

# LANDFILL CASE STUDY



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**AEA – CON SITES AUDITING INCLUDING LANDFILL**

**IN VICTORIA – A LOT OF AUDITOR INVOLVEMENT IN LANDFILLS**

**VERIFICATION AND CERTIFICATION OF DESIGN**

**APPROVAL OF MONITORING PLANS**

**APPROVAL OF RISK ASSESSMENTS**

**HYDROGEOLOGICAL ASSESSMENTS**

**OTHER STATES - ONLY INVOLVED IN SIGN OFF RELATED TO LAND  
USE/CLASSIFICATION**



# MELBOURNE SITE

- Historical uses of the property include
  - market gardening (1892-1933),
  - sand quarrying (1933-1985), average depth of 20m
  - landfilling (1976-1989)
  - filled with a mixture of soil, demo waste and some limited putrescible material
- No liner or capping of the landfill.
- Sandy soil, groundwater at 15m
- High Density Residential Development (in construction)





## MELBOURNE SITE

- Townhouse development proposed
- Environmental audits 53x conducted 1994, 1998 and 2011
- Evidence of landfill gas generation identified in 1994 audit
- Methane generation rates have been estimated at
  - 0.25 - 12.4L/s (1994 audit)
  - 1.9L/s (1998 audit)
  - <0.54L/s (2011 audit)
- LFG management required for proposed residential development
- Based on gas flow, methane data, carbon dioxide data and calculated Gas Screening Values ('GSVs') the CIRIA C665, it was concluded that Characteristic Situation 3 ('CS3') applies





