



CUSTOMER SERVICES DIVISION

GUIDELINES

FOR

DESIGNERS

**BUILDING AND CONSTRUCTION WORKS
WITHIN PROXIMITY
TO
CORPORATION SERVICES**

September 2000

FOREWORD

This document provides guidelines for the structural protection of Corporation water, sewer and drainage services, and requirements for access to those services, where building or construction activities are carried out in their proximity.

The document does not cover other asset protection issues such as the requirements for sizing and placement of service connections nor industrial waste discharges. These aspects should be separately negotiated with the Corporation.

The document was prepared as a means of maintaining communication with designers. It seeks to promote a consistent and methodical approach towards building and construction works in proximity to Corporation services. It is, however, only a set of broad guidelines and does not remove the need for careful consideration, and the detailed design, of individual building or construction proposals. It also does not replace the need for compliance with any regulatory requirement for the design. These are clear responsibilities of the designer, and the issue of this document does not reduce or transfer those responsibilities.

A handwritten signature in black ink, appearing to read 'Graham Cargeeg', written in a cursive style.

Graham Cargeeg

A/GENERAL MANAGER CUSTOMER SERVICES

September 2000

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1 DOCUMENT MANAGEMENT

1.1 Ownership

This document remains the property of the Water Corporation (Western Australia) and shall not be reprinted by others, either in part or in full, without the prior written authorisation of:-

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1.2 Standards

This document complies with the Customer Services Division's Standards for the Preparation of Documents, which are based on the AS 3900 series of Australian Standards.

1.3 Responsibilities

- (a) The Water Corporation's Manager Customer Technical Services is responsible for approving the original issue, and all re-issues and revisions of this document.
- (b) Approval of the document and any revisions is shown on the Revision Status Summary Sheet (Table 1.1 - Section 1.4) under the heading "Approved By".
- (c) Any suggestions in relation to the use of this document and its contents should be addressed in writing to:-

Manager, Customer Technical Services
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1.4 Revision Status

The following table contains a summary of the revision status of this document.

Table 1.1 - Revision Status Summary Sheet

Rev. No	Date of Issue	Description	Approved by
0	September 2000	Original document finalised	G. Finch

Refer to Glossary of Terms for definition of "Approved by".

A detailed Revision Status Sheet is attached at Appendix 1.

2 SUMMARY

2.1 Overview

The Water Corporation is responsible for the maintenance and operation of water, sewerage and major drainage systems within its operating area. These services are utilised by the community and it is important that they be protected from any undue effects of building and construction activity. The guidelines are provided to assist you in developing an appropriate design that protects against:-

- undue restriction of access to water, sewer and drainage services,
- physical damage to water, sewer and drainage services,
- physical damage to structures on the property,
- undue structural load on water, sewer and drainage services, and
- undue costs for future maintenance or emergency repair to those services.

The guidelines identify the minimum requirements of the Corporation for the support of structures adjacent to or over its services. As a means of determining where action is required, and the nature of that action, this document:-

- classifies structures and activities, and
- seeks to take account of related risk factors both to the Corporation and property owners or developers.

The guidelines do not cover the requirements for sizing and placement of service connections nor industrial waste discharges. These are equally important issues and should be separately negotiated with the Corporation.

2.2 Potential Impact

Without implementation of these guidelines there would be a significant risk of damage or interference to important water, sewerage and major drainage services. In many cases access to those services would not be possible and this would be of detriment to the community and individual property owners.

All work and costs associated with the protection of services are to be funded by the owner/developer (who is disturbing the status quo). It is therefore better for the matter to have been considered at the initial design stage rather than immediately prior to commencement of work on site.

Our Customer Service staff will assist you if you require advice on the interpretation of requirements for your particular project.

2.3 Activities Subject to Protection of Services Action

These guidelines apply to any proposal to erect, construct or place any building, wall, fence or obstruction within proximity to any sewer, water or drainage service controlled by the Corporation.

2.4 Gravity Services

Gravity sewers are often, of necessity, in private land. They provide connection points to individual properties and their location is determined by both subdivisional layout and ground contours.

Stormwater drains controlled by the Corporation are larger in size and provide an outlet for local authority drainage schemes. They are therefore generally in dedicated reserves or public land, however, in some situations they may cross private land.

The location of services on private land may or may not be indicated by easements.

2.5 Pressure Mains

Water mains, water reticulation pipes, and sewer or drainage pressure mains, are, as pressure services, normally located in road reserves, pedestrian access-ways or dedicated reserves. In these cases building or construction activity may be within proximity even though at, or further away than, the edge of that reserve or access-way. In the unusual circumstance where such services are located within private property, without protection of an easement, the emphasis should be on their relocation, wherever practicable, to a road reserve, pedestrian access-way or dedicated reserve. Where this is not feasible, building is not permitted over the service and negotiations will seek to establish a deed of grant easement.

2.6 Important Considerations

The guidelines comment on the key factors that should be considered when assessing a building or other construction proposal for protection of services action. The action required may be more extensive and may vary greatly from one project to another.

Aspects to be considered include the nature of the building or structure and whether it is intended for habitable or other use. Risk should be considered and the need for protection against structural loads and impact loads, methods of construction, access for future maintenance, headroom and soil cover, protective covers in vehicular traffic areas and anchoring of services to prevent flotation.

Most local authorities require that a Professional Structural Engineer be used for footing and major retaining wall design, and that a compaction certificate be obtained. These are detailed structural considerations that are the responsibility of the designer.

2.7 Overall Approach

The Corporation may require building works within the zone of influence to have special footings or access tunnels. The requirements for tunnels are included in the guidelines, however, it is stressed that all efforts should be made to avoid building over Corporation services. In summary the guidelines identify that, where protection of services action is required, consideration is to be given in the following order:

- Relocation of the proposed structure.
- Relocation of the Corporation service.
- Provision for structural support and access.

The full costs associated with protection of services action shall be borne by the owner/developer. This does not include costs for normal maintenance, replacement or repair of the Corporation's service where those costs would have been incurred in any event. It may, however, include the construction, amplification, replacement or relocation of a Corporation service where those works are necessary to offset the effect of the owner/developer's proposed works.

The attitude taken towards building proposals will primarily depend on the service type, size and depth. The guidelines identify (for gravity, vacuum and pressure pipes):-

- the method of determining if the proposed work will be within proximity of the Corporation service,
- the need to avoid placement of buildings over or in close proximity to pressure mains and larger services, and
- requirements for special footings/piles and/or access to the Corporation's service (footings/piles are to be taken at least 300 mm below the zone of influence or to refusal in unexcavated solid rock).

Certain works are exempted from these requirements, however, only where specific conditions are met. The conditions are set out in the guidelines and include aspects such as maintenance of soil cover over services and access to access chambers, inspection shafts and inspection openings.

Areas where fixed machinery or heavy equipment is, or is likely to be installed are not treated as exempt. No commercial or industrial building is to be treated as exempt.

2.8 Specific Structures

The requirements for specific structures may be identified by using Appendix 4. This cross-references the user to detailed graphs in Appendix 5 and diagrams in Appendix 6. The guidelines identify the approach that should be taken with each of the following:

- Habitable structures
- Commercial and industrial
- Fixed machinery and/or heavy equipment installations
- Industrial storage tanks
- Outbuildings
- Carports, residential garages and patio additions
- Buildings with basements
- Fences and garden walls
- Retaining walls
- Structures supported by retaining walls
- Swimming pools and spas
- Surface treatments
- Other utility and private services

2.9 Structural Footings and Support

The guidelines identify the Corporation's requirements for each of the following:

- Cantilevered footings and floor slabs.
- Pipes through walls and other structures.
- Pipes slung under ceilings.
- Situations where pipes are shallower than the proposed structure.
- Situations where corrective support (underpinning) is required to structures

It is the responsibility of the certifying Structural Engineer to design suitable footings and structural support for the proposed works. *Corporation staff will not provide advice on specific aspects of structural design.*

3 INTRODUCTION

3.1 Purpose

This guidelines document identifies the need to protect assets operated by the Corporation from the effects of building and construction activities. It is intended to provide a means of ensuring an appropriate level of protection to community sewers, stormwater drains, water mains and reticulation pipes.

Of necessity, and as permitted by the legislation governing operation of the Corporation, those assets are often located on, or are often in close proximity to, private land. Stormwater drains are normally in dedicated reserves or, in certain cases, within easements negotiated over private land. Not all services within private land, however, are indicated by easements.

3.2 Scope

These guidelines apply to any building or construction activity, on private or other land, that has potential to affect the integrity of Water Corporation services or access to those services. The guidelines do not cover other asset protection issues such as the requirements for sizing and placement of service connections nor industrial waste discharges. These aspects should be separately negotiated with the Corporation.

As a means of determining where protection of services action is required, and the nature of that action, this document:-

- classifies structures and activities, and
- determines the requirements for special foundations based on associated risk factors, and the need to prevent interference or damage to Corporation assets.

4 COMMENCEMENT OF WORK

Following receipt of the completed building plans for the project together with any related fees and application for services-

- we will, within 7 days, return a copy of the plan with written directions in relation to our water supply, sewerage, drainage or irrigation services.

Redesign is normally required where plans have been finalised without appropriate action having been taken in relation to protection of services. This can incur considerable delays for the project and frustration for your client. **You are therefore urged to liaise closely with the Corporation to clarify protection of service requirements as part of the design process.**

5 CRITICAL ISSUES

5.1 Building and Construction Activities

The potential impact of building and construction activities should be considered at the design stage. In particular, care should be taken to avoid the following:

- Restriction of access to water, sewerage and drainage services.
- Physical damage to water, sewerage and drainage services.
- The imposition of undue structural load on water, sewerage and drainage services, thereby reducing their effective life and complicating future access.

5.2 Designers

It is important to appreciate that this document is provided only as a guide to designers in identifying the minimum requirements of the Corporation for protection of its services. The document does not seek to cover all aspects of the design process, as these are clearly matters for the designer.

5.3 Costs

All costs associated with action to protect services are a responsibility of the owner/developer, who is disturbing the status quo. It is therefore better for the matter to have been considered at the initial design stage rather than immediately prior to commencement of work on site.

Refer to section 7.1(d) for further detail.

6 APPLICATION OF THESE GUIDELINES

6.1 Defining Proximity

Proximity is defined by this document and in particular by its Appendices 4, 5 and 6.

Water mains, water reticulation pipes, and sewer or drainage pressure mains, are, as pressure services, normally located in road reserves, pedestrian access-ways or dedicated reserves. In these cases building or construction activity may be within proximity even though at, or further away than, the edge of that reserve or access-way.

In the unusual circumstance where such services are located within private property, without protection of an easement, the emphasis should be on relocation of the service, wherever practicable, to a road reserve, pedestrian access-way or dedicated reserve. Building is not permitted over pressurised services.

Stormwater drains controlled by the Corporation, being larger sized services, are normally in dedicated reserves or public land although in certain cases they may be on private land and protected only by an easement

The location of services on private land may or may not be indicated by easements.

6.2 Important Considerations

Key factors to be considered when assessing a building or other construction proposal for protection of services action may vary greatly from one project to another. Typical aspects are as follows:

- (a) The need to ensure that structural load from any building or construction within proximity to a Corporation service is, where required by these guidelines, taken to a level where its influence falls below the service.

The most appropriate arrangement for footings and on-ground slabs should be considered. A raft slab/footing arrangement may provide better distribution of the overall load rather than a series of point loads from separate footings. The type of design to be used is ultimately, however, a matter for the Design Engineer to determine.

The nature of the ground should be taken into account in order to ensure the structural integrity of any on-ground floor slabs and footings. The Water Corporation does not require any confirmation of compaction as this is a local authority and design matter. Local authorities normally require that a Professional Structural Engineer be used for footing and major retaining wall design, and that a compaction certificate be presented.

- (b) Settlement and the shearing effect of buildings or structures close to, or over, a Corporation service.
- (c) Cantilevered footings (refer sections 7.6.9 and 8.2) shall be designed to allow removal of soil within the zone of influence (refer Appendices 2 and 5). Soil anchors (refer section 8.5 and Appendix A3) shall not be placed within the zone of influence.
- (d) Soil or ground characteristics (rock clay or sand and whether dry or wet).
- (e) Potential for natural or accidental flooding of the structure and any need for:-
 - drainage of service access tunnels or enclosures provided for protection of the Corporation service, and
 - any requirements for anchoring of the service to prevent flotation as a result of flooding.

- (f) Permanency of the affected components of the building or structure and whether intended for habitable or continuous use. This would affect the attitude taken towards any prospect of future dismantling or demolition to enable service repair or replacement.
- (g) Any prospect of undermining the Corporation's service as work progresses.
- (h) Impact (dynamic) loads as work progresses (eg. vehicle loads, pile driving and site compaction).
- (i) Method of carrying-out the work (eg. excavated access ramps, soil stockpiles restricting access).
- (j) Sufficient headroom is required to be maintained at all times over any Corporation service. Requirements are specified by section 7.2.1(d) and, for tunnels, by section 7.4 and Appendix 3.
- (k) The need for access to access chambers, inspection shafts and inspection openings. This should include consideration of any need for sleeving or internal access to the pipe service. Corporation access should be possible 24 hours/day every day of the year via the property in which any Corporation access chamber, inspection shaft or inspection opening is located. An accessway of at least 900 mm width is required. The gaining of access past security systems is not a matter covered by these guidelines.
- (l) No part of any structure or installed equipment shall be within a zone extending 1.5 metre horizontally from the:-
 - centre-line of any Corporation sewer inspection shaft, rising shaft or inspection opening, or
 - from the centre-line at any Corporation access chamber.
- (m) Where a Corporation sewer passes between structures on a single lot (not a strata lot) at least 2.4 metre clearance is to be maintained between those structures. This condition does not apply where one or more of the adjacent structures is an exempted structure (refer section 7.7) or a boundary fence.
- (n) Any need to amend access chamber or inspection shaft levels, and to maintain required soil cover over pipes, where earthworks are to be carried out. Access chambers and inspection shafts should be brought to finished ground level with appropriate protective covers if in a vehicular traffic area. Corporation assets shall only be modified by the Corporation or its contractors.

