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29 July 2021
Our Ref: 20971 – S8/DD

SJA

Attention: Ben Marshall

RE: Engineering Assessment of Impact on Existing Pipe
For proposed Budawang Primary School development

SUBJECT PREMISES: CROOBYAR ROAD,
MILTON, NSW

As requested, Henry and Hymas Consulting Engineers (H&H) have undertaken a review of the impact of the proposed development at the above address on the existing sewer pipe within the site.

The site is located primarily parallel to the existing school service road, with a slight splay. The pipe in the existing condition would be subject to wheel loads from unrestricted school traffic (garbage trucks, deliveries, busses etc) and surcharge loads application to any road or accessible area loads.

The proposed modification to the site, replace the existing traffic surcharge loads with additional retaining walls within the zone of influence of the pipe to raise the ground levels to suite the new school classroom levels. The pipe will not be subject to traffic loads in these locations, however we have also added construction loads and nominal live load surcharges.

The site plan and easement location are provided below in Figures 1 and 2.

Figure 1: Pipe location at existing school access road.

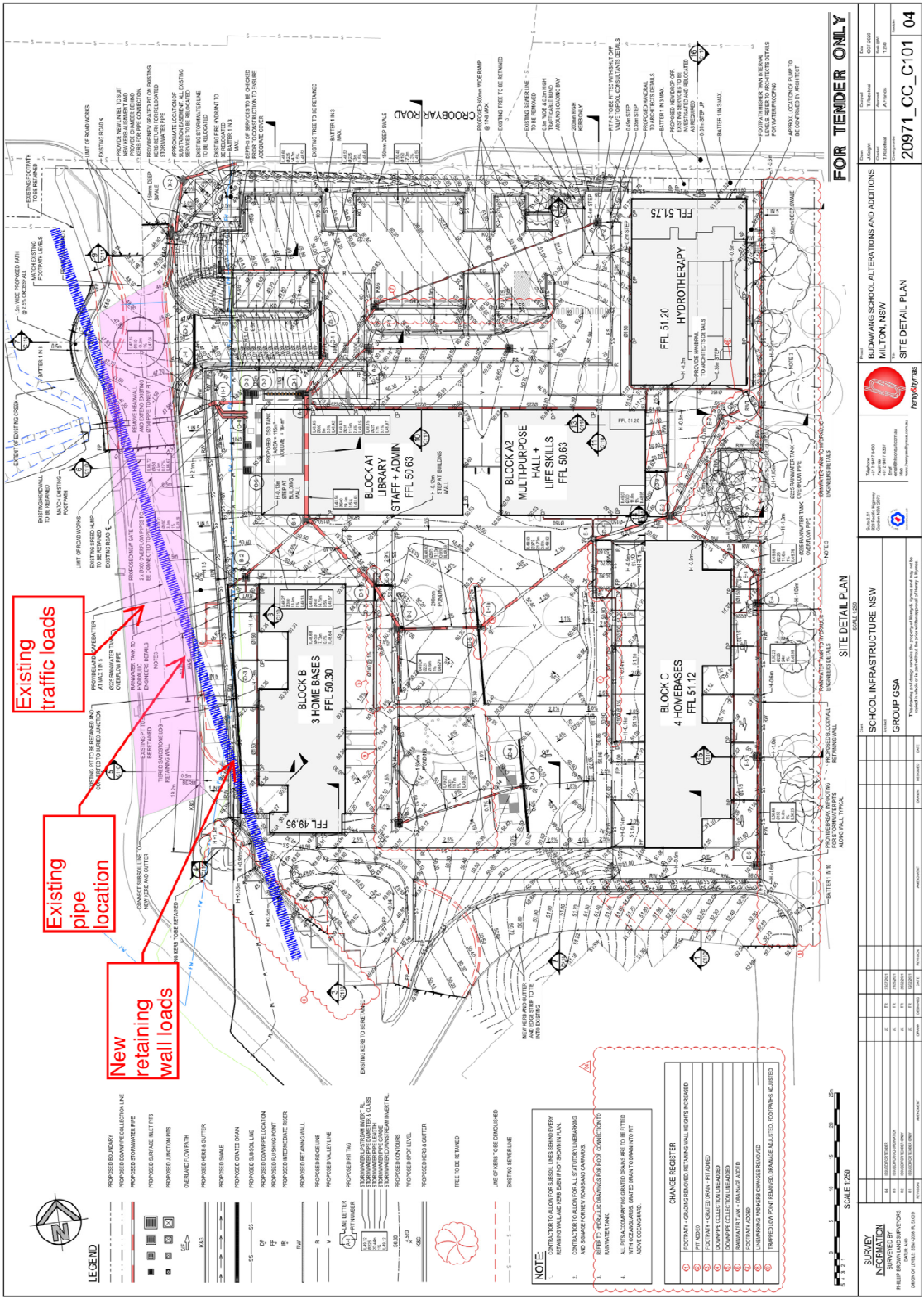


Figure 2: Site Plan with pipe location.

