



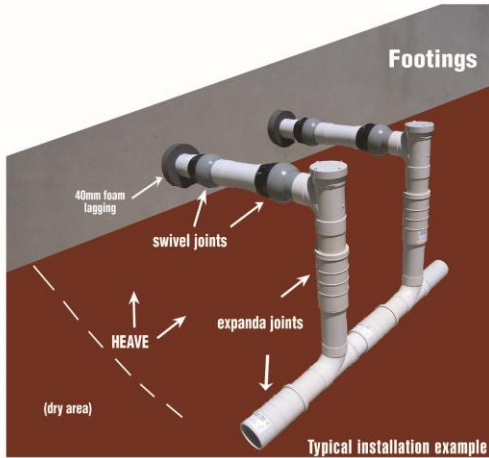
Storm Plastics

MANUFACTURERS OF SPECIALISED PVC-U PLUMBING PRODUCTS

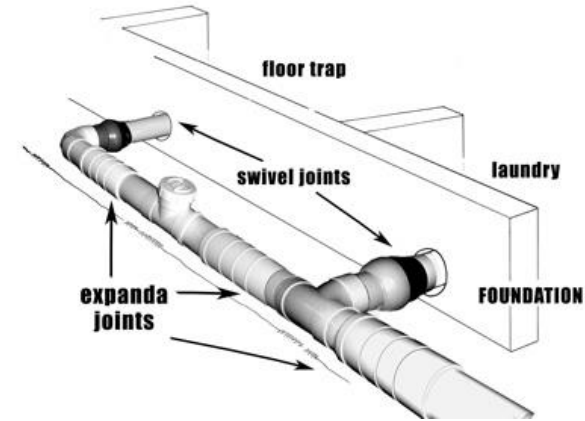
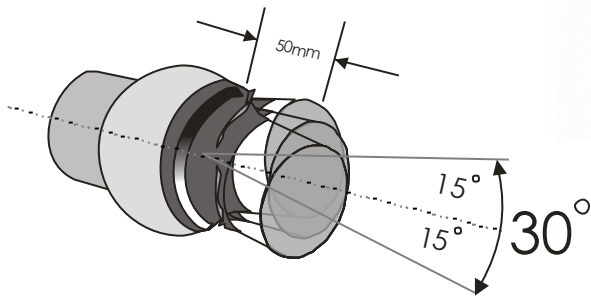


-----DRAINAGE REQUIREMENTS – AS 2870-2011 & AS 2032-2006. 1

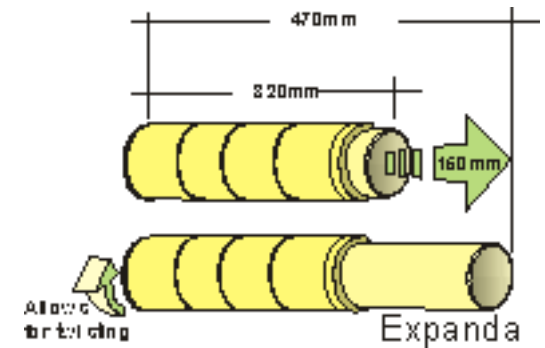
THE MAIN PRODUCTS



Swivel Expansion Joint
100mm DWV
+/- 50mm Expansion

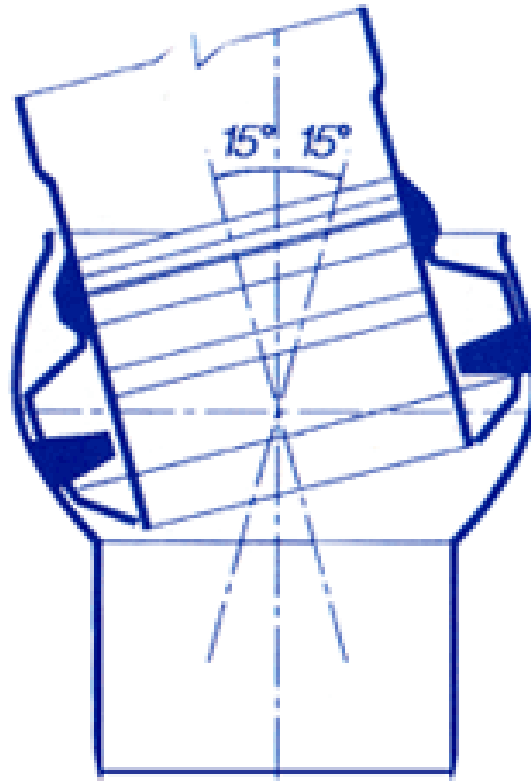


Expander Joint
100DWV
150 mm linear expansion



THE INSIDE COATING

Copper Sulphate Crystals coated section



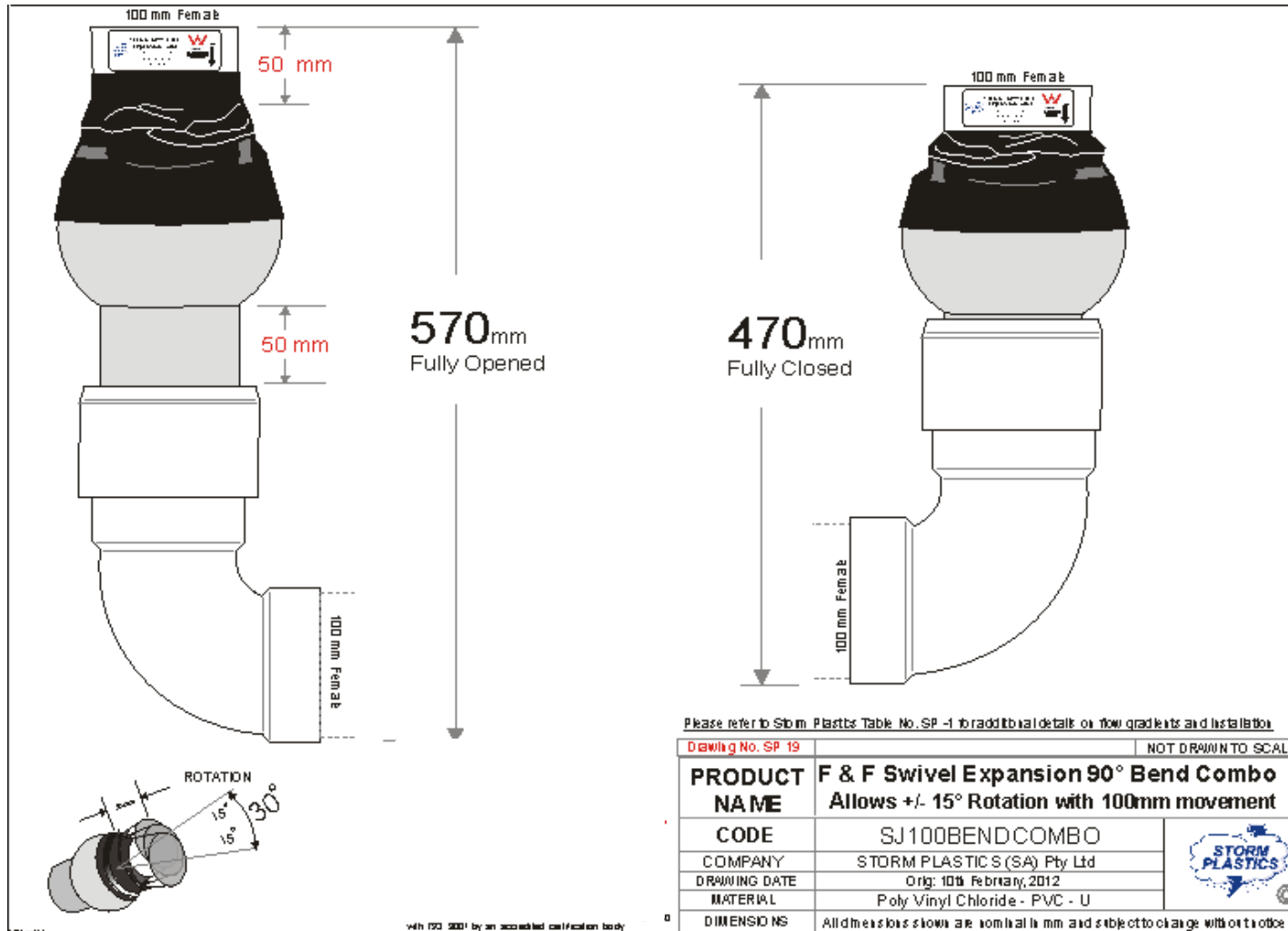
Tamworth Seminar, July, 2012

Dust Protection Tape



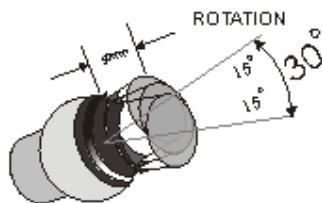
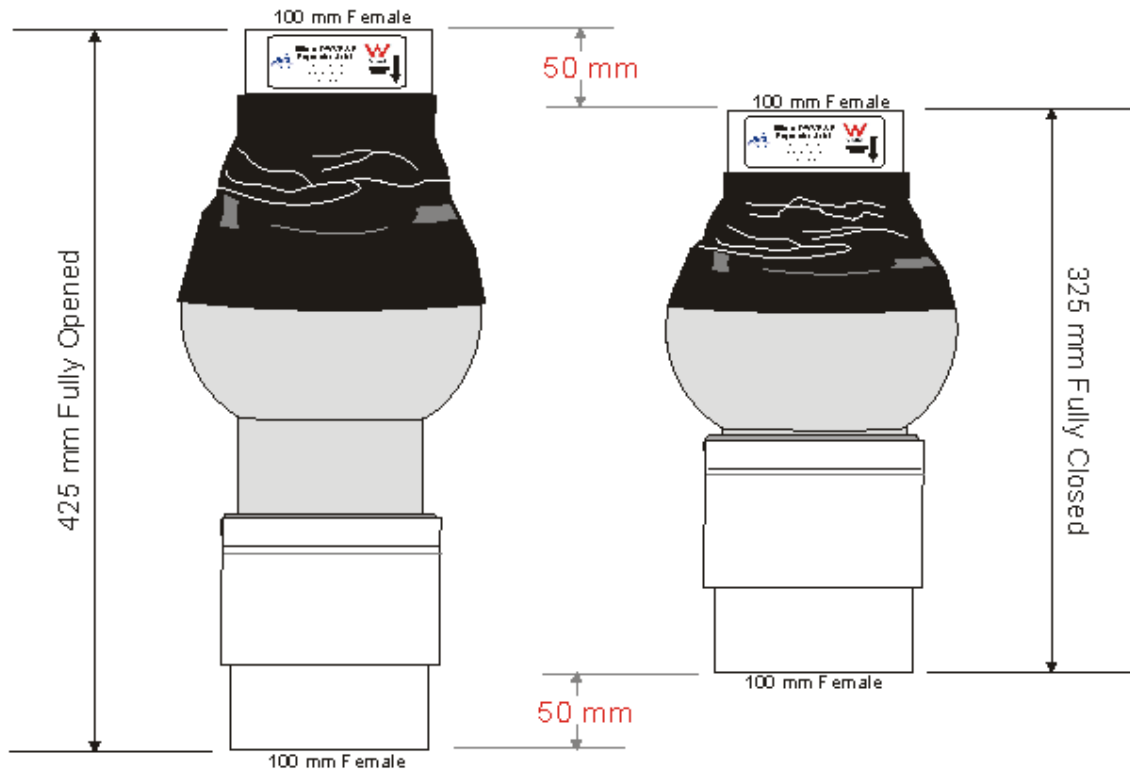
THE COMBO BEND - 100mm MOVEMENT

+ 30 degree DEFLECTION



THE COMBO STRAIGHT - 100mm MOVEMENT

+ 30° degree DEFLECTION



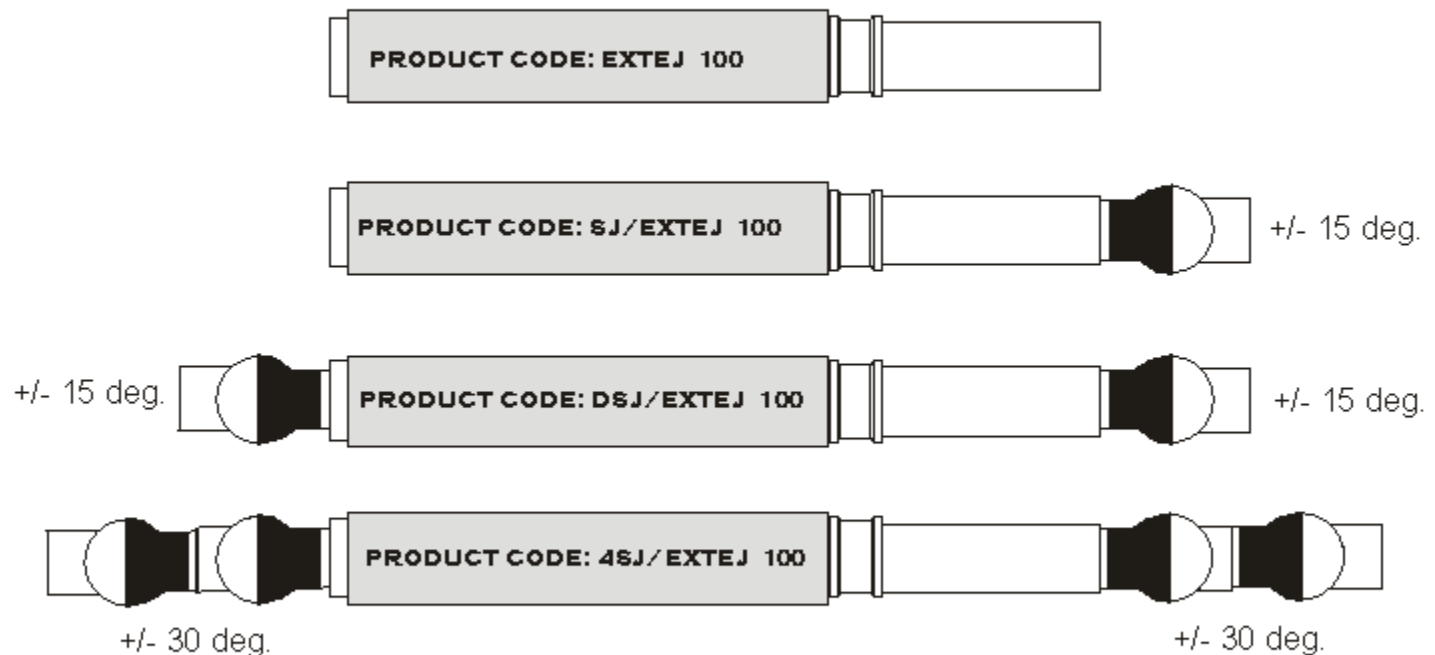
Please refer to Storm Plastics Table No. SP -1 for additional details on flow gradients and installation.