6.3 Structural Design

The design is required to be carried out and certified/approved by a practicing Professional Engineer (as defined by the Building Code of Australia). The design is to include all drawings necessary for construction.

The Building Code of Australia defines a Professional Engineer as a person who is:-

- (a) if legislation is applicable - a registered professional engineer in the relevant discipline who has appropriate experience and competence in the relevant field; or
- (b) if legislation is not applicable -
 - (i) a Corporate Member of the Institution of Engineers, Australia; or
 - (ii) eligible to become a Corporate Member of the Institution of Engineers, Australia, and has appropriate experience and competence in the relevant field.

Certification/approval should be given by the original signature of the practicing Professional Engineer (also in these guidelines referred to as the Structural Engineer or the Design Engineer) who should be identified by printed name and company details.

7 PROCEDURES

7.1 Overall Approach Taken to Building and Other Proposals

In addition to other requirements of these guidelines, when considering proposals that require protection of services action the following approach is taken by the Corporation:

- (a) Priority is given to relocation of proposed structures such that they do not fall within proximity as defined.
- (b) Where relocation of the proposed structure/s is not practicable, consideration is given to relocation of the Corporation's service such that no further protection of services action is required. This would only be expected to occur however, where it was cost effective. It should not simply transfer the problem to another property (unless by formal agreement between both landowners).
- (c) Where neither (a) nor (b) are practicable, design of the structure shall be such that the requirements for structure and pipe support, and access, are met. This may involve replacement of the Corporation's service and/or, for vitrified clay (VC) pipes, its encasement in concrete. Consideration may also be given to the use of a carrier pipe to act as a sleeve for insertion of the service.

- (d) The full costs associated with protection of services action shall be borne by the owner/developer. This does not include costs for normal maintenance, replacement or repair of the Corporation's service where those costs would have been incurred in any event. It may, however, include the construction, amplification, replacement or relocation of a Corporation service where those works are necessary to offset the effect of the developers proposed works.
- (e) Any construction, amplification, replacement or relocation of a Corporation service shall be:
- for sewers, in accordance with the Corporation's Wastewater Manual,
 - for main or reticulation pipes used for the purposes of water supply, in accordance with the Corporation's Water Design requirements, and
 - for drains, in accordance with the Corporation's Urban Drainage Manual.
- (f) Any work on a live sewer, including concrete encasement, shall be carried out by experienced Corporation personnel or contractors approved by the Corporation for such work.
- (g) Private building or construction activities are not permitted within any drainage reserve or land owned by the Corporation.

7.2 Examination of Building Plans

Building plans are assessed at the same time application is made for connection to our services. The assessment determines any impact on those services (sewers, stormwater drainage pipes, water mains or reticulation pipes). Our commitment is to confirm our requirements in writing within 7 days after the receipt of the plan and prescribed fee.

We would, however, prefer to discuss your requirements at the design stage (prior to the preparation and formal submission of building plans).

In order to enable correct assessment of proposals, levels shown on design plans are required to be to the Australian Height Datum (AHD). This is a standard reference datum that is used for Corporation service plans and shall be used by Structural Engineers when submitting structural support drawings for assessment.

The attitude taken towards building proposals primarily depends on the service type (gravity, vacuum or pressure), size and depth. Consideration may also be given to the factors in section 6.3 and the nature of the proposed building works. Major construction activities (see section 7.4) may require more detailed consideration. In general, however, the following requirements can be applied to any building works:

7.2.1 Gravity pipes

Where the Corporation's service is a gravity pipe, required footing depths are determined by reference to Appendices 4, 5 and 6. These are based on the following approach:

- (a) Determine the shortest distance between the centre-line of the Corporation's service and:-

- the outer leaf of wall cladding for cottages with standard footings, or
- the edge of the footing for other developments.

The centre-line of the service is indicated on Corporation as-constructed plans. It should be used whether or not the service is concrete encased.

- (b) Determine the vertical depth of the Corporation's service below the:-

- finished ground surface level for cottages with standard footings, or
- for other developments, the base of the proposed footings.

The level of the service is its invert level to AHD.

- (c) If the depth determined by (b) is more than the following, protection of services action will be required:

- For 150 mm and 225 mm pipes, distance (a) minus 600 mm.
- For 300 mm to 600 mm pipes, distance (a) minus 1000 mm.

For cases involving larger pipes and other soil conditions an assessment by our engineering staff is required. This will confirm any additional requirements of the Corporation for protection of its services.

- (d) Action will also be required where at least the following vertical clearance between the finished ground level above the service and the underside of any slab (or other part of the structure) is not maintained by the proposed design:-

- For 150 mm to 300 mm pipes, 2.4 metres
- For 375 mm to 600 mm pipes, 2.8 metres.

Larger pipes shall not be built over at any time.

- (e) Where protection of services action is required due to the proposed building or building alteration being in proximity to the Corporation's service reference should be made to Appendix 5 as follows:-

- Where the proposed work falls within the zone of influence special footings/piles and/or access to the Corporation's service may need to be provided. Footings/piles are to be taken at least 300 mm below the zone of influence or to refusal in unexcavated solid rock. The Structural Engineer responsible for the work shall confirm in writing that this has been achieved.

Note: The Structural Engineer may opt to use friction piles. These rely, at least in part, on friction over their buried length for support. Only the length below the zone of influence should be taken into account for this aspect of the design.

- Where the proposed work falls within the zone of construction, but not within the zone of influence, special footings/piles will not be a requirement of the Corporation.

It is important to ensure either that ground compaction is adequate for the proposed works or that consideration is given to this as part of the structural design process.

7.2.2 Vacuum Pipes

At this stage vacuum sewer pipes are not in common use by the Corporation. They are normally only of small diameter and at shallow depth. Repositioning may be possible, however, if this is not the case they should be treated in the same manner as 150 mm to 300 mm gravity pipes (refer 7.2.1).

Advice should be sought from the Corporation where its vacuum pipes are in proximity to the proposed building or construction work.

7.2.3 Pressure pipes

Where the Corporation's service is a pressure pipe, requirements are determined as follows:

- (a) Determine whether the proposed building or construction work is within proximity. Proximity in this case is defined as within 1.5 m from the centre-line of the pipe (whether or not it is concrete encased). The centre-line of the pipe is indicated on Corporation as-constructed plans.
- (b) Proposals will be referred to our asset management staff where the proposed building or construction work is:-
 - within proximity, or
 - within 2 m of a Corporation pressure main located on private property.

- (c) Where action is required due to the proposed building or building alteration being in proximity to the Corporation's service:-
- No building works, other than exempted works, shall be permitted above the level of the pressure main and within an area extending horizontally 1.0 metre either side of the centre-line of the pressure main.
 - Building works, other than exempted works, within the balance of the zone of influence shall only be permitted in exceptional circumstances. In such cases, the structural load from the building shall be taken to a continuous strip footing with its base at a depth of at least 300 mm below the pipe invert. It shall support a continuous structural wall.
 - Building works within the zone of construction, but not within the zone of influence, are permitted without special footings being required by the Corporation.

It is important to ensure either that ground compaction is adequate for the proposed works or that consideration is given to this as part of the structural design process.

7.2.4 Open stormwater drains and compensating basins

Where any open stormwater drain or compensating basin operated by the Corporation is located other than in a dedicated reserve no building is permitted within 5 metres of either:-

- the top of the bank of the drain or compensating basin, or
- the floodway (or waterway) of a 1 in 10 year storm event.

Our customer service staff will refer drains in this category to the relevant asset management section within the Region to determine protection of service requirements. Piping of Corporation drains, at the proponent's cost, may be allowed in certain circumstances.

Designers need to ensure adequate compaction, where the proposed work is within the zone of construction of a piped main drain.

7.2.5 Building in easements and reserves

It should be noted that easements and reserves may provide future access rights for proposed services.



Private building within a Water Corporation reserve is not permitted. Building within an easement may be permitted subject to protection of service requirements being met. Application is required to build within an easement.

For strata developments, encroachment into an easement by an approved structure will require surrender of the affected portion of the easement at the strata titling stage. This is a Department of Land Administration (DOLA) requirement and is at the owner's cost.

7.3 Redevelopment of Existing Buildings

In cases involving the redevelopment of existing buildings, where only the building shell or portion of the building shell remains, the requirements for protection of services is normally negotiated with the owner or developer for an agreeable solution.

Replacement of the Corporation service, or concrete encasement of the service, may be necessary where it is in poor condition [refer section 7.1(d) for comment on funding].

7.4 Major Construction Activities

It is often the case that construction is either of a major type (eg. bridge construction and underpasses) or intended across most or all of a property. In these circumstances, and where it is not possible to either amend the proposal or relocate any Corporation services that are on the site, any requirements for protection of services that are not covered in detail by these guidelines must first be confirmed acceptable to the Corporation. Pressure services shall not be built over at any time.

All efforts should be made to avoid building over Corporation gravity sewers. However, where it is necessary to build habitable, commercial or industrial buildings, or major structures, over Corporation sewers, access tunnels that meet the requirements of Appendix 3 shall be provided. It should be ensured that Corporation access to the tunnel is possible at all times. Tunnels are not a requirement for exempted structures (see section 7.7).

7.5 Other Proposals

Where the proposed or completed work involves the erection, construction or placement of any of the following, individual consideration is given to each case:

- Any building other than a habitable, commercial or industrial building.
- Any wall, fence or obstruction that is not an exempt structure or activity as defined by section 7.7.

In general:-

- proximity is determined in the same manner as described in section 7.2.
- Corporation access to access chambers and inspection shafts to IS sewers shall be maintained at all times. Access shall be via the property or building in which the access chamber or inspection shaft is located. An accessway of at least 900 mm width is required.
- where it is accepted that a significant structure (ie. other than an exempted structure) may be built over a vitrified clay (VC) sewer the sewer shall be concrete encased under the structure and for an additional distance extending one (1) metre each side of the structure. Sewers of other materials do not need to be encased. Building over without tunnel access being provided to the Corporation's service, would normally only be acceptable where walls for the structure are transverse to the sewer and the structure is bridged across the zone of construction.

Specific requirements for other structures are listed in section 7.6.

7.6 Specific Structures

The requirements for specific structures may be identified by using Appendix 4. This cross-references the user to detailed graphs in Appendix 5 and diagrams in Appendix 6.

Where a proposed structure is not covered by Appendix 4 it should be referred to the Corporation for advice. Some examples are radio masts, bridges, grandstands and wheat silos.

7.6.1 Habitable

Habitable buildings are classed as residential and are treated differently depending on whether they are multi-storey or single-storey within the zone of influence.

Consideration is given to the ease with which a structure may be converted, without further reference, to a habitable area. Patios enclosed by three walls, games rooms, studios, facility rooms and darkrooms are all potentially habitable. They are therefore, even if detached from the main building, treated in the same manner as residential buildings.

If associated carports and garages under the main roof are assessed as potentially habitable they are treated in the same manner as the main structure. If they are assessed as not being potentially habitable, or are only attached to the main structure or are free standing they are treated as outbuildings.

7.6.2 Commercial and industrial

Commercial and industrial structures are treated in the same manner as single-storey residential buildings provided the wall height within the zone of influence is less than 4 metres. Where walls exceed this height they are treated in the same manner as multi-storey residential buildings.

7.6.3 Fixed machinery and/or heavy equipment installations

These are treated in the same manner as multi-storey residential developments, or commercial and industrial developments with sidewall heights equal to or greater than 4 metres.

7.6.4 Industrial storage tanks

These are treated in the same manner as an industrial or commercial structure where above ground. They are treated in the same manner as a basement or swimming pool where below ground.

7.6.5 Outbuildings

Outbuildings are buildings not attached to the main building.

They are typically non-habitable structures such as private garages, aviaries, garden sheds and private workshops. These are of less concern than habitable, commercial and industrial buildings as they can often be dismantled or demolished and rebuilt to allow access to the sewer.

The approach taken with outbuildings of this type is based on their construction and the total area of the structure. Assessment is based on the total area, rather than the area within the zone of influence, as the total area dictates or limits the possible usage of the building. Also, removal of the total structure would normally be required when replacing the sewer.

A framed structure of 40 m² or less in area is exempted from any requirement for special footings. Framed structures of more than 40 m² in area; and structures constructed of brick, block or precast components, are not exempt.

Special purpose outbuildings or structures such as those for transformers, tanks and fixed plant are treated in the same manner as commercial and industrial buildings.

7.6.6 Residential carports, garages and patio additions

Where integral with the main structure and assessed as potentially habitable, these are, as noted in section 7.6.1, treated in the same manner as the main structure. If they are assessed as not being potentially habitable, or are only attached to the main structure or are free standing they are treated as outbuildings.

7.6.7 Buildings with basements

Care should be taken with basements within the zone of influence in that they may be to a level lower than the adjacent sewer. The builder should be made aware of the need to maintain access to the sewer (refer section 8.5) and the risk of undermining the sewer during construction.

7.6.8 Fences and garden walls

Fences and garden walls (not retaining walls) are only considered for protection of services action where they are of mass construction and exceed 1.8 metres in height (distance between finished ground level and top of wall or fence). Those constructed of brickwork, concrete or limestone are examples of mass walls/fences.

Garden walls/fences designed for dismantling, such as post and rail, sheeting and precast components, are exempt from any requirement for special footings.

7.6.9 Retaining walls

Typically retaining walls may be reinforced and mass concrete (cast in-situ), precast interlocking components or limestone. Local authority (shire council) approval is not normally required where a retaining wall is to be less than or equal to one (1) metre in height. You should, however, check with your local authority in relation to its requirements.

Other than in respect to the maintenance of access to access chambers, inspection shafts and inspection openings [refer section 6.3 (n), (o) and (q)] the Corporation does not have any requirements for the footings of walls of less than or equal to 1.2 metre in height. For precast interlocking components, however, this figure is increased to 1.8 metre in height.