The site is to be developed for a proposed single level primary school. The school building structure has been designed on pile foundation below the level of the pipe and will not be addition additional load to the existing pipe.

The proposed retaining walls will add approximately 1.5m of soil pressure in the worst location.

There is no major excavation occurring in this development. Any excavations would be limited to those required for the installation of in-ground services etc. It is envisaged that any excavations within the fill or natural material will be readily achievable using conventional earth moving equipment.

It is also envisaged that conventional construction methods and equipment/plant will be used during the construction of the super structure. Final details of construction methodology and equipment / plant to be utilized would need to be confirmed by the Main Contractor.

Typically, we envisage the main building works for the contractor piling methodology adjacent to existing pipe to be undertaken as below:

i. Establish exclusion zone in sewer easement for Heavy Construction plant
ii. Use Screw Piles in lieu of concrete bored piers
iii. Screw piling rig with minimum 4m reach to install screw piles without encroaching on the exclusion zone.

REVIEW OF PIPE LOADING:

H&H have undertaken a review of the pipe loads using PipeClass software. The review has assessed the existing condition under the road to the new condition with the additional soil surcharge. The existing pipe under the road has been assessed with W80 wheel loads and 15kPa live load surcharge with the existing soil cover.

The pipe has then been assessed with the traffic load replaced by the new earth loads, construction equipment and 5kPa surcharge with the area no longer assessable to traffic.

The existing design calculation summary is provided in Appendix A. The revised load assessment is shown in Appendix B and the specifications for the construction equipment used in the assessment are provided in Appendix C attached.

The review shows the loading on the pipe to be similar for both scenarios, with 7 % of the applied existing loads. The additional surcharge loads are shown to have relatively minor impact on the pipe loads due to the depth of the existing sewer.

In our engineering opinion the construction and support of the new retaining wall will not adversely impact the existing sewer assets.

We trust this satisfies your requirements, please do not hesitate to contact myself on 9417 8400 to discuss this matter or any future concerns.

Yours faithfully,

DEREK DUNS
Senior Structural Engineer
For, and on behalf of, H & H Consulting Engineers Pty Ltd.

APPENDIX A – REVIEW OF EXISTING PIPE LOADS – 15kPa SURCHARGE WITH TRAFFIC

Concrete Pipe Association of Australasia

CPAA
PipeClass
Pipe Load Summary Sheet

DESIGN OF 225 DIA. RRJ PRESSURE PIPE

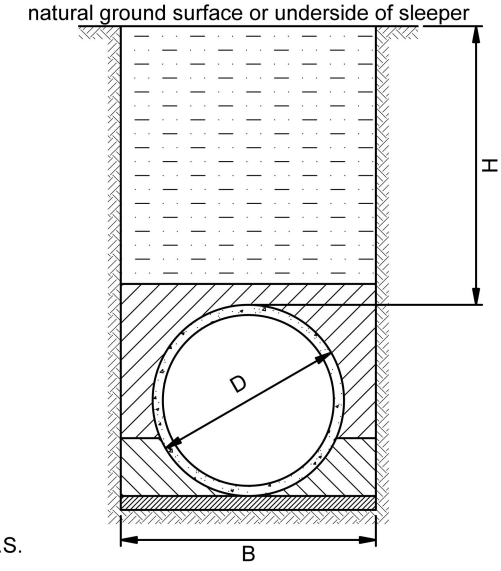
Client And Project Details

Date: 29-Jul-2021

Job number:	20971	Design:	ex pipe
Client:	SINSW	Designer:	DD
Project:	Budawang	Company:	H&H
Description:	Ex sewer	File:	New Project

Design Parameters

Installation Condition:	trench
Pipe Nominal Diameter (mm):	225
Pipe External Diameter, D (mm):	287
Pipeline Orientation:	longitudinal
Soil Type:	wet clay
Soil Density (kN/m³):	20
Soil Parameter K_μ:	0.1100
Trench Width, B (m):	0.587
Height Of Fill, H (m):	1.250
Flexible Pavement Type:	asphalt
Flexible Pavement Density (kN/m3):	21.000
Flexible Pavement Thickness (m):	0.150
Effective Height Of Fill, He (m):	1.407
Support Type:	H2
Bedding Factor:	2.0



N.T.S.