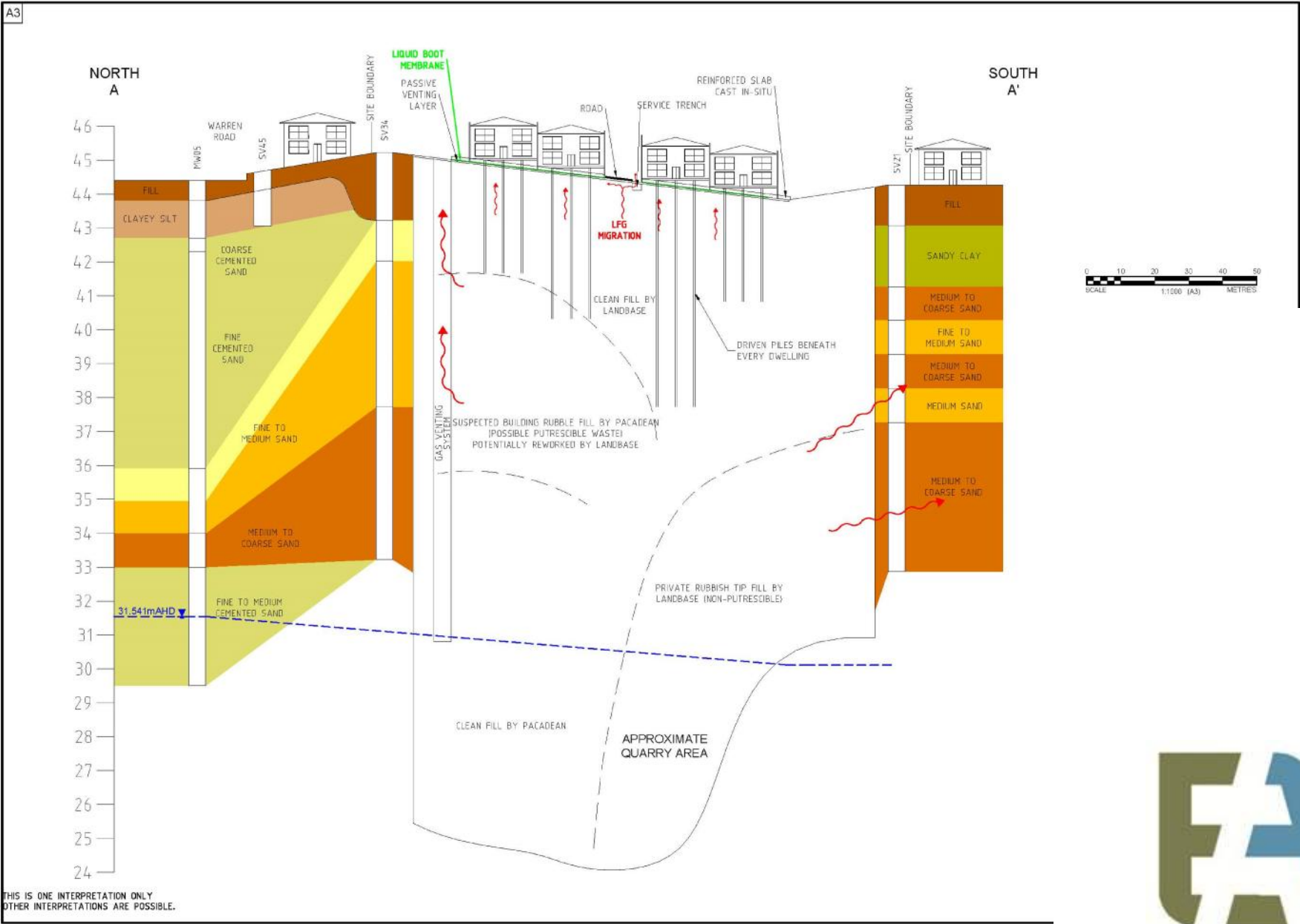
# MELBOURNE SITE



THIS IS ONE INTERPRETATION ONLY  
 OTHER INTERPRETATIONS ARE POSSIBLE.



