



West Facing 3D - Proposed Plantrooms A & B



West Facing 3D - Proposed Entrance A & Plantroom B



West Facing 3D - Proposed Entrance with Plantrooms A & B



West Facing 3D - Proposed Entrances A & B with Plantrooms A & B



3D Proposed Entrance A



East Facing 3D - Proposed Plantrooms K & L



East Facing 3D - Proposed Plantroom K



3D Showing Proposed Plantrooms A & B

Upgrading of Car Parking

In line with the revised contract strategy elements of the car parking and external works have been included in the last phase of the works. Parking is an issue at Prince Charles Hospital and the provision of the temporary kitchen on the Rhymney car park will remove disabled and general parking. Additional parking has been provided to offset the lost parking in phase 1a.

The principles are to maintain the current number during the phases and to provide temporary parking on the site.

Some elements of the site infrastructure and car parking are being undertaken within the phases of the works. phase 1b includes providing displaced parking to the site of the former helipad (Car park area 3 below) to maintain parking numbers as the early phase 2 works to the car parks will impact on the parking numbers (car park area 4 below).

This parking is temporary as once the phase 2 parking is completed the area will revert to the contractor for site accommodation to deliver the phase 2 works. Car park area 3 will be completed in the later phases of the works. The attenuation tanks required for the final drainage out fall are to be placed below the temporary car park to reduce the impact in future phases.

4.3 Preferred Option Civil & Structural Engineering Design Principles

CIVIL ENGINEERING

Ground Conditions

Site Investigations

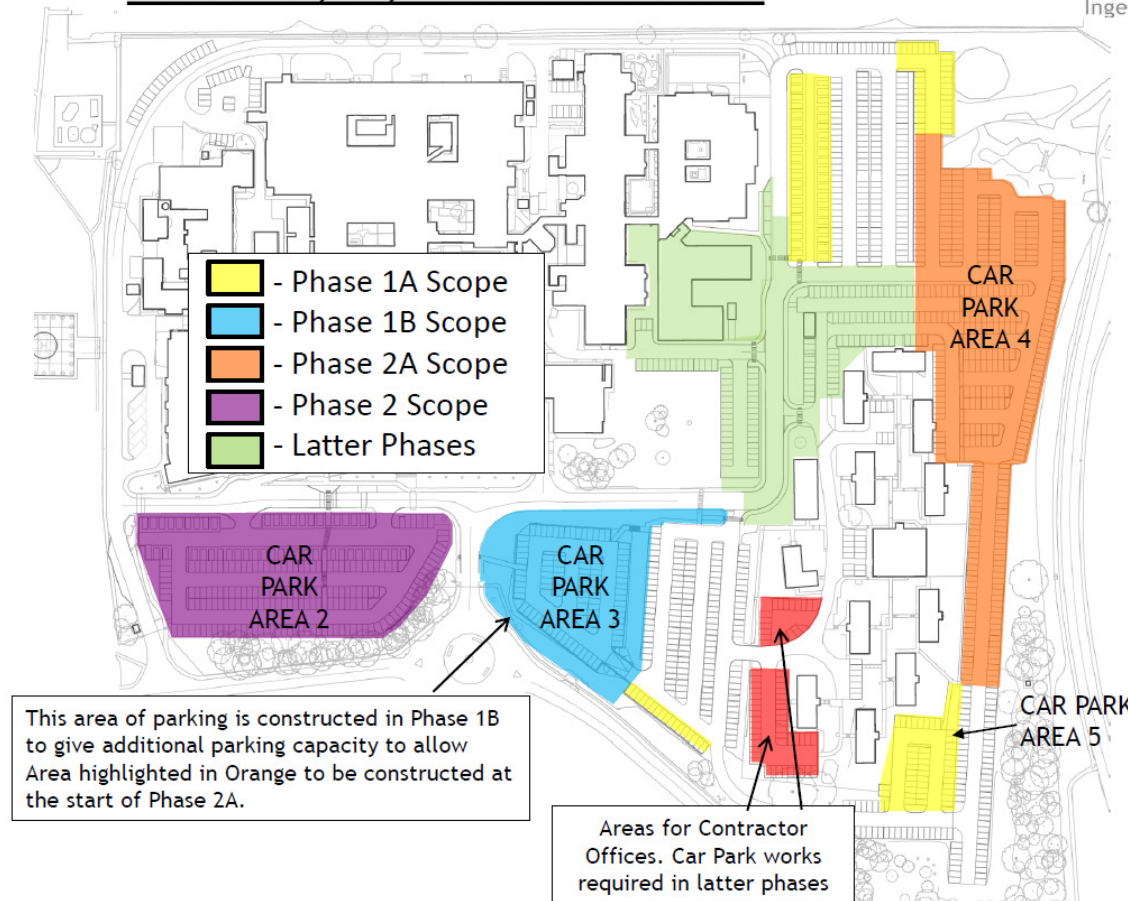
Geotechnical investigations (GI) relevant to Phase 2 were carried out on site in 2012, 2014, 2015 and 2017. A summary of the ground information relevant to each building included in Phase 2 has been summarised below.

BUILDING	RELEVANT GROUND INVESTIGATION
OPD	ESP 2015
Therapies	ESP 2015
Max-Facs	ESP 2015
Endoscopy	ESP 2015
Trauma Lift	ESP 2015
Theatres and 23.59	Soil Mechanic 2008, Ground Investigation (Swansea) 2012
Radiology	ESP 2015
MTDU (Units 2 & 3)	ESP 2017

The ground conditions at the site at the following locations are as shown below:

OPD			
LAYER	DESCRIPTION	THICKNESS (m)	DEPTH (m)
Made Ground	Brown grey slightly clayey to clayey sandy angular to subangular fine to coarse GRAVEL.	0.8	GL - 0.8
Bishopston Formation (possible residual soil)	Very stiff brown mottled orangey brown and grey slightly sandy slightly gravelly silty CLAY.	0.55	0.8 - 1.35
Bishopston Formation (Sandstone)	Strong grey stained brown fine to medium SANDSTONE generally recovered as very angular to angular fine to coarse gravel	1.15	1.35 - 2.5
Bishopston Formation (Highly to Completely	Extremely weak to very weak brown and grey MUDSTONE. Complete loss of strength, increased fracture spacing from weathering and strong orangey	1.40/1.85	2.5 - 4.2

INTERSERVE PCH - POTENTIAL CAR PARKING SCOPE WITHIN PHASES 1A, 1B, 2 & LATTER PHASES



Weathered)	brown and black penetrative discolouration through core mass.		
Grade B Bishopston Formation	Extremely weak to very weak brown and grey MUDSTONE.	2.85	4.2 - 6.05
Grade C/D Bishopston Formation	Weak locally very weak grey thinly laminated MUDSTONE locally grading to SILTSTONE.	-	Proved to 7.0m

THERAPIES			
LAYER	DESCRIPTION	THICKNESS (m)	DEPTH (m)
Made Ground	Loose to medium dense dark grey slightly sandy fine to coarse angular GRAVEL with some angular cobble content.	1.35	GL - 1.35
Made Ground	Firm to stiff brown slightly sandy slightly gravelly CLAY.	0.35	1.35 - 1.70
Glacial Diamicton	Boulders (Drillers Description Only)	1.00	1.7 - 2.7
Grade C Bishopston Formation	Residual soil of very dense brown grey coarse angular GRAVEL in firm to stiff brown CLAY matrix.	1.1/3.0	2.7 - 2.9
Grade A/B Bishopston Formation	Very strong purplish red SANDSTONE. (core loss between 3.05 - 4.0m)	0.15	2.9 - 3.05
Grade D Bishopston Formation	Very dense brown grey coarse angular gravel in firm to stiff brown CLAY matrix.	0.10	4.0 - 4.1

MAX-FACS			
LAYER	DESCRIPTION	THICKNESS (m)	DEPTH (m)
Made Ground	Brown grey slightly clayey sandy angular to subangular fine to coarse GRAVEL.	0.8	GL - 0.8
Bishopston Formation (possible residual soil)	Very stiff greyish brown mottled orangey brown and brown slightly sandy gravelly silty CLAY.	1.7	0.8 - 2.5
Grade B Bishopston Formation	Extremely weak locally very weak grey and brown MUDSTONE.	1.2	2.5 - 3.7
Grade C/D Bishopston Formation	Weak locally very weak grey thinly laminated MUDSTONE locally grading to SILTSTONE.	-	Proved to 8.2m

ENDOSCOPY			
LAYER	DESCRIPTION	THICKNESS (m)	DEPTH (m)
Made Ground	Loose to medium dense grey slightly sandy fine to coarse angular GRAVEL. Gravel noted to commonly comprise mudstone. Possible re-worked soils.	0.85	GL - 0.85
Glacial Diamicton	Soft becoming firm to stiff grey mottled brown very gravelly CLAY with layers of clayey fine to coarse very angular to subangular mudstone and sandstone gravel. No recovery between 2.0m and 3.0m (very wet).	0.3	0.85 - 1.15
Grade D Bishopston Formation	Extremely weak greenish grey very thinly to thinly laminated MUDSTONE. Very clayey in upper 100mm.	-	Proved to 2.85m

THEATRES			
LAYER	DESCRIPTION	THICKNESS (m)	DEPTH (m)
Made Ground	Brown grey slightly clayey to clayey sandy angular to subangular fine to coarse GRAVEL of vesicular slag, glassy slag, limestone and sandstone with medium to high cobble content, mainly slag.	0.9/1.1	GL - 1.1
Possible Bishopston Formation	Stiff becoming very stiff below 2.7m, light brown locally mottled grey slightly sandy slightly gravelly silty CLAY. Gravel is angular to subangular fine to coarse of mudstone, siltstone and occasional sandstone.	1.7/2.1	1.1 - 3.2
Highly to Completely Weathered Bishopston Formation	CLAY and weathered MUDSTONE. Arisings recovered as slightly sandy clayey very angular to angular fine to medium gravel of extremely weak to very weak siltstone and occasional weak sandstone	1.2/1.3	3.2 - 4.5
Slightly Weathered Bishopston Formation	Weak locally very weak dark grey to grey thinly laminated MUDSTONE grading to SILTSTONE. Distinctly weathered with slight discolouration and loss of strength along discontinuity surface with penetrative iron staining up to 10mm. Some very closely spaced subhorizontal smooth planar tight fractures. Locally non-intact recovered as angular medium to coarse gravel.	>3.0	Proved to 7.5m

TRAUMA LIFT			
LAYER	DESCRIPTION	THICKNESS (m)	DEPTH (m)
Made Ground	Medium dense grey brown slightly sandy slightly clayey fine to coarse angular GRAVEL. Some fragments of brick.	1.35	GL - 1.35
Made Ground	Firm to stiff brown slightly sandy slightly gravelly CLAY.	0.35	1.35 - 1.7
Glacial Diamicton	Boulders (Drillers Description Only)	1.0	1.7 - 2.7
Grade C Bishopston Formation	Residual soil of very dense brown grey coarse angular GRAVEL in firm to stiff brown CLAY matrix.	1.1/3.0	2.7 - 2.9
Grade A/B Bishopston Formation	Very strong purplish red SANDSTONE. (core loss between 3.05 - 4.0m)	0.15	2.9 - 3.05
Grade D Bishopston Formation	Very dense brown grey coarse angular gravel in firm to stiff brown CLAY matrix.	0.10	4.0 - 4.1
Grade B/C Bishopston Formation	Strong to very strong grey light grey SANDSTONE recovered as angular gravel and cobbles. Non intact due to drilling induced fracture.	0.40	4.1 - 4.5
Grade A-D Bishopston Formation	Weak to strong grey mainly thinly laminated MUDSTONE. Some core loss and portions of higher grade weathering noted as recovered as fine medium gravel with rare clay. SANDSTONE band at 5.6-5.95m.	-	Proved to 10.0m

THERAPIES			
LAYER	DESCRIPTION	THICKNESS (m)	DEPTH (m)
Made Ground	Loose to medium dense dark grey slightly sandy fine to coarse angular GRAVEL with some angular cobble content.	1.35	GL - 1.35
Made Ground	Firm to stiff brown slightly sandy slightly gravelly CLAY.	0.35	1.35 - 1.70
Glacial Diamicton	Boulders (Drillers Description Only)	1.0	1.7 - 2.7
Grade C Bishopston Formation	Residual soil of very dense brown grey coarse angular GRAVEL in firm to stiff brown CLAY matrix.	1.1/3.0	2.7 - 2.9
Grade A/B Bishopston Formation	Very strong purplish red SANDSTONE. (core loss between 3.05 - 4.0m)	3.05	2.9 - 5.95

Grade C Bishopston Formation	Weak to medium strong grey dark clayey MUDSTONE recovered as medium coarse angular gravel in a clay matrix. (Core Loss between 6.05 - 7.0m)	1.2	5.95 - 7.25
Grade A/B Bishopston Formation	Medium strong to strong light grey very thinly to thinly laminated MUDSTONE.	0.55	7.25 - 7.80
Grade A to C Bishopston Formation	Weak to medium strong dark grey thinly laminated MUDSTONE recovered as medium coarse angular gravel.	>2.2	Proved to 10.0m

MTDU (UNITS 2 & UNITS 3)			
LAYER	DESCRIPTION	THICKNESS (m)	DEPTH (m)
Made Ground	Loose to medium dense dark grey slightly sandy fine to coarse angular GRAVEL with some angular cobble content.	1.35	GL - 1.35
Made Ground	Firm to stiff brown slightly sandy slightly gravelly CLAY.	0.35	1.35 - 1.70
Glacial Diamicton	Boulders (Drillers Description Only)	1.00	1.7 - 2.7
Grade C Bishopston Formation	Residual soil of very dense brown grey coarse angular GRAVEL in firm to stiff brown CLAY matrix.	1.1/3.0	2.7 - 2.9
Grade A/B Bishopston Formation	Very strong purplish red SANDSTONE. (core loss between 3.05 - 4.0m)	0.15	2.9 - 3.05
Grade D Bishopston Formation	Very dense brown grey coarse angular gravel in firm to stiff brown CLAY matrix.	0.10	4.00 - 4.10

Material Waste Classification

No Chemical analyses have been carried out for waste disposal classification purposes in the 2015 GI. It is therefore not possible to determine a suitable waste classification should materials in this area require to be taken to landfill.

