Susdrain – Celebrating SuDS –
Converting challenges to opportunities

Roger Nowell – SuDS Officer Sheffield City Council

GREY to GREEN
WEST BAR to CASTLEGATE

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-- Strategic pedestrian links within Sheffield city centre --
- Gold Route
- Steel Route

PROJECT AREA
The Area’s Context

CONSTRAINTS
- Redundant highway capacity, poor image
- 2007 Flood Legacy

OPPORTUNITIES
- Developing Riverside character
- Large Scale development opportunities (West Bar)

The Layered approach

Limited spaces, multiply uses and functions while still creating a strong sense of place. To deliver:

- Economic regeneration
- Connectivity
- Clean air
- Water management,
- Habitat
- Safe attractive recreational space
- Health and well being
PRINCIPAL CONCEPTS

• Creating a setting for investment – perception change
• SUDS managing rainwater discharge to the river
• Sustainable transport and connectivity
• Innovative Meadow planting and developing the green linear route theme
• Reclaiming the highways, activating urban spaces that better reflect the surrounding areas opportunities

History of water being part of regeneration
Funding

- ERDF- programme end (07-13) £1million
- Presented an opportunity and a challenge!
- Economic case made for investment
- Sheffield City Region Infrastructure Fund £2.4million – had to underwrite to secure ERDF while case made for SCRIF

Risk taking
Team work
Trust
Long-term view

Client – City Regeneration team
Lead designer – Council Landscape Architects
SuDS support – City Council SuDS Officer
Suds advisory – Professor Nigel Dunnett, University of Sheffield
Planting advisory – RBA, McCloy Consulting
Highways design – Amey

Commitment
SuDS – Advisory and modelling – RBA, McCloy Consulting
CONCEPT MASTERPLAN

Sustainable Drainage

GREY to GREEN

[Diagram showing sustainable drainage systems]
SuDS Rationale

- Regeneration driven as opposed to a solution to a significant water problem
- Enhancing new landscapes as water managers
- Water becoming an asset to new landscape
- Future proofing
- Removing impermeable area
- Removing flow from combined sewer – accumulative benefits – CSO and WWTW
- Returning water to natural catchment

SuDS design advice

- Mimicking nature – keeping water on or near surface;
- Avoiding pushing water underground through conventional gulley/pipes
- Capture and treatment of pollutants
- Interception losses achieved for small events preventing discharge to watercourse
- Controlling flow using shallow landscapes before discharge to river - frequency, rate and volume
Controlling quantities - infiltration

- Contamination doubts – modelling based on sealed system
- Not in favour of sealing – planting viability
- Geo-environmental assessment suggested very low risk of mobilisation
- Site excavation revealed some highly impermeable areas.

Controlling quantities

- Capture is through over-edge sheet flow
- Control delivered through 27 almost level swale cells
- Modelling of inflow and transfer down the system informed resultant controls.
- Protected orifice controls allow accumulation of flows followed by drawdown 2-4 hours
- As inflows increase can overtop check dams – notch weir providing further controlled discharge and top weir and whole weir – sized to avoid flooding of highway
- Robust and fail safe
Art of the possible

- Long sections, cross sections and plans formed the basis of physical input to model.
- Topo for contributing area (soft areas taken as 30% effective in generating run-off). Note upslope overland flow on other side of road.
- Micro-drainage model run for various return periods and durations using variety of controls to determine volumes.
- 30mm -75mm orifice 30mm -50mm notch width.
- Initially sized based on 1 in 30 return.
- Modelled as a series of under-drained swales in series - averaged width and slope.
- Void ratio of growing area material 30% in swale base.
1 in 100 plus 30% for climate change

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<th>Swale Cell</th>
<th>Inflow (l/s) direct runoff to cell</th>
<th>Max Controlled Outflow Rate (l/s)</th>
<th>Max Overflow Rate (l/s)</th>
<th>Max Volume retained (m³)</th>
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1 in 30yr

- Combined Inflow into SuDS
- Final Outflow from SuDS
FLOW CONTROL

Control Flow Chamber
(scale 1:10)

DETAIL H

HOLDING BACK THE FLOW
**COLLECTION & DISPER SAL**

Summary of results

- Peak inflow for the 1 in 30 year 60 minute rainfall event is reduced from 80l/s to 9l/s
- Peak inflow for the 1 in 100 year 60 minute rainfall event is reduced from 115l/s to 14l/s
- Peak inflow for the 1 in 100 year (+30% CC) 60 minute rainfall event is reduced from 150l/s to 18l/s
- 225mm pipe to Don caters for 18l/s – none to combined sewer
- Not greenfield rate but significant reduction
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01/11/2016

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GROWING MEDIUM (Semi extensive medium)
50% 5-20mm Sandstone aggregate, 25% Crushed glass sand, 15% Composted green waste & 10% natural sandy silt loam (max 8% clay)

NURSERY STOCK
NEWWLY PLANTED
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RETAINED SERVICES
GRASS CRETE / GEO GRIDS

ORIGINAL INTENTIONS
INLETS AND OVERFLOWS
Management

• Scheme has been an overall reduction in management resource need for the area
• Initial 3 years of experimental maintenance to refine the optimal regime to take forward in the future
• Cut and collect is main activity
• Provided an opportunity for Amey and Sheffield Council to resolve management issues for a bespoke SuDS
Impacts

• Yorkshire Water taken interest in scheme
• Useful to revisit model as design changes during construction and an allowance for infiltration needed
• What benefits can be attributed to these works, e.g. resilience of combined sewer, microclimate?
Grey to Green 2

• Future challenge making space for cycling – new policy for cycling emerged after design and associated funding case was complete.
• Shared surface for less confident /family cycling
• Very much reduced traffic on highway for others