
GREY to GREEN
WEST BAR to CASTLEGATE
Roger Nowell – SuDS Officer Sheffield City Council


- 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

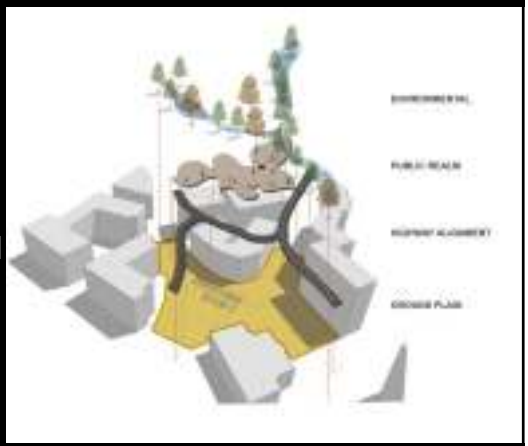
Developing Riverside character

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



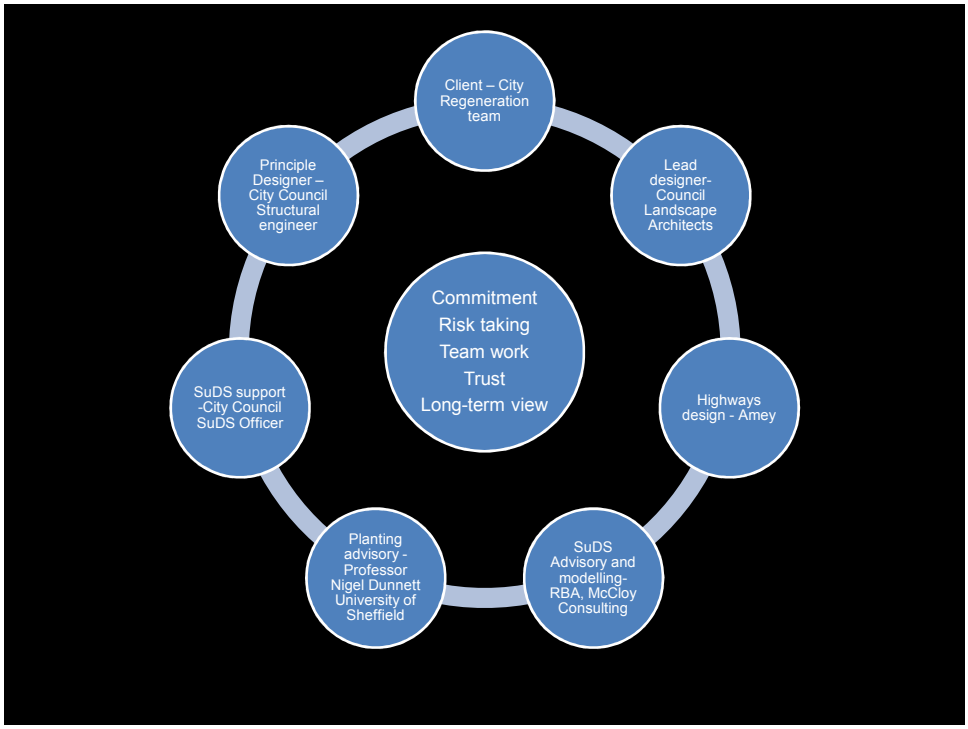
PRINCIPAL CONCEPTS

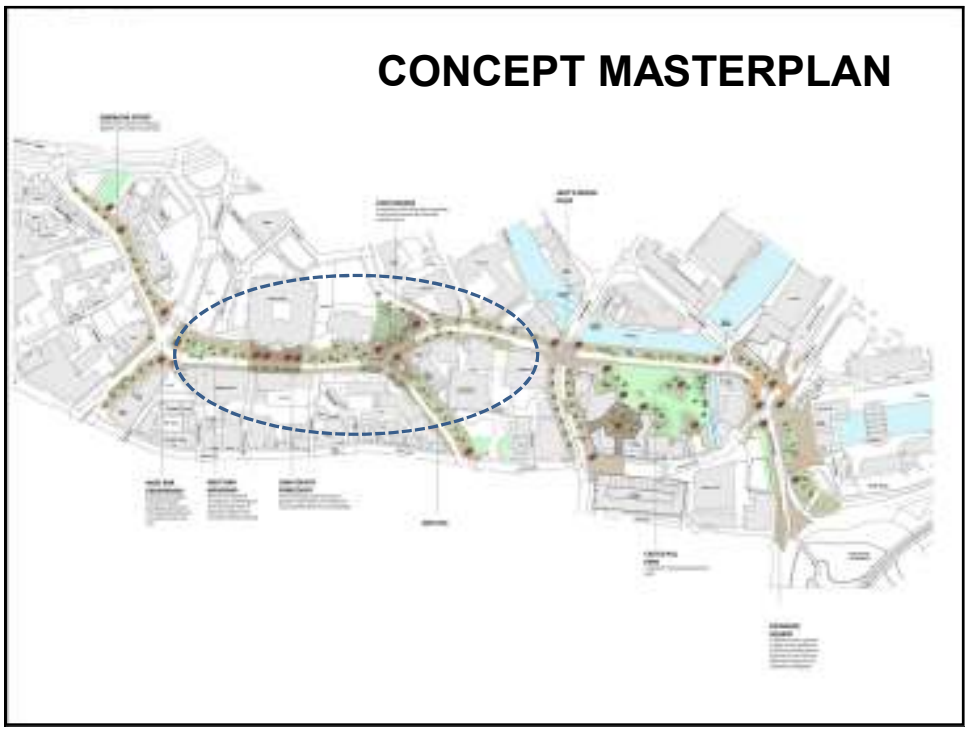
- Creating a setting for **investment – perception change**
- **SUDS** managing rainwater discharge to the river
- **Sustainable transport** and connectivity
- Innovative **Meadow** planting and developing the green linear route theme
- **Reclaiming the highways**, activating urban spaces that better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




CONCEPT MASTERPLAN


Sustainable Drainage
GREY to GREEN

SuDS Rationale

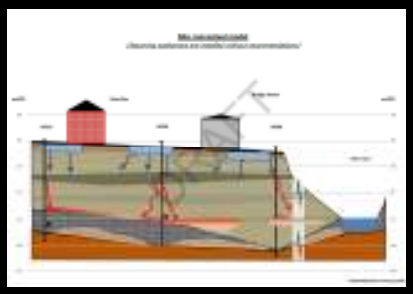
- Regeneration driven as opposed to a solution to a significant water problem
- Enhancing new landscapes as water managers
- Water becoming an asset to new landscape
- Future proofing
- Removing impermeable area
- Removing flow from combined sewer – accumulative benefits – CSO and WWTW
- Returning water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

