Fiddlers Ferry Development Framework – Ground Conditions Technical Briefing Note v3.0

Dated: 11/12/2023

This Technical Briefing Note has been prepared to summarise the findings of the detailed environmental assessment and ground investigation activities completed across the site of the former Fiddler's Ferry Power Station (FFPS) and agricultural land to the east, which is allocated in the Warrington Local Plan (adopted December 2023) for a mixed-use development comprising approximately 101ha of employment land and a minimum of 860 new homes in the plan period ('the FF Allocation Site').

The note is informed by the outcome of assessment and investigation activities undertaken by Arcadis (UK) Consulting Limited since 2021. The works were undertaken in accordance with the Land Contamination Risk Management (LCRM) framework, and are detailed in the following reports:

- Geo-Environmental Preliminary Risk Assessment Report, January 2021, FFPS-AUK-XX-XX-RP-ZZ-0010-01-Geo Environmental Report.
- Ground Investigation Report, September 2021, FFPS-AUK-XX-XX-RP-ZZ-0048-03-Ground Investigation Report.
- Ground Investigation Report; Fiddler's Ferry Power Station, dated March 2023 FFPS-AUK-XX-XX-RP-ZZ-0048-04.
- Phase 2 Ground Investigation Interpretative Report; Former Fiddler's Ferry Power Station Coal Pad, dated July 2023, 10054666-AUK-XX-XX-RP-ZZ-0010-P1-Coal_Pad_P2.
- Detailed Quantitative Risk Assessment; Former Fiddler's Ferry Power Station Coal Pad, dated June 2023, 10054666-AUK-XX-XX-RP-ZZ-0021-02-Coal_Pad_DQRA.
- Remediation Strategy; Former Fiddler's Ferry Power Station Coal Pad, dated September 2023, 10054666-AUK-XX-XX-RP-ZZ-0010-P1-Coal_Pad_P1.
- Addendum Hazardous Ground Gas Monitoring Report; Former Fiddler's Ferry Power Station Coal Pad, dated September 2023, Ref: 10054666-AUK-XX-XX-RP-ZZ-0037-P1-Addendum_bulk_ground_gas_report.
- Letter report detailing PFAS sampling works, dated 24th November 2023, 10054666_PFAS Monitoring.

The assessment and investigation cover the entirety of the FF Allocation Site. This includes: the land occupied by the former power station; the former coal stacking area including land immediately to the south; the associated ash lagoons south of the St Helens Canal (Lagoons A-D and Site E); and the surrounding agricultural fields. These areas are highlighted on Figure 1.

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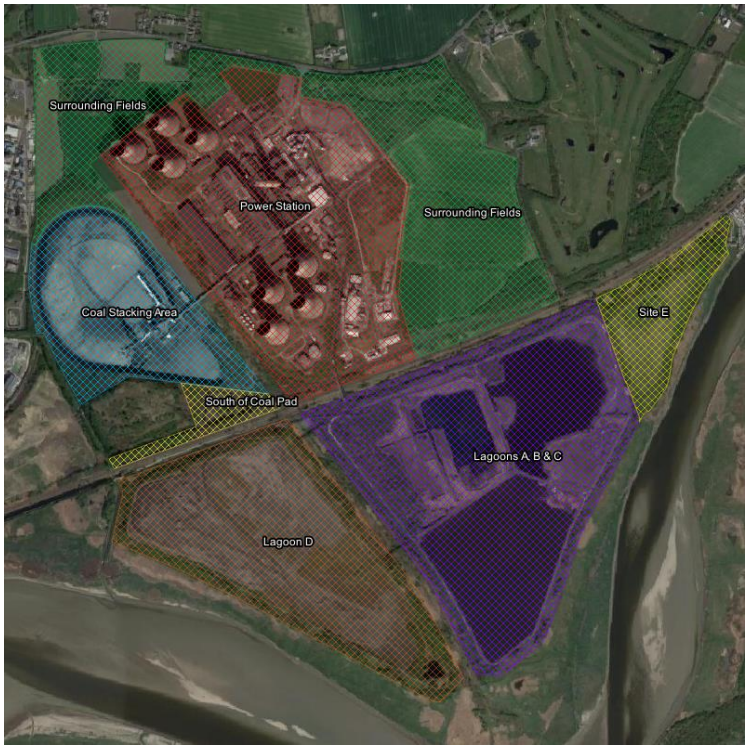

Figure 1 – Fiddlers Ferry Allocation Site Investigation Areas

The assessment and investigations summarised in this Technical Briefing Note were undertaken to establish potential geo-environmental risks and constraints to the redevelopment of the FF Allocation Site. This was considering both future employment (commercial/industrial) and residential end-uses.