| | | |
|---------------------|--|--|
| Drawing No. SP 18 | NOT DRAWN TO SCALE | |
| PRODUCT NAME | F & F Swivel Expansion Combo Joint | |
| | Allows +/- 15° Rotation with 100mm movement | |
| CODE | SJ100EXP COMBOFF | |
| COMPANY | STORM PLASTICS (SA) Pty Ltd | |
| DRAWING DATE | Orig: 10th February, 2012. | |
| MATERIAL | Poly Vinyl Chloride - PVC - U | |
| DIMENSIONS | All dimensions shown are nominal in mm and subject to change without notice. | |



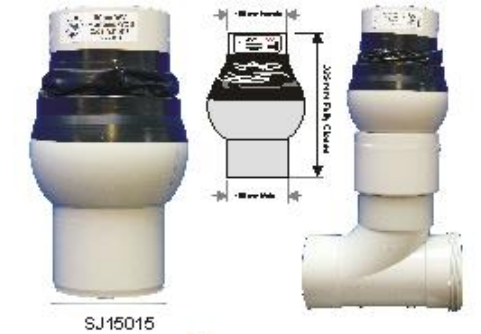
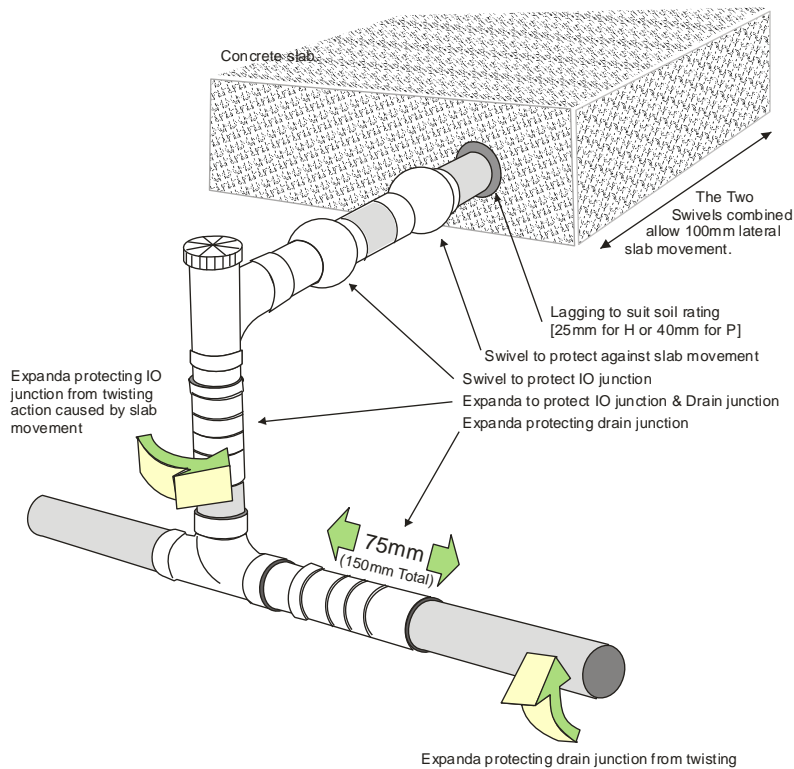
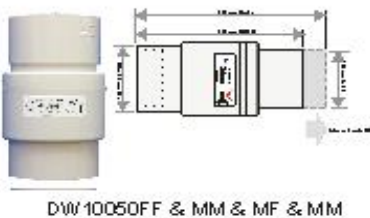
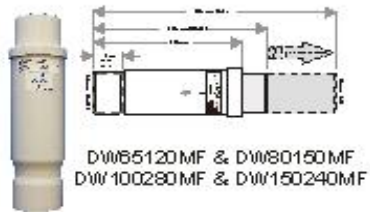
THE 'BAZOOKA' – 500 mm MOVEMENT

500mm Expansion Joints



...other styles and performance - made to order.

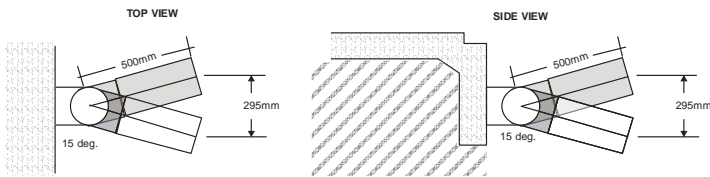
THE RANGE – from 50 mm MOVEMENT ... to suit ALL - ys - requirements



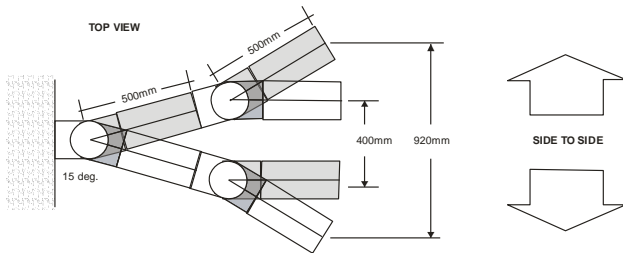
ARTICULATION MOVEMENT

SWIVEL MOVEMENT

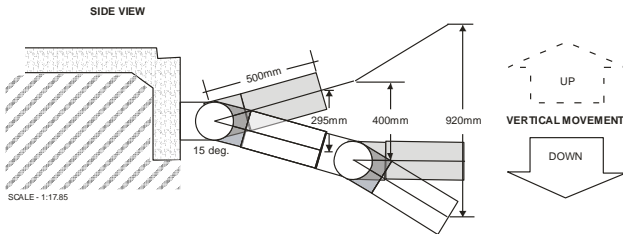
...IN PRACTICE



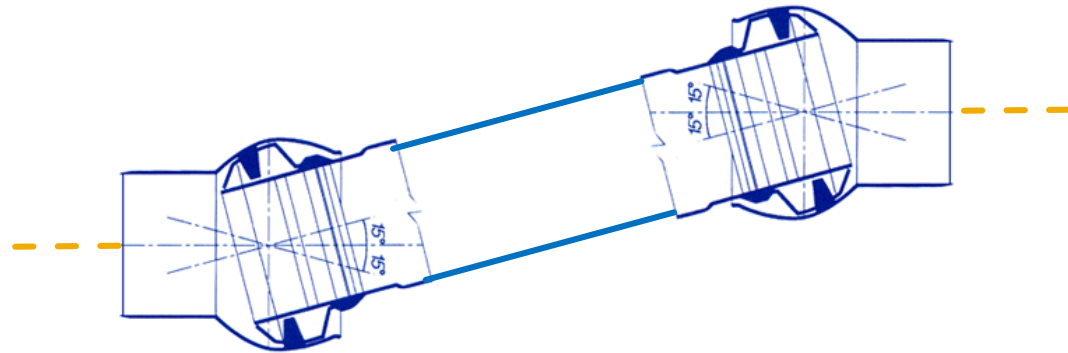
With one Swivel, at a deflection of 15 degrees either side of centre, over a length of 500mm, the Swivel unit allows 295mm of horizontal and vertical movement.



With two Swivels, at a deflection of 15 degrees either side of centre, over a length of approx. 1000mm, the Swivel units allow a pipe deflection of 400mm to 920mm, of horizontal and vertical movement.



By using a combination of Swivel Joints all reactive soil movements can be remedied.



Some applications may only need one, but to have the articulation effect..ie enable misalignment without stressing pipeline, two are required.

NON FLEXIBLE INSTALL



CREEP & SLIP

Bazooka applications



THE STANDARD: AS2870-2011

Now linked to AS3500 and
part of the Plumbers code

THE STANDARD: AS2870-2011

As2870-2011 is the most radical change to interpreting Soils and House Engineering we have seen since 1986 and several trades will need to update their current knowledge.

AS 2870-2011 Drainage Requirements

Section 1.

The site classification **shall** be stated on the drawings.

The selected footing system and any required site work and required site drainage **shall** be documented.

MOVING INTO REACTIVE SOILS

In the greater
Melbourne area,

Housing developments
expand further into areas
of REACTIVE SOILS.



MOVING INTO REACTIVE SOILS

In the greater Melbourne area,
60-70% of
Housing developments
expand further into areas
of REACTIVE SOILS.

Sydney and Brisbane
are
similar



ITS NOT JUST FLOW!!

The Grade of Fall is of great importance.

Reduction from 1:60 to 1:80 in grade, and often shallower (to suit take off heights) causes material-fluid separation and congestion due to poor flow rates.

Already happening.



ITS NOT JUST FLOW!!

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Reduction from 1:60 to 1:80 in grade, and often shallower (to suit take off heights) causes material-fluid **separation** and **congestion** due to poor **flow** rates.

Already happening.

SELF CLEANING FLOW
IS PARAMOUNT IN
REACTIVE SOILS.



FALL DISCHARGE PROBLEMS

| SOIL CLASSIFICATION | SOIL DESCRIPTION | DIFFERENTIAL MOVEMENT | SEWER DRAIN GRADE |
|---------------------|----------------------|-----------------------|-------------------|
| A | Most sand & rock | Zero | |
| S | Slightly reactive | 0 – 20 mm | |
| M | Moderately reactive | 20 – 40 mm | |
| H ₁ | Highly reactive | 40 – 60 mm | |
| H ₂ | Very Highly reactive | 60 – 75 mm | |
| E | Extremely reactive | 75 mm + | |
| P | All other soils | As Tested | |

FALL DISCHARGE PROBLEMS

| SOIL CLASSIFICATION | SOIL DESCRIPTION | DIFFERENTIAL MOVEMENT | SEWER DRAIN GRADE |
|---------------------|----------------------|-----------------------|------------------------------|
| A | Most sand & rock | Zero | 1 : 60 (167 mm in 10 M) |
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| H ₁ | Highly reactive | 40 – 60 mm | |
| H ₂ | Very Highly reactive | 60 – 75 mm | |
| E | Extremely reactive | 75 mm + | |
| P | All other soils | As Tested | |

FALL DISCHARGE PROBLEMS

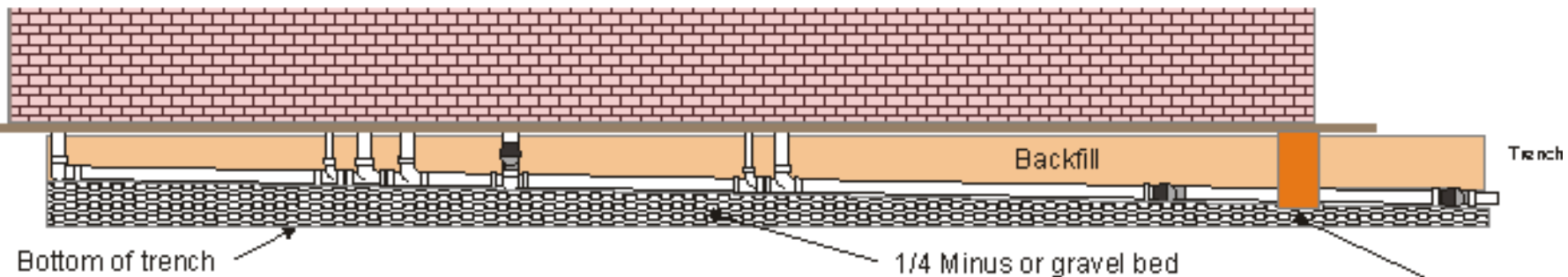
| SOIL CLASSIFICATION | SOIL DESCRIPTION | DIFFERENTIAL MOVEMENT | SEWER DRAIN GRADE |
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| H ₁ | Highly reactive | 40 – 60 mm | 1 : 50 (200 mm in 10 M) |
| H ₂ | Very Highly reactive | 60 – 75 mm | |
| E | Extremely reactive | 75 mm + | |
| P | All other soils | As Tested | |

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| SOIL CLASSIFICATION | SOIL DESCRIPTION | DIFFERENTIAL MOVEMENT | SEWER DRAIN GRADE |
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| A | Most sand & rock | Zero | 1 : 60 (167 mm in 10 M) |
| S | Slightly reactive | 0 – 20 mm | |
| M | Moderately reactive | 20 – 40 mm | |
| H ₁ | Highly reactive | 40 – 60 mm | 1 : 50 (200 mm in 10 M) |
| H ₂ | Very Highly reactive | 60 – 75 mm | |
| E | Extremely reactive | 75 mm + | 1 : 50 / 1 : 40 (200-250 mm in 10 M) |
| P | All other soils | As Tested | |

FALL DISCHARGE PROBLEMS

DRAIN GRADE FORMED BY 1/4 MINUS OR GRAVEL BED



1. The drain GRADE should NEVER be created by the 1/4 minus or gravel bed alone.

Reasons:- Any leakage from broken pipes or junctions will **filter** thru the gravel and swell the soil. Outside rainwater will capillary to the dry soil **under** the slab and cause structural heave.