In Service Load Cases/Combinations Considered (controlling load case/combination highlighted)

Load Description*	Fill Height (m)	Wg/2.0	Wq/1.5	Tc	Pipe Class
earth	1.408	5.8		5.8	2
uniform surcharge load	1.408	7.9		7.9	2
W80(AS/NZS3725)	1.408	5.8	2.9	8.6	2

All loads in kN/m. *Includes earth load at fill height shown.

Controlling Loads: earth + W80(AS/NZS3725) standard vehicle
Minimum Test Load: Tc = 5.8 + 2.9 = 8.6 kN/m

Adopt 225 dia. Class 2 RRJ pipe (225/2 RRJ) in accordance with AS/NZS 4058:2007.

Design Notes:
1. A nominal pipe wall thickness of 25 mm has been assumed.

Concrete Pipe Association of Australasia

CPAA
PipeClass
Pipe Installation and Quantities Sheet

INSTALLATION OF 225 DIA. CLASS 2 RRJ PRESSURE PIPE

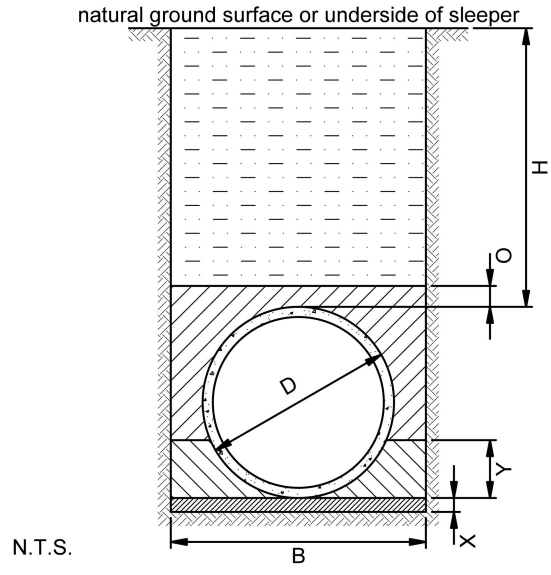
Client And Project Details

Date: 29-Jul-2021

Job number:	20971	Design:	ex pipe
Client:	SINSW	Designer:	DD
Project:	Budawang	Company:	H&H
Description:	Ex sewer	File:	New Project

Design Parameters

Installation Condition:	trench
Pipe Nominal Diameter (mm):	225
Pipe External Diameter, D (mm):	287
Pipeline Orientation:	longitudinal
Trench Width, B (m):	0.587
Height Of Fill, H (m):	1.250
Flexible Pavement Type:	asphalt
Flexible Pavement Density (kN/m3):	21.000
Flexible Pavement Thickness (m):	0.150
Effective Height Of Fill, He (m):	1.407
Support Type:	H2
Excavation Volume (solid) (m³/m):	1.0



N.T.S.

Installation Quantities

Support Zone	Depth (mm)	Quantities(m³/m)		Minimum Zone Compaction (%)	
		Solid	Loose	Density Index (for cohesionless soils)	Relative Density (standard compaction)
Bed zone	X = 100	0.059	0.071	60	-
Haunch zone	Y = 90	0.036	0.043	60	-
Overlay zone	O = 150	0.157	0.235	as per project specification	as per project specification
Backfill	1100	0.646	0.969	as per project specification	as per project specification

Material Grading Requirements

Sieve Size (mm)	75.0	19.0	9.5	2.36	0.60	0.30	0.15	0.075
Bed & Haunch Zones (% mass passing)	-	100	-	100-50	90-20	60-10	25-0	10-0

Construction Equipment Requirements

No construction vehicles considered.

Design Notes:

1. All bed and haunch zone material passing the 0.075 mm sieve to have low plasticity (AS 1726).
2. Ordinary fill material to have no stones > 150 mm dia., and no more than 20% to be 75-150 mm.
3. For additional information refer to the project specification.
4. A nominal pipe wall thickness of 25 mm has been assumed.

