

23 April 2010
IG09/309/JH/le

J P Chick & Partners Limited
Consulting Civil & Structural Engineers



STRUCTURAL INVESTIGATION REPORT

**ST PETERS CHURCH
THETFORD**

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**St Peters Church
Thetford**

1.0 BRIEF

- 1.01 J P Chick & Partners Limited were appointed on behalf of Thetford Town Council by Susan Glossop to undertake intrusive investigations and inspection of St Peters Church to determine any necessary structural works or preventative works, which may be necessary in the foreseeable future.
- 1.02 This report should be read in conjunction with our previous report based upon an inspection of the church in December 2008.

2.0 DATE OF INSPECTION AND WEATHER

- 2.01 Investigations by J.P.Chick & Partners Limited were undertaken on Thursday, 10 December 2009.
- 2.02 The weather was cold, dry and sunny.
- 2.03 Drainage investigations were undertaken by Powerrod Eastern on Tuesday 2nd of March.

3.0 GENERAL INFORMATION

- 3.01 General information regarding the church has previously been referred to in our earlier report with further information provided by Mr Chambers of Thetford Town Council in the form of the 'Pastoral Measure Report: Thetford St Peter' produced by the Council for the Care of Churches, Church House, Great Smith Street, London, SW1P 3NZ.
- 3.02 Points of note from this document refer to the restoration of the West Tower in 1789-91 and refurbishing internally around 1875.

4.0 SCOPE OF INVESTIGATIONS

- 4.01 Investigations were scheduled to determine the necessity for any remedial works including substructure and superstructure where these existed. As such it was decided to undertake excavations both internally and externally against the existing structure to determine foundation and soil profiles, as well as insitu soil strengths. Findings are contained in Appendix B.
- 4.02 Verticality surveys of the nave were undertaken in conjunction with re-assessment of existing crack damage, which coupled with the above would provide an indication of any areas of structural concern. Findings are contained in Appendix C.
- 4.03 Separately a CCTV drainage survey of the rainwater goods serving the structure was commissioned to establish how the site and more importantly the structure is drained and if soakaways exist, their current efficacy. This report is contained in Appendix D.
- 4.04 From previous inspection the church tower restored in 1789 is considered to be in good general order and no further intrusive investigations were warranted as necessary as part of our undertaking.

5.0 TRIAL PITS

- 5.01 A total of 7 trial pits were excavated, 4 externally and 3 internally, the main area of interest being the nave with further holes dug against the chancel and the North aisle adjacent the chancel. The location of these trial pits is given on sketch IG09/309/SK01 contained in Appendix A.
- 5.02 All findings from the trial pitting exercise can be summarised as follows.

Trial Pit 1

- 5.03 Trial pit 1 was undertaken at the intersection between the external wall of the chancel and the most Westward buttress of the three. This revealed that the wall of the chancel continued including its chalk flint and lime foundation to a depth of 590mm below ground level. The wall was found to be vertically plane and as such had no projections as would typically be found with more contemporary foundation arrangements. The buttress was proven to continue to the same depth with the same construction thicknesses in terms of the chalk flint foundation, although this had a toe projection of 200mm. Soils were found to comprise the following: -

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- | | |
|-----------------|---|
| ▪ 500 – 1500mm | Moist loose to medium dense grey / brown
gravelly silt with chalk fragments. |
| ▪ 1500 – 1600mm | Moist loose to medium dense grey slightly
sandy silt with chalk gravels. |

The borehole was terminated at 1.6m depth due to the increasingly gravelly nature of the soil.

Insitu strength testing was undertaken at the trial pit location with the use of a Perth Penotrometer. Findings indicate that at foundation depth soil bearing is in the region of 25kN/m² increasing gradually with depth to the lower level where readings of 260kN/m² were recorded.

Trial Pit 2

- 5.04 Trial pit 2 was undertaken against the nave positioned centrally against the buttress. At this location it was proven that the wall of the nave continued to a total of 450mm below ground level. There is no toe projection with a chalk rubble foundation providing a thickness of 150mm beneath the wall itself. The buttress penetrates the ground by a similar depth and was found to have no toe projection or perceptible foundation and terminated with flint work. Soils comprised of the following: -

- | | |
|-----------------|---|
| ▪ 400 – 1400mm | Slightly moist loose to medium dense grey /
brown gravelly silt with chalk fragments and flint
gravels. |
| ▪ 1400 – 1700mm | Moist loose to medium dense mottled light
brown / grey silt / sand with flint and chalk
gravels. |

Insitu bearing capacities were ascertained with the use of a Perth Penotrometer and readings of 30kN were obtained at 750mm increasing with depth to 190kN/m² at 1.5m to in excess of 250kN/m² at 1.7m.

Significant voiding was noted directly beneath the wall of the nave. This voiding was found to continue horizontally by up to 500mm where further masonry was encountered and vertically continued to approximately 1.5m below ground level. A further internal trial pit directly adjacent trial pit 2 was undertaken within the nave and was numbered TP3.

Trial Pit 3

- 5.05 Trial pit 3 was undertaken internally to the South wall of the nave immediately adjacent the location of trial pit 2 externally. The floor construction of the nave comprises of 120mm thick concrete slab which is poured directly upon a crushed brick sub-base. Against the wall a void of 110mm was noted between the concrete slab and the subgrade beneath. Directly beneath floor level the wall continued with its internal face consisting of red bricks laid in a lime mortar. This continued to 1.9m below finished floor level. These appeared well laid with consistent jointing in what appeared to be Flemish bond. At the base of this wall there was a concrete foundation or slab upon which the wall is situated. The wall can be confirmed as being 215mm or 9 inches thick and projects beyond the inner finished face of the main wall of the church by 25mm.
- 5.06 Material beneath the concrete slab comprised mainly of dry brown clayey silty sand with concrete and brick fragments and from approximately 600mm below finished floor level bones and bone fragments were encountered.
- 5.07 The wall above floor level was also exposed to determine its composition and this can be confirmed as being of more traditional walling associated with church structures comprising flints and clunch stone set in lime based mortars. From this exposure it can be noted that there appeared to be possibly up to three render coats on the internal wall of the church providing an overall thickness of approximately 60mm. The most recent of these and thickest appears to be a sharp sand cement mix.
- 5.08 Two further trial pits were undertaken within the nave, one to the South East corner and one to the South West corner to confirm the construction below finished floor level at these locations and specifically as to whether the brick substructure as seen within trial pit 3 continued at these locations.

Trial Pit 4

- 5.09 Trial pit 4 was undertaken internally within the North aisle adjacent to the chancel. An external hole (see trial pit 5) was dug to the external aspect in order to provide a cross section representation of this area. Internally a concrete strip foundation was exposed, situated 230mm below finished floor level with a toe projection of 130mm at an overall thickness of 180mm. This was founded on the following material: -

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- 230 – 900mm Loose to medium dense slightly moist light brown / yellow sandy silt with occasional chalk fragments and flint gravels.
- 900 – 1350mm Slightly moist silty light brown / yellow fine sand with occasional gravels.
- 1350 – 2000mm Loose to medium dense slightly moist mottled orange, brown and light brown silty slightly gravelly sand with flint gravels.

- 5.10 At this location the insitu bearing capacity of the subsoils were established with the use of a Perth Penetrometer. Material directly below foundation depth provided readings of approximately 40kN/m² increasing to approximately 120kN/m² at 1m depth and continuing with similar values beyond this.

