

Vacuum Sewerage Code of Australia

Requirement	Clause
<p>The Power and Water Corporation (PWC) has a strong preference for gravity sewers and will only consider pressure sewers or vacuum sewers where it can be demonstrated that whole-of-life costs of gravity sewers and related conventional pumping stations are excessive.</p> <p>PWC has moved to adopt the Vacuum Sewerage Code of Australia as the general basis for the design and construction of vacuum sewerage infrastructure under its control in the Northern Territory. This document is read as a supplement to the Vacuum Sewerage Code of Australia to provide details of those modification and additions to suit the particular requirements of PWC.</p>	<p>PWC Comment</p>
<p>PWC has adopted the 'Planning Guidelines for Water Supply and Sewerage' as issued by the Queensland Department of Environment and Resource Management. PWC has also adopted the WSAA codes and this supplement provides details of those modifications and additions that suit the particular requirements of PWC.</p> <p>This supplement only applies to those areas of the Northern Territory which are:</p> <ul style="list-style-type: none"> (i) Served by a public sewerage system under the direct control of PWC (ii) New schemes or extensions to existing systems to be taken over by PWC (iii) Areas declared as Sewerage Districts under the Northern Territory Water Supply and Sewerage Services Act <p>The requirements of this supplement in respect of the WSAA codes take precedence over the requirements of the Queensland Planning Guidelines.</p> <p>Preference in design will be given to conventional gravity systems.</p> <p>The use of vacuum sewer systems will only be considered if proven to the satisfaction of PWC that a gravity system is not technically feasible.</p> <p>Vacuum sewer systems shall not be used in industrial areas.</p> <p>The supplement assumes vacuum sewers will only be used in tropical areas. Contact PWC for applicable parameters for arid zones for emergency storage, EP limit per interface valve and number of SD blocks that can be connected to a collection chamber. Other items remain unchanged.</p> <p>Specific written approval is required for connection of caravan parks to vacuum sewer systems.</p> <p>The use of vacuum sewer systems is only permitted where specifically approved by PWC.</p>	<p>1.1</p>
In the first paragraph, delete "industrial and".	1.2.1
Delete: "(f) in aquifer protection zones"	1.2.2
PWC will not provide a Concept Plan. The Designer shall liaise with PWC, prior to commencement of design, to ensure that sufficient planning is completed to enable design to proceed.	1.5.2

Requirement	Clause
<p>Replace list of possible stakeholders with the following:</p> <p><i>Stakeholders may include, but are not limited to:</i></p> <ul style="list-style-type: none"> a) <i>Property Owners served (or affected) by the works, including absentee owners;</i> b) <i>heritage and indigenous people groups;</i> c) <i>AAPA</i> d) <i>Native Title holders;</i> e) <i>tenants;</i> f) <i>municipal councils;</i> g) <i>other utility agencies, including PWC Power Networks;</i> h) <i>road and rail owners</i> i) <i>planning authorities;</i> j) <i>developers of adjacent works; and</i> k) <i>environmental and community groups</i> 	1.5.4
<p>Delete: "(b) a single gravity connection for each property with maximum drainage of the property"</p>	1.6.3
<p>Insert: "(b) full lot control is to achieved for each property"</p> <p>After the last paragraph, insert:</p>	1.7.3
<p>"Rectification of design errors with vacuum sewers can require significant expenditure. Developers should consider obtaining a performance undertaking or security from the system supplier and/or engineering consultant for a period of two to three years from completion of works."</p>	
<p>Delete: "(b) Pump peak dry weather flow plus an allowance for wet weather flow"</p>	2.2
<p>Insert: "(b) Pump peak wet weather flow"</p>	
<p>Delete (b).</p> <p>Dual power supplies shall be provided for all vacuum stations.</p>	2.5
<p>Delete (i).</p> <p>In the first paragraph, delete the sentence "Where a commissioning plan is not supplied by the Water Agency the Designer shall be responsible for producing a plan for prior approval by the Water Agency at concept design stage" and replace with:</p> <p>"The Designer shall produce a Commissioning Plan at the concept design stage for PWC approval."</p> <p>Add:</p> <ul style="list-style-type: none"> (g) Where applicable, interconnection to existing vacuum sewerage systems (h) Flood testing to tune new vacuum sewers (i) Flood testing to re-tune existing vacuum sewers interconnected with the new vacuum sewers (j) Outline of proposed operating manuals and maintenance manuals 	2.11
<p>Coordinates to be specified to MGA. Pine Creek and west of Pine Creek falls within Zone 52. East of Pine Creek falls within Zone 53.</p>	3.2