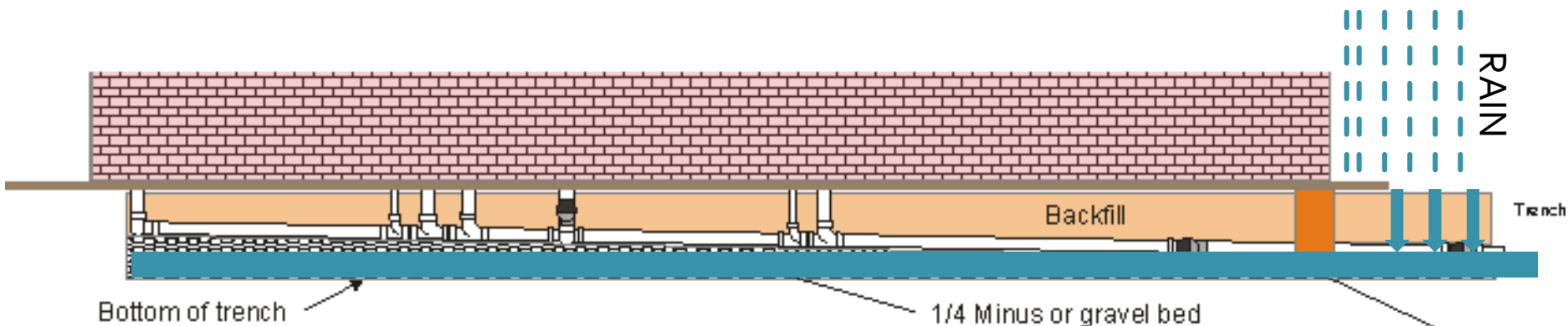
2. The Clay Plug MUST seal to the bottom of the trench.

Reason:- The trench outside the building footprint contains **air** in the backfill and allows rain water to percolate and fill inside much quicker than non trenched ground. Without trench GRADE and without the Clay Plug sealing to the bottom of the trench, water can seep/capillary back **inside** the building footprint and cause structural heave. The level of rainfall and depth of trench are factors that **accelerate** this heave effect.

FALL DISCHARGE PROBLEMS

UNDER SLAB DRAINAGE

DRAIN GRADE FORMED BY 1/4 MINUS OR GRAVEL BED



1. The drain GRADE should NEVER be created by the 1/4 minus or gravel bed alone.

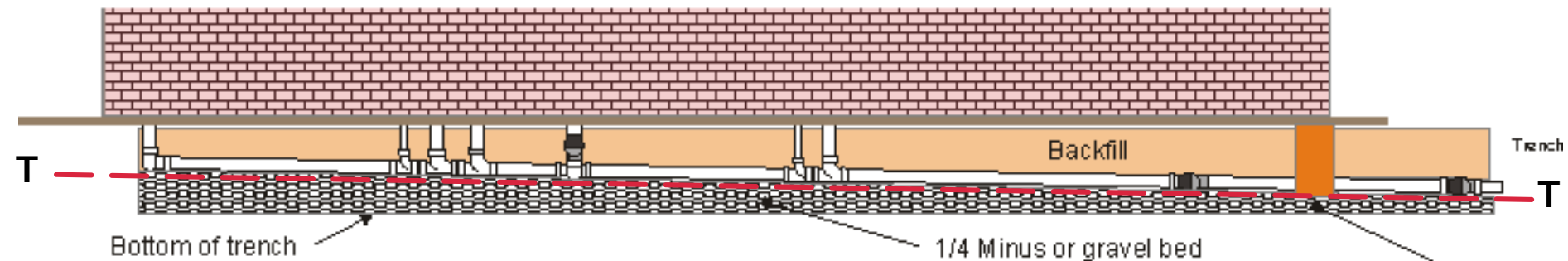
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T = Bottom
of Trench





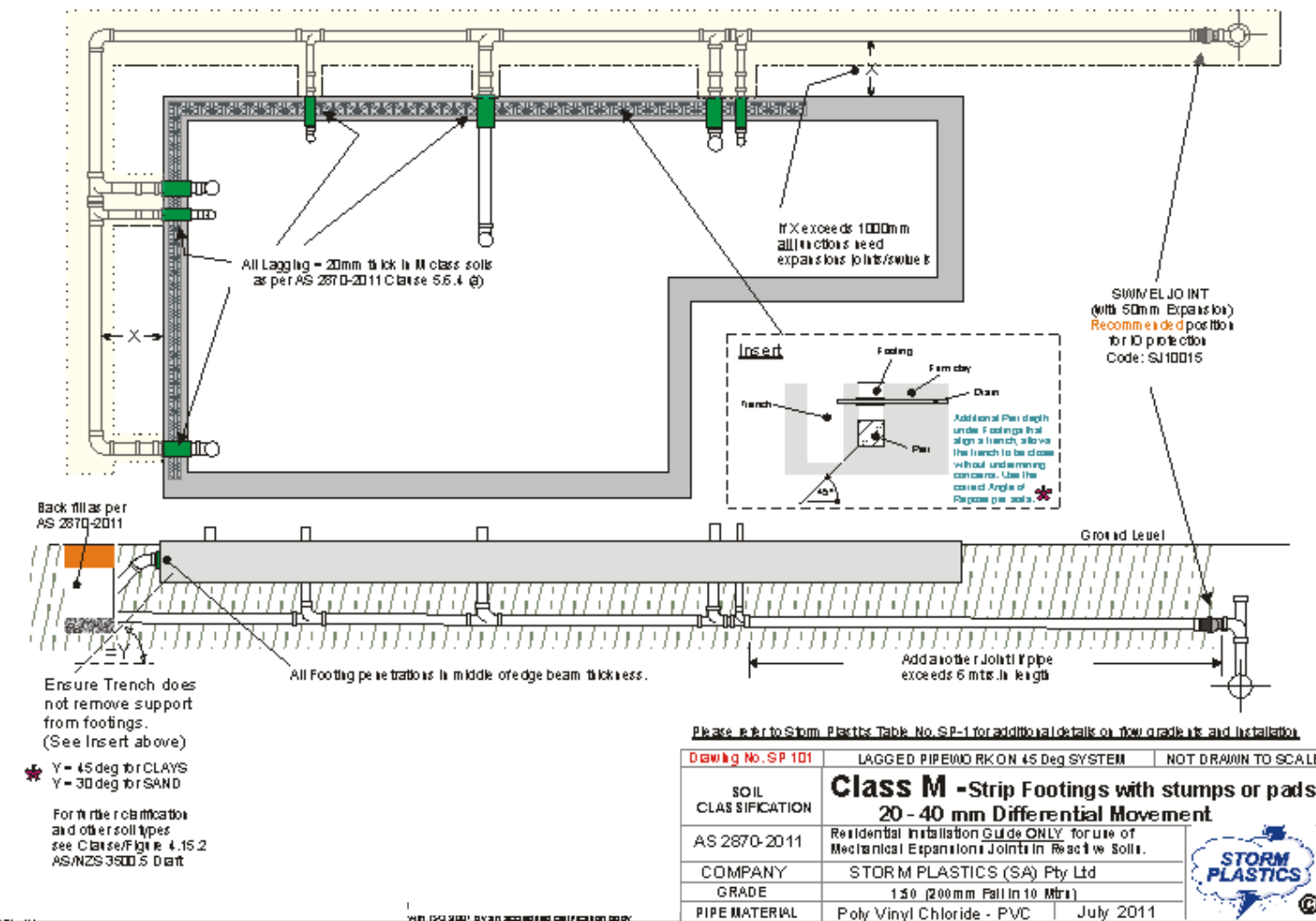






EXPANSION JOINT LAYOUT

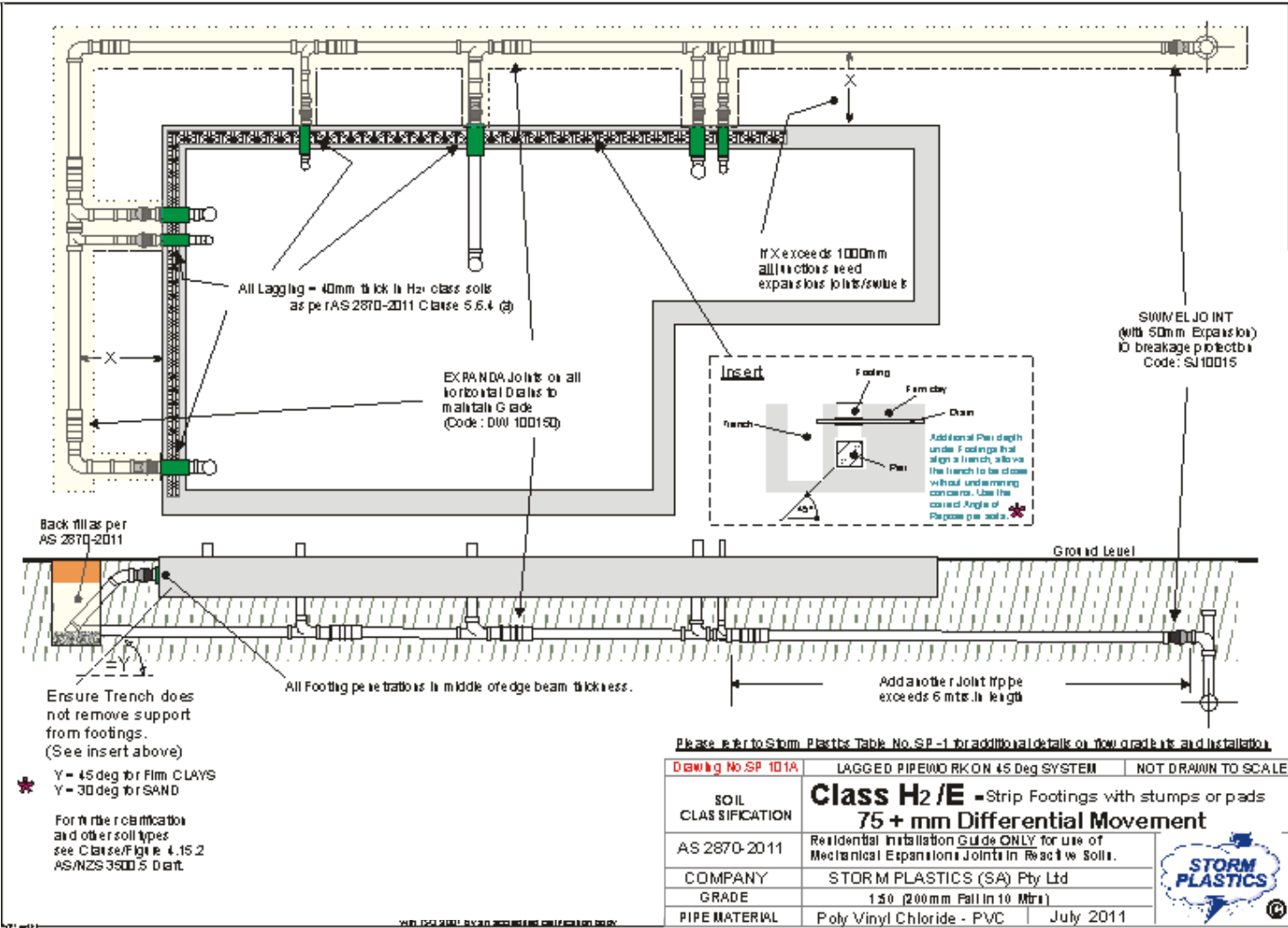
AS2870-2011 is the most radical change to interpreting soils and house engineering we have seen since 1988 and several trades will need to know what is in it and how to apply it.