Trial Pit 5

- 5.11 Trial pit 5 was excavated externally against the North Aisle adjacent trial pit 4. This proved a plain flint and mortar foundation to extend only 160mm below external ground level. This was founded on the following materials: -

- 150 – 550mm Loose to medium dense slightly moist sandy silt with chalk fragments and flint gravels.
- 550 – 1000mm Loose to medium dense orange brown / brown silty fine sand with occasional gravels.
- 1000 – 1500mm Loose to medium dense orange brown / brown silty fine sand with chalk gravel and flints throughout.

- 5.12 The borehole was terminated at 1.5m depth and insitu strength testing was undertaken with the use of a Perth Penetrometer. This recorded values in the region of 100kN/m² at approximately 600mm increasing gradually to approximately 140kN/m² at 900mm and continuing to a greater depth with similar values.

Trial Pit 6

- 5.13 Trial pit 6 was undertaken to the South western corner of the nave. At this location the concrete slab is approximately 80mm thick laid on compact hardcore consisting of flints, concrete and brick fragments. There is no voiding beneath the slab with

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material beneath the hardcore consisting of silty sand with chalk gravels and flint fragments.

- 5.14 The construction of the wall itself at this location was proven to extend by approximately 150mm below floor level, consisting of mainly clunch stone set in a mortar matrix. There was no indication of any brick structure continuing beneath this level.
- 5.15 At this location the soils beneath the floor composition were tested for their insitu strengths with the use of a Perth Penetrometer. Findings indicate that at 450mm below finished floor level, values in the region of 60kN/m² were encountered, increasing to in excess of 100kN/m² at 900mm depth.

Trial Pit 7

- 5.16 Trial pit 7 was undertaken to the South East corner of the church. It can be confirmed that the concrete slab in this location is approximately 65mm thick with 35mm of hardcore beneath. At this location no voiding was recorded beneath the slab and subgrade material consisted of slightly moist gravelly sandy silt with cobble size clunch stone and chalk flints. There was no indication of any brick structure continuing beneath this level.
- 5.17 Insitu strength testing of the subgrade material was undertaken with the use of a Perth Penetrometer indicating 90kN/m² at 500mm below finished floor level increasing to 150kN/m² at approximately 750mm before reducing again to approximately 100kN/m² at just over 1m depth.

6.0 VERTICALITY DISTORTION SURVEYS

- 6.01 As part of the investigative works a verticality survey of the South wall to the nave was undertaken. Verticality readings were taken at intermittent positions to the South wall of the nave to a height of 5m. The first reading was taken to the eastern end of the wall progressing westward, terminating at position number 5 abutting the tower.
- 6.02 Readings confirm that rotation of the wall has occurred and that this is most significant to the eastern end and reduces at a relatively constant rate toward the West. Maximum distortion is recorded at 190mm over 5m height reducing to 150mm, 120mm, 60mm and 45mm at successive points. Readings are presented on drawing number IG09/309/SK07 in Appendix C.

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- 6.03 At the maximum point of rotation, that being to the eastern end of the wall a further verticality was taken to the opposing North wall at the same location. To this North side rotation of 130mm was recorded at a height of 4.7m. This is clearly not as significant as that occurring to the Southern wall.
- 6.04 Externally the South East return wall of the nave was checked for verticality. This was found to be overturning eastward by approximately 100mm with the majority of this distortion occurring above the first lift of the abutment in close proximity.
- 6.05 The external wall of the North aisle was checked with a 1.8m long spirit level. Rotation of the wall was noted throughout its length with a maximum displacement of approximately 100mm over its height. The brick chimney situated centrally along the northern aisle appears to be unaffected by distortion movement. This suggests that the majority of distortion is historic and that the chimney may have been subsequently constructed.
- 6.06 The external face of the North aisle has historically been rendered and subsequently within the panel significant cracking has occurred. In order to establish the composition of the wall an area of render was removed to facilitate inspection of the masonry beneath.
- 6.07 It can be confirmed that the wall beneath comprises of flints, although these would appear to be typically secondary, smaller and poorly sorted stones, possibly of inferior quality to those used within the main structure. This may therefore provide reasoning for the render application so as to firstly conceal and secondly provide protection to this element built with low quality materials which is likely to suffer degradation at a faster rate than the remainder of the flint work.

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7.0 DRAINAGE

- 7.01 The drainage survey was undertaken on 2 March 2010. This was to establish the location of rainwater and foul drainage goods and where possible their efficacy. The survey report is contained in Appendix C and should be referred to accordingly.
- 7.02 Foul drainage is situated to the eastern end of the church and the toilets to the vestry. Pipework beneath the footprint of the structure is confirmed as being of salt glazed clayware and generally appears in reasonable condition with the exception of hairline longitudinal cracks between WC3 and manhole 1.
- 7.03 Pipework between manhole 1 and manhole 2 was proven to have been compromised by root penetration noted through numerous joints and cracks along the length of the run. The most significant occurs at the joint immediately upon exit of manhole 1. Drainage then changes direction to exit the curtilage of the church grounds to the North. Again root penetration and cracks are visible as well as displaced joints. Manhole 3 is stated as being located within the neighbouring property and this inspection chamber has also been compromised by root activity.
- 7.04 Surface water drainage comprises of seven rainwater down pipes all of which are considered to connect to soakaways. Rain water pipes 1 and 2 are considered to connect to a soakaway located somewhere in close proximity to the church.
- 7.05 Rainwater pipe 3 discharges to a soakaway measured as being 1.8m from the gully. It is considered that rainwater pipe 4 to the rear which discharges directly into pipework below ground may be linked to this soakaway also, although this underground drain was found to be full of soil and debris and totally ineffective.
- 7.06 Rainwater pipes 5, 6 and 7 located to the South side exit perpendicular to the church structure, all to soakaways considered to be between 5 and 6m from the church itself. Rainwater downpipe 7 was found to be full of debris and is considered to be ineffective whilst both rainwater pipes 5 and 6 were found to be considerably silted at 1.8m and 4.5m from the point of discharge. The probable location of the soakaway was determined by passing a sonic probe through the silted pipework in order to determine the proximity of the soakaway as a final destination.

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8.0 LIMITATIONS

- 8.01 It should be noted that the possibility that different conditions exist other than at the trial pit locations, or at greater depth, should not be ruled out. In particular, ground water records apply only to the time and place of investigation, since wide variations may occur through seasonal or other causes.
- 8.02 This report is confidential between J P Chick & Partners Ltd and the client and is not to be passed to a third party without the consent of the original parties. Legal matters are not dealt with but if Solicitor's Searches reveal anything unusual we should be informed as this may have an adverse affect on the property.
- 8.03 Unless stated otherwise in the report, we have not disturbed any fixtures and therefore no fitted carpets, floorboards or linings have been removed. Coupled with this, we have only exposed the foundations in localised areas and cannot guarantee that information is consistent or common throughout or applicable to other areas. We are therefore unable to report that such part of the property is free from defect.
- 8.04 We have not inspected woodwork or other parts of the structure, which are covered, unexposed or inaccessible and we are therefore unable to report that any such part of the property is free from defect.
- 8.05 The condition of the finishes, waterproofing, damp penetration and structural timbers, unless specifically referred to, are not the subject of this report. We would recommend the services of a specialist to cover these areas.