Requirement	Clause								
<p>Before construction commences, Aboriginal Areas Protection Authority (AAPA) clearances shall be obtained, including a set of clearances in the name of the Power and Water Corporation.</p> <p>Add:</p> <p>(m) areas under control of an aboriginal land council</p> <p>(n) areas where Native Title has been granted</p>	3.6.1								
<p>Add the following after final paragraph:</p> <p>"Note that trees and some landforms, particularly in desert areas, can form part of an aboriginal sacred site. If there is any doubt, then the advice of the Aboriginal Areas Protection Authority should be sought, and if necessary, an AAPA certificate obtained and paid for by the developer.</p> <p>Developers should be aware that significant delays may occur should AAPA certificates not be obtained in time to commence construction. Power and Water will not accept any site that has been the subject of destruction of sacred sites until all outstanding issues resulting from that destruction have been finalised and final AAPA certification issued.</p> <p>Severe penalties apply under NT law for destruction of sacred sites."</p>	3.6.3								
<p>Add:</p> <p>(e) In coastal areas subject to storm surge, the weir crest of any ERS shall be set at least 0.5m above the storm surge level.</p> <p>At the end of the clause, add the following:</p> <p>"In coastal areas subject to storm surge, electrical switchboards and electrical connection points shall be set at least 0.9m above the storm surge level."</p>	3.6.5								
<p>Delete the third paragraph ("For some Water Agencies, an easement over private property...") and insert:</p> <p>"An easement over private property is not the preferred location for a pipeline and may only be used as temporary solution pending future permanent pipeline within a road reserve".</p> <p>Delete the paragraph "<i>Typical situations where the Water Agency may approve...</i>".</p> <p>Delete the paragraph "Specific requirements for the use of an easement..." and insert the following:</p> <p>"Where a vacuum or pressure main must be located within private property, an easement shall be provided in favour of PWC. All easements in favour of PWC shall be in accordance with the PWC Policy 'Minimum Easement Dimensions, Conditions and Restrictions for Water and Sewerage Infrastructure'.</p> <table border="1"> <thead> <tr> <th>Vacuum Mains</th> <th>Minimum Easement Width (m)</th> </tr> </thead> <tbody> <tr> <td>≤ 1.5 m depth to invert</td> <td>3</td> </tr> <tr> <td>>1.5m to ≤4.0m depth to invert</td> <td>6</td> </tr> <tr> <td>> 4.0m depth to invert</td> <td>Refer to PWC</td> </tr> </tbody> </table>	Vacuum Mains	Minimum Easement Width (m)	≤ 1.5 m depth to invert	3	>1.5m to ≤4.0m depth to invert	6	> 4.0m depth to invert	Refer to PWC	3.7
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≤ 150	3									
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≥450	8									
<p>The easement is generally to be centrally located over the pressure or vacuum main.</p> <p>Pressure mains located within private land may be subject to increased easement requirements to the satisfaction of PWC, where:</p> <ul style="list-style-type: none"> the pressure or vacuum main is not parallel to the property boundary there is a shared alignment for services approved by the relevant authorities there more than one PWC asset within the easement" <p>After the last paragraph, insert: "Where collection chambers are located on private property between the street boundary and the building alignment (refer Clause 10.1.2), an easement shall be provided over the collection chamber."</p>										
<p>Insert before first paragraph, "Pipe joints for all crossing of roads, railway lines, creeks and drainage reserves shall be fully restrained".</p>		3.9.1								
<p>Delete reference to Standard Drawings WAT-1211, WAT-1212 and WAT-1213. Additionally the minimum clearances in Table 3.1 shall be 300mm for vertical clearance and 600mm for horizontal clearances.</p>		3.12.5.2								
<p>Figure 3.1 – Deflection at Joints, only applies only for small vertical deflections.</p> <p>Deflections must be fully restrained for Figure 3.2 – Deflection using SOC-SOC Bends.</p> <p>For Figure 3.3 – Deflection using SOC-SOC Connectors, only applies only for small horizontal deflections and deflections must be fully restrained where allowable horizontal bearing pressure of the soil, when saturated, is less than 100 kPa.</p> <p>Vacuum sewers shall be laid below water mains and sewer pressure mains wherever possible.</p>		3.12.7								
<p>Delete: "(e) the use of chemical dosing, as appropriate"</p>		3.14.1								
<p>Delete the paragraph "Gravity sewers incorporated in vacuum schemes..." and insert: "Gravity sewers incorporated in vacuum schemes shall be designed to carry peak wet weather flows (PWWF), where: $PWWF = \text{Peaking Factor} * PDWF \quad \text{and}$</p>		5.1								