Unless otherwise specified, these joints are to be set at 50% of their sliding ability

EXPANSION JOINT LAYOUT

Unless otherwise specified, these joints are to be set at 50% of their sliding ability



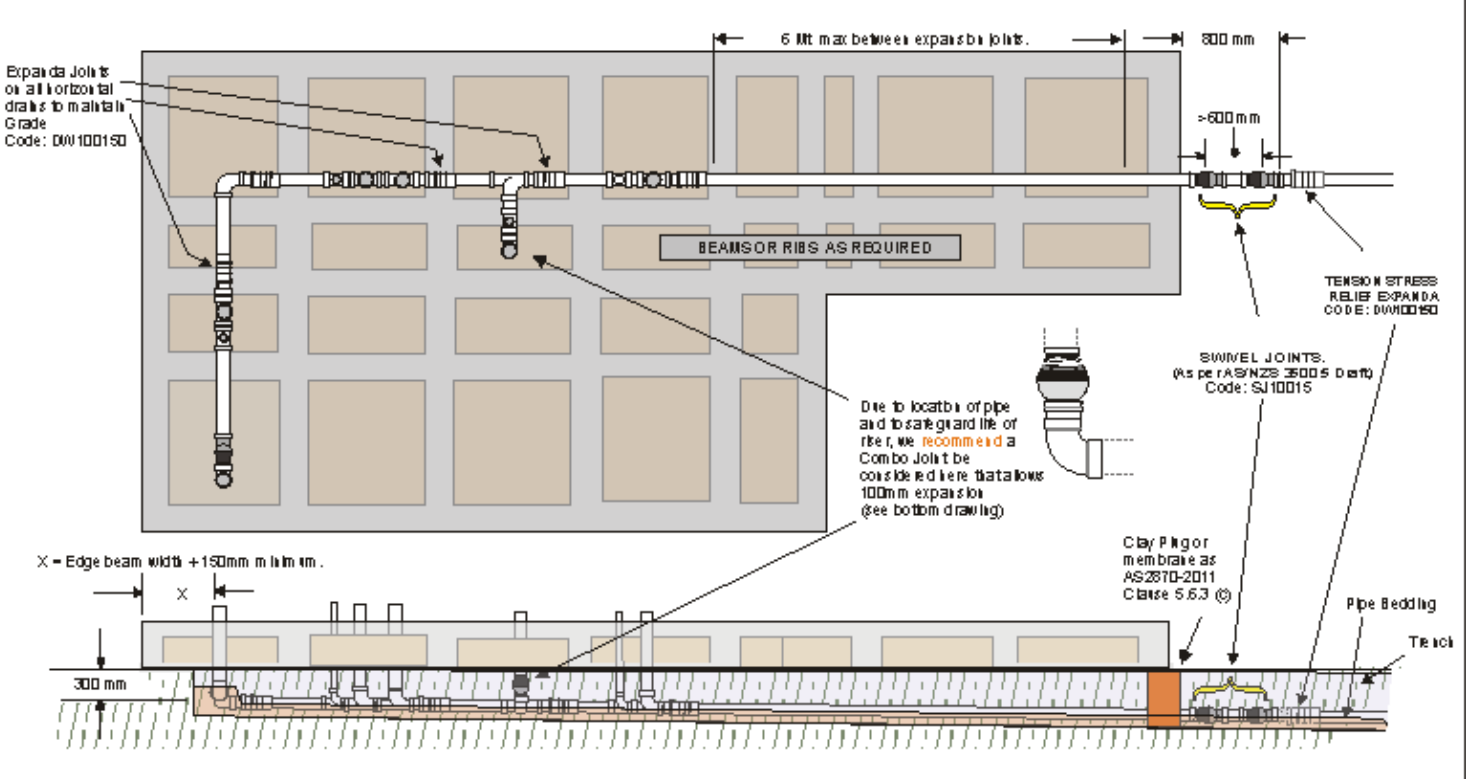
ZERO SIDE AREA



EXPANSION JOINT LAYOUT

AS2870-2011 is the most radical change to interpreting soils and house engineering we have seen since 1996 and several trades will need to know what is in it and how to apply it.

Expansion Joints on all horizontal drains to maintain Grade Code: DW100150



COMBO JOINT



Please refer to Storm Plastics Table No. SP-1 for additional details on flow grade size and installation.

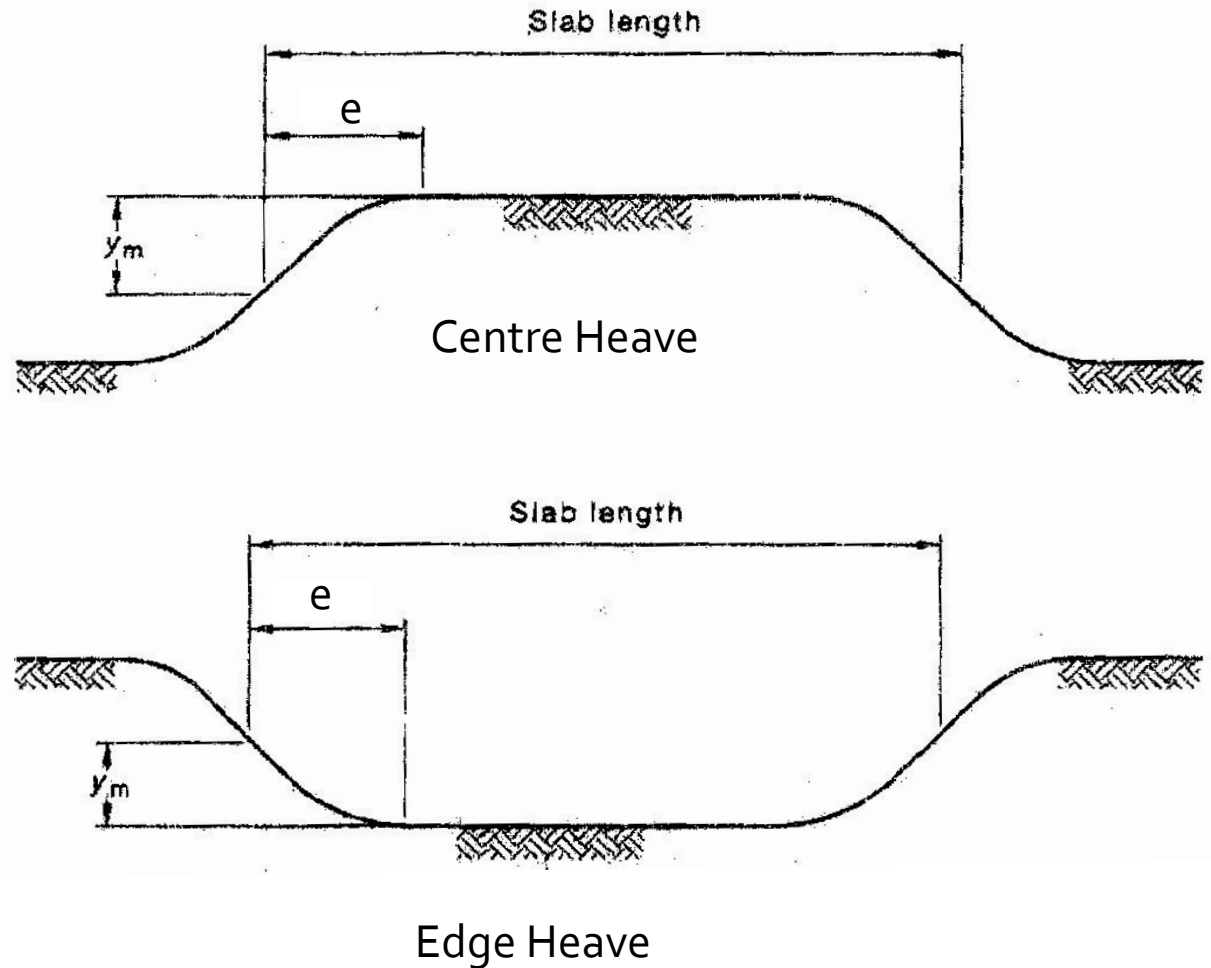
| Drawing No. SP 102 | UNDER SLAB DRAINAGE | NOT DRAWN TO SCALE |
|---------------------|---|--------------------|
| SOIL CLASSIFICATION | Class H1/H2 - Waffle Pad / Slab | |
| | 40-75 mm Differential Movement | |
| AS 2870-2011 | Residential Installation Guide ONLY for use of Mechanical Expansion Joints in Reactive Soils. | |
| COMPANY | STORM PLASTICS (SA) Pty Ltd | |
| DRAIN GRADE | 1:50 (200mm Fall in 10 Mts) | |
| PIPE MATERIAL | Poly Vinyl Chloride - PVC | July 2011 |



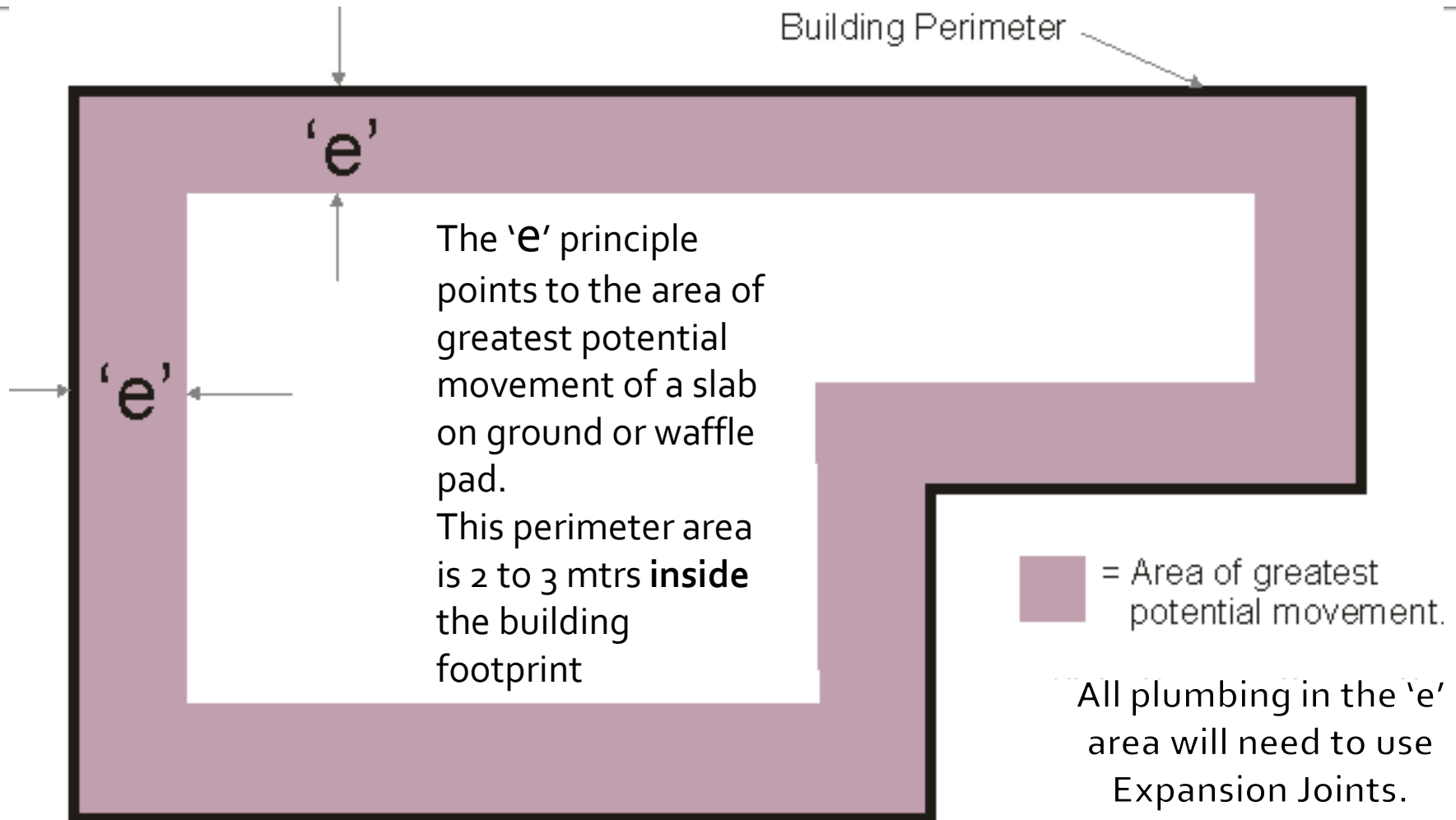
Unless otherwise specified, these joints are to be set at 50% of their sliding ability

THE 'e' FACTOR

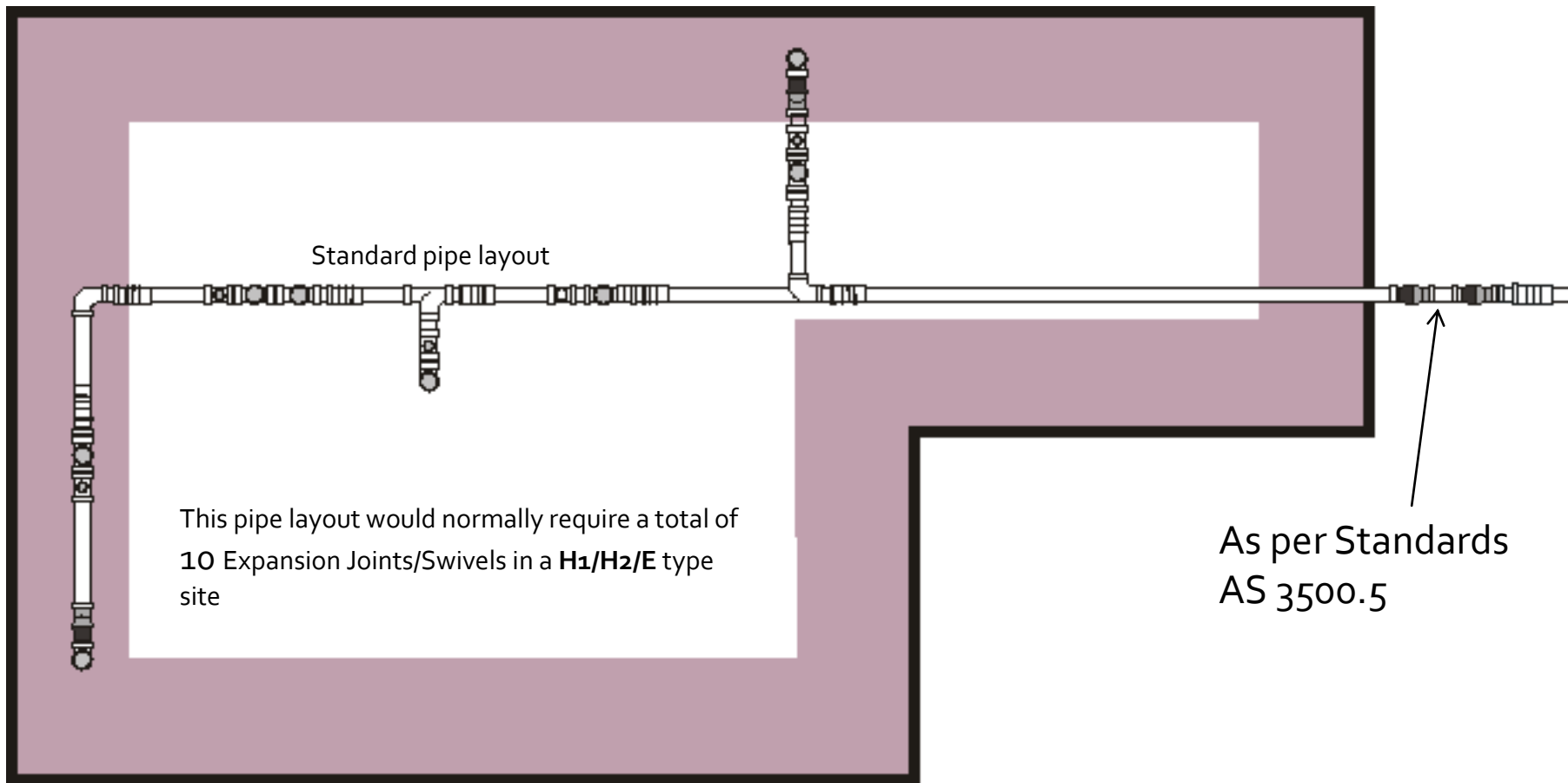
The 'e' Factor came about from the Walsh method mentioned in Appendix F In AS2870-2011 where movement occurs over an 'edge distance' (e) which applies to both Edge and Centre heave on slab design.