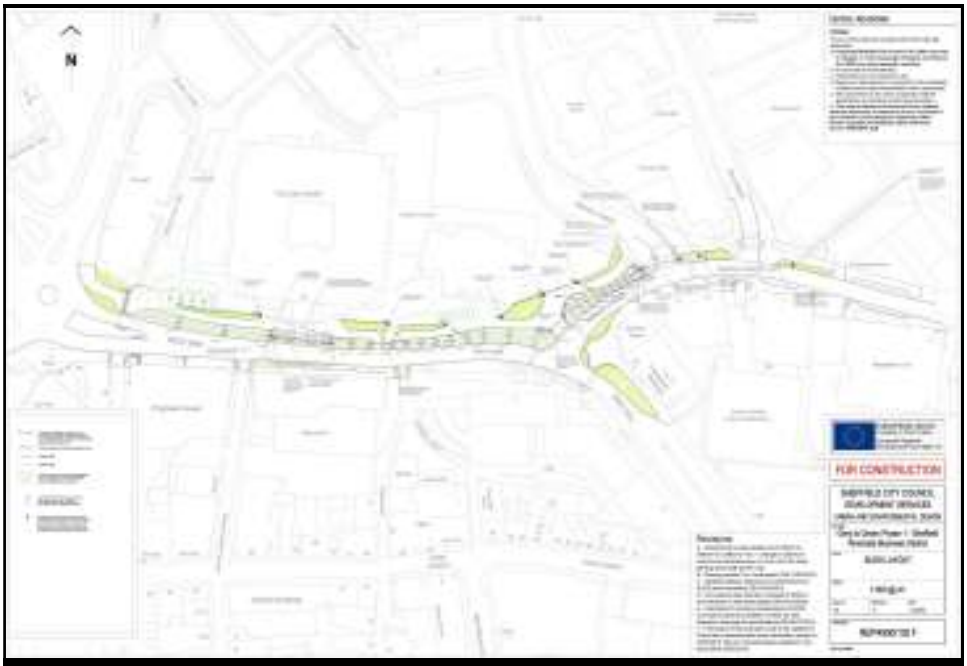


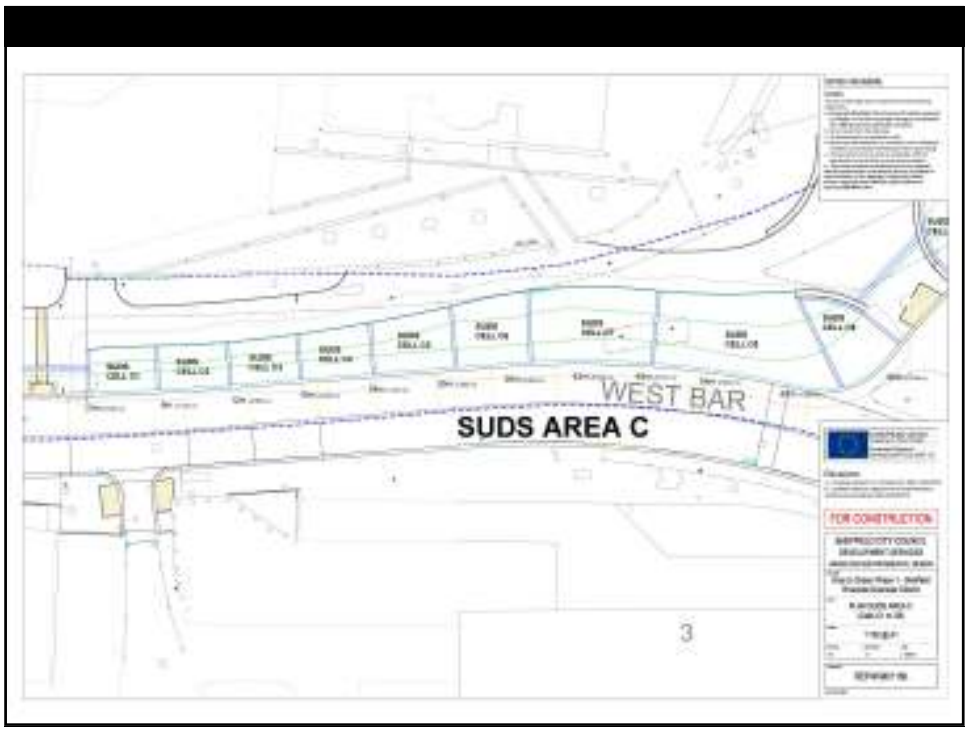
Controlling quantities

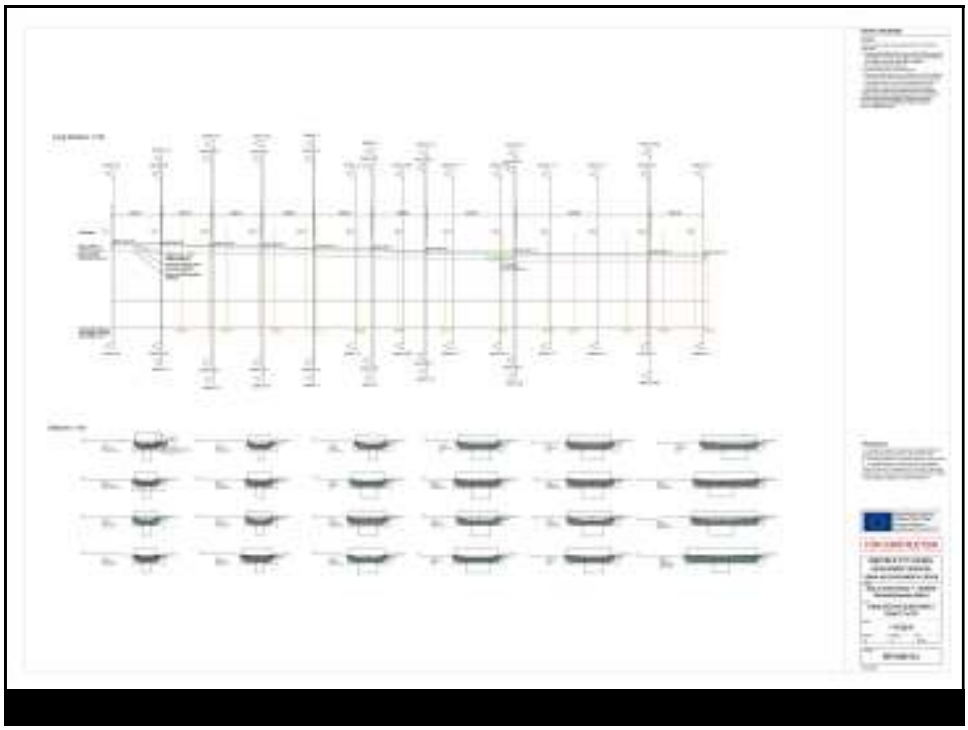
- Capture is through over-edge sheet flow
- Control delivered through 27 almost level swale cells
- Modelling of inflow and transfer down the system informed resultant controls.
- Protected orifice controls allow accumulation of flows followed by drawdown 2-4 hours
- As inflows increase can overtop check 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

