



Brownfield Briefing Awards 2016 Category 12: Best biodiversity enhancement

Abercarn Gasworks: cultivating a lasting bio-legacy

Introduction

The Abercarn Gasworks is situated along the picturesque River Ebbw in the valleys north of Newport, south Wales. The site historically contained the entire coal gas production facility, which included two below-ground gasholders with one subsequently repurposed as a tar and liquor tank. The site currently contains an above-ground pressure reduction installation (PRI) and a dense arrangement of gas mains across the wider landholding. The river bank boundary of the site is formed by historically-placed gabion retaining walls.

Site investigation had identified significant statutory liabilities with reference to tar materials and PAHs in close proximity to the river. Through anecdotal evidence from the local community and a suite of ecological appraisals, the **site was identified as a potentially sensitive site due to various protected and/or notable habitats and species.**

Wales & West Utilities Ltd employed Hydrock to provide a design and build voluntary remediation solution at Abercarn Gasworks with Keystone Habitats acting as ecological sub-contractor. Working closely with Natural Resources Wales (NRW) and Caerphilly County Borough Council (CCBC) as well as regularly engaging with local residents and businesses, WWU, Keystone and Hydrock started an **environmentally sensitive remediation programme with early consideration of ecological/biodiversity protection and enhancements.**

Strategy

The primary objective of the works was to render the site suitable for its existing use as an operational gas pressure reduction facility. The remediation strategy was designed to ensure the site would no longer pose an ongoing statutory risk of harm to human health or controlled waters.

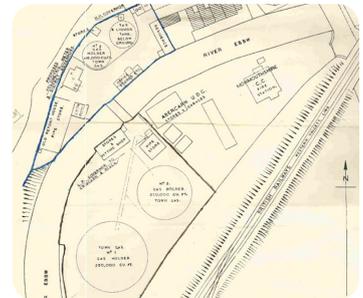
The remedial strategy was based on the following objectives:

- maximise the reuse of materials on-site through segregation and treatment (stabilisation/solidification) of soils with multi-stakeholder input;
- remove soils impacted with Japanese knotweed and asbestos to an off-site facility; and
- reduce the potential for contamination to leach and impact the River Ebbw.

Before any remedial works and in line with current best practice, the site was subject to a detailed ecological appraisal conducted by Keystone Ecology. This highlighted a range of potential constraints to the delivery of our primary objectives associated with various protected and/or notable habitats and species, such as otter and reptiles, as well as a



Historical photograph of Abercarn Gasworks



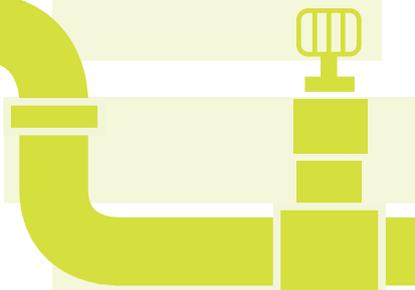
Historical plan of Abercarn Gasworks



Excavation to expose the tar tank



The former gasholder and tar tank during remediation





The southern area before remediation



Tree thinning to improve gas pipe river crossing security

number of locally protected Sites of Importance to Nature Conservation (SINC), including the River Ebbw riparian corridor which runs parallel to the site.

In accordance with the National Planning Policy Framework, the survey provided an assessment of the various opportunities for the ecological enhancement of the site, in line with the range of species and habitats present/potentially present, relevant local planning policy, Local Biodiversity Action Plans (LBAP) objectives and targets and Section 42 Species/Habitats of Principal Importance (SPI/HPI) for Wales. The assessment also included a review of local and national print and social media avenues to deliver a fully justified enhancement plan.

The pre-remediation phase of works involved a programme of ecological appraisal, selective vegetation clearance where necessary, positive identification of utilities, bench-scale stabilisation and solidification (S/S) trials (using site-derived substrate samples) and finalisation of planned biodiversity enhancements. These tasks were critical to the remediation programme to obtain regulatory approvals and relevant consent in time for potential protected species surveys. Following this, a carefully co-ordinated programme of works was developed to work with and around the significant ecological constraints at the site which could not be removed, including segregated areas which were not to be disturbed.