DESIGN OF 225 DIA. CLASS 2 RRJ PRESSURE PIPE

Client And Project Details Date: 29-Jul-2021

Job number:	20971	Design:	ex pipe
Client:	SINSW	Designer:	DD
Project:	Budawang	Company:	H&H
Description:	Ex sewer	File:	New Project

In Service Load Cases/Combinations Considered (controlling load case/combination highlighted)

Load Description*	Fill Height (m)	Wg/2.0	Wq/1.5	Tc	Pipe Class
earth	1.408	5.8		5.8	2
uniform surcharge load	1.408	7.9		7.9	2
W80(AS/NZS3725)	1.408	5.8	2.9	8.6	2

All loads in kN/m. *Includes earth load at fill height shown

earth
Height of fill, H = 1.250 m
Pipeline orientation is longitudinal

Flexible pavement type is asphalt.
Flexible pavement density = 21 kN/m3
Flexible pavement thickness = 0.150 m

Effective height of fill, He = 1.407 m

Trench Condition, vertical walls
Spangler coefficient, Ct = 1.863
Working load due to earth fill, Wg = 12.8 kN/m

Positive Projection Check
Settlement ratio, rs = 1.000
Projection ratio, p = 0.700
Plane of equal settlement height, He = 0.571
Modified Spangler coefficient, C'e = 1.430
Working load due to earth fill, Wg = 11.6 kN/m

Positive projection controls, adopt Wg = 11.6 kN/m

W80(AS/NZS3725)
Footprint width at top of pipe, L1 = 2.540 m
Footprint length at top of pipe, L2 = 2.240 m
Footprint area, A = 5.690 m2
Load on footprint = 80.0 kN

Impact factor = 1.19
Live load pressure at top of pipe, q = 16.716 kPa

Minimum of L2 and D, S = 0.287 m
Effective supporting length of pipe, Le = 2.852 m

Working load due to live load, Wq = 4.3 kN/m

uniform surcharge load
Working load due to uniform surcharge load, Wg = 4.3 kN/m

Installation Specification for Type H2 Support

This specification is prepared to ensure the pipe installation conforms with the requirements of AS/NZS 3725:2007 Design for installation of buried concrete pipes.

Type H2 supports represents an installation with controlled compaction in the bed zone and haunch zone.

Excavation and Bedding

The trench width for both trench condition and embankment condition shall be as shown on the drawings.

Any deviation in trench width in the field from that specified must be referred to the designer prior to continuation of construction.

For an embankment installation, the positive projection of the pipe shall be 0.7 times the pipe outside diameter or less. Where the projection of the pipe above natural ground surface is greater than 0.7 times the pipe outside diameter, it will be necessary to construct the embankment to a height above top of bed level at least equal to 0.3 time pipe outside diameter, prior to laying the pipe, and to a width equal to at least 1.0 times pipe nominal diameter on each side of the proposed trench width.

The embankment shall be constructed in accordance with the specification for refilling, bed zone. A trench is then to be cut through the constructed embankment.

The required trench for the installation, to the width and depth shown on the drawings shall be excavated centrally through the above compacted select fill material.

Excavation shall be to line and level shown on the drawings.

Should the excavation to the required foundation at the bottom of the bed level reveal material, which in the opinion of the superintendent is unsuitable, the trench shall be over-excavated to a depth required to remove the unsuitable material and refilled with compacted material conforming to the requirements for the bed zone.

Bedding

Bed zone material shall be select fill. Select fill as defined in AS/NZS 3725:2007 is material obtained from excavation of the pipe trench or elsewhere with a particle size not greater than 19 mm, and which conforms with the soil classes as defined in Appendix D of AS 1726.

Select fill grading requirements are defined as below.

Sieve Size (mm)	19.0	2.36	0.60	0.30	0.15	0.075
% Mass Passing	100	100-50	90-20	60-10	25-0	10-0

The material passing the 0.075m sieve must have low plasticity as described in Appendix D of AS 1726.

Alternatively select fill as defined in AS/NZS 3725:2007 which does not conform with the above grading limits may be used provided that it is cement stabilized.Where controlled low strength materials are used they should comply with Appendix A of AS/NZS 3725:2007 to achieve 28 day compressive strength in the range of 0.6 to 3.0 MPa.

