

# **THE NEWARK OUTFALL**

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## **SYNOPSIS**

This paper outlines how WASSP was utilised to optimise the design of the Newark Outfall Sewer project, in order to achieve Water Company levels of service.

## **BACKGROUND**

Mansfield District Councils' Drainage Division was commissioned by Severn Trent Water Ltd, in September 1990, to undertake the Newark Drainage Area Study. On completion of the Study, the Division was subsequently commissioned to undertake feasibility work on the notional schemes proposed, one such project was the Newark Outfall Sewer.

Newark is a market town with a population of 24,500, situated adjacent to the River Trent. Due to its historical and architectural significance the town is a major tourist centre in Nottinghamshire.

The catchment is predominantly combined and drains to Crankley Point Sewage Treatment Works via an existing combined outfall sewer running through the town adjacent to the River Trent.

A number of unsatisfactory overflows are situated along the outfall discharging to the River, most having minimal freeboard with four overflows having submerged outfalls.

Surface water drains from the Northern Road catchment to a screw pumping station which lifts flows to the River Trent.

The Newark Outfall project encompassed both the combined outfall and Northern Road Pumping Station.



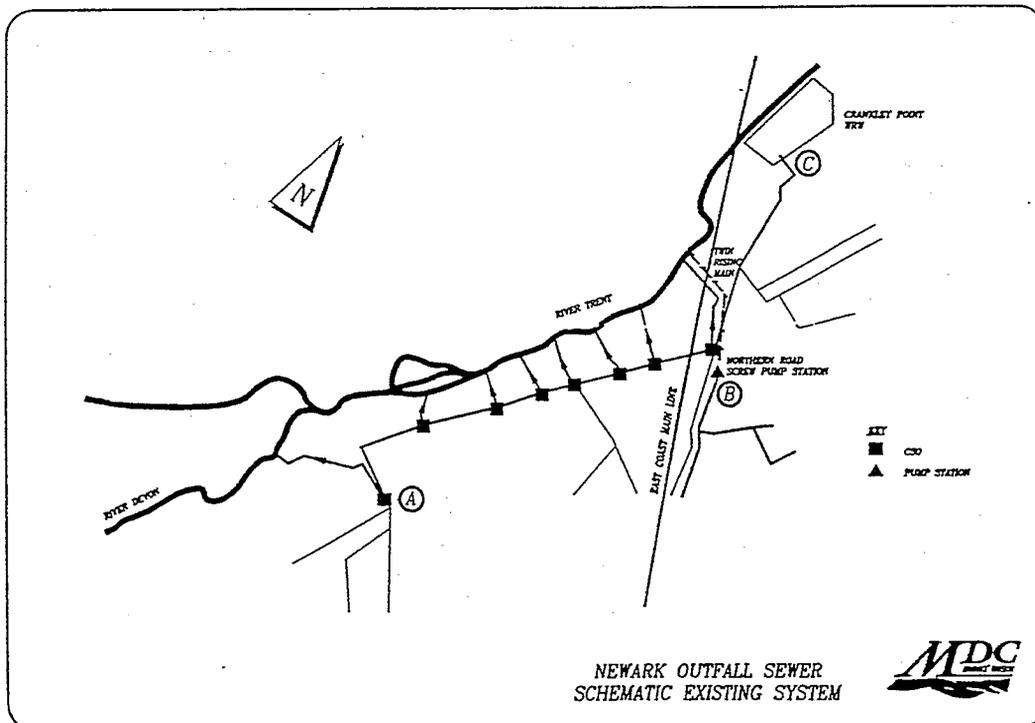
## PROJECT TRIGGERS

The project was triggered due to the presence of 8no unsatisfactory combined sewer overflows, 6no of which were listed in the Company's Licence, with the remaining 2no having temporary consents.

In addition, structural deficiencies had caused operational problems at the Northern Road Pumping Station.

Furthermore, the Water Company had proposals upgrade the Sewage Treatment Works at Crankley Point.

In view of these considerations, a coordinated approach had to be adopted to achieve a cost effective overall strategy for the town, whilst delivering a satisfactory level of service.



## PROJECT CONSTRAINTS

Due to the nature of the catchment a number of constraints limited the choice of options:

- narrow streets
- traffic implications
- route of existing outfall sewer and its proximity to the River
- Trent
- East coast main line
- Amenity value of river
- Topography of area/high river levels
- Ground conditions
- Historic/archaeological sites
- Combined nature of catchment
- Lack of suitable locations for storage



## PROPOSED PROJECT

The proposed project incorporated a new 2.7 Km trunk sewer constructed in tunnel from Boundary Road to the Sewage Treatment Works, ranging in size from 1800 to 2440mm diameter. A new Pumping Station/Combined Sewer Overflow complex was proposed to lift foul flows to treatment and storm/surface flows to the River Trent.

The project facilitated the abandonment of the 8no unsatisfactory overflows and the existing Northern Road Pumping Station.

Total value of the Project was estimated at £10.5 million.

## PROJECT DESIGN CRITERIA

The design criteria for the project was for the outfall to be sized to accommodate a 1 in 5 year design storm at pipe full, and 1 in 20 year design storm without surface flooding.

Capacity was to be incorporated for upstream schemes and, to accommodate future growth in base flows.

Pumping rates were to be optimised for present flows by activating available storage in the system.

The new overflow was to be designed to meet stringent AMP 2 aesthetic control requirements.

## OPTIMISATION OF PUMPING REGIME

The hydraulic model used was based on that formulated for the Drainage Area Study, and initially configured with a single pumping station to represent the proposed foul/storm pumping station complex.

The key objective was to achieve no flooding under a 20 year design storm loading. Various rates were tested using an iterative process to give the desired level of service for both present and future flow scenarios.

The optimum configuration was as follows:

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Design Horizon	Peak Flow 1 in 20 yr	Pumping Rates	
		1 in 5 yr	1 in 20 yr
Present	6.5 cumecs	3.0 cumecs	4.0 cumecs
Future	10.5 cumecs	4.0 cumecs	6.0 cumecs

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Based on these results, the regime to be adopted was to provide 4no 1.0 cumec pumps to handle present flows, but with the structure designed to accommodate a further 2no 1.0 cumec pumps for the future flow scenario.

#### OPTIMISATION OF COMBINED SEWER OVERFLOW

The overflow was to be designed to meet stringent AMP 2 aesthetic control requirements.

In the case of Newark, the River Trent flowing through the town was classified as moderate amenity due to the following criteria:

- River used for recreational purposes
- Located in town centre
- Public footpath adjacent to River

For moderate amenity AMP 2 specifies the following screening requirements:

- more than 30 spills/year - 6mm solids separation
- less than 30 spills/year - 10mm solids separation

The design centred around achieving a maximum of 30 spills/year to enable 10mm solids separation criteria to be used.

Due to level constraints and ground conditions a side weir design was adopted, designed initially in accordance with WRc guidelines.

The designed overflow was incorporated in the WASSP model, and initially run with a free discharge whilst determining an appropriate weir level to achieve a maximum of 30 spills/year.

Sample events from a ranked time series were used to determine an appropriate weir level using the Divisions' in house facilities. Once an appropriate level had been determined to achieve 30 spills/year, a final full time series was run using Severn Trent Waters' mainframe to verify the overflow performance.

On completion of the optimisation process, the proposed overflow/pumping station complex was incorporated in the full model and re-run under a 20 year design storm loading to confirm compliance with the desired level of service.

#### CONCLUSIONS

By undertaking the optimisation process, significant cost savings were achieved on the project in relation to the pumping station/overflow complex.

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