Markham Vale North, Derbyshire

SuDS used

- *Retention ponds*
- *Outlet controls*
- *Swales and conveyance channels*
- *De-canalisation of existing watercourse*

Benefits

- *Surface water managed on site and discharged to natural drainage channels*
- *Ecological enhancement, environmental improvement and increased biodiversity*
- *Forms part of a pleasant landscape for recreational use*

1. Location

Land around Seymour Link Road, Markham Vale, Derbyshire, S43 3FG, known as Markham Vale North.

2. Description

Markham Vale North covers approximately 88 hectares the majority of which was the site of the former Seymour Colliery and coal stocking grounds. Markham Vale North is part of the 365 hectare Markham Vale reclamation and regeneration scheme located in the north east of the county of Derbyshire. The cessation of coal mining in the locality in the mid to late 1990's prompted Derbyshire County Council to undertake the regeneration of a number of interconnected former colliery sites to provide employment, remove dereliction and deliver environmental improvements. The reclamation of Markham Vale North commenced at the end of 2014 and the earthworks were completed in July 2016, landscape planting, fencing etc. was undertaken over the following two years.

The reclamation works involved the formation of four large industrial plots the last of which is due to be developed in 2020, a new road and large scale ecological enhancements including the de-canalisation of an existing watercourse. The majority of the site had lost its connectivity with the natural drainage system, in particular Hawke Brook that bisects the site from east to west. Hawke Brook had been canalised through the site by the previous industry and at the time the site was bought by Derbyshire County Council the brook languished in a straight channel, approximately three metres wide and three metres deep that was overshadowed by dense tree and shrub growth. The combination of the deep narrow channel and overshadowing trees and shrubs meant that there was little opportunity for aquatic and riparian species to flourish, invertebrates were practically absent and so were the species that depended on them. There was also a lack of standing open water on site with the exception of a pair of small settlement ponds that provided rudimentary treatment for surface water leaving the site into Hawke Brook.

3. Main SuDS components used

The strategy was to keep as much of the drainage at the surface as practicable, as habitat to benefit biodiversity and as part of a visually pleasant landscape for visitors and users of the site. This was achieved by utilising retention ponds with outlet controls and swales and conveyance channels to control the movement of water across the site. Subterranean pipes were used to convey water to the ponds where it was impractical to form open channels and swales. Pipes were also used to control outflows from each of the pond. The drainage from the ponds discharges into Hawke Brook and onwards to the River Doe Lea. The scheme also involved de-canalising Hawke Brook to reconnect it to the adjacent land and to improve conditions for invertebrates and riparian flora and fauna. De-canalisation has also improved access for land fauna to utilise Hawke Brook.

4. How it works

The Markham Vale North SuDs scheme was designed and is maintained by Derbyshire County Council. This scheme manages surface water drainage from four large industrial platforms and Seymour Link Road, the highway built to serve them. The subsequent development of the four industrial platforms has been undertaken by a third party working in partnership with Derbyshire County Council, the developer elected to pipe drainage from the industrial platforms due to the constraints of their development, namely large industrial buildings with expansive roofs located within service yards.

Traditionally it would not have been unusual for the drainage from each of the industrial and highway components to have been viewed as separate problems for the respective owners to manage. However, the holistic approach taken by the design team viewed the whole site as a single entity and consequently the management of the drainage likewise. One of the assets of the site was the area of land involved, another was the natural drainage channel that bisects the site east to west. These two assets provided the opportunity to do something quite special in terms of providing drainage management whilst ultimately creating a landscape that to the casual observer looks naturalistic and inviting as a place for relaxing recreation and interaction with nature.

