
Job Title

Medieval Quarter & Glade of Light
Manchester

Prepared for

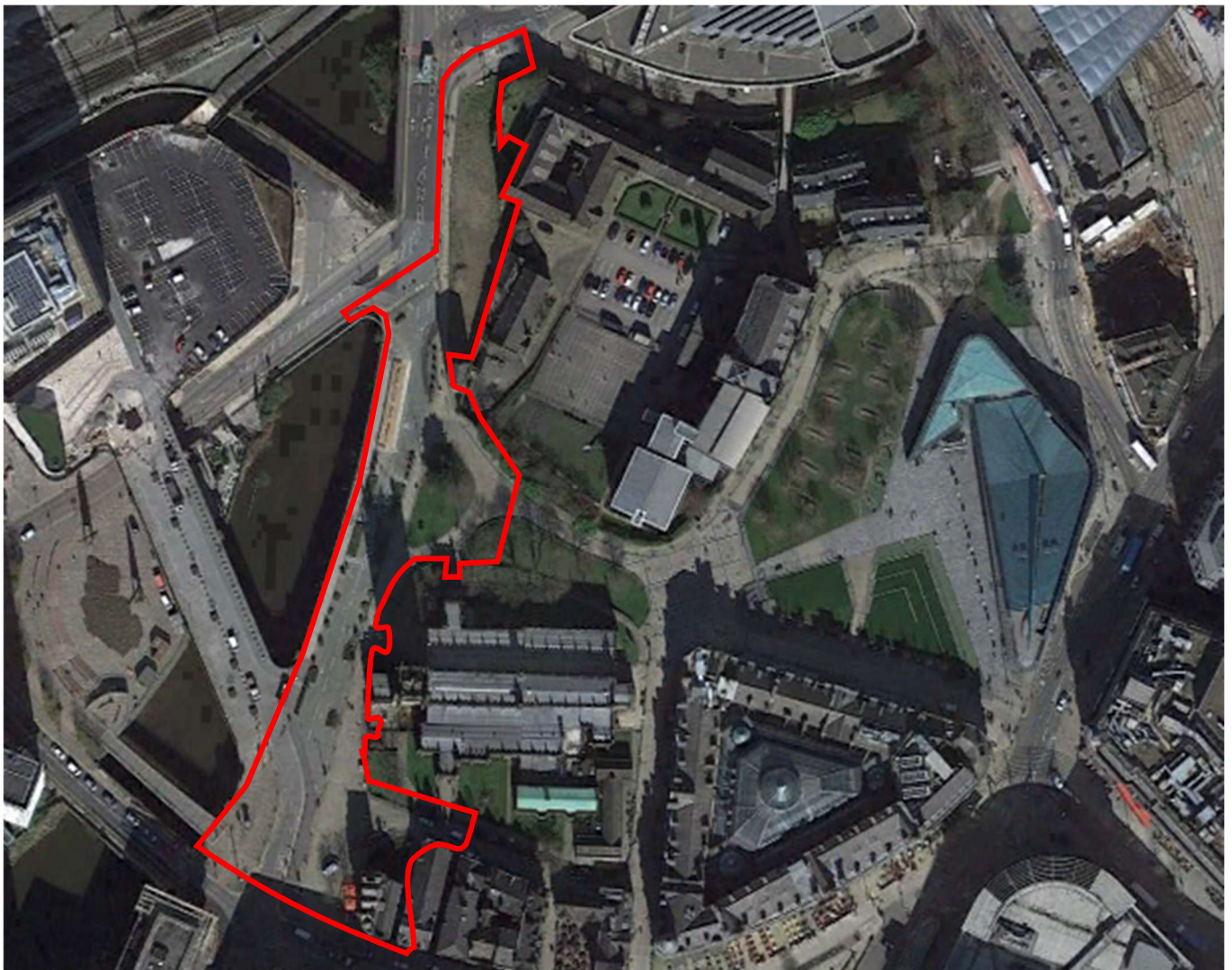
Manchester City Council

Report Type

Flood Risk Assessment

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Flood Risk Assessment

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Civic Job No. 949-02

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1. Introduction

1.1 Scope and Objectives

Civic Engineers Ltd has been appointed by Galliford Try on behalf of Manchester City Council (MCC) to prepare a Flood Risk Assessment to support a full planning application for the proposed public realm improvements at the Medieval Quarter, Manchester.

The Flood Risk Assessment presented herein will demonstrate that the proposed development will be safe from flooding and will not pose a flood risk to sites elsewhere.

This Flood Risk Assessment will:

- Investigate all potential risks of flooding to the site.
- Consider the impact the development may have elsewhere with regards to flooding.
- Consider proposals to mitigate any potential risk of flooding determined to be present; and,
- Consider drainage proposals to mitigate flood risk from the site.

This report reviews the following information:

- Environment Agency Online Flood mapping.
- UK Government Long Term Flood Risk Information for surface water flooding and reservoir flooding.
- CCTV Survey output information.
- GPR survey.
- United Utilities Asset Location Search Sewer Map.
- Preliminary results from Phase 2 Ground Investigation.

1.2 Development Proposals

Full Planning Permission is sought for proposed public realm improvements including repaving, the provision of new furniture and features, the adaptation of green spaces and the introduction of new green spaces including SuDS.

2. Existing Site Details

2.1 Location

The proposed development site is located in Manchester city centre adjacent to Chethams School of Music and Manchester Cathedral. The site includes Victoria Street at the northern end of Deansgate which is adopted highway and has been closed to vehicular through movement. The site is bounded by the River Irwell which runs along the western site boundary.

The site area is approximately 0.76Ha and the OS Grid Coordinates at the approximate centre of the site are 383860, 398806.

The site location and extents are shown in Figure 1 below.

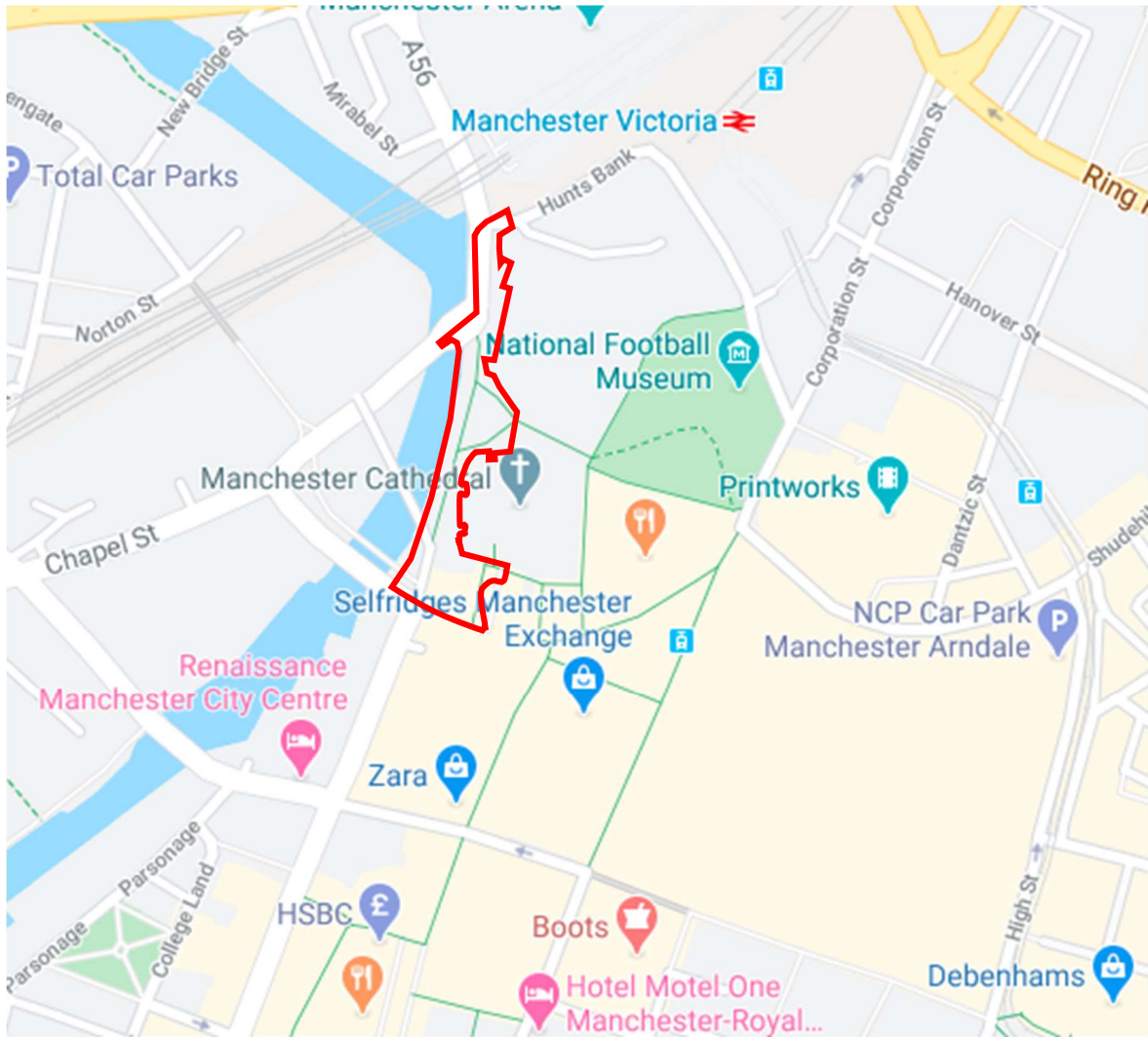


Figure 1: Site location plan

2.2 Existing Drainage

A GPR survey was undertaken of the site by Survey Operations, on behalf of Galliford Try and can be found in Appendix A. Additionally, a Utilities Search, also undertaken on behalf of Gulliford Try, revealed a United Utilities combined water sewer underneath the proposed development area. The sewer runs through the site from north to south, and is a 720 x 900mm egg-shaped brick sewer, which is 8m deep at the proposed point of connection.

A CCTV survey was undertaken by General Utilities Northwest Ltd. in January 2019. Outputs are shown below in Figure 2, and include multiple outfalls to the River Irwell. However, these outfalls have been determined to be too shallow to connect the proposed drainage strategy in to. Additionally, the CCTV survey picks up numerous connections to the United Utilities sewer however due to the extents of the survey, this was not explored further. The presence of road gullies provide evidence for the existence of some form of existing, shallow highways drainage.

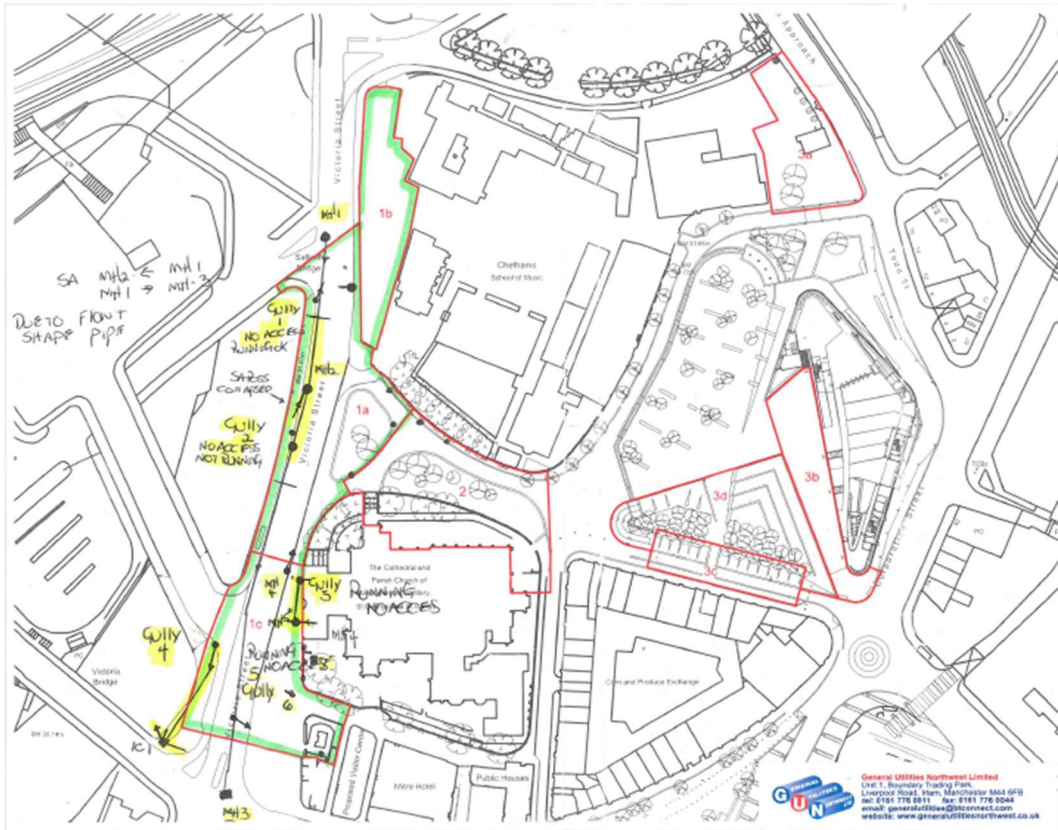


Figure 2 CCTV output of Site Pre-Development

2.3 Topography

A topographical survey has been undertaken and is contained in Figure 3 as well as Appendix B of this report. The survey shows the site falls from approximately 33mAOD at its eastern edge, on the walkway between the Cathedral and Chethams School of Music and falls towards the River. The eastern channel to Victoria Street forms the low point in the cross section and falls from a level of approximately 33mAOD in the south to approximately 30mAOD at the junction of Victoria Street and Chapel Street. The trafficked section of Victoria Street then continues to fall to the north with the low point within the survey boundary shown at approximately 28.5mAOD.