9.0 CONCLUSIONS TO INVESTIGATIONS

- 9.01 Investigations confirm that subsoils across the footprint of the church structure are relatively consistent comprising essentially of gravelly sandy silt. These soils have typically been proven to have relatively low bearing capacity at founding depths for the main walls and buttresses with values commencing from approximately 25kN/m² increasing thereafter with depth.
- 9.02 The highest anticipated loadings from the structure with a possible exception of the tower are those of the walls to the nave which are anticipated to be in the region of 125 – 150kN / linear metre. Currently allowing for foundation widths of approximately 750mm to the main structure a load of 165 – 200kN/m² is considered to be imparted on founding subsoils. Despite the clear disparity between actual ground bearing capacity and loading from the structure the church appears relatively stable and free from significant structural distress. It is likely that slow settlement has occurred under sustained load and over time stresses within founding soils have equalised leading to consolidation of the soils increasing bearing values and limiting movement.
- 9.03 It is considered likely that over the lifetime of the church subsoils have also suffered from washout and migration of finer particles causing a reduction in density and bearing capacity. By the nature of construction the church has absorbed much of the relatively minor movements which are likely to have subsequently occurred again under sustained loading and settlement. These are present today in the form of distortions seen around the structure.
- 9.04 It was proven that what appeared to be a tomb, has been constructed beneath the nave. The external wall of this tomb marginally sits beneath the middle of the Naves South wall. Judging by the brickwork exposed this is thought to date from the 18th or early 19th Century. This is likely to have created something of a hard spot, which will give rise to the potential for rotation of the South wall as a result. There is evidence that minor settlements of the wall have occurred either side of the substructure wall with indication that the South East buttress of the nave may be rotating to the East suffering minor horizontal and vertical distortion. This may have been exacerbated by the position of nearby rainwater goods. Where water is able to escape subsoils may be destabilised.

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- 9.05 Excavations to the North aisle reveal differing foundation depths and profiles. Internally a traditional concrete foundation is exposed whilst externally flint coursing penetrates approximately 160mm below ground level. Internal foundations are considered to be of a later construction and are situated at a greater depth than the original foundation exposed externally. This may exacerbate the potential for this North wall to rotate, which has done so primarily as a result of historic thrust from the North wall of the chancel. It is considered possible that the more recent concrete foundation supports an internal skin providing supplemental support to the roof of the North Aisle reducing the potential for lateral thrust and movement from the North wall of the Chancel. Soil strengths in this locality were found to be slightly higher than that of the South side of the church with values of approximately 50 – 60kN/m² commencing at approximately 400mm below ground level, increasing thereafter to 120kN/m² at approximately 900mm increasing thereafter with depth. The outer foundation of the wall in this locality is therefore founded in the weaker stratum of soil.
- 9.06 Rotational movement of the Nave walls is not as dramatic as it would visually appear. The maximum distortion recorded was measured as 190mm over its height. Given the construction thickness this does not represent movement sufficient to cause instability issues. It can therefore be concluded that the walls are currently stable.
- 9.07 From the Power Rod investigation into the drainage we would consider that drainage within the vestry toilets is largely serviceable with the exception of gully 1 which was found to be full of debris and overflowing. Downstream from manhole 1 pipework is proven to be compromised by root activity with penetration of a root measuring approximately 15 – 20mm in diameter in close proximity to manhole 1. The soakaway serving rainwater pipe 3 and possibly rainwater pipe 4 was located at a distance considered inadequate from the structure and due to a build up in debris rainwater pipe 4 is clearly not reaching its intended destination.
- 9.08 Rainwater goods serving the main church structure were all found to be largely ineffective due to their being silted up. In times of heavy or prolonged precipitation we consider that rainwater pipes serving the structure will become ineffective at discharging the water causing it to back up and spill against the structure itself.

10.0 CONCLUSIONS TO FURTHER INSPECTION

- 10.01 Inspection of the roof structure from a higher level indicated that this generally appears sound. There is no appearance of significant or active rot and only limited insect or beetle holes which are considered to be old although cannot be guaranteed to be inactive. There is evidence of historic movement between the walls and the lower hammer beams to which these connect, although this does not appear to be significant or represent any recent activity.
- 10.02 The roof structure within the North aisle has been identified as suffering from water penetration although this can be confirmed as being relatively localised and not having progressed to decay the structural members. Within the North aisle against the chancel joists are noted to be pulled from their sockets, although again this is historic and relative to the rotation of the North aisle wall. From that which can be seen the structure is relatively sound with no evidence of significant deterioration.
- 10.03 External inspection of the leaded sloped roof to the North Aisle indicates that this is in need of recovering. The last Quinquennial report by Birdsall Swash and Blackman Chartered Architects commented on the need for this and it remains in the same state. As well as being too large the lead sheets should be installed with rolls on the angle to reduce the potential for creep to occur along angle of the slope. Currently this is not the case and this may have contributed to accelerated failure.
- 10.04 General maintenance in the form of repointing around string courses and cappings to parapet tops etc. is required. Observations of some weathering to stonework causing slaking / shaling appears not to have progressed significantly since our earlier inspection. A watching brief should however be maintained and further comment made in subsequent inspections.
- 10.05 Window units are in need of overhauling both to softwood elements in the toilet area and the stained glass within the church itself. The stained glass is in need of re-leading to ensure longevity of these elements. Some of the corroding ironwork is inset within the stonework and will spall this as a result. This should also be addressed.
- 10.06 With regard to external walling, that to the North boundary is being directly affected by the mature Sycamore tree growing in close proximity. This would appear to have received little maintenance over recent years and has grown too large given its position.

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- 10.07 From separate undertakings we are aware that Asbestos materials exist within the boiler room of the Church. Quotations for the removal of this material have been obtained and will be dealt with by a suitably qualified appointed specialist contractor.

11.0 RECOMMENDATIONS

- 11.01 In view of the current loadings from the structure and the ground bearing potential of the subsoils we recommend consideration be given to soil substructure works to stabilise the foundation of the perimeter walls to the Nave, Chancel and North Aisle. We would recommend that consideration be given to using Uretek deep injection. This would use polymer injection within the weak soil stratum to provide bearing capacity sufficient to stabilise the church for the future. This will provide an all encompassing solution to varying construction such as the presence of underground structures which can be difficult to account for with more traditional underpinning techniques.
- 11.02 By stabilising the structure in this manner the outward lean of the Nave walls may be restricted omitting the necessity to install high level restraint to the roof which over time has suffered some spread.
- 11.03 The floor within the Nave has suffered movement and failure in places and from our investigations voids can be seen. Some of these voids are associated with the presence of what we consider to be an old tomb or crypt which appears to have been indiscriminately backfilled. We would recommend that the floor either be replaced or stabilised in a similar manner to external walls using a polyurethane injection procedure.
- 11.04 With regard to the roofs, the most important job is to re-lay the roof to the North aisle to make it watertight. This should be done by a competent lead roofer in accordance with good building practice and the Lead Sheet Association providing wetted wood cored rolls installed at an angle to reduce movement and creep of the lead. At the time of these works the contractor should also be asked to inspect the roof to the North slopes of the nave and chancel with a view to initially refixing / replacing slipped and broken tiles. Comment on the necessity for reroofing the North slope should be given.

