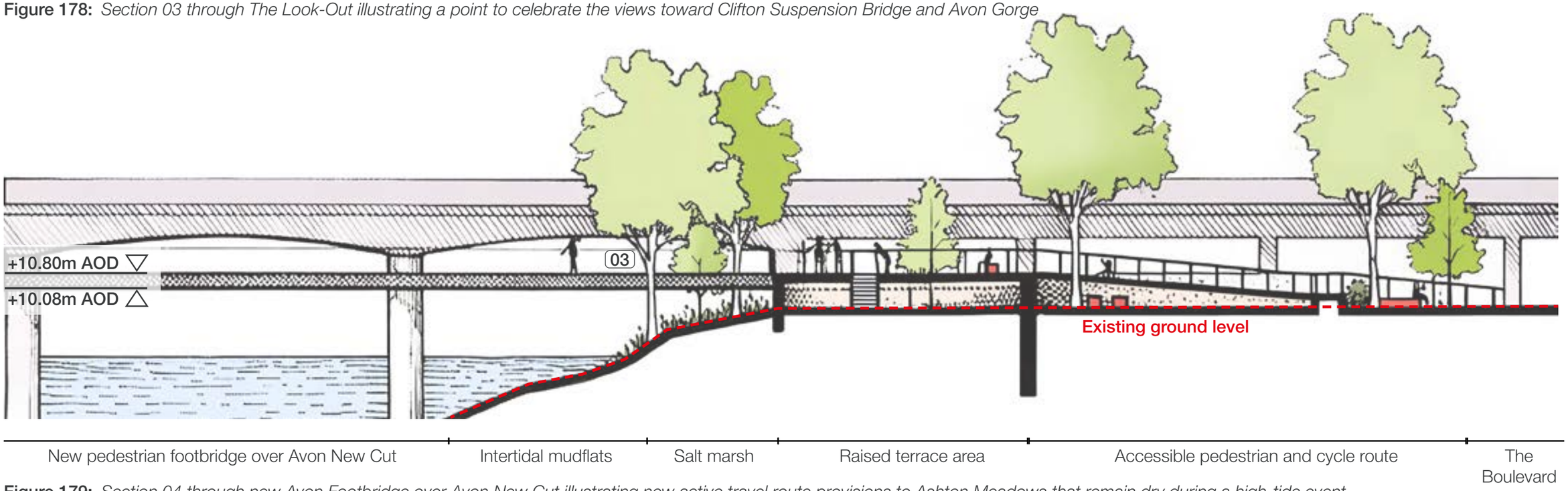


Figure 179: *Section 04 through new Avon Footbridge over Avon New Cut illustrating new active travel route provisions to Ashton Meadows that remain dry during a high-tide event*

> *The historic buildings, historic harbour and iconic views and the position of these in both the landscape and cityscape. It is not only about what is within the boundary as drawn, but also what you see from the area looking out.*

Note: Design and integration of public realm and flood defence to be coordinated with Avon Riversides 2100 project. Separate consultation and engagement on the Avon Riversides 2100 proposals is expected to begin in 2027, when you will have the opportunity to provide feedback on the proposals.

Blue infrastructure

07.02 Flood defence integration

Northern bank of Avon New Cut

Butterfly Junction Park will be a vibrant riverside destination located at the intersection of the Ashton Avenue Bridge and the River Avon Trail.

Butterfly Junction Park - A Future Vision:

01) The continuous River Avon Trail is elevated and projected over the flood protection line.

02) Saltmarsh habitats are sensitively addressed and planted with flood and climate resilient species to maintain the riverbank habitat.

03) During flooding Ashton Avenue Bridge could flood and the MetroBus service would be suspended or re-routed.

04) The River Avon Trails dry walking route continues west to Avon Fixed Bridge where an alternative permanently dry route diverts to Ashton Meadows.

05) Spaces for people to dwell, socialise and play integrated on route.

06) Ground raised c.1.5m above existing ground level providing accessible and inclusive access to the bonded warehouses.

07) Places to drop down from the dry route and engage with the water.

08) MetroBus and active travel route from Ashton Avenue Bridge features a gentle and accessible slope over the raised flood protection level.



Figure 180: *Illustration of Butterfly Junction Park during a high flood event*

"Use this as an opportunity to increase and link up biodiversity. Put the river banks and Butterfly Junction at the heart of this."

Note: Design and integration of public realm and flood defence to be coordinated with Avon Riversides 2100 project. Separate consultation and engagement on the Avon Riversides 2100 proposals is expected to begin in 2027, when you will have the opportunity to provide feedback on the proposals.