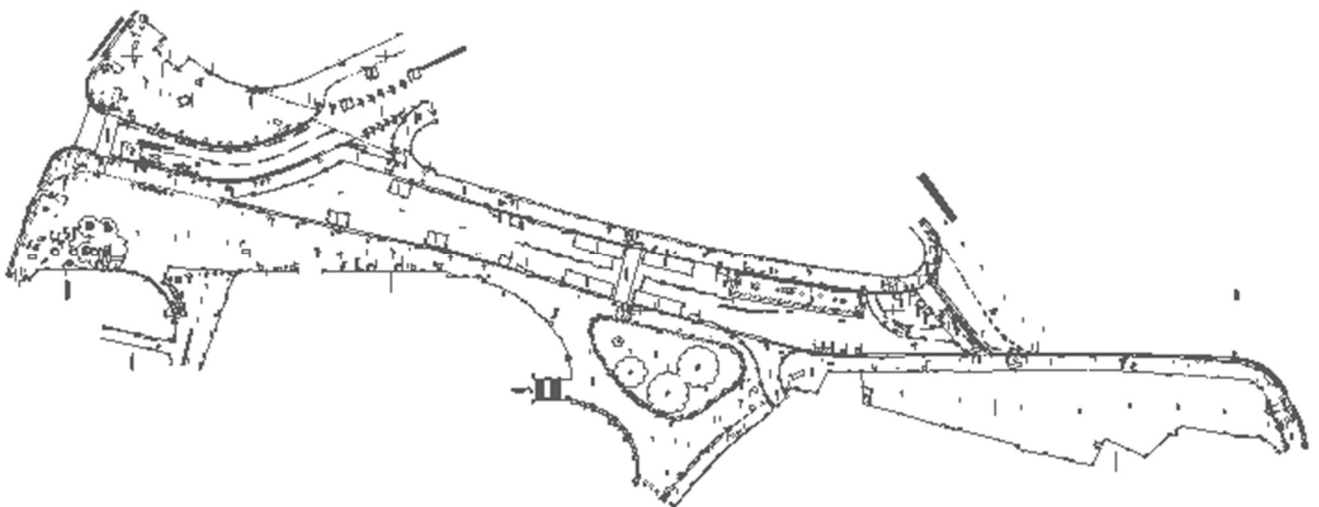


Figure 3: Topographic View of Site.

The River Irwell runs in a cutting along the western boundary of the site. The water level is not identified on the survey but at the time of site walkover the water level was approximately 10m below the level of Victoria Street. This is equivalent to the water level shown on elevations of the river wall structure provided by MCC an extract of which is included as Figure 4 below.

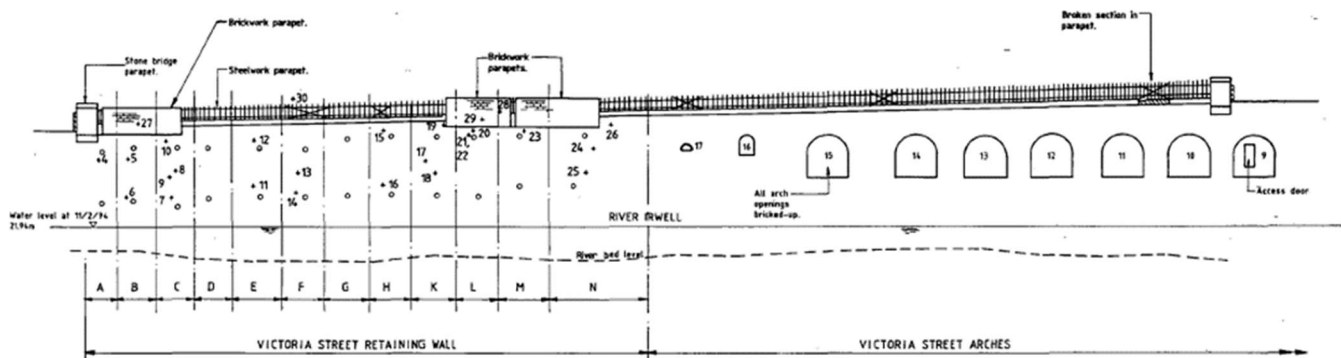


Figure 4 Extract of drawing provided by MCC showing an elevation of the River Wall adjacent to the site.

2.4 Geology

An intrusive investigation was undertaken by LK Group in February 2019. All exploratory hole work, associated sampling, in-situ testing and logging was carried out in accordance with the relevant British Standards. 5no. slot trenches were excavated across the roads and footpaths, as well as 6no. hand dug pits being excavated in areas of soft landscaping to obtain samples for contamination testing. The results from this ground investigation can be found in Appendix C of this report.

Desk based study and enquiries submitted to MCC have identified the presence of a series of catacombs beneath the site as illustrated in Figure 5 below which is an extract of a drawing provided by MCC.



Figure 5 Extract of drawing provided by MCC showing a plan of the buried arches beneath the site.

3. Relevant Policy and Guidance

3.1 National Planning Policy Framework

In February 2019, the Ministry of Housing, Communities and Local Government revised the National Planning Policy Framework document (NPPF) and the Planning Practice Guidance which provides guidance on how flood risk should be assessed during the planning and development process.

The NPPF refers to the Flood Zones which are shown on the Environment Agency Flood Map, and establishes the range of uses which are appropriate, or compatible, land uses for each Flood Zone.

The Flood Zones can be summarised as follows:

Zone 1: Low Probability. This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any one year. (<0.1%)

Zone 2: Medium Probability. This zone comprises land assessed as having between 1 in 100 and 1 in 1000 annual probability of river flooding (1%-0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year.

Zone 3a: High Probability. This zone comprises land assessed as having 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

Zone 3b: Functional Flood Plain. This zone comprises land where water must flow or be stored in times of flood. Strategic Flood Risk Assessments should identify this zone.

The 'Technical Guidance to the National Planning Policy Framework' defines the type and nature of different development classifications in the context of their flood risk vulnerability. The following extract in Figure 6 below outlines the NPPF Flood Risk Vulnerability Classifications.

More vulnerable • Hospitals. • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non-residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste⁶. • Sites used for holiday or short-let caravans and camping, <i>subject to a specific warning and evacuation plan</i>.⁷
Less vulnerable • Police, ambulance and fire stations which are <i>not</i> required to be operational during flooding. • Buildings used for shops, financial, professional and other services,
restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in "more vulnerable", and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do <i>not</i> need to remain operational during times of flood. • Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).
Water-compatible development • Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel working. • Docks, marinas and wharves. • Navigation facilities. • Ministry of Defence defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, <i>subject to a specific warning and evacuation plan</i>.
Essential infrastructure • Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
Highly vulnerable • Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use³. • Installations requiring hazardous substances consent⁴. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as "essential infrastructure")⁵.

Figure 6 Table 2 from Technical Guidance to the National Planning Policy Framework (2012)

The flood risk vulnerability and flood zone 'compatibility' has been summarised in Table 1 below. The EA presents a set of recommendations based on the level of vulnerability of a proposed structure and its Flood Zone.

Table 1: Flood Risk vulnerability and Flood Zone compatibility from NPPF Technical Guide

Flood Risk Vulnerability Classification		Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Flood Zone (See Table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	Exception Test Required	✓	✓	✓
	Zone 3a	Exception Test Required	×	Exception Test Required	✓	✓
	Zone 3b (functional floodplain)	Exception Test Required	×	×	×	✓
		✓ Development is appropriate × Development should not be permitted.				

3.2 Site Specific NPPF Flood Risk Categorisation

To assess the NPPF flood risk classification for the site, the Government web based 'Flood Map for Planning' is reviewed, the flood map identifies the probability of flooding from rivers or sea (not taking into account the presence of flood defences). The Government web based 'Long Term Flood Risk Assessment for Locations in England' should also be used to identify the flood risks from rivers and seas, surface water and reservoirs.

From the 'Flood Map for Planning', shown in Figure 7, the proposed site sits mainly within Flood Zone 1, with a small section of Victoria Street to the south of the site falling within Flood Zone 2.

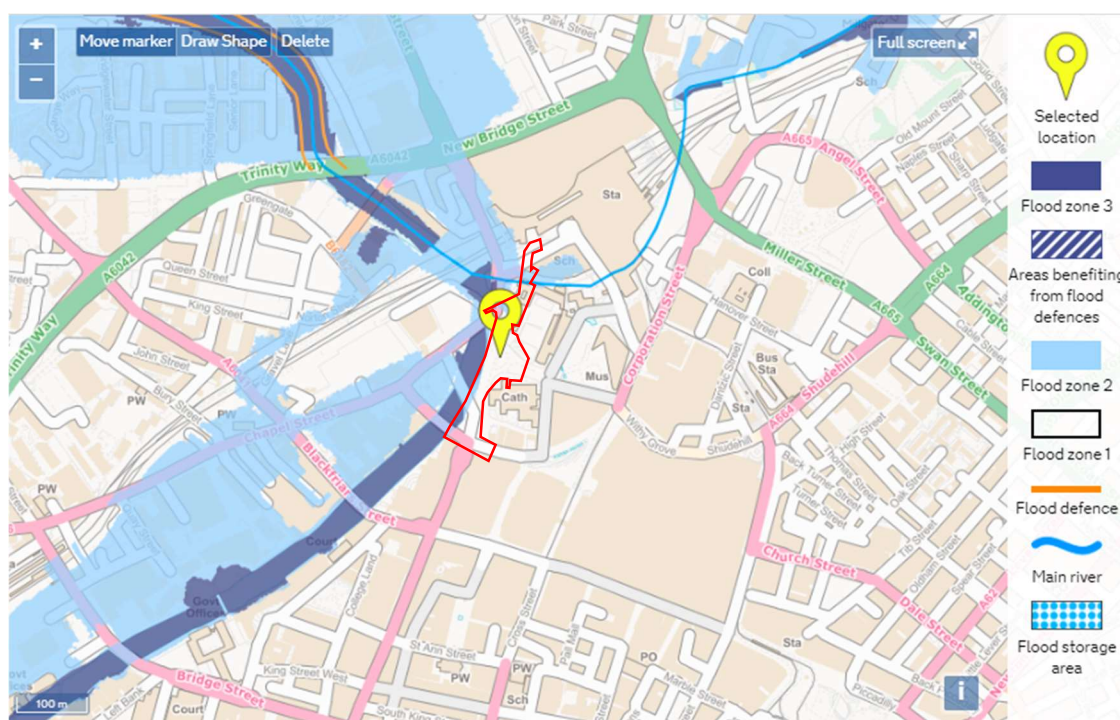


Figure 7 Flood Map for Site

3.3 Manchester City Council Strategic Flood Risk Assessment (SFRA) and Manchester Core Strategy 2012

Manchester City Council SFRA states:

"Development should aim for a minimum reduction in surface water runoff rates of 50% for Brownfield sites, with an aim of reducing runoff to Greenfield rates up to a 1 in 100 year storm event, considering climate change.

Development should be designed so that there is no flooding to the development in a 1 in 30 year event and so that there is no property flooding in a 1 in 100 year plus climate change event."

Policy EN 14 (Flood Risk) of the Manchester Core Strategy requires that:

- In line with the risk-based sequential approach contained within PPS25, development should be directed away from sites at the greatest risk of flooding, and towards sites with little or no risk of flooding; this should take account all sources of flooding identified in the Manchester-Salford-Trafford Strategic Flood Risk Assessment (SFRA).
- In addition to the requirements for site-specific Flood Risk Assessments (FRAs) set out in PPS25, an appropriate FRA will also be required for all development proposals, including changes of use, on sites greater than 0.5ha within Critical Drainage Areas (CDAs) and Canal Hazard Zones identified in the SFRA.
- All new development should minimise surface water run-off, including through Sustainable Drainage Systems (SuDS) and the appropriate use of Green Infrastructure.
- Developers should have regard to the surface water run-off rates in the SFRA User Guide. In CDAs, evidence to justify the surface water run-off approach / rates will be required.
- The City of Manchester contains many sections of rivers which are culverted or 'hidden'. Where these are indicated in the SFRA beneath the proposed development site, further investigation will be required and the development proposal should take this into account; where feasible and appropriate development should seek to open up culverted/hidden rivers to reduce the associated flood risk and danger of collapse, taking advantage of opportunities to enhance biodiversity and Green Infrastructure.

4. Flood Risk Assessment

The potential sources of flooding to the development have been assessed and are discussed below.

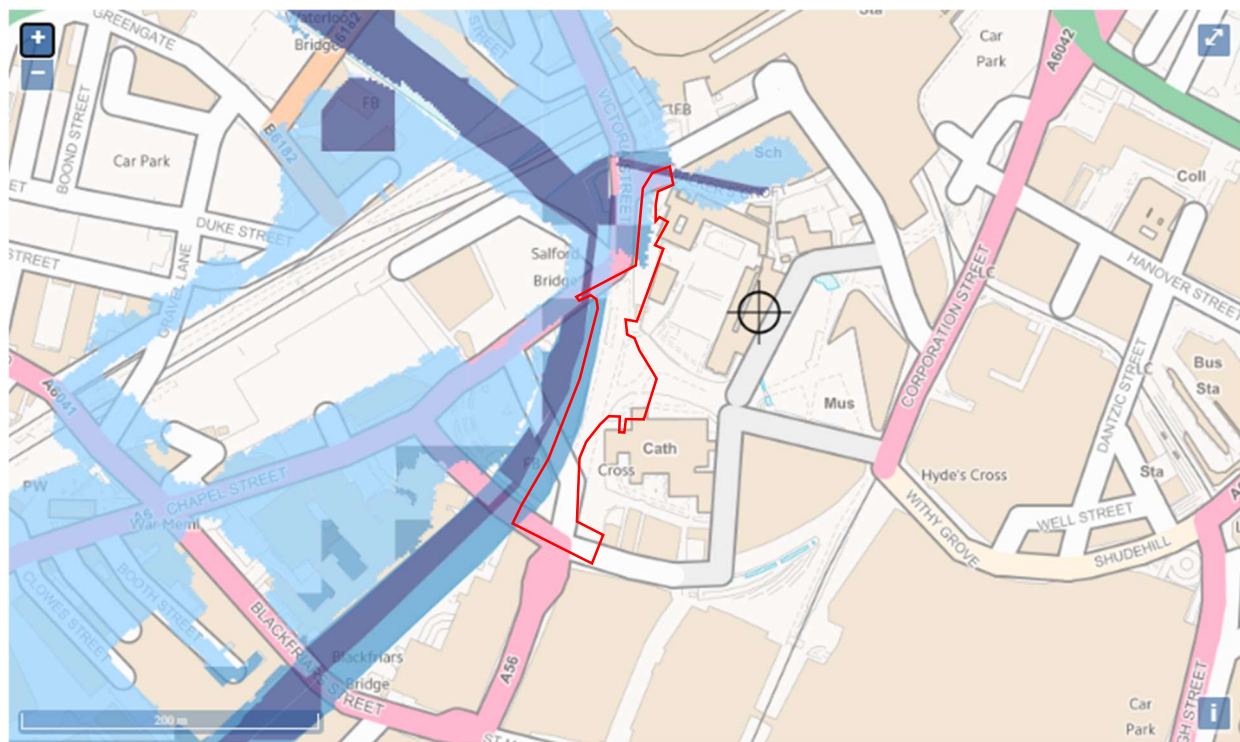
4.1 Rivers and Sea Flooding

From the Government flood map for planning:

- Where a site is in a dark blue shaded zone, this indicates that the site is within high flood risk where there is a chance of flooding of greater than 1 in 30 (3.3%).
- Where a site is in a blue shaded zone, this indicates that the site is within medium flood risk where there is a chance of flooding between 1 in 100 (1%) and 1 in 30 (3.3%).