For retaining walls exceeding this height (1.2m or 1.8m as relevant), limitations are placed on the horizontal separation between the centre-line of the sewer and the toe or heel of the wall, as appropriate (see Appendix 6). In addition, the builder should be made aware of the need to maintain access to the sewer and any prospect of undermining the sewer during construction (refer section 8.5).

Cantilevered footings are often used for larger retaining walls and the weight of the soil above the cantilevered section of the footing prevents overturning of the wall. Cantilevered footings should be designed such that they allow for removal of soil within the zone of influence (refer Appendices 2 and 5).

7.6.10 Structures supported by retaining walls

Structures supported by retaining walls, even where they are integral with the retaining wall, should be considered separately and in accordance with these guidelines. The structure may or may not be exempt.

Where a structure of this type is not exempt the retaining wall is considered to be part of the footings of the structure.

7.6.11 Swimming pools and spas

Generally swimming pools and spas require local government approval before work commences. It is recommended that you determine any local authority requirements prior to commencing design. Typically swimming pools and spas may be concrete, fibreglass or poly-lined. They may be above or below ground, or partially above/below ground. Above ground pools and spas are, subject to section 7.7, treated by these guidelines as exempted structures.

Swimming pools are generally installed with a horizontal lip at the surface. This is integral with the pool sidewall and would affect access to an adjacent sewer. For this reason, and as dimensions on building plans are normally shown to the inner edge of the pool side wall, the zone in which building is not permitted is increased by the lip width or, where the lip width is not known, by 300 mm. The diagrams in Appendix 7 refer.

Paving around pools, provided not integral with the pool or adjoining structures, is treated as a surface treatment (refer section 7.6.12).

Care should be taken during the construction of below ground pools as ramping into an excavation could result in damage to services. Pool builders should therefore be made aware of the location of services in the vicinity. They should be made aware of the need to maintain access to those services and the prospect of undermining them during construction (refer section 8.5).

Below ground concrete pools are usually designed to act as retaining walls so that they do not collapse when the pool is emptied. Pools are normally emptied when excavating adjacent to them for sewer installation, maintenance or repair. It is not necessary to design a pool to allow excavation without emptying the pool. You may, however, opt to design the pool in this way where continued use of the pool is important (eg. public swimming pools and hotel developments).

7.6.12 Surface treatments

Typical surface treatments are concrete, bitumen, paving, blockwork and gravel. The Corporation does not have any specific requirements for surface treatments other than in respect to the maintenance of access to access chambers, inspection shafts and inspection openings [refer section 6.3 (n), (o) and (q)], and soil cover over pipes (refer section 7.6.13).

7.6.13 Alteration of surface levels

On private property at least 750 mm of soil cover is to be maintained at all times over Corporation sewer mains, and 600 mm over water mains. If this is not achievable then:-

- sewer pipes are, where the soil cover is inadequate, to be protected by concrete slabs (capable of supporting the imposed loads and bridging the service) approved by the Corporation, or concrete encased by an approved licensed plumber, and
- water mains are to be lowered by the Corporation at the owner's cost.

In other areas the cover to sewer mains is to comply with the Water Corporation Wastewater Manual, and the cover to reticulation water mains is to comply with the Water Supply Reticulation Manual.

7.6.14 Other utility and private services

All efforts should be made to avoid the placement of other utility or private services within the zone of influence. Crossings should be made at right angles to the Corporation service wherever possible. This is not, however, a requirement for minor private water and stormwater drainage pipes.

When electrical, gas or telephone mains or cables are approved within a Water Corporation easement suitable protection is required to be provided for its maintenance personnel. This may include concrete slabs laid 200 mm above those mains or cables, and plastic ribbon that describes the type of main or cable laid along the line of the main or cable and above the slabs.

Any proposed creation of, or alteration to, public roads and railway lines should be referred to the Corporation for assessment of service protection needs and the programming of any works required.

Reference should also be made to the Utility Providers' Code of Practice as reprinted on 16 February 2000.

7.7 Exempted Structures and Activities

For any property, the following structures and activities are **(subject to the conditions at the end of this section)** exempted from any requirement to provide special foundations:

- (a) Pergolas.
- (b) Demountable above ground swimming pools and spas.
- (c) Any framed structure, with or without cast-in-situ concrete floors, that has a total area of 40 m² or less and is one of the following:
 - An attached or freestanding carport, residential garage or patio addition.
 - An outbuilding (ie. not attached to the main building).
 - A carport or garage under the main roof that is assessed as not being potentially habitable.

Special purpose buildings that are intended for transformers, tanks, fixed plant and the like shall not be treated as exempt.

- (d) Garden walls/fences less than 1.8 metres in height. The height being the distance between finished ground level and the top of the wall or fence, not including the height of any supporting retaining wall.
- (e) Garden walls/fences that are designed for dismantling, such as post and rail, sheeting and precast components. These may or may not be supported by a retaining wall (which should be considered separately under these guidelines).
- (f) Retaining walls of less than 1.2 metre height or, for precast interlocking components, 1.8 metre in height (the wall may, or may not, support an exempted structure). The wall height is the distance between the finished ground level at the base of the wall and the top of wall.
- (g) Surface treatments. These are typically concrete, bitumen, paving, blockwork or gravel.
- (h) Earthworks and landscaping, barbecues, domestic fishponds and domestic fountains.
- (i) Other utility and private services. Although these are classed as exempt all efforts should be made to avoid the placement of significant services within the zone of influence. Crossings should be made at right angles to the Corporation service wherever possible.

However, only where each of the following conditions is met:

- It does not provide structural support to a non-exempt structure.
- Sufficient soil cover is maintained over any main sewer to meet the requirements of the Corporation's Wastewater Manual or water main to meet the requirements of the Corporation's Water Supply Reticulation Manual.
- Access chambers, inspection shafts and inspection openings are not built over and remain accessible in accordance with sections 6.3(n), (o) and (q) of these guidelines. Access to Corporation inspection shafts and inspection openings may alternatively be via tunnels as described in item 11 of Appendix 3.
- The levels of access chambers and inspection shafts are adjusted where necessary due to changes in ground level.

Areas where fixed machinery or heavy equipment is, or is likely to be installed shall not be treated as exempt.

8 STRUCTURAL FOOTINGS AND SUPPORT

8.1 Acceptable Types

It is the responsibility of the certifying Structural Engineer (refer section 6.4) to design suitable footings and structural support for the proposed works. *Corporation staff will not advise on specific aspects of structural design.*

It is the designer's responsibility to ensure that ground conditions are acceptable for the final design [refer sections 6.3(a), 7.2.1(e) and 7.2.3(c)].

In all cases, other than for exempted structures, piles or footings must extend at least to a level 300 mm below the zone of influence or to refusal in unexcavated solid rock. The Structural Engineer responsible for the work shall confirm in writing that this has been achieved.

In certain situations, as outlined in section 7.2.3 continuous strip footings supporting a structural wall may be required.

8.2 Cantilevered Footings

Cantilevered footings rely on the soil above them for support. They are often used for larger retaining walls (refer section 7.6.9) and the weight of the soil above the cantilevered section of the footing prevents overturning of the wall.

Cantilevered footings should be designed such that they allow for removal of soil within the zone of influence (refer Appendices 2 and 5).

8.3 Pipes Through Walls and Other Structures

Provision shall be made to protect against settlement and the shearing effect of buildings or structures close to, or over, Corporation services.

A compressible foamed plastic insert or similar is normally acceptable as a means of filling the space between the pipe and the building or structure. Sufficient clearance should be allowed for settlement to occur without damage to the Corporation's service. Typically clearances of 50 to 80 mm would be allowed, however, the actual dimensions could only be determined based on the Structural Engineer's assessment of long-term building or structure settlement.

8.4 Pipes Slung Under Ceilings

In certain cases involving major construction across all or most of a site a Corporation gravity sewer may be slung from the underside of a basement ceiling (eg. underground car park). In these cases the designer of the building is also responsible for the design of support straps and integrity of the sewer.

The sewer should be supported at each joint and at intervals that ensure maintenance of the required grade without deflection even where the pipe is full (eg. during blockages). The spacing of pipe supports should not exceed that recommended by the pipe manufacturer.

8.5 Pipes Shallower than Structure

This may occur where a retaining wall, swimming pool or basement to a proposed structure is taken to a level below the Corporation sewer invert. The builder should be made aware of the need to maintain access to the sewer and the prospect of undermining the sewer during construction.

Soil anchors (soil nails) are not to be installed over Corporation services, and they are not to rely on any soil within the zone of influence. Soil anchors support retaining walls and tunnel or basement sidewalls by using the frictional restraint of the soil in which they are placed. They are placed in the soil before backfilling or are drilled, concreted and then post-stressed. The use of soil anchors is often considered a construction technique and they are not always shown on design plans. Designers, however, should take account of this when designing structures in proximity to Corporation services.

8.6 Corrective Support of Structures

Underpinning of structures may be necessary where construction has commenced without provision of footings to the required depth. Underpinning of existing structures may be necessary during construction of the proposed works.

Corporation staff will not provide detailed advice on the methods whereby underpinning may be achieved. Applicants seeking approval of building proposals are, in regard to this issue, only advised that:-

- a Structural Engineer is required to ensure that appropriate remedial action is taken where construction has already commenced without provision of footings to the required depth,
- structural support meeting the Structural Engineer's requirements is to be taken at least to the required level (as dictated by these guidelines),
- the requirements of these guidelines (particularly in regard to maintaining the nominated clearance from the centreline of the sewer, or alternatively providing an access tunnel) are still to be met,
- all costs are with the owner/developer, and
- a plan is to be submitted for examination by the Corporation.

8.7 Cantilevering of Above Ground Floor Slabs

Above ground floor slabs may be cantilevered to form balconies or verandahs. Alternatively columns or posts may support the slab projection. In cases involving verandahs over footpaths, water mains and service connections may be affected.

Protection of service requirements should be determined based on the location of building walls and posts/columns relative to Corporation services. Where the proposed structure is within proximity then action shall be taken in accordance with these guidelines. An above ground floor slab may only be cantilevered over a Corporation service where:-

- the service is of 300 mm or less diameter, and
- the required 2.4 m headroom (distance between finished ground level and underside of slab) is maintained at all times over the service [see section 7.2.1(d)].

In certain situations columns or posts are not structural as they are suspended from a cantilevered slab or independent of the slab. This type of structure is often built to maintain aesthetic appeal and to ensure compatibility with other existing buildings, which is often a requirement in some older areas.

It is not possible, however, when the Corporation processes building plans to identify that the posts or columns are purely decorative. If the building is self-supporting when the posts or false columns are removed certification to this effect is required from the Structural Engineer. Piles to the posts or false columns are not then required.

8.8 Cantilevering of Ground Floor Slabs

Cantilevering of ground floor slabs is permitted up to, but no further than, the sewer centreline, and only if all other alternatives have been exhausted.

The cantilevering of ground floor slabs must be supported by a continuous wall supported on a strip footing to at least 300 mm below the sewer invert level. A ground floor slab may only be cantilevered over a Corporation service where:-

- the service is of 300 mm or less diameter, and
- at least 1.2 metre of headroom (distance between pipe invert and underside of slab) is maintained at all times.

This is intended to allow ensuites, walk-in-robos, bedrooms and similar domestic areas to be cantilevered. It is not the intention to allow cantilevering for the full length of a building.

9 REFERENCES

- Building Code of Australia.
- Country Areas Water Supply Act 1947.
- Country Areas Water Supply By-laws.
- Country Towns Sewerage Act 1948.
- Country Towns Sewerage By-laws.
- Metropolitan Water Supply, Sewerage and Drainage Act 1909.
- Metropolitan Water Supply, Sewerage and Drainage By-laws.
- Utility Providers Code of Practice for Western Australia (16 February 2000).
- Water Agencies (Powers) Act 1984.
- Water Corporation Wastewater Manual.
- Water Corporation Urban Drainage Manual
- Water Corporation Water Supply Reticulation Manual.



APPENDIX 1 - REVISION STATUS SHEET

Section No.	Revision No.	Page No.	Section Title or Description	Date of Issue
All	0	All	Original issue	September 2000



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APPENDIX 2 - GLOSSARY OF TERMS

Approved by: The senior officer who is currently occupying the position nominated in Section 1.3 (Responsibilities) and who, prior to issue, approves all additions or revisions to this document.

CAWS Act: The Country Areas Water Supply Act 1947.

CTS Act: The Country Towns Sewerage Act 1948.

Design Engineer: A “Professional Engineer” as defined below.

Developer: The person/s or company carrying out, or responsible for, building works or property improvements on private or other land.

Easement: An area of land identified on the title documents and normally having certain conditions or restrictions applied. A deed of grant easement requires a document (the deed of grant) to identify the parties that have a legal right of access to the affected area of land and any associated terms. Other easements may simply notify the existence of services on the land.

IS Sewer: A length of sewer with an inspection shaft at the upstream end and a junction at the downstream end.

MWSS&D Act: The Metropolitan Water Supply, Sewerage and Drainage Act 1909.

Professional Engineer: As defined by the Building Code of Australia. This defines a Professional Engineer as a person who is:-

- (a) if legislation is applicable - a registered professional engineer in the relevant discipline who has appropriate experience and competence in the relevant field; or
- (b) if legislation is not applicable -
 - (i) a Corporate Member of the Institution of Engineers, Australia; or
 - (ii) eligible to become a Corporate Member of the Institution of Engineers, Australia, and has appropriate experience and competence in the relevant field.

Reserve: An area of land set-aside for a specific purpose or purposes and owned by the Water Corporation. The reserve may provide for the future installation of services.

Structural Engineer: A “Professional Engineer” as defined above.

Zone of Influence: Zone in which building restrictions may apply or where special footings/piles may be required in order to protect Corporation services from the impact of building works.

Zone of Construction: Defines proximity and is the zone in which land has or may have been disturbed as a result of construction of a Corporation service.



