



## **Springburn Winter Gardens**



## **Structural Appraisal and Condition Report**

For:  
**Glasgow City Council**

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**20.1520**

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## 1.0 Introduction

David Narro Associates (DNA) was appointed by Glasgow City Council (GCC) to carry out an updated structural appraisal of the Category 'A' listed Springburn Winter Gardens Glasshouse complex located within Springburn Park to the north of Glasgow.

This report provides commentary on the current structural condition of the building generally, identifies areas where any emergency works are required to maintain stability in the short term, and provides outline proposals for structural repair works and highlights ongoing future maintenance issues. Costed proposals for works required to fully restore or to conserve as a safe shell for public access are included and have been prepared by NBM Quantity Surveyors.

It also makes a preliminary assessment of the structural capacity of the structure and its ability to accept alteration and includes an assessment of what would be required to maintain the building over the medium-to-long term, including any actions and interventions that may be required so to do.

This report is based on an initial visual walkover survey on 18 February 2021 and follow-up site visits on 21 April 2021, 24 May 2021, 3 August 2021 and 31 August 2021 arranged to continue our site survey but also to discuss access requirements, drone surveys and building surveys with the Springburn Winter Gardens Trust.

Some analysis and calculations as to the capacity or strength of structural elements has been carried out where appropriate in order to determine the sensitivity of the existing structure to alteration and to allow assessment of any repairs.

## 2.0 History of the Site

The Glasgow Corporation acquired the land for Springburn Park in 1892. The first historic map prior to the acquisition is dated 1865. This shows that the land was used for agriculture with old quarries noted to the north east and south west of the site. Four estates were noted as being in or adjacent to the current Springburn Park; Stobhill to the north east, Cockmuir to the south east, Old Mosesfield to the south west and New Mosesfield to the west. By the next map publication in 1893 Belmont House was constructed to the north east and the land had been developed with the removal of the tree lines which marked out the fields. The model yacht pond, Cockmuir reservoir and Band Stand were also notable additions.

Belmont House was home to the Reid Family who owned some of Europe's largest manufacturing companies including Hyde Park Locomotive Works and the North British Locomotive Company. The Reid Family were major contributors to the park development and donated £12,000 to the design and construction of the Winter Gardens.

The Winter Gardens were designed by Messrs Simpson and Farmer in association with William Baird and Son of Temple Park Ironworks. The Springburn Winter Garden, at 842 metres square, was once the largest glasshouse in Scotland.

The Winter Gardens opened in 1899 and closed to the public in 1983. Since closure the building has been derelict and subject to vandalism, water ingress and material degradation.

The building was given category A listing status in May 1985, two days before Glasgow City Council was to consider its demolition and is currently on the Buildings at Risk Register for Scotland. Since closure the two Plant Houses to the east and the Entrance Porch to the south and north have been demolished. Only the Main Hall and the two Plant Houses to the west remain.

The listing is concise and merely states: "Simpson and Farmer, hothouse builders, with William Baird of Temple ironworks, 1899-1900. Substantial (approx 180' long) glasshouse. Tall red brick walls (approx 12') punctuated by round arched windows. 7 arch-framed lattice girders span the main block and support the extensive glass roof, latter boldly curved at angles and made up of wide overlapping layers of glass; low

clerestory straddles ridge with crowning brattishing in thistle design. Internally gallery to all sides reached by cast-iron stairs and with decorative cast-iron balustrades".

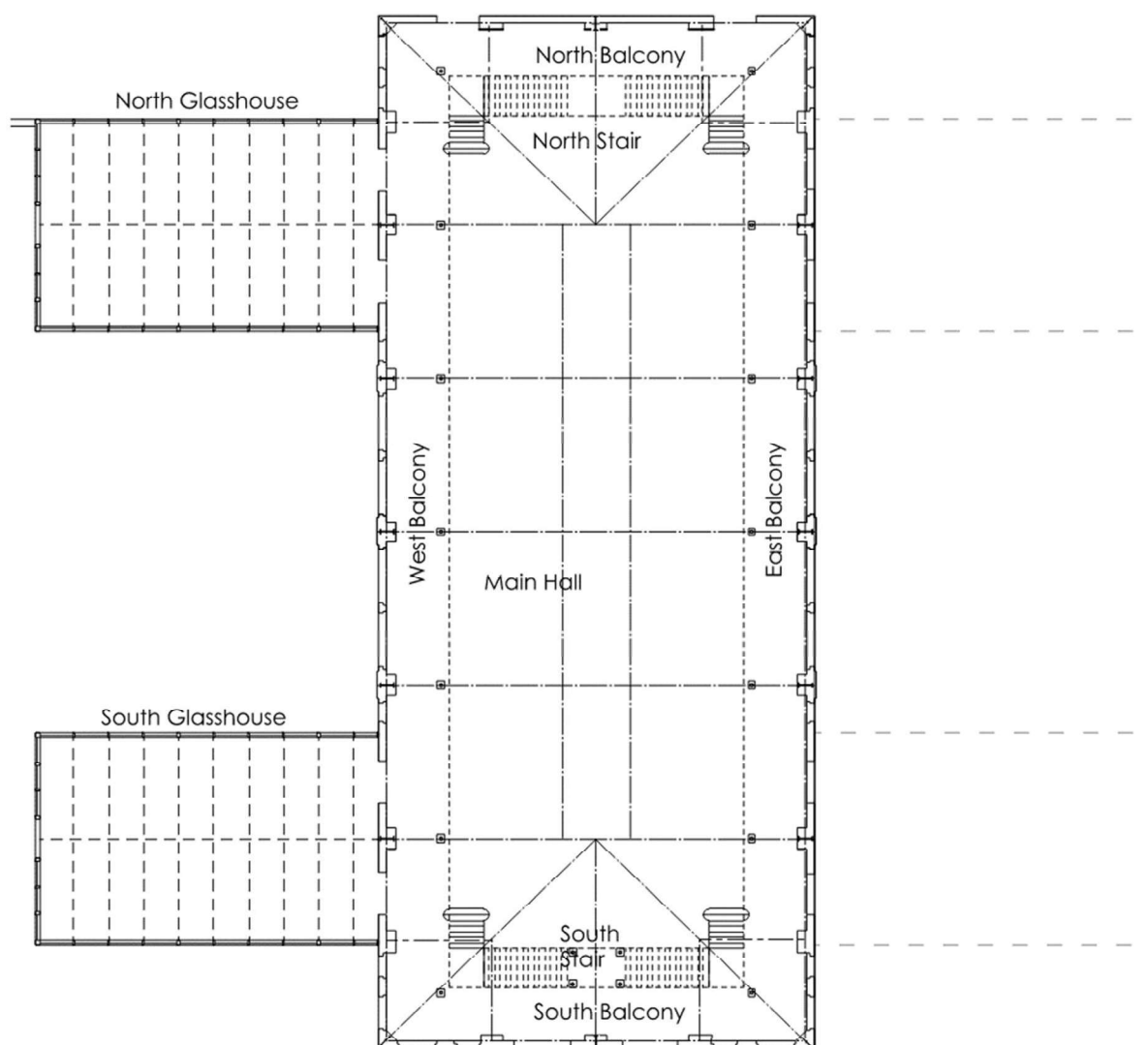


Figure 1: Naming convention of the main elements or spaces

DNA was commissioned to inspect the condition of the building in 2014 leading to our initial 14.108 Structural Condition Report dated October 2014. This report was subsequently updated in 2017 prior to partial repair/strengthening to the upper cupola.