- Where a site is in a lighter blue shaded zone, this indicates that the site is within low flood risk where there is a chance of flooding between 1 in 1000 (0.1%) and 1 in 100 (1%).
- Where a site is in the lightest blue shaded zone, this indicates that the site is within very low flood risk where there is a chance of flooding of less than 1 in 1000 (0.1%).

Flood risk to the site from rivers and seas is indicated in Figure 8 and shows that the majority of the site is within an unshaded area and therefore has no risk of flooding from rivers or sea. However, parts are highlighted as a medium risk of fluvial flooding from the River Irwell, which runs along the western border of the site.



Extent of flooding from rivers or the sea

High Medium Low Very low Location you selected

Figure 8 Rivers & Seas Flood Risk Map

4.2 Reservoir Flooding

Reservoir flooding is extremely unlikely to happen and there has been no recorded loss of life in the UK from reservoir flooding since 1925. The Environment Agency is the enforcement authority and ensures that reservoirs are inspected regularly, and essential safety work is carried out.

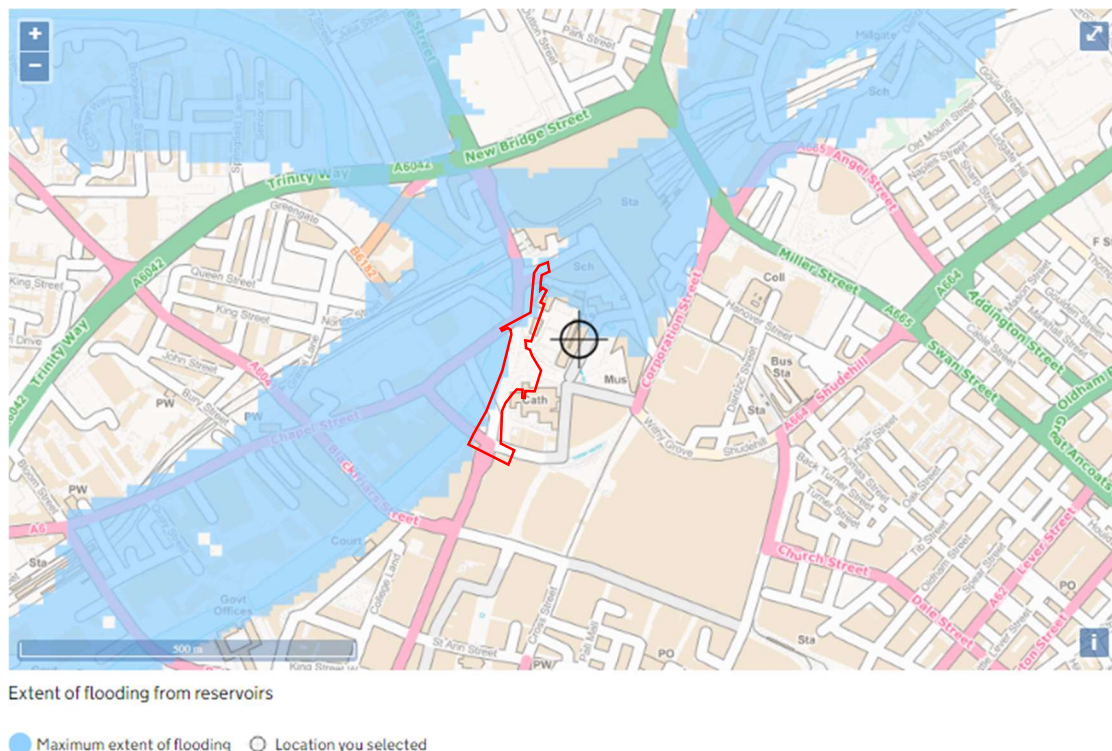


Figure 9: Extents of Flooding from Reservoirs

4.3 Public Sewers, Highway Drainage Flooding and Infrastructure Failure

There are no known cases of the site flooding as a result of surcharged public sewers or highway drainage.

Providing United Utilities and Manchester City Council maintain their drainage assets in the surrounding area of the site, the risk of flooding to the proposed development site from public sewer or highway drainage is low.

4.4 Surface Water Flooding to the Site

Surface water flooding can be caused when rainwater, during extreme rainfall events, does not drain away through the normal drainage system or soak into the ground. Surcharging sewers can result in overland flows which if originating at a higher elevation than a development site can potentially pose a flood risk.

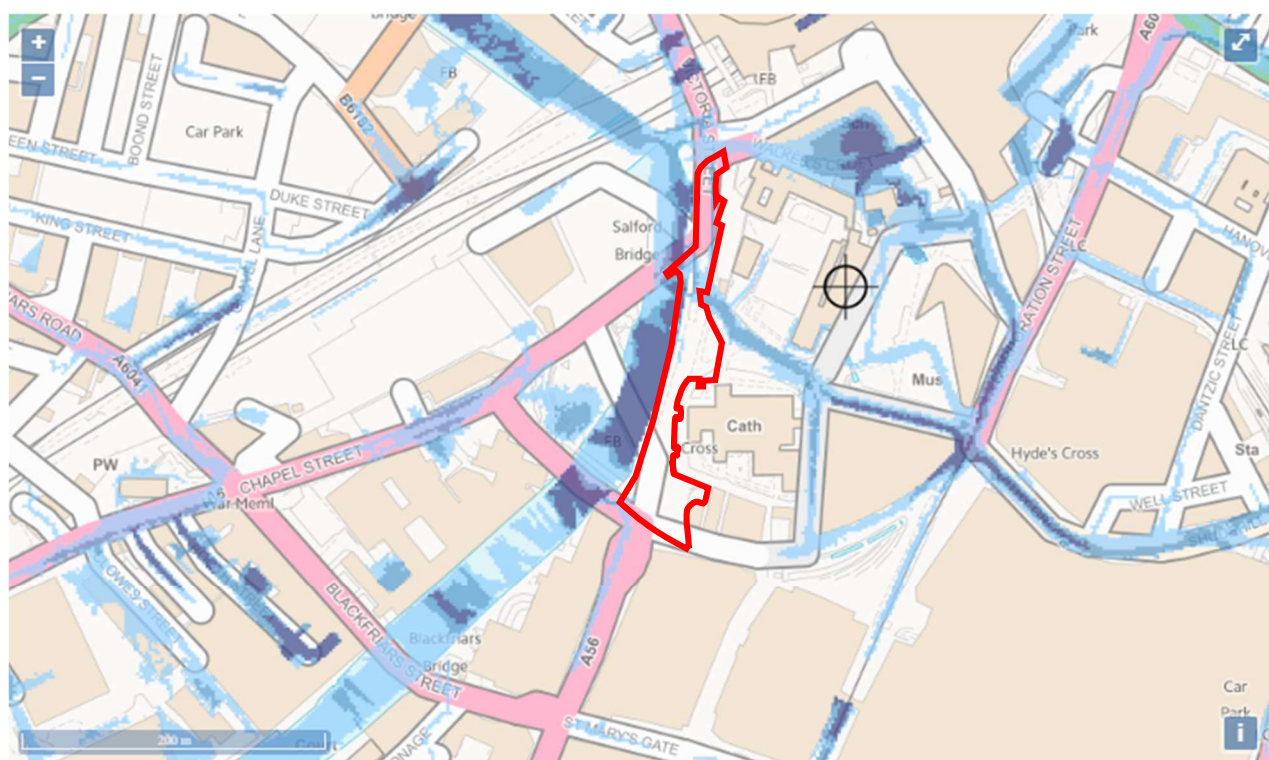
Surface water flooding is dependant primarily on topography which dictates either the flow path of overland flow which is not contained within public sewers, or areas in which ponding may occur. Surface water flooding is more difficult to predict than the risk of flooding from Rivers or Sea as it is dependent on the amount of rain which will fall in a very localised area, the specific topography of that region and the capacity and functionality of the drainage network within that section.

From the UK Government's Flood Risk from Surface Water (extent of flooding) map.

- Where a site is in a dark blue shaded zone, this indicates that the site is at high risk of flooding where there is a chance of flooding of greater than 1 in 30 (3.3%).

- Where a site is in a mid-blue shaded zone, this indicates that the site is at medium risk of flooding where there is a chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%).
- Where a site is in a light blue shaded zone; this indicates that the site is at low risk of flooding where there is a chance of flooding between 1 in 1000 (0.1%) and 1 in 100 (1%).
- Where a site is in a white (unshaded) area; this indicates that the site is at very low risk of flooding where there is a chance of flooding of less than 1 in 1000 (0.1%).

The extent of flooding to the site from surface water is indicated in Figure 10. It shows that a portion of the site to be at medium risk of surface water flooding. Given the topography of the site and the location of the potential flooding as identified on the map it is evident that the risk is associated with a surface water flow path through the site from east to west. Review of detailed mapping shows that the flood flows are anticipated to be less than 300mm in depth but greater than 0.25m/s in velocity. Flood mapping also shows surface water flood risk within the courtyard area to Chethams School of Music.



Extent of flooding from surface water

● High ● Medium ● Low ○ Very low ○ Location you selected

Figure 10: Surface Water Flood Risk Map

4.5 Surface Water Flooding from the Site

Developers are responsible for ensuring that new development does not increase the flood risk elsewhere. The proposed surface water drainage network shall be designed to not flood for the critical 1 in 30-year storm event and flood water generated up to the critical 1 in 100-year plus climate change storm event shall be constrained within areas on site so as not to cause damage to buildings, essential services or adjoining developments and services.

As the development decreases the amount of impermeable area within the site, the potential to increase flood risk to the surrounding area is low. A detailed assessment of the proposed surface flows is carried out within the drainage strategy within Section 5 of this report.

4.6 Summary of Flood Risk

From the evidence collated and subsequent negotiations, the flood risk proposed to the development can be summarised as follows:

- Rivers and Sea – Low/Medium Risk
- Reservoir – Low Risk
- Groundwater – Low Risk
- Public Sewers – Low Risk
- Surface Water – Medium Risk

5. Surface Water Management Strategy

5.1 Existing Site/Pre-development Runoff

The site is currently public open space consisting of both hard and soft landscaping and contains some raised planters. Approximately 0.69Ha of the site is covered in man-made impermeable surface, 0.05Ha is lawn, and 0.02Ha is covered by planters.

The site currently drains via road gullies and a network of highways drainage to the 720x900 brick egg shaped United Utilities (UU) combined sewer which runs north to south beneath Victoria Street. Survey has shown the UU sewer to be approximately 8m to invert which would mean it runs beneath the underground arch structures that are present under the southern section of Victoria Street.

Pre-development run off rates have been calculated using a simulated network within Micro Drainage. Surface Water Calculations are included in Appendix D. Based on the existing site's impermeable area 0.69 hectares, the existing/predevelopment runoff rate is 102.9 L/s.

5.2 Post-development Runoff and Attenuation

As the site is previously developed and is located within a Critical Drainage Area, surface water drainage from the main development site will be restricted such that it does not exceed the pre-development run off rates, with the aim of achieving a 50% reduction in accordance with the recommendations as set out in the Manchester, Salford & Trafford SFRA.

Surface water flood risk mapping identifies a potential surface water flood flow path in the 1in30yr event, which is likely to coincide with the local drainage network reaching capacity. The flow path passes through the site from the east before flowing on to Victoria Street to the north. This overland flow route will be maintained through the proposals to prevent an increased risk of flooding elsewhere and the impact of additional flows will be considered in the development of the drainage design.

As part of the proposals the area of soft landscaping (permeable area) will increase and man-made impermeable areas will reduce as illustrated in Table 2 below (See Civic Engineers' drawing 949-02-CIVIC-C-XX-GA-100 within Appendix E for Phasing Plan).

Table 2: Potential SuDS Scheme Components

Phase	Description	Pre-development areas (Ha)	Post-development areas (Ha)	Increase/ Decrease (Ha)
1A	Impermeable	0.2359	0.2078	-0.0281
	Permeable (Lawn)	0.0486	0.0712	0.0226
	Permeable (Raingarden)	0.0212	0.0266	0.0054
1B	Impermeable	0.1537	0.0635	-0.0902
	Permeable (Lawn)	N/A	0.0809	0.0809
	Permeable (Raingarden)	N/A	0.0092	0.0092
1C	Impermeable	0.3003	0.2748	-0.0255
	Permeable (Lawn)	N/A	0.0088	0.0088
	Permeable (Raingarden)	0.0031	0.0197	0.0166

In February 2016, the Environment Agency released updated climate change allowances for peak rainfall intensities which should be applied to new developments. Table 3 demonstrates the climate change allowances with central and upper end allowances being considered.