The primary contaminants of concern (CoCs) comprised a range of PAHs, asbestos and tar-impacted material. The remedial objective was to treat impacted material using stabilisation S/S techniques with the aim to eliminate or permanently adsorb/absorb organic molecules, strongly bind all contaminants in a permanent solidified material and reduce the permeability of soils to eliminate contaminant leaching. S/S is applicable for gasworks wastes due to the range of contaminants typically encountered and has successfully been applied on a number of sites for Wales & West Utilities in the past as part of a range of technological solutions to maximise material reuse on these difficult sites.

Sustainable approach

In the context of the SuRF-UK Framework for sustainable remediation, Hydrock considered the potential impact of the works on the 15 SuRF-UK Indicator sets and determined the key drivers for sustainability (including ecology). This enabled Hydrock to optimise the sustainability of the project and still fulfil the brief. Key indicators for this project were identified so that the minimisation of negative impacts and the maximisation of benefits were considered as part of the strategy.

Bench-scale S/S trials were performed (as set out in Environment Agency document *Guidance on the use of Stabilisation/Solidification for the Treatment of Contaminated Soil* Ref: Science Report: SC980003/SR1) to understand appropriate additive constituents and dosage ratios that produce an end-product with leaching characteristics that are suitable to enable on-site reuse. The mix design strategy was based on developing a site-specific S/S formulation that aimed to deliver retardation of contaminant mobility through the use of cementitious binders.

While the site holds little or no value as a breeding/resting site for otters, it is considered to be of local importance as a commuting route. In terms of reptiles, low numbers of slow-worms, a species common to the wider area, were identified on-site during further reptile population surveys. With the above findings in mind, a sustainable approach for potential protected species to benefit from the remediation works was incorporated into the design. Wales & West Utilities, Hydrock and Keystone undertook a review of the layout of the site and how the final reinstatement could be adapted to incorporate a suite of biodiversity enhancements to benefit a diverse range of species.

Delivering best practice

A Materials Management Plan (MMP) was developed for the material reuse under the CL:AIRE Development Industry Code of Practice. All appropriate documentation and evidence was provided as part of the submission of the CL:AIRE MMP form, including Wales & West Utilities' position as a statutory undertaker and associated benefits with

regards to not having to attain planning consent. Qualified Person (QP) declaration was achieved without any concerns raised.

To demonstrate the treated and retained materials achieved the leachability targets for the site, representative bulk samples were obtained and submitted to an accredited geotechnical laboratory where they were moulded into a triaxial cell before strength tests and accelerated permeability testing were carried out. The results of the testing demonstrated that the strength of the treated material is comparable to brick mortar at 2,476 kPa. Permeability of the treated materials is very low – at 1.01×10^{-10} m/s. Such permeability is similar to clay and therefore it is considered that the S/S treatment applied to the excavated materials at the Abercarn site was successful in capturing the CoCs within a low permeability media and restricting their environmental availability to cause harm.

A total of 640 tonnes of material was excavated and reused, with an additional 216 tonnes of Japanese knotweed and asbestos-contaminated material disposed of to a licensed facility.

The treatment and reuse of 75 per cent of material on-site significantly reduced haulage traffic, which delivered less noise, vehicle emissions and nuisance impact to the community of Abercarn than using traditional off-site solutions.

To minimise the impacts to the resident reptile population and avoid any accidental killing/injury during the works, suitable habitat was cleared under specialist supervision and slow-worms “flushed” into retained fringe habitat bordering the site. The remedial works were then segregated from this corridor with high-quality reptile fencing which remained in situ until completion of the works, demonstrating that best practice was employed at the site.

Protection and enhancement of a visual amenity

An area of the site was made available by Wales & West Utilities for biodiversity enhancement. It was considered that the most significant ecological gains could be achieved through a focus around improving the retained vegetation corridor along the river bank and an area of coarse grassland bordered by broadleaved woodland within the southern portion of the site. Enhancement of the retained vegetated boundary section of the site was proposed to ensure functional connectivity through the site along the riparian corridor, thereby enabling the continued movement of species (including slow-worms) throughout the wider landscape.