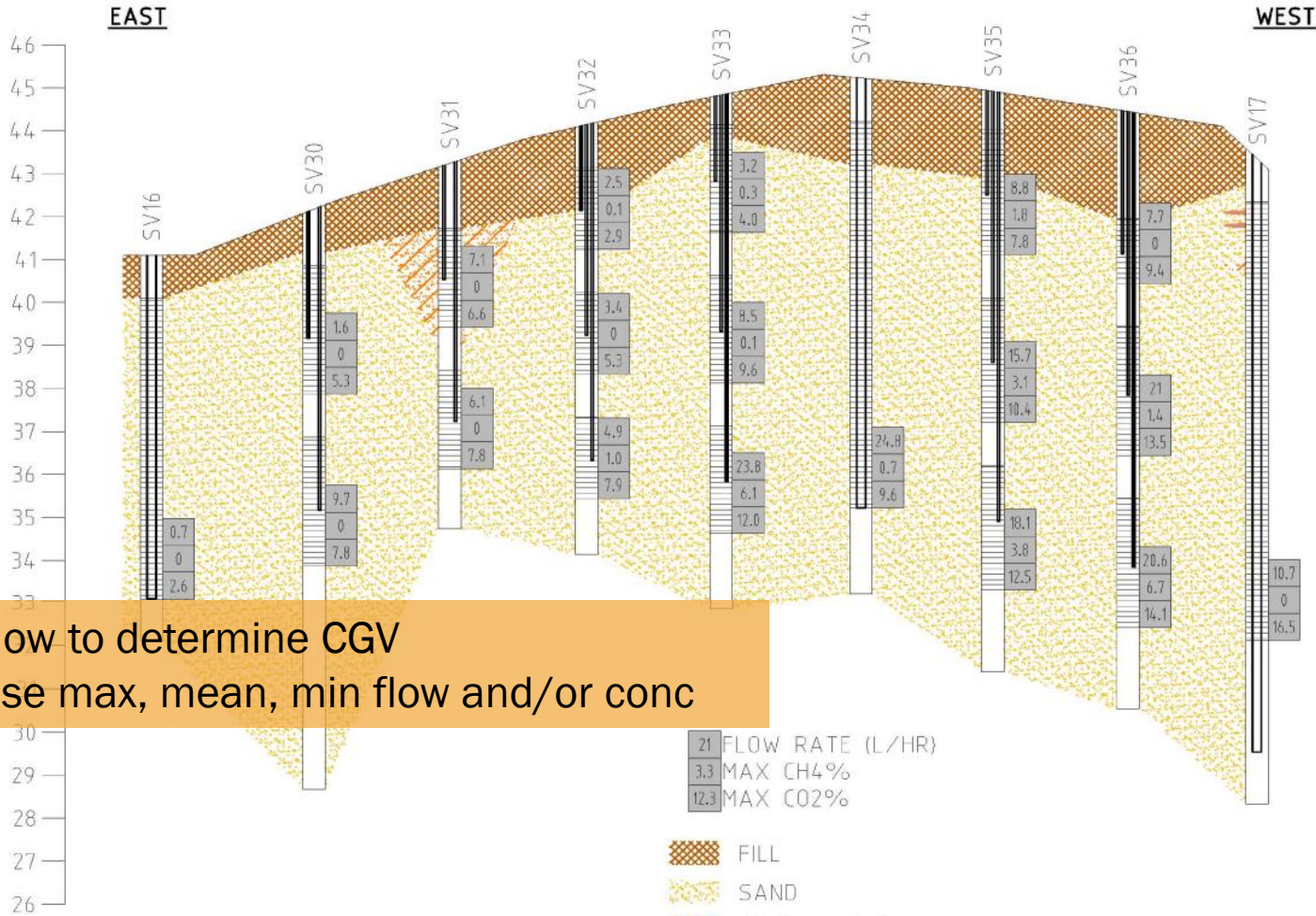
# MELBOURNE SITE





# MELBOURNE SITE

A3