Table 3: Extract from Environment Agency Guidance - Peak Rainfall Intensity Allowance in small urban catchments

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

Based on the nature of the development, a lifespan in excess of 60 years is anticipated. The potential climate change allowance for 2070-2115 ranges between 20% for the central allowance and 40% for the upper end allowance. As such, the design will consider an allowance of 40% climate change on peak rainfall intensity for calculations.

In restricting the flows from the development site to the 1 in 1-year brownfield rate (with betterment) there will be a requirement to provide attenuation to accommodate flows up to the critical 1 in 100-year event with a climate change allowance of 40%. The purpose of the attenuation being to maintain operation of the system during the 1 in 1yr, 1 in 30yr and the 1 in 100yr (plus climate change) storm events.

The required volume of attenuation has been calculated using Micro Drainage based on the proposed development. Surface Water Calculations are included in Appendix D and propose a restricted rate of 51.45/s and 187m³ of attenuation.

A drainage strategy drawing has been produced within Appendix E of this report showing indicative drainage connection points and layouts incorporating attenuation. Consideration has been given to the use of permeable paving however given the heritage setting and the potential to reuse existing pavement construction in some areas the use of permeable paving was not deemed suitable for this scheme.

In order to provide a functional landscape and to provide the necessary water treatment plus amenity and biodiversity benefits it is proposed that the planters in the proposed scheme are designed as bioretention planters or raingardens which will intercept initial rainfall, and will attenuate and filter run-off from more extreme events prior to discharging to the existing highways drainage network. An illustration of the type of feature is shown on Civic Engineers' drawing 949-02-CIVIC-C-DE-004 in Appendix E.

5.3 Sustainable urban Drainage Systems (SuDS)

Where possible the site drainage will look to utilise SuDS features. Section 1.1 of the SuDS Manual (Ciria C753) states the following:

"Sustainable drainage systems (SuDS) can deliver multiple benefits.

Surface water is a valuable resource, and this should be reflected in the way it is managed and used in the built environment. It can add to and enhance biodiversity, beauty, tranquillity and the natural aesthetic of buildings, places and landscapes and it can help make them more resilient to the changing climate.

The philosophy of sustainable drainage systems is about maximising the benefits and minimising the negative impacts of surface water run-off from developed areas.

The SuDS approach involves slowing down and reducing the quantity of surface water runoff from a developed area to manage downstream flood risk and reducing the risk of that runoff causing pollution. This is achieved by harvesting, infiltrating, slowing, storing, conveying and treating runoff on site and, where possible, on the surface rather than underground. Water then becomes a much more visible and tangible part of the built environment, which can be enjoyed by everyone."

The SuDS Manual describes the four pillars of SuDS design as Water Quality, Water Quantity, Amenity and Biodiversity as illustrated in Figure 11.

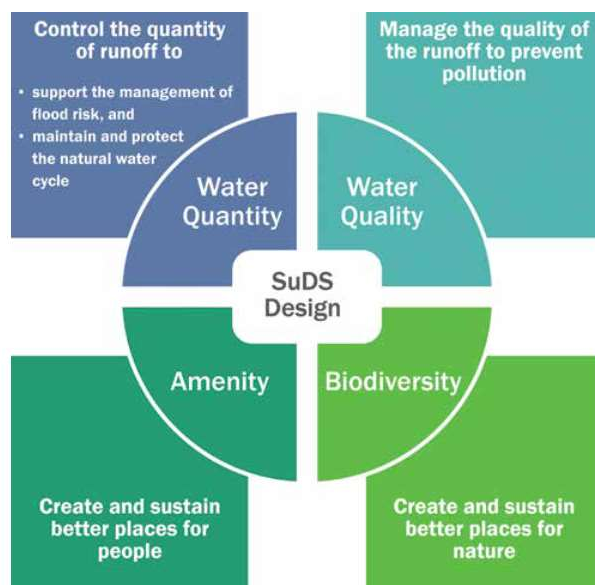


Figure 11: Sustainable Development Objectives (Representation of Figure 2.1 of the SuDS Manual)

Minimising the Impact of the Development on the Quantity of Surface Water Run-off

In order to minimise the impact of the development on existing infrastructure and to reduce the risk of downstream flooding it is important to manage the rate and volume of surface water discharge such that it does not exceed the pre-developed condition and where practicable achieves a betterment.

Surface water drainage from the built development site will be restricted such that it does not exceed the pre-development run off rates, with the aim of achieving a 50% reduction in accordance with the recommendations as set out in the Manchester, Salford & Trafford SFRA.

Minimising the Impact of the Development on the Quality of Surface Water Run-off

To protect the water quality of receiving surface waters and groundwaters effectively, run off discharged from the site should be of an acceptable water quality.

The surface water run-off from the site will predominantly be from the public realm which will be subject to occasional vehicular traffic and would be classified as having a low "pollution hazard level" in Table 4.3 of the SuDS Manual and as such a "simple index approach" to treatment should be adopted. The raingardens incorporated into the proposed drainage strategy should sufficiently treat the pollutants from the surrounding area. Table 26.2 of the SuDS Manual describes the "pollution hazard indices" for different land use classes and Figure 12 below is an excerpt from that table that relates to the proposed scheme.

TABLE 26.2 Pollution hazard indices for different land use classifications				
Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4

Figure 12 :Excerpt of SuDS Manual Table 26.2 Pollution hazard indices for different use classes

Table 26.3 (represented in Figure 13 below) illustrates the "indicative SuDS mitigation indices for discharge to surface waters" and can be used to inform the SuDS strategy at the site.

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters			
Type of SuDS component	Mitigation indices¹		
	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4 ²	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond ⁴	0.7 ³	0.7	0.5
Wetland	0.8 ³	0.8	0.8
Proprietary treatment systems ^{5,6}	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

Figure 13: Representation of SuDS Manual Table 26.3 SuDS mitigation indices (for notes refer to source material)

Maximise Amenity and Biodiversity Opportunities

Improvements to the public realm and new areas of soft landscape and planting, including SuDS, will provide significant opportunities for improved amenity and enhanced biodiversity.

5.4 Drainage Hierarchy Points of Discharge

The NPPF Planning Practice Guidance Paragraph 080 states that:

"Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable:

1. into the ground (infiltration).
2. to a surface water body.
3. to a surface water sewer, highway drain, or another drainage system.
4. to a combined sewer."

Infiltration Potential Sustainable Drainage Systems (SuDS) Features to be Considered

Due to anticipated areas of made ground and proximity to structures including significant retaining walls and underground arches it is not considered feasible to dispose of surface water from the site area through infiltration. on the preliminary Phase 2 ground investigation output it is likely that infiltration into the natural strata will not be feasible due to made ground found on site and potential contamination risks.

Water Body

The River Irwell runs along the eastern boundary of the site however the existing surface water outfalls to the River were investigated and deemed to be too shallow to connect in to for the proposed SW Drainage Strategy. Also, the significant height of the wall and level difference between the site and the water level mean that construction of new outfalls in a safe manner would not be practicable.

Surface Water Sewer

Investigations are currently underway to check the feasibility of discharging to the existing highways drainage network, replicating the existing scenario however the rate of discharge would be reduced as described in the conclusion of this report.

Combined Sewer

There is a combined sewer system located on Victoria Street which runs through the site, these sewers are classified as Combined Water Sewers and would be considered suitable for the discharge of surface water, however they are located 8m below ground level. Hence the investigation into discharging into the existing highways drainage. Any connection to the public sewer network will be subject to a formal agreement with the sewerage provider under Section 106 of the Water Industry Act 1991.

Summary

The surface water discharge options are summarised below in Table 4.

Table 4: Summary of Surface Water Disposal

Surface Water Disposal Method	Potential	Description
Infiltration	X	Made ground is present, retaining walls & underground arches

Water Body	X	No existing outfalls at required depth
Surface Water Sewer	✓	Investigation underway looking into discharging into highways drainage
Combined Water Sewer	✓	Victoria Street combined public sewer within the vicinity of the site which would be suitable for surface water discharge.

6. Conclusion

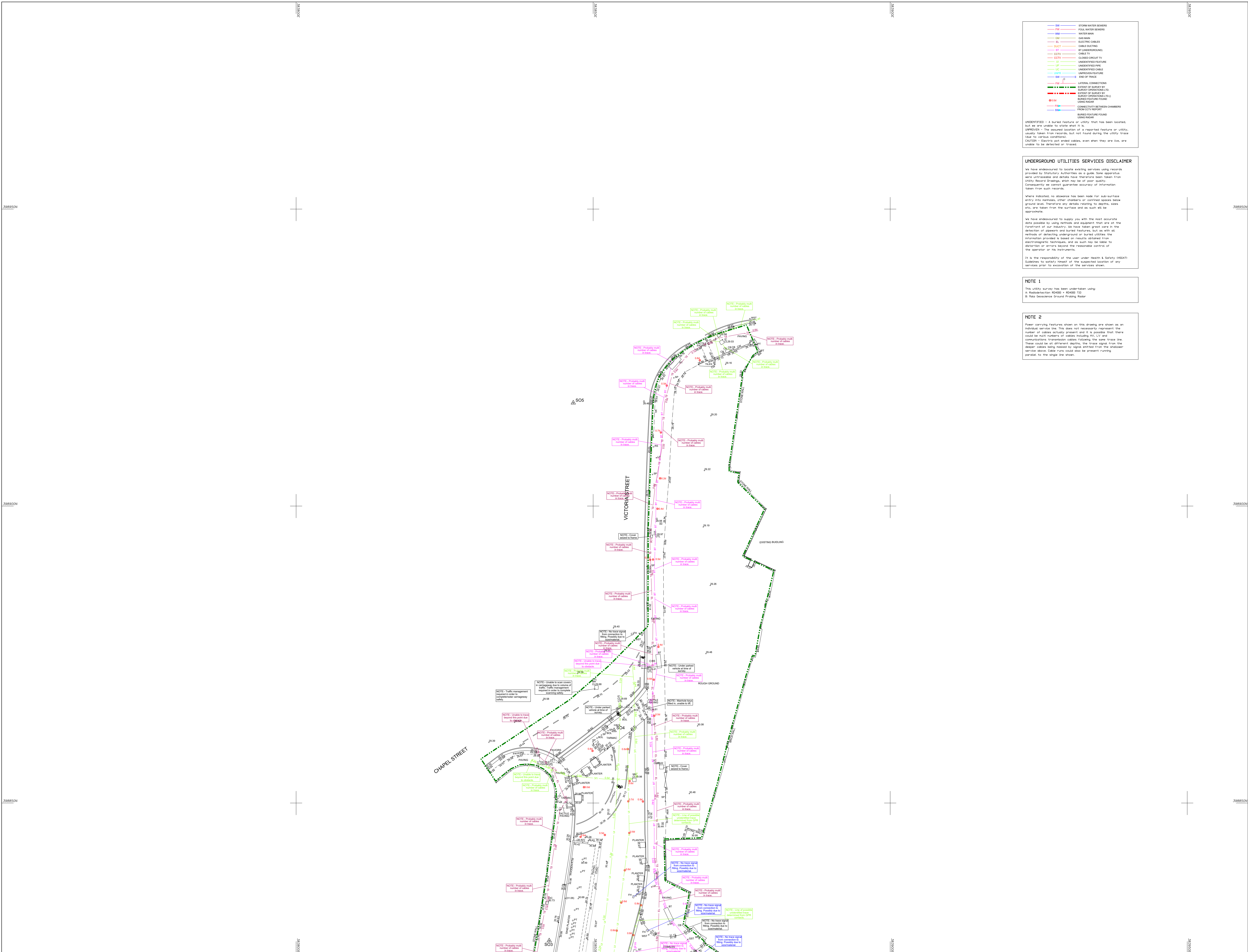
The proposed development is located within Flood Zone 1 and 2 and is considered "water compatible" as such is appropriate for development in the Flood Zone.

Flood risk from all sources has been considered and it has been identified that the primary flood risk to the site is as a result of surface water overland flow. Surface water flood risk mapping identifies a potential surface water flood flow path in the 1 in 30yr event, which is likely to coincide with the local drainage network reaching capacity. The flow path passes through the site from the east before flowing on to Victoria Street to the north. This overland flow route will be maintained through the proposals to prevent an increased risk of flooding elsewhere and the impact of additional flows will be considered in the development of the drainage design.

Flood mapping also shows surface water flood risk within the courtyard area to Chethams School of Music, levels will be set to minimise this risk of flooding so as not to be worse than the existing scenario.

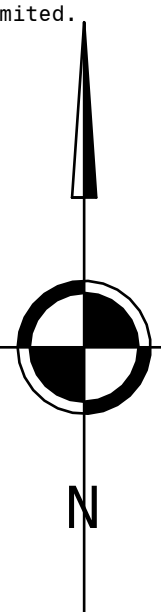
Surface Water discharge for the development will be limited to 50% of the 1 in 1-year current storm event (from 102.9 L/s to a reduced rate of **51.45 L/s**), with attenuation provided for a 1 in 100-year storm event including a 40% climate change (**187m³**) allowance. In line with the requirements of the Manchester City Council SFRA. Where possible SuDS will be incorporated to further improve the water quality. Surface water will likely be discharged into an existing combined sewer network. With incorporation of the proposed mitigation measures, as described above the proposed scheme of public realm improvements, will comply with National and Local Planning Policy.

Appendix A: Ground Penetrating Radar Survey



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Note:

The survey is plotted on a plane local
Grid. Orientation to National Grid.

All levels relate to Ordnance Datum

achieved using the

OS National GPS Network.

Survey Control Markers established for Mapping purposes only and should not be

used for Construction without the written
approval of Survey Operations Ltd.