Biodiversity benefits and delivering a long-term plan

While we delivered our statutory contaminated land obligations at Abercarn, we demonstrated our commitment to deliver both environmental and community benefits which go above and beyond these requirements. In addition to the remediation work, we worked with the local residents, local authority and specialist sub-contractors to **improve the biodiversity at the site in a way which respects the integrity of the area and enhances the local ecosystem to its full potential.**

Taking the above into account, the following recommendations were proposed and delivered:

- **additional shrub planting and wildflower seeding** – specifically along the river corridor, a mix of native species, of local provenance, such as field maple, hawthorn, blackthorn and occasional hazel, spindle, dog rose and holly. This increased the floral diversity on site which in turn is expected to increase foraging opportunities for a number of invertebrate, mammalian and bird species as well as a growing and thriving resident reptile population.
- **installation of additional bat roosting features** – target bat species included brown long-eared bat, Daubenton’s Bat, Natterer’s Bat, noctule bat, common pipistrelle bat and whiskered/Brandt’s bat, all of which we identified as Caerphilly BAP Priority Species



Tit and sparrow nesting box with integrated predator protection and rear bat recess, left, and a larger species bird nest box, right



Small passerine species nest box, ie wrens, tits and goldcrests



Bat refuge boxes



Invertebrate hotel



Log piles, composts and habitat hotel



Hibernacula



Hedgehog house

Although records of bat presence on or near to site are limited, the River Ebbw is likely to be an important commuting corridor for a number of species. The increase in foraging and installed roosting habitats will optimise the site for any passing species.

- **installation of additional bird roosting and foraging features** – the site itself holds potential for two Caerphilly BAP bird species, song thrush and tree sparrow, so appropriate nest boxes were installed in keeping with the respective species' requirements. Although there is no potential habitat for kingfishers on site, the river corridor itself provides foraging and commuting potential, the same is also true for the white-throated dipper. Although it is unfeasible to provide suitable roosting features for kingfishers at the site, an artificial foraging perch was installed along with a nest box suitable for the white-throated dipper.
- **enhancements for reptiles** – there are little natural refugia present on site for reptiles. Therefore, a subterranean hibernaculum was created to generate increased foraging habitat in the spring and summer as well as offering a suitable rest site for winter hibernation. The hibernaculum was built primarily from arisings obtained during selective thinning of the woodland canopy. This not only generated the required material for its construction, but also created sunny glades within the woodland suitable for basking. The knock-on effect of the glades is that spring flowers are encouraged to grow, benefiting invertebrate populations which act as a food source for reptiles and other species. The establishment of spring flowers is aided with the introduction of a native wildflower seed both along the bank of the river corridor and within the newly created glades.
- **enhancements for terrestrial invertebrate species** – there is no habitat or potential for any Section 42 SPI or LBAP invertebrate species on site, however many of the aforementioned species would benefit either directly or indirectly from increased invertebrate populations. In addition to increasing the floral biodiversity on site, the constructed reptile hibernaculum will also double as a refuge for a wide variety of saproxylic invertebrate species which are dependent on dead or decaying wood. A series of natural invertebrate "hotels" were also created from a range of materials including natural stone, deadwood and tree root balls. Bee species have also benefited from an artificial hive and an increase in nectar producing wildflowers.
- **mammal enhancements** – the reptile hibernaculum will provide suitable resting and foraging habitat for wood mouse and vole species alike. Log pile arrangements will also serve as a refuge and foraging site for hedgehogs; a species which is declining rapidly in many areas of Wales.

Conclusion

Despite the essential remedial works which have taken place, the potential of this small site has been maximised through targeted, ecologically functional enhancements aimed at achieving a net biodiversity gain. With the allocated enhancement zone being within a live gas compound containing regionally critical energy infrastructure, the biodiversity improvements will be secure and managed over the long term.



A general view of the southern biodiversity enhancement area