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APPENDIX 3

GUIDELINES FOR ENCLOSING SEWERS IN TUNNELS

1. Enclosing sewers in tunnels should be considered as an option that is secondary to relocation of the obstruction or diversion of the sewer. Tunnelling does not provide an ideal solution and should only be considered as a last resort.
2. Depending on the age and condition of the sewer to be tunnelled, complete replacement of the sewer may be required as a condition of tunnelling. An increased diameter of pipe may also be required. These requirements will only be imposed where considered necessary and no financial contribution from the Water Corporation will be made.
3. Tunnel size:
 - Sewer less than 1.5 m deep - Minimum size 1200 mm high x 900 mm wide
 - Sewer 1.5 m to 3.0 m deep - Minimum size 1200 mm x 1200 mm
 - Sewer 3.0 to 5.0 m deep - Minimum size 1800 mm x 1800 mm
 - If deeper - Individual assessment

The minimum clearance between the underside of the access tunnel roof slab (tunnel soffit) and the top of the Corporation's service, or its concrete encasement, shall be 0.9 metres. To achieve this clearance in a pipe tunnel, the minimum internal tunnel diameters are as follows:

Sewer internal diameter (mm)	150 - 225	300 - 450	600
Tunnel internal diameter (mm)	1200	1500	1650

4. The tunnel must be designed by a Professional Engineer experienced in the area. All designs must comply in every respect with the Water Corporation Wastewater Manual.
5. Tunnels constructed below the maximum level of the water table, or in areas subject to flooding, shall be fully watertight and designed to resist flotation at maximum water level and with the sewer removed. They shall be graded to easily accessible sumps to facilitate pumping out from ground level. Sewers shall be adequately restrained against uplift and lateral movement, and shall not be used as a means of preventing flotation.
6. Sewers in rectangular tunnels in dry ground shall be laid on a sand underlay with side support compacted to the level of the pipe centre. PVC sewers in rectangular tunnels in wet ground and in all pipe tunnels shall be laid on a 10:1 sand/cement bed up to the level of the pipe centre. Other sewer types shall be supported on a concrete block placed behind the socket of each pipe.

7. The ends of sewer tunnels are to be formed with a structural wall and shall be properly sealed off to prevent the ingress of soil, water and gas. Structural load on the sewer shall be avoided by using suitable compressible material between the sewer and the end wall of the tunnel. The designer is responsible for assessing long term settlement of the building or structure. Typically clearances of 50 to 80 mm would be allowed, however, the actual dimensions could only be determined based on the Structural Engineer's assessment of long-term building or structure settlement.
8. Access chamber access openings are to be provided at a spacing no greater than 100 metres along the tunnel length. At least one access opening is required for each tunnel and either a vent of at least 230 mm diameter or an access opening is to be provided within 1.5 metres of each tunnel end. Vents do not need to be taken to roof level as forced ventilation may be used when access is required. Vent and access chamber covers should be trafficable where appropriate.
9. Tunnel access chambers, including aspects such as ladders and covers, shall meet the requirements for access chambers as specified by the Water Corporation Wastewater Design Manual. Holes cut into the soffit of a culvert to allow access are not acceptable.
10. Access openings to a tunnel should not be in an enclosed area and shall be sited to allow Corporation access for 24 hours/day every day of the year via the property in which the access chamber is located. At least 900 mm wide access is required.
11. Existing property connections shall, wherever possible, be relocated such that they are in accessible locations outside of tunnels. Where this is not possible they shall be located in the corner of a tunnel access chamber. Unobstructed access to the inspection shaft is then required from within the access chamber and more than one property connection may be provided in each access chamber.
12. Soil anchors (soil nails) are not to be installed over Corporation services, and they are not to rely on any soil within the zone of influence. Soil anchors support retaining walls and basement sidewalls by using the frictional restraint of the soil in which they are placed. They are placed in the soil before backfilling or are drilled, concreted and then post stressed.

Approval to build over sewers of 300 mm or greater diameter should be obtained from the Water Corporation's Asset Management Group within the Region before proceeding with detailed design.

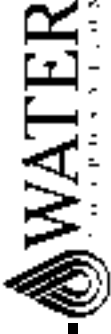
APPENDIX 4 - MATRIX TO IDENTIFY FOOTING DEPTH REQUIREMENTS FOR SPECIFIC STRUCTURES

ITEM	PROPOSED STRUCTURE	SEWER ENCASED		SEWER SIZE				SEWER MATERIALS				FOR REQUIRED FOOTING DEPTH		
		NO	YES	150	225	300 - 600	PVC	VC	AC	ALL	GRAPH	APPENDIX		
(A)	Residential single storey and commercial/industrial with less than or equal to 4 m wall height (excluding basement)	■	■	■	■	■	■	■	■	■	■	■	1	5
		■	■	■	■	■	■	■	■	■	■	■	3	5
		■	■	■	■	■	■	■	■	■	■	■	2	5
		■	■	■	■	■	■	■	■	■	■	■	5	5
(B)	Residential multi-storey and commercial/industrial with greater than 4 m wall height (excluding basement)	■	■	■	■	■	■	■	■	■	■	■	3	5
		■	■	■	■	■	■	■	■	■	■	■	1	5
		■	■	■	■	■	■	■	■	■	■	■	5	5
		■	■	■	■	■	■	■	■	■	■	■	4	5

■ Denotes situation that applies

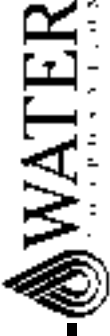
If the proposed structure is not covered by either the above or the following part of this matrix, or if it would be in proximity to a Corporation pressure main or water main, it will be referred to our regional asset management staff for advice. Approval to build over sewers of 300 mm or greater diameter should be obtained from the regional asset management group before proceeding with detailed design.

The required soil cover to pipes, and Corporation access to access chambers and inspection shafts to IS sewers, shall be maintained at all times. Access shall be via the property in which the access chamber or inspection shaft is located. An accessway of at least 900 mm width is required.

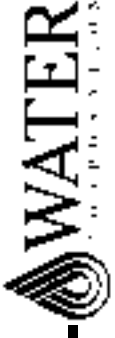


APPENDIX 4 (CONTINUED) - MATRIX TO IDENTIFY FOOTING DEPTH REQUIREMENTS FOR SPECIFIC STRUCTURES

ITEM	PROPOSED STRUCTURE		REQUIRED FOOTING DEPTH
	DESCRIPTION	SIZE OR TYPE	
(C)	Enclosed patios (3 walls), games rooms, studios, facility rooms and dark rooms (all are potentially habitable)	<p>Single storey structures of block, brick or precast construction</p> <p>Multi-storey structures of block, brick or precast construction</p> <p>Framed structures of 40 m² in area or less</p>	<p>As for residential single-storey (see item A on page A4.1)</p> <p>As for residential multi-storey (see item B on page A4.1)</p> <p>No requirements for footings</p>
(D)	Garages, carport and patio additions	<p>Integral (under main roof) & single-storey - potentially habitable</p> <p>Integral (under main roof) & single storey - not habitable</p> <p>Attached or free standing.</p>	<p>As for residential single-storey (see item A on page A4.1)</p> <p>150 and 225 mm sewers can be built over, provided footings taken to depth nominated for residential single-storey (see item A), and required headroom over As for outbuildings (see item E under)</p>
(E)	Outbuildings (structure not attached to main building) that are non-habitable structures such as garages, sheds and workshops	<p>Structures of block, brick or precast construction, and framed structures greater than 40 m² in area.</p> <p>Framed structures of 40 m² in area or less.</p>	<p>As for commercial/industrial buildings (see items A and B on page A4.1)</p> <p>No requirements for footings</p>



ITEM	PROPOSED STRUCTURE		REQUIRED FOOTING DEPTH
	DESCRIPTION	SIZE OR TYPE	
(F)	Special purpose outbuildings such as those for transformers, tanks and fixed plant.		As for commercial/industrial buildings with greater than 4 m wall height (excluding basement). See item B on page A4.1
(G)	Industrial storage tank	Above ground Below ground	As for commercial/industrial structures (page A4.1) As for basements
(H)	Buildings with basements		As for supported structure (also see sections 7.6.7, 8.3, 8.4 and 8.5)
(I)	Fences and garden walls	Less than or equal to 1.8 metre height Greater than 1.8 metre height	No requirements for footings As for commercial/industrial structures (page A4.1)
(J)	Retaining walls with precast interlocking components	Higher than 1.8 metre Lower than or equal to 1.8 metre	As for commercial/industrial structures (page A4.1) No requirements for footings
(K)	Retaining walls of other materials	Higher than 1.2 metre Lower than or equal to 1.2 metre	As for commercial/industrial structures (page A4.1) No requirements for footings
(L)	Structures supported by retaining walls		As for supported structure (also see section 7.6.10)
(M)	Swimming pools and spas	Below ground Above ground	Refer Section 7.6.11 and App. 6 No requirements for footings - See 7.6.11 and 7.7
(N)	Pergolas		No requirements for footings
(O)	Surface treatments		No requirements for footings
(P)	Earthworks and landscaping		No requirements for footings
(Q)	Barbecues, domestic fish ponds and domestic fountains		No requirements for footings
(R)	Other utility and private services		No requirements although placement over or in proximity should be avoided wherever possible



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APPENDIX 5

GRAPHS FOR REQUIRED DEPTH OF STRUCTURAL SUPPORT

BUILDING RESTRICTION ZONE



Indicates where building may not be acceptable without an access tunnel.

ZONE OF INFLUENCE

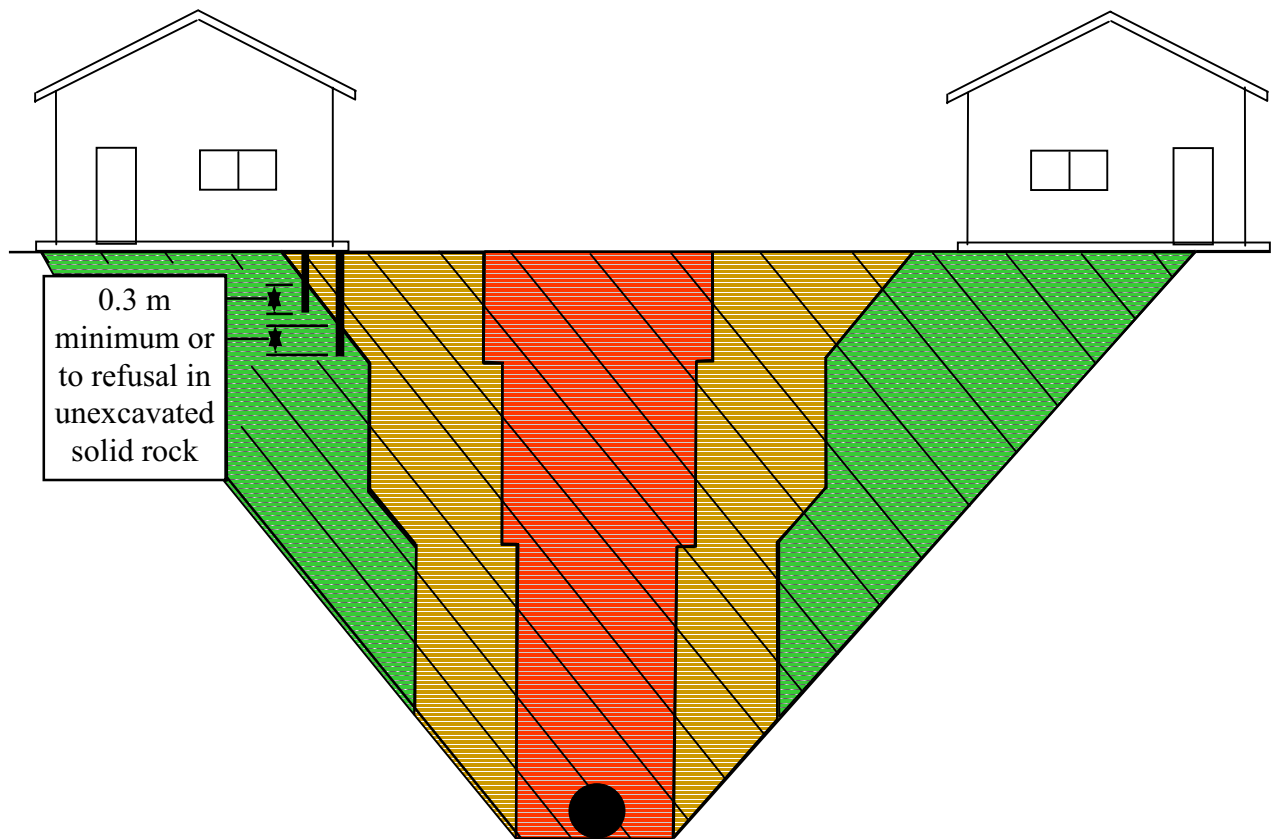


The zone in which building restrictions may apply or where special footings/piles may be required.

ZONE OF CONSTRUCTION



Indicates where land may have been excavated during construction of a Corporation service.