### 3.0 Observations on Condition And Detailing

The building has been assessed on a Range-by-Range basis, and the following annotated photographs should provide a reasonable summary of the condition and any degradation in each area.

#### 3.1 Main Hall Roof and Steel Frames



1 – View of Main Hall looking south

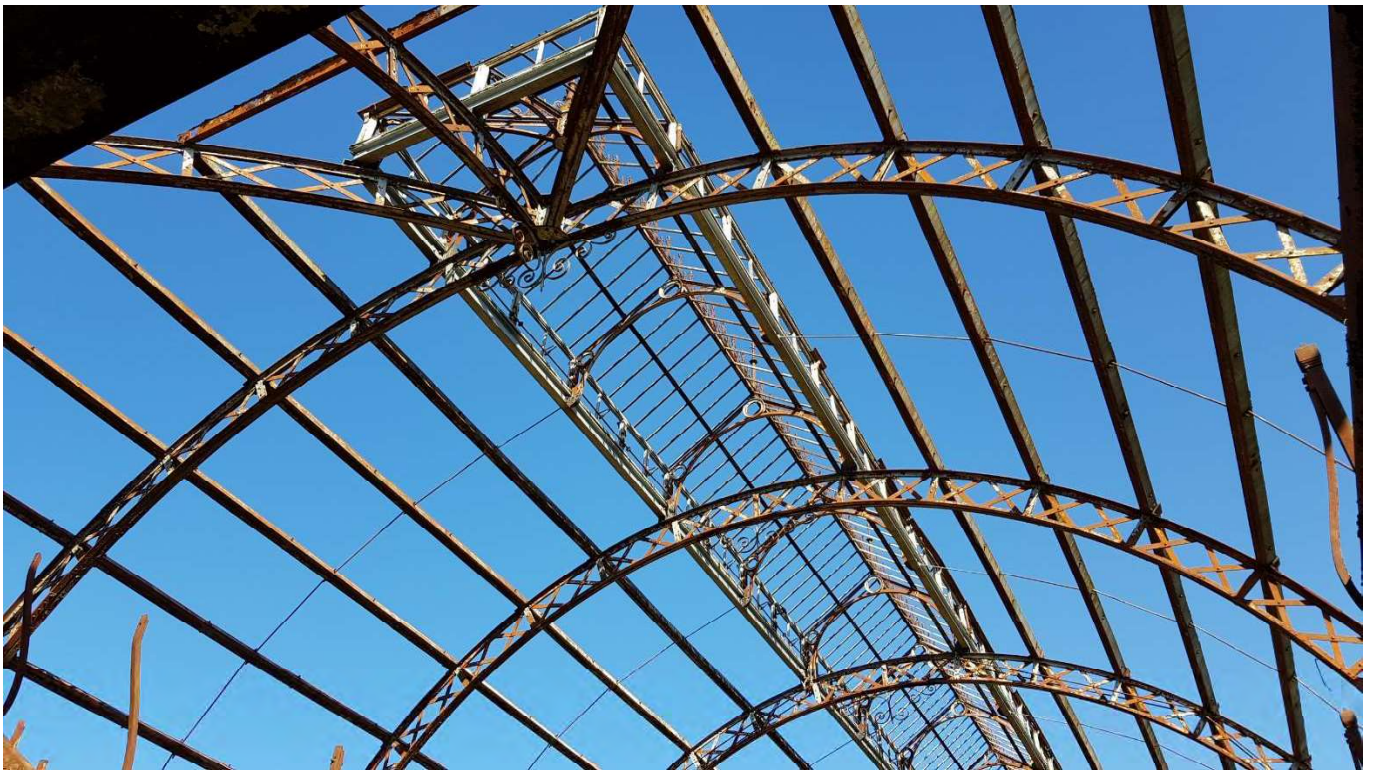


2 – View to south-east showing the regularity of the main lattice frames and the 'hanging' steel bracket





3 – View of 'hanging' bracket (looking north-west) and recently repaired cupola ringbeam



4 – View of Main Hall roof showing the relatively good condition of the purlins on running north-south





5 – North elevation purlin deterioration showing severe section loss to single purlins on the north and south main elevation frames



6 – Similar to Photo 5, the corrosion of the main purlins on the north elevation is severe, but the anti-sag rods appeared to be in reasonable condition





7 – Base of one of the lattice frames on the west elevation showing the localised corrosion of the lower level angles



8 – The opened-up lattice frame base to the south-west of the Main Hall, showing some delamination and loss of rivets/bolts at slab level





9 – View along the south gallery showing the condition of the floor surface and missing cross members in the main lattice frame



10 – View along north balcony with cracked finishes to slab and the original table framing. Some original paint finishes are still shown on the steelwork





11 – Close-up view at base of main frame showing the steel is intact but has delaminated and needs some attention



12 – View of one of the worst corroded angle frame connections with severe deterioration of the steelwork locally





13 – View below the lower steelwork in the north-west corner with intact rivets and only surface corrosion



14 – Close-up view of lower frame connection with more deterioration to rivets



### 3.2 Main Hall Balcony



15 – View along west balcony looking south



16 – View of north-east corner showing window frames and lower level steelwork





17 – West balcony showing missing balustrading and failed top surface



18 – View of underside of balcony showing filler joists with some corrosion and some spalling of the concrete infill, but the structure appeared intact





19 – Underside of balcony with corroded steel beam in the wall and some spalling in the slab



20 – Underside view of balcony at column location showing intact but deteriorating concrete





21 – Underside view of balcony slab and steel edge beams and cast iron column. Edge beams still have paint remnants and although surface deterioration on filler joists and concrete, all can be repaired



22 – Underside view of slab with more intact finishes and corroded steel support beam





23 – Cast iron column is in good condition but the slab and filler joists will need some attention, as will the main stanchion base half-embedded in the pier



24 – Corroded steel beams at the corner which will need re-painted, but are intact





