CASE STUDY

Improve channel geomorphology to create habitat

Project Summary

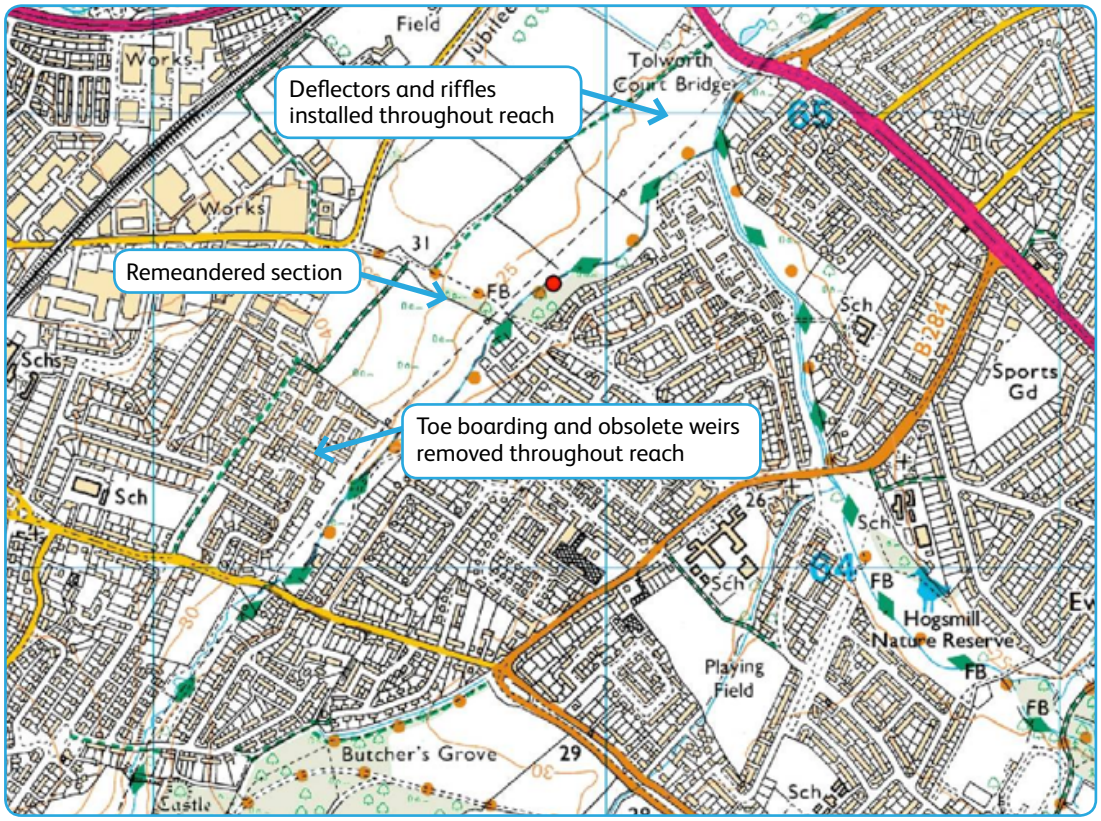
Title: Bonesgate Stream Restoration Sscheme
Location: Bonesgate Stream, West Ewell, Surrey, England
Cost of technique: ££
Overall scheme cost: ££££
Dates: 2008

Mitigation Measure(s)

Improve channel geomorphology to create habitat
Use green engineering techniques instead of hard bank protection

How it was delivered

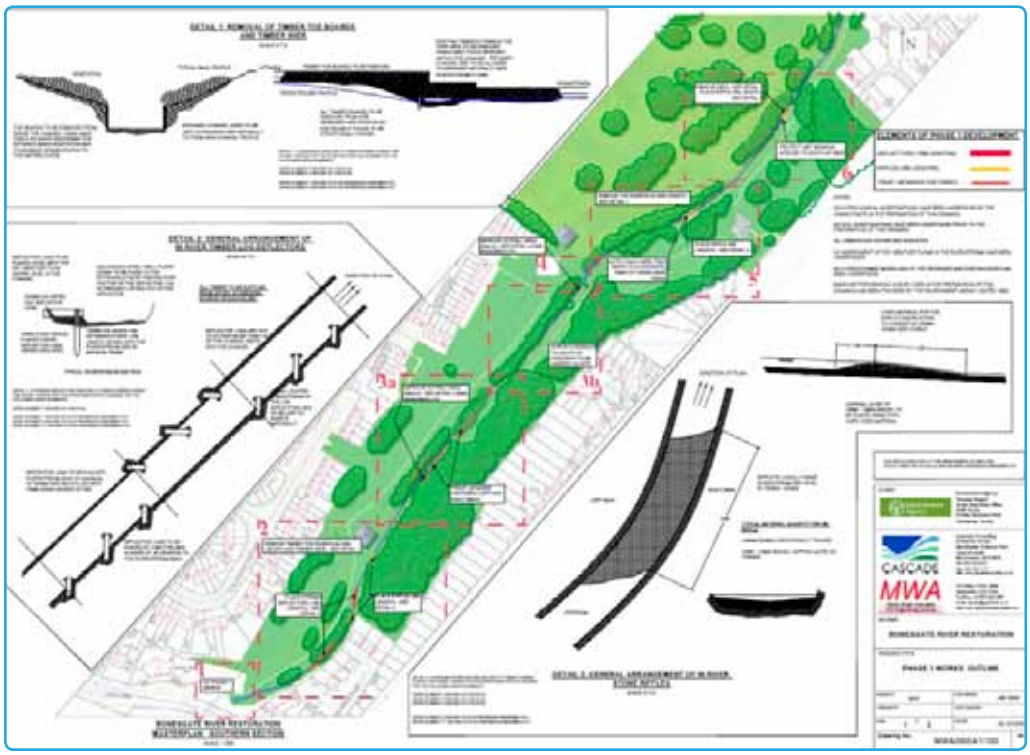
Delivered by: Environment Agency
Partners: Cascade Consulting, Martin Wright Associates