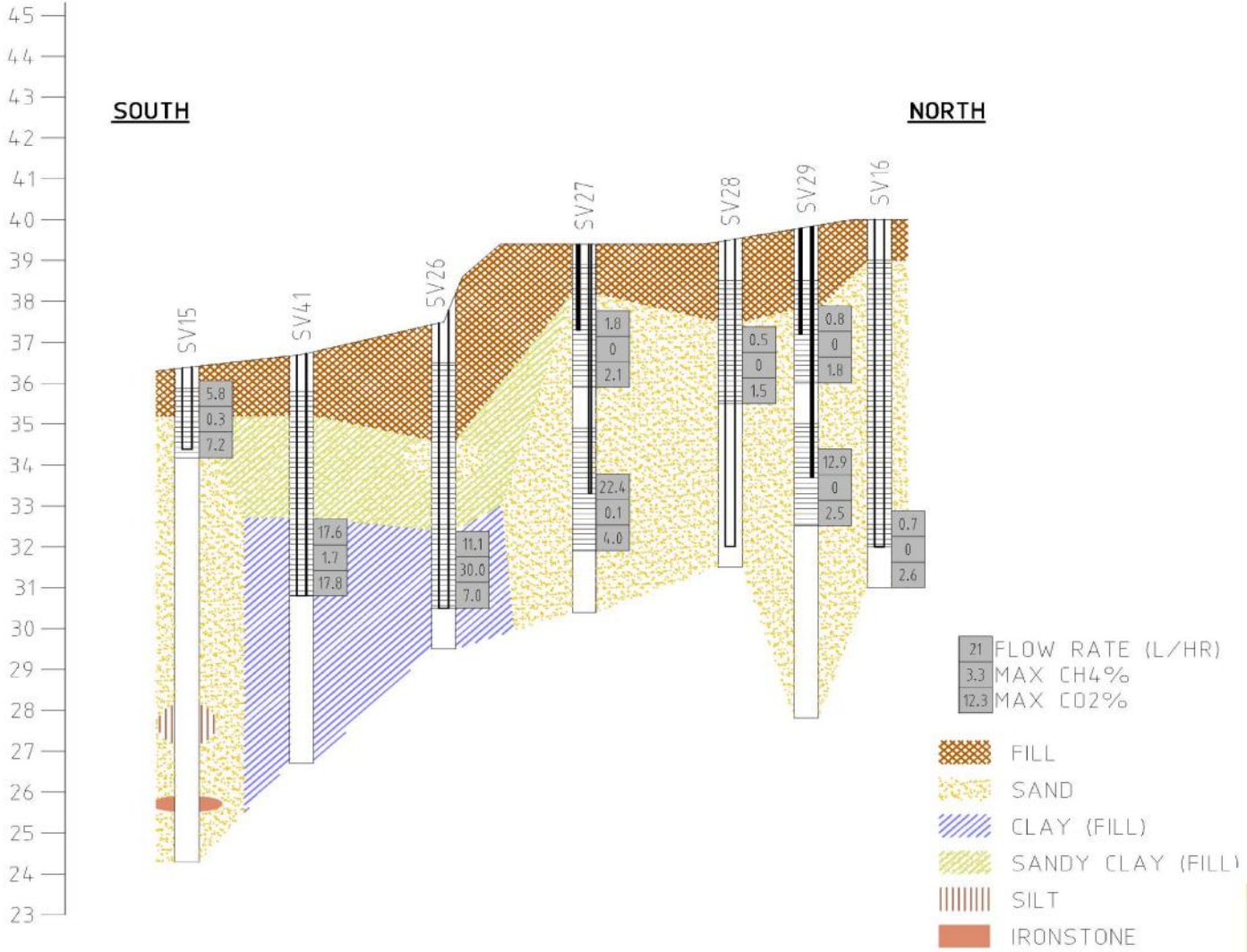
How to determine CGV  
Use max, mean, min flow and/or conc