25 – Steel stairs have been damaged but the remaining steel is in reasonable condition and they could be repaired



26 – View of steel stairs to south





27 – View of steel stairs to north, which again can be repaired



28 – Close-up of steel stairs showing surface deterioration but intact joints



### 3.3 Main Hall Ground Floor Walling



29 – View of east elevation showing previous openings bricked-up and the vestige of eastern glasshouses. Vegetation growth has rooted in the masonry mortar joints and will need to be removed

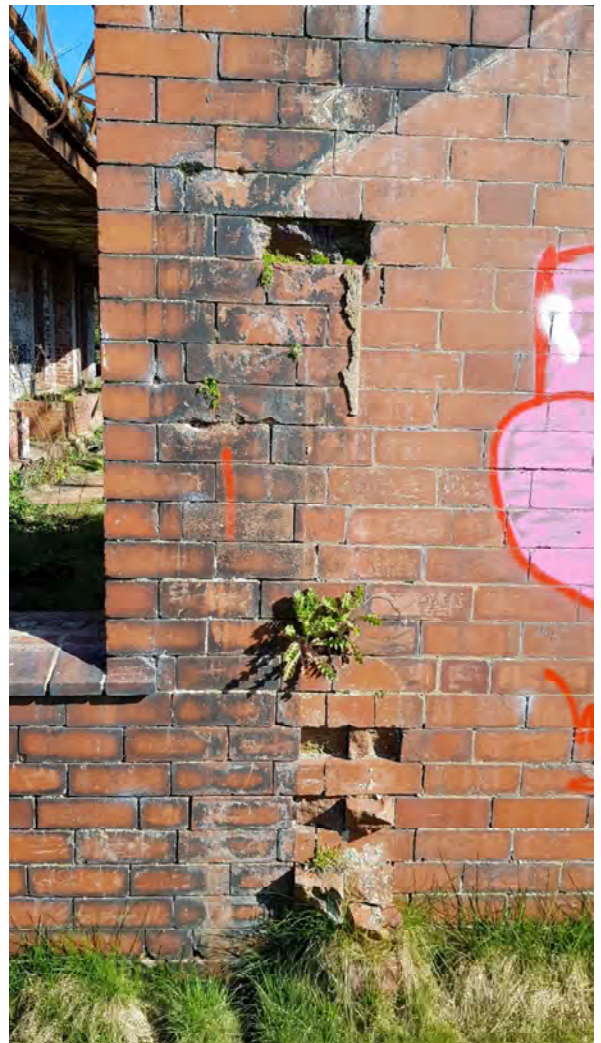


30 - View of north elevation showing the vestige of a northern glasshouse and bricked-up openings. Vegetation growth has rooted in the masonry mortar joints and will need to be removed





31 – Close-up of some root damage and dislocation of a course of masonry



32 & 33 – View of south-west corner vegetation and cracking/movement and some missing bricks





34 – Movement of masonry and failure of flat arch requiring some re-building and repointing



35 – Main flat arch with steel lintel behind showing localised jacking failure at the pier bearing





36 – Similar view showing the movement of bricks to the bearings of the main lintels



37 – Local arch slip failure due to vegetation growth and some expansion of the upper walling





38 & 39 – Missing bricks and small cracks up masonry jamb and corner deterioration and movement of the upper panel





40 & 41 – Vegetation growth is causing severe damage to sections of masonry and removing water ingress and roots to limit water penetration and jacking of masonry is key for any repair





42 – View of south-west upper wall panel showing it 'prying' outwards locally – this will need re-set



43 – Internal view of internal steel lintel beam showing some deterioration needing re-painted





44 & 45 – Internal view of embedded stanchion and localised delamination at opened-up section





46 – Infill of original opening shows signs of failure near the bearing end



47 – Internal view of pier in good condition along with steel beams and filler joists





48 – Masonry panels on the east elevation which are in reasonable condition structurally



49 – Root growth at window jamb has caused outwards movement of the outer pier masonry





50 & 51 Deterioration or opening-up at internal stanchion base showing corroded but serviceable steelwork in the temporary case. Masonry deterioration to be repaired at main pier





52 – Localised opening-up at stanchion showing surface corrosion



53 – Arch over opening appears to be intact and aligned properly





54 – View of internal surface corrosion of embedded stanchion – all steelwork embedded will need to be assessed in due course to determine final repair detail



55 – View of stair at south end and cast iron column/steel ring beam around balcony





56 – Corroded edge beam with filler joists and main beam needing repainted and potentially repaired



57 – Embedded stanchion with paint still visible





58 – Detail view of embedded steelwork showing some deterioration



59 – Heavier corrosion including rivet heads which may need direct steel repairs for the longer term project



### 3.4 North Glasshouse



60 – View of partially-collapsed north wall which will need to be rebuilt



61 – Close-up view of failed wall section with the upper brickwork rotated outwards dramatically. Note the steel 'hoop' within the glasshouse is intact with minor surface corrosion





62 – View of west end of north wall where it becomes a freestanding boundary wall. Ivy growth and water ingress through the cope has caused deterioration in the brickwork



63 – View of west end of the glasshouse showing missing roof mullions and deflection in the upper purlins





64 – View along glasshouse showing general geometry has been maintained but needing re-set



65 – View to south showing heavily vegetated benches and self-seeded bushes





66 – View to north showing the condition of the timberwork which might be able to be re-used and saved



67 – End frame with timber uprights in place and some movement in the eaves beams



### 3.5 South Glasshouse



68 – South elevation with freestanding boundary wall and gate pier. This glasshouse is in better condition and alignment compared with the north glasshouse



69 – Vegetation growth through the structure needs to be removed and the existing framing re-used





70 – South-east end of the glasshouse showing the relationship with the Main Hall



71 – West wall of South Glasshouse showing the internal steel 'hoops' and intact timberwork





72 – Partial collapse of masonry at north-west corner which will need to be rebuilt



73 – Some movement of wing glazing frames on existing masonry walling





74 – Connection of south glasshouse to Main Hall walling with vegetation in the masonry jointing and some poor connections of the original rafters



### 3.6 Summary:

The remaining buildings of the Springburn Winter Gardens, namely the Main Hall and two remaining Plant Houses, are in a reasonable condition structurally with localised decay in areas where water has been able to gather and stand.

The primary steel trussed arches can be restored in situ with localised repairs necessary directly above Gallery level. The steel within the brick encasement appears to be in a reasonable condition and any strengthening or repair works can be carried out in situ when the brickwork is removed. The secondary steel purlins remaining to the north and south elevations over the Main Hall have corroded beyond repair and should be replaced.

The corroded steelwork around the base of the cupola has already been strengthened or replaced as part of a partial repair contract. One of the hanging scroll-work brackets suspended from the cupola is now hanging by what appears to be a single bolt, and will need to be removed as part of the initial clearance works.