Preliminary Risk Assessment (PRA)

An initial Preliminary Risk Assessment has been completed. The PRA is based on the outcome of a site inspection, review of site records and review of published data sources.

The PRA summarises the development history of the FF Allocation Site taken from historical Ordnance Survey (OS) mapping. Prior to the 1960's the FF Allocation Site comprised farmland and marsh land, with railway lines shown in the northwest (1894-1954), a railway station to the northeast (1849-1958) and the Vyrnwy Aqueduct crossing the site first shown in the mid 1890's. The FF Allocation Site was later developed as a coal fired power station during the 1960s and commissioned in the early 1970s. Numerous current and historical surrounding land-uses of interest were also identified as part of the PRA. Most notably these included a former 'refuse tip' to the southwest of the coal pad, still visible adjacent to the site, and numerous industrial and 'works' buildings largely to the west of the site in the vicinity of the existing industrial estate.

The outcome of the PRA developed the initial conceptual site model (CSM). The CSM considered the numerous potential sources of contamination which may have impacted the site condition, identified the specific contaminants of concern (CoC) which may be present, and qualitatively assessed the potential risk to future site users from these CoC via the identified potential exposure pathways. This included consideration of both future employment and residential end-uses across the FF Allocation Site.

The CSM was then used to inform the design the detailed ground investigation strategy for the FF Allocation Site, determining what site specific geo-environmental data needed to be collected to further refine the CSM and identify potential risks to the environment and future site users based on the actual site conditions.

Ground Investigation

An extensive ground investigation was completed across the FF Allocation Site to identify and evaluate the potential geo-environmental risks associated with the site. The investigation comprised a variety of investigation techniques across the entirety of the FF Allocation Site, including the collection of soil and groundwater samples and initial soil gas screening. The data was collected to both confirm ground conditions beneath the site and identify the presence or absence of potential CoC.

Key Findings - Geology

Former Power Station, Coal Stacking Yard and Land South of the Coal Stacking Yard - Ground conditions have been identified to compromise made ground deposits up to 5.5m thick. The made ground deposits comprise a heterogenous mix of clays, sands and gravel comprising limestone, sandstone, brick, concrete, ash, clinker, slag, coal and galligu. The made ground deposits beneath the southern half of the coal stacking yard and land immediately to the south have been identified to include notable thickness of Galligu deposits, deposited prior to the use of the site as a power station.

The made ground is in turn underlain by superficial deposits comprising Glacial Till and Tidal Flat deposits proven to a maximum depth of 10m below ground level (bgl). Weathered sandstone bedrock has been identified beneath the superficial deposits.

Ash Lagoons - It is understood that each lagoon is contained within a clay lined bund and that the embankments are faced with 300mm of silty clay and sand and then surfaced with a 150mm thick sand and cement layer. Investigations around the former ash lagoons have identified made ground deposits to depths in excess of 10m bgl, including pulverised fuel ash (PFA) deposited in the ash lagoons. PFA is currently in the process of being extracted for re-use from Lagoon D.

Superficial deposits including Glacial Till and Tidal Flat deposits were also encountered beneath the made ground underlain by weathered sandstone bedrock.

Agricultural Fields - To the east of the former power station land, limited made ground deposits or reworked ground, typically less than 0.5m thick, have been identified underlain by glacial till proven to a maximum depth of 5m bgl.

Key Findings - Hydrogeology

Groundwater in the northern section of the FF Allocation Site, north of the St Helens Canal, has been identified in the made ground deposits, superficial deposits and bedrock.

Based on the outcome of the investigation completed, it is considered likely that within the northern section of the site groundwater within the made ground is likely perched owing to the predominantly cohesive nature of the underlying superficial deposits, albeit localised lateral flow may occur where the made ground is sufficiently deep to facilitate this (e.g. within the land in the south of the coal pad). Within the southern portion of the site (in the vicinity of the Ash Lagoons), where made ground (which includes PFA) was typically identified to significantly greater depths than in the north, lateral flow of groundwater in the made ground is likely to be occurring.

Within the superficial deposits across the site, it is considered that their predominantly cohesive nature along with the presence of localised granular bands is influencing the variation in groundwater elevations recorded. However, it is anticipated that in general, groundwater will be flowing towards the River Mersey in a southerly to south-westerly direction.

Groundwater in the sandstone bedrock was observed at depths of between 7.9m AOD and 9.5m AOD, albeit only in the northern section of the site.

Generic Quantitative Risk Assessment (GQRA)

A GQRA was completed as part of the ground investigation activities. The GQRA compared the measured concentrations of potential CoC measured in soil and groundwater sample to Generic Assessment Criteria (GAC). This data was then used to refine the site CSM with respect to potential sources and types of contaminants present.