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# MELBOURNE SITE

A3



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## MELBOURNE SITE

Gas Vapour Barrier Design based on the CS3 which governs

- Geovent spacings
- Active versus passive venting
- Minimum venting area
- Blanket thickness

2011 Audit required that an Auditor:

- 1) Approve the CEMP
- 2) Monitors gas emissions from completed house venting systems
- 3) Performance is '**Good**' as per British Standard BS8485 (2007)  
Code of Practice for the Characterization and Remediation from  
Groundwater Gas in Affected Developments;

*Methane concentration over 100% of the ventilation layer*

*<1% by volume at a wind speed of 1 m/s and  
<2.5% by volume at a wind speed of 0.3 m/s.*

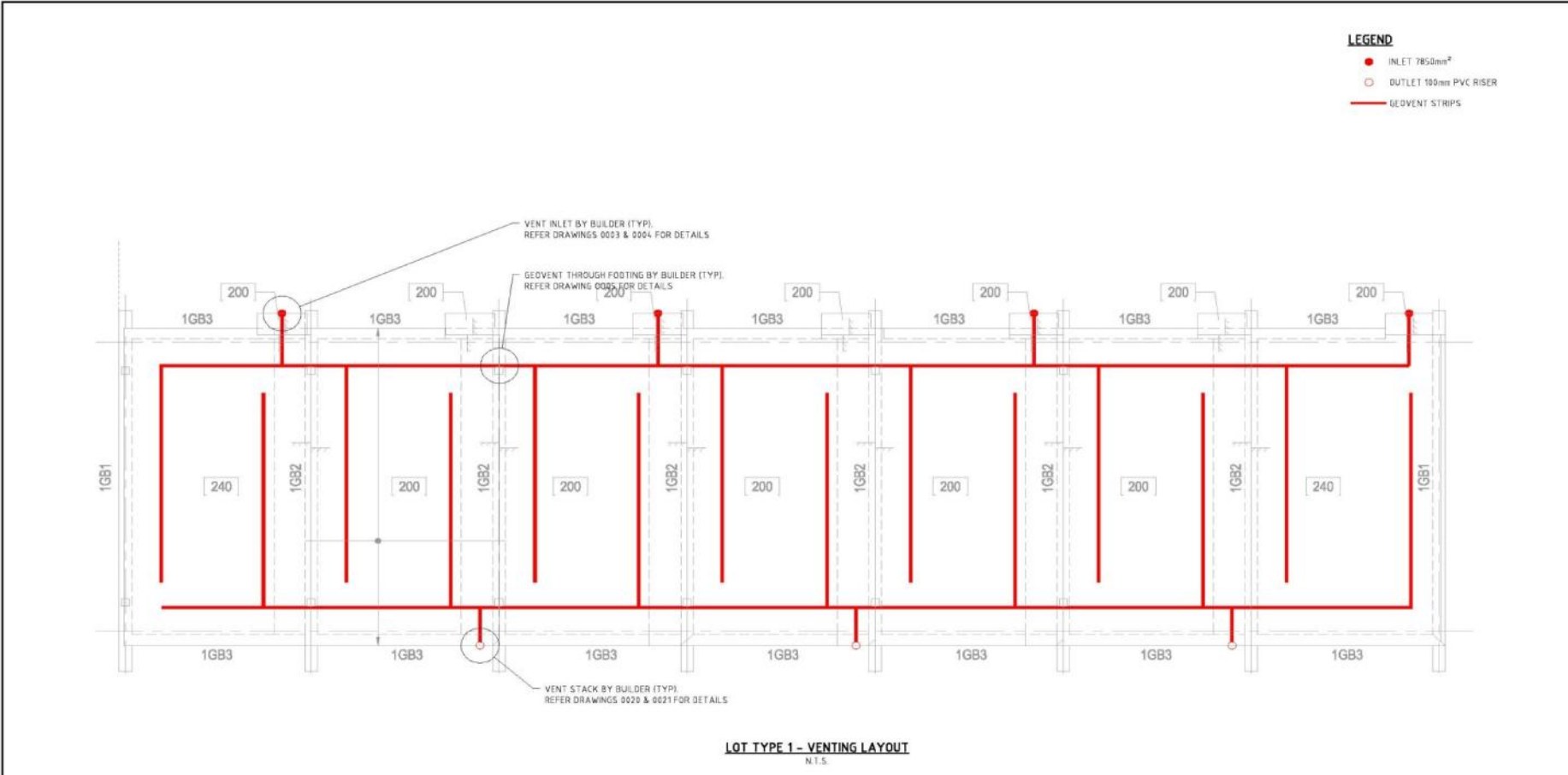


## MELBOURNE SITE Vapour Design Summary

Barrier (top to bottom)	Details
Ground Slabs	180-240mm thick poured concrete slab.
Gas Membrane	1mm thick layer of LIQUID BOOT sprayed over VI-20 geomembrane
Passive Ventilation System	<p><b>Interleaved geovent strips laid at 2m-3m spacings</b></p> <p>Geovent strips connected to inlets/outlets.</p> <p>Inlets at a height less than 1m above ground level</p> <p>Risers constructed using 100mm diameter PVC</p> <p>Risers extended to 1m above roof level</p> <p><b>100mm layer of gravel</b></p>
Sub-grade	1m of compacted clay



# MELBOURNE SITE Vapour Design



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A 31.07.12 ISSUED FOR INFORMATION REV DATE DESCRIPTION BY CHECK DESIGN VERIFY	IN: _____ SB: _____	<b>A3 ORIGINAL</b> DO NOT SCALE THIS DRAWING	PR CEN	DRAWING: _____