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- 11.05 Elsewhere around the structure general repointing is required at high level where weathering has occurred and in conjunction with this flashings should be renewed accordingly to re-establish weather tightness and protection. In particular the flashing to the North East corner of the Nave should be renewed.
- 11.06 A full programme of repointing works should be considered. This should be done by a competent contractor using suitable Lime based mortars in mixes which should attempt to match the original. Low level repointing to the base of buttresses should also be undertaken to ensure solidity of the structure and good load transfer to the foundations.
- 11.07 Windows within the vestry toilets should be renewed with existing veluxes being inspected and overhauled to ensure that they continue to be weather tight. Windows of the church are in need of some maintenance in terms of re-leading to ensure they do not deteriorate to a point where failure may occur with loss of individual glass elements. Similarly remedial works to the inset iron bar ends should be undertaken to prevent spalling of the stonework. Where protective grills are installed some of these are noted to have deteriorated and may require replacement.
- 11.08 Remedial works to the drainage are required and these are considered to be relatively widespread. We would recommend that drain runs between manhole 1 to the boundary are cleared of all root intrusion before lining with a resin impregnated structural liner to prevent any further roof penetration. All drainage upstream to manhole 1 including gully 1 should be cleared to ensure efficacy. Rainwater pipe 4 should be cleared out to ensure rainwater is discharged effectively so as not to cause potential damp issues such as can currently be seen. The soakaway serving rainwater pipe 3 and 4 is considered to be too close to the structure, however this is likely to be a more recent addition than the remainder and we would currently recommend that this remain.
- 11.09 We would recommend that the remainder of soakaways serving the rainwater pipes to the South side of the church and to the North aisle are excavated, grubbed out and replaced with a modern soakaway system, which may require design for acceptance by the local authority.
- 11.10 All guttering should be cleared of debris to ensure effective operation.

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- 11.11 Rendered panels to the North Aisle should simply be repaired. Where render is sound these should take the form of simple crack repairs with proprietary fillers or preferably some lime putty. Where render is debonded patch repairs will be required. It is important that repairs are undertaken using materials to match the existing to ensure good continuity and longevity of repair. Alternatively the wall may be stripped in its entirety exposing any areas in need of minor repair prior to re-rendering in sympathetic materials i.e. Lime based render before applying coats of suitable limewash to protect the surface.
- 11.12 The large Sycamore within the North yard should be managed and consultation with an Arborist is recommended. We consider however that this tree should undergo significant reduction if not wholesale removal. As a result of this it may be necessary to undertake repairs to the perimeter North walling. Elsewhere we would recommend that vegetation growing in close proximity to the structure be removed and this should include all creepers such as Ivy and that these should be cut at the root and left to die before carefully removing from face work to reduce the damage that this will cause.
- 11.12 The electrical wiring will require full testing to current legislative requirements to determine its condition and suitability for continued use. There is the potential that some if not the majority of the existing wiring will need replacement or upgrade of some description.
- 11.13 All works recommended will be subject to agreement from the Local Authority Listed Buildings Officer. Furthermore relevant bodies should be contacted where any works will involve excavation (or substructure works) upon what is essentially consecrated ground as this may not have been desanctified. The Local Listed Buildings department will be able to offer advice on such organisations.

Signed.....

J Harvey ACIOB
On behalf of J P Chick & Partners Limited

Countersigned.....

23 April 2010
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Consulting Civil & Structural Engineers



APPENDIX A

Trial Pit Locations

Notes

Rev.	Date	By	Amendment

JP Chick & Partners Limited

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7 Museum Street,
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T: (01473) 280699
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F: (01245) 493578

E: ipswich@chick.co.uk

23 St Stephens Road, Norwich,
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T: (01603) 819093
F: (01603) 810840

Client

Thetford Town Council

Project

St. Peters Church,
King Street,
Thetford

Drawing Title

Trial Pit Location Plan

Scale

NTS

Checked

JH

Date

14/12/10

Date

December 2009

Drawn By

CC

Drawing Number

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Rev

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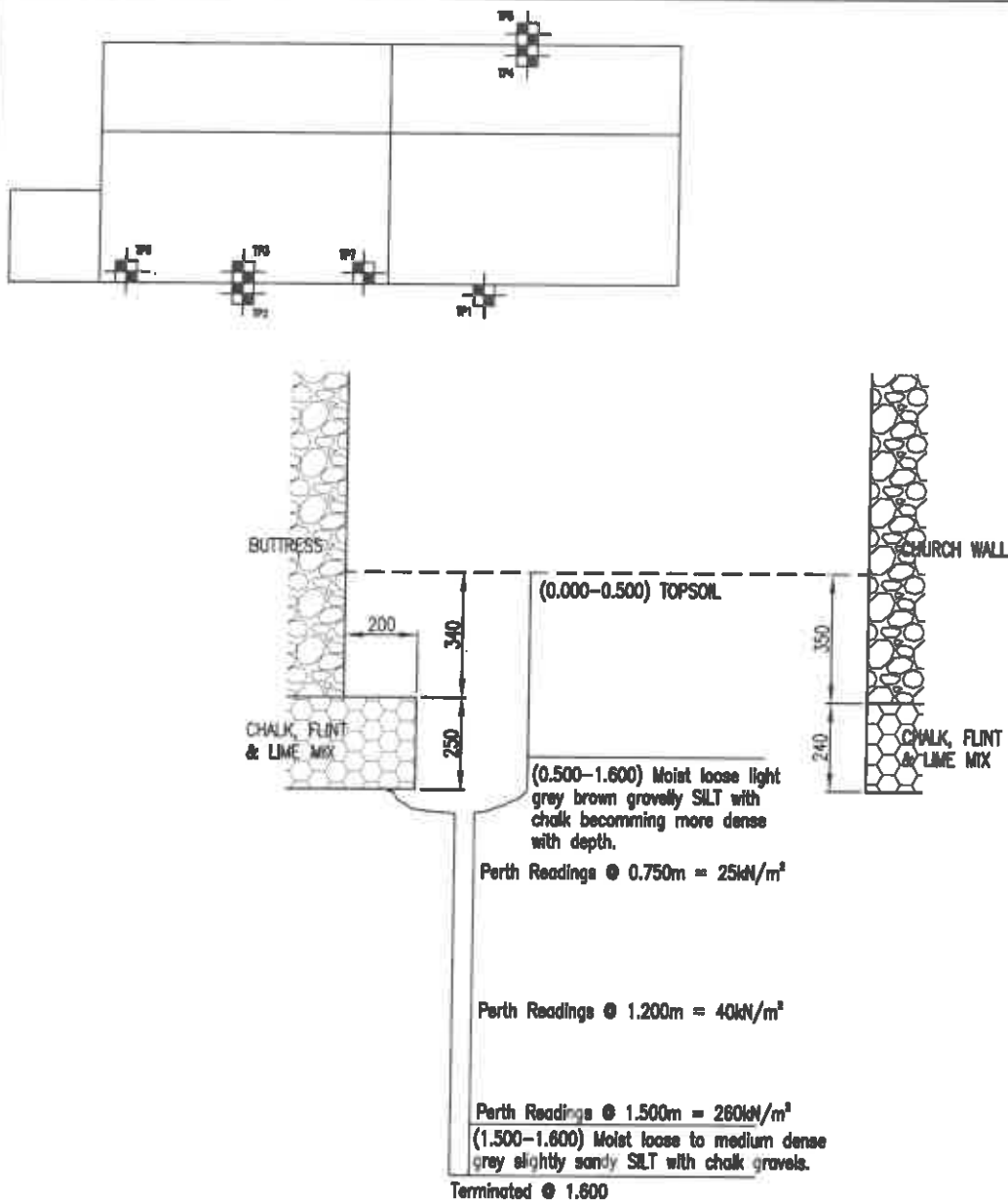
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APPENDIX B