The concrete walkway around the Gallery should be repaired, along with the external steel ring beam which supports it. The steel beams and columns which support the inner edge can be repaired in situ.

Parts of the upper sections of external brick leaf of wall should be taken down and rebuilt where it has been affected by root growth, and the steel lintels should be repaired and repainted with rust inhibiting paint as required. Any contemporary brick infill panels should be rebuilt with a suitably compatible brick.

The upper timber glazing panels which surround the upper walkway level are in remarkably good condition and could be re-used as part of an initial 'making safe' contract, albeit some fixings will be required to stabilise opening lights and negate the risk of debris fall. In time and as part of a full refurbishment these elements may need to be replaced due to softening of the underside of the sill, but in essence the hardwood has weathered well. The corroded steel protective 'handrail' appears to have served its purpose well and has sheltered the timber below in an effective manner.

The northern Glasshouse requires the north walling to be largely rebuilt due to extensive root damage, although most of the material can be reused. The main original hardwood timber sections could be re-used as part of a more sensitive refurbishment but will require some augmentation and re-setting of the bracketry and infill timberwork.

The southern Glasshouse only requires minor repairs in situ to remove loose debris and stabilise the remaining timberwork to make it safe to access. Removal of embedded roots in the walling can be carried out on a localised basis with rebuilding of the walling using the same bricks. Again, the quality of the timber has meant that many sections can be re-used as part of a refurbishment for 'making safe', and could also be used as part of a full refurbishment.

The building has been open to the elements and unmaintained for a number of years but despite this has survived better than one would expect. The only concern over the the immediate stability of the structure is the corroded bases of the main curved stanchions just above the upper walkway level, and these should be repaired as a matter of urgency prior to any re-use being considered.

Material deterioration will continue until such time as the building is made watertight and repair of the weatherproofing elements, such as the walkway finish, brickwork pointing and steel paint finishes will be required as part of the initial 'making safe' contract.



## **4.0 Repair Strategy And Approach To Rehabilitation**

The default strategy when approaching the repair of a listed structure is to replicate original details and replace with like-for-like materials, but this usually assumes that the existing detailing is sound and that the choice of original material is compatible with the use of the building.

Access to the buildings should continue to be restricted, until a meaningful 'holding works' operation can commence. It would be prudent to install signage warning of the dangers of localised instabilities within the building. All visitors within the security fencing should be required to wear appropriate Personal Protective Equipment (PPE).

The main risks to building occupants are:

- Localised collapse of the hanging steel scrollwork over the Main Hall
- Sections of corroded steel falling from height
- Collapse of the Main Hall frames if corrosion to the stanchion bases is not repaired
- Collapse of the northern Plant House Roof

The building fabric will continue to degrade as long as the structure is open to the elements and unmaintained. There are a number of measures that can be taken at this stage to offer protection to the building fabric and reduce the rate of further decay until such time as the building is made water tight.

The different areas of the building are discussed in detail below

The building is Category A listed therefore all repairs must be agreed in principal and in detail with Historic Scotland. The recommendations below give an indication of the nature and scale of work required.

### **4.1 Main Hall**

#### **4.1.1 Main Hall Roof and Steel Frames**

##### **4.1.1.1 Full Refurbishment Repair Recommendations**

In the scenario where the full building repair is to be undertaken the following structural repairs are recommended:

The steel frames should be fully exposed including where they are encased in brickwork below Gallery level. The bricks should be sensitively dismantled and where possible set aside for refurbishment and reuse. The steel should be wire brushed and painted with a suitable corrosion inhibiting coating. Localised repairs will be required to the latticework trusses above Gallery level. This should consist of replacement of say 5% of the diagonal flat bar members. The steelwork is likely coated in a lead-based paint therefore suitable protective measures should be taken when carrying out this work.

There is uncertainty on whether the riveted connections have deteriorated resulting in a loss of strength. Allowance should be made for enhancing the connections by riveting or, if acceptable, spot welding.

Below Gallery level the steel should wire brushed and painted with a suitable corrosion inhibiting coating. Allowance should be made at this time for strengthening the columns by bolting 200x90x30 PFCs either side of the flange and bolting through. This will enhance the compressive and bending capacity of each column. A further assessment of the columns should be made when they are fully exposed.

The brickwork encasement to the piers have thin bed mortar joints and a high strength mortar, therefore it is unlikely that a significant number of the bricks will be able to be salvaged. The rebuilding of the piers should allow for a specialist imperial brick to match the existing which should be advised by the project Architect or masonry specialist.



All existing purlins should be removed and replaced with a like-for-like section. If historic Rolled Steel Channels are not able to be sourced it may be acceptable to substitute for modern equivalents. An assessment should be made as to whether the RSC purlins on the east and west elevations are original and whether they need to be replaced.

A timber rot specialist was commissioned (Cuthbertson Preservation Ltd) to assess how much of the timber can be salvaged, allowance should be made for replacing all timber elements of the Lantern in iroko or another appropriate timber.

The steel beams supporting the Lantern have already been fully replaced but a hanging steel scrollwork element needs to be removed to make the central space safe to access.

The reinstated glazing should be of the same thickness and weight as the original. If a heavier glass is to be used or the form in which the glass is supported within the steel structure is altered, a full structural appraisal of the roof frames will be required to assess whether the additional loads can be carried.

#### **4.1.1.1 'Making Safe' to Create Publicly Accessible Shell Recommendations**

There are measures which can be taken to address the localised but significant deterioration which is on-going and which could lead to significant instabilities in the medium term. These measures would include: wire brushing the steel in the zone directly above the Gallery floor, repairing the diagonal bracing members which have corroded and separated from the truss chords and paint the steel with a suitable corrosion inhibitor.

Existing corroded purlins on the north and south end elevations should be checked by crane basket to confirm fixity and whether they are a risk going forward for public access. Allow for replacement of the end bay purlins as part of the public access works.

The hanging steel scrollwork element below the Lantern is in danger of collapsing locally. Access to the central zone within the main hall should be restricted until this is removed and this area inspected at regular intervals of say 4-6 weeks.

### **4.1.2 Main Hall Balcony Level**

#### **4.1.2.1 Full Refurbishment Repair Recommendations**

The concrete walkway should be repaired around the entire Gallery perimeter. The ring beam on the line of the external wall should be repaired by wire brushing and repainting with suitable rust inhibiting paint (such as K-RUST by Hammerite), and any localised plating repairs carried out at the same time.

The filler joists should be wire brushed and painted with a suitable corrosion inhibitor.