Within the land around the industrial platforms, eight retention ponds were formed (see separate drawing numbers 9033/1370 & 9033/1376). The retention ponds vary in capacity but all take the drainage from the hard surfaced elements of the site and process it by scrubbing, settlement and

biological interaction. Some of the retention ponds are interconnected, three discharge directly into Hawke Brook. The discharge from each pond is controlled by a piped outfall set low enough to drain the pond to maximise its storage capacity in extreme rain events but at a height that will retain a level of static water for ecological and environmental benefits. The diameter of the pipes and their respective invert levels have been calculated to restrict the flow into Hawke Brook to 5 litre per second per hectare and the system has been designed to accommodate a 100 year +30% flood event.

Some of the ponds have been designed to have a relatively shallow permanent water level, the intention being that these ponds will become populated by reeds and rushes whereas others have been designed to have large areas of open water. This mix of ponds with differing water levels has been provided in the interest of developing a variety of habitats and increasing biodiversity within the site. A key design feature of the ponds are their bank gradients, wherever possible these have been designed to be as gentle as possible to maximise the transition area from water through wetland to grassland to provide diverse habitats and opportunities in which indigenous flora can populate and thrive. The gentle bank gradients are also visually pleasant and contribute significantly to the naturalistic appearance of the site.

Fig 1 the largest pond in the Markham Vale North SuDs, designed to have permanent open water as well has storage capacity for a 100 + 30% flood event.

5. Specific project details

One of the key considerations during the planning and design of the drainage for the Markham Vale reclamation scheme was to have a holistic overview of the site as a functioning landscape and to design the drainage to be an integral and active part of that landscape wherever practicable. The design team's goal was to produce a landscape that not only provided the functions needed to service the industrial elements of the site but to also provided diverse habitats that would be populated by indigenous flora and fauna that in turn could be enjoyed by people using the site for recreation. This vision is almost the polar opposite to that of traditional drainage which often seeks to get water off of the surface and away from the site as quickly as possible with little or no ecological or environmental benefits.

At the early planning stage of the Markham Vale scheme local communities were consulted by virtue of several roadshows where they could discuss their thoughts and observations with members of the design team. Prior to designing this scheme Derbyshire County Councils Land Reclamation team had already amassed several decades of experience in reclaiming and maintaining former industrial sites for mixed industrial and recreational use and brought that experience together for this design. The team also had Ecological, archaeological, topological and site investigations surveys were undertaken and their findings were used by the Land Reclamation team to inform and guide the design.

Taking concepts from the design process to the construction phase can bring its own challenges. Certain things like invert levels of pipes and pipe diameters will be as designed and installing them are the bread and butter of most civil engineering contractors. Whereas forming natural looking undulations and varying gradients on the banks of a stream can be difficult and time consuming to capture on drawings. This is where having a contractor who is willing to work with the design team towards getting these details looking and performing just right is invaluable. A perfect example of this partnership approach are the works undertaken to de-canalise Hawke Brook. These works were overseen by one of the design team working with a dedicated machine driver so that each feature that was created added character and interest to the brook along with ecological benefits and improvements to its function and resilience particularly during flood events.

The earthworks contractor, Fitzwise Ltd, also implemented the primary landscaping of the site undertaking cultivation and seeding of the final topography. In addition to the primary landscaping Fitzwise, under the guidance of the design team, installed habitat features such as fallen deadwood, stone and log hibernacula and translocated reeds and other riparian species to the new ponds to prime them with desirable species. One of the hibernacula is in excess of 270 metres long and varies in width from approximately 8 to 22 metres, it runs along the top of the embankments of two of the larger ponds. The organic materials used to form these habitat features where all collected during the site clearance work and stockpiled on site during the construction phase. The stone was recovered during the earthworks and also stockpiled on site ready for use as areas were completed. The installation of these habitat features has given the landscape an established feel and has awarded it with characteristics that ordinarily would take years to accumulate, this has allowed desirable species to quickly populate the site.