Trial Pit Logs



TRIAL PIT 1

Project St. Peters Church, King Street, Thetford

JP Chick & Partners Limited
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E: ipswich@chick.co.uk

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Date

December 2009

Checked By

✓

Scale

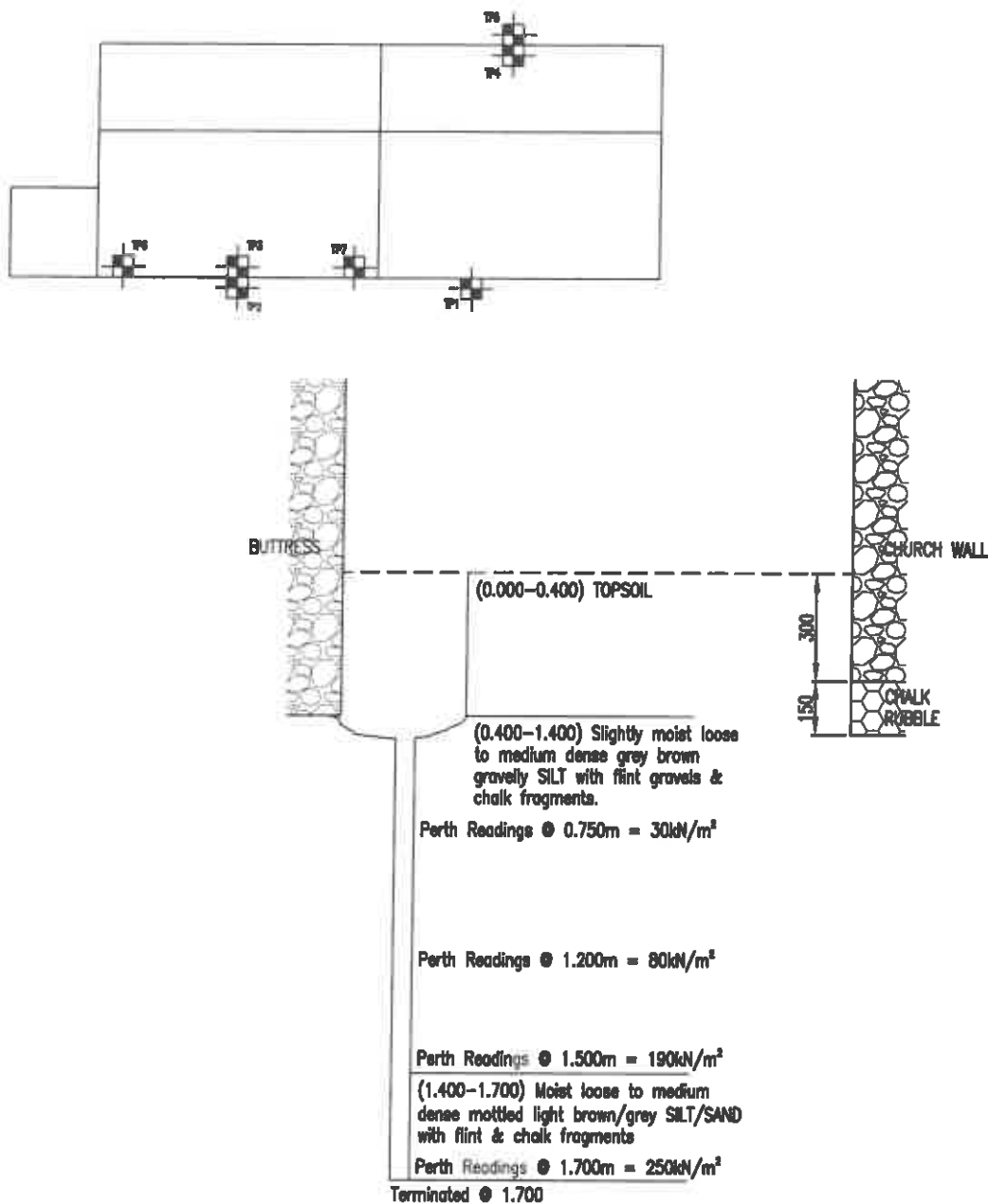
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TRIAL PIT 2

Project St. Peters Church, King Street, Thetford

JP Chick & Partners Limited
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7 Museum Street,
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W: www.chick.co.uk

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Date

December 2009

Checked By

JA

Scale

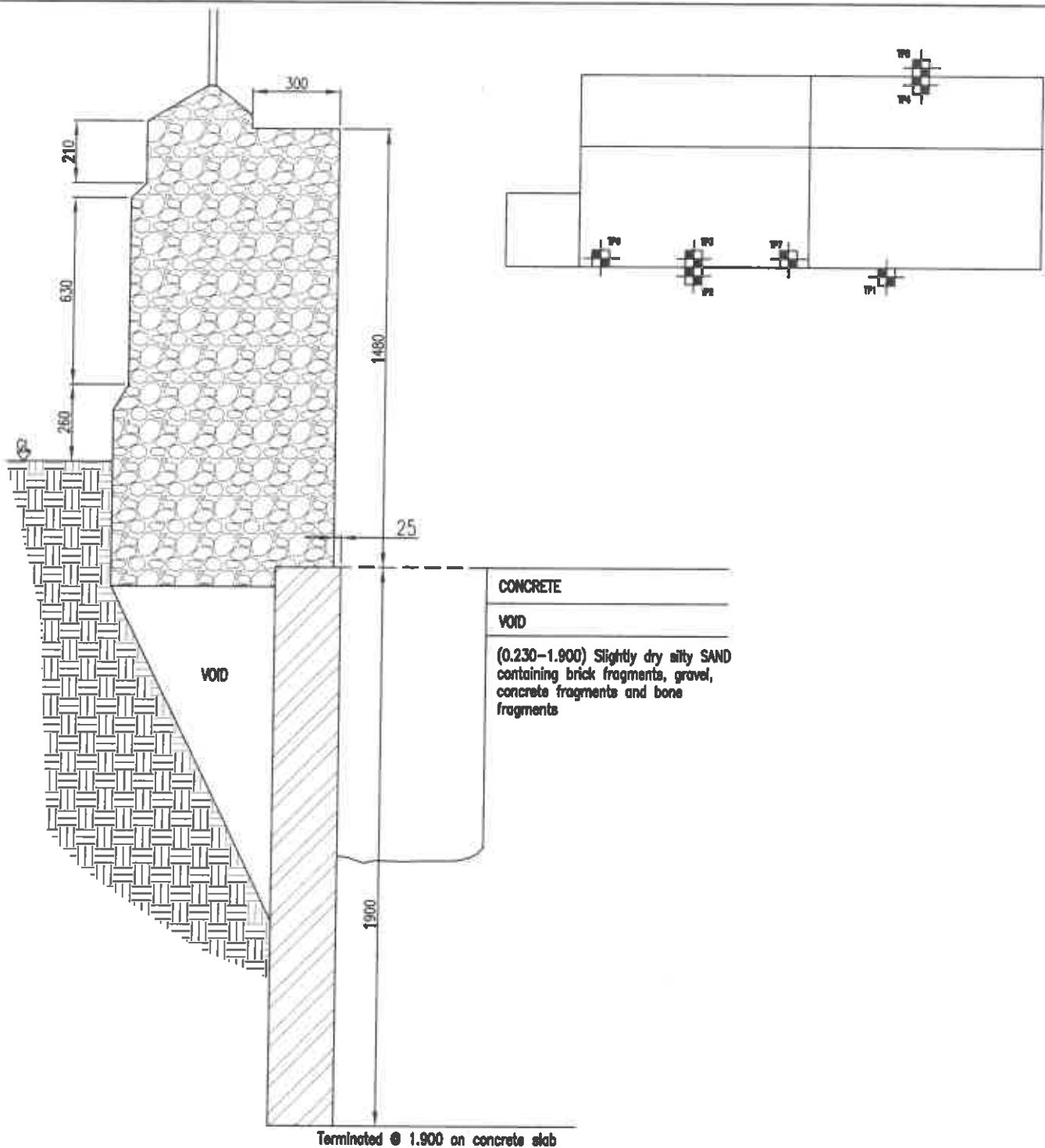
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TRIAL PIT 3