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## MELBOURNE SITE





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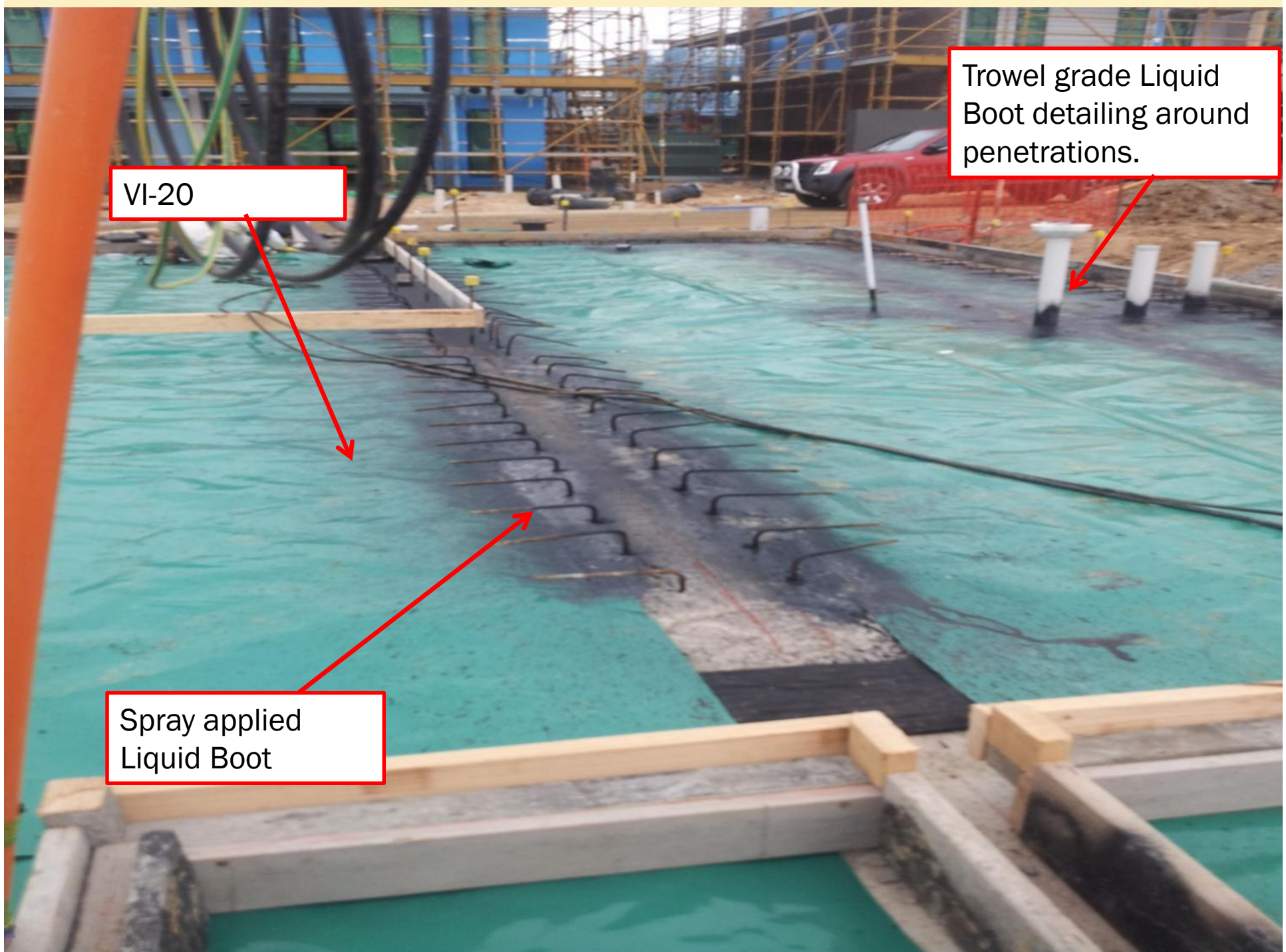




Outlet  
connected to  
Liquid Boot  
Geovent.

Geovent





VI-20

Trowel grade Liquid Boot detailing around penetrations.

Spray applied Liquid Boot



## MELBOURNE SITE











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## MELBOURNE SITE



## MELBOURNE SITE





## MELBOURNE SITE ISSUES

Stage 1A, Block D, Lot E08	Smoke testing of gas membrane identified that a plumbing pipe had been damaged and was providing a preferential flow path for smoke beneath the gas membrane.
Stage 1A, Block D, Lot E10	Wall bracing contractors penetrated a pipe associated with the gas management system.
Stage 1A, Block H	Electrical contractor cut hole through gas membrane when relocating a conduit.
Stage 1B, Block L, Lot G07	Contractor using a grinder directly over gas membrane.
Stage 1A, Block A, Lots D02, 4, 7, 8, and 9.	Unable to repair breach in membrane due to overlying formwork for step.

## MELBOURNE SITE ISSUES





## MELBOURNE SITE ISSUES

Photograph 1 – Formwork surrounding future step into building. Smoke breaches under formwork to be repaired by CETCO.



Photograph 2 – Punctured membrane. Based on size of puncture, cause possibly due to steel. Puncture and sealed with Liquid Boot roll grade.




Vent system outlet

Dedicated sampling port extends to centre of gravel layer.