The Gallery edge beam on the inner face should be wire brushed and painted with a suitable corrosion inhibitor. The Gallery walkway should then have its waterproofing finishes reinstated with a fall and suitable drip to allow water to fall into the central space.

The steel and ironwork to the stairs should be wire brushed and reused with new timber treads installed. The Gallery balustrade should be wholly replaced using the few remaining balusters as a template.

The Gallery walkway would have a permanent wearing course of Fosroc Dekguard W waterproofing finish.

#### **4.1.2.2 'Making Safe' to Create Publicly Accessible Shell Recommendations**

Remove all vegetation and apply herbicide to discourage growth of moss and grasses on the upper surface. Remove any boss or loose surfacing which allows water to pool.



The Gallery walkway would have existing failed finishes removed and scabbling back of any failed or spalling concrete, application of Fosroc Renderoc ST 05 patch repair/levelling screed then felt or hot applied asphalt deck finish for minimal public access works and to provide a temporary waterproofing layer, with a fall and suitable drip to allow water to fall into the central space.

The Gallery edge beam on the inner face should be wire brushed and painted with a suitable corrosion inhibitor. The Gallery walkway should then have its waterproofing finishes reinstated with a fall and suitable drip to allow water to fall into the central space.

The filler joists should be wire brushed and painted with a suitable corrosion inhibitor.

The upper timber panels around the perimeter of the Gallery should have any loose timber either removed or screwed in place to remove the risk of debris fall in high winds. Refer to the timber rot report in Appendix B.

### **4.1.3 Main Hall Ground Floor Walling**

#### **4.1.3.1 Full Refurbishment Repair Recommendations**

In the scenario where the full building repair is to be undertaken the following structural repairs are recommended:

Where root growth of vegetation has taken hold, the outer leaf of brickwork should be carefully taken down locally (generally over the top quarter of the wall) and set aside for refurbishment and reuse. All roots within the cavity should be removed prior to reinstatement of the bricks and full pointing carried out to weatherproof the masonry.

The wall should then be rebuilt with collar joint stainless steel wall ties drill fixed to the inner leaf and coursed into the outer leaf. The openings which have been previously infilled with a brick of inferior quality should be taken down and rebuilt in an appropriate brick. The mortar mix and any replacement brick should be specified by a masonry conservation specialist.

The steel angle lintels to the outer leaf should be replaced with a like-for-like galvanised section.

#### **4.1.3.2 'Making Safe' to Create Publicly Accessible Shell Recommendations**

Ensure that no further deterioration due to vegetation growth within the cavities by applying a herbicide and regularly cutting back.

Where root growth of vegetation has taken hold and caused movement of the masonry, the outer leaf of brickwork should be carefully taken down locally (generally over the top quarter of the wall) and set aside for refurbishment and reuse. All roots within the cavity should be removed prior to reinstatement of the bricks and full pointing carried out to weatherproof the masonry.

The wall should then be rebuilt with collar joint stainless steel wall ties drill fixed to the inner leaf and coursed into the outer leaf. The openings which have been previously infilled with a brick of inferior quality should be taken down and rebuilt in an appropriate brick. The mortar mix and any replacement brick should be specified by a masonry conservation specialist.

The floor trenches should be either filled in with a suitable material which can be removed if required, or bridged over using metal plates to allow plant access across the floor.

## **4.2 Glasshouses**

### **4.2.1 Southern Glasshouse**

#### **4.2.1.1 Full Refurbishment Repair Recommendations**



In the scenario where the full building repair is to be undertaken the following structural repairs are recommended:

The steelwork should be fully exposed where it is embedded within the brick perimeter wall (6 No locations). All the steelwork should then be wire brushed and painted with an appropriate corrosion inhibitor. It may be necessary to carry out localised strengthening works to the steelwork embedded within the wall to ensure sufficient compression and bending capacity. This would involve bolting small steel angles or parallel flange channels to the existing RSJ 'hoops'.

The existing glazing bars and astragals should be taken down and refurbished where possible. New astragals as required should be fabricated from a suitably compatible timber; if teak is not available or it is cost prohibitive an appropriate alternative such as iroko should be substituted. Any replacement glazing bars should use galvanised mild steel. Allow for replacing all astragals and glazing bars at this stage.

Window frames should be taken out and refurbished where possible. Any timber repairs or replacement should use teak or an appropriate alternative such as iroko. Allowance should be made for replacing all windows at this stage.

The primary timber rafters may be able to be refurbished in situ. Where this is not possible they should be dismantled and refurbished on the ground. A timber specialist should comment on whether the long term exposure to the elements has resulted in any structural deterioration and whether any treatments are required. Allow for replacing 30% of the timber rafters.

The cast iron haunches should be wire brushed and painted with a suitable corrosion inhibitor.

The gable end on the west elevation should be re-aligned either in situ or by dismantling and re-erecting.

The brickwork perimeter wall should be taken down and repaired locally where root damage has caused instability in the form of bulging. Where any walls are taken down the original bricks should be refurbished and used in the rebuild. It is suggested that the brickwork on the inner face is left with no repair other than where it has bulged due to root growth. Although it is showing some signs of deterioration, sufficient stability remains in the wall.

The glass installed should be of the same thickness (or lighter) than the original. If heavier glass is proposed or the principles of how it sits within the structure differs from the original detail, the structural elements will require to be fully appraised.

Refer also to the rot report in Appendix B.

#### **4.2.1.2 'Making Safe' to Create Publicly Accessible Shell Recommendations**

There are no immediate stability concerns within this building, but loose timbers should be removed (if small mullions) or screwed in place.

Masonry affected by root growth should have localised repairs to ensure the wall does not collapse, with roots removed and localised rebuilding of walling.

### **4.2.2 Northern Glasshouse**

#### **4.2.2.1 Full Refurbishment Repair Recommendations**

In the scenario where the full building repair is to be undertaken the following structural repairs are recommended:

Repairs to the steel superstructure as noted above for the southern Plant House (section 4.2.1.1)



Due to the widespread damage to the perimeter brick wall it is recommended that the timber superstructure is dismantled and set aside for refurbishment. The top eight courses of the north brick perimeter wall should be carefully dismantled with bricks salvaged and refurbished for reuse where possible. Allow for replacing all glazing bars and astragals and for replacing 30% of rafters. Timber replacement should be in teak or iroko.

The glass installed should be of the same thickness (or lighter) than the original. If heavier glass is proposed or the principles of how it sits within the structure differs from the original detail, the structural elements will require to be fully appraised.

Refer also to the rot report in Appendix B.

#### **4.2.2.2 'Making Safe' to Create Publicly Accessible Shell Recommendations**

There is a risk that this Plant House will continue to destabilise due to the extent of damage to the perimeter wall and localised collapse is a possibility. Acrow props should be installed to support the ridge and prevent it from dropping further.