Project St. Peters Church, King Street, Thetford

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CC

Date

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JH

Scale

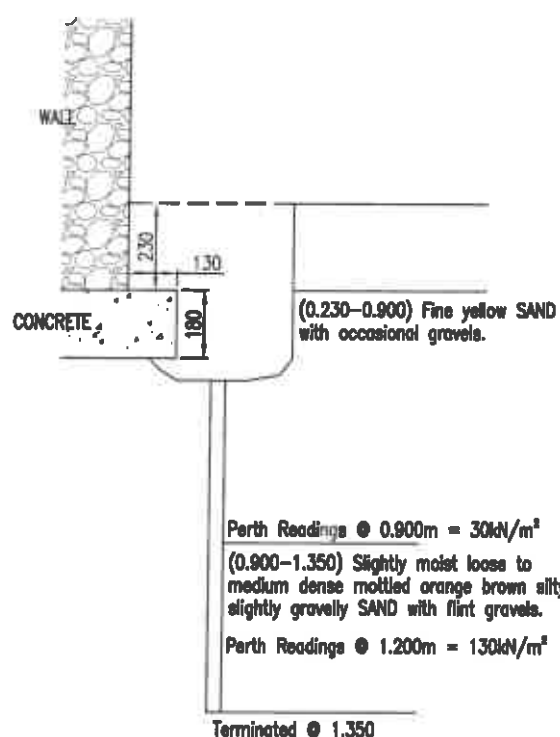
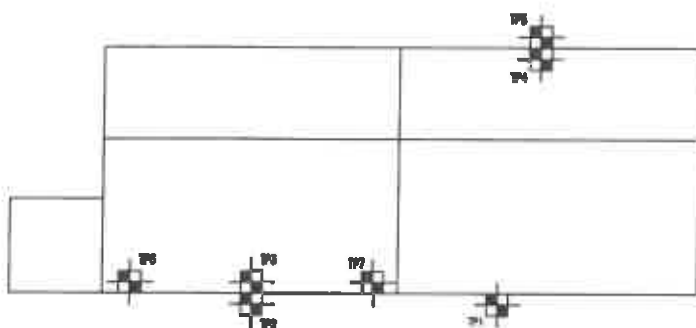
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Rev.

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TRIAL PIT 4

Project St. Peters Church, King Street, Thetford

JP Chick & Partners Limited
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Drawn By

CC

Date

December 2009

Checked By

JH

Scale

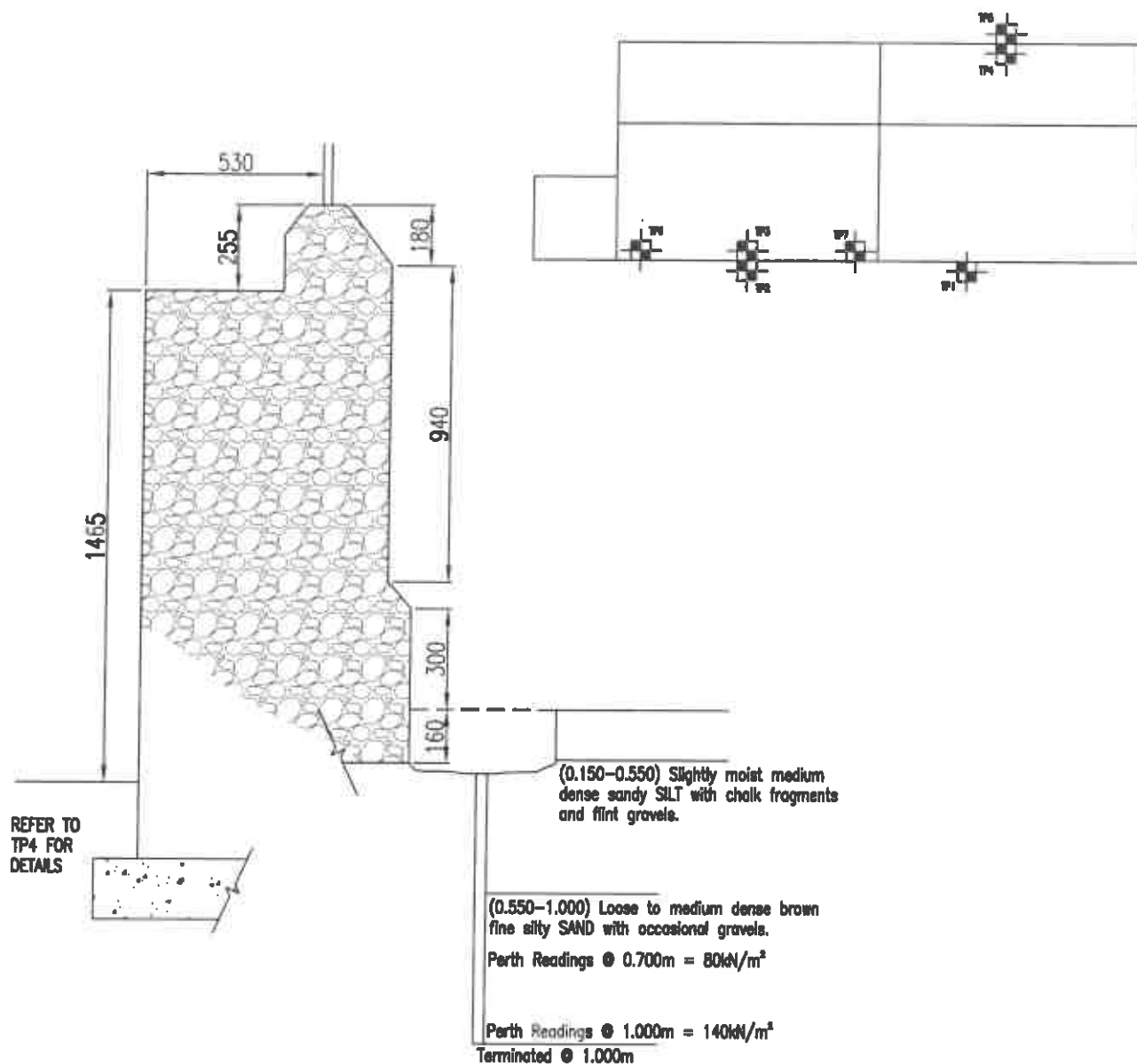
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Date

December 2009

Checked By

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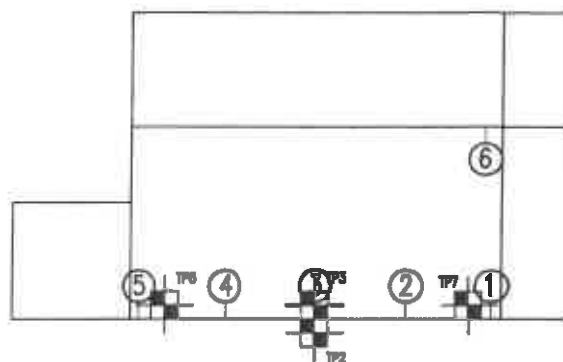
23 April 2010
IG09/309/JH/le