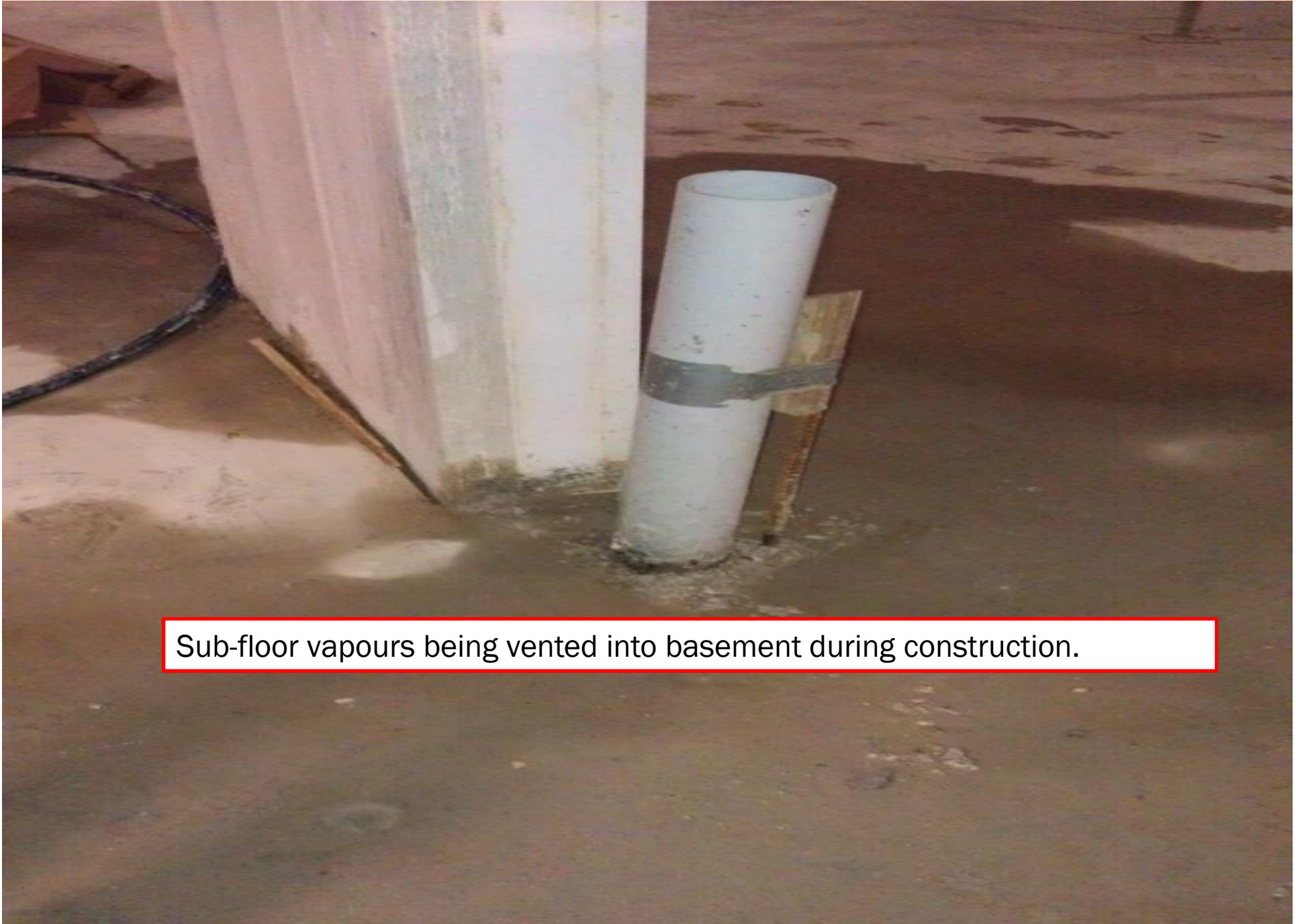


Outlet on wrong side of plinth (required coring, undesirable bend in outlet riser pipe).




Temporary wall bracing bolts breached outlet pipe.





Sub-floor vapours being vented into basement during construction.





'Soil vapour' stickers used to differentiate from other pipes.

Protective bollard in front of passive ventilation riser.

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✘ CQA plan needs to define roles and responsibilities. Lowest potential for issues at the end of the job if:

- + A single experienced contractor is responsible for every aspect from design through to validation.
- + Inspections are conducted by an independent third party (as necessary).
- + The responsibility and methods for demonstrating compliance with the design are clearly defined before commencement.



## MELBOURNE SITE

### Take Home Messages

- It is possible to build over landfills and this has been done frequently in UK and USA
- Need to understand worst case? flux of methane rather than just concentrations
- There are building guidelines available based on category of risk
- CQA plan is critical - Builders aren't use to doing this, many trades involved, **need a good PM/foreman**
- Close inspection during installation is critical – suggest full time supervision
- Liquid boot is good, provides quick assessment of leaks and easy to fix