Loose timbers should be removed (if small mullions) or screwed in place.

#### **4.3 Ongoing Maintenance:**

An ongoing maintenance regime should be adhered to and which should include:

- An annual visual inspection of the structure, both internally & externally to highlight any areas requiring attention.
- Cleaning all gutters & water channels, twice yearly & checking for leaks.
- Touching up defective paintwork as required.



## 5.0 Further Surveys

The following surveys are recommended to be undertaken as part of the next stage of detail design:

- CCTV Survey: The existing drainage around the site should be investigated and a CCTV survey of the existing drains would be useful to confirm their integrity going forward.
- Trial Pit Investigation: The existing foundations appear to be intact and capable of transferring loads to an adequate bearing stratum but this should be tested in detail given the number of tree roots within and below existing dado wall panels.
- Opening-up of the base of the north wall to check any waterproofing and condition of low-level retaining wall structures
- Lead paint survey.
- Mortar and Brick sampling and analysis.



## 6.0 Review of Costs

DNA commissioned NBM Construction Cost Consultants (NBM) to prepare a Feasibility Cost Report for the proposed repair works, based on the following scenarios:

1. A cost range for repairs to make the building initially safe as part of a 'holding works' package, which would allow the public to access the ground floor only in a safe manner.
2. Full refurbishment including reinstatement of glazing over the entire structure, along with all associated public access requirements to the Gallery.

See Appendix C for the Feasibility Cost Report. Refer to the Cost Options summary at the rear of the report showing the differences in potential cost ranges of each of the two main options above.

Please note the Exclusion pages on each Costing Document, as they set out the parameters for the costing assumptions.

The total cost for Option 1 'holding works/ public access' is £

The total cost for Option 2 'full refurbishment' is £



## **Appendix A**

### **Sketch Plans of Proposed Rehabilitation Works**

**20.1520/1000 Ground Floor Plan**

**20.1520/1001 Gallery Level Plan**

**20.1520/1002 Roof Plan**







All notes to allow Public Access to the ground floor areas and to effect immediate repairs to the structure are noted in black text.  
Any further works which would be required for any full refurbishment project are added as a note in red text.

**Note:** for full restoration works apply new rust inhibiting paint finish such as Hammerite K-RUST. Further repairs may be required which high-level inspection is carried out

Note: for full refurbishment allow for Fosroc Dekagard W as permanent wearing surface

For these two stanchion bases, restate masonry around exposed steel stanchions at floor level and infill concrete floor using 4No. M10 dowels and re-casting the floor slab in minimum RC28/35 concrete

**Note:** for full refurbishment paint remaining steel stairs with either Hammerite K-RUST directly onto existing surfaces, or wire brush and apply new paint coating of 100 microns high solid epoxy zinc phosphate primer

Check fixity of existing balustrade and remove any loose sections, otherwise paint with Hammerite K-RUST rust-inhibiting paint

Upper timber panels around the perimeter of the Gallery should have any loose timber either removed or screwed in place to remove the risk of debris fall in high winds

**Note:** Although the existing timber is very good hardwood and could be saved/salvaged as part of a full refurbishment, it would be prudent to allow for replacing all timber elements of the gallery surround in iroko or another appropriate timber.

Make safe existing stairs by cordoning off for initial public access works (can be refurbished for full restoration works with timber steps and infilled new steel stringers/posts)

Sheet Title Gallery Level Structural Repair Notes	Job Title Springburn Winter Gardens, Glasgow Public Access Works Full Refurbishment Notes	Drawn BWA	Date 28.10.21	Client Glasgow City Council	Status Information/Costing	Rev Description By Date
		Scale 1:200 @ A3	Checked EM	Architect N/A		

debris fall in high winds

the gallery surround in liroko or another appropriate timber.

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Notes for Full Refurbishment:

The reinstated glazing should be of the same thickness and weight as the original. If a heavier glass is to be used or the form in which the glass is supported within the steel structure is altered, a full structural appraisal of the roof frames will be required to assess whether the additional loads can be carried.

All existing purlins should be removed and replaced with a like-for-like section. If historic Rolled Steel Channels are not able to be sourced it may be acceptable to substitute for modern equivalents. An assessment should be made as to whether the RSC purlins on the east and west elevations are original and whether they need to be replaced.

There is uncertainty on whether the riveted connections have deteriorated resulting in a loss of strength. Allowance should be made for enhancing the connections by riveting or, if acceptable, spot welding.

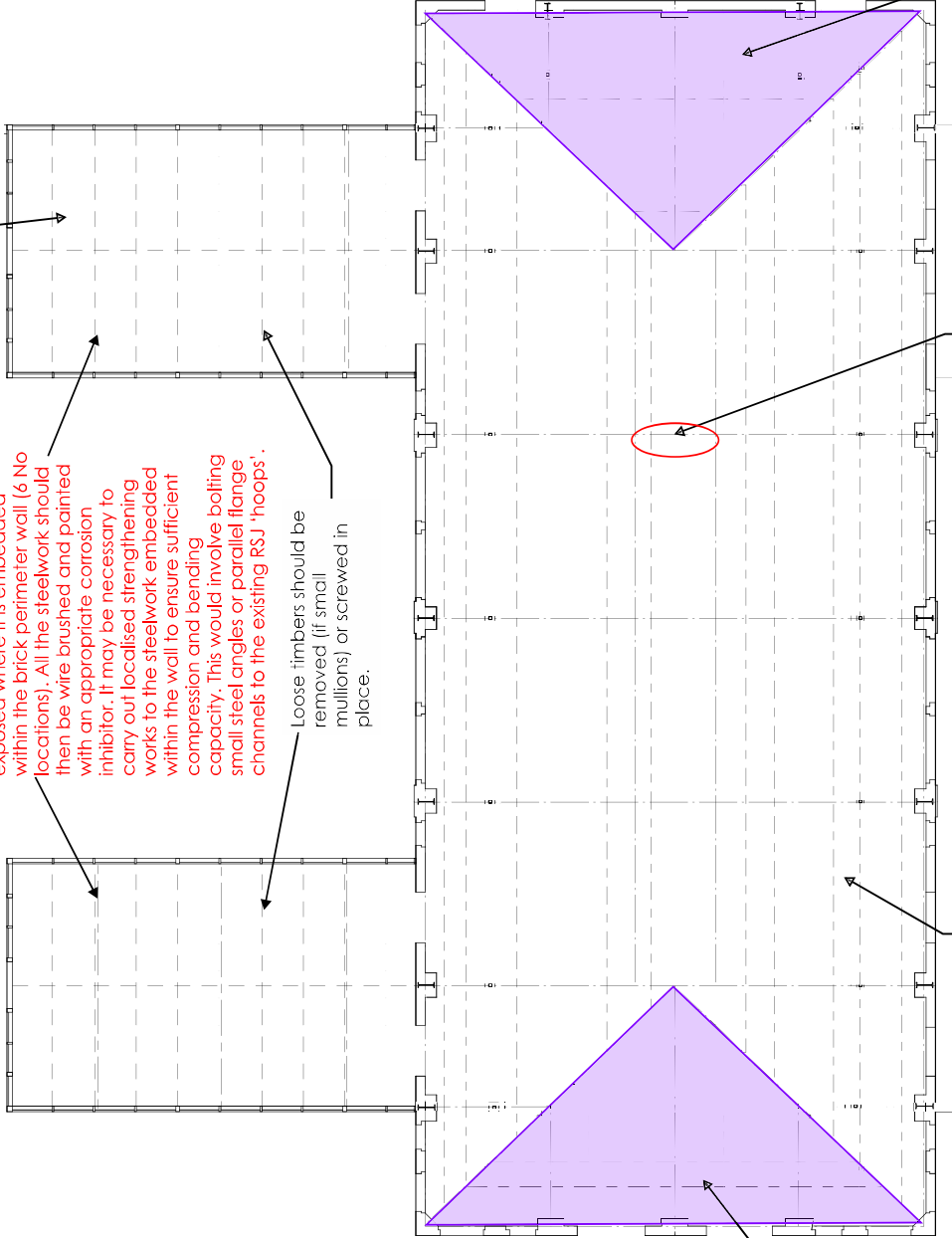
Localised repairs will be required to the lattice-work trusses above Gallery level. This should consist of replacement of say 5% of the diagonal flat bar members.