Further waste classification testing will be required for any excavated made ground to be removed from site.

Geotechnical Recommendations

Based on the GI findings, a series of recommendations concerning the likely engineering requirements are presented as follows:

- It is recommended that mass concrete pad foundations, with additional concrete fill where necessary, should be founded on or within firm to stiff natural sandy gravelly CLAY, noting that the ground conditions and the depth of any additional concrete fill required beneath the pads may vary across the

site. It should also be noted that in order to avoid damage from frost heave and/or thermal shrinkage the minimum foundation depth below the finished ground level should be 0.90m.

- Where working adjacent to or connecting in to existing foundations, the existing foundations should not be undermined or surcharged by the additional/extension to the foundation.
- Providing all made ground and soft materials are removed from beneath the proposed building and replaced with well compacted imported granular materials as previously described, the floor labs can be designed as reinforced ground bearing. Alternatively, the made ground and soft materials may be left in place and a suspended floor slab used.
- All foundation formations should be inspected by a suitably qualified Engineer before being concreted.
- The excavations in general are likely to encounter perched water/groundwater inflows. For the shallow excavations these inflows together with rainwater infiltration should be dealt with by conventional pumping techniques. For the deeper excavations allowances may be required for specialist dewatering techniques.

Drainage Strategy

Surface and foul water drainage strategy

Existing surface water drainage

The overall site is currently served by a number of surface water sewer systems which all discharge to an existing public surface water sewer which runs along Gurnos Road to the south of the site.

Phase 2 areas are all served by the same existing surface water sewer which discharges from the site near the existing pond in the south eastern corner of the site. The sewer discharges to the 900mm diameter public sewer along Gurnos Road. A CCTV survey has been carried out on the existing sewer network which identifies any defects within the pipework.

Proposed surface water drainage

Permeability tests have been carried out as part of the site investigation works for the development. These tests have confirmed that due to the underlying strata on site no infiltration is possible as a means of surface water disposals. As there are no watercourses within the vicinity of the site to discharge too, a positively drained solution to the public sewer is the only option for surface water disposal.

Due to the nature of and location of the phase 2 works it is not feasible to attenuate each individual phase of works therefore a section of the proposed carpark works, which has planning permission under a previous application, will be undertaken as part of the phase 1a works. These works will involve removing an area of existing carpark from the surface water network and reconnected it further downstream via a flow control chamber and attenuation tank. These works will decrease the existing run-off from the overall site and will provide enough betterment to offset against the increases in hard area generated by the phase 2 works.

The works involved in phase 2 will utilise the existing surface water pipework where possible with new pipe runs constructed to connect with the existing pipework where required. Any defects affecting the proposed or amended flows highlighted in the CCTV survey will be rectified as part of the works for each phase. Where the proposed building works affect existing drainage runs the existing pipework will be adapted or diverted to suit the works.

The proposals will ensure no increase in peak flow from the development as a result of the works and therefore no detriment to the public sewer network. Dwr Cymru Welsh Water (DCWW) were consulted and briefed on the proposals prior to the submission of the planning application for phase 1A. Any drainage works associated with discharging into the public sewer will be subject to a section 106 agreement with DCWW.

Existing foul water drainage

The existing foul drainage for the site is split into two systems which both discharge to the public sewers in Gurnos Road. The area of works for phase 2 are all served by the same foul network which discharges from the site in the south eastern corner. The network is formed of 100mm to 300mm diameter pipework. A CCTV of the system has been carried out and defects have been highlighted with the network.

Existing below ground drainage defects will be repaired where necessary and where directly affects the phase of work. Condition of some drainage runs are unknown due to accessibility or blind connection and therefore condition will not be obtained until works start and access obtained. Plans have been provided indicating runs that have not been surveyed.

Proposed foul water drainage

Phase 2 will utilise the existing foul drainage network where possible with new pipework installed to suit the proposals and provide new connections to the existing system where required. Where the proposed building works affect existing drainage runs the existing pipework will be adapted or diverted to suit the works. Any defects affecting the proposed or amended flows highlighted in the CCTV survey will be rectified as part of the works for each phase.

Existing below ground drainage defects will be repaired where necessary and where directly affects the phase of work. Condition of some drainage runs are unknown due to accessibility or blind connection and therefore condition will not be obtained until works start and access obtained. Plans have been provided indicating runs that have not been surveyed.

External works and internal drainage

MDTU

Conversion and extension of temporary kitchens building and provision of Unit 3 for use as MDTU. Utilise previously installed drainage points for existing buildings and provision of new below ground drainage for extension and new building.

Provisions of ramps and steps for Unit 3 access.

(ref. dwg. P003-OIC-V00-UN-DR-C-910116, 910117 & 910118)

OPD

Modification to the layout of the externals to the front entrance to OPD to provide a drop off facility with pedestrian links to the entrance and a 1 way circulatory road to prevent conflict. The external works also provide 2 No. Parking/drop-off ambulance spaces near the OPD entrance.

Provision of additional drainage runs to accommodate revised internal configuration of building requiring excavation through and reinstatement of ground floor concrete slab.

(ref. dwg. P003-OIC-V13-UN-DR-C-900302, 900502 and 900503)

Therapies

Along with the extension to therapies building maintenance/pedestrian access has been provided along with maintaining pedestrian links with Cynon building and maintaining vehicular access to the east of the therapies building.

Provision of additional drainage runs to accommodate revised internal configuration of building requiring excavation through and reinstatement of ground floor concrete slab.

(ref. dwg. P003-OIC-V13-UN-DR-C-900301, 900303 and 900501)

Trauma lift

Trauma lift is located to the northern end of the site and sits outside the main building footprint. It is situated on existing tarmac area and a DDA compliant pedestrian access has been provided.

(ref. dwg. P003-OIC-V04-UN-DR-C-900502)

Radiology

Radiology is predominantly internal refurbishment works, however, the new MRI building which forms part of the radiology works is situated outside the main building replacing existing administration buildings at the northern end of the site. The externals have provided necessary pedestrian links to the hospital and a landscaped area provides future scope for a secondary MRI building mirroring the current proposals.

Provision of additional drainage runs to accommodate revised internal configuration of building requiring excavation through and reinstatement of ground floor concrete slab. The layout has taken into account the phased implementation of the works.

(ref. dwg. P003-OIC-V14-UN-DR-C-910301 and P003-OIC-V17-UN-DR-C-910200)

Remodel of Cynon/Rhymney

Works to Cynon and Rhymney are predominantly internal refurbishment works requiring the provision of additional drainage runs to accommodate revised internal configuration of building requiring excavation through and reinstatement of ground floor concrete slab.

(ref. dwg. P003-OIC-V02-UN-DR-C-901010 & P003-OIC-V03-UN-DR-C-901020)

External works

For details of individual department see descriptions above.

To provide a compliance access/egress to the building a number of retaining structures are required around the site. These walls are generally masonry where the retained material is engineered fill. Gabions have also been used on Temporary works under Phase 2 (Unit 3) for ease of construction.

Finished floor levels of building associated with Phase 1a, 1b & 2 have been designed to reflect the existing building FFL's or to provide DDA access and therefore no scope available to reduce or balance earthworks

Infrastructure

See individual department descriptions above.

STRUCTURAL ENGINEERING

EXISTING STRUCTURE

The existing hospital building dates back to the early 1970s and consists of a two storey podium block structure with a four storey 'H' plan central ward block. The hospital has been in constant use since its opening and has had numerous extensions to the surrounding site over the years.

Existing Sub-structure

The existing columns are supported by a series of mass concrete pad foundations with a reinforced ring beam around the perimeter of the building. The ground floor slab is a reinforced concrete ground bearing slab. The thickness varies and there are localized thickenings underneath stairwells and lift shafts. Record drawings indicate there is an existing liquid applied damp proof membrane between the top of the slab and the screed.

There is an extensive network of underground service tunnels within the footprint of the main hospital. Existing foundations around the service tunnels have been taken down to the depth tunnel foundations, so not to surcharge onto the tunnel walls.

Existing Super Structure

Generally, the existing building is a steel frame structure, with the columns encased in concrete for fire protection reasons. The roof construction is made up of precast reinforced concrete hollowcore slabs, covered in screed and finishes. The floor construction is made up of precast ribbed reinforced concrete slabs, covered in screed and finishes. The depth of the rib varies depending on the length of the span and the design imposed load in that area.

The external walls are clad with glazing and pre-stressed precast concrete panels - which are fixed to the perimeter columns. Stairwells and lift shafts are generally reinforced concrete construction.

There is an existing boiler house and switch room towards the North of the site.

The area in the vicinity of the proposed operating theatres have been monitored for vibration to ensure suitability to become theatres. The results have shown that there is a minor exceedance in the vibration requirements but as a whole the structure is suitable.

Existing Stability

The existing main hospital building maintains lateral stability through a series of in-situ reinforced concrete shear walls located within the stair cores and lift shafts.

The more modern ECC building is a fully braced frame with diagonal vertical bracing transferring lateral loads down to ground level.

PROPOSED STRUCTURAL WORKS

Proposed Sub-structure

New foundations will be mass concrete pad foundations, some of which will be dowelled into the adjacent existing foundations depending on their proximity. Shallow strip foundations may be required in places into support new wall cladding.

There will be a significant area of ground floor slab that needs reinstating following the groundworks. This will take the form of a new reinforced concrete ground bearing slab.

A new hydrotherapy pool will be formed in the therapies extension with waterproof tanking in place to prevent water ingress or the pool water escaping.

A section of the new MRI building ground floor slab will be suspended as it will be spanning over an existing service tunnel. In the case of the new MTDU building (Unit 3), steel columns that clash with the existing tunnels will be supporting by galvanized transfer beams - that will span over the tunnels.

Proposed Super Structure

As part of the redevelopment works across the hospital there are a number of new plant rooms that will be constructed at existing roof level. Some of these have been designed as bridging structures (Plant Rooms A, B and C) as the contractor will not have possession in the areas below during construction. These structures consist of a series of vierendeel steel frames supported by truss columns. The plant room floor will be a composite metal deck spanning between a series of secondary steel beams.

As part of the construction of Plant Room A the existing roof will be removed and be raised to accommodate a larger service zone. This will be achieved through a series of column stubs, with knee bracing fixed to the new roof beam.

A section of Plant Room B will be achieved by building on top of the existing structure and strengthening the columns below to increase their capacity. Depending on the individual capacity of each column strengthening may be required from ground to first floor or ground to roof level.

A new two storey link building will fill the gap between the existing structures at the South of the main building and increase the size of the proposed endoscopy department.

A new two storey Atrium building will form the new waiting area and entrance to the OPD department. A precast concrete lift shaft will be used to support a number of first floor and roof beams whilst also providing lateral stability.

There are extension over current single storey portions proposed in the Max facs and Endoscopy departments.

The existing Therapies department will have a single storey extension with a new plant room built at roof level (Plant Room D).

The radiology department will be significantly extended with a new plant room built on top of an existing single storey structure (Plant Room G). Steel columns from the plant room above will bear onto steel transfer beams concealed within the ceiling void which in turn will be supported by steel columns within the wall line below. This plant room will have a section of floor consisting of removable steel open mesh panels. A new MRI building will be constructed at the North end of the department and will be connected to the main hospital via single storey link corridor.

A new precast reinforced concrete lift shaft will provide improved access to the critical care department. A second storey steel link corridor will also be constructed off the new lift shaft into the main hospital.

Proposed Stability

Wind loading on the proposed structures will be transferred down to ground via a series of braced bays. In the case of the bridging structures and new independent buildings this will be achieved through the new bracing system.

For structures built off the existing building (i.e. those that require column strengthening) new vertical cross bracing will be positioned where practical and be fixed between each slab level. The existing slabs will act as a diaphragm - distributing the horizontal load across the entire plane.

The new precast concrete lift shafts in the Atrium (OPD) and the Trauma lift have been designed to carry a proportion of the wind load from the connecting structure.

Robustness

The building is classed as Consequence Class 2b (CC2b) when assessed to BS EN 1991-1-7. Therefore a systematic risk assessment will be undertaken to highlight any potential hazards and the building will have effective vertical and horizontal ties. Connection capacities will be specified to conform to tying force requirements. Any elements identified as 'key elements' will be designed as such to ensure global stability.

Deflection and Movement

Structural elements have been designed to the following deflection limits;

Vertical deflections - Span/360 for variable loads
- Span/250 for permanent plus variable loads

Horizontal deflections - Column height/300

Vibration The operating theatres have stringent vibration requirements outlined in HTM 08-01. The existing structure has been monitored and further monitoring after removal of the roof and construction of plant room A is required of the structure in its revised formats.

Design Codes and Standards

The structural design has been undertaken in accordance with the relevant design codes. These have been summarized below;

- Eurocode 1 - BS EN 1991-1: Actions on structures
- Eurocode 2 - BS EN 1992-1: Design of concrete structures
- Eurocode 3 - BS EN 1993-1: Design of steel structures
- Eurocode 4 - BS EN 1994-1: Design of composite steel and concrete structures
- Eurocode 6 - BS EN 1996-1: Design of masonry structures
- Eurocode 7 - BS EN 1997-1: Geotechnical design

In addition to the Eurocodes listed above, the accompanying National Annex documents for the UK were also used to determine nationally determined parameters.

Structural and Civil Engineers Documents

The register for the documents produced by the civil and structural engineers is included in Appendix A.11 and a complete set of their drawings is included on the disc

4.4 Preferred Option Mechanical & Electrical Engineering Design Principles

MECHANICAL & ELECTRICAL SERVICES

Introduction

The following statements are intended to give an overview of the MEP works proposed for the phase 2 refurbishment works at PCH.

The design was finalised prior to the issue of HTM 06 2017. A review has been undertaken and the actions arising from this review are listed in the report included in Appendix A.8 together with the departmental servicing strategies. The drawing register is included in Appendix A.10 and a complete set of drawings is included on the disc.