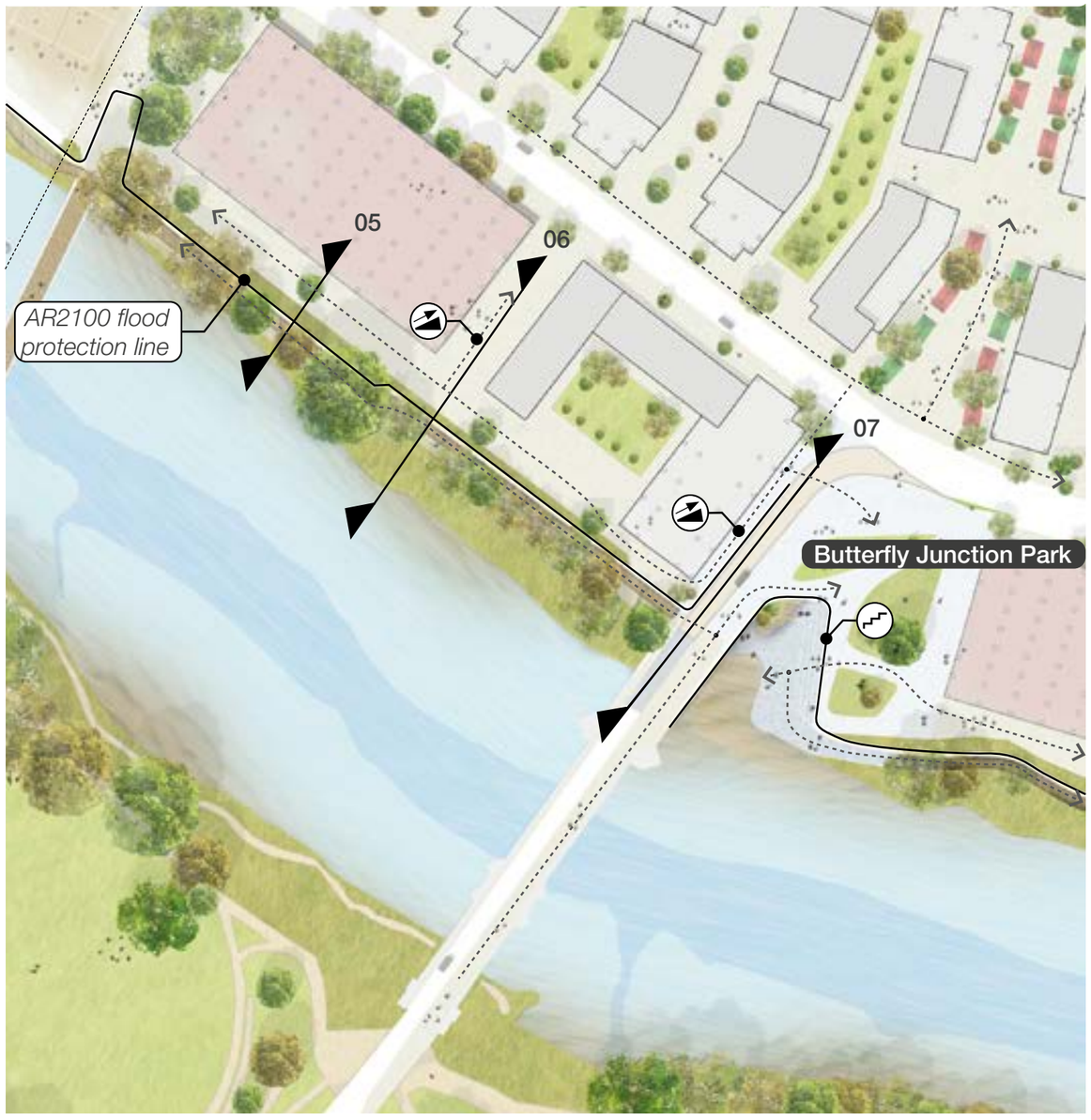


Figure 181: *Illustrative plan of Butterfly Junction Park and the adjacent bonded warehouses*