OWNERS AND/OR BUILDERS NEED TO CHECK GROUND CONDITIONS ARE SUITABLE FOR BUILDING PRIOR TO COMMENCEMENT

DRAWING NOT TO SCALE



GRAPH 1 ON THE NEXT PAGE APPLIES TO THE FOLLOWING COMBINATIONS OF STRUCTURE AND GRAVITY SEWER TYPE:

STRUCTURE TYPE	GRAVITY SEWER TYPE								
	ENCASED		SIZE			MATERIALS			
	NO	YES	150	225	300-600	PVC	VC	AC	ALL
1									
2									

 Denotes situation that applies

Type 1 structures:

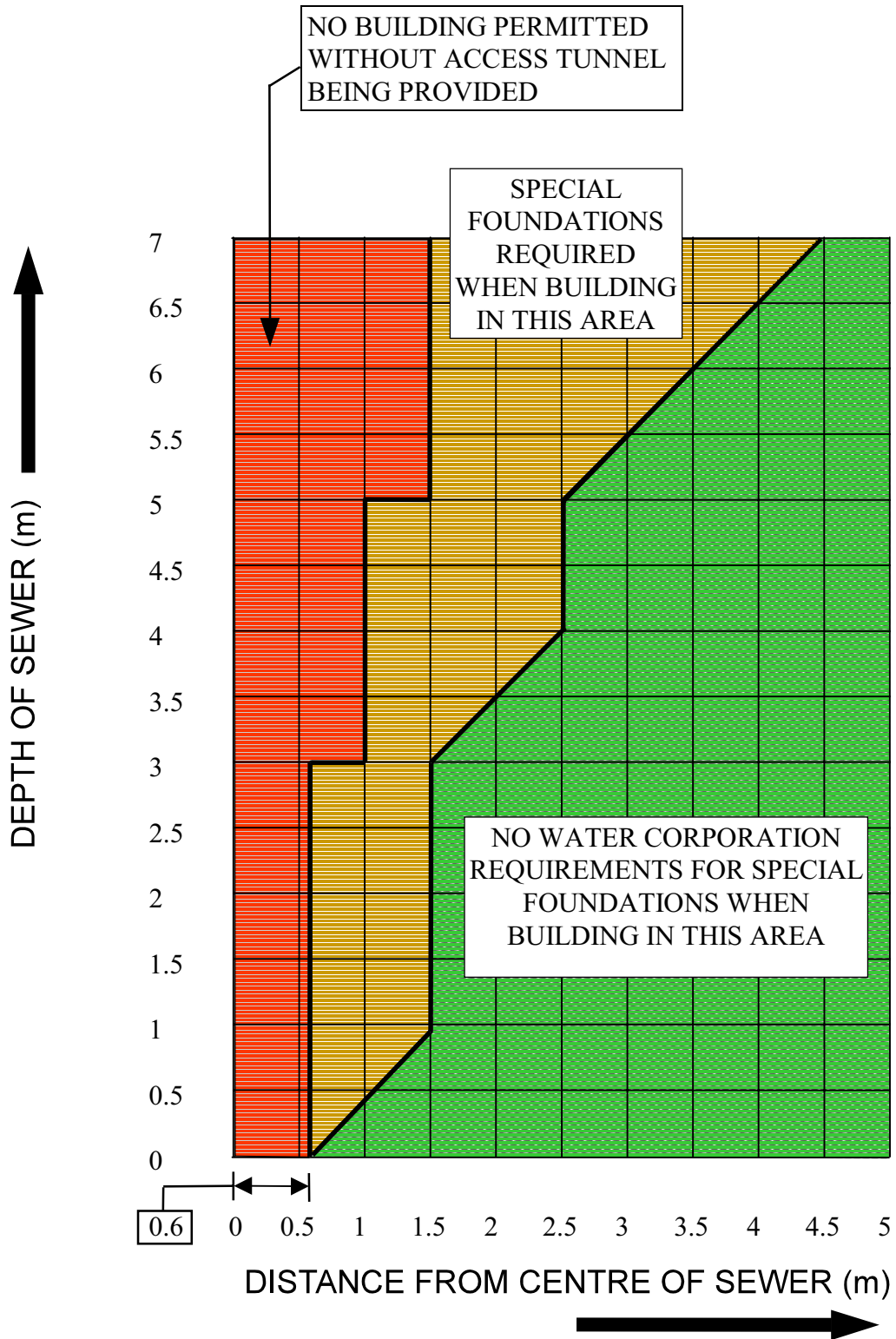
- Residential single storey.
- Commercial/industrial buildings with less than or equal to 4 m high walls (excluding basement).

Type 2 structures:

- Residential multi-storey.
- Commercial/industrial buildings with greater than 4 m high side walls (excluding basement).

Notes:

- These requirements should be considered in conjunction with clause 6.2(l), which sets the minimum clearances from sewer inspection shafts, rising shafts, inspection openings and Corporation access chambers.
- Attention is drawn to clause 6.2(m), which deals with sewers between adjacent structures.




GRAPH 1



GRAPH 2 ON THE NEXT PAGE APPLIES TO THE FOLLOWING COMBINATIONS OF STRUCTURE AND GRAVITY SEWER TYPE:

STRUCTURE TYPE	GRAVITY SEWER TYPE								
	ENCASED		SIZE			MATERIALS			
	NO	YES	150	225	300-600	PVC	VC	AC	ALL
1									

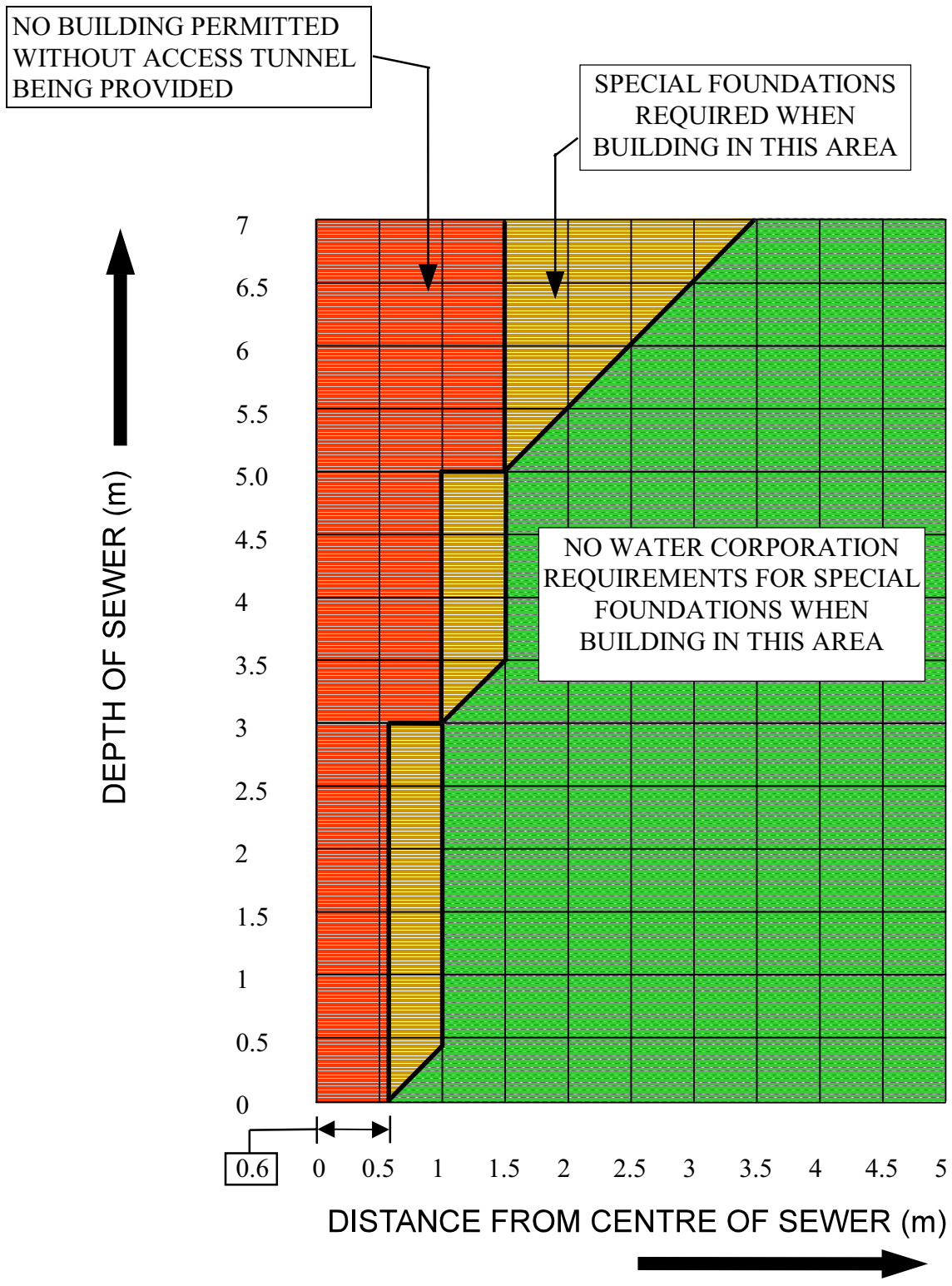
 Denotes situation that applies

Type 1 structures:

- Residential single storey.
- Commercial/industrial buildings with less than or equal to 4 m high walls (excluding basement).

Notes:

- These requirements should be considered in conjunction with clause 6.2(1), which sets the minimum clearances from sewer inspection shafts, rising shafts, inspection openings and Corporation access chambers.
- Attention is drawn to clause 6.2(m), which deals with sewers between adjacent structures.




GRAPH 2



GRAPH 3 ON THE NEXT PAGE APPLIES TO THE FOLLOWING COMBINATIONS OF STRUCTURE AND GRAVITY SEWER TYPE:

STRUCTURE TYPE	GRAVITY SEWER TYPE								
	ENCASED		SIZE			MATERIALS			
	NO	YES	150	225	300-600	PVC	VC	AC	ALL
1									
2									

 Denotes situation that applies

Type 1 structures:

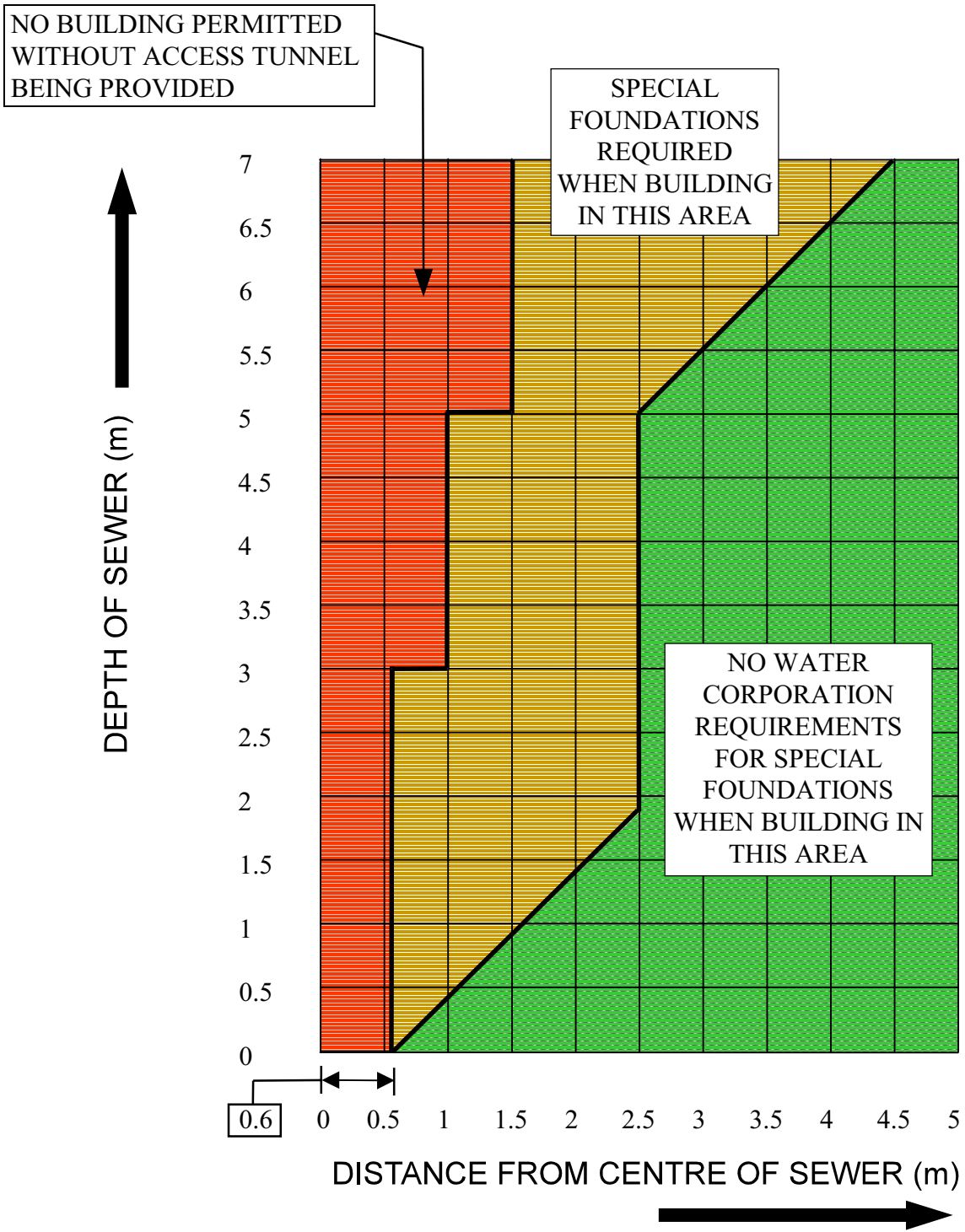
- Residential single storey.
- Commercial/industrial buildings with less than or equal to 4 m high walls (excluding basement).

Type 2 structures:

- Residential multi-storey.
- Commercial/industrial buildings with greater than 4 m high side walls (excluding basement).

Notes:

- These requirements should be considered in conjunction with clause 6.2(l), which sets the minimum clearances from sewer inspection shafts, rising shafts, inspection openings and Corporation access chambers.
- Attention is drawn to clause 6.2(m), which deals with sewers between adjacent structures.