Existing corroded 8"x4" RSJ purlins on the north and south end elevations should be checked by crane basket to confirm fixity and whether they are a risk going forward for public access. Allow for replacement of the end bay purlins as part of the public access works with new 203x102x23UB sections

The steelwork should be fully exposed where it is embedded within the brick perimeter wall (6 No locations). All the steelwork should then be wire brushed and painted with an appropriate corrosion inhibitor. It may be necessary to carry out localised strengthening works to the steelwork embedded within the wall to ensure sufficient compression and bending capacity. This would involve bolting small steel angles or parallel flange channels to the existing RSJ 'hoops'.

Loose timbers should be removed (if small mullions) or screwed in place.

Cordon off existing north glashouse



All purlins to east and west sides should be investigated further by crane basket to confirm condition and fixity prior to any further works being confirmed to allow public opening. These purlins appear to be 82x4" RSJs with 8" RSC bolted through and appear more robust than the north/south roof purlins

'Hanging' partially collapsed bracket below lantern to be removed immediately

Existing corroded purlins on the north and south end elevations should be checked by crane basket to confirm fixity and whether they are a risk going forward for public access. Allow for replacement of the end bay purlins as part of the public access works.

NOTES:  
Refer to DNA Survey Report for further repair specification notes.

All notes to allow Public Access to the ground floor areas and to effect immediate repairs to the structure are noted in black text.  
Any further works which would be required for any full refurbishment project are added as a note in red text.

Notes for Full Refurbishment of the Glasshouses:

The existing glazing bars and astragals should be taken down and refurbished where possible. New astragals as required should be fabricated from a suitably compatible timber; if teak is not available or it is cost prohibitive an appropriate alternative such as iroko should be substituted. Any replacement glazing bars should use galvanised mild steel. Allow for replacing all astragals and glazing bars at this stage.

Window frames should be taken out and refurbished where possible. Any timber repairs or replacement should use teak or an appropriate alternative such as iroko. Allowance should be made for replacing all windows at this stage.

The primary timber rafters may be able to be refurbished in situ. Where this is not possible they should be dismantled and refurbished on the ground. A timber specialist should comment on whether the long term exposure to the elements has resulted in any structural deterioration and whether any treatments are required. Allow for replacing 30% of the timber rafters.

Sheet Title

Roof Level  
Structural Repair Notes

Job Title  
Springburn Winter Gardens,  
Glasgow  
Public Access Works

Full Refurbishment Notes

Drawn

BWA

Date

28.10.21

Client

Glasgow City Council

Architect

N/A

Status

Information/Costing

Rev.

-

Description

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By

Date



## **Appendix B**

### **Timber Rot and Decay Survey by Cuthbertson Preservation**



11<sup>th</sup> May 2021

Ref: 9A.21LET/RMC/LB

Mr B Adams  
David Narro Associates  
20 James Morrison Street  
Glasgow  
G1 5PE

Dear Sirs,

**Springburn Winter Gardens, Mosesfield Street, Glasgow**  
**- Non- Disruptive Timber Inspections To Accessible Areas**

We write with reference to the above and thank you for your kind instructions to carry out inspections to the accessible timber elements of the aforementioned remaining Winter Gardens structure. Further to our recent visit we now report on our findings. Weather conditions at time of survey were dry and bright.

For purposes of orientation, references are made such that the original Porch Entrance is located to the South side of the Main Hall Structure, with the 2 No. remaining Glasshouses attached to the West side of the Main Hall. Orientation references are made accordingly.

**Recorded Defects**

We understand that the original group of Glasshouse buildings which comprised the Springburn Winter Gardens were constructed in or around 1899, however at present it was noted that 2 No. of the original glasshouses to the East side of the Main Hall have been demolished, together with the removal of the Porch Entrance which was located to the South end of the Main Hall. To the West side it is evident that 2 No. dilapidated glasshouses remain (attached to the Main Hall), however both of the West side glasshouses are in a state of severe dilapidation, and this will be commented upon further. The Main Hall structure was again noted to be in a state of dilapidation, and is currently open to the elements. A glasshouse to the North side was also noted to have been demolished.

It is apparent that public access has been denied to the Winter Gardens due to the Health and Safety risks posed by the derelict structures and the principal doorway entrances into the Main Hall have been bricked up.

We understand that the scope of our inspection was to provide an appropriate comment with regard to the timber elements within the Glasshouse buildings and this is now set out as follows:



Hall Structure/.....

**CUTHBERTSON PRESERVATION**

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### Main Hall Structure

The Main Hall building was noted to comprise of a red brick base course which extends from Ground to First Floor level. The ridge line orientation of the Main Hall runs North/South and the building footprint forms a rectangular shape. 5 No. principal curved trusses were noted to extend across the North/South axis, and these principal trusses have been formed using mild steel riveted lattice work to form arches over the footprint. The structure is hip-ended with similar mild steel riveted lattice trusses (curved) present at all hip positions, and with minor trusses noted to be bearing on to the hip members to continue the curved roof profile.