PROPOSED DESIGN PRINCIPALS - MECHANICAL

S10-1: Utility Incoming Water

There are two mains water supplies from Welsh Water. One, a 250mm supply enters the site from the Heads of the Valley Road with a meter and by-pass chamber and runs around ECC to between the energy centre and the Merthyr block, where it splits into potable and fire service supplies.

The second service, a 150mm metered supply, enters the site from the Heads of the valley Road and passes under the existing Helipad to serve the residential areas of the site and the existing Renal building.

No works to Utility incoming pipes proposed, however, the replacement of the existing wireless water meter to BMS link with cabled / hard-wired connection to existing meter (part of BREEAM credits for identifying unexpected water loss / leakage) will be carried out since the present wireless connection no longer functions.

No works are proposed for the below ground mains water pipe from the boundary utility water meter on the 250mm supply serving the main hospital, however, the 150mm mains water from the utility meter on the boundary currently extending across the southern part of the site adjacent the existing Helipad, will be lowered to suit the revised ground levels under future phases.

S10-2: Cold Water Distribution & Storage

Existing cold water storage capacity is considered to be adequate. The storage tanks in the roof plant room of the Merthyr building serve the following systems.

Tank 1 - Merthyr Building CW down service

Tank 2 - Merthyr Building CW down service

NOTE:- only one or other of the above is in use at any one time and alternates every six months. If tank 1 is in use, tank 2 is drained or vice versa.

Tank 3 - Pathology cold water service - to provide supply protection

Tank 4 - Hot water system cold feed tank. This runs to the energy centre to the calorifiers and then serves the most of the site.

Tank 5 - Mortuary cold water service - to provide supply protection.

All of the cold water service pipework will be replaced throughout the works areas in the ground and first floors of the Merthyr Block. New mains will be extended to each department which will be sub-metered for consumption monitoring.

The basement mains cold water distribution will be replaced with improved insulation to mitigate heat gain from other services. The mains cold water distribution up the main East & West risers to the main cold water storage tanks is also being replaced.

S65: Private Fire Hydrant System

The existing system is outside of phase 2 zones and is believed to be functioning. The bulk of the pipe installation is approaching forty years old. The installation is believed to be steel pipework for the large part, and therefore at the end of its expected working life.

The existing below ground fire hydrant ring main that has not been replaced within the last ten years will be replaced with new MDPE below ground service to address continuing failures of the main. There will be two new fire hydrants are to be added onto the existing fire hydrant ring main to ensure suitable connection within 90m of the buildings and dry riser points.

Existing fire hydrant points will be re-located and modified to suit the temporary kitchen under Phase 1a works.

S61: Fire Fighting Dry Risers

There are in the four stair risers sections of redundant dry riser pipes in addition to the functioning dry risers.

These redundant sections are to be removed as part of the works. The works in and around the new theatres plant areas will be provided with a new dry riser from the existing stair adjacent the main entrance at the front of the hospital. A second dry riser will be provided for the stair service to the first and second floors of the Cynon building to provide fire water facilities to the Cynon building and Roof plant areas.

S32: Utility Incoming Natural Gas

The site is provided with natural gas from the utility company in two locations. One via a 250mm medium pressure main entering the site via the entrance off Heads of the Valley Road to a governor and meter station adjacent ECC serving the main hospital site. The other from a low pressure main off Gurnos Road, to a meter adjacent the car park, which serves the residential areas of the site.

No works to Utility incoming supplies are proposed.

S32-2: Natural Gas (CTLHB) Site Infrastructure

On site distribution pipework runs from both meter locations in either MDPE or Steel pipework to destinations as indicated on the record drawings.

There are distribution pipes underground which run to serve the phase two building old boilers, but the sub meter and rising service for this have been disconnected. The below ground main is assumed to still be live, as this also has a branch with runs to the modular steam package plant room adjacent to the current pharmacy bulk delivery zone and which provides steam for the kitchen and former Aseptic Suite.

Natural Gas services are also extended via the basement service tunnels from the energy centre to various risers for supplies including the kitchen, and CSSD. There is no ventilation as require for a covered gas route to meet the required safety standards.

Due to non-compliance with safety requirement, the natural gas distribution will be removed from the basement services tunnel and an alternative route will be provided by providing an external buried main. This will be carried out in a previous phase of works. If not it will be carried out here.

S41: Fuel Oil Storage

The site is provided with fuel oil 'Bulk' and 'Day Service' storage tanks that serve the dual fuel central boilers and the central two generators in the event of either a failure or loss of mains natural gas or national grid electricity.

The arrangement appears to be the original installation (mid 1970's) and is in reasonable condition for its age although is expected to require increasing maintenance as it is approaching its typical 'end of life' replacement.

The original fuel system is likely to have been based upon 'Heavy' oil which has since been changed to 'Gas/Oil'.

'Bulk' fuel oil storage:

The bulk storage comprises three fuel tanks located in a bunded compound. Each bulk tank is approximately 4 metres high and 5.5 meters in diameter with an estimated storage capacity of 85m³ (not including 10% ullage), equating to an estimated total of 255m³.

The existing bulk fuel oil storage is sufficient to meet the HTM 06-01 requirements for the current demands for boilers or generation.

The fuel transfer from the 'Bulk' storage tanks to the 'Day Service' tanks is piped and incorporates an electric pump and will operate automatically, however, we understand is currently manually operated to refill the 'Day Service' tanks.

Day Service tanks in the Central generator hall of the energy centre plant room has two emergency power generators. Each of the two generators has a 'Day Service' fuel oil tank to separate the 'Bulk' storage from the generators and to provide a gravity feed to the engines.

HTM 06-01 requires the day tank and gravity feed not to exceed either 750 litres or 10 hrs at maximum generator capacity. The combined capacity of the tanks exceeds these requirements.

Therefore there are no works proposed.

R11: Above Ground Drainage

The existing Merthyr building has ranges of predominantly cast iron above ground drainage pipes with plastic waste pipes from appliances. The Merthyr block ground and first floor above ground drainage pipework will be replaced (except for ECC) along with providing above ground drainage for the new build areas as necessary, including connecting drainage and vent pipework from existing floors above.

T10: Central Low Temperature Hot Water (LTHW) Plant & Distribution

The existing LTHW system for the site is largely centralised at the Energy Centre, which serves the all heating loads except for the Hydrotherapy Pool, a small standalone system in Therapies. The energy centre has circa 6.8MW of heating power in it inclusive of 750kW from a CHP unit. The boiler plant operates primarily on natural gas, but can be operated on oil if the gas supply is suspended.

The new wards refurbishment scheme has extended independent LTHW heating mains via two separate routes directly to the upper floors of the Merthyr block (floors 2,3,4 & Roof). These are treated as a separate circuits from the energy centre with its own circulating pump sets.

All the Merthyr block ground and first floor LTHW pipework, along with the LTHW distribution in the basement service tunnels and risers to high level on first floor will be replaced.

New mains will be extended to the new plant rooms where hydraulic headers will be provided, from which constant temperature and variable temperature circuits will be distributed as required.

Ventilation to the basement services tunnel will be provided to reduce heat build-up caused by the LTHW heating distribution pipework and minimise the risk of increasing temperature in the MCW supply.

S10-3: Central Domestic Hot Water Service (DHWS) Plant & Distribution

The domestic hot water system for the main hospital site is in the most part created in the Energy Centre and distributed by copper flow and return pipework to most parts of the site. The system consists of four rapid recovery storage calorifiers with circa 2000 litre storage capacity each. One of these units is new to address concerns about the HWS supply.

The current distribution arrangement is flow and return from the energy centre, down the basement service ducts and to rise up main east and west service risers for the Merthyr building, and to rise from the service duct to the Cynon block to serve both Cynon and Rhymney block via the link bridge between the two buildings.

The new ward scheme has recently taken two diverse flow and return pipe routes up the outside of ground and first floor of the Merthyr building and entered risers on the north end of the wards to serve the wards on level two and above. The scheme then runs HWS F&R back down the east and west riser to feed back into the basement service ducts to allow the leaky original service from the energy centre to be removed under the wards scheme project.

The existing central DHWS capacity is considered to be adequate.

All of the Merthyr block ground and first floor DHWS pipework, in the phase 2 works areas, will be replaced including complete replacement of the Basement services tunnel DHWS distribution.

T60: Central Chilled Water (CHW) Plant & Distribution

There is a central chilled water system located in the main energy centre for the hospital, which consists of two Carrier electric water / water chillers. These are connected to dry coolers at high level on the outside of the energy centre, and via run and standby pumps located adjacent to the two chillers, distribute chilled water to the Merthyr block. The chilled water is run via insulated steel pipework in the basement service ducts rising up common service riser points to serve, the existing theatre plant room, the new roof mounted Critical Care AHU, and the X-Ray ventilation plant in Radiology. The water is delivered at circa 6 deg C flow with a design intent return of 12 deg C.

The existing chillers will be removed and replaced with three new air cooled chillers. The new chillers will be provided with new circulating pumps, pressurisation kit and expansion vessels, allowing the new system to be run in parallel with the existing allowing a phased removal of the existing system.

An additional absorption chiller using waste heat from the CHP will also be provided. The unit will be the lead chiller when CHP is running.

New distribution pipework will be provided throughout the tunnels rising to the new plantrooms. Within each plantroom a hydraulic header will be provided from which a chilled water circuit will be provided to serve the air handling units and department cooling as required. Each chilled water circuit will be sub-metered for energy monitoring.

S51: Steam Generation

Two existing steam generation plants provide steam to the existing Kitchen & Aseptic Suite AHU, and the CSSD department. The CSSD plant was installed c1996. The Kitchen/Aseptic plant was installed c2006.

The steam system serving the CSSD department is to be replaced in a new location as part of the departmental reorganisation under future phases, and as part of the relocation of the gas service which will be extended from the externally routed gas main (refer to gas commentary).

U10: Ventilation

The ventilation arrangements for ground and first floors varies dependent on the use of the spaces and areas. Here is a mix of clinical mechanically ventilated spaces and other naturally ventilated spaces by use of opening windows.

The ventilation systems will be replaced with new, including new plant in configurations and arrangements to suit the new departmental layouts. The new ventilation equipment will be to current regulatory standards for efficiencies, and will serve greater areas of the departments to meet the full requirements of the HTMs. The new plant will predominantly be located in new roof top plant areas. Some nonclinical areas will continue to have ventilation by use of opening windows, providing natural ventilation for the users.

Local room extract systems will be provided as necessary for the specialist activity being carried out.

V82-1: BMS & Controls

2 existing 'Trend' BMS systems currently operate across the site and its associated engineering services systems. The older of the two existing 'Trend' systems is understood to be original and is therefore circa forty

old and well in excess of its typical life span, despite periodic upgrades. The more recent existing 'Trend' system is understood to be circa ten years old and a likely effective and serviceable life span remaining of approximately twenty years, subject to continued availability of hardware and software upgrades.

The more recent Trend system will be extended to serve the remodelled departments and plant.

V82-2: Alarm Management System (Santana)

Existing Santana alarm system is a hard wired arrangement and is understood to be part of the original installation, thereby circa forty years old. The existing system has numerous redundant connections and no longer picks up all alarms, including some of the more recent projects.

It is proposed to add a new slave 'Head end' to the existing more recent 'Trend' BMS to provide the alarm management system and user interfaced using the comm's network. This arrangement is to incorporate the capacity for the whole hospital and allow rationalisation of the old alarms on the Santana system. All critical alarms from the Building Services alarms will be transposed to this new arrangement and strip-out the existing system for the associated areas.

V82-3: Metering & BMS

The existing metering arrangements are predominantly at the main utility meters, some of which are connected to the BMS system. The more recent projects i.e. Ward project have BMS linked sub metering installed. It is understood that not all existing metering facilities are fully functioning or recording data that may otherwise provide benefits in refurbishment/development, management, monitoring, life cycle analysis of improvements, diagnostics, alerts, etc.

Sub-metering not only relate to BREEAM credits but more importantly economic and environmental efficiency.

BMS sub-metering will be provided including: 'Cumulative'; 'Maximum demand'; and 'Real-time' consumption (i.e. kWh; kW; and say ½ hourly kW profiles, for example) for the phase 2 works.

This sub-metering will be provided across the entire site to include:

Electricity - lighting (zonal)

Electricity - power (zonal)

Electricity - power (main mechanical plant)

Electricity - power (high demand clinical / equipment)

LTHW - heating (main+zonal)

LTHW - hot water (calorifiers)

CHW - cooling (main+zonal)

MCW - cold water (tanks)

MCW - cold water (kitchen)

DCWS - cold water (zonal)

Gas - natural gas (point of use)

X31: Pneumatic Tube

There are 2 existing pneumatic tube systems (one relatively new 160mm diameter system and the original 110mm diameter system). The 110mm diameter system is predominantly connecting departments with Pharmacy and Pathology. The 110mm diameter system is approaching its 'End of life' and parts and maintenance are likely to limit this to 5 to 10 years remaining life. The new 160mm system is extended from ECC and the wards on level two and above to the current pharmacy.

The existing 110mm.dia system will be replaced with re-routing where required with a new 160mm diameter system in parallel with the existing 160mm system allowing integration between the two 160mm systems. This will entail new 160mm services through parts of the site, including such areas as Oncology in Cynon and the six stations currently in Rhymney, to allow the systems to be completed and functional.

Fire stopping collars will be installed to align with the fire compartmentation boundaries on the fire strategy drawings

S23: Medical Gas - Vacuum System

There are four new/recently installed vacuum pumps. It is understood that one pump is sufficient to cope with the existing demand.

Other than reconfiguration and extension of distribution pipework to suit the remodelled departments on ground and first floor, to meet HTM 02-01, new basement tunnel vacuum pipework will be provided to combine the capacities of current multiple vacuum pipelines.

S22: Medical Gas - Compressed Air

There are five new/recently installed compressors. It is understood that two compressors are sufficient to cope with the existing demand.

The works other than reconfiguration and extension of distribution pipework to suit the remodelled departments on ground and first floor, to meet HTM 02-01, will be to provide new basement tunnel Compressed Air pipework to increase capacity and combine existing multiple services into one (i.e. one MA4 and one SA7).