GRAPH 3



GRAPH 4 ON THE NEXT PAGE APPLIES TO THE FOLLOWING COMBINATIONS OF STRUCTURE AND GRAVITY SEWER TYPE:

STRUCTURE TYPE	GRAVITY SEWER TYPE								
	ENCASED		SIZE			MATERIALS			
	NO	YES	150	225	300-600	PVC	VC	AC	ALL
1									

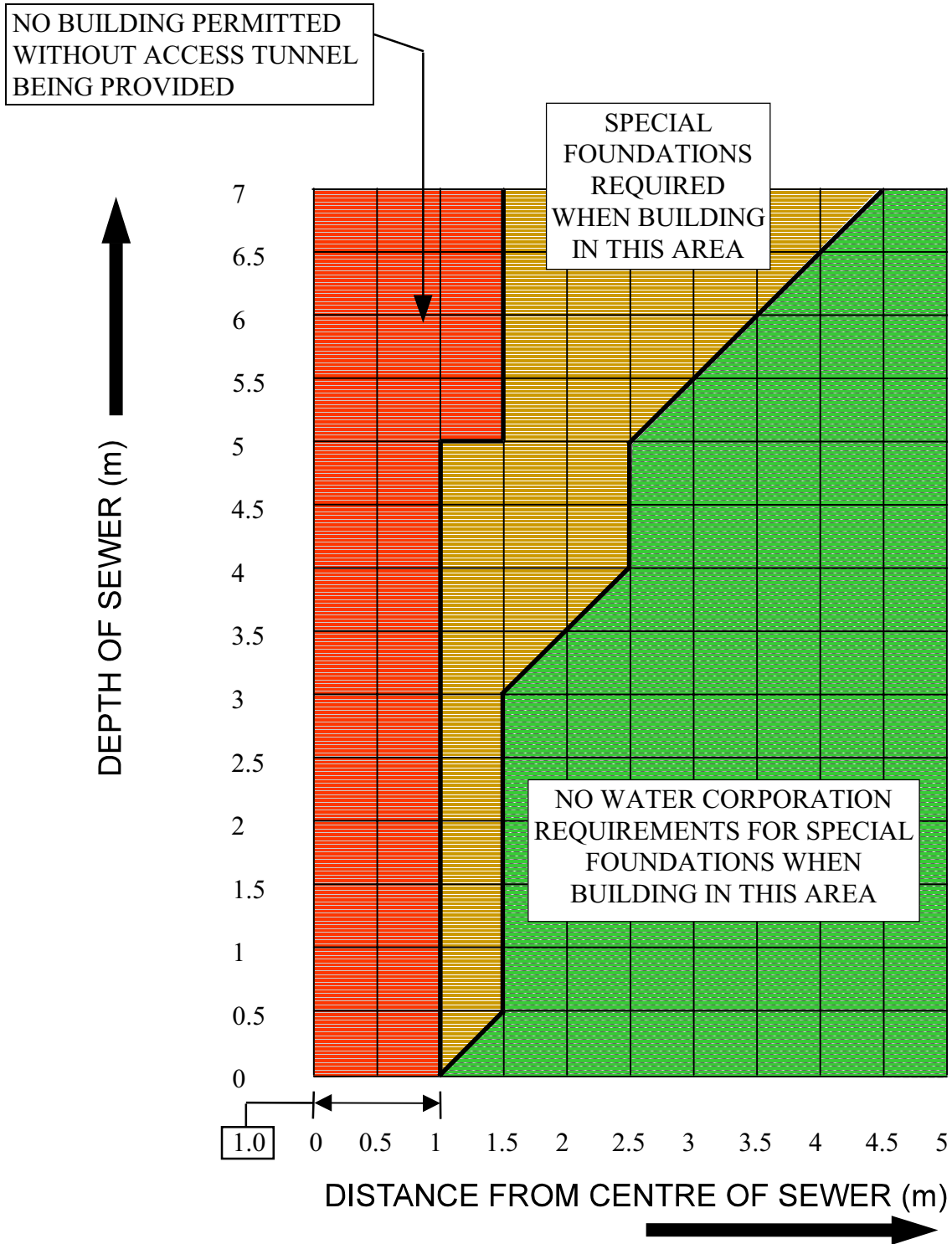
 Denotes situation that applies

Type 1 structures:

- Residential single storey.
- Commercial/industrial buildings with less than or equal to 4 m high walls (excluding basement).

Notes:

- These requirements should be considered in conjunction with clause 6.2(1), which sets the minimum clearances from sewer inspection shafts, rising shafts, inspection openings and Corporation access chambers.
- Attention is drawn to clause 6.2(m), which deals with sewers between adjacent structures.




GRAPH 4



GRAPH 5 ON THE NEXT PAGE APPLIES TO THE FOLLOWING COMBINATIONS OF STRUCTURE AND GRAVITY SEWER TYPE:

STRUCTURE TYPE	GRAVITY SEWER TYPE								
	ENCASED		SIZE			MATERIALS			
	NO	YES	150	225	300-600	PVC	VC	AC	ALL
1									
2									

 Denotes situation that applies

Type 1 structures:

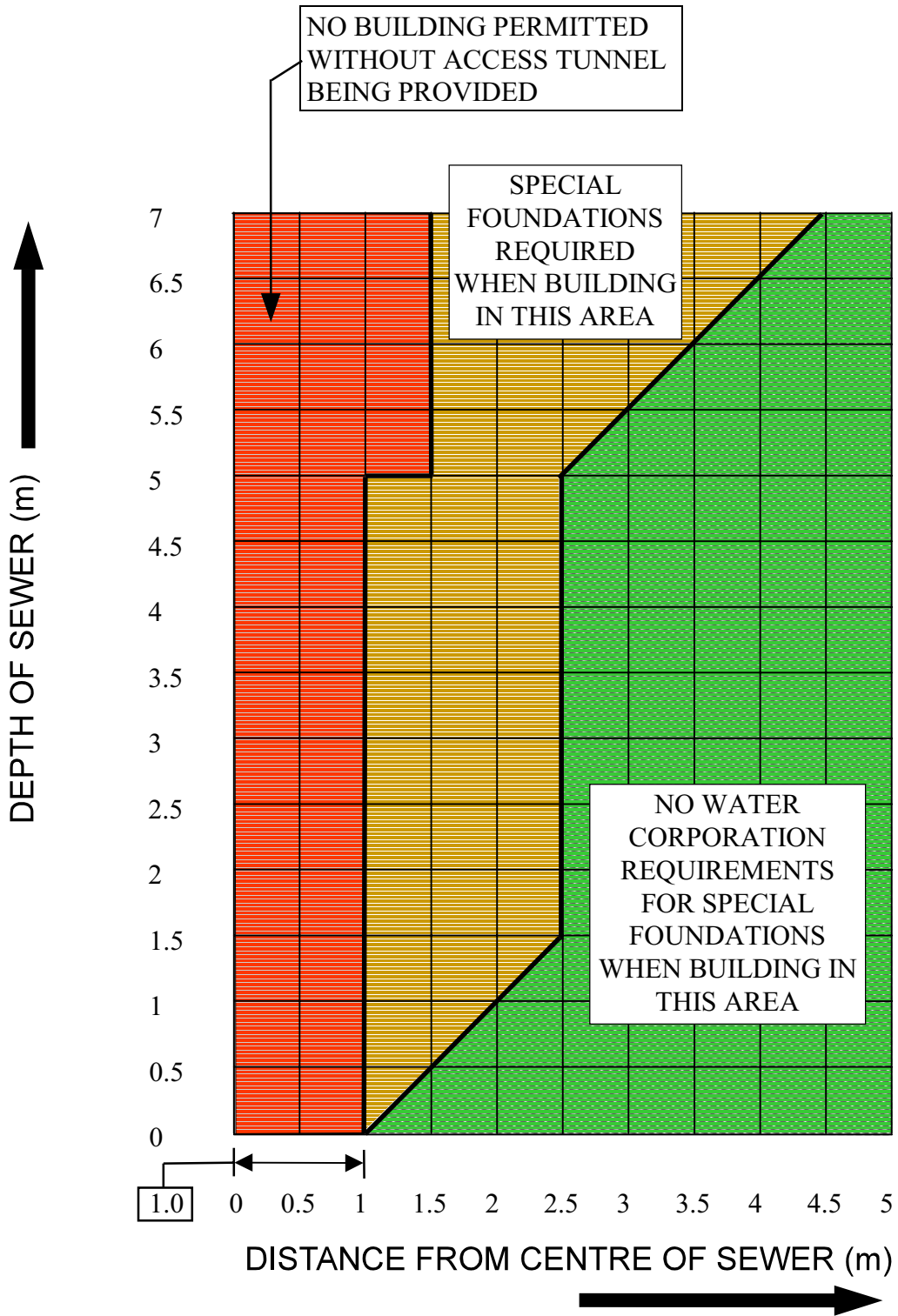
- Residential single storey.
- Commercial/industrial buildings with less than or equal to 4 m high walls (excluding basement).

Type 2 structures:

- Residential multi-storey.
- Commercial/industrial buildings with greater than 4 m high side walls (excluding basement).

Notes:

- These requirements should be considered in conjunction with clause 6.2(l), which sets the minimum clearances from sewer inspection shafts, rising shafts, inspection openings and Corporation access chambers.
- Attention is drawn to clause 6.2(m), which deals with sewers between adjacent structures.



GRAPH 5

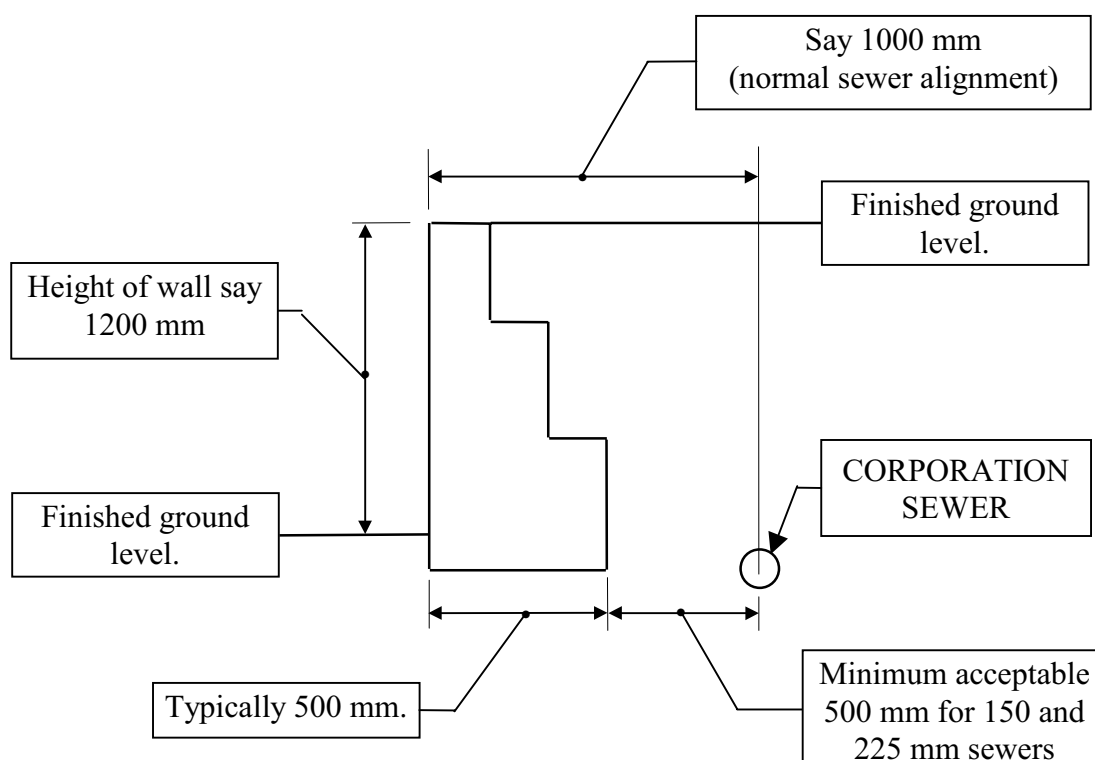


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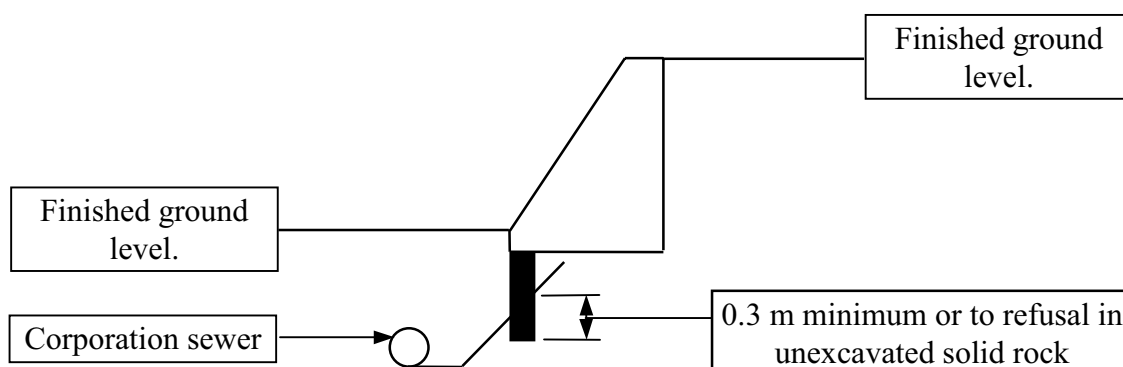
APPENDIX 6

PROXIMITY FOR RETAINING WALLS

When determining requirements for retaining walls, ease of removal of the wall and access are the principal factors to be considered. There is generally not a problem in accessing the sewer where it is adjacent to or higher than the heel of the wall as follows. Deepened structural support to the retaining wall would not then be required.



Where the sewer is in front of the retaining wall (adjacent to toe), and within the zone of influence, deepened structural support (e.g. piles under the toe) may be required. Requirements are determined in the same manner as for a single storey residential development (see page A4.1).