At the apex of the Main Hall the curved lattice trusses were noted to extend above the principal trusses to form an upper lantern structure which has opening timber sashes present to the vertical upstand of the upper lantern.

At Gallery level (First Floor level) the presence of opening timber sashes was noted also.

In general, we would record that all of the glazing pertaining to the Main Hall is now missing, and the bare structure is exposed to the elements at all levels. It was noted that mature and semi-mature vegetation and trees are growing extensively from the joints of the brickwork base course, and this is creating distortion and movement to the brickwork, which in places has led to structural weakening and movement which is now evident.

The opening timber sash elements located at Gallery level and also at the upper lantern level were noted to be extremely deteriorated and weathered. We do not envisage that any of the existing timber elements will be in a suitable condition to be salvaged/reused and as such we would advise that allowances for repairs/renewals should include for 100% renewal of the existing timber opening sashes. The upstand frames and sill, however, at Gallery level were noted to comprise of hardwood timber materials (mahogany or similar) and the sill, transom and post uprights were test bored to establish their internal integrity. While significant movement and distortion of these components has taken place we would note that their internal condition is generally sound and the post/sill/transom joints were noted to remain generally in a tight condition. NOTE: It is likely/possible that the underside of the sill timbers (in contact with the Ground Floor wallhead) may be in a softened condition where direct damp penetration has occurred, and where concealed.

NOTE: Due to the fact that no physical access was possible to examine the upper lantern timbers we cannot comment specifically as to the integrity of the timber components therein.

NOTE: Due to the movement which is evident within the vertical timber frames at Gallery Level we would advise that these timbers should not be relied upon by way of serving as an edge support or handrail upstand. Independent handrail barrier provision should be provided for within the line of the vertical glazed elements at Balcony level.



### **Main Hall Structure**

NOTE: We would advise that detailed recording of these components should be made at this stage in order to maintain an accurate record of the existing components as originally constructed and for historical reference purposes. Indeed, on the West elevation the outline of the original East-side abutting glasshouse is visible together with the established roof profile, roof pitch and timber formwork which is reflected in the Gallery timber elements (refer to photographs).

Due to the exposed conditions affecting the existing timber components, together with a lack of maintenance, decoration or appropriate protection, it will be necessary to allow for timber repairs to rotted sill (and other) components, to remove tree roots and vegetation, and to re-align the timber sills and sashes, to fill and seal same and to prime and redecorate all round after consolidation works are complete. The moveable sash elements could be screwed shut or removed from the frames and all broken glazing fully removed for safety.

In summary, we would advise that 100% of the timber components which exist on the four elevations around the Main Hall Gallery and Main Hall Upper Lantern/Cupola will require to be repaired, re-aligned and sashes removed, glazing removed all round prior to filling, priming and full re-decorations being undertaken.

NOTE: A complex arrangement of steel rods, winding handles and gears exist to open the Upper Lantern timber sashes, as well as the Gallery timber sashes. These should be inspected by the Project Engineer with a view to the suitability for possible re-use in the future. Similarly, a detailed examination of the principal trusses and secondary steel purlins should be undertaken by the Structural Engineer and appropriate comment provided in this regard.

### **2 No. West Side Glasshouses**

It was noted that 2 No. of the original plant houses remain to the West side of the Main Hall. It is evident that 2 No. former Glasshouses previously existed to the East side, with a further single Glasshouse present to the North side of the Main Hall. The 2 No. Glasshouses to the East side as well as the 1 No. Glasshouse to the North side have all been demolished and are no longer in existence.

The ridge line of the 2 No. rectangular-shaped Glasshouses on the West side of the Main Hall runs from East to West to a simple pitched roof profile.



## **2 No. West Side Glasshouses** (continued)

Both of the West side glasshouses have a brick base course construction extending to approximately 1m above ground level, then a vertical timber opening sash section which extends to eaves level at approximately 2.2m, and from there pitched timber rafters extend up to a timber ridge with an upper timber transom running East/West below opening clerestorey upper glazed sashes (set to the roof pitch profile). The presence of 3 No. arched I beam trusses were noted to be positioned at equal spacing along the length of each of the 2 No. West side glasshouses, with the steel I beams positioned below the corresponding timber rafters at each location. The timber rafters are interconnected at the glasshouse apex using cast iron/steel ornate connecting brackets, with further strengthening brackets noted at eaves level where the rafter feet are connected to the vertical frames adjacent to the opening sashes (above the brick base course level).

Due to the fact that both of the West side glasshouses are open to the elements a thick covering of briars and mature/semi-mature vegetation has taken hold and is growing from the floor and lower walls of the 2 No. subject Glasshouses. Within the North-most glasshouse the lower brickwork wall was noted to have failed structurally and is at the point of collapse (North side of the North-most glasshouse).

The roof structure has been compromised as a result of both the structural failure of the perimeter boundary walls as well as the growth and expansion of mature vegetation which has taken hold within both of the West side glasshouses. The hardwood components themselves, however, are in reasonably sound condition. Despite this, to preserve same will require the introduction of propping, removal of broken glazing, removal and reconstruction of the boundary walls followed by re-fixing of the vertical frames, transoms, rafters and purlin sections as well as all detached loose other components. Full priming and redecorations will also be necessary.

NOTE: A detailed and ornate steel opening structure was noted to exist for the ridge level clerestorey glazing and this is connected via a series of rods and winders to an opening mechanism at Ground Floor level. For historic purposes it may be worth salvaging the ornate cast iron/steel apex brackets and eaves brackets together with the winding structure for future reference and historical purposes (refer to photographs). With the introduction of some centre supports and after reinstatement of the steel intermediate purlin bracers it may be possible to preserve in-situ the remaining hardwood roof components (rafters, transom, posts etc) as the actual timbers are in reasonably sound condition.



Mr B. Adams

11<sup>th</sup> May 2021

**Summary**

In summary, we are of the opinion that some of the remaining timber elements within the Main Hall and within the 2 No. West side glasshouses may have a useful function going forward. We would, however, strongly advise that detailed records are taken of all of the timber components, as well as the associated cast iron/steel connecting brackets and opening winder mechanisms in order that appropriate recording is made should it be intended at some point in the future to fully reinstate the structure as existing. Our earlier notes and qualifications should be borne in mind, however.

**Photographs**

Please refer to the attached photographs which provide an up-to-date record of the conditions both within the Main Hall as well as within the 2 No. West side Glasshouses.

Please call our Director, Rory Cuthbertson, on 07773 391180 should you have any queries regarding the enclosed report.

Yours faithfully

  
pp R.M.CUTHBERTSON

ARIBA, B.Arch P.President Scot.M.Wrights

Enc. 15 No. Photographs



## **Appendix C**

### **Feasibility Cost Report by NBM Construction Cost Consultants**