Blue infrastructure

07.02 Flood defence integration

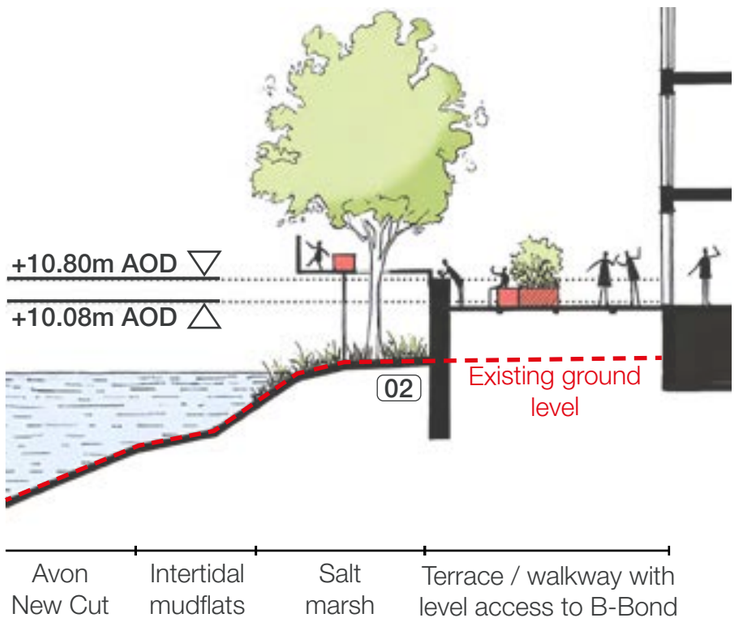


Figure 182: *Section 05 through B Bond*

Note: Design and integration of public realm and flood defence to be coordinated with Avon Riversides 2100 project. Separate consultation and engagement on the Avon Riversides 2100 proposals is expected to begin in 2027, when you will have the opportunity to provide feedback on the proposals.

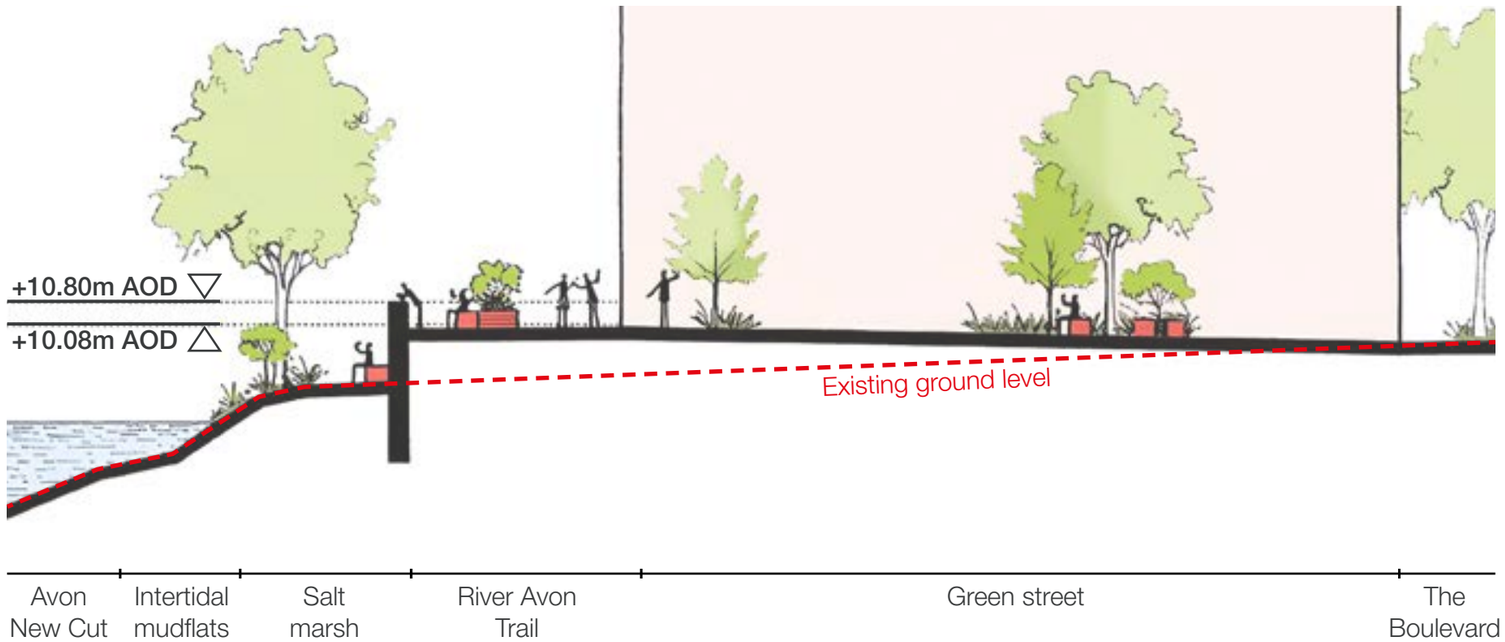


Figure 183: *Section 06 through green street providing an accessible route between the Boulevard and the River Avon Trail*