S21: Medical Gas - Nitrous Oxide

The NO₂ arrangement includes 7 x 7 cylinders (configured with 1 x 1 reserve).

The existing NO₂ service pipework is to be removed with new to suit the modification of the ground and first floor layout and also to bring the existing distribution system within scheme to HTM 02-01 requirements.

S20: Medical Gas - Oxygen

The existing oxygen storage facility is approximately 10 years old and is provided and maintained by BOC.

Resilience is considered to be moderate as there is potentially a single pipe between the VIE and the buildings which constitutes a single point of failure in the pipework distribution route. The distribution is the original

installation in the mid 1970's and this single non diverse route from the VIE to the buildings doesn't meet current HTM requirements. Parts of the distribution system in the basement tunnels and risers is being supplemented with new (alongside the original) to serve the newly refurbished wards on level two and above.

The remaining original pipework distribution in the basement services tunnel, risers and ground and first floor will be replaced with new, sized to form a new 'ring' style oxygen supply, which addresses the problem of non-diversified supply routes.

A new VIE rented by the Health Board will be installed in a new compound at the rear of the Rhymney building will be dual piped through the Rhymney and Cynon buildings to link with the new pipes in the Merthyr tunnels to form an oxygen service ring with supplies from either end of the site.

BST: Basement Services Tunnel

Very poorly ventilated space is understood to have had past modifications which obstructed or removed the ventilation. The lack of ventilation is unacceptable for routing of natural gas pipework distribution and in the event of a leak may build-up within the basement and potentially represent a catastrophic situation should it ignite

The poor ventilation poses health / safety risk to undertaking works in this basement services tunnel.

The fire stopping and compartmentation of basement services tunnel is incomplete and or damaged.

Many of the services within the basement services tunnel date from the original installation in the mid 1970's and have therefore exceeded their reliable 'Life span'.

The lighting (some bare tube) is ineffective; access and crossovers poor; and the services support system have eroded components

PROPOSED DESIGN PRINCIPALS - ELECTRICAL

The following proposals are being adopted in the PCH phase 2 refurbishment.

V10: Utility Incoming HV Electricity

The site is supplied by Western Power Distribution (WPD) at 11kV. The supply arrangement from WPD is a normally closed 11kV ring circuit, with both supply cables for the ring emanating from WPD Merthyr East Grid substation. Each leg can support the currently agreed supply capacity as a radial arrangement for the site if necessary for maintenance or fault reasons.

The WPD cabling was installed in 2007 and terminates in HV switchgear, located in an HV switchgear and metering room at the Energy Centre, the switchgear was installed in 2007.

The existing 'Agreed' Utility HV supply is 2.5 MVA and we anticipate this is adequate for the development

V20: HV Electricity (CTLHB) Site Distribution

The existing HV switchboard will be used to feed a new substation "Sub X" consisting a new ring feeding two new 2.0MVA (Subject to agreement of future growth strategy) transformers which in turn feed individual LV switch panels which feed switchboard in the main hospital block.

Modifications to the existing arrangement could not be achieved to create a modern compliant installation. The existing substation 1 will be decommissioned on a phased basis and transferred to sub X

V30: LV Electricity Site Infrastructure (downstream of Substations)

The proposal is to replace all existing Switchgear, distribution boards and cabling and equipment for the phase 2 works apart from DSU where the existing arrangement will be modified to provide a switching arrangement in line with HTM06-01. Subject to decant/phasing requirements also provide new local distribution boards, cabling and equipment connected to existing Substation 2 Phase II & III LV switchgear for phase 2 requirements

The electrical distribution strategy provides a compliant distribution arrangement as required by HTM 06-01.

Sub-Distribution

New switchboards shall be of Form 4 Type 6 construction in accordance with BS EN 60439. These shall incorporate incoming isolators and outgoing MCCB protective devices with suitable protection.

Every 'Essential' and 'Non-Essential' submain is rated to take the full assumed maximum demand of the switchboard it is supplying.

The new switchboard shall include a bus-coupler separating the 'Essential' and 'Non-Essential' segments that is normally open. In the event of an interruption of either incoming supply, the arrangement can be manually re-configured such that the remaining incoming supply will support the whole panel.

Each department will be served by 'Essential' and 'Non-Essential' distribution board arrangements.

Each 'Essential' and 'Non-Essential' distribution board shall comprise of a 'side-by-side' power and

lighting section to allow sub-metering of each section. The distribution boards shall comprise of incoming isolation and MCB or CBM protective devices.

Switch panels and distribution boards shall include a minimum of 25% spare capacity, in terms of both load & physical capacity, this shall include as a minimum one spare device of every size of breaker fitted within the Switchboard.

All distribution / sub-mains cables are to be armoured multicore thermosetting cables LSOH to BS5467.

Items of critical/life safety equipment, such as fire safety & alarm systems, are to be wired in armoured multicore fire resistant cables to BS5839 and are to meet the requirements of mechanical protection and water spray as BS8434.

Final circuit cabling is to consist of LSOH single cabling within steel trunking/conduit.

Cables for differing voltage bands shall be separated in accordance with the requirements of BS EN 61000, containment systems shall be selected as appropriate for the type of cabling and the voltage band it operates under, typically this will be:

- LV distribution cables - galvanised steel cable tray or ladder,
- IT/data network wiring - galvanised steel basket tray
- Fire alarm/life safety - galvanised steel basket tray
- ELV cables (including security, BMS cables) - galvanised steel basket tray
- Lighting and power circuits - galvanised trunking & conduit

Metering

Metering shall be provided in accordance with recommendations of the building regulations approved documents.

Distribution boards shall be of split-load type, with power and lighting segments separately monitored via digital multi-function meters. Bulk-load supplies to Mechanical equipment and other major equipment shall be metered at the switchgear it is supplied from. All meters shall have suitable outputs to allow for remote monitoring via the BMS.

Surge Protection

Class I surge protective devices shall be incorporated in both sides of the new switchboard (i.e. to Supply A

and Supply B), and shall also be installed on all distribution boards service any equipment externally. The final specification of the surge protective devices, along with the requirement for any coordinated surge protective devices are subject to a risk assessment in accordance with BS EN 62305 and shall be undertaken by the lightning protection specialist (see lightning protection section).

Power Factor Correction (PFC)

Power factor correction will be provided at substation X to control power factor to 0.95 or above

Harmonic filtering

Provision will be made to enable active harmonic filtering equipment to be incorporated into the networks, if required.

Isolated Power Supply

Isolated power supplies (IPS), also known as medial IT systems shall be provided in all Group 2 medical locations (Clinical Risk Category 5 areas) as defined in Guidance Note 7 of BS.7671 and HTM 06-01.

This shall include medical locations where medical electrical equipment is employed in applications such as inter-cardiac procedures or life support treatment. Circuits will be design in accordance with HTM 06-01

IPS systems shall comprise floor standing distribution cubicles with the output isolated from earth. The system shall be equipped with fully programmable remote alarm panels which will incorporate audible and visual alarms.

For operating theatre applications the remote alarms panels will be integrated into the theatre control panels.

All final circuit wiring from IPS panels shall be protected by double pole MCB's with socket outlets being unswitched, coloured blue and engraved with 'MEDICAL EQUIPMENT ONLY' to easily identify these from general socket outlets.

Earth reference bars will be provided for all group 1 and group 2 locations.

All IPS systems shall provide an N+N resilient configuration, and all locations requiring IPS socket outlets shall have at least two separate socket-out sub-circuits (e.g. bedhead or theatre pendant) supplied from different IPS units. The IPS circuit cabling shall be installed in dedicated trunking.

Small Power Installation

The small power installation shall comprise the installation of switched socket outlets, fused connection units and local isolators to serve the small power requirements throughout the extent of works. .

Socket outlets and connection units shall be provided as shown on Room Data Sheets / 1:50 loaded plan layouts plus additional to support any additional equipment not shown.

All outlets shall be of suitable finish for the area they serve. All areas of clinical risk category 3 and higher shall be served by metalclad accessories. Other areas shall be thermo set plastic, and 3 compartment dado trunking will be used wherever possible. The dado trunking shall be suitable for the installation of Cat 6a IT cables and associated accessories.

Where accessories are mounted in plasterboard walls, which form part of a fire compartment then an intumescent back box shall be used to maintain integrity of the fire compartment.

A network of cleaners sockets, will be installed at 9m intervals, shall be installed around the hospital.

Circuits for cleaner's supplies shall be on a dedicated cleaner's circuit to minimise the risk of disruption to core hospital activities.

Small power circuits will be wired in ring or radial circuits. Final circuits incorporating socket outlets shall be fed from combined Residual circuit devices with overload protection (RCBO's). The rating of RCBO's shall not exceed 30mA for residual currents.

All small power circuits shall be wired in LSF single core cables contained throughout their entire length in galvanised steel conduit/trunking.

Bedhead trunking and Surgical and anaesthetic Pendant

Medical Supply Units (Bedhead Trunking) shall be provided to patient ward areas and shall house small power, data and medical gas outlets in accordance with room data sheets.

Medical Supply Units shall comply in full with HTM 08-03 and BS EN ISO 11197.

V44: Tertiary power supplies (UPS)

The existing UPS for the existing Theatres/Recovery/Critical Care is located within a room not dedicated just to UPS, in the Energy Centre building. This building also houses Substation 1 and the Standby Generators. If there was a disaster such as an explosion in this area, there is the risk the Primary, Secondary and Tertiary Power supplies could all be compromised.

2 New 160kVA UPS's (N+N) & associated battery racks each providing 1 hour autonomy shall be installed to supply UPS backed power to the Operating Theatres, Procedure suite, Recovery and Critical Care Beds. UPS's to be located in the new Theatre roof plant room.

V12: Central Emergency LV Generation

The existing central emergency generators comprise:

- 1 x 1500kVA c11years old and
- 1 x 1000kVA c30yrs old

The generators operate in a parallel arrangement with the 1500kVA generator being the lead generator.

The controls are configured to support both the Essential and Non-Essential power. The generators supply LV power to Substation 1 and 2 Switchboards.

The proposal is to provide a new 2.0MVA LV generator (containerised unit in compound adjacent to the existing Energy Centre) with connection to the existing 'Bulk' fuel oil storage tanks.

The existing LV generator supply cables to Substation 2 shall be removed from the basement tunnels and replaced with new cables installed around the east perimeter of the site.

W30-1: Incoming Telecoms

The site is supplied with Telecommunications services by BT. The BT service cable is installed below ground, and enters the site boundary at the South of the site near the Residential area of the site. It is believed this is

then installed below ground, possibly in ducts circa 1974, until it enters the Merthyr Block Basement Services Tunnels at the South West corner

A new incoming cable route shall be established with new incoming BT cable installed. The cable will enter the site boundary at the Cynon block and Merthyr block.

The new cable shall then be installed on new dedicated Telecoms/Data Utility containment that shall be installed through the Ground Floor to the Phase II (Cynon Block)

The cables will be installed in to the existing core in the Cynon block and a new Main Distribution Frame located in the FF core area of the Merthyr block

A new incoming telecoms room will be provided housing all main telecoms incoming supply equipment along with a new IT distribution core.

W30-2: Incoming Fibre

A new route shall be established with new incoming BT Fibre Route 1 installed. New blown fibre tube and fibres will enter the building and distribute to the new core located at first floor level in the core area of the Merthyr block.

A secondary supply to the north of the site will be re routed from the existing room to the new core.

W31-1: Internal Telecoms

New IT distribution hubs will be formed within the refurbished works and fed from the new cores. Existing hubs will be transferred to the new cores.

Main Building to the Residential area buildings are buried below ground. New cables shall be installed and new route established. The new route will install cables from the new core to the Cynon block and then on to the residences.

W31-2: Internal Data

The internal data network comprises two central fibre cabinet 'cores' that are linked to the main server. These 'cores' are interlinked by a multi-fibre backbone. Core 1 is located in the first floor corridor in the West of the Merthyr Block. Core 2 is located in the second floor plantroom of the Phase II (Cynon Block).

Local data cabinets are supplied by fibre and in some instances telecoms cable from either or both 'cores' and the telecoms infrastructure. The local data cabinets provide a mixture of data and VOIP over structured cabling to final RJ45 outlets. Not all cabinets are in dedicated Hub Rooms.

The proposal is to provide a new 'Core 1' within a dedicated room and replace all existing cabinets (in the works area with new) 47u cabinets in dedicated Hub rooms to suit the new departmental layout. Provide new fibre links to 'Core 1 & 2' cabinets for cabinets in phase 2 areas and all other cabinets outside of the works, including the Residential area,

A new Cat6A structured cabling to supply new RJ45 data/voice outlets and a 15m grid of RJ45 outlets in the ceiling voids that will allow for Wireless Access points to be put above the suspended ceiling will be provided.

All new fibre shall be OM3 50/125, 8-core multimode fibre, with LC terminations.

All new Cat6a cabling shall be copper cabling, Low Smoke Zero Halogen, capable of running at gigabit speed, and providing Power over Ethernet.

All active equipment (including switches, servers and rack mounted UPS) shall be provided by the client.

V50: Lighting

The lighting schemes will provide general lighting within all interior spaces. The schemes will be in accordance with mandatory, legislative and regulatory requirements, British Standards, Codes of Practice and Best Practice professional guidance publications. In particular this will include ; CIBSE/SLL: Code for lighting, LG2 - Hospitals and Healthcare Buildings, HTM 06-01, Building Regulations parts L & M, EN12464-1,

The interior lighting schemes will be sympathetic and complementary to the architectural form, function and construction. The emphasis upon form and function will be dependent upon the nature and use of each space.

There will be illumination of both vertical and horizontal surfaces appropriate to the specific tasks taking place, providing the occupants with a comfortable operational working environment.

Luminaires will be specified for their photometric performance, with suitable distribution, efficiency and appropriate glare control, for effective illumination of a particular task or space. Lamps and luminaires will be selected for their performance, material construction, design, fabrication and ingress protection properties.

The lighting installation will be designed to use luminaires selected from manufacturer's standard ranges.

Energy efficiency will be an inherent function of the lighting scheme. Illumination methods will be employed in accordance with Part L (Conservation of Fuel and Power) of the Building Regulations.