Utility survey added to topographical sheet

job number 188009.

with local authority records before use

SURVEY STATIONS			
Name	Easting	Northing	Height
S01	383825.85	398719.27	33.1
S02	383828.87	398773.22	32.0
S03	383842.60	398826.83	30.4
S04	383853.52	398962.22	29.8
S05	383846.65	398917.38	28.8

STANDARD REFERENCE & ABBREVIATIONS

[illegible]

1

2

Sheet Layout

Survey

Smith Street, Skelmersdale, Lancs. WN8 8LN
Tel: 01695 725662 Fax: 01695 51816
Email: mail@survops.co.uk - www.survops.co.uk

Client
Galliford Try Infrastructure Limited

Drawing Title
Utility Survey of Land at:

Victoria Street Cheethams

Sheet 1 of 2

Scale(s)	1:200	Surveyor	
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Date	Jun 18	Drawn	MP
------	--------	-------	----

Job Number	18F064	Checked	PE
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Sheet Size & Drg Number & Revision

A0 18F064/001



	SW	STORM WATER SERVICES
	FW	FAUL WATER SERVICES
	WM	WATER MAIN
	GM	GAZ MAIN
	EC	ELECTRIC CABLES
	DUCT	CABLE DUCTING
	BT	BELONGUNDERGROUND
	CCTV	CABLE TV
	CT	CLOSED CROCK TYP
	UP	UNIDENTIFIED PIPE
	UPH	UNIDENTIFIED PIPE
	UPH	UNIDENTIFIED PIPE
	UPH	UNIDENTIFIED PIPE
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	UPH	UNIDENTIFIED PIPE

UNIDENTIFIED = A buried feature or utility that has been located, but an exact location has not been determined.

UNIDENTIFIED = The assumed location of a reported feature or utility, unless the location is confirmed, but not found during the utility trace (due to various conditions).

CAUTION = Electric panel enclose cables, even when they are live, are

WE have endeavored to locate existing services using records provided by Statutory Authorities on a good faith basis. We have endeavored to provide information that is accurate and complete to the best of our knowledge. We do not warrant the accuracy or completeness of the information provided, nor do we warrant that the information is free from errors or omissions. We do not warrant that the information is free from errors or omissions. We do not warrant that the information is free from errors or omissions.

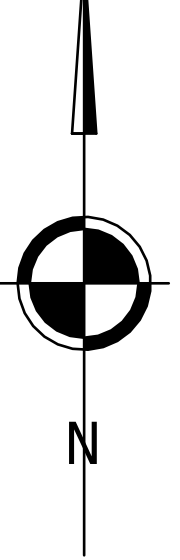
NOTE 1

This utility survey has been undertaken using:
A: Radiotelection RD4030 + RD4040 TID Rod
B: Bathy Geosounder Ground Penetrating Radar

NOTE 2

Power carrying features shown on this drawing are shown as an individual service line. This does not necessarily represent the number of cables actually present and it is possible that there could be multi turnings of cables including HV, LV and communications transmission cables following the same trace line. These could be at different depths, the trace signal from the decoder cables being masked by signal emitted from the shallow service above. Cable runs could also be present running parallel to the single line shown.

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Note: |

The survey is plotted on a plane local Grid. Orientation to National Grid.

All levels relate to Ordnance Datum, achieved using the

OS National GPS Network.

Survey Control Markers established for Mapping purposes only and should not be used for Construction without the written approval of Survey Operations Ltd.

Levels in parenthesis indicate top of walls

Utility survey added to topographical survey job number 188009.

All drainage information must be verified with local authority records before use.

SURVEY STATIONS			
Name	Easting	Northing	Height
S01	383825.85	398719.27	33.14
S02	383828.87	398773.22	32.11
S03	383842.60	398826.83	30.89
S04	383853.52	398862.22	29.92
S05	383846.65	398917.38	28.72

STANDARD REFERENCE & ABBREVIATIONS

[illegible]
$$\frac{1}{2}$$

Sheet Layout

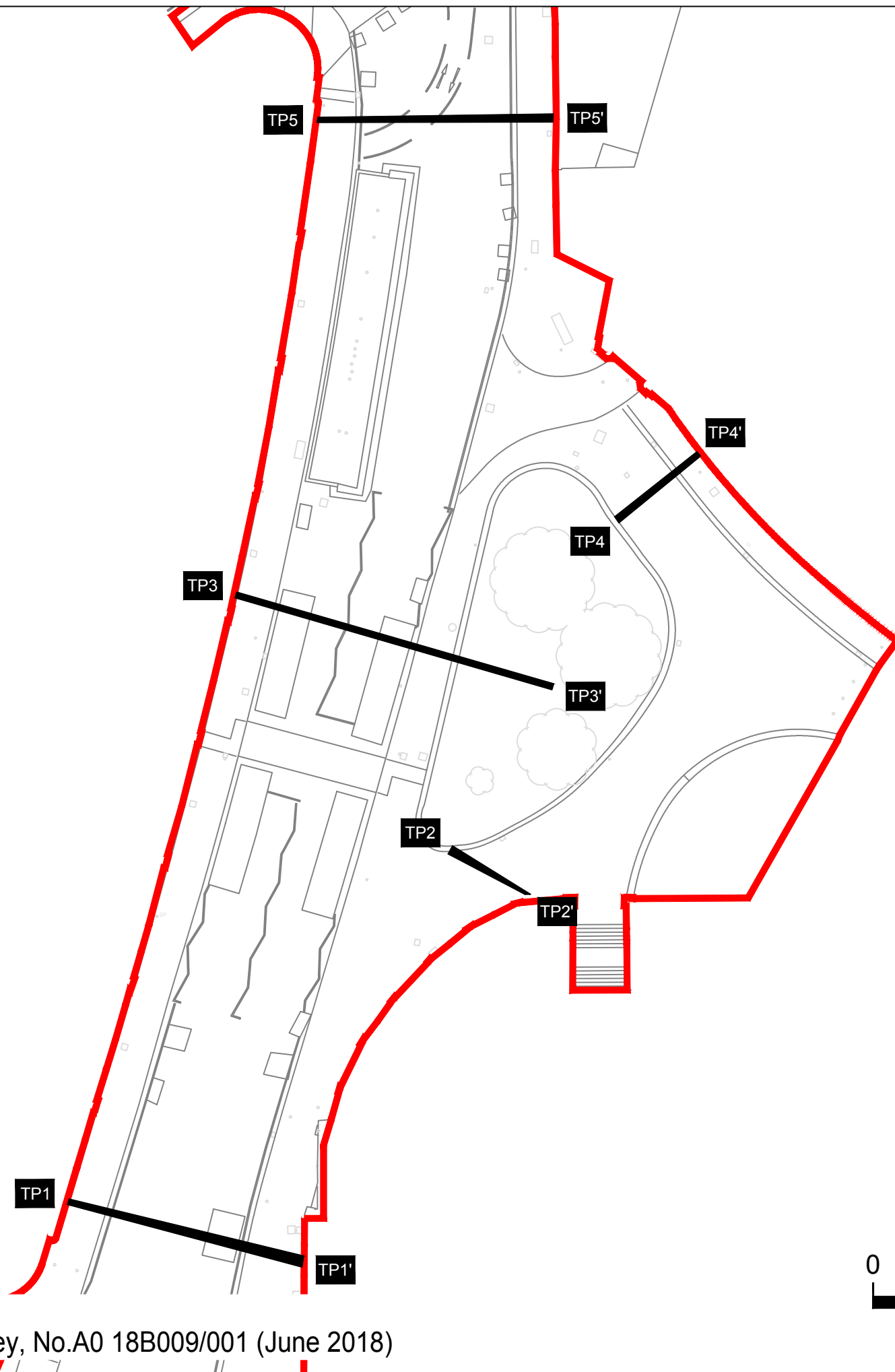
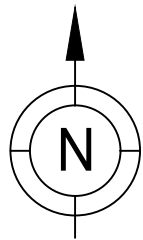


Smith Street, Skelmersdale, Lancs. WN8 8LN
Tel: 01695 725662 Fax: 01695 51816
Email: mail@survops.co.uk - www.survops.co.uk

Client		Galliford Try Infrastructure Limited	
Drawing Title			
Utility Survey of Land at: Victoria Street Cheethams Manchester			
Sheet 2 of 2			
Scale(s)	1:200	Surveyor	PE
Date	Jun 18	Drawn	MP / I
Job Number	18F064	Checked	PE / I

Sheet Size & Drg Number & Revision
A0 18F064/002

Appendix C: Ground Investigation Results



KEY

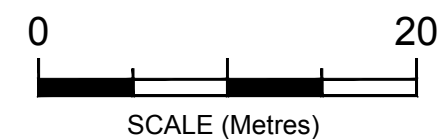
-  Site Boundary
-  Machine Dug Trial Pit (TP)

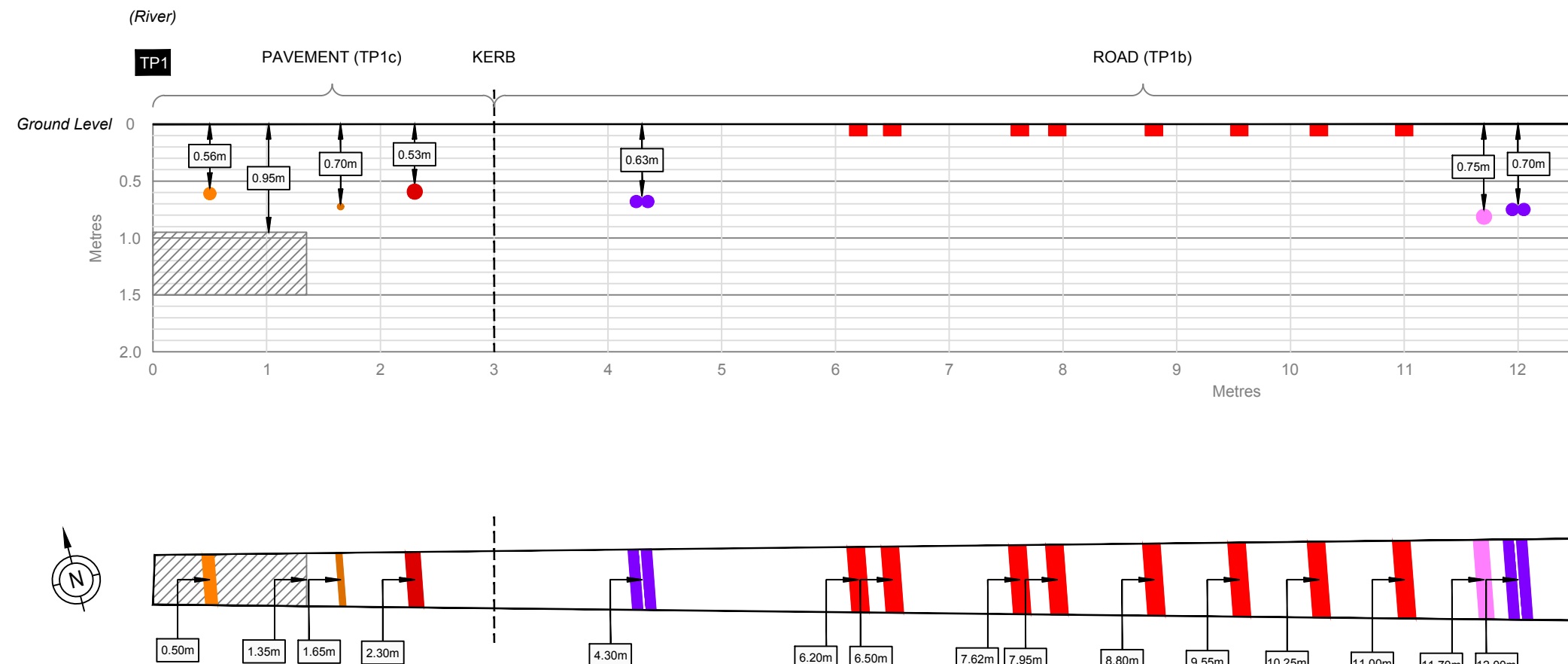
Sampling Locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.



Client: Civic Engineers			
Site: Medieval Quarter, Manchester			
Title: Trench Section Location Plan			
Job No.: LKC 18 1367	Scale (See Scale Bar): See Scale Bar	Figure: 4	Revision:
Drawn By: AC	Checked By: PP	Drawn: Feb 2019	

Extract from: Survey Operations
Drawing Ref: Topographical Survey, No.A0 18B009/001 (June 2018)