Requirement	Clause												
<ul style="list-style-type: none"> • PDWF (Q_d) is calculated in accordance with the requirements of WSA 02 as amended by the PWC supplement to WSA 02, however, the Diurnal Peak Factor (Peak Flow/Average Flow), r, shall be limited to a maximum of 8; • Peaking Factor is taken from Table 5.5 below <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">Number of Lots Connected to Collection Chamber</th> <th style="text-align: center;">Peaking Factor (PVC Gravity Sewers)</th> <th style="text-align: center;">Peaking Factor (Sealed PE Gravity Sewers)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">≤ 4</td> <td style="text-align: center;">1.50</td> <td style="text-align: center;">1.20</td> </tr> <tr> <td style="text-align: center;">5</td> <td style="text-align: center;">1.75</td> <td style="text-align: center;">1.30</td> </tr> <tr> <td style="text-align: center;">6</td> <td style="text-align: center;">2.00</td> <td style="text-align: center;">1.40</td> </tr> </tbody> </table> <p>Sealed polyethylene gravity sewers will be similar to Brisbane Water Nusewer. Pipe shall be PE80B or PE100 with a minimum SDR of 21 and an internal surface coloured white or light yellow. All PE/PE joints shall be butt-welded or electro-fusion jointed using Plasson 'LightFit' couplings or equivalent. Depth to invert shall not exceed three metres at any point. Refer Attachment A.</p> <p>No more than six lots shall be connected to any collection chamber.</p> <p>For design, no single vacuum interface valve collection chamber shall serve a load of more than 36EP without the written approval of PWC.</p> <p>No more than two vacuum interface valves shall be fitted to any collection chamber.</p> <p>For design, no dual vacuum interface valve collection chamber shall serve a load of more than 72EP without the written approval of PWC.</p> <p>Unless approved in writing by PWC, only one MR lot or HR lot shall be connected to a collection chamber.</p> <p>Excluding sealed PE gravity sewers, the total length of gravity sewer flowing to a collection chamber shall not exceed 100 metres and shall not include a maintenance structure (maintenance hole or maintenance shaft).</p> <p>For sealed PE gravity sewers, the total length of gravity sewer flowing to a collection chamber shall not exceed 200 metres and shall not include more than one PE maintenance shaft.</p> <p>Pipes shall be of a standard size and excluding sealed PE gravity sewers, the minimum size for gravity sewers incorporated in vacuum schemes shall be DN150. For sealed PE gravity sewers, the minimum pipe size shall be DN110.</p> <p>Pipes shall be sized and graded in accordance with the PWC supplement to WSA 02 to ensure adequate hydraulic capacity at PWWF.</p> <p>Pipe grades shall be selected such that self cleansing velocity is achieved at most probable peak dry weather flow (Q_m) in accordance with the PWC supplement to WSA 02.</p>	Number of Lots Connected to Collection Chamber	Peaking Factor (PVC Gravity Sewers)	Peaking Factor (Sealed PE Gravity Sewers)	≤ 4	1.50	1.20	5	1.75	1.30	6	2.00	1.40	5.1 (cont)
Number of Lots Connected to Collection Chamber	Peaking Factor (PVC Gravity Sewers)	Peaking Factor (Sealed PE Gravity Sewers)											
≤ 4	1.50	1.20											
5	1.75	1.30											
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Requirement	Clause
Minimum gravity sewer grades shall not be less than listed in Table 4.6(NT) of the PWC supplement to WSA 02."	5.1 (cont)
Delete the existing paragraphs and insert: "Sewage inflows to vacuum stations (L) shall be assessed in accordance with the following equation: $L = \sum PWWF \quad \text{for all vacuum valves}$ Where PWWF is calculated in accordance with 5.1 above. Vacuum sewers shall be designed to carry the gravity sewer design flow."	5.2
Delete this clause and insert the following: "Where there is more than one incoming main to a vacuum station, Designers shall ensure that the static head losses in each line are of the same order of magnitude, and if possible, the friction head losses are also of the same order of magnitude. To assist in achieving the same friction losses, the following rules are applicable: <ol style="list-style-type: none"> 1. DN100 or DN110 lines are not to exceed 600 metres in length; 2. No carrier shall exceed two kilometres in length; 3. Total losses in each line shall not exceed 5 metres of head, and static lift shall be in accordance with Clause 9.3.3. Friction losses shall be less than 20% of total losses in each line when calculated in accordance with Clause 9.3.2 as amended by this supplement. 4. PE100 SDR 17 pipe is preferred. PE80B SDR 13.6 may be used with written approval of PWC. 5. PVC-U or PVC-M pipe may be used with written approval of PWC. 6. PVC-O shall only be used where specific project approval has been granted in writing by PWC. 7. To ensure that friction losses are not excessive, fluid velocities are to be constrained by design. The maximum permissible fluid flow shall be calculated from the mean internal diameter of the pipe, using the following formula: <ul style="list-style-type: none"> • Maximum Permissible Velocity (m/s) = $0.167 + 1.3333 \times D$ where D is the mean internal diameter of the pipe in metres 8. Tables 5.1, 5.2 and 5.3 of WSA 06 are not to be used 9. Table 5.3A is provided below for information and is based on the formula given at Item 8 above 	5.3.1