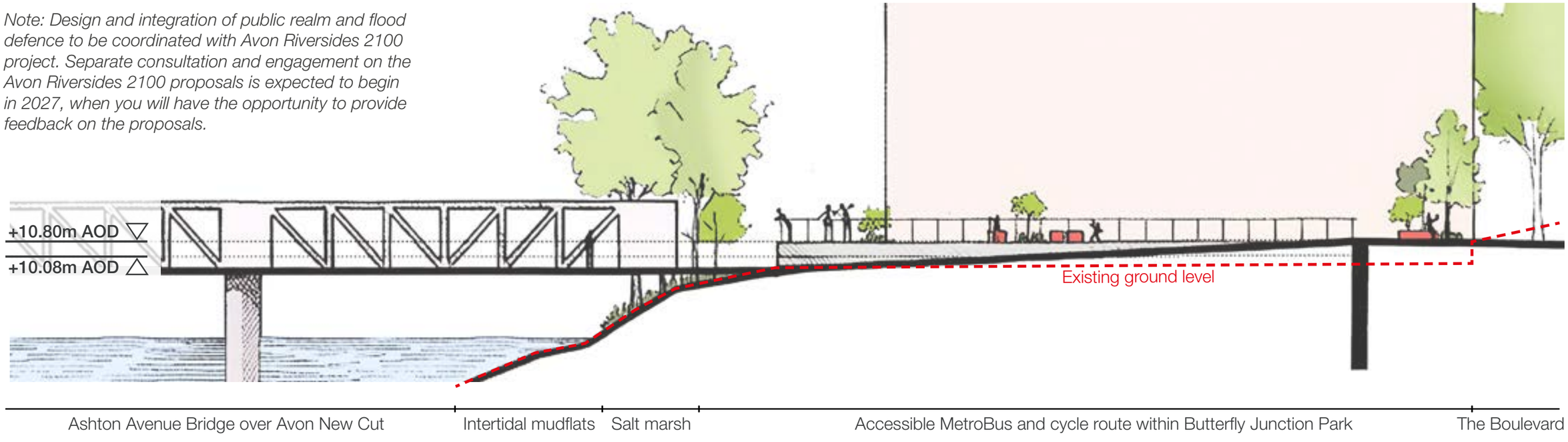


Figure 184: *Section 07 through Butterfly Junction Park illustrating the accessible journey along the MetroBus route between Ashton Avenue Bridge to the Boulevard*

Blue infrastructure

07.03 Wider landscape resilience

Climate change is happening now, not at some remote point in the future; our species' situation is now, thanks to years of inaction, rather desperate.

Key principles:

Sustainable urban drainage systems (SuDS)

Sustainable drainage systems (SuDS) will provide a beautiful network of landscape features that celebrate Western Harbour's close relationship with the water. By weaving a landscape-led drainage network into the public spaces around Cumberland Basin, we can build long-term flood resilience while creating distinct, nature-rich, neighbourhoods.

Key outcomes:

- Integrate natural water management features such as swales, wetlands, and permeable surfaces directly into the waterfront and public squares.
- All new developments must connect with the wider Western Harbour drainage network - supporting a site-wide approach to managing the River Avon's tidal nature and local rainfall.
- Transform functional infrastructure into attractive public amenities, actively reducing runoff while providing habitats for local wildlife.
- Establish a connected network of practical and visually appealing water management features that reinforce the richness and legibility of Western Harbour's character.



Figure 185: *Rain Garden in the street, Sheffield Grey to Green Project © Sheffield City Council*



Figure 186: *Creative planting incorporating SuDS © SLR*

Resilience

To future-proof Western Harbour against rising temperatures, more intense rainfall, and drier summers our green spaces must be robust and adaptable. This means creating an urban landscape that actively cools the environment and supports Bristol's wider ecological ambitions.

Key outcomes:

- Plant climate-resilient urban trees and pocket parks to provide shade, improve air quality, and offer comfortable spaces during hotter months.
- Design public realm planting to maintain clear sightlines, securing safety and accessibility while delivering colour, seasonal variation and ecological richness.
- Maximise biodiversity by prioritising habitats for the *Bristol Local Biodiversity Action Plan* priority species and embedding wildflower planting and native hedgerows along active travel routes.
- Introduce rain gardens as climate-adaptive landscape features integrated with wider SuDS strategies.



Figure 187: *Opportunities for Floating habitats within Cumberland Basin © SLR*



Figure 188: *New Tree and understory planting to be wildlife friendly and climate resilient © SLR*

Figure 189: *Krøyer's Square - precedents of a climate adapted urban space © Vilhelm Lauritzen Architects & COBE © Photo by Rasmus Hjortshøj*