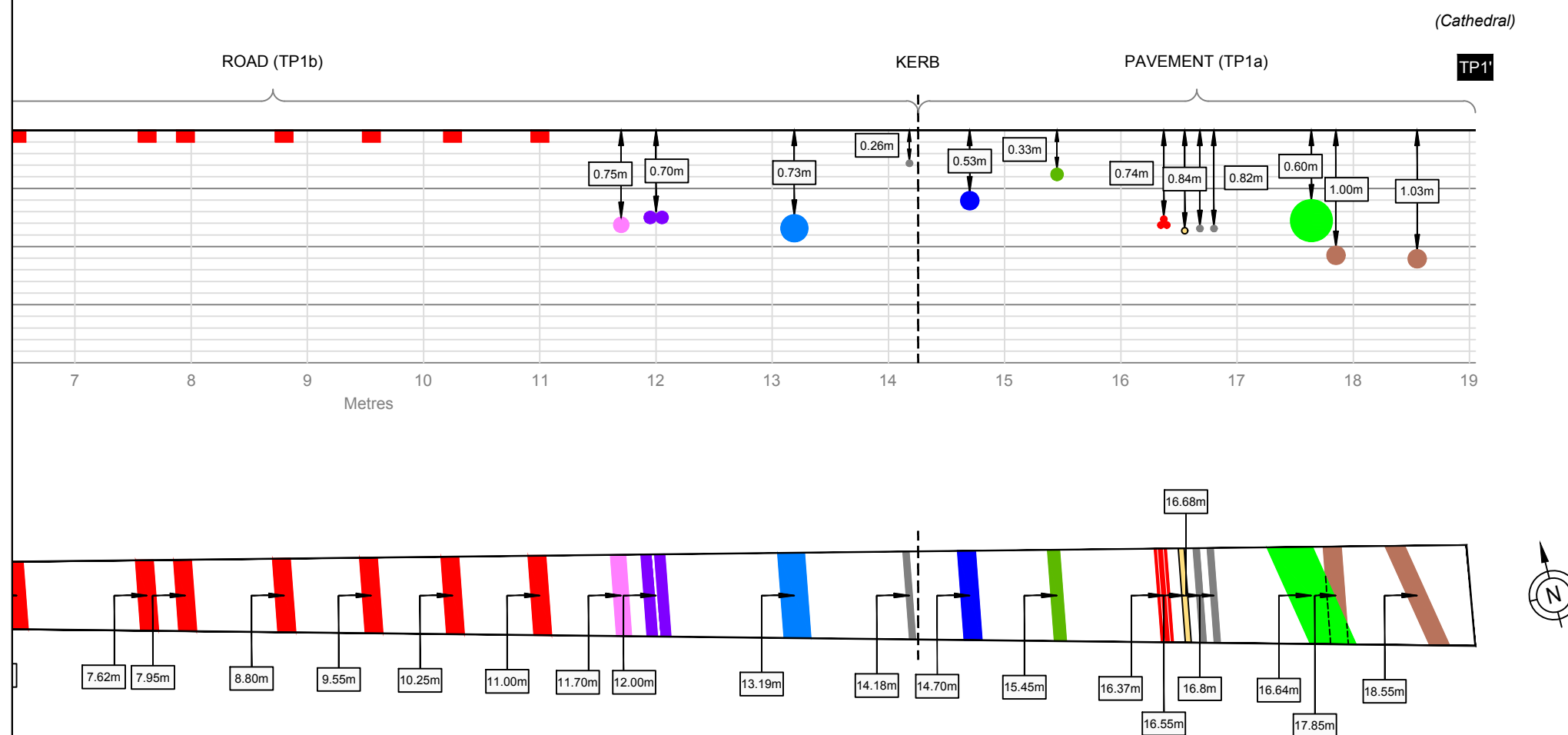
KEY

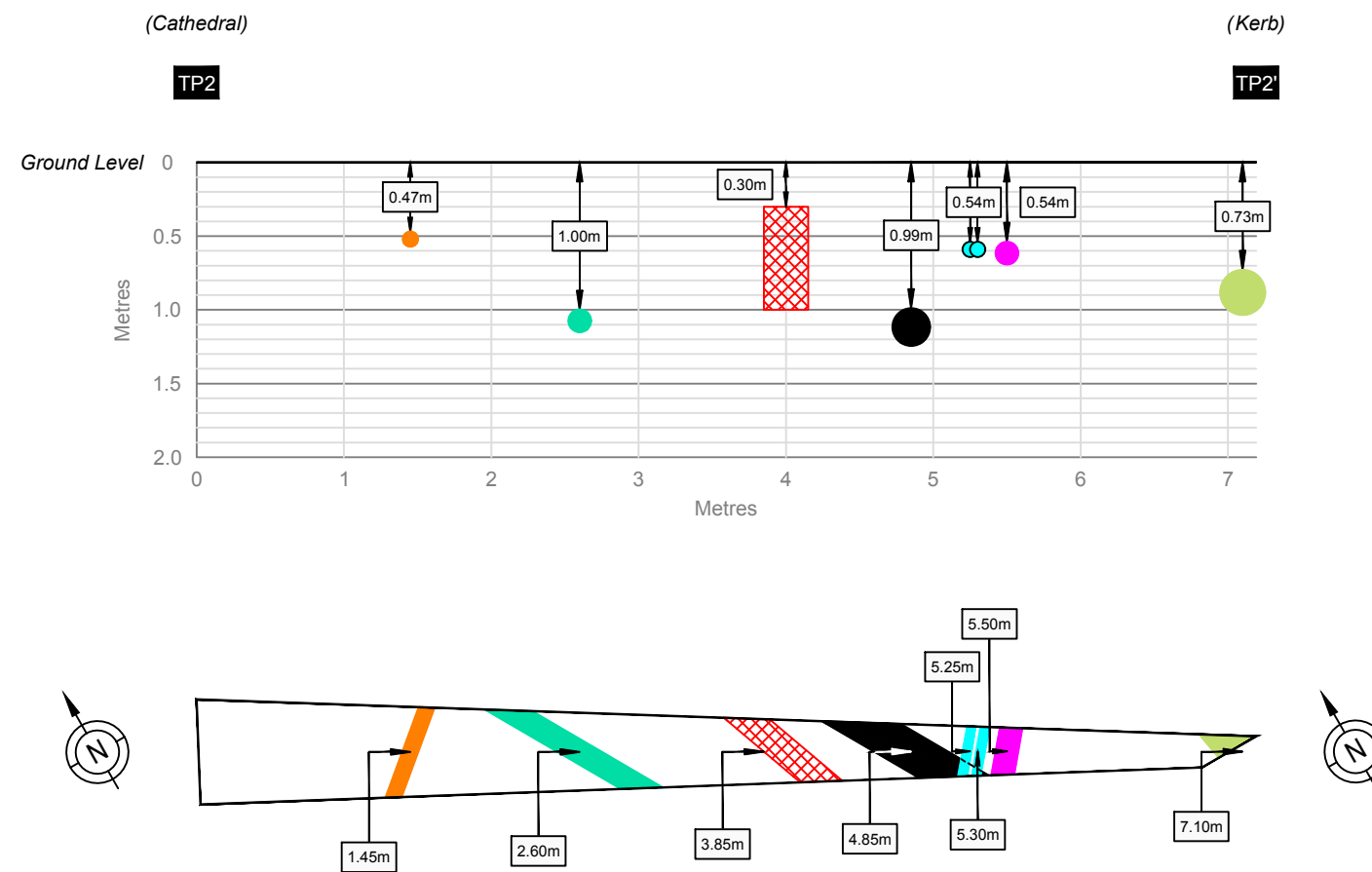
- Old Gas (14" Cast Iron)
- Drain (6" Clay)
- HV Electric (2" Cable)
- Electric (2" Cable)
- Old Electric (Ceramic Joint)
- Unknown Service (4" Plastic Flexipipe Duct)
- Old Water (6" Cast Iron)
- Water Pipe (9" PE)
- Fibre Optic (4" PE)
- Unknown Service
- Street Light (4" Flexipipe)
- Old Tram Track
- Concrete
- Unknown Service (2" Cast Iron)
- Foul Water (5" Clay)

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Client: Civic Engineers			
Site: Medieval Quarter, Manchester			
Title: Trench 1 (Section TP1 - TP1')			
Job No.: LKC 18 1367	Scale (See Scale Bar): 1:50 @ A3	Figure: 4a	Revision:
Drawn By: AC	Checked By: PP	Date: Feb 2019	





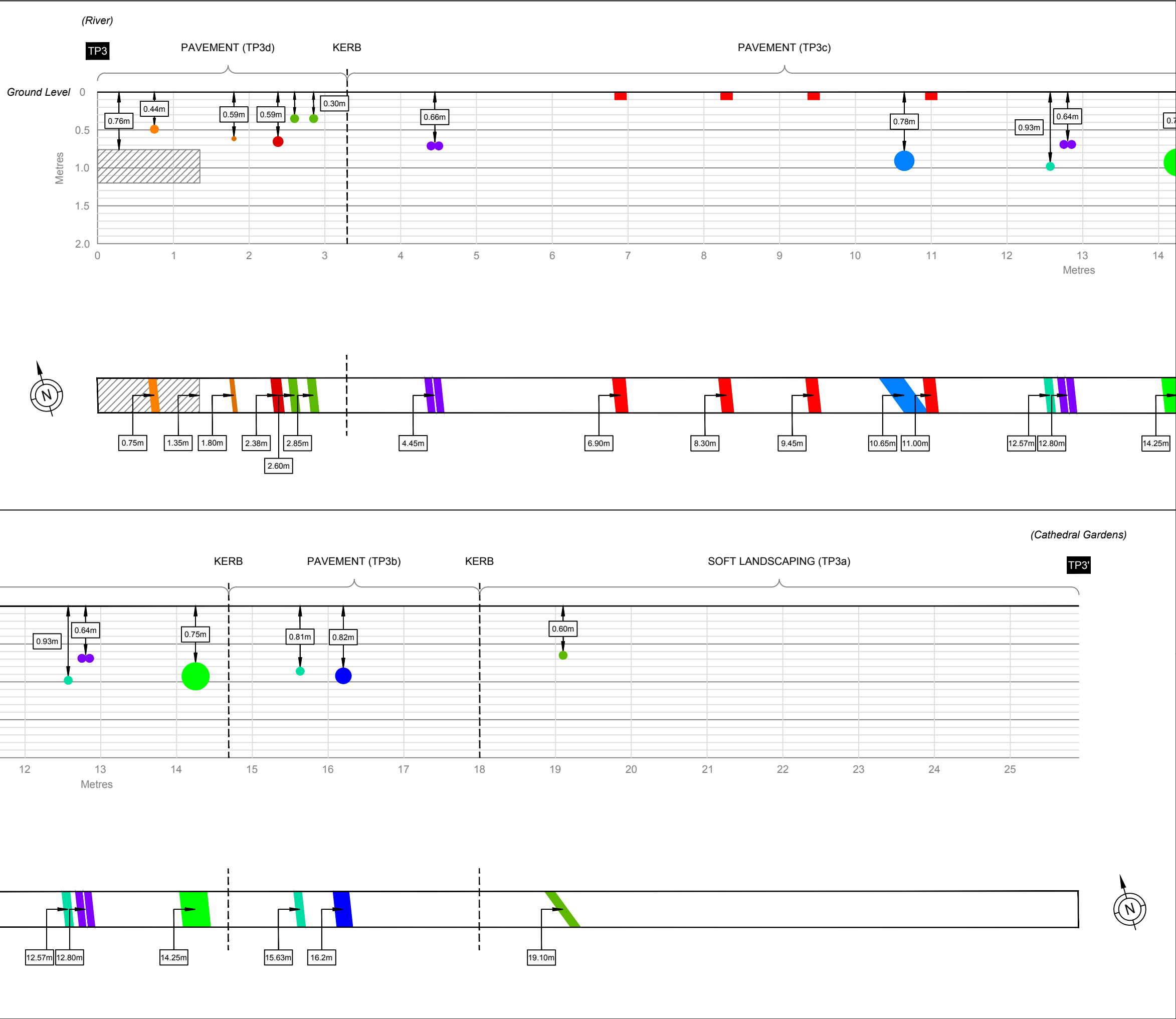
KEY

- Street Light (4" Flexipipe)
- Unknown Service (6" Metal Pipe)
- Brick Wall
- Electric (10" Cable)
- Electric (4" Cable)
- Unknown Service (6" Plastic Flexipipe Duct)
- Possible Gas Main (12" Cast Iron)

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Client:			
Civic Engineers			
Site:			
Medieval Quarter, Manchester			
Title:			
Trench 2 (Section TP2 - TP2')			
Job No.:	Scale (See Scale Bar):	Figure:	Revision:
LKC 18 1367	1:50 @ A3	4b	
Drawn By:	Checked By:		
AC	PP	Feb 2019	



KEY

- Old Gas (14" Cast Iron)
- Unknown Service (4" Plastic Flexipipe Duct)
- Unknown Service (8" Cast Iron)
- Fibre Optic (4" PE)
- Street Light (4" Flexipipe)
- Old Tram Track
- Concrete
- Unknown Service (2" Cast Iron)
- Foul Water (5" Clay)
- Water (10" Cast Iron)
- Unknown Service (4" Cast Iron)

Sampling Locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.

Client:

Civic Engineers

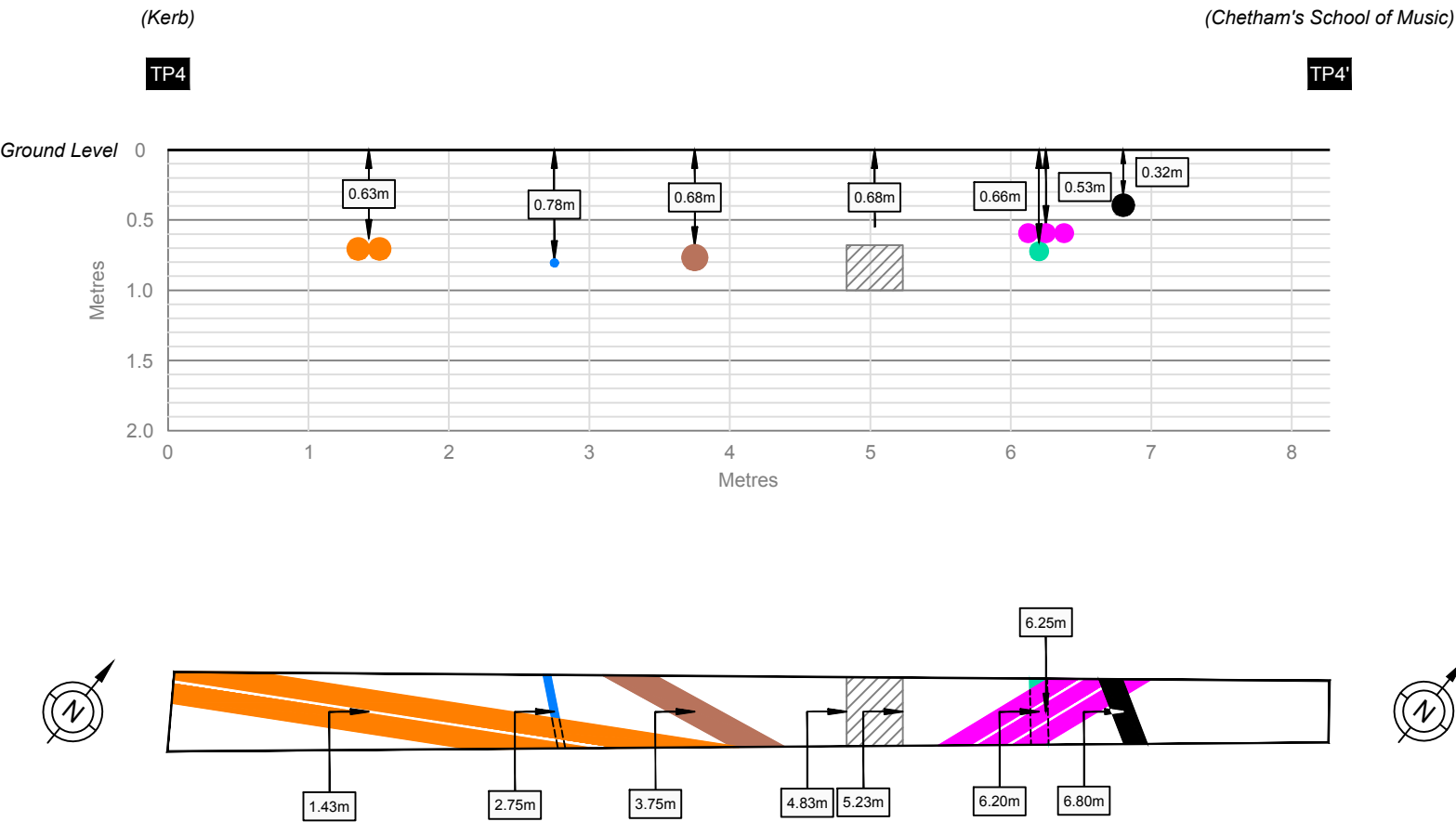
Site:

Medieval Quarter, Manchester

Title:

Trench 3 (Section TP3 - TP3')

Job No.:	LKC 18 1367	Scale (See Scale Bar):	1:50 @ A3	Figure:	4c
Drawn By:	AC	Checked By:	PP	Drawn:	



KEY

- Drain (7" Clay)
- Water (2" PE)
- Street Light (6" Flexipipe)
- Concrete
- Unknown Service (5" Metal Pipe)
- Unknown Service (5" Black Plastic Flexipipe Duct)
- BT (6" PE Pipe)

Sampling Locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.