J P Chick & Partners Limited
Consulting Civil & Structural Engineers

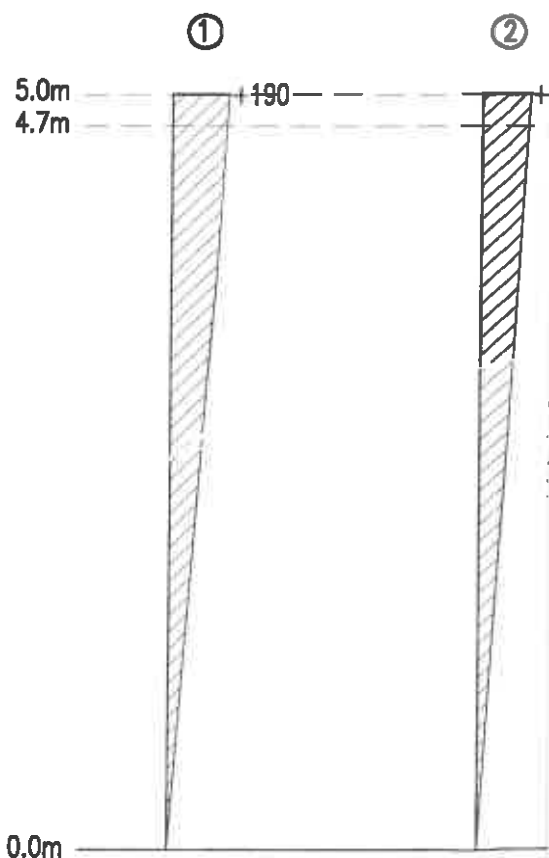


APPENDIX C

Distortion Survey



PLAN SHOWING VERTICALITY RE



Notes

Rev.	Date	By	Amendment

JP Chick & Partners Limited

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23 St Stephens Road, Norwich,
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Client

Thetford Town Council

Project

St. Peters Church,
King Street,
Thetford

Drawing Title

Verticality Readings for
South Wall of Nave

Scale NTS	Checked JH	Date APRIL 10
Date December 2009	Drawn By CC	
Drawing Number IG09/309/SK07		Rev
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23 April 2010
IG09/309/JH/le

J P Chick & Partners Limited

Consulting Civil & Structural Engineers



APPENDIX D

CCTV Drainage Survey

POWER ROD EASTERN

14 St Edmundsbury Mews
Bury St Edmunds
IP33 3PJ



☎ 01284 769326
☎ 0800 585998
✉ powerrodeastern@btinternet.com
🌐 www.powerrodeastern.co.uk

24 hour mechanised drain and pipe clearance
High pressure water jetting
CCTV Surveys. Drain installations, repairs, tests
Approved installer of resin lining

SURVEY REPORT

Client - **J.P. Chick & Partners**
7 Museum Street
Ipswich
Suffolk
IP1 1HQ

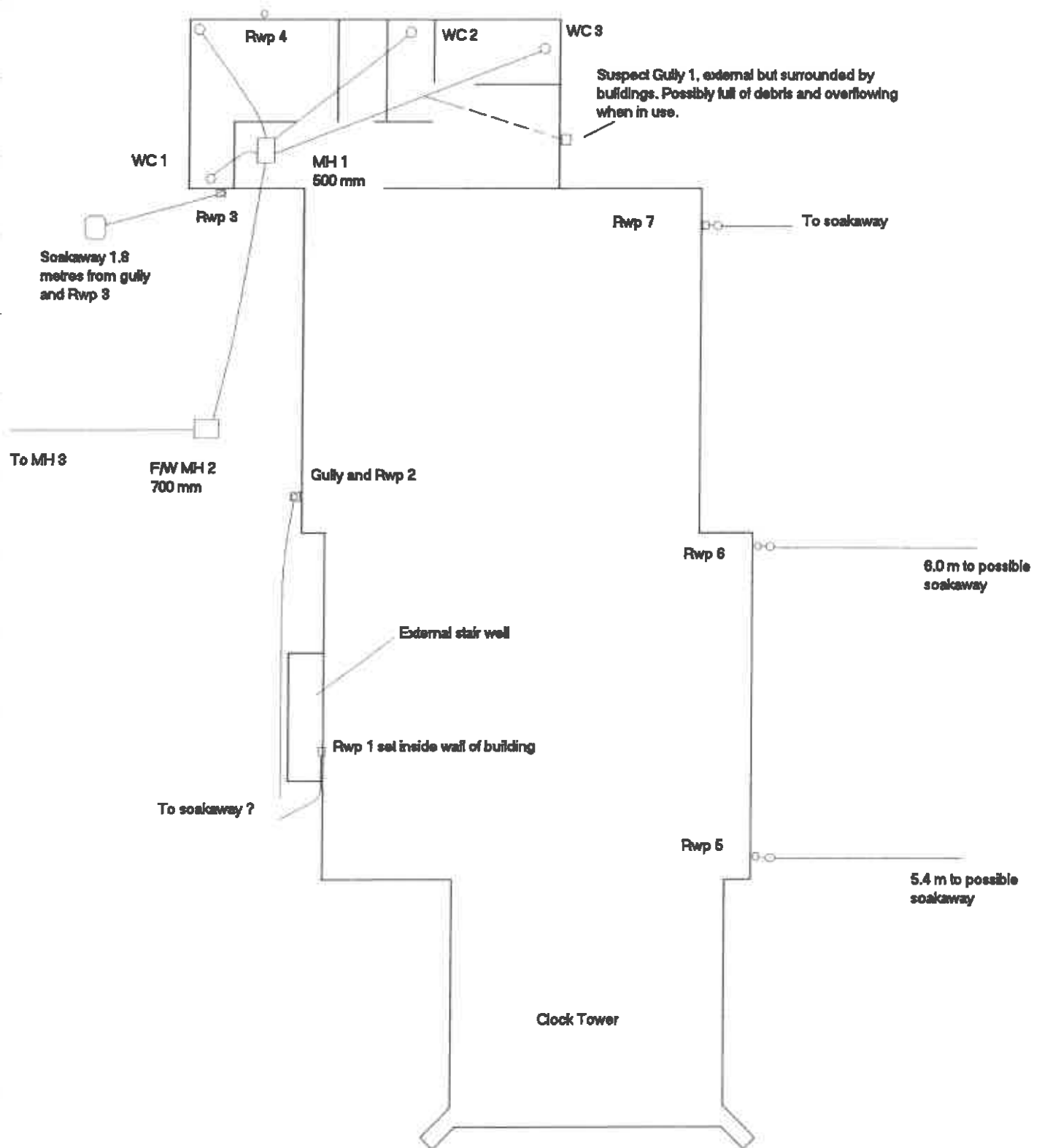
Site - **St Peters Church**
Kings Street
Thetford
Norfolk

Date - **2nd March 2010**

Reference - **E-Mail (J. Harvey)**

25.03.10

IG09/309
m.
NQ
NQ.