6. Maintenance & operation

The Markham Vale North SuDs is entirely in the ownership of Derbyshire County Council. The in-house team designed the system to be as maintenance free as practicable, for example the only moving parts within the system are three flap valves that control water flow at the three outfalls into Hawke Brook. Reeds within many of the ponds provide primary trash screening resulting in a reduction of trash accumulating against the metal trash screens and therefore a reduction in the quantity and frequency of clearing required. The ponds have also been designed to accommodate years of predicted silt deposits without affecting their flood mitigation function so dredging should not be required for the foreseeable future.

With regard to vegetation management the current policy is to monitor it and only intervene if a particular species becomes problematic. The grassland, riparian and aquatic habitats all have a good mix of species within them with no individual species becoming oppressive within the mix. The vegetation is an integral part of this SuDs, it provides services such as scrubbing and a depth of vegetation will retain water longer than if it was cropped or cut, this has the benefit of slowing flows into the ponds and therefore potentially reducing the impact of extreme rain events. To that end, there is no need or intention to actively manage vegetation growth other than to remove problematic species if and when they occur.

Monitoring and maintenance of the SuDs is undertaken by the onsite maintaining team and members of the design team as part of the ongoing works on site.

7. Monitoring and evaluation

Monitoring of the system is undertaken on a semi-casual basis by the following three groups; members of the design team, onsite maintenance team, conservation volunteers.

Because the Markham Vale regeneration scheme is ongoing, some members of the design team are based on site, consequently they are able check that the system is functioning as per its design along with their other site work. The design team specifically check the system during heavy rain events, checking it is functioning correctly and capacity is as expected. They also assess if there are opportunities to improve or refine the system to benefit its function or the biodiversity benefits it bestows on the site

The site maintenance team is based on site and is comprised of volunteers from Derbyshire County Councils Adult Care Services. This group of volunteers undertakes grounds maintenance work around the Markham Vale site including mowing, litter picking and safety checks. They report to the design team any issues they find with the system during their daily tasks.

Because the site has been designed with public accessibly as one of its key features and objectives it is well used by the public, some of whom are involved in conservation work and ecological reporting. Over several years members of the public have been reporting their sighting of birds, dragonfly and butterfly to various organisations, sometime as part of a structured survey but often on a casual basis. Since 2018 the design team and volunteers have been working to build a cohesive group to

enable reporting to be consistent and to provide a more comprehensive view of the flora and fauna that occupy and utilise the site.

8. Benefits and achievements

In addition to successfully functioning as it was designed by limiting flows into Hawke Brook to 5 litres per second per hectare, the Markham Vale North SuDs has introduced a diverse range of habitats to the 88 ha site. The main purpose of the retention ponds, the most visual elements of this SuDs is to accommodate the surface water drainage particularly from the hard surfed areas of the site and manage its progress to Hawke Brook, the natural drainage channel that runs through the site. However, from a visitor and wildlife perspective the ponds and their margins provides aquatic, riparian, grassland and woodland habitats and ecosystems that are a pleasure to visit. Volunteers undertaking surveys for Butterfly Conservation record 1182 butterflies from 21 species utilising the site in 2017, the first year after the completion of the earthworks. Numbers increased to 2024 individuals from 23 species in 2018, and rose again in 2019 to 2142 individuals from 24 species. Volunteers have also been undertaking Odonata surveys and have recorded a total of 21 species using the site, Markham Vale North is now considered to the best site in Derbyshire for Dragonfly and Damselfly numbers and species diversity.

Fig 2 & 4 (left and right) show two of the 21 dragonfly species recorded on site
Fig 3 (centre) shows a Painted Lady photographed on one of the pond embankments
Photographs curtesy of Mark Radford

The de-canalisation of Hawke Brook has been something that officers working for the Environment Agency (EA) have suggested and requested since Derbyshire County Council purchased the site. The results of surveys undertaken on behalf of the EA had identified that Hawke Brook would benefit from improvements to biodiversity and water quality in line with the EU Water Framework Directive (WFD). The improvements that have been undertake are visible by the diversity of flora that has established within the brook and along its banks. Small fish can be seen along its length which is a good indicator that the brook is in a good condition. The de-canalised banks now allow floodwater to overtop, loose energy and deposit silt as it passes over grassland. The vegetation that now grows on the stream bed and along the banks help to retain the stones of the streambed and also cause the deposition of silt which is assisting in maintaining and developing the streambed as a habitat.