LK

CONSULT LIMITED

Client:

Civic Engineers

Site:

Medieval Quarter, Manchester

Title:

Trench 4 (Section TP4 - TP4')

Job No.:

LKC 18 1367

Scale (See Scale Bar):

1:50 @ A3

Figure:

4d

Revision:

Drawn By:

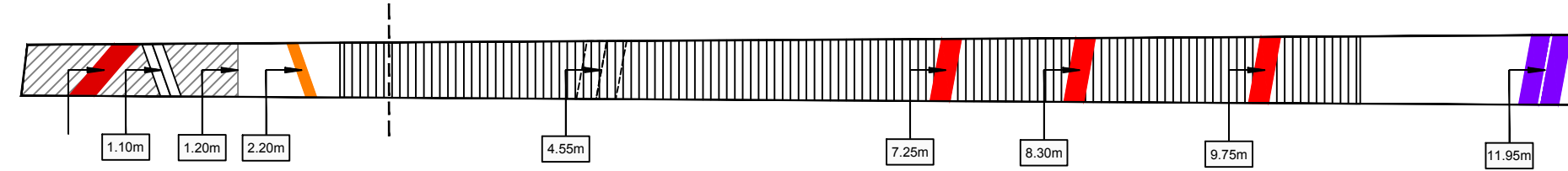
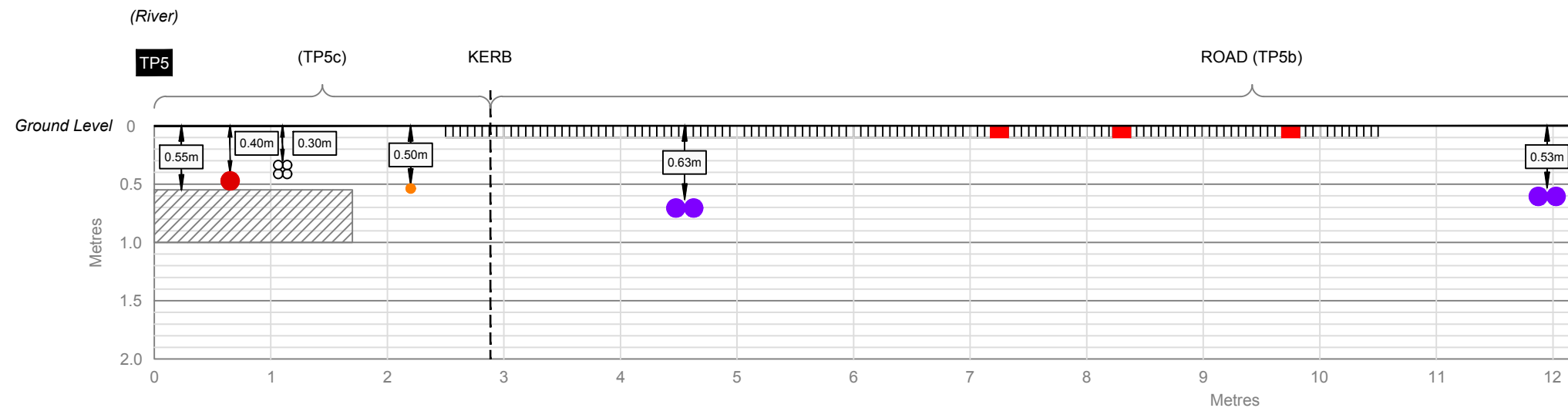
AC

Checked By:

PP

Drawn:

Feb 2019



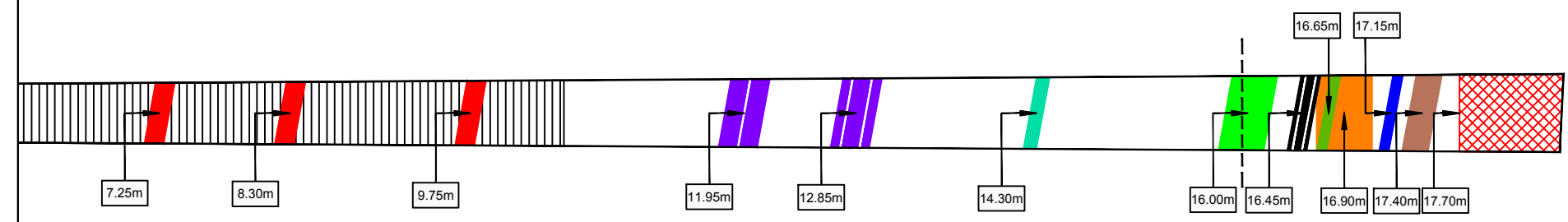
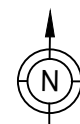
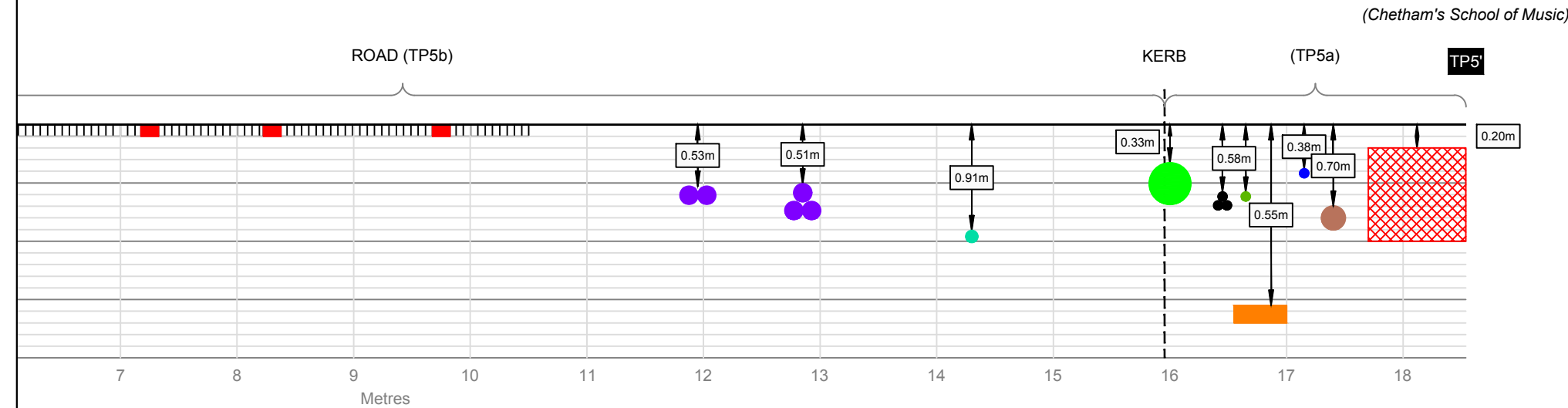
KEY

- Possible Old Gas (14" Cast Iron)
- Drain (8" Clay)
- Fibre Optic (6" PE)
- Street Light (3" PE)
- Old Tram Track
- Concrete
- Foul Water (6" Clay)
- Old Cobble Road
- Unknown Service (4" Cast Iron)
- Comms (3" PE Duct)
- BT (3" Cast Iron)
- Unknown Service (3" Cast Iron)
- Electric Tiles
- Brick Structure

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Client: Civic Engineers			
Site: Medieval Quarter, Manchester			
Title: Trench 5 (Section TP5 - TP5')			
Job No.: LKC 18 1367	Scale (See Scale Bar): 1:50 @ A3	Figure: 4e	Revision:
Drawn By: AC	Checked By: PP	Date: Feb 2019	



Job Title

Medieval Quarter & Glade of Light

Prepared for

Manchester City Council

Report TypeSW Run-Off & Attenuation
Calculations**Date**18th August 2020

SW Run-Off & Attenuation Calculations

Prepared by	David Close
--------------------	--------------------

Reviewed by	Nanette Heystek
-------------	-----------------

Civic Job No.	949-02
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Issued	18/08/2020
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1. Introduction

The purpose of these calculations is to establish the pre-development peak 1 in 1-year surface water run-off rate for the development at Medieval Quarter, and to calculate what attenuation volume will be required, if the surface water run-off from the proposed site were to be restricted to 51.5l/s (which includes 50% betterment), including 40% climate change.

2. Surface Water Catchment / Impermeable Areas

Overall Site Drainage Area = 0.76 ha

Pre-development Impermeable Area = 0.69 ha

Post-development Impermeable Area = 0.55 ha

3. Surface Water Calculation Variables

Data to calculate the pre-development 1 in 1-year surface water run-off rates and attenuation volumes are based on figures from the Flood Studies Report (FSR) data and Wallingford Procedure, which have been sources from HR Wallingford.

The variables used to calculate the surface water run-off rates and requires attenuation volumes are as follows:

M5 – 60 (mm) = 17

Ratio R = 0.4

Cv (Summer) = 0.75

Cv (Winter) = 0.84

Time of Entry = 5 Minutes

Climate Change = 0% (Pre-development)

= 40% (Post-development)

4. Pre-development Peak 1 in 1 Year Surface Water Run-off

Based on the above variables, and calculations undertaken using a two-pipe simulated network within MicroDrainage computer software, the pre-development surface water run-off rate is as follows:

Pre-development 1 in 1-Year Rate = 102.9 l/s (15-minute critical storm)

5. Post-development Restricted Surface Water Run-off Rate

The surface water from the proposed development is to be restricted by a flow control, in this case a 90mm orifice plate will be used, to give:

Post-development SW Run-off rate = **51.45 l/s** (50% betterment)

6. Surface Water Attenuation Volumes

The surface water attenuation volumes have been calculated using the above variables and show that the attenuation volume for the post-development site, when restricted to 51.45l/s is:

1 in 100-Year Event + CC (40%) = **187m³** (51.45 l/s)