DRAINAGE CHOICES...



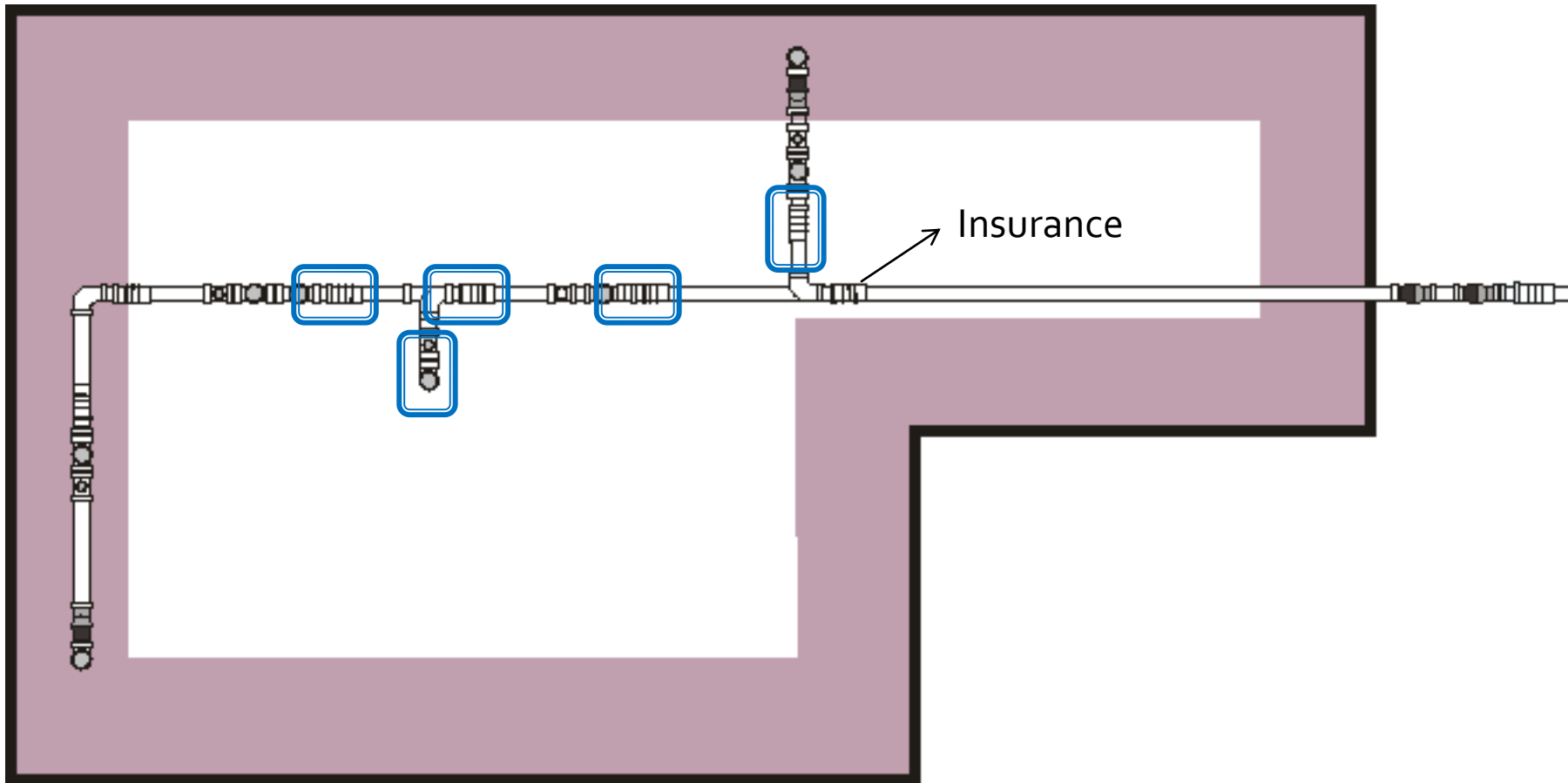
DRAINAGE CHOICES...



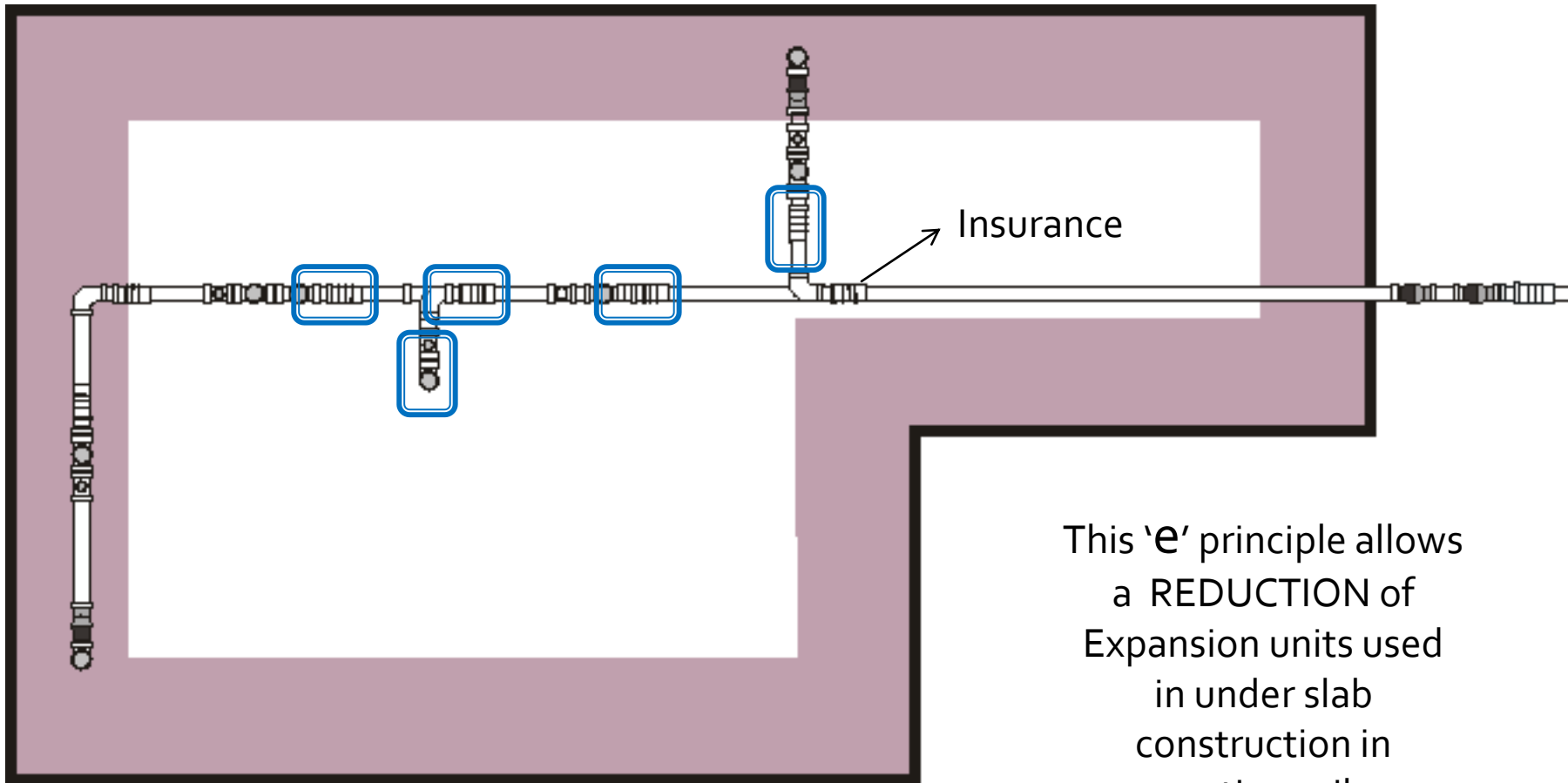
This pipe layout would normally require a total of 10 Expansion Joints/Swivels in a H1/H2/E type site

As per Standards AS 3500.5

DRAINAGE CHOICES...



DRAINAGE CHOICES...



This 'e' principle allows a REDUCTION of Expansion units used in under slab construction in reactive soils.

MORE CONCERNS...



Water problems...?



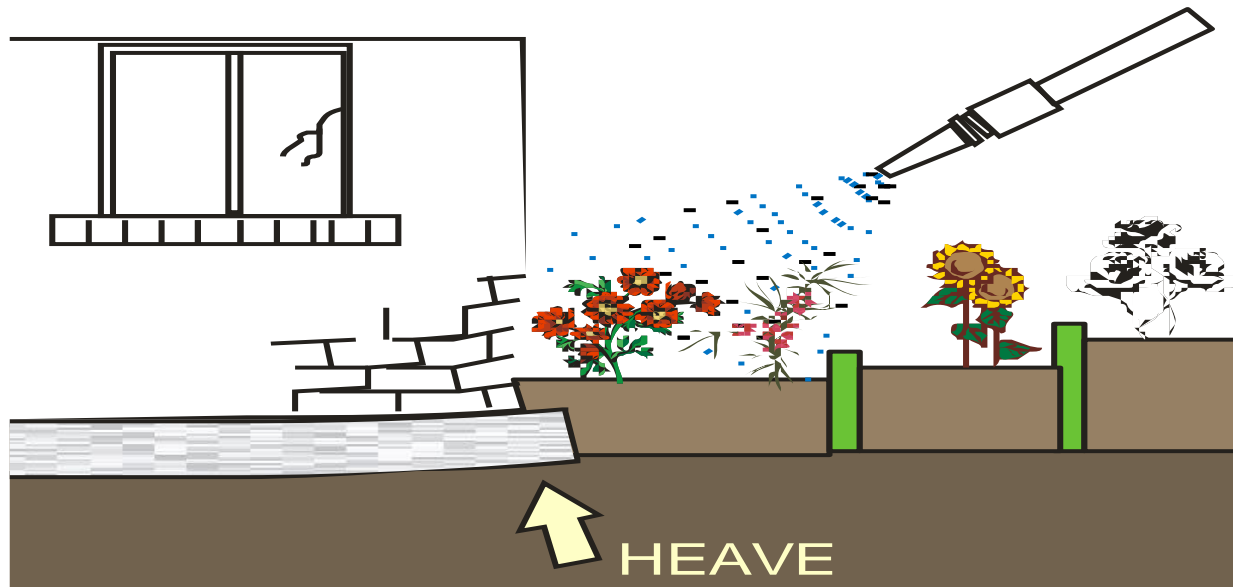
Trench failures occur due to incorrect installation and poor compaction.



The root of all problems

WHO IS RESPONSIBLE?

The Owner is responsible for 'unbalanced' garden watering. (*This changes moisture balance*)



MORE MOVEMENT



MORE MOVEMENT



CONDEMNED!



WHEN SOILS MOVE, ALL ELSE FOLLOWS



CONDEMNED!



Tamworth Seminar, July, 2012

DRAINAGE CHOICES



DRAINAGE CHOICES



Tamworth Seminar, July, 2012

DRAINAGE CHOICES



Tamworth Seminar, July, 2012

DRAINAGE CHOICES

Ready to pour.....