TABLE 5.3A
DESIGN FLOWS FOR PN10 PE100 (SR17) VACUUM SEWERS

Nominal Diameter (DN)	Mean Bore (mm)	Recommended Maximum Liquid Flow (L/s)
110	96.5	2.15
160	140.6	5.50
225	197.8	13.18
280	246.3	23.54
315	277.1	32.23

Requirement	Clause
Delete (iii)(B) and (iii)(D).	6.2.1
After final paragraph, add: "Pressure mains are not permitted in private property except where specifically approved in writing by PWC. In such circumstances, easements shall be provided in accordance with Clause 3.7."	
In the first paragraph, delete "50m" and insert "125m".	6.2.3
In the last paragraph, delete "100mm" and insert "500mm".	
Add the following after final paragraph: "Note that where aboveground buildings are contemplated, and especially in built up areas, local council and/or DCI planning officers must be given an opportunity to comment on the acceptability of the building appearance."	
Add the following after final paragraph: "The access road shall be constructed at least 300mm above the 1:100 flood level.	6.2.5
Specific consideration shall also be given to the access to the site so that vehicles leaving the site can safely merge with the traffic on the public road."	
After the first paragraph, insert "PWC has a strong preference for vacuum stations to be built above ground where feasible">	6.3
In the sixth paragraph, delete the words "The sump in the dry well" and insert "Two independent sumps shall be provided in the dry well, each".	
Delete reference to WSA PS-260.	6.4.3
In the last paragraph, delete "DI".	6.7
Delete the second sentence in the first paragraph, "This pumping rate equates to approximately 1.33 times design flow".	6.8.1
In the last paragraph, delete "18.5 kW" and insert "30kW".	
After the final paragraph, insert: "Sewage pumps shall be consistent with existing pumping equipment owned by PWC, such as Flygt and Grundfos pumps."	
Delete (a) and (c).	7.2.1
In the first paragraph, delete "power from a mobile generator" and insert "automatic changeover to the on-site generator."	7.2.2
Delete the second and third paragraphs.	
Delete this clause.	7.2.4
Delete this clause.	7.2.5
Delete this clause.	7.2.7
Liaise with PWC regarding power and control cubicle requirements.	7.3.1
Liaise with PWC regarding switchboard requirements.	7.3.2
Delete (a)	8.2.1
In the last paragraph, delete ", on both automatic and manual control." and insert "on automatic control. In manual mode, it shall be possible to select either one pump running or both pumps running."	8.2.4
At 7, delete "(if required by Water Agency)."	8.3.1