The bed zone shall be placed to the final required thickness as follows:

Pipe Nominal Diameter	Minimum bed zone thickness
≤ 1500mm	100mm
> 1500mm	150mm

The bed material shall extend over the full width of the trench and shall be compacted by tamping, rolling and/or vibration to a minimum Density Index (DI) of 60.

Compaction achieved shall be monitored by field testing in accordance with AS 1289.

The bed level shall be graded to provide for a uniform fall to the discharging end of the pipeline, with line and level as shown on the drawings.

For pipes with sockets protruding beyond the barrel outside surface, chases shall be dug into the bed and foundation if necessary, in the appropriate positions, so that each pipe is supported along the full length of the barrel and the socket is not subjected to point loading.

Refilling

The refilling shall be carried out in three stages and these are to be identified as:

- Haunch zone
- Overlay zone
- Backfill or embankment fill

The **haunch zone** shall extend from the top of the bed zone to 0.1 times the pipe outside diameter and shall be fill material complying with the requirements shown above for the bed zone.

The material shall be placed over the full width of the trench either in layers not exceeding 150mm compacted thickness and compacted by conventional methods or compacted in one operation by saturation and vibration to achieve a minimum Density Index (DI) of 60.

The select fill in the haunch zone should be placed and compacted in relatively thin layers of not more than 150mm.

Compaction achieved shall be monitored by field testing in accordance with AS 1289.

The **overlay zone** shall extend from the top of the haunch zone to 150mm above the top of the pipe and around the pipe measured radially from any point. The fill material in the overlay zone shall be ordinary fill consisting of material from the excavation or elsewhere. It shall not contain any stones larger than 150mm, nor more than 20% with a size between 75mm and 150mm. No defined degree of compaction is specified yet material should be compacted as necessary to prevent excessive settlement in the ground surface level over the installed pipeline.

Fill material should be placed and compacted in relatively thin layers. For ordinary fill the layer thickness should not exceed 200mm.

Backfill or Embankment fill is to be the remainder of the refilling and should consist of any available material up to finished levels as shown on the drawings.

Refilling of sheeted trenches shall be carried out to the following requirements:

- No struts, walling or other supports shall be removed until the top of the compacted refilling has reached the level of these supports.
- No wall sheeting is to totally removed from the trench until the level of the compacted refill is within 1500 mm of the surface.
- No wall sheeting is to be removed, in dewatered trenches, until the level in water table between natural ground and refill material is less than 500mm.
- The wall sheeting is to be withdrawn or removed in such a manner that the pipe and compacted bed and haunch support are not disturbed during such withdrawal or removal.

Important Notes:

- Ensure the bed zone is even and well graded to provide uniform support for the pipe.
- Do not compact directly over the pipe.
- Ensure the pipe is appropriately embedded and covered before allowing any construction equipment or plant over the top.
- Compact as you go and ensure that the appropriate levels of compaction are reached.

APPENDIX B – REVIEW OF NEW PIPE LOADS – 5kPa SURCHARGE, ADDITIONAL SOIL LOADS AND 12.7T EXCAVATOR CONSTRUCTION PLANT

Concrete Pipe Association of Australasia

CPAA
PipeClass
Pipe Load Summary Sheet

DESIGN OF 225 DIA. RRJ PRESSURE PIPE

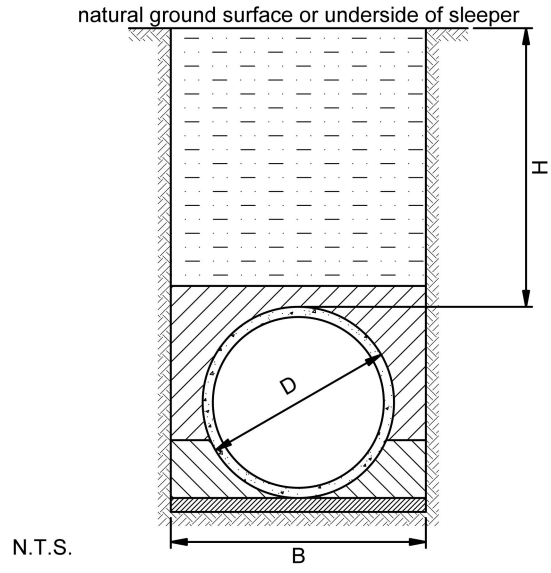
Client And Project Details

Date: 29-Jul-2021

Job number:	20971	Design:	ex pipe with retaining wall
Client:	SINSW	Designer:	DD
Project:	Budawang	Company:	H&H
Description:	Ex sewer	File:	New Project