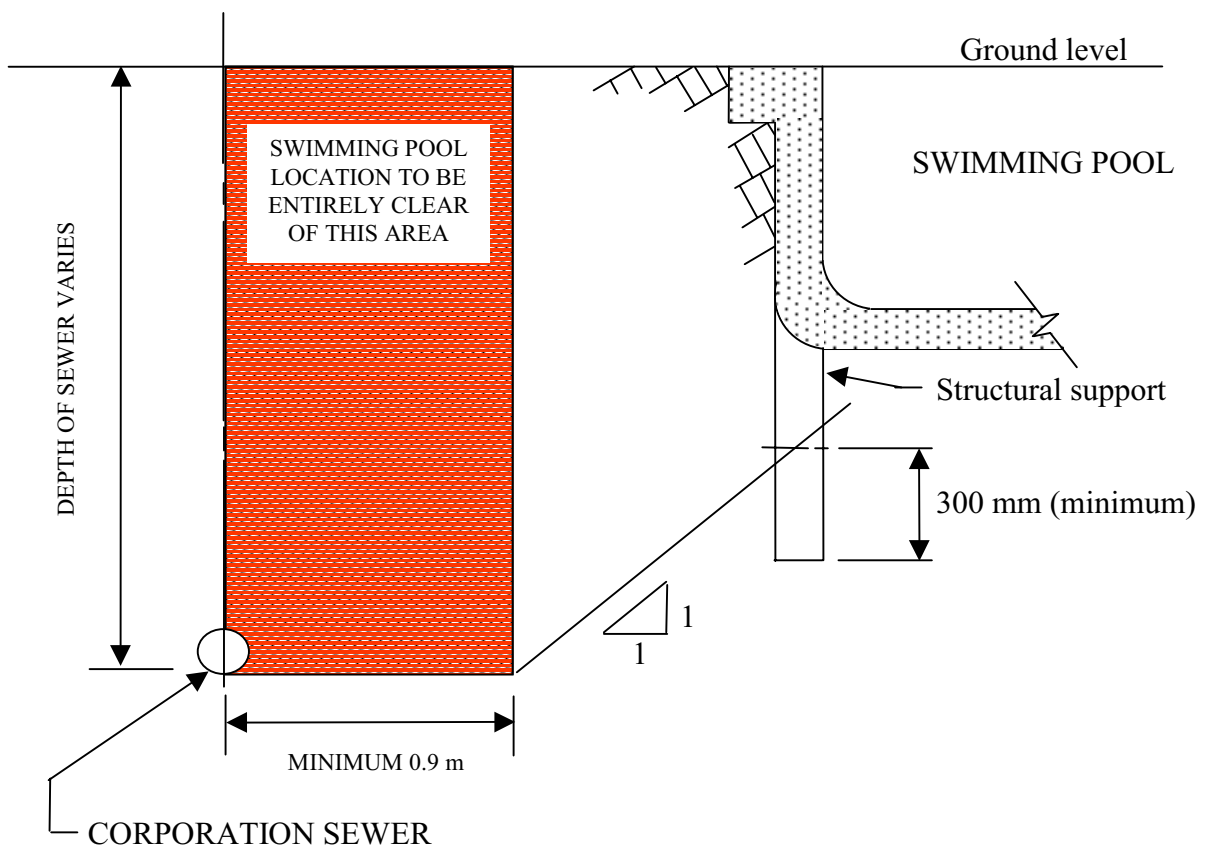
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APPENDIX 7

PROXIMITY FOR SWIMMING POOLS AND SPAS

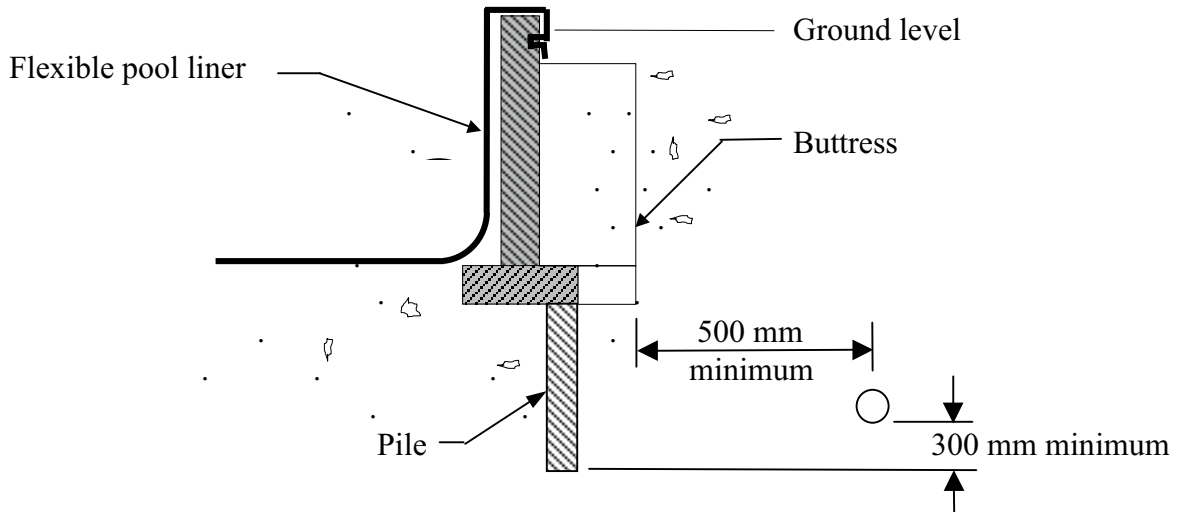
Swimming pools and spas may be installed using a range of materials and may be above or below ground, or partly above and partly below ground.

Swimming pools and spas, regardless of their material of construction, are considered in a similar manner to buildings with basements (see item H of Appendix 4). The zone of influence, however, is to be widened to allow for the lip of the pool. Where the dimensions of the lip are not indicated on the design plans an additional 300 mm is to be allowed for this purpose as follows:



TYPICAL CROSS-SECTION

Liner pools are treated in the same manner. These pools are normally installed with buttresses as shown in the following cross-sectional sketch. They rely on the soil and the water to provide lateral support to the liner. For this reason they would not be emptied for any adjacent excavation to a Corporation sewer. Timber would be used for support of the excavation and this would be left in place on completion of maintenance work on the sewer.



TYPICAL CROSS-SECTION

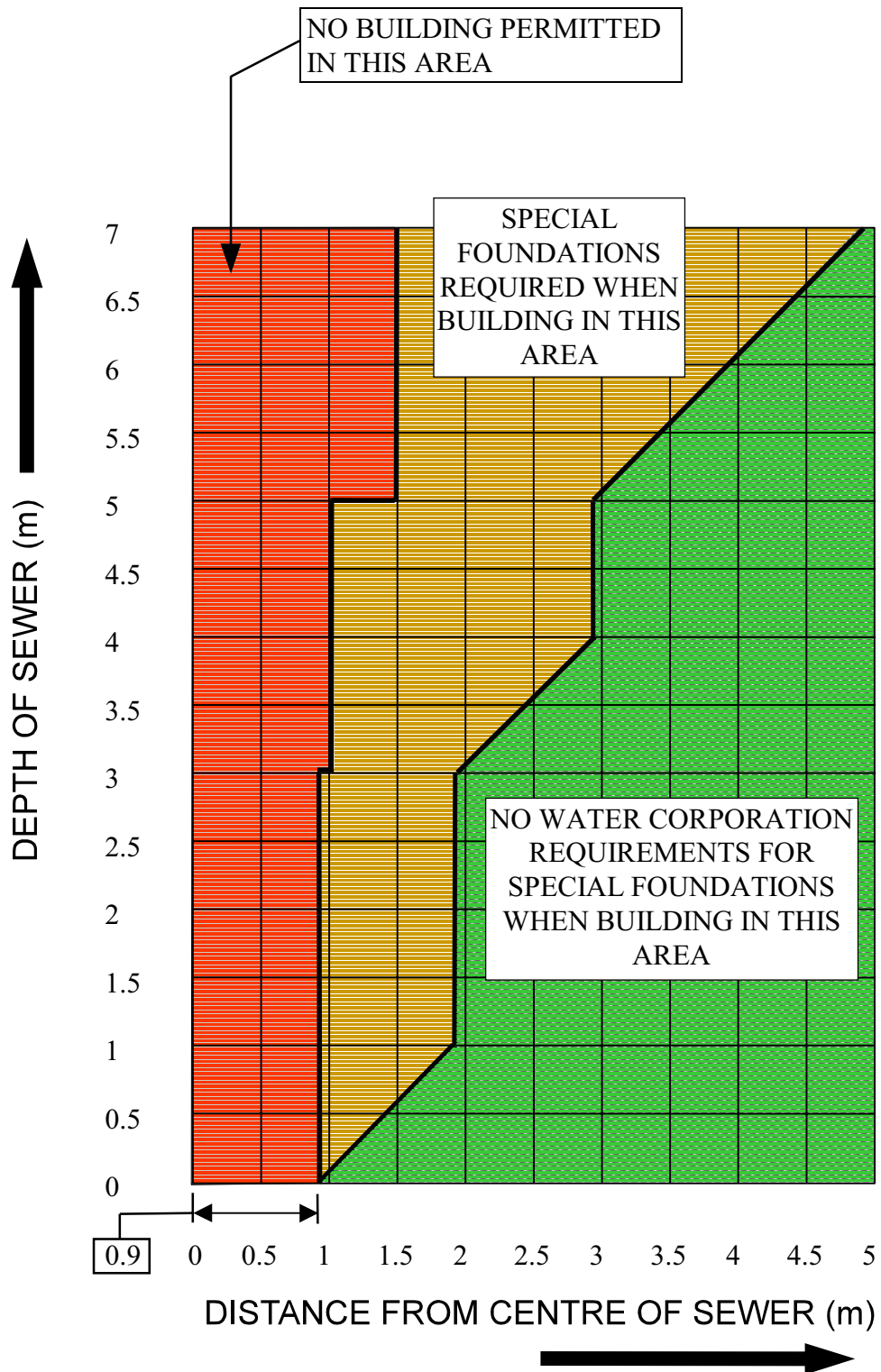
GRAPH P1 ON THE NEXT PAGE APPLIES TO THE FOLLOWING COMBINATIONS OF STRUCTURE AND GRAVITY SEWER TYPE:

STRUCTURE TYPE	GRAVITY SEWER TYPE								
	ENCASED		SIZE			MATERIALS			
	NO	YES	150	225	300-600	PVC	VC	AC	ALL
Pools									

Denotes situation that applies

Notes:

- These requirements should be considered in conjunction with clause 6.2(l), which sets the minimum clearances from sewer inspection shafts, rising shafts, inspection openings and Corporation access chambers.
- Attention is drawn to clause 6.2(m), which deals with sewers between adjacent structures.




GRAPH P1 - POOLS ONLY



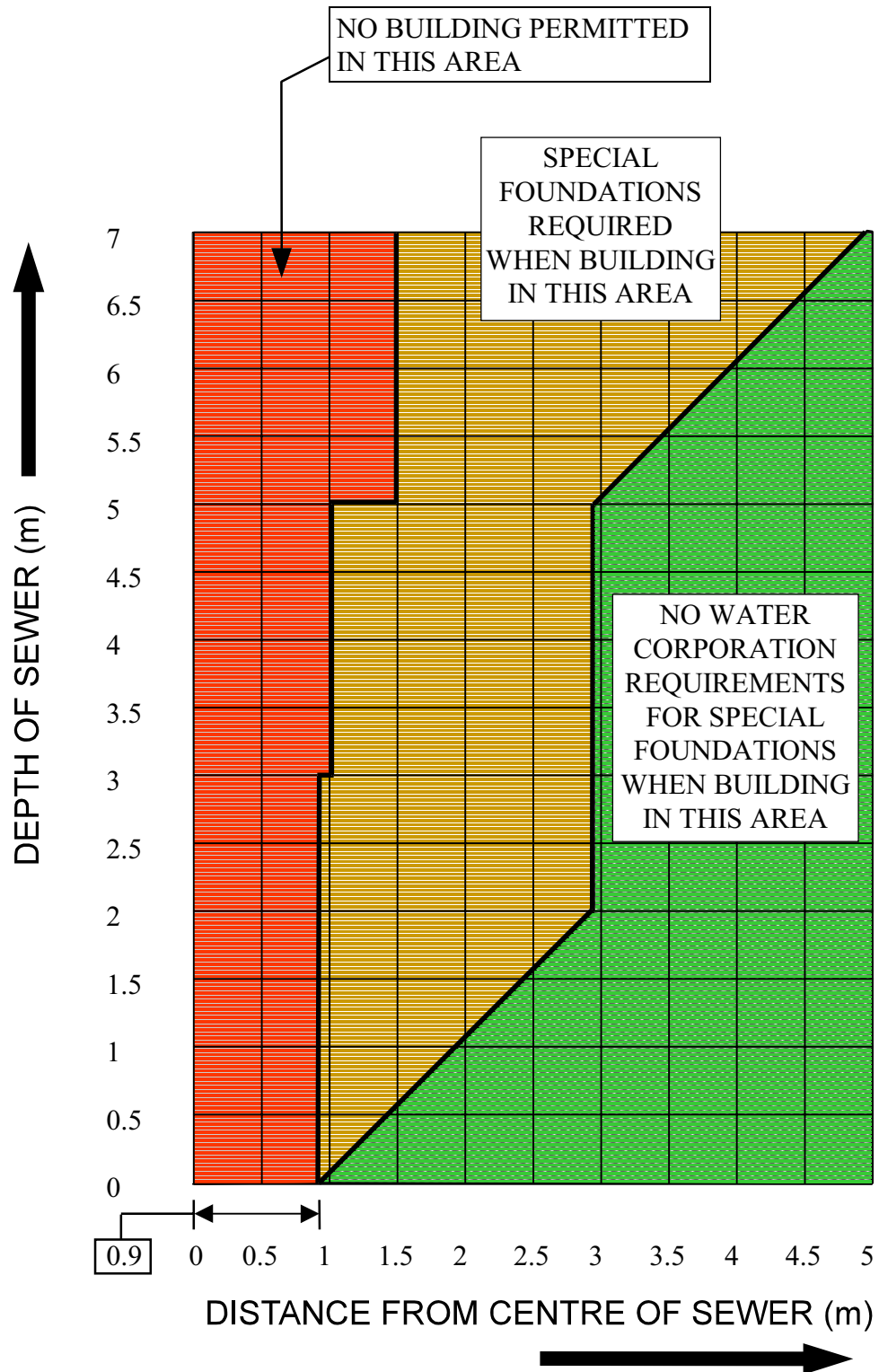
GRAPH P2 ON THE NEXT PAGE APPLIES TO THE FOLLOWING COMBINATIONS OF STRUCTURE AND GRAVITY SEWER TYPE:

STRUCTURE TYPE	GRAVITY SEWER TYPE								
	ENCASED		SIZE			MATERIALS			
	NO	YES	150	225	300-600	PVC	VC	AC	ALL
Pools									

 Denotes situation that applies

Notes:

- These requirements should be considered in conjunction with clause 6.2(l), which sets the minimum clearances from sewer inspection shafts, rising shafts, inspection openings and Corporation access chambers.
- Attention is drawn to clause 6.2(m), which deals with sewers between adjacent structures.