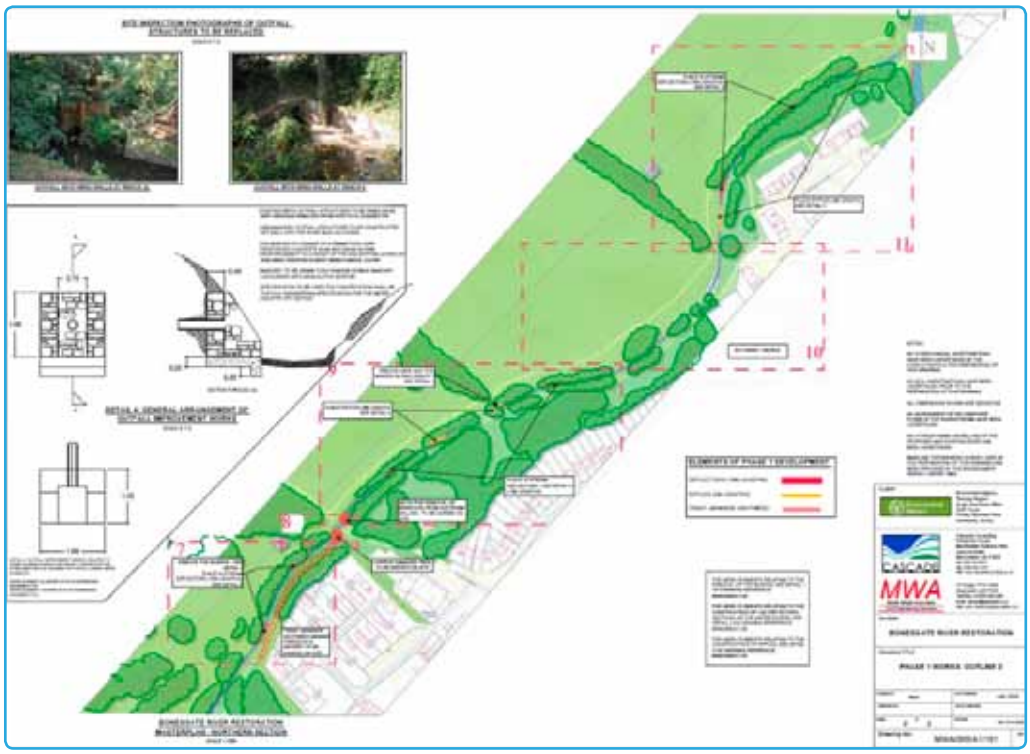


Overview of Bonesgate Stream restoration

Background and issues

The Bonesgate Stream was historically modified to improve drainage in the neighbouring urban areas. The stream was designated as a main river in 2005, and responsibility for its maintenance was passed to the Environment Agency. The Environment Agency instigated a river restoration scheme in 2008 to improve the ecological value of the watercourse and return its geomorphology to its pre-modification (1859) character. The pre-restoration channel consisted of a narrow, steep sided ditch that had been historically straightened to increase the conveyance of flood flows. In order to reduce the gradient, the pre-restoration channel contained six concrete step weirs at intervals of approximately 200 m.





Details of restoration plan for Bonesgate Stream

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Step-by-step

Approximately 0.8 km of the Bonesgate Stream at the downstream end was restored by the Environment Agency in 2008. The aim of the project was to recreate some of the historical course of the river, identified from the 1859 historical mapping. The following construction took place:

- The weirs were removed. This involved either in situ crushing, leaving some parts in the stream, or complete removal from the stream.
- Meanders were reinstated along one section of the stream – two stage channel for these sections.
- The toe-boards were removed (entirely in some sections, but in others, sections remain in situ).
- Two different designs for log flow deflectors were installed in four locations in sets of threes, made from the conifer trees removed from part of the bank – small deflectors and large 'box' deflectors.
- Gravel riffles were constructed.

(1) Reach where toe-boarding has been removed; (2) pine-box deflectors backfilled with gravel; (3) small flow deflectors; (4) artificial riffle in a straightened section of the channel; (5) remeandering of previously straightened channel; (6) former location of weir with concrete base and banks retained.

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Benefits

- Toe board removal has increased flow and geomorphological variability at the channel margins, resulting in undercutting a short distance up and downstream.
- Deflectors have locally increased flow diversity and resulted in localised erosion and bank retreat (the small deflectors have achieved this to a greater extent than the larger ones, which are above normal low flow levels).
- The new riffles locally increase flow diversity, changing slow, uniform glide flows into swift, shallow riffle flows, although they remain as static features and have not yet dynamically joined up with the wider river system.
- Remeandering has locally increased sinuosity and flow diversity.
- The removal of weirs has increased upstream flow diversity, and also bed scour and bank adjustment where hard bank protection has also been removed

Improved channel conditions resulting from mitigation measures outlined above.

Lessons Learnt

- The large deflectors and riffles used in this scheme are not appropriately scaled to the channel, resulting in a degree of ineffectiveness and a failure to become properly incorporated into the channel system. Deflectors need to be appropriate scaled to a scheme to be successful.
- The effectiveness of the toe boarding removal could be enhanced if the protection was removed from the entire reach, rather than in a more sporadic fashion.
- The effectiveness of the measures is likely to be limited by the continued presence of the flow control structures upstream of the restoration reach, which constrain the conveyance of coarse sediment downstream.

Project contact: Fisheries and Biodiversity team, South Thames Region, Environment Agency