.....ready to break

BUILT IN PROBLEMS



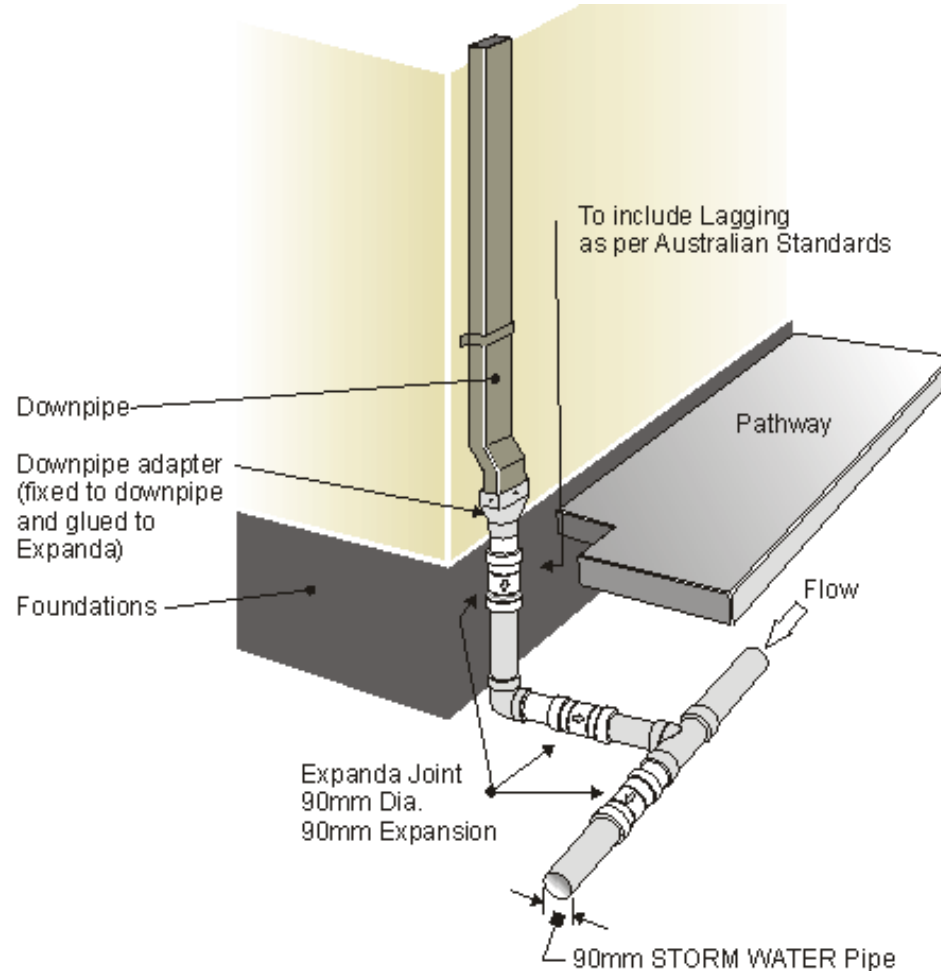
BUILT IN PROBLEMS



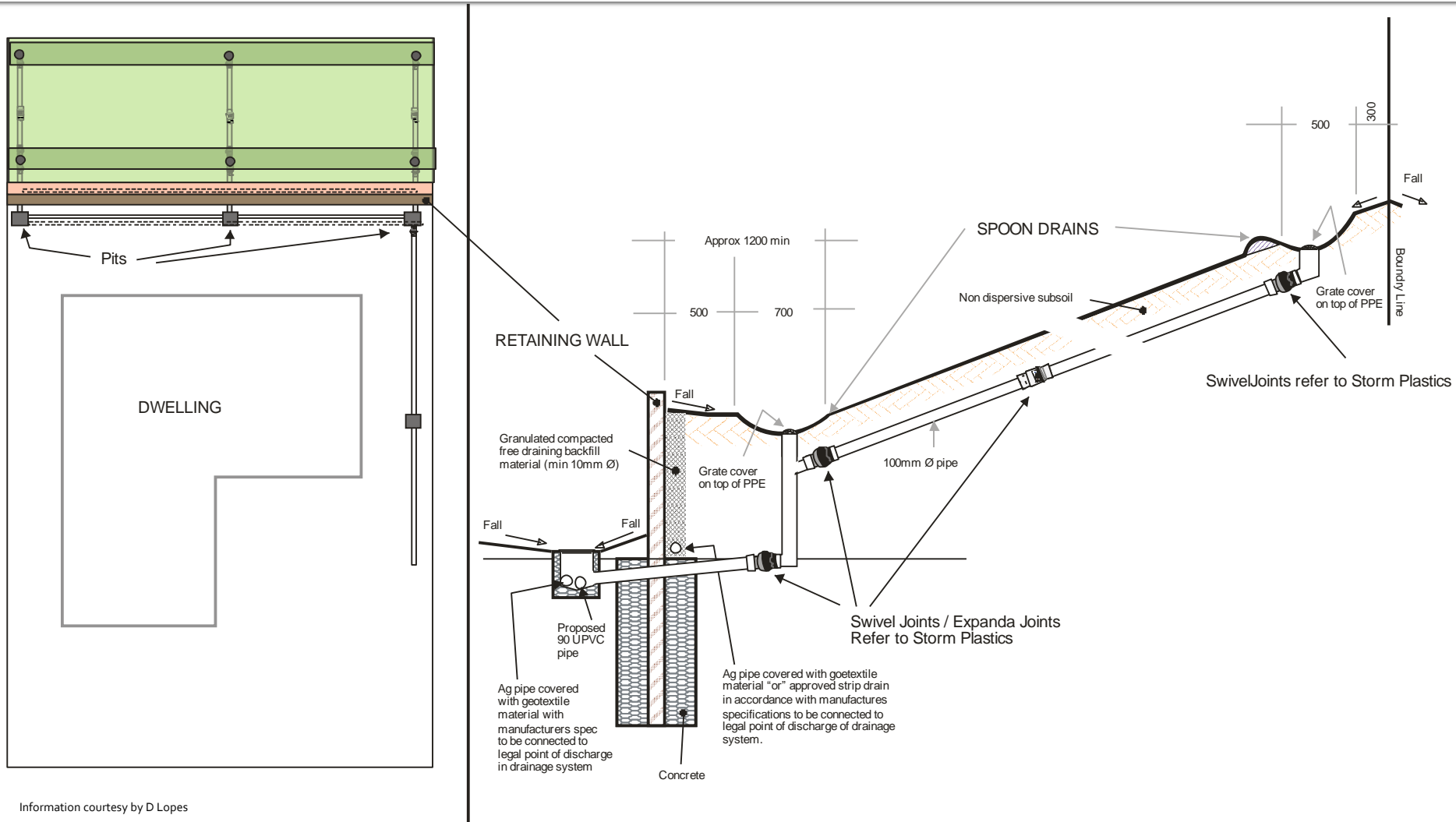
THE STANDARD: AS2870-2011

Now incorporates
Flexible Couplings
in
Sewer and Stormwater
installations
in
Reactive soils

AS 2870-2011 DRAINAGE REQUIREMENTS



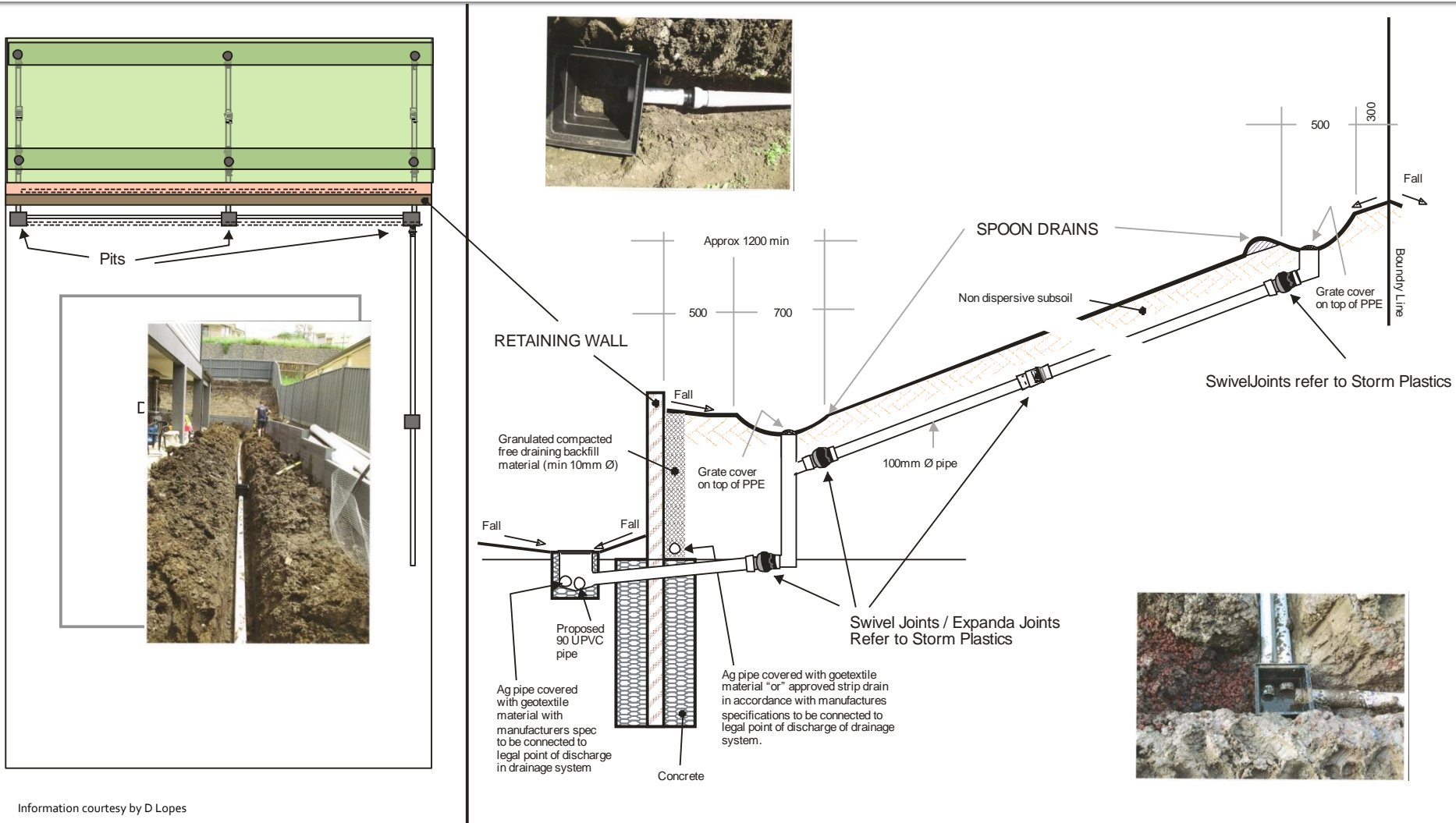
RETENTION WALL DRAINAGE



Information courtesy by D Lopes

Tamworth Seminar, July, 2012

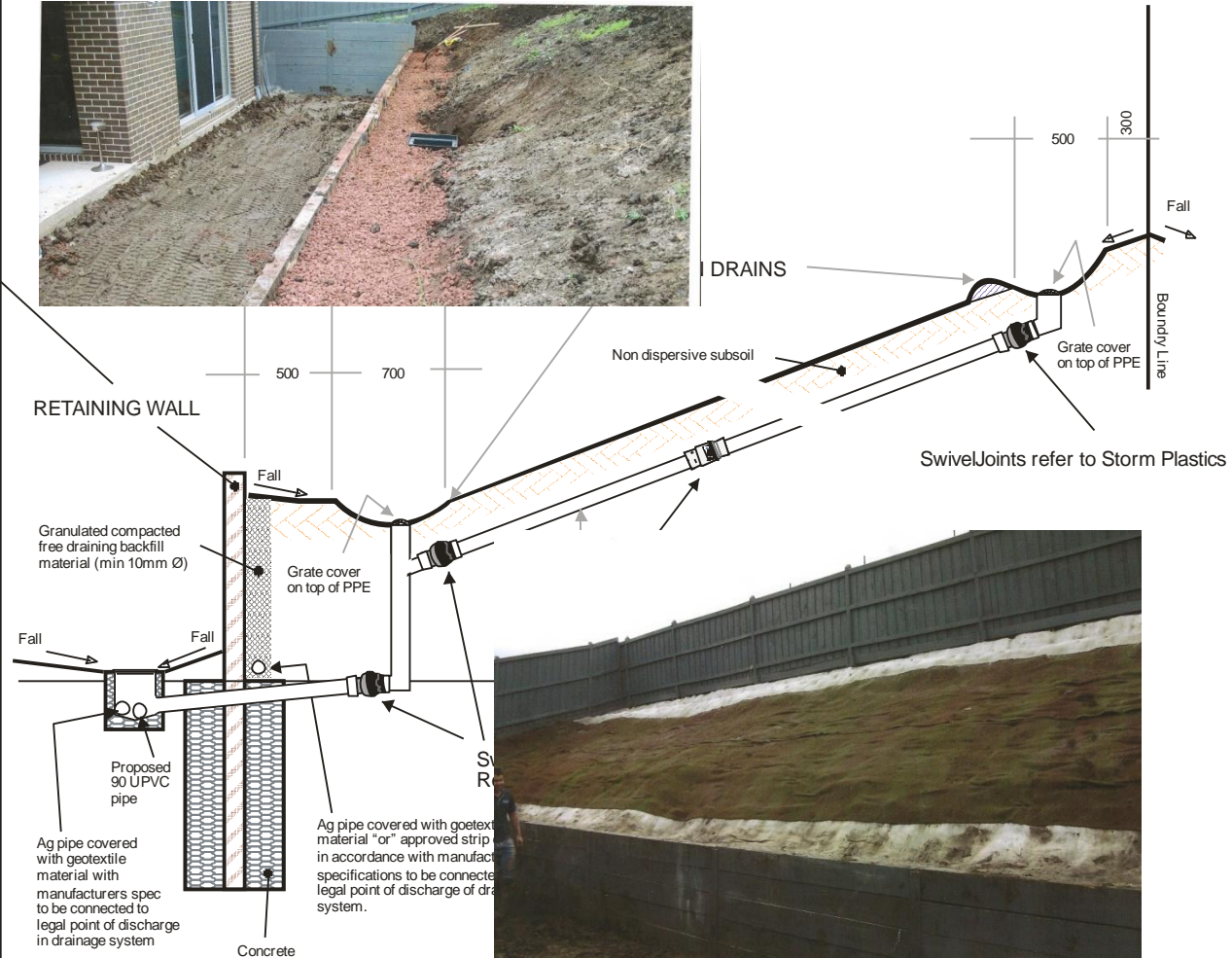
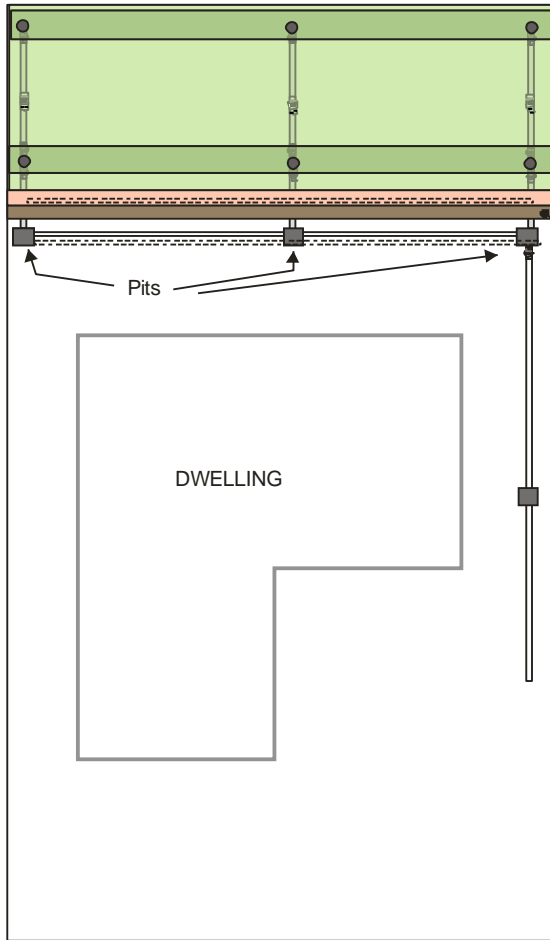
RETENTION WALL DRAINAGE



Information courtesy by D Lopes

Tamworth Seminar, July, 2012

RETENTION WALL DRAINAGE



Information courtesy by D Lopes

Tamworth Seminar, July, 2012

FLEXIBILITY?