The schemes will provide cost effective, sustainable and energy efficient system, in terms of initial capital costs and continuing operational use.

LED light source luminaires shall be installed. Their colour rendering will be as defined in CIBSE LG2

Lighting controls will provide illuminance levels suitable for the task taking place within the space, including security, maintenance and normal operational requirements, minimising energy consumption and maintenance. Automated lighting controls comprising a combination of motion detectors, time clock or dimmable controls will be utilised, where appropriate, to achieve effective, energy efficient lighting

Control. Daylight linking controls will be employed where there is a benefit to be gained from making best use of available daylight, without adversely affecting healthcare procedures and tasks.

V55: Emergency Lighting

A complete emergency lighting scheme will be provided in accordance with lighting scheme in accordance with mandatory, legislative and regulatory requirements, British Standards, Codes of Practice and Best Practice professional guidance publications. In particular this will include; BS 5266:2016, BS EN 1838:1999, LG2 - Hospitals and Healthcare Buildings: 2008, HTM 06-01,

Emergency lighting will be provided by luminaires with self-contained emergency battery packs to provide escape lighting during mains failure conditions. Usually, they will operate in "maintained" mode.

Illuminated exit signage will be provided along escape routes from the building.

An Advanced Electronics emergency lighting central test system will be provided to undertake automated testing monitoring and reporting of the emergency lighting installation.

The new local Advanced Electronics testing panels shall have the facility to be networked to each other and the existing Advanced Electronics testing panels on site in the future.

V60: External Lighting

New external lighting shall be installed to new roads, car parks (within the phase 2 element of the works) and new building perimeters in accordance with mandatory, legislative and regulatory requirements.

In particular this will include; CIBSE/SLL: Code for lighting, LG2 - Hospitals and Healthcare Buildings, LG6 - The Outdoor Environment, Building Regulations parts L & M, ILP Guidance Notes for the Reduction of Obtrusive Light (zone E3).

The new luminaires shall comprise of LED light sources for maximum energy efficiency combined with reduced maintenance requirements.

W50: Fire Detection and Alarm

A fire detection and alarm facility will be provided in accordance with Firecode, HTM Publications and BS 5839:2012 Category L1 Fire detection and alarm systems for buildings.

The systems will be designed, installed tested and commissioned to operate in a manner that is consistent with the fire operational policies and procedures employed at the Prince Charles Hospital site.

The site is currently served by “Vigilon” fire alarm control panels supplied by “Gent”.

New fire alarm panels will be provided in the ground and first floor of the Merthyr block and will phase out the existing panels. The new panels will be manufactured to BS EN 54 and will network to the existing panels on the site by retrofitting new network cards

The existing fire alarm system will be maintained operational during the works and as far as practical to provide protection to departments adjacent the works.

The fire alarm detection and cabling shall be replaced within works areas.

Any new fire alarm panels shall be Gent ‘Vigilon’ type. Any new fire alarm devices shall be from the Gent ‘S-quad’ range.

The fire alarm system will be designed in accordance with the requirements of the overall fire strategy for the site. A strategy will be developed whereby all stakeholders provide input to the fire strategy and the design of the fire alarm system. There will be on-going liaison and review with the Project Board during the design development process.

The fire alarm system will initiate and control other building services equipment and systems according to a preprogrammed cause-and-effect’ response for ancillary services during fire alarm conditions.

Automatic detection will be provided in accordance with BS EN 54. Multi-sensor detectors will be provided. Programmable loop sounders will be utilised. Where appropriate, sounders will be incorporated into detector bases.

Where possible, opportunities to provide value engineered solutions will be considered. It is proposed that, in accordance with the HTM, detectors will be omitted for the following areas:

- Voids and roof spaces of any depth which contain only:
- MCCC or wiring clipped to a metal tray or within metal conduit or trunking
- Non-combustible pipe work and ducts
- Metal or plastic pipes used for water supply or drainage
- Toilets
- Small cupboards (less than 1m2)

Door hold open devices will be provided at doorways on primary circulation routes and escape routes through the hospital site. They will be controlled by the fire alarm system, and will close during a fire alarm condition.

W44: CCTV

CCTV cameras will be provided throughout main corridors, lift/stair lobbies, department entrances and external entrance/exits from works areas.

The CCTV system shall be developed based on using IP camera cameras. The system shall comprise of static cameras internally and PTZ dome cameras externally as appropriate, connected to new network video recorders in the existing Security Room.

The network video recorder shall be capable of storing up to 31 days for all cameras

The internal cameras and recording facility will be of suitable specification and quality for full human identification as defined in BS EN 50132 CCTV surveillance Systems for Use in Security Applications.

The CCTV Specialist Contractor shall be SSAIB or NACOSS accredited.

W41: Intruder Alarm

Local stand-alone departmental intruder alarm systems with door contact and PIR detectors will be provided where requested. The systems shall indicate activation in the existing Security Control Room

W40-1: Access Control

A new IP based access control system has been provided in accordance with the requirements of the users.

Fire Alarm interfaces will be connected to the access control system to fail safe doors open in particular on escape routes when triggered by the fire alarm.

W40-2: Intercoms

Intercom systems have been provided in accordance with the end user requirements. .

W52: Disabled Refuge Alarm

Disabled refuges will be provided as required by the fire strategy.

W54-1: Nurse Call and Disabled Call

New local systems will be provided to suit departmental layouts and requirements. The system manufacturer shall be Wandsworth to match the existing recent Nurse Call system installations at the Hospital. The systems will not be linked to the existing Nurse Call entertainment Head-end in the Wards block in accordance with the Clients requirements.

W54-2: Pager system

The new head-end equipment shall be located in the new core, the existing aerials and user keypad shall be retained and reused.

W54-3: Patient Monitoring

Not included in the works

W60: Lightning protection

Lightning Protection will be provided in compliance with BS EN 62305 and will be replaced in line with the proposed works. Upgrades to the existing systems beyond our works are not included.

The lightning protection system will comprise of an air termination network at roof level, down conductors and an earth termination network. Where possible, the metallic components of the building fabric and structure will be used to form integral parts of the system.

The existing system shall be modified / extended for new plant and associate building works, access, etc.

Surge protection will be provided to electrical distribution systems and electronic services systems to prevent damage by lightning.

MAJOR PLANTROOM DESIGN PRINCIPLES

Plantrooms have been arranged to suit the phasing and departmental arrangement for the refurbished facility. Where space allows, they contain all of the major plant associated with a department (s).

Access to plantrooms has been afforded in the architectural design to allow safe access for routine maintenance. Where possible all plantrooms have been equipped with external landing pads to facilitate removal/replacement of major components.

Plantroom A

Plantroom A is required to enable the new theatre department to be operated and serviced in an energy efficient manner, in accordance with HBN 26, HTM 03-01 and HTM 06-01.

The Plantroom will contain air handling units serving each theatre, recovery bays and associated offices. Secondary heating and cooling pumps are to be provided, distributing chilled water to cooling coils and hot water for the space heating requirements. Medical gas plant will be provided to serve the theatres. IPS/UPS plant and electrical switchgear will be provided to serve the electrical requirement of the department

Plantroom B

Plantroom B is required to enable the new Maxillofacial and the Outpatients department to be operated and serviced in an energy efficient manner, in accordance with HBN 12, HTM 03-01 and HTM 06-01.

The Plantroom will contain air handling units serving the Maxillofacial and Outpatients department. Secondary heating and cooling pumps are to be provided, distributing chilled water to cooling coils and hot water for the space heating requirements. Medical gas plant will be provided to serve the Maxillofacial and Outpatients department. IPS/UPS plant and electrical switchgear will be provided to serve the electrical requirement of both the departments.

Plantroom C

Plantroom C is required to enable the new Endoscopy department to be operated and serviced in an energy efficient manner, in accordance with HBN 52, HTM 03-01 and HTM 06-01.

The Plantroom will contain air handling units serving the Endoscopy department. Secondary heating and cooling pumps are to be provided, distributing chilled water to cooling coils and hot water for the space heating requirements. Medical gas plant will be provided to serve the department. IPS/UPS plant and electrical switchgear will be provided to serve the electrical requirement of the department. The Pneumatic Tube central plant will also be housed within this plantroom.

Plantroom D

Plantroom D is required to enable the new Therapies department to be operated and serviced in an energy efficient manner, in accordance with HBN 08, HTM 03-01 and HTM 06-01.

The Plantroom will contain air handling units serving the Therapies department and Hydrotherapy Pool. Secondary heating and cooling pumps are to be provided, distributing chilled water to cooling coils and hot water for the space heating requirements. Medical gas plant will be provided to serve the department. IPS/UPS plant and electrical switchgear will be provided to serve the electrical requirement of the department.

Plantroom E

Plantroom E is an existing plantroom that primarily contains mechanical plant that serves the existing Day Surgery Unit. The mechanical services within this plantroom will be re-configured to suit the new department layout on the first floor. This will entail a new air handling unit being provide and new chilled water and hot water pump sets.

To improve maintenance within this plantroom a new lifting beam is to be provided to assist with the removal of large plant items.

Plantroom F

Plantroom F is an existing plantroom currently serving the Theatres department. The mechanical and electrical services will be fully removed from this plantroom.

New mechanical ventilation plant will be provided along with secondary heating and cooling pumps providing chilled water to cooling coils and the space heating requirements. Medical gas plant will be provided to serve the department. IPS/UPS plant and electrical switchgear to serve the Intensive Care department will be housed within this plantroom.

This is required to enable the new Intensive Care department to be operated and serviced in an energy efficient manner, in accordance with WHBN 04-02, HTM 03-01 and HTM 06-01.

Plantroom G

Plantroom G is required to enable the new Radiology department to be operated and serviced in an energy efficient manner, in accordance with HBN 06, HTM 03-01 and HTM 06-01.

The Plantroom will only contain air handling units serving the Radiology department.

Plantroom K

Plantroom K is required to enable the new Medical Records, Facilities Management and CSSD department to be operated and serviced in an energy efficient manner, in accordance with HBN 13, HTM 03-01 and HTM 06-01.

The Plantroom will contain air handling units serving each department; secondary heating and cooling pumps providing chilled water to cooling coils and the space heating requirements. Medical gas plant will be provided to serve the department. IPS/UPS plant and electrical switchgear will be housed in this plantroom.

Plantroom M

Plantroom M constructed under phase 1b is required to enable the new Pathology, Pharmacy and Catering department to be operated and serviced in an energy efficient manner, in accordance with HBN 15, WHBN 14-01, HTM 03-01 and HTM 06-01.

The Plantroom will contain air handling units serving Pathology, Pharmacy and Catering. Secondary heating and cooling pumps will be provided, distributing chilled water to cooling coils and hot water for the space heating requirement for each of the departments. Medical gas plant will be provided to serve the department. IPS/UPS plant and electrical switchgear will be housed in this plantroom to serve the departments mentioned above.

Plantroom X

Plantroom X constructed under phase 1b is required to primarily facilitate the site electrical infrastructure to be upgraded to comply with HTM 06-01.

The plantroom will contain transformers, Low Voltage switchgear and Emergency Generator switchgear.

The roof of the plantroom will be utilised to house new energy efficient chillers to enable the site chilled water system to be upgraded.

4.5 Preferred Option Fire Engineering Design Principles

Introduction

The following statements are intended to provide an overview of the fire strategy for the Phase 2 refurbishment works at PCH. The full fire strategy report for each phase is included in Appendix A.7 together with the construction phase fire strategy document and will be referred to.

Proposed Fire Strategy Principles

This section relates to the proposed refurbishment and phase 2 works, namely in the following areas; Cynon, Rhymney, New switchroom/cash office, new Comms room, temporary Cardio Pulmonary, Maxillofacial, Therapies, temporary MDTU, OPD, Endoscopy, Theatres, Radiology and MRI.

Purpose Group Classification

Given the proposal to design the overall building in accordance with the recommendations of WHTM 05-02 for a hospital building it is considered appropriate to classify the building as Purpose Group 2a - Residential (Institutional).

It should be noted that in line with the guidance given in WHTM 05-02, the offices and other specific accommodation where occupants can evacuate independently such as the MDTU etc. will be assessed in

accordance with the guidance given in BS 9999 as the occupants will be independent and not dependent patients.

The risk profiles for these areas, based on Table 4 of BS 9999, are:

- A2 (offices),
- A3 (storage).

Means of Warning

HTM 05-03 B provides general guidance on the design and installation of new fire detection and alarm systems in hospitals and acts as a supplement to BS 5839: Part 1. HTM 05-03 B recommends full coverage by smoke detectors, manual call points, visual alarms and audible alarms and on this basis, a category L1 fire detection and alarm system will be provided.

Full guidance is given in the Hoare Lea Fire Strategy for the hospital refurbishment (Ref: REP-1903082-11-GD-260214 (PCH_Rev2) and the Electrical Engineers information.

Construction Sites

It is not proposed to retain the existing fire alarm system as operational within the construction sites. This is due to the possibility of false alarms caused by dust, etc.

An inter-connecting (could be wired-in or wireless) system of call-points and sounders will be required to provide an effective fire warning system. This system will be provided with a control panel and this panel will be interlinked to the main building panel. The system will be designed to meet the requirements of BS 5839: 1: 2013.

This system will alert the occupants of the construction site(s) in the event of a fire and also activate the fire alarm of the building in the same manner to as if a manual call point in the building was activated. In addition, on activation of the system the site manager will contact Prince Charles Hospital Security office as soon as it is possible to do so, to alert them to the incident.

The site manager will ensure that all operatives are aware of the necessity to activate the call point system within the construction site.

The site manager will ensure that senior operatives are aware that they are responsible for ensuring that their team has left the construction area.

Note: where fire alarm systems are being retained in areas under construction, the detector heads will be covered. Any coverings will be removed when work is complete and this will be checked by the site manager before the area is handed over.

Outside of the Construction Sites

The detection system within the remainder of the building will be retained as existing. On activation of the detectors within the building, detection and investigation process (where permitted) will still be employed as per the existing strategy.