GRAPH P2 - POOLS ONLY



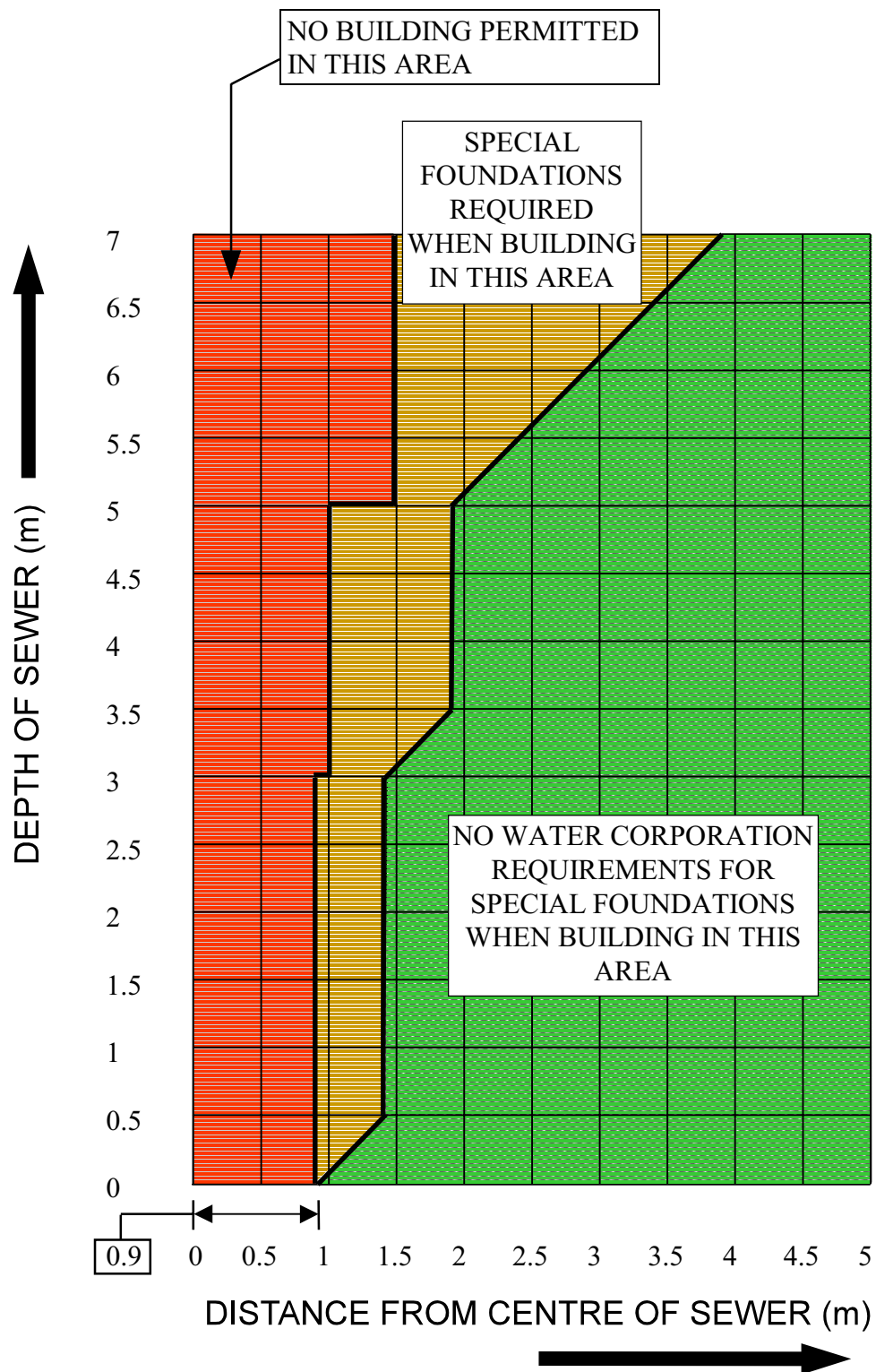
GRAPH P3 ON THE NEXT PAGE APPLIES TO THE FOLLOWING COMBINATIONS OF STRUCTURE AND GRAVITY SEWER TYPE:

STRUCTURE TYPE	GRAVITY SEWER TYPE								
	ENCASED		SIZE			MATERIALS			
	NO	YES	150	225	300-600	PVC	VC	AC	ALL
Pools									

 Denotes situation that applies

Notes:

- These requirements should be considered in conjunction with clause 6.2(l), which sets the minimum clearances from sewer inspection shafts, rising shafts, inspection openings and Corporation access chambers.
- Attention is drawn to clause 6.2(m), which deals with sewers between adjacent structures.




GRAPH P3 - POOLS ONLY



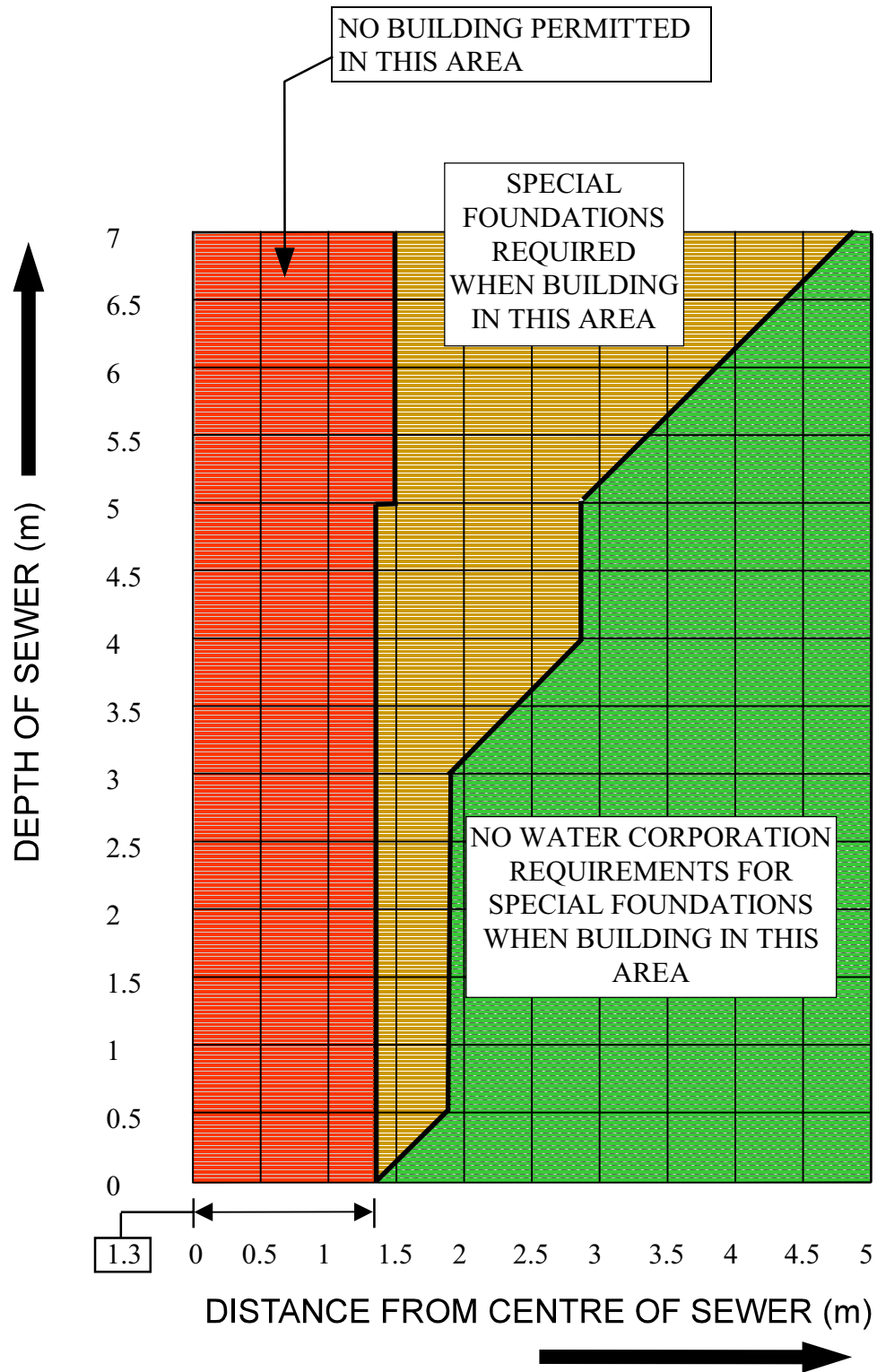
GRAPH P4 ON THE NEXT PAGE APPLIES TO THE FOLLOWING COMBINATIONS OF STRUCTURE AND GRAVITY SEWER TYPE:

STRUCTURE TYPE	GRAVITY SEWER TYPE								
	ENCASED		SIZE			MATERIALS			
	NO	YES	150	225	300-600	PVC	VC	AC	ALL
Pools									

 Denotes situation that applies

Notes:

- These requirements should be considered in conjunction with clause 6.2(l), which sets the minimum clearances from sewer inspection shafts, rising shafts, inspection openings and Corporation access chambers.
- Attention is drawn to clause 6.2(m), which deals with sewers between adjacent structures.




GRAPH P4 - POOLS ONLY



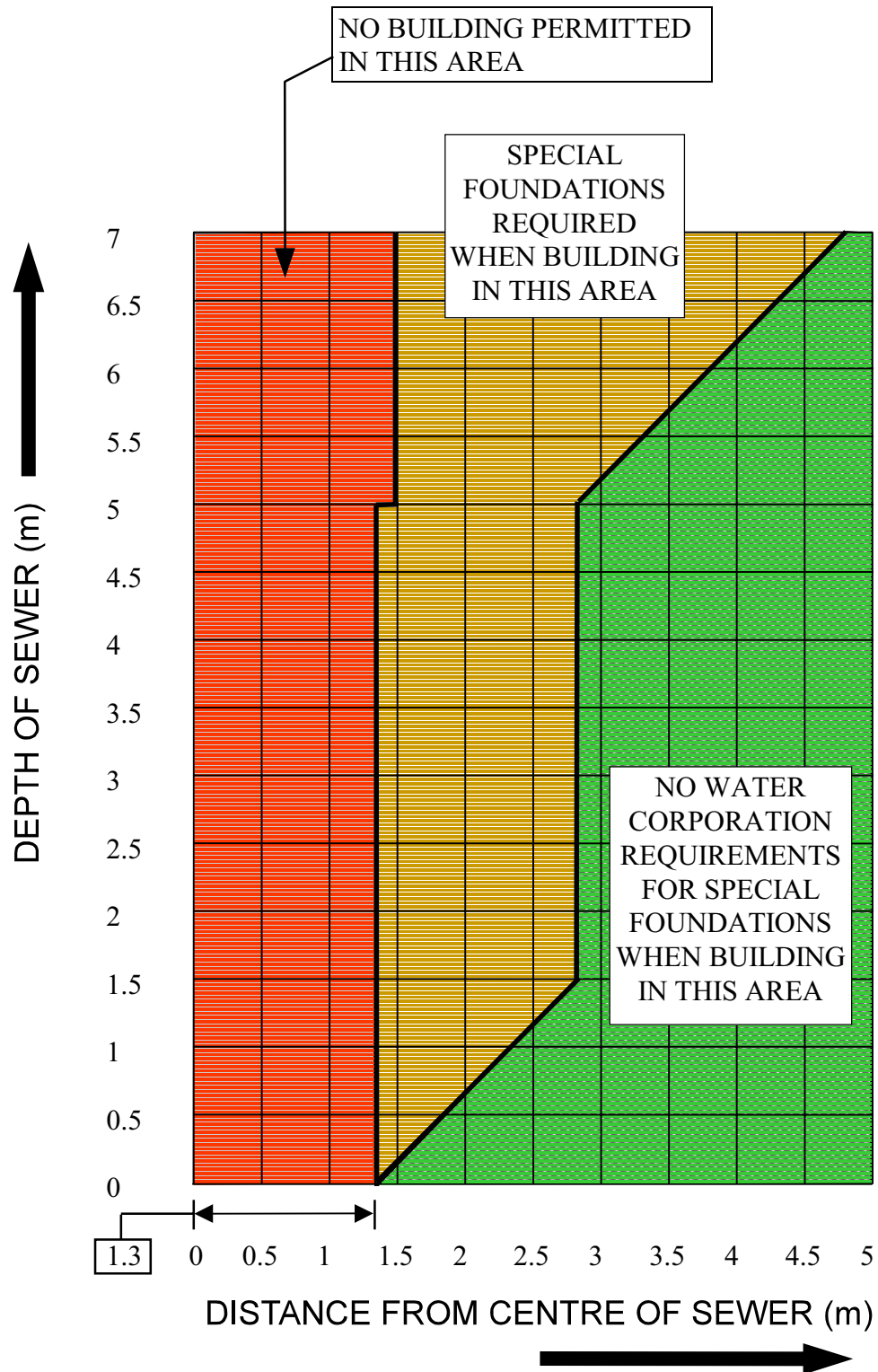
GRAPH P5 ON THE NEXT PAGE APPLIES TO THE FOLLOWING COMBINATIONS OF STRUCTURE AND GRAVITY SEWER TYPE:

STRUCTURE TYPE	GRAVITY SEWER TYPE								
	ENCASED		SIZE			MATERIALS			
	NO	YES	150	225	300-600	PVC	VC	AC	ALL
Pools									

 Denotes situation that applies

Notes:

- These requirements should be considered in conjunction with clause 6.2(l), which sets the minimum clearances from sewer inspection shafts, rising shafts, inspection openings and Corporation access chambers.
- Attention is drawn to clause 6.2(m), which deals with sewers between adjacent structures.



GRAPH P5 - POOLS ONLY



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