ST PETERS CHURCH
KINGS STREET
THETFORD

POWER ROD EASTERN

14 St Edmundsbury Mews
Bury St Edmunds
IP33 3PJ



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🌐 www.powerrodeastern.co.uk

24 hour mechanised drain and pipe clearance
High pressure water jetting
CCTV Surveys. Drain installations, repairs, tests
Approved installer of resin lining

VIDEO SURVEY REPORT

Client	Site Address (if different)	Date
J.P. Chick & Partners 7 Museum Street Ipswich Suffolk IP1 1HQ	St Peters Church Kings Street Thetford Norfolk	2 nd March 2010

Job No. 159/0910 Your Order No. E-Mail (J. Harvey)

Chainage Metres	OBSERVATIONS
	<u>SVP DOWNSTREAM (100mm dia. salt glazed) via access point on the side of stack.</u>
0.6	Pipework bends to the horizontal. Broken vent cowl laying in pipework.
2.6	Internal manhole chamber under floor covering.
	<u>MH 1 UPSTREAM TO W.C. 1 (100mm dia. salt glazed)</u>
0.1	Pipework bends to the left.
0.5	Pipework bends upwards.
0.7	Connection to W.C. 1.
	<u>MH 1 UPSTREAM TO W.C. 2 (100mm dia. salt glazed)</u>
0.4	Hairline radial crack.
2.6	Pipework bends upwards.
2.8	Connection to W.C. 2.
	<u>MH 1 UPSTREAM TO W.C. 3 (100mm dia. salt glazed)</u>
2.8	Hairline longitudinal crack 08.00 (photo).

Chainage Metres	OBSERVATIONS
3.0	Lateral connection from the right. We assume this serves an external gully for the basin/sink waste.
5.1	Pipework bends upwards.
5.4	Connection to W.C. 3.
	<u>MH 1 DOWNSTREAM (100mm dia. salt glazed)</u>
0.0	Tap root penetrating through the base of the joint and growing along the downstream pipework (photo).
0.4	Mass root infestation (photo).
3.0	Build up of water and debris. Camera pushed through debris.
8.9	External MH 2 (photo).
	Camera withdrawn and pipework inspected in reverse.
7.9	Source of root penetration through joint 03.00 (photo).
7.5	Fibrous roots laying in pipework (photo).
6.4	Radial crack to joint with fibrous root penetration through the joint (photo).
5.0	Fibrous root penetration through joint (photo).
1.9	Slight joint displacement with fibrous root penetration (photo).
0.5	Mass root infestation (photo).
	<u>MH 2 DOWNSTREAM (100mm dia. salt glazed)</u>
0.0	Root penetration through joint with roots travelling downstream.
1.6	Slightly displaced joint (photo).
2.1	Radial crack (hairline).
12.7	MH 3 located to the rear of neighbouring property with roots hanging down in chamber (photo).
13.0	MH 3 (photo).
	Camera withdrawn and much of the root growth removed with camera.
	<u>RWP 2 DOWNSTREAM (100mm dia. upvc) through rodding eye in gully</u>
0.2	Pipework bends downwards.
0.8	Pipework changes to the original salt glazed.

Chainage Metres	
2.1	Build up of debris 50%. Unable to proceed.
1.6	<p>Camera withdrawn to show debris (photo).</p> <p>A probe was passed through this drain run and traced to a point 7.2 metres downstream as indicated on the attached drawing. It is not clear whether this is a junction from Rwp 1, a soakaway or a break in the pipework. Rwp 1 is set into the wall of the church with no access to the pipework (see photo).</p> <p><u>RWP 3 DOWNSTREAM (100mm dia. salt glazed)</u></p> <p>Access to this pipework was gained by excavation and cutting into the outflow from the trapped gully.</p>
1.8	<p>Soakaway (photo).</p> <p><u>RWP 5 DOWNSTREAM (100mm dia. salt glazed)</u></p>
1.8	<p>Build up of debris (photo). Unable to proceed.</p> <p><u>RWP 6 DOWNSTREAM (100mm dia. salt glazed)</u></p>
4.5	<p>Build up of debris (photo). Unable to proceed.</p> <p>A probe was passed through the pipework serving Rwp 5 & Rwp 6 and the termination points traced at 5.4 metres and 6.0 metres. We suspect this is where the soakaways are located.</p>
	<p style="text-align: center;"><u>SUMMARY</u></p>
	<p>The drainage consists of separate foul and surface water systems.</p>
	<p>The foul water drainage runs from an internal manhole chamber via an external manhole chamber through to a manhole chamber located to the rear of the neighbouring property. We assume the final discharge is to the main sewer.</p>
	<p>We were unable to access Gully 1, which appears to be external but enclosed with various buildings. We suspect this gully may be full of debris and overflowing, as we were unable to gain a significant flow through the pipework.</p>
	<p>A CCTV inspection of the foul water drainage indicated some minor cracking to the internal connections with structural damage and root penetration of the external pipework between MH 1, MH 2 & MH 3. We recommend all the defective pipework is repaired by machining out the tree root infestation and the installation of resin impregnated structural liners.</p>
	<p>The rain water downpipes discharge to soakaways.</p>
	<p>On the left hand side of the Church Rwp 1 is set into the wall of the building but may connect with the drain run from Rwp 2, which was located to an area close by, prior to discharge to a soakaway.</p>
	<p>Rwp 3 discharges to a soakaway at 1.8 metres away from the building.</p>

cld.....

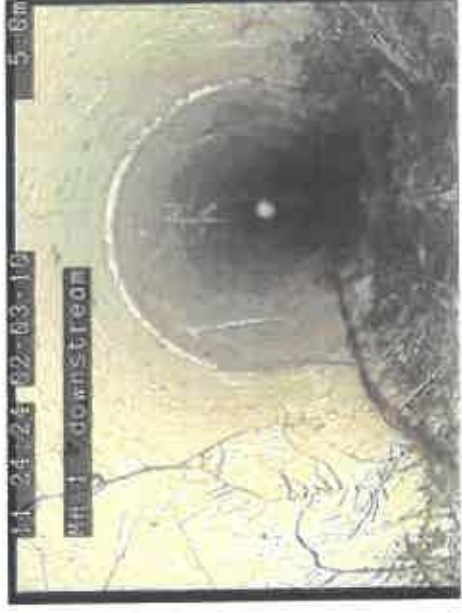
ctd.....

Rwp 4 at the rear of the building discharges directly into the ground with the underground drain found to be full of soil and debris and ineffective.

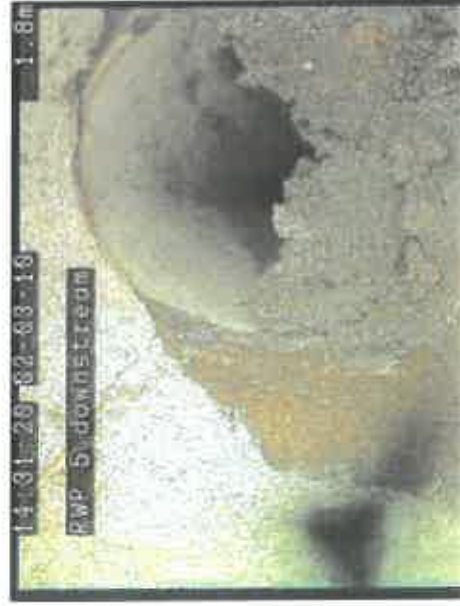
On the right hand side of the church, Rwps 5 and 6 discharge to soakaways approximately 5 –6 metres away.

Rwp 7 was found to be full of debris and ineffective.

End of Survey Report.









RWP 1



RWP 3