In the event that the compartment of fire origin is evacuated, the alert signal will also activate the construction site via the link to the contractor's fire alarm panel to initiate an alert signal.

Means of Escape

Philosophy

In accordance with WHTM 05-02, for all areas of the building where patients are present, occupants will be evacuated by progressive horizontal evacuation.

Staff only accommodation and areas where visitors are considered to be independent will also employ a progressive horizontal evacuation strategy, which is acceptable under the guidance of BS 9999. The MDTU facilities will adopt a simultaneous evacuation strategy, however, where the MDTU adjoins the main building, escape into the main building is considered to be acceptable.

Full details of the means of escape philosophy from each area of the building is detailed in the fire strategy in the appendices of this FBC document.

Travel Distances

Under the guidance of WHTM 05-02, the maximum travel distances from any point within a compartment should be not more than 60m to:

- Each of two adjoining compartments,
- An adjoining compartment and a stairway / final exit.

Where means of escape is possible in a single direction, the travel distance should never be more than 15m for inpatient accommodation and 18m for outpatient accommodation

Generally the travel distances are considered to be within the permitted limits, however, reference should be made to the full fire strategy in the appendices of this report for further details with regards to extended travel distances within:

- The Ground floor reception during construction works (approximately 4.5m extension to single direction)
- Theatres compartment T1 prep-room, post complete (approximately 3m extended travel distance)

Within accommodation which is assessed under the guidance of BS 9999, travel distances are limited to the following:

- A2 single direction - 25m

- A2 multiple direction - 63m
- A3 single direction - 18m
- A3 multiple direction - 45m
- B2 single direction - 23m
- B2 multiple direction - 57.5m

Where permitted these distances have been modified by 15% to account for the provision of an automatic fire detection and alarm system in accordance with BS 9999 (note this only applies to accommodation accessed using BS 9999)

The travel distances are considered to be within the permitted limits, however, reference should be made to the full fire strategy in the appendices of this report for further details

Escape Widths

Sufficient escape capacity is considered to be provided during the phase 2 works.

As per WHTM 05-02, Section 3.42, where beds or patient trolleys will not be used, the minimum clear width of escape routes will be 1200mm as the population is not considered to exceed 200 persons.

In non-patient accommodation, escape capacity has been determined in accordance with BS 9999.

Emergency lighting

There is a general requirement to provide emergency escape lighting within hospitals for both fire and non-fire conditions. General guidance on emergency lighting is detailed in WHTM 05-02, BS 5266: Part 1 *Emergency lighting - Code of practice for the emergency escape lighting of premises* and supplemented by HTM 06-01 *Electrical services: supply and distribution* and CIBSE guide *Lighting guide LG2: hospitals and healthcare buildings*.

Refer to Clause V55 Emergency Lighting in the Mechanical & Electrical Services Proposed Design principles Section.

Signage

Every common escape route, other than those in ordinary use, will be distinctively and conspicuously marked by emergency exit signage complying with the recommendations of BS ISO 3864 Part 1 and the Health and Safety (Safety sign and signals) Regulations 1996

While not a requirement under WHTM 05-02, displayed escape plans that contain information relevant to fire safety, escape, evacuation and rescue of the facility's occupants complying with BS ISO 23601 will be provided and displayed as signs in key public and staff areas

Internal Fire Spread

Elements of Structure

All new structural frames, beams, columns, load bearing elements, and floor structures to the refurbished areas are required to have 60 minutes fire resistance in an unsprinklered hospital, which is less than 12m above Ground floor level. This has been provisionally agreed with the Statutory Authority.

Where altered by the refurbishment work the existing structure will be provided with 60 minutes fire protection or made good to this standard of fire resistance.

It is noted that structure which only supports a roof will not require fire resistance unless the roof performs the function of a floor (i.e. supporting roof-top plant), supports a roof-top means of escape route, or the structure is essential for the stability of a fire-rated element of external wall.

Compartmentation

Compartment walls (integrity and insulation) and compartment floors with 60 minutes fire resistance will be provided in accordance with WHTM 05-02.

The contractor's hoarding is considered to be a compartment wall and, therefore, will provide 60 minutes fire resistance in both directions.

Further details are provided in the full fire strategy in the appendices of this document.

Fire Hazard Rooms

Fire hazard rooms will be enclosed by at least 30 minutes fire resisting construction (integrity and insulation).

Table 1 - Fire Hazard Rooms

Fire Hazard Room - Doors kept locked shut	Fire Hazard Room - Doors with free swing closing devices	Fire Hazard Rooms - Doors with self-closing devices
Chemical stores	Patient bedrooms provided specifically for: <ul style="list-style-type: none"> ▫ Those suffering from mental illness ▫ People with learning disabilities 	Linen stores
Cleaners rooms	Relatives overnight rooms	Staff on call rooms
Clothes storage	Ward kitchens	
Disposal rooms		
Hub rooms		

Lift motor rooms
Staff changing / locker rooms
Storerooms

Additional Client Requirements

The client has confirmed that beverage bays are to be treated as kitchens due to the migration of cooking appliances into the space. Offices are not defined as such in WHTM 05-02 and will not be upgraded to fire hazard rooms

Cavity Barriers

Cavity barriers will be provided to sub-divide concealed roof or ceiling voids. These should be positioned to coincide with sub-compartment walls and walls to fire hazard rooms.

In hospitals, the subdivision provided through the requirements for compartmentation and sub-compartmentation to facilitate progressive horizontal evacuation is such that, generally, the additional subdivision of ceiling voids by cavity barriers is not required.

Additional cavity barriers will also be provided:

- To prevent the interconnection of vertical and horizontal cavities,
- At the intersection of fire resisting construction and elements containing a concealed space,
- Within the void behind the external face of rain screen cladding, at every floor level and on the line of compartment walls abutting the external wall.

Due to the complexities of ventilation ductwork systems above operating departments mean that the provision of cavity barriers would seriously compromise the service access. Therefore, cavity barriers are not required over operating departments.

Cavity barriers are required in the suspended ceiling or floors of the offices and as per the guidance given in 5.64 of WHTM 05-02, these will not be provided:

- in cavity walls; or
- in double-skinned insulated roof sheeting; or
- below a floor next to the ground or oversite concrete providing:
 - the cavity is less than 1000 mm in height; or
 - it is not accessible by persons; and
 - there are no openings in the floor such that it is possible for combustibles to accumulate in the cavity

Fire & Fire / Smoke Dampers

Dampers will comply with the guidance given in Table 7 of WHTM 05-02 provided in the full fire strategy in the appendices of this report

Internal Fire Spread of Flame

Wall and ceiling finishes and roof lights will meet the recommendations provided below.

- Small rooms not exceeding 4m² - Class 0,
- Other rooms - Class 0,
- Circulation space (including means of escape corridor and stairs - Class 0).

External Fire Spread

Given the complex nature of the refurbishment, an extensive external fire spread assessment was carried out to ensure that the amount of unprotected area overlooking the boundary is restricted in order to limit the potential for fire spread by radiant heat transfer to other buildings.

The full external fire spread assessment is provided in the fire strategy in the appendices of this report.

Junctions of Compartment and Sub-compartment Walls

Where a compartment, sub-compartment or protected shaft wall meets an external wall a 1000mm wide storey height strip having 60 minutes fire resistance (integrity and insulation) will be provided.

Junctions of Walls and Low-level Roofs

In accordance with Section 6.12 of WHTM 05-02 there is a requirement for 3m of fire resistance where a lower level roof meets an external wall. This occurs between Ground and First floor and, therefore, sufficient fire protection will be provided to ensure this provision is met.

This also includes the canopy which connects the main building to the new Clean and Dirty cabins and new courtyard bed store to prevent the risk of fire spread to the First floor accommodation.

External Wall Construction

The external facade is required to be provided with a minimum surface spread of flame rating of Class 0 (national class) or Class B-s3, d2.

Fire Service Access and Facilities

As this is an existing building, it is proposed to retain the existing fire service access provisions.

Further details of site access, internal access and fire control points are provided in the full fire strategy in the appendices of this document.

Fire Control Point

It is currently proposed that the fire control panel will be provided within the building at the main entrance. An additional repeater panel will be provided at the outpatient's entrance; however the provision of the fire

control panels will be subject to discussion and agreement with the Statutory Authorities, Welsh Health Shared Services and the Project Board.

Active Fire Suppression

The refurbished building will not be provided with a life safety sprinkler system. The omission of sprinklers from the scheme meets the guidance given in WHMT 05-02 Section 5.68 which states

With the exception of buildings over 30 m in height, the guidance in this document does not require the installation of sprinklers in patient care areas of healthcare buildings

The design team has considered the advantages that may be gained by installing life safety sprinklers.

However, given:

- The limited scope of the refurbishment (Ground and First floor only).
- The nature of the refurbished rooms and the fire risk associated with the rooms.

The design team considers the provision of sprinklers to provide limited benefit with regards to overall patient safety within the hospital building and limited benefit with regards to potential savings for the Health Board

The design team have considered the provision of alternative suppression methods for critical areas, such as patient records and this is detailed in the relevant sections of this report, as appropriate

Suppression systems will be provided to the extract hoods of all new catering equipment in consultation with The Project Board.

Hand held portable fire extinguishers will be in accordance with BS 5306-3:2017

4.6 Preferred Option Acoustics

Hunter Acoustics Ltd has been appointed by Interserve to provide acoustic design advice for various elements of the refurbishment of the Prince Charles Hospital, Merthyr Tydfil. Copies of the acoustic reports are included in Appendix A.6 of this document. The following gives an overview of the scope of works and initial specifications:

Vibration Assessment

New operating theatres and vibration-sensitive areas are being created in existing first-floor spaces.

Vibration surveys have been undertaken in existing training accommodation and pharmacy staff areas to confirm the current vibration levels on the existing first floor slab. A copy of the report is included in Appendix A8

Measured vibration levels have been compared against the guidance vibration figures quoted in HTM08-01. Vibration levels are low and a low probability of adverse comments is indicated. However tighter criteria may be required for any specialist equipment - manufacturers to confirm.

The assessment has only covered existing vibration sources. It does not include any new sources of vibration which may be introduced (such as footfall in new corridors, or new mechanical plant).

Plant Noise Assessment

An environmental noise survey has been undertaken around the site to confirm background noise levels at critical residential receivers. Results are in line with previous noise survey undertaken in 2012. A copy of the report is included in Appendix A8

Background noise levels are used as basis for negotiating plant noise emission criteria with the local authority.

A full noise impact assessment of noise emissions from the new plantrooms and louvres is to be undertaken in accordance with BS4142.

A preliminary noise emission assessment of the more critical Plantroom X including new chillers and standby diesel generator - has been carried out with plant noise limits / noise mitigation measures indicated for each to meet proposed noise criteria. A copy of the report is included in Appendix A8

AHU noise levels to internal areas are to be assessed, including reviewing silencer specifications to meet internal plant noise level criteria quoted in HTM08-01, and plantroom structures where plantrooms are located above existing clinical areas.

4.7 Preferred Option Energy and Sustainability

Introduction

The following statements are intended to give an overview of the Sustainability measures proposed for the phase 2 refurbishment works at PCH. More detailed information can be found in the detailed design packages.

The objective of this document is to propose the sustainability strategy for the phase 2 works

The majority of the work is refurbishment with some elements of new-build work, including the following; Refurbishment of clinical, facilities and administration areas and departments, Building services distribution infrastructure upgrade, Façade and roof improvements.

The NHS is one of the largest employers in the world and has a carbon footprint of approximately 18 million tonnes of CO2 per year. The NHS approach to sustainability is documented in 'Saving Carbon, Improving Health' which sets out the following sustainability requirements:

- Energy and carbon management
- Low carbon travel, transport and access
- Water
- Waste
- Designing the built environment
-

In order to meet future carbon reduction targets the NHS environmental policy is driving sustainable development, stating that built environments should be designed to encourage sustainable development and low

- carbon usage in every aspect of their operation, whilst ensuring optimum healthcare.
- The Welsh Assembly Government requires that healthcare refurbishments seeking approval for an Outline
- Business Case (OBC) should commit to achieving a BREEAM 'Very good' rating.

- BREEAM is the world's foremost environmental assessment method and rating system for buildings. The
- BREEAM process sets the standard for best practice in sustainable building design, construction and
- operation and has become one of the most comprehensive and widely recognised measures of a building's
- environmental performance.
- This BREEAM scheme covers ten categories of sustainability including:
- Management
- Health & Wellbeing
- Energy
- Transport
- Water
- Materials
- Waste
- Land Use and Ecology
- Pollution
- Innovation

Opportunities

The associated existing building services distribution and systems, together with elements of the building fabric and materials will be replaced

Opportunities for sustainable improvements are captured utilising the BRE's BREEAM assessment methodology as an overall framework with a target rating of 'Good+'.

The proposals extend to the areas of the phase 2 works predominantly being necessary to internal elements with only isolated works proposed to the existing envelope and replacement of local building services systems and distribution with connection to the existing boiler house and new chilled water plant, including an absorption chiller.

The proposals will be in compliance with relevant Health Building Notes (HBN's), Health Technical Memoranda (HTM's), and all other relevant codes, standards and guidelines except where highlighted in the derogations schedules.

Many of the existing building services systems distribution and local equipment date back to the original hospital construction are approaching 40 years old, no longer meet current standards of clinical care and do not provide sufficient resilience of service. The scheme addresses the aging infrastructure by replacing life expire equipment in the areas of refurbishment with modern energy efficient equipment and controls.

Despite the age and condition of much of the existing building services distribution and point of use equipment, the majority of the existing central plant has been replaced and modernised since the original hospital construction in the mid 1970's. For example approximately 7 years ago the central energy supply arrangement for heating, hot water, cooling was rationalised to include Combined Heat & Power (CHP) plant and modern vapour compression air cooled chillers, however the chillers are failing and are being replaced with the latest energy efficient turbo core units.

The overall sustainability strategy and approach for the project is to adopt the BREEAM assessment methodology and a target rating of 'Good+'.