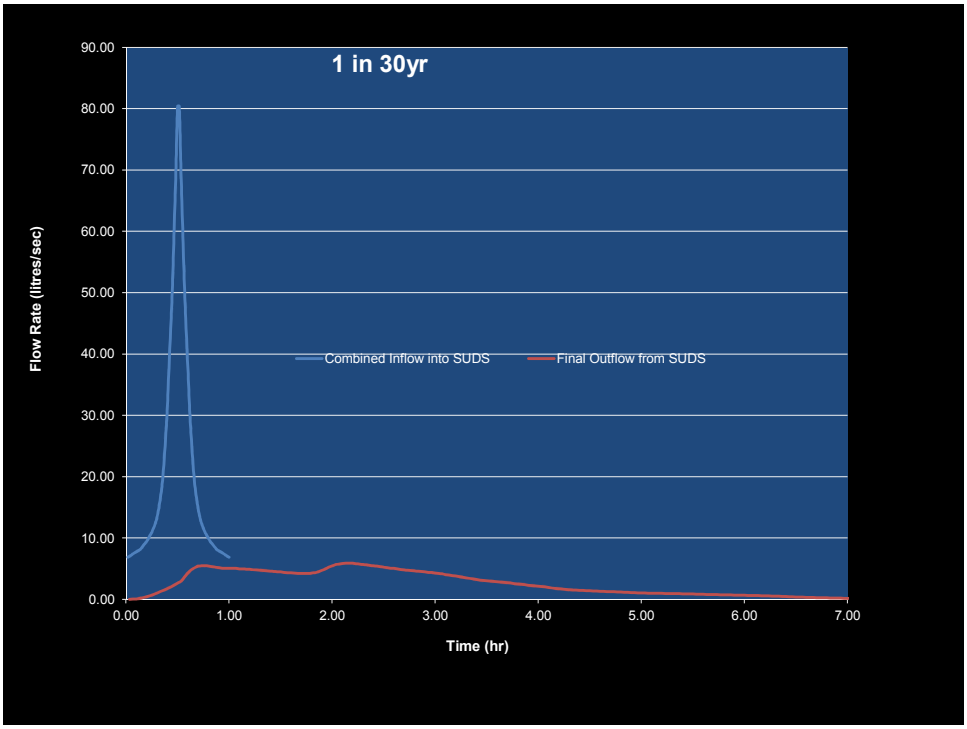



WEST BAR
SUDS AREA C
3
FOR CONSTRUCTION

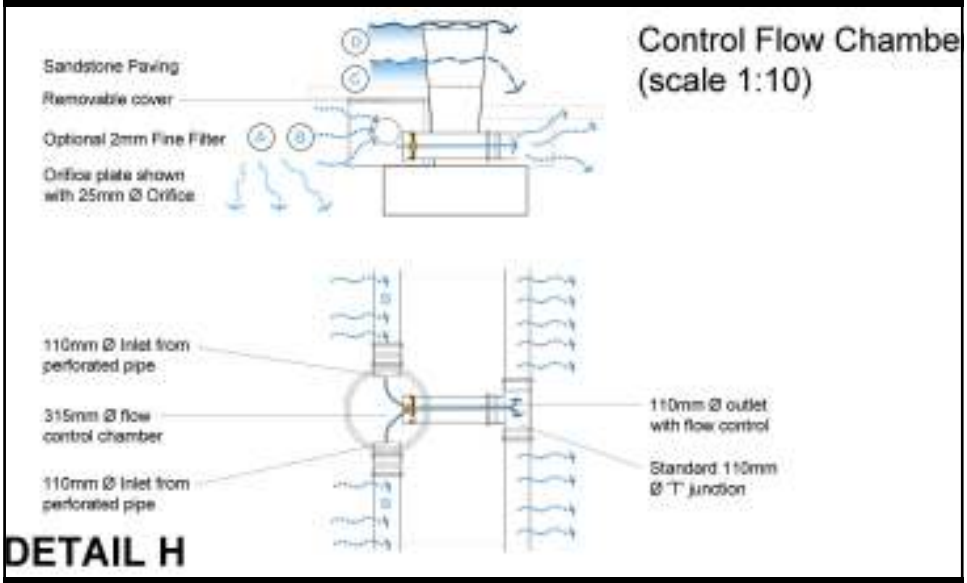

FOR CONSTRUCTION

1 in 100 plus 30% for climate change

Swale Cell	Inflow (l/s) (direct runoff to cell)	Max Controlled Outflow Rate (l/s)	Max Overflow Rate (l/s)	Max Volume retained (m^3)
A1	21.7	3.9	8.1	6.9
A2	8	5.4	0	10
A3	5.1	5.2	0	9.8
B1	42	14	9.3	8.1
B2	7.8	8.5	9.7	8.7
C1	12.2	12	8.7	4
C2	3.5	10.9	8.9	4.1
C3	2.4	16	5.3	2.5
C4	3.3	13.4	8.1	2.5
C5	1.7	15.1	7.5	4.7
C6	1.5	14	6.5	6.8
C7	2.9	9.8	7.5	16.6
C8	3.6	5.3	12.6	14
C9	3.5	8.8	6.7	9.4
D1	16.6	9.4	11.7	2.5
D2	3.6	7.6	13.3	3.2
D3	2.8	6.9	11.7	2.7
D4	1	11.3	5.3	3.5
D5	0.6	7.6	9.3	1.5
D6	0.5	9.4	7.7	1.1
D7	0.5	4.5	13.1	0.4
D8	0.4	5.8	12.4	0.5
D9	0.3	6.9	11.5	0.8
D10	0.3	11.5	6.9	2.3
D11	0.2	17.6	0	2.3
E1	1.2	18.1	0	3.2