Requirement	Clause
In the first paragraph, delete "If required by the Water Agency,"	8.4.1
Where vacuum sewers are constructed in road reserves, the alignment shall conform to that nominated on the service allocation plan and by gaining approval from PWC and the relevant road authority or Council. Refer also 'Service Allocations in Road Reserves' in Section 4 of Volume 2 of the Power Supply Volumes of PWC's Standard Drawings (drawing numbers SO2-4-1-XX).	9.2.3.2
Where vacuum sewers are less than 1.5m from the property boundary, easements in favour of PWC shall be provided over the adjacent portion of the property.	
Delete the second paragraph and insert "Friction losses shall be deemed to be acceptable provided fluid velocity (m/s) is less than $(0.167 + 1.3333 \times D)$, where D is the mean internal diameter of the pipe (expressed in metres).	9.3.2
Delete reference to WSA PS-210, WSA PS-211 and WSA PS-212.	9.5.2
After the final paragraph, insert: "Pipe and fittings shall comply with PWC Water Supply and Sewerage Infrastructure Products Manual."	
Flexible PVC pipes shall only be used if specifically approved by PWC in writing.	9.5.4
In the second paragraph, delete "complying with WSA PS 260".	9.6.1
In the third paragraph, delete "anti-clockwise" and insert "clockwise".	
After the final paragraph, insert: "Resilient seated gate valves shall comply with PWC Water Supply and Sewerage Infrastructure Products Manual."	
Delete the existing wording and insert: "Division valves can be direct buried."	9.6.2
After the final paragraph, add "Collection chambers shall not be installed in roadways."	10.1.2
After the final paragraph, insert "No more than six lots shall be connected to any collection chamber. Refer also amendments to Clause 5.1 above."	10.1.3
Delete the second paragraph ("In all cases...").	
Delete the last paragraph ("Where the maximum number...").	
In the first paragraph, delete "0.25 L/s" and insert "1.9 L/s".	10.1.4
After the final paragraph, insert "Refer also Clause 5.1 for maximum load permitted on a single vacuum interface valve collection chamber."	
Delete the existing wording and insert: "Emergency storage shall be provided at collection chambers to prevent overflows.	10.1.8
The installation of larger volume collection chambers is preferred relative to the installation of overflow chambers (Refer Standard Drawing VAC-1205-V-NT) attached to the collection chamber.	

Requirement	Clause
<p>Calculation of available storage shall not include any available storage remaining in gravity sewers.</p> <p>The emergency storage shall be capable of retaining at least 100 litres/EP for the ultimate development. The emergency storage volume is in addition to the batch volume (as calculated by the Designer) and shall allow 500mm freeboard to an overflow occurring at any point on the gravity sewers connected to the collection chamber, or the collection chamber itself.</p> <p>Where travel time (at a reasonable average speed) from the PWC depot to the vacuum sewer catchment exceeds forty-five minutes, the minimum storage capacity shall be increased in accordance with the following formula:</p> <p style="padding-left: 40px;">Adjusted emergency storage (litres/EP) = $100/180 * (135 + \text{travel time in minutes})$</p> <p>Some PWC systems are remote from regional depots or have accessibility issues, therefore, emergency storage requirements must be discussion with PWC during the planning stage.</p> <p>For environmentally sensitive areas or high population areas or CBD areas, additional emergency storage may be required by PWC."</p>	10.1.8 (cont)
<p>Add the following new clause:</p> <p>"Each collection chamber shall be provided with a high level alarm set at 40% of the emergency storage volume.</p> <p>Each vacuum interface valve shall be provided with an alarm to indicate that the valve has been open for 30 seconds or more.</p> <p>The above alarms shall be transmitted to an LCD display at a central location within the boundary of the vacuum sewer area. Wireless communications are envisaged on a licence free frequency (ie. 433 MHz) using a pass-forward system. A single general alarm to the PWC SCADA system is envisaged from the central display location."</p>	10.1.10
<p>Cycle counters shall be provided.</p>	10.2.2
<p>Delete the sixth paragraph ("Where the Water Agency has a single-supplier...") and insert:</p> <p>"Pump equipment shall be consistent with existing pumping equipment owned by PWC, such as Flygt and Grundfos pumps."</p> <p>Delete the eighth paragraph ("If required by the Water Agency...") and insert:</p> <p>"Pumpsets ≤30 kW shall be provided electrical de-contactors located above the station floor to facilitate their removal. For pumpsets >30 kW, liaise with PWC."</p> <p>Delete the ninth paragraph ("Pump performance curves...") and insert:</p> <p>"Pump performance curves shall be submitted to PWC."</p> <p>In the tenth paragraph ("For pressure mains..."), delete "75 mm" and insert "80 mm".</p>	11.4.1