Although a good alternative to replacing and excavating entire drains, relining, by design, does not allow for **any** movement in **any** reactive soils. Expansion and Swivel Joints are necessary for this method.

What's the problem?



WHAT DOES STANDARDS SAY ?



- LAGGING: Must be....
- a) Non-absorbent
 - b) very flexible
 - c) the right thickness

This means.....a minimum of **20**mm thick on H1 Soils

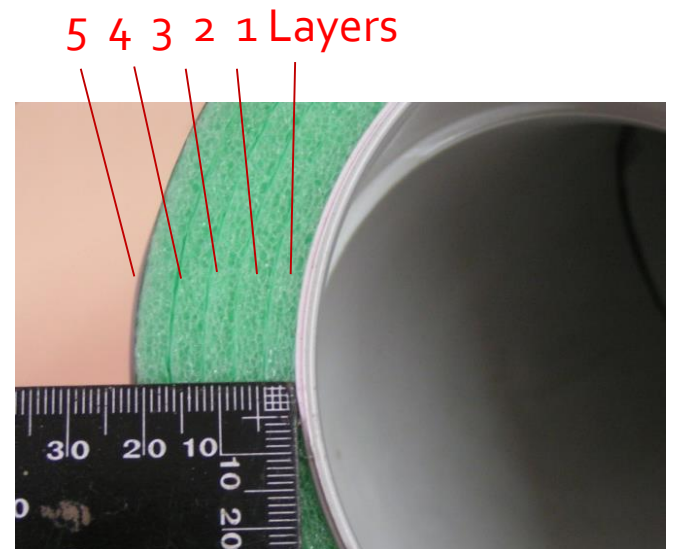
Anda minimum of **40**mm thick in H2 and E Soils

CARPET UNDERLAY? – NO.

- Styrene is used as a simple method but is available in only one thickness and has minimal compressibility resulting in high stress-transfer to junctions



- Closed Cell Polyethylene lagging can be layered to provide 20mm on highly reactive sites or 40mm if in extremely reactive areas. Benefits of high compressibility results in reduced stress-transfer to junctions.



REACTIVE SOILS IMPACT



REACTIVE SOILS IMPACT



Tamworth Seminar, July, 2012

REACTIVE SOILS IMPACT



DEEP REPAIR



PROTECTED SYSTEM



Tamworth Seminar, July, 2012

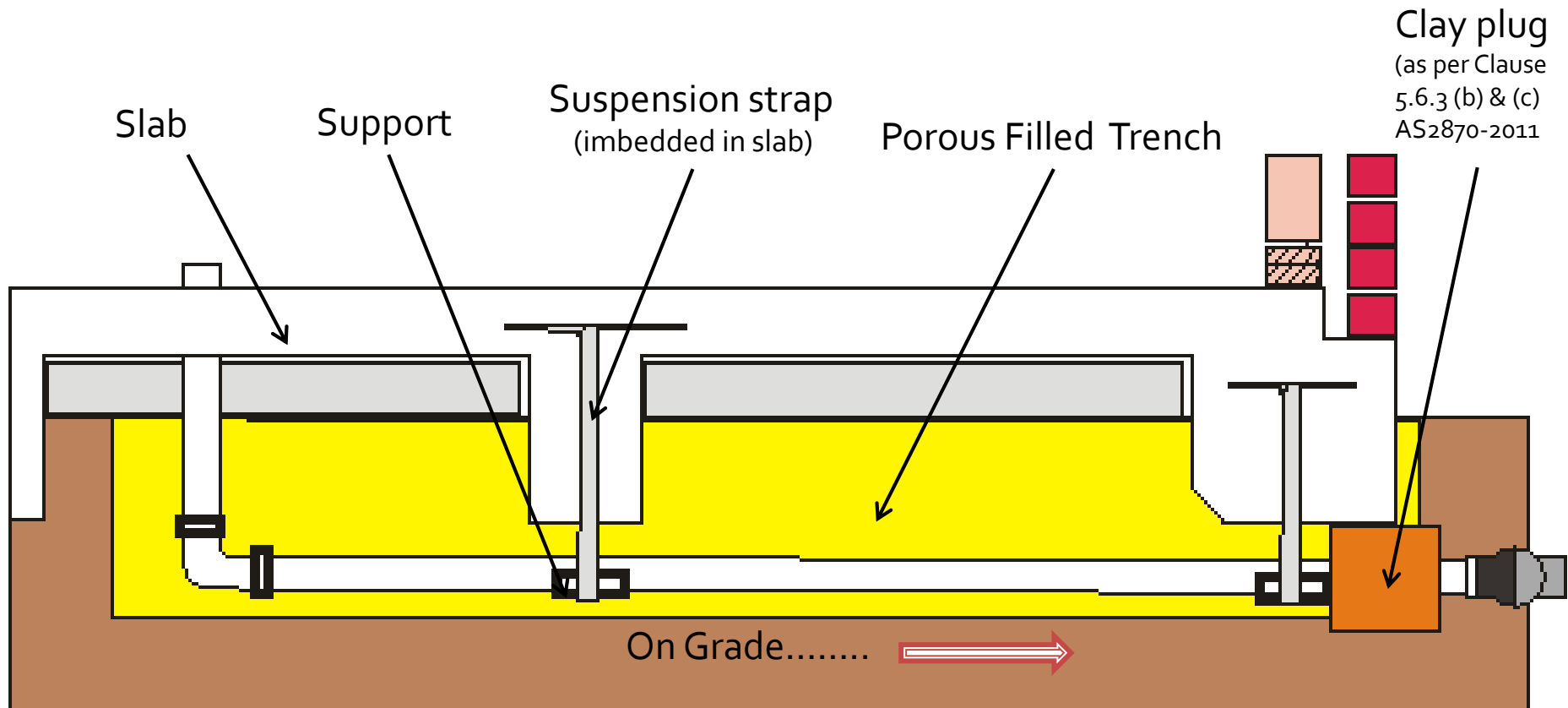
SLIPPED....



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DRAINAGE SUSPENSION

- Drainage construction alternative:
 - All underslab drainage systems could be tied into the slab. All movement can then be accommodated OUTSIDE the building with one Joint.



DRAINAGE SUSPENSION



DRAINAGE SUSPENSION



RESTRICTED ACCESS INSTALL



TREES ARE CLEVER...



Tamworth Seminar, July, 2012

WHO IS RESPONSIBLE?

- Additional Tree planting, after handover, is the responsibility of the Owner. *(This changes the block's soil ratings)*



COULDN'T GIVE A ROOT?

Roots can
penetrate
Rubber Sleeve
Joints with
serious
consequences.



RUBBER SLEEVES DON'T EXPAND



AS 2870-2011

DRAINAGE REQUIREMENTS

Clause 5.6.3

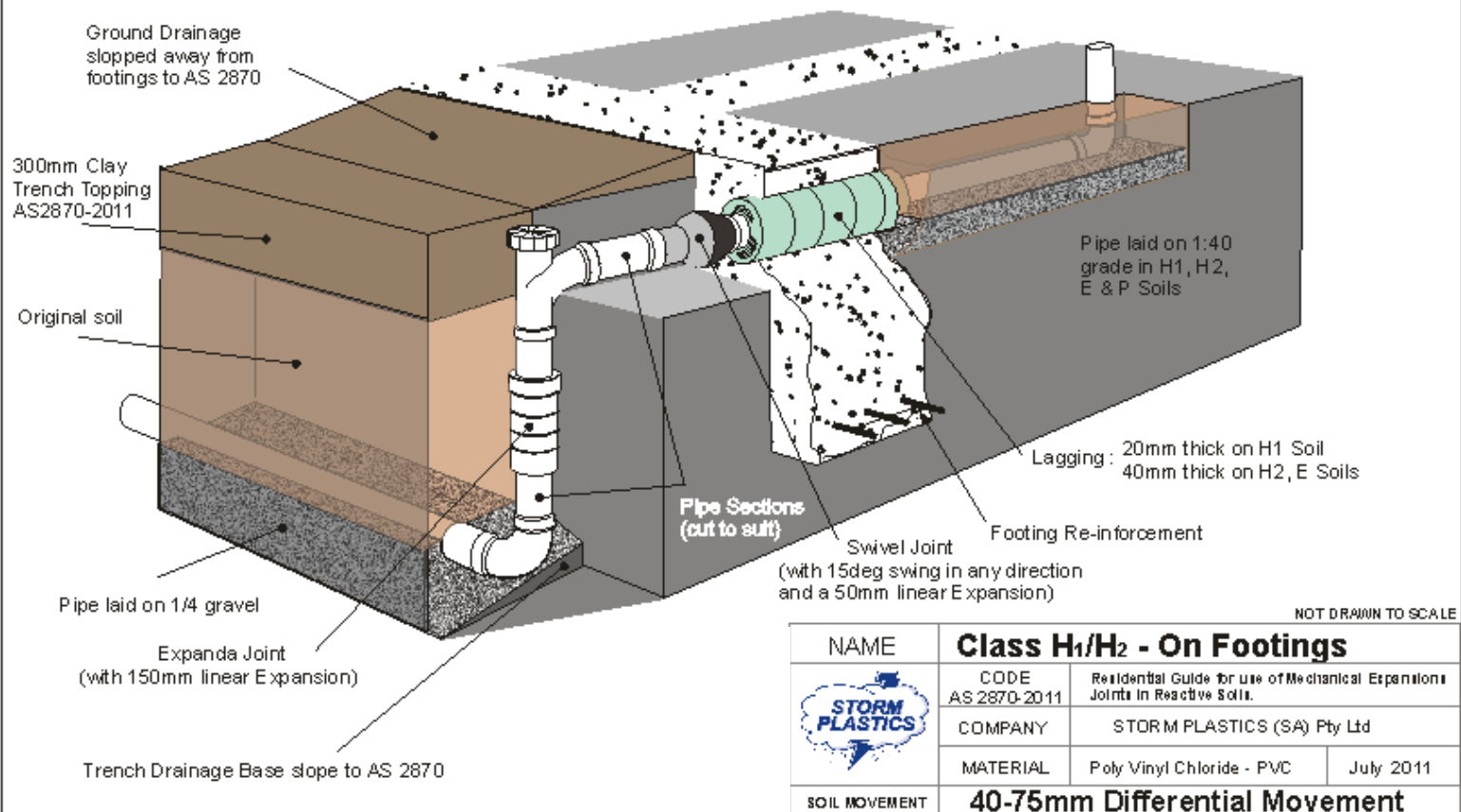
- (a).....The drainage system **shall** be completed by the finish of the construction of the building
- (b)The base of trenches **shall** be sloped away from the building. Trenches shall be backfilled with clay in the top 300 mm within 1.5m of the building

PLUMBING IN REACTIVE SOILS..