7. Proposed Outline Surface Water Drainage Strategy

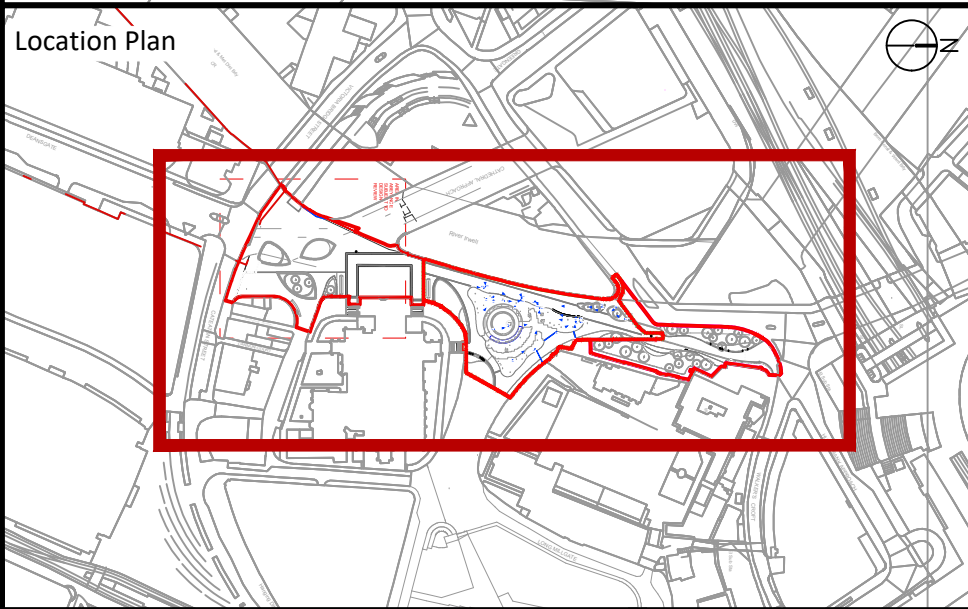
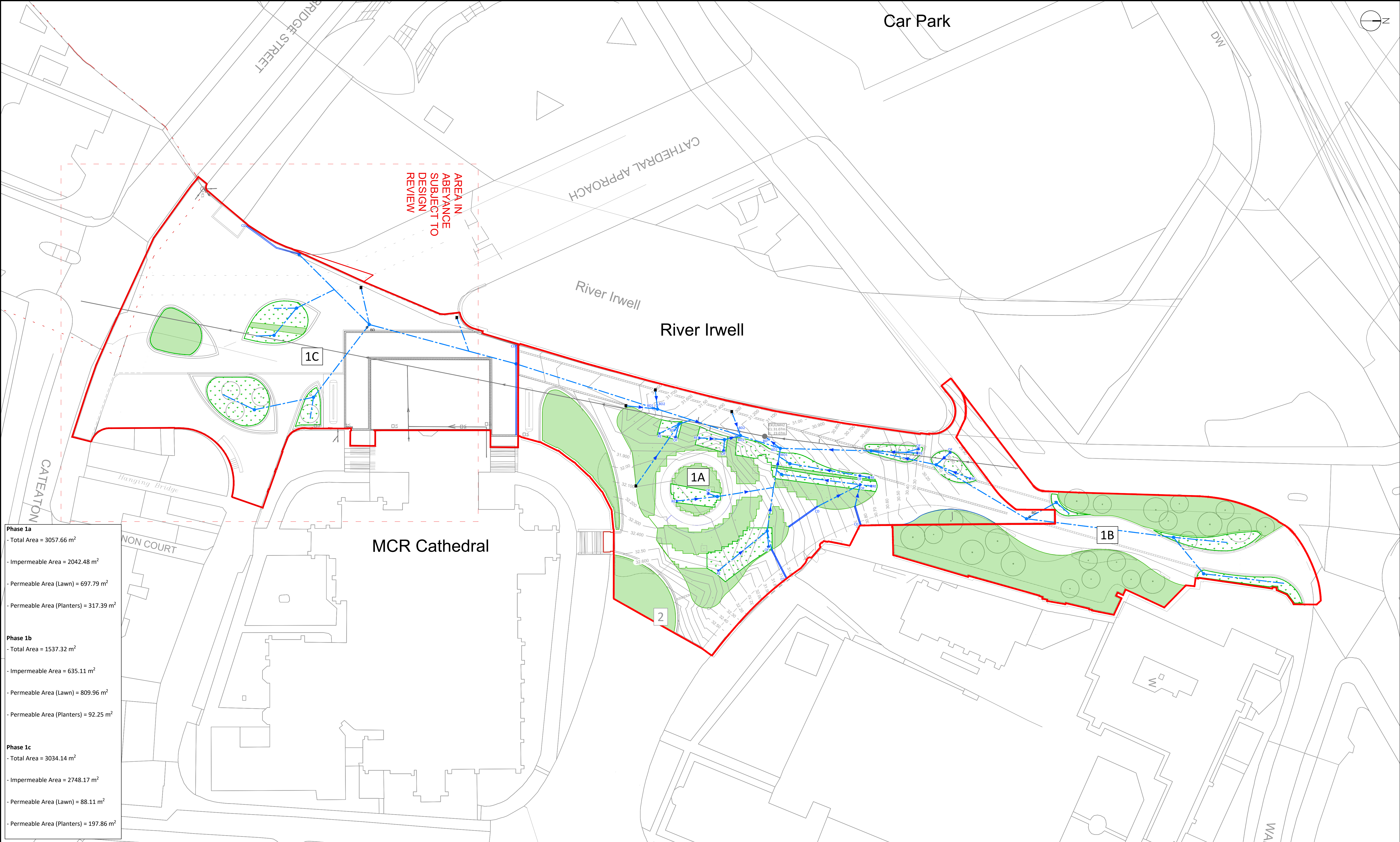
The proposed surface water strategy has been developed and is presented in Appendix E.

Appendix E: Civic Engineers' Drawings

949-02-CIVIC-C-XX-DR-001 - Proposed Surface Water Drainage General Arrangement

949-02-CIVIC-C-XX-DE-004 - Proposed Raingarden Detail

949-02-CIVIC-C-XX-GA-001 – Proposals Against Topographical Survey (shows phasing boundaries)



Standard Notes

1. This drawing is to be read in conjunction with all relevant Architect's and Engineer's drawings and the specification.
2. This drawing should not be scaled.
3. All dimensions are to be verified by the contractor on site.
4. All discrepancies should be reported to the C.A. prior to the commencement of the works.

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Notes and Keys

1. PROPOSED GENERAL ARRANGEMENT, SITE BOUNDARY ARE AS PER PLANT-IE DRAWING 'PL1784-VW-001-23-PLANT IE WORKING FILE', RECEIVED ON 02/07/2020.
2. ESTIMATED STORAGE REQUIRED BASED ON MICRODRAINAGE QUICK STORAGE ESTIMATE FOR THE SITE BASED ON A RESTRICTED RUN-OFF RATE OF 51.45l/s.
3. RESTRICTED RUN-OFF RATE BASED ON 50% BETTERMENT OF EXISTING RUN-OFF RATE FOR THE SITE.

Notes and Keys

- ZONE AND SITE BOUNDARY
- PROPOSED SW SEWER
- PROPOSED PERFORATED SW SEWER (LAID AT MIN 1:150 FALLS)
- EXISTING UNITED UTILITIES SEWER
- PROPOSED SW MANHOLE
- EXISTING UNITED UTILITIES MANHOLE
- PROPOSED RODDING EYE
- PROPOSED OVERFLOW

Notes and Keys

- XX.XX-
- PROPOSED LEVELS CONTOURS
- PROPOSED ATTENUATION AREAS
- PROPOSED LAWN AREA
- PROPOSED ACO M200 CHANNEL DRAIN

16/07/20	P01	ISSUED FOR INFORMATION	DC	NH
Date	Rev	Description	Drawn	Chk

Project	MEDIEVAL QUARTER & 22 MEMORIAL MANCHESTER			
Title	PROPOSED DRAINAGE STRATEGY			
Scale @ A1	Date Created	Drawn	Checked	
1:350	16/07/20	DC	NH	

Civic Engineers

MANCHESTER LONDON LEEDS

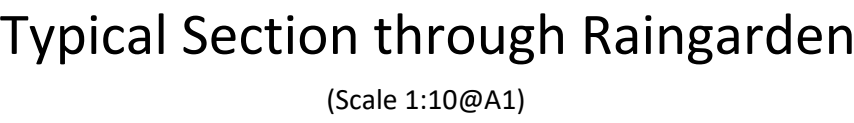
Carver's Warehouse, 77 Dale Street, Manchester, M1 2HG. Tel: 0161 228 6757
Lloyds Wharf, 3 Mill Street, London SE1 2BD. Tel: 020 7253 2977
Tower Works, Unit G2-01, Globe Road, Leeds, LS11 5GB. Tel: 0113 2025 130

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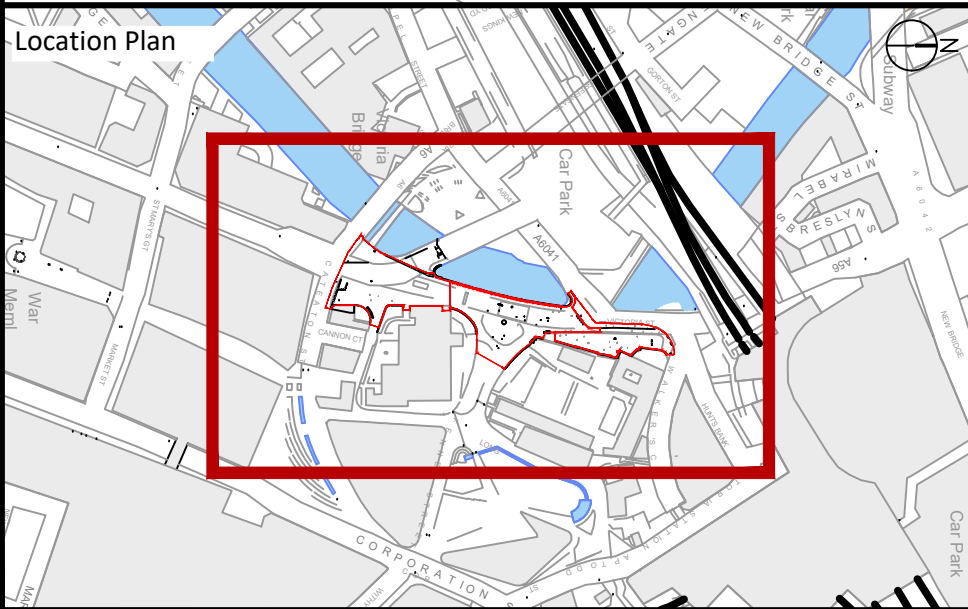
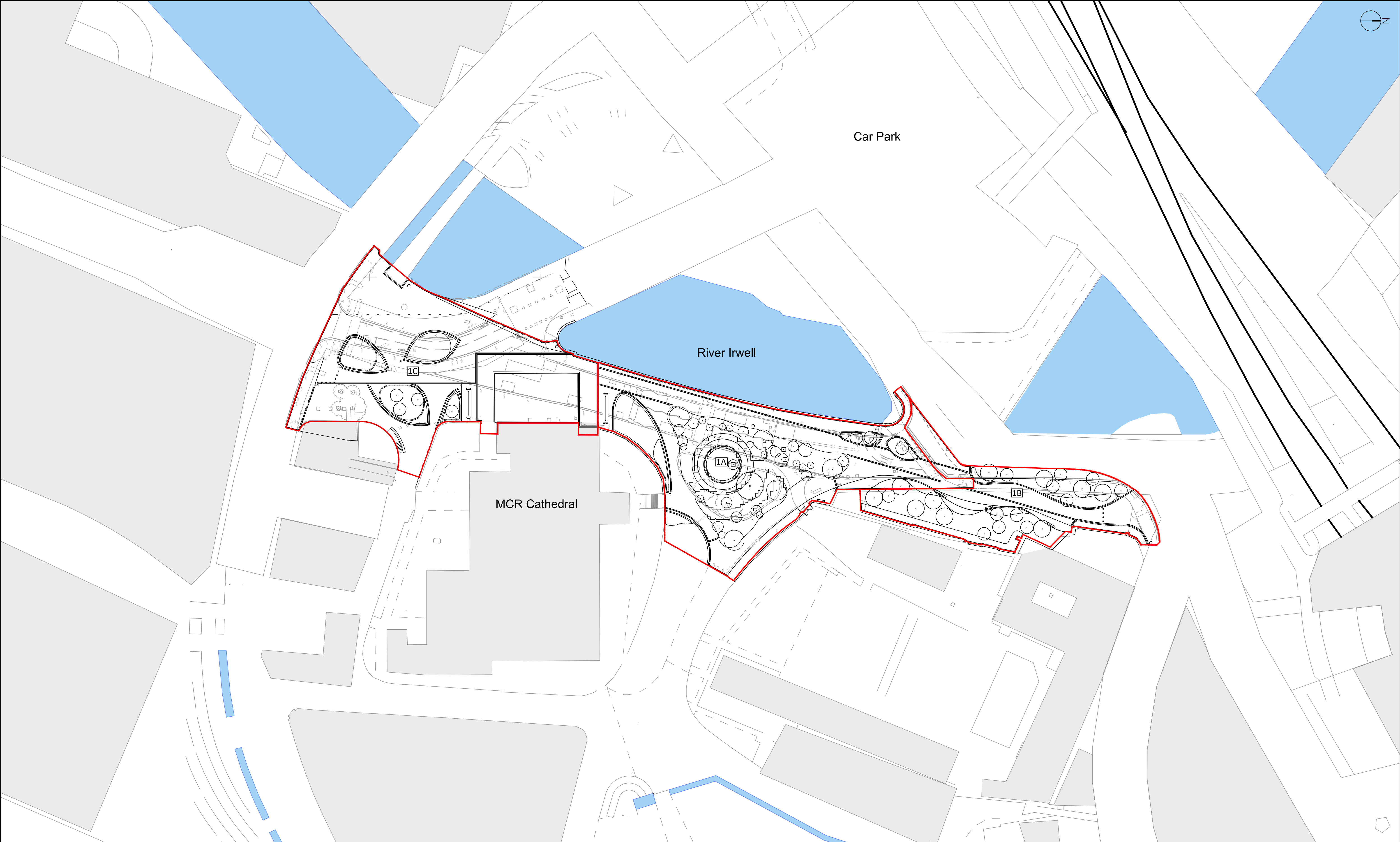
Status

INFORMATION

Project Number	Originator	Discipline	Drawing Number	Revision
949-02	CIVIC	C	DR-001	P01



Standard Notes	Notes and Keys	Notes and Keys	Notes and Keys	Notes and Keys																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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Standard Notes

1. This drawing is to be read in conjunction with all relevant Architect's and Engineer's drawings and the specification.
2. This drawing should not be scaled.
3. All dimensions are to be verified by the contractor on site.
4. All discrepancies should be reported to the C.A. prior to the commencement of the works.

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Notes and Keys

1. PROPOSED GENERAL ARRANGEMENT AND SITE BOUNDARY ARE AS PER PLANIT-IE PL1784-VW-001-23-PLANIT IE WORKING FILE DRAWING, RECEIVED ON 02/07/2020.
2. TOPOGRAPHICAL SURVEY CARRIED OUT BY SURVEY OPERATIONS IN JUNE 2018, RECEIVED FROM GALLIFORD TRY INFRASTRUCTURE LIMITED ON 25.06.2018.

Notes and Keys

- PROPOSED SITE LAYOUT
- EXISTING SITE LAYOUT
- PHASE/SITE BOUNDARY

Notes and Keys

14/08/20	P02	STAGE 3 ISSUE	DC	NH
16/07/20	P01	ISSUED FOR INFORMATION	DC	NH
Date	Rev	Description	Drawn	Chk

Project MEDIEVAL QUARTER & GLADE OF LIGHT MANCHESTER				
Title SITE PROPOSALS AGAINST TOPOGRAPHICAL SURVEY				
Scale @ A1	Date Created	Drawn	Checked	
1:500	16/07/20	DC	NH	



Civic Engineers

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INFORMATION				
Project Number	Originator	Discipline	Drawing Number	Revision
949-02	CIVIC	C	GA-001	P02

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