Requirement	Clause
In the first paragraph, delete "to WSA PS 260" and insert "complying with the requirements of the PWC Water Supply and Sewerage Infrastructure Products Manual".	12.5.3
After "WSA 04", insert "as amended by the PWC supplement to WSA 04".	13.1
In the second last paragraph, delete "Products and Materials Information and Guidance available from www.wsaa.asn.au." and insert "the PWC Water Supply and Sewerage Infrastructure Products Manual".	14.2.2
Delete the last paragraph " <i>Default maximum depths to invert and design assumptions are given in Clause 30.2 of WSA 02-2002</i> ".	14.2.3
Refer WSA Technical Note WSA-TN4 Guidelines for Design of Pressure Pipeline Systems for Water Supply Using PVC-M and PVC-O Pipes for surge, fatigue and temperature conditions.	14.2.4
After the last paragraph, insert "For PWC pressure mains, use 30°C as the time weighted average temperature."	
In the first paragraph, delete "Where reasonable doubts exist regarding the suitability of the ground to provide adequate support to the pipeline and for pressure mains >DN 300,".	14.2.7.1
Minimum test pressure shall be 1000 kPa for pressure mains ≤DN 300 and minimum test pressure shall be 1200 kPa for pressure mains >DN 300.	14.2.11.2
Permanent thrust blocks are to be provided on buried mains incorporating unrestrained, flexible joints. When designing thrust blocks it shall be assumed that the total unbalance thrust is transferred from the thrust block to the adjacent soil or rock.	
When sizing a thrust block, the block shall not protrude beyond the trench with allocation for that main, unless approval is obtained from the affected service utility whose allocation is encroached upon. Thrust blocks must be constructed within the allocated service corridor.	
Concrete shall be used to construct permanent thrust blocks.	
Before the first paragraph, insert: "PWC will normally request security fencing, and will advise if it is not required at a particular site. Fencing shall be 2400 chainmesh in accordance with PWC Standard Drawing W1-6-02. In urban areas, PWC may require anti-climb fencing in lieu of chainmesh fencing. Furthermore, in critical areas or areas of high public importance, further architectural treatment of fencing may be required."	15.5
Add the following after final paragraph: "Information on waterwise gardening principles acceptable to Power and Water is contained in http://www.powerwater.com.au/powerwater/docs/green_guide/PW_WaterWise_Garden.pdf .	15.8
Landscaping will be restricted to the perimeter of the site to enable maximum utilisation of the site for future hardstand."	
In the first paragraph, delete "≥DN 40" and insert "DN50", plus delete "≥25m head" and insert "≥15m head".	16.1.2
Delete the second and third paragraphs.	
In the first paragraph, delete "Where Water Agency experience has shown that it is best...and safe work environment,".	16.2.1

Requirement	Clause
Delete the sentence "The workbench shall be of robust...vacuum supply from the vacuum vessel."	16.2.3
Delete the last paragraph "On-site cranes and other...the Water Agency's mobile handling equipment."	16.3.1
Add: (d) municipal boundaries (e) vacuum station site boundaries (f) AAPA certificate number/s applicable to any sacred sites clearance, plus locations and details of known and suspected sacred sites, including trees, that may be affected by any works related to the construction and maintenance of the site.	19.2.2
Refer to PWC's Drawing Procedures Volume available on the PWC website (www.powerwater.com.au).	19.3.1
Delete Appendix A	Appendix A