The GAC selected considered potential risks to water resource receptors and future site users, based on a combination of employment and residential end-uses. The key findings from the outcome of the GQRA are detailed below.

Key Findings – GQRA (Human Health)

Based on the outcome of the investigation completed the following potential risks were identified with respect to potential future human health receptors.

Former Power Station Coal Stacking Yard and Land South of the Coal Stacking Yard: Considering a future employment (commercial / industrial) end-use, exceedances of the GAC were limited to:

- Soil: Volatile Organic Compounds (VOC) in soil in two locations south of the coal stacking yard.
- Groundwater: No exceedances of the GAC were identified in groundwater samples collected.

Ash Lagoons: Considering continued extraction of PFA will continue on the land south of the railway, with progressive restoration of the land for nature conservation and recreational uses, exceedances of the GAC were limited to:

- Soil: Metals and polyaromatic hydrocarbons (PAH) in soils (noting these do not apply for the current ongoing ash extraction use)
- Groundwater: No exceedances of the GAC were identified in groundwater samples collected.

Agricultural Fields: Considering a future residential end-use, exceedances of the GAC were limited to:

- Soil: Metals in one soil location.
- Groundwater: No exceedances of the GAC were identified in groundwater samples collected.

Key Findings – GQRA (Water Resources)

Based on the outcome of the investigation completed, the following potential risks were identified with respect to water resources.

Former Power Station Coal Stacking Yard and Land South of the Coal Stacking Yard: Exceedances of the GAC were limited to:

- BTEX, PAH and VOC in soils, largely associated in the south of the former coal stacking yard and in the vicinity of the known Galligu deposits.
- Metals, BTEX, petroleum hydrocarbons, and VOC in groundwater, again most notably in the south of the former coal stacking yard and in the vicinity of the known Galligu deposits.
- PFAS, identified within shallow ground water and surface water adjacent to the Johnson's Lane landfill which is the likely source of the contamination.

Ash Lagoons: Exceedances of the GAC were limited to:

- PAH in soils.
- Metals and VOC in groundwater (one location only).

Agricultural Fields: Exceedances of the GAC were limited to:

- PAH in soil samples.
- Metals in groundwater.

Key Findings – Ground Gas

Initial bulk ground gas data collected across the site indicates the site will fall into Characteristic Situation (CS) 2 with regard to ground gas mitigation measures. Further data collection will be undertaken for each development phase as specific remediation strategies are prepared and submitted as part of planning applications for each phase.

Constraints & Management Actions

Given the previous development of the site, particularly to the north of the St Helen's canal, it is anticipated that following demolition of above ground structures the following below ground constraints will require management as part of the future development.

- Made ground across the site (typically of limited thickness).
- Basements associated with former significant structures.
- Piled foundations for historic structures.
- Localised areas of deeper/ problematic and/or contaminated made ground (e.g., Galligu).
- Low shear strength/ compressible soils (along line of St Helens Canal).
- Ground gas.

To deal with these constraints, a programme of enabling works will be completed ahead of development. The extent of these enabling works will be dependent on the nature of each specific phase of development, and the management actions would be defined in remediation strategies developed for each phase. It is expected management actions would include consideration of the following.

- Shallow made ground to be "turned over" to remove shallow obstructions and to allow for formation of an engineered development platform.
- Basement voids will need to be backfilled with a suitable engineering fill or grout, and side walls broken down to suit future levels. It is anticipated that following demolition works on site a suitable material can be generated on site by processing demolition and earthworks arisings or sourced via the ongoing ash extraction process from the lagoons.
- Removal of piled foundations is unlikely to be economical. Where identified during demolition or enabling works their location and level will need to be recorded and may be re-used if feasible.
- Management of the soft alluvial deposits and Galligu, including taking into account the known contamination in soil and groundwater linked to those areas where Galligu has been observed. This is likely to included localised removal of contaminant hotspots, stabilisation of Galligu deposits in-situ, and installation of cover layers or engineering barriers where necessary.
- Drainage strategies in Galligu impacted areas (i.e. the coal stacking yard) should avoid soakaway features to prevent potential impact from contamination.
- Installation of ground gas mitigation solutions consistent with the outcome of ground gas testing and assessment and the proposed end-use.

Summary

The assessment and investigation completed across the FF Allocation Site has identified the principal constraints to future development with respect to the proposed end-uses. It is not considered these constraints present a significant impediment to the proposed redevelopment and can be eliminated or satisfactorily managed during the redevelopment of the FF Allocation Site.

As such, on the basis of the investigations completed to date the FF Allocation Site is considered suitable for the proposed uses subject to the completion of the relevant remedial actions which would be defined within phase specific remediation strategies in accordance with the LCRM process.