As part of the sustainability strategy key areas of focus include:

- Replacement of materials will utilise the 'Green guide' targeting sustainable and responsible resources
- Development of a decant strategy to minimise multiple departmental relocations, provision of otherwise unnecessary temporary facilities and building services arrangements, reducing waste and environmental and associated clinical impacts
- Improvement of thermal performance of the building envelop windows and insulation to the existing wall constructions (limited to the areas of the refurbishment), reducing energy consumption and carbon dioxide emissions
- Improvement of thermal performance of the building's roof in areas of significant roof works,
- Improved performance of the existing central CHP plant and associated Energy Supply Company (ESCo) by maximising the use of its waste heat by using an absorption chiller and extending its annual run-times, increasing this existing low carbon solution, reducing carbon emissions associated with UK grid electricity generation and transmission losses
- Rationalisation of existing localised heating and hot water plant to be supplied from the existing central plant and extending the demand for waste heat and run-time of the existing CHP plant, reducing carbon emissions associated with UK grid energy supplies
- Rationalisation and removal of the majority of localised unitary refrigerant based cooling systems and plant by transferring the associated cooling demand to the central cooling plant including provision of an absorption chiller; reducing a range of refrigerants and carbon emissions
- Provision of an Absorption chiller driven by waste heat from the existing CHP, again extending the demand for waste heat and existing CHP run-time, reducing carbon emissions associated with UK grid energy supplies
- Adopting low energy, high efficiency and low carbon solutions such as high efficiency LED lighting and controls, new efficient air plant and local heating controls.
- Utilising water saving appliances in the re-provision of domestic hot and cold water systems and devices, including sub-metering, leak detection and isolation where appropriate
- Replacement of existing and often original localised air handling plant with modern more efficient plant incorporating energy recovery arrangements, reducing energy demands and carbon emissions
- Departmental sub-metering for the electrical, heating and cooling systems, including BMS monitoring and reporting
- Reduction of waste during construction
- Further information regarding other components of the sustainability strategy is contained within the project's BREEAM Pre-assessment.

Proposals

The design of the Prince Charles Hospital, Phase 2 scheme has been designed with sustainability principles in mind to enhance the hospitals environmental credentials, reduce operation costs and improve the healthcare environment. This includes reducing energy and water consumption, minimising the building's embodied carbon and minimising waste.

The design for the project embeds sustainability through integrated architectural, engineering and landscape design.

In accordance with NHS policy the new hospital will provide sustainable development with low carbon usage in every aspect of their fabric and function.

Sustainable measures will be incorporated in the design process which reflects BREEAM requirements:

We have undertaken the involvement of relevant stakeholders including building users, local residents and local government during the design process to provide the most suitable facility for the building users.

Sustainable procurement and the involvement of a BREEAM Accredited Professional have allowed all opportunities to enhance sustainability within the project have been exploited whilst engaging in the BREEAM process to make sure the performance targets are achieved.

Health and Wellbeing

Visual comfort; the design has sought to optimise the percentage of total floor area that has an average daylight factor of 2% or more to give building users sufficient access to daylight. In addition the lighting design considers the specification of artificial lighting in accordance with the latest CIBSE Code for Lighting to provide lighting in line with best practice for visual performance and comfort.

A thermal comfort analysis has been undertaken to ensure the proposed building will provide an acceptable level of comfort within the occupied spaces, in accordance with CIBSE AM11: Building Energy Environmental Modelling and relevant HTMs

Safety and security

The design team have engaged the local police Architectural Liaison Officer and Crime Prevention Design Advisor to design out the opportunity for crime, in accordance with the principles and guidance of Secured by Design.

Energy

Reduction of CO2 emissions; the design embraces the Mean, Lean, Green carbon saving hierarchy. Firstly passive (Mean) design measures such as natural ventilation will be incorporated wherever appropriate to deliver significant carbon savings at a relatively low additional cost. Secondly, active (Lean) measures are included such as specifying energy efficient plant that supply, use and recycle energy efficiently. And lastly low or zero carbon (Green) technologies are considered which help reduce carbon emissions but are generally higher capital cost technologies.

Energy monitoring; the design integrates separate accessible energy sub-meters, labelled with the end energy consuming use to facilitate the monitoring and reduce the consumption of energy.

Transport

Travel plan; the development works being largely refurbishment of existing spaces will include for additional car parking and increased number of disabled parking spaces across the site. The existing Travel Plan for the hospital remains unaffected with current public transport (bus) links of which, the phased construction approach will seek to minimise impact on members of the public and hospital staff.

Water

Water Consumption; the design includes low water use sanitary appliances to minimise the consumption of potable water.

Water monitoring; the design includes a water meter connected remotely to the developments BMS to ensure water consumption can be monitored and managed therefore encouraging reduction in water usage.

Materials

Life cycle impacts; the design favours the use of construction materials with a low environmental impact over the full life cycle of the building. All new buildings will be steel frame clad in composite insulated cladding panels that not only provide the highest thermal values but also fire resistance qualities required for proximities with existing structure around the site.

Responsible sourcing of materials; the design looks to favour the use of construction materials with known Environmental Management Systems to reduce the environmental impact of the development on extracting and processing building materials.

Waste

Construction waste management; a Site Waste Management Plan will ensure resource efficiency via the effective and appropriate management of construction site waste.

Operational Waste; a dedicated storage space will be provided to facilitate the recycling of operational waste so that it can be diverted from landfill or incineration.

Land use and Ecology

Enhancing Site Ecology; a suitably qualified ecologist has been appointed to provide recommendations of how to protect any ecology on site and seek to enhance biodiversity through the design process.

Pollution

Reduction of night time light pollution; the lighting design is concentrated in the appropriate areas and ensures that any upward lighting is minimised, reducing unnecessary light pollution, energy consumption and nuisance to neighbouring properties.

Surface water runoff; the site is located in a zone which has a low annual risk of flooding which means the likelihood of the development being effected by any flooding events is minimal.

Innovation

Responsible construction practices; the construction team will manage the site in an environmentally and socially considerate, responsible and accountable manner beyond current best practice.

4.8 CDM Statement

The Construction (Design and Management) Regulations 2015 (CDM) have the key aim of integrating health and safety into the management of the project and to encourage everyone involved to work together.

There are five main duty holders under CDM, these are:

- Client
- Principal Designer
- Designers
- Principal Contractor
- Contractors

Each of the above must comply with their duties as set out in the CDM Regulations.

CDM requires the design to consider health and safety throughout the whole project not just during construction but during cleaning, maintenance, repair, refurbishment and demolition.

The CDM Regulations require the systematic management of projects from concept to completion, hazards must be identified and eliminated where possible and any remaining risks reduced and controlled.

Interserve Health Wales will act as Principal Contractor. They will have adequately trained, experienced and competent engineers and planners, both technically and with regards to Health and Safety, for the proposed scheme.

The role of Principal Designer will be carried out by Boyes Rees Architects. Advice and support on complying with CDM duties will be provided by the Principal Designer.

Co-operation and dialogue between the design team, constructor and Principal Designer will continue in the developing design stage through to construction by review of design information and regular formalised meetings that will also include input from temporary works designers and those subcontractors who have design responsibilities.

All subcontractors will be assessed for health and safety competency, and will have satisfied this assessment prior to appointment. They will also be provided with relevant pre-construction health and safety information such that they can adequately consider the health and safety requirements for their work. This will be by providing as a minimum:

- Sufficiently developed Health and Safety Plan (Project Management Plan)
- Interserve Health, Safety and Environmental Code for Subcontractors (L8)
- Any necessary briefings to identify and educate on any relevant CDM issues.

The Principal Designer has maintained a regular involvement with the design team, contractor and client throughout the design team meetings.

4.8.1 General

CDM Compliance

The requirements of the Construction (Design & Management) Regulations 2015 have been included in the development of the design and the contractor's proposals for the construction of Phase 2 of the refurbishment works at Prince Charles Hospital, Merthyr Tydfil.

Risk Management

There has been an ongoing programme of hazard and risk management throughout the design. The principals of risk elimination and safety by design have been addressed by the designers and the hazard and risk registers reviewed and updated in response to changes in design.

Design Coordination

Design meetings have been regularly held to coordinate design elements. Health and safety implications within the design have been identified and assessed.

Code of Practice

The Health Board's Code of Conduct and Safety Rules for Contractors has been issued to the Principal Contractor. The method statements and procedures developed for the works will comply with the requirements set out in the code in addition to all relevant legislation and guidance.

Infection Control

Infection Control is consulted as part of the project development and the requirements to prevent the spread of infection are included in the proposals.

Construction Phase Plan

Interserve Project Services Ltd has developed a Construction Phase Plan which is suitable for the planning and management of the works. This plan will be developed as the works proceeds through the main works phases.

4.8.2 Site Considerations

Provision of Site Compound

Site compound will be set up with agreement of the Health Board to ensure minimal impact on the existing site traffic and parking arrangements.

Deliveries & Material Storage

Interserve will undertake a traffic assessment and develop a management plan for approval by the Health Board. The plan will set out the measures to alleviate the increase traffic flow caused by the construction works and include the management arrangements to prevent the obstruction of hospital routes and maintain access for emergency vehicles. The project will require just in time and part load deliveries to avoid issues from lack of storage space

Contractor Parking

Parking of contractor vehicles on hospital roads will be prohibited. The construction phase plan includes the permitted parking locations and traffic arrangements. Potential alternative parking arrangements may be proposed by the Health Board.

Lifting Operations

Lift plans will be developed to ensure that all lifts are undertaken safely and subject to the Health Board's agreement

Site Temporary Services

Connections of site temporary services will be undertaken in a manner that will not put the main hospital supplies at risk at any time by unplanned events.

Unauthorized access, trespass and vandalism

Localised areas of works will be made secure to prevent unauthorized access and minimise the potential threats of arson. Keypad control locks will be employed to prevent unauthorised access. Where works are being undertaken within occupied areas of the hospital method statements will include procedures to ensure that the hospital security arrangements are not compromised

4.8.3 Demolitions

Demolition Plan

A written plan of works will be developed and agreed for the demolition works. The extent of demolition works are defined on the Boyes Rees Drawings.

Premature Collapse of Structures

Available structural information on the existing buildings has been supplied to the structural engineers. A demolition plan will be developed and procedures adopted to prevent premature uncontrolled collapse of the structures.

Services

The M&E Strategy Report identifies services that will require diverting. All services will be isolated prior to demolition and the Health Board's isolation procedures followed to prevent any impact on operational areas of the hospital.

Asbestos

The Health Board's Asbestos Register has been provided to the Principal Contractor who will arrange further Refurbishment and Demolition Asbestos Surveys as required. ACMs identified will be removed by a licensed contractor utilising procedures and methods detailed in 'L143 Work with Materials Containing Asbestos'.

4.8.4 Structural & Civils

Ground Conditions

A Geo-Environmental investigation has been undertaken and its findings detailed in the ground investigation report the recommendations have been incorporated into the design and construction methodology. Varying degrees of oil and asbestos contamination have been found during specific and focused Site Investigation. Suitable control procedures will be incorporated into the works' methodology to mitigate risks to patients, visitors, staff, neighbours and construction personnel. Further Site Investigation will be incorporated into the advance planning of works to all areas of the site affected by the proposed development. The outputs of this site investigation will inform future management protocol.

Foundation Design

The foundation design has been detailed by Opus International to provide the most practical and economical solution for the agreed layout.

Structural Design

The structural steel option has been developed taking account of stresses and loads that will be imposed on the structure and to accommodate the services necessary for the operation of the building.

The Civil and Structural designs have been developed with the Health and Safety of the end user and construction operatives at the forefront. Hazards and risks were identified at the outset and designed out where possible. The risks that cannot be eliminated have been mitigated against in our design and construction information

For example the construction of the roof top plant rooms presents numerous hazards. To accommodate their construction the existing structure needs to be strengthened. We have examined the comprehensive set of record drawings for the hospital and developed our solution accordingly. We have also ensured that the strengthening work is able to be completed in phases preceding the actual construction of the plant rooms so that there is no need for temporary propping.

Where the strengthening of the existing structure has not been possible we have designed a bridging structure incorporating a Vierendeel girder. This bridging structure has been designed to span over the existing hospital building therefore eliminating the need for strengthening works. We have ensured that where the new frames are founded does not have a negative impact on the existing foundations or mitigated this affect by designing a regime of underpinning. Any underpinning exercise will be constructed in such a way that it is only done in short lengths ensuring adequate support for the existing building is maintained at all times.

The bridging structure itself has been spliced to allow safe delivery and erection whilst maintaining large enough section to make the construction as quick as possible over the live hospital. The construction sequences are clearly identified on our drawing and in our risk assessments ensuring that the construction team completely understand the mitigation measures inherent in our designs.

4.8.5 Architectural Design

Fire Strategy

Building Control and HLP Fire Engineering have been consulted and inputted to inform the proposals during the design. The fire strategy and equipment installed will interface with the remainder of the hospital through the required sectional completion sequences.

Compliance with Workplace Regulations, HTMs and HBNs

The design has taken account of the requirements of the Workplace (Health, Safety and Welfare) Regulations 1992. Where a variation from a HTM or HBN is proposed then derogation has been sought from the Health Board and an assessment undertaken to ensure that no unreasonable risks have been introduced.

Access and Egress

Assessments of the access and egress requirements have been undertaken. The design provides suitable access for those with restrictions on their mobility.

Maintenance and Cleaning

Consideration has been given by Boyes Rees in the design of the methods to safely maintain and clean the structure. Further consultation will be undertaken with the Health Board's maintenance team to accommodate their requirements.

4.8.6 Mechanical & Electrical

Compliance with Legislation, HTMs and HBNs

The design process has been developed to ensure compliance with the legislation and with the HTM's and HBNs. Where a variation from a HTM or HBN has been proposed then derogation has been sought from the Health Board and an assessment undertaken to ensure that no unreasonable risks have been introduced.