Fig 5 (left) 15th April 2016, illustrates the works undertaken to de-canalise Hawke Brook. On this section banks slopes were reduced, the width was increased and a second channel formed to accommodate flood waters and allow them to loose energy and deposit silts.

Fig 6 (right) 31st May 2020, shows the same view as shown in Fig 1 four years later. With the exception of the grasses all of the vegetation that can be seen within the second channel is the result of natural regeneration promoted by the de-canalisation and removal of overshadowing trees. The primary channel in which Hawke Brook runs remains as open, flowing water.

9. Lessons learnt

Although it was not particularly a challenge on this scheme it can sometimes be difficult for people to understand or accept that green engineering solutions sometimes take time, possibly a few years to establish and become fully functional. They can also suffer from initial damage such as erosion which will require monitoring and remedial action, this is in contrast to what is expected from traditional construction methods .e.g. concrete channels that are rightly expected to function as designed as soon as their construction is completed.

A significant part of this SuDs was the formation of hibernacula using stone and tree roots, stems and branches recovered from site. One of the challenges for the design team was how to instruct the contractor to construct these without producing elaborate paperwork or expending disproportionate hours on drawings that would be difficult to reproduce on site. The simple solution was to build into the contract day works and a budget specifically to undertake these tasks and to have an understanding contractor who is comfortable with their machine drivers being instructed directly by members of the design team.

There are health and safety implication when a design team works directly with machine operators, however, providing a risk assessment is undertaken and everyone involved is aware of its findings and knows the limitations of the work, the machines, site conditions, etc. then risks can be eliminated or kept to an acceptable level.

10. Interaction with local authority

The 365 Ha Markham Vale development straddled the boundaries of three local planning authorities; Chesterfield Borough Council, Northeast Derbyshire District Council and Bolsover District Council. Consequently a joint planning application was submitted to the three authorities with Chesterfield Borough Council taking the lead role. Due to the size and scope of the Markham Vale site, planning conditions were written to enable the scheme to be developed in phases or as specific areas of land. Each phase or plot developed would require documentation submitting to the local planning authorities to discharge the relevant conditions, this has effectively meant there has been continuous communication with the planning authorities since the original planning approval was granted in 2005

11. Project details

Construction completed:

Earthworks including the main drainage features - July 2016

Seymour Link Road and drainage – March 2017

Landscape planting – March 2019

Development of industrial plots, construction of buildings, yards and drainage – the development of the remaining industrial plot is programmed to commence in June 2020.

Cost: the civils works to undertake earthworks, form industrial platforms ready for further development and to construct the road to serve them amounted to approximately £12.5 million, this figure does not include the installation of servicers provided by statutory undertakers.

It is difficult to completely extract the cost of the SuDs from the above figure because the formation of the ponds were an integral part of the reclamation earthworks, however, it has been calculated that works attributable to the construction, primary landscaping and habitat creation of the SuDs amount to approximately £560,000 with £400,000 of this being for pipe work, chambers and headwalls.

Extent: Markham Vale North covers an area of 88 Ha.

12. Project team

Funders	• Derbyshire County Council	DERBYSHIRE County Council
Clients	• Derbyshire County Council	DERBYSHIRE County Council
Designers	• Derbyshire County Council Land Reclamation Section • Chris Beech Senior Project Engineer • Jaimie Bingham Project Engineer	DERBYSHIRE County Council
Contractors	• Fitzwise Ltd – Earthworks & habitat • N T Killingley Ltd – planting	FITZWISE LIMITED killingley