RESIDENTIAL FOOTING in REACTIVE SOILS- H1, H2, as per AS2870-2011 & AS 3500

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INSPECTION CHAMBERS

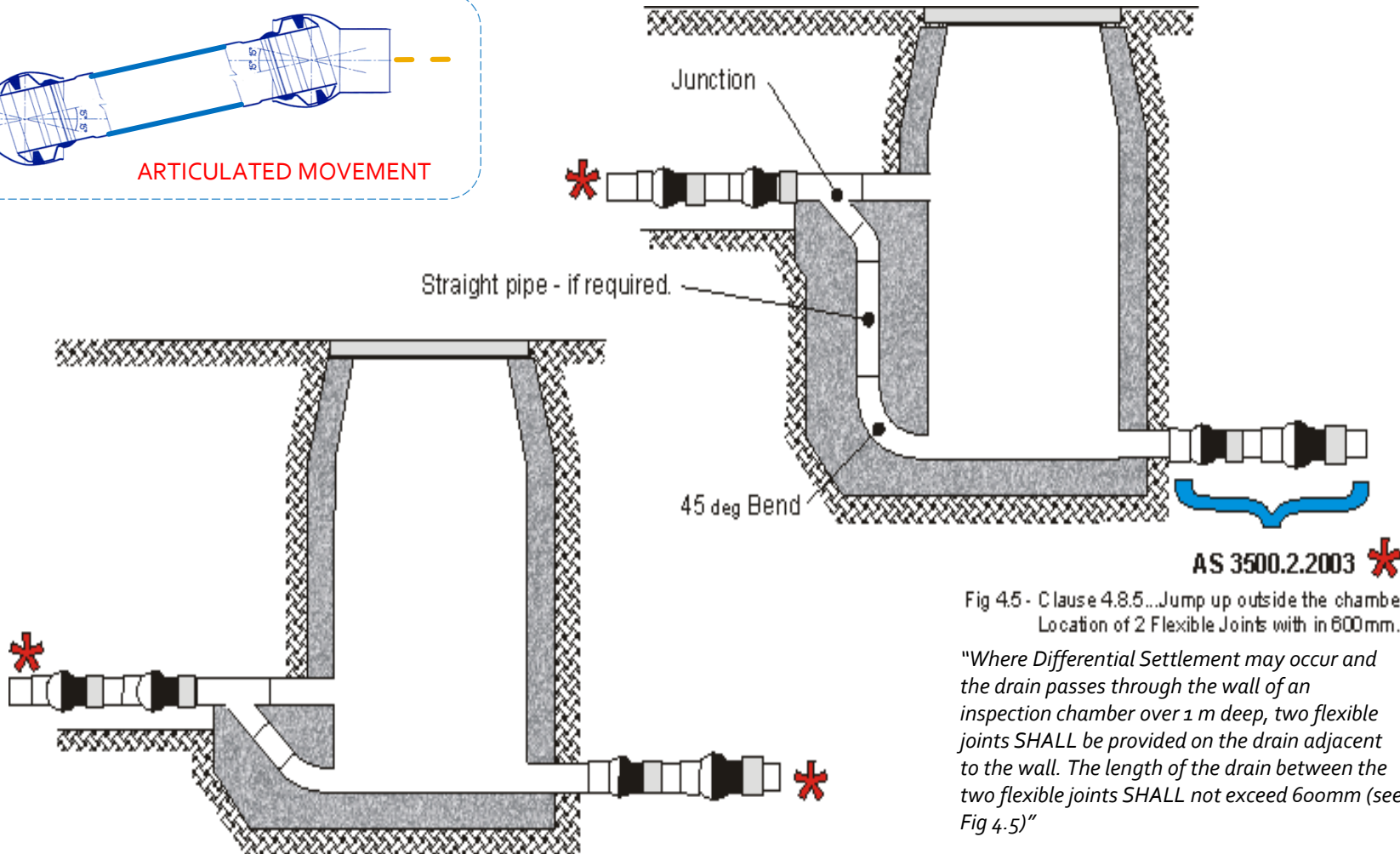
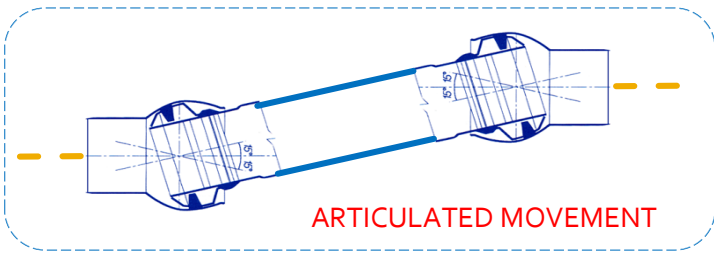
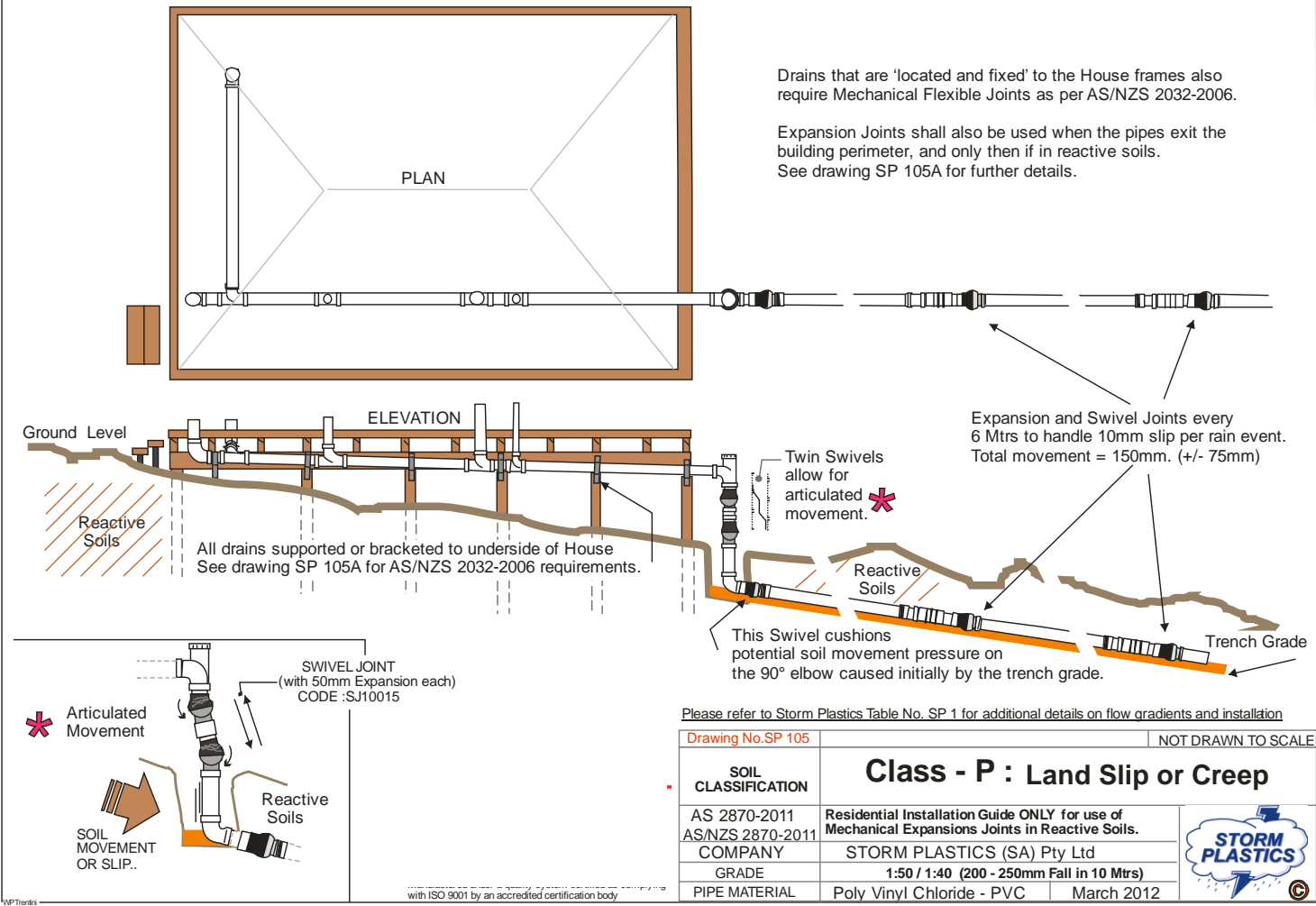


Fig 4.5 - Clause 4.8.5...Jump up outside the chamber
Location of 2 Flexible Joints with in 600mm.

"Where Differential Settlement may occur and the drain passes through the wall of an inspection chamber over 1 m deep, two flexible joints SHALL be provided on the drain adjacent to the wall. The length of the drain between the two flexible joints SHALL not exceed 600mm (see Fig 4.5)"

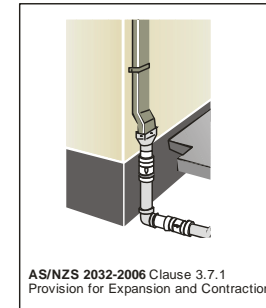
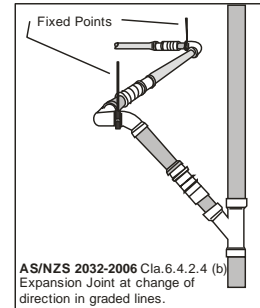
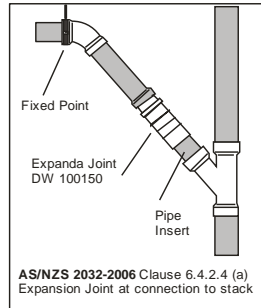
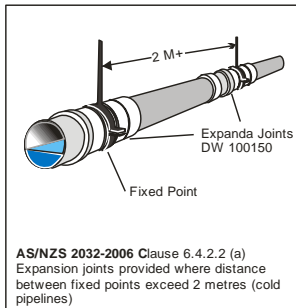
RURAL Applications : H2 / E Class and or SLIP SITES

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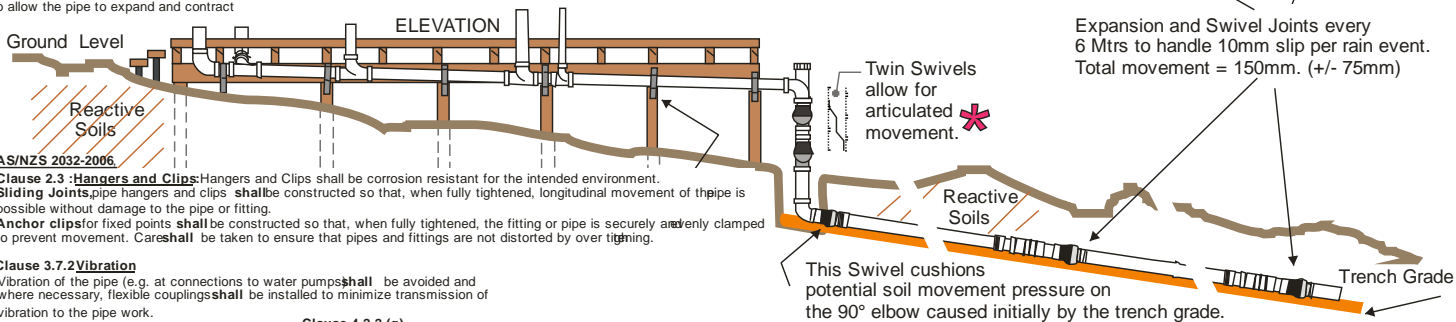
RURAL Applications : H₂ / E Class and or SLIP SITES

AS2870-2011 is the most radical change to interpreting soils & house engineering we have seen since 1986 and several trades will need to know what is in it and how to apply it.



AS/NZS 2032-2006 Clause 3.7.1 Provision for Expansion and contraction

Downpipes do not normally need special provision for expansion and contraction. However, when a downpipe is connected to a Stormwater pipe, or otherwise restrained at the discharge end, provisions shall be made to allow the pipe to expand and contract



AS/NZS 2032-2006

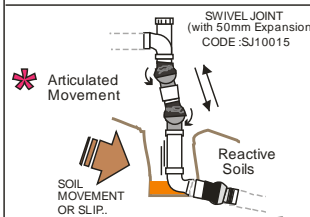
Clause 2.3 :Hangers and Clips:Hangers and Clips shall be corrosion resistant for the intended environment. Sliding Joints,pipe hangers and clips shall be constructed so that, when fully tightened, longitudinal movement of the pipe is possible without damage to the pipe or fitting. Anchor clips for fixed points shall be constructed so that, when fully tightened, the fitting or pipe is securely and evenly clamped to prevent movement. Care shall be taken to ensure that pipes and fittings are not distorted by over tightening.

Clause 3.7.2Vibration

Vibration of the pipe (e.g. at connections to water pumps) shall be avoided and where necessary, flexible couplings shall be installed to minimize transmission of vibration to the pipe work.

Clause 4.2.2 (g) Solvent Cement Jointing

Allow the joints to cure for 24hrs. Do not fill the pipeline with water until at least 1 h after making the last joint. Do not pressurize for at least 24 h after making the last joint.



Please refer to Storm Plastics Table No. SP- 1 for additional details on flow gradients and installation

Drawing No.SP 105A

NOT DRAWN TO SCALE

| SOIL CLASSIFICATION | Class - P : Land Slip or Creep | |
|---------------------|--|------------|
| AS 2870-2011 | Residential Installation Guide ONLY for use of Mechanical Expansions Joints in Reactive Soils. | |
| AS/NZS 2870-2011 | COMPANY STORM PLASTICS (SA) Pty Ltd | |
| GRADE | 1:50 (200mm Fall in 10 Mtrs) | |
| PIPE MATERIAL | Poly Vinyl Chloride - PVC | March 2012 |



Is this a plumbing Problem??



Tamworth Seminar, July, 2012

Sodic Soil + Plumbing leaks + heavy rainfall = Disaster



Guatemala City: April, 2010
6m wide x 10m deep.
Major contribution was heavy rain and
poor plumbing

Summary

60 to 70% of Residential housing, in Victoria and the Greater New South Wales area are currently being **built** on **REACTIVE SOILS**.

Drainage problems **will** increase maintenance costs if AS 2870-2011 and AS 2032-2006 regulations are **not** followed.



Storm Plastics

MANUFACTURERS OF SPECIALISED PVC-U PLUMBING PRODUCTS



ENGINEERS AUSTRALIA – STH WEST GROUP - VICTORIA