The proposed services have been designed to avoid foreseeable risks to health and safety for all those involved in the construction, maintenance, and demolition of the works. Hazards which may give rise to risk have been eliminated through the design process as far as reasonably practicable. For example, all major plant is located within accessible plantrooms sized to accommodate and facilitate maintenance and removal of key components such as air handling unit filters and UPS batteries. Landing platforms have been provided outside of key plantrooms for major plant replacement such as AGSS pumps. Similarly, major mechanical and electrical services will be installed and routed within accessible ceilings to facilitate future rewiring, modification and maintenance, generally through major circulation and corridors, to avoid affecting the clinical processes. Valves, drainage rodding eyes, wifi data outlets, lighting control modules etc, will be situated in accessible positions within the ceiling. Residual risks with control measures have been identified within the designers risk assessments

Capacity of Services

Hoare Lea have reviewed the capacity of the hospital services and has included proposals for their upgrade where required as part of the new proposed works.

Failure of Critical Services

The potential for failure of life critical and major services has been examined during the design and although back up supplies as such are not being provided the Hospital's supply capability is being redesigned to provide a compliant standard of resilience which does not exist at the moment. Existing dilapidated infrastructure is being replaced and updated.

The Construction Phase Plan for the works sets out the management arrangements and procedures to ensure that services to the hospital are not disrupted during the works.

4.9 Preferred Option Phasing Strategy

The phasing of the works was developed from the OBC and the revised contract strategy issued in 2016 and is:

Works to the kitchen element as phase 1. Following further discussion this element was separated into two contracts to be presented as BJC's:

- a. Phase 1a - the temporary kitchen and other decant works
- b. Phase 1b - the permanent Kitchen and Pharmacy works

Phase 2 - The main ground and first floor works and provide a full business case for approval.

Phase 3 - The works to the remaining ground and first floor element mainly to the rear of the ground and first floor. To be added to the phase 2 works through a compensation event.

Phase 4 - Infrastructure and car parking. To be added to the phase 2 works through a compensation event.

It should be noted that elements of car parking are included in phase 1a, 1b and 2 the remaining elements and completion of these works are included in phase 4.

Phase 1a comprise of enabling works to facilitate phase 1b and are summarised as follows:
Ground Floor

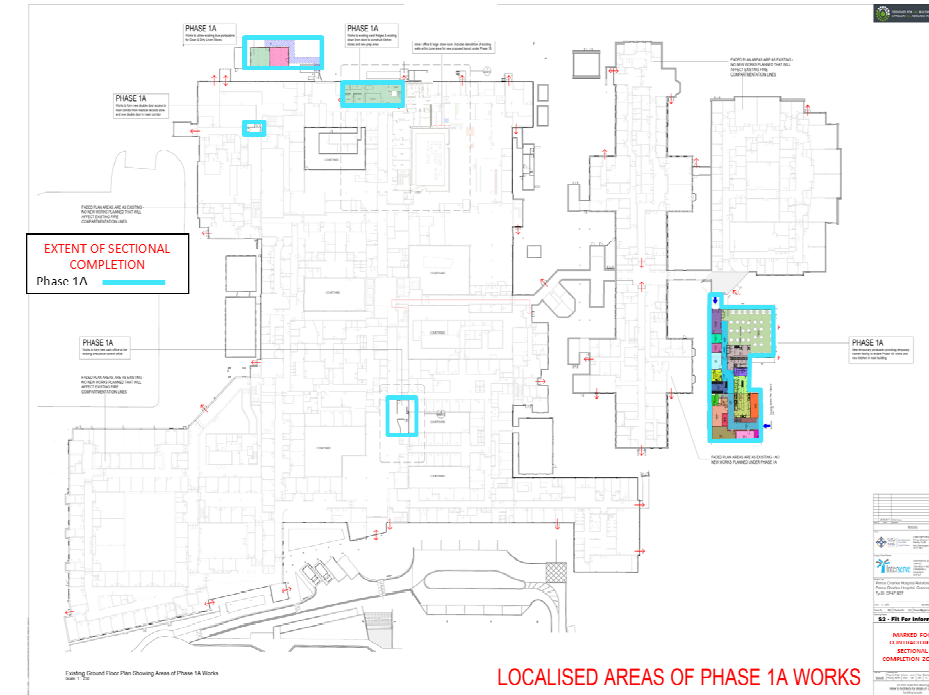
- Enhancement works to existing parking and access arrangements around Rhymney block
- Provision of unit 1 for temporary kitchen/dining building
- Works to convert ambulance response to cash office
- Works to blue boxes for clean and dirty linen including access
- Works to ward kitchen and temporary provision
- Access through med records/mortuary corridor

First Floor

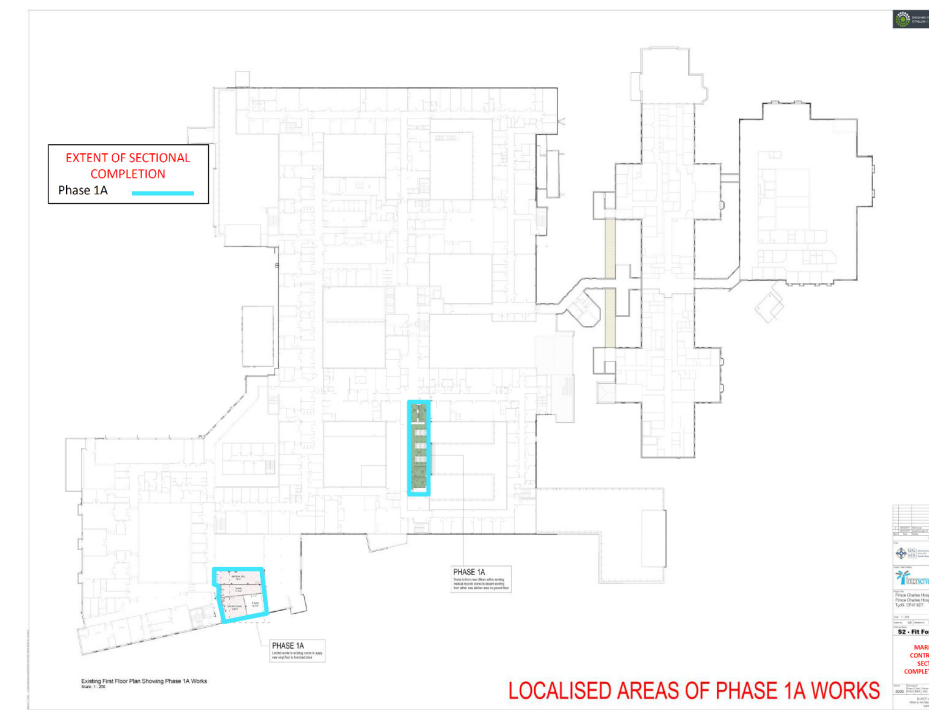
- Works for temporary area for bed store in white space above A&E
- Works to redundant area on 1st floor (old med records for admin)

The following plans indicate the location of the above works to the ground and first floors.

Phase 1a Ground Floor Plan



Phase 1a First Floor Plan



The phase 1b and phase 2 works are the main works that impact on the fire enforcement notice. Phase 2 has been subdivided into separate phases for the purposes of management of the works and contractual issues. The phase 1b is a separate contract all the phase 2 works are contained within one contract.

PHASE 1B

- Demolition of existing bed store and installation of unit 4 within kitchen courtyard
- Works to form new kitchen/dining & pharmacy departments
- Remaining delivery areas to kitchen / Dining & Pharmacy

PHASE 2A- Enabling

- Infrastructure works
- Temporary fit out of Cynon for Therapies
- Temporary fit out of 1st floor Merthyr for Cardio pulmonary
- Temporary fit out of Rhymney for OPD
- Form new Comms. room
- Form new switch room
- Temporary fit out of max fax for diabetes
- Demolition of diabetes
- Demolition of Cardio Pulmonary & the training building

PHASE 2 B

- Works to Therapies department (including plantroom D)
- Dismantle part of temporary kitchen and install unit 2
- Install unit 3 temporary Admin /MDTU
- 2nd fit out for Cynon for Diabetes & Cardio Pulmonary

PHASE 2 C

- Works to OPD phases 1 & 2
- Works to Max fax (1st floor)
- Construct 2 storey Endoscopy link
- Refurbish 1st floor Merthyr used for temp Cardio Pulmonary for Endoscopy
- Refurbish G floor Merthyr block previously Max Fax and temp Diabetes for OPD
- Plantrooms B,&(C - part hand over not Oncology)
- Temporary accommodation for Neurophysiology

PHASE 2 D

- New theatres
- 23.59 & white space
- Trauma lift and link corridor
- Phase 1 Radiology
- Plantroom A , works in existing plantroom E & Temporary plant in courtyard for Radiology phase 1

PHASE 2 E

- Radiology phases 2 &3
- 1st floor CITU
- Possible remodel of Rhymney block for admin – (No details at this time)

- Demolition of admin buildings & externals– (No details at this time)
- Construct new MRI facility and plant room H
- Plantrooms F &G

PHASE 3

- Oncology / transfusion department
- Pathology Department
- CSSD
- Housekeeping and waste management
- Fit out of white space (use to be determined in design stage)
- Existing MRI building converted for office use.

PHASE 4

- Remaining car parking and road alignments.
- Final infrastructure for external lighting and CCTV to bring into use.

4.10 Sectional Completion for Phase 2

The OBC included the works within three contracts with an overall programme of 5 years. The revised strategy included the works to phase 1a - Temporary Kitchen phase 1b permanent kitchen and then the majority of the original OBC three contracts included in phase 2. Phase 1a and 1b are separate contracts providing enabling works for the commencement of phase 2. Following detailed design development and the need to maintain operational use while the works are progressing the programme for phase 2 has been established at 6.75 years. This could be increased further depending on the approval for the remaining phase 3 and 4 to be included in phase 2 as compensation events.

This revised strategy increased the contract period from circa 2 years for each OBC contract to a contract period of some 6.75 years for phase 2. Following reviews by the Health Board, NWSSP SES, GMS, Health Boards legal advisor and the SCP it was considered that the revised strategy changed the details of the original contract.

The NEC contract enables at completion:

1. The release of half of the retention at the completion of the whole of the works or if the employer has taken over the whole of the works. Option X16 refers.
2. The commencement of the defects period and the release of full retention at the end of the defects period, 52 week after the completion of the whole of the works.
3. Delay damages no longer apply when completion of the whole of the works is issued. If part of the works are taken over the delay damages are assessed by the PM and proportionally reduced. Option X7 refers.
4. The contract, clause 53, states that the assessment of the contractors share is the difference between the Total of the Prices and the Price for Works Done to Date. There can be a preliminary assessment at the Completion of the Whole of the Works.

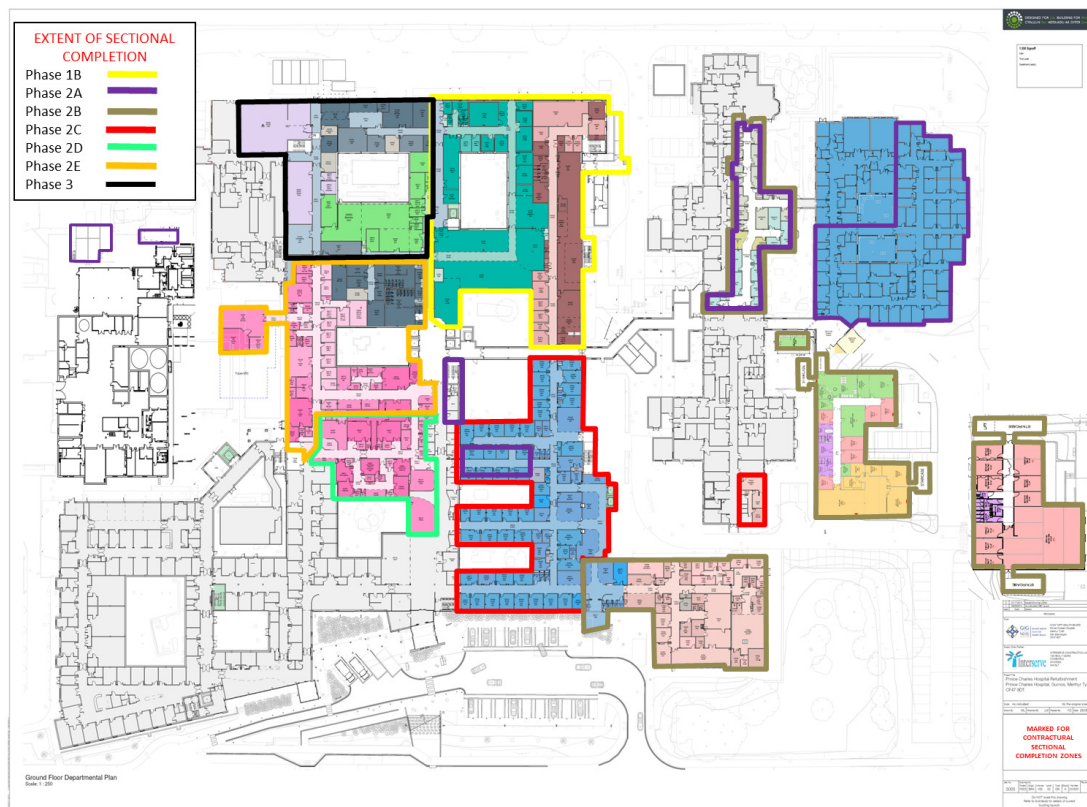
The contractor was appointed to undertake three separate contracts of circa 2 years duration which would allow completion and the contract mechanisms noted above to be implemented. The revised strategy now includes a programme of some 6.75 years this would mean that the contractor would not have retention released, defect commenced or the contractors gain share assessed until completion some 7 years and several years after the Health Board would have taken beneficial use of parts of the completed works.

It was agreed that this deviated from the basis of original appointment and following reviews it was established that the project would be divided into sections. Each section would be a defined area that could be completed and handed over for use. The contract would be amended to enable the sectional completion to align with completion of the works that would allow for retentions to be released, the defects period to commence and the contractors for each completed section.

This has been agreed in principle and the Health Boards Legal advisor, Blake Morgan, have confirmed that the contract can be amended. Prior to contract and commencement the contract document and works information will have to be developed to:

- Provided works information packages for each section of the works.
- Target costs sums for each section of the works
- Contract documentation indicating each section start and completion dates
- Liquidated and ascertained damages for each section
- Insurance requirements for sectional completion
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Sectional Completion Ground Floor



Sectional Completion First Floor