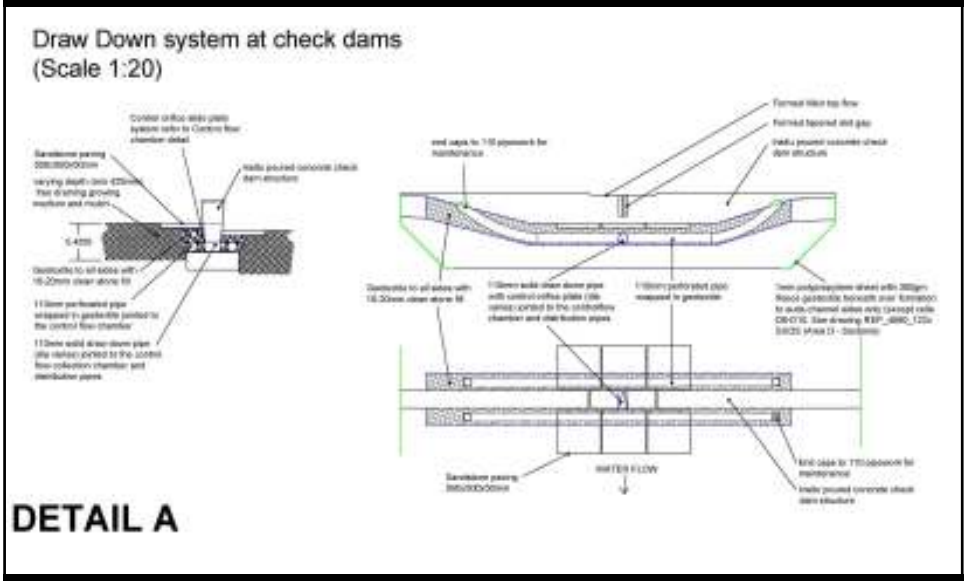
FLOW CONTROL



HOLDING BACK THE FLOW

INDIVIDUAL MODELLING

WATER CONTROL



COLLECTION & DISPERSAL

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


SUDS Construction - October 2014

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

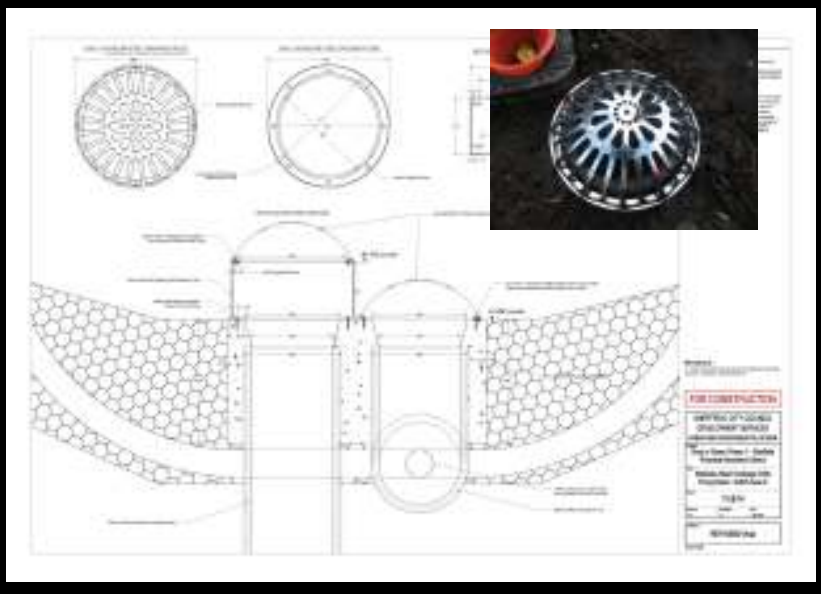
NEWLY PLANTED

RETAINED SERVICES

GRASS CRETE / GEO GRIDS

ORIGINAL INTENTIONS

INLETS AND OVERFLOWS




POROUS SHELF

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

PLACE MAKING


2014 Snig Hill
2016 Snig Hill


Grey to Green Phase 1 - Sheffield Riverside Business District
Sheffield City Region

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