Design Parameters

Installation Condition:	trench
Pipe Nominal Diameter (mm):	225
Pipe External Diameter, D (mm):	287
Pipeline Orientation:	longitudinal
Soil Type:	wet clay
Soil Density (kN/m³):	20
Soil Parameter K_μ:	0.1100
Trench Width, B (m):	0.587
Height Of Fill, H (m):	2.800
Support Type:	H2
Bedding Factor:	2.0



In Service Load Cases/Combinations Considered (controlling load case/combination highlighted)

Load Description*	Fill Height (m)	Wg/2.0	Wq/1.5	Tc	Pipe Class
earth	2.800	10.2		10.2	2
uniform surcharge load	2.800	10.9		10.9	2

All loads in kN/m. *Includes earth load at fill height shown.

Controlling Loads: uniform surcharge load
Minimum Test Load: Tc = 10.9 kN/m

Construction Load Cases/Combinations Considered

Load Description^	Allowable Fill Ranges (m)
CAT312B (Const)	0.150 - 2.799

All loads in kN/m. ^Includes earth load at fill ranges shown.

Adopt 225 dia. Class 2 RRJ pipe (225/2 RRJ) in accordance with AS/NZS 4058:2007.

Design Notes:

1. Construction loads are considered as acting directly (no distribution) on the pipe (for cover < 0.4 m) in accordance with AS/NZS 3725:2007.
2. A nominal pipe wall thickness of 25 mm has been assumed.

Concrete Pipe Association of Australasia

CPAA
PipeClass
Pipe Installation and Quantities Sheet

INSTALLATION OF 225 DIA. CLASS 2 RRJ PRESSURE PIPE

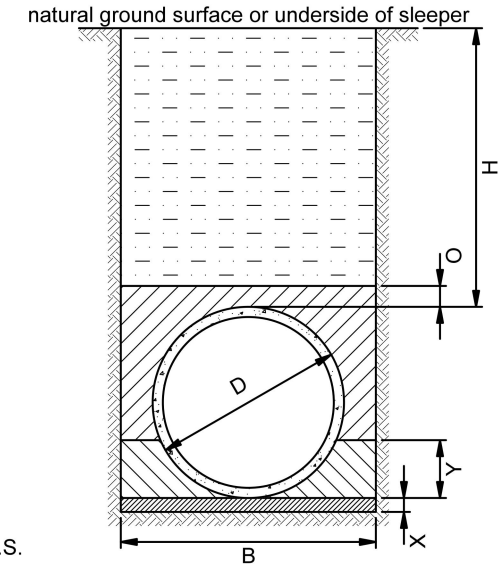
Client And Project Details

Date: 29-Jul-2021

Job number:	20971	Design:	ex pipe with retaining wall
Client:	SINSW	Designer:	DD
Project:	Budawang	Company:	H&H
Description:	Ex sewer	File:	New Project

Design Parameters

Installation Condition:	trench
Pipe Nominal Diameter (mm):	225
Pipe External Diameter, D (mm):	287
Pipeline Orientation:	longitudinal
Trench Width, B (m):	0.587
Height Of Fill, H (m):	2.800
Support Type:	H2
Excavation Volume (solid) (m³/m):	1.9



N.T.S.

Installation Quantities

Support Zone	Depth (mm)	Quantities(m³/m)		Minimum Zone Compaction (%)	
		Solid	Loose	Density Index (for cohesionless soils)	Relative Density (standard compaction)
Bed zone	X = 100	0.059	0.071	60	-
Haunch zone	Y = 90	0.036	0.043	60	-
Overlay zone	O = 150	0.157	0.235	as per project specification	as per project specification
Backfill	2650	1.556	2.334	as per project specification	as per project specification

Material Grading Requirements

Sieve Size (mm)	75.0	19.0	9.5	2.36	0.60	0.30	0.15	0.075
Bed & Haunch Zones (% mass passing)	-	100	-	100-50	90-20	60-10	25-0	10-0

Construction Equipment Requirements

Name	Description	Allowable Fill Ranges^ (m)
CAT312B	Excavator CAT312B - Total Weight 12.4t	0.150 - 2.799

^Equipment is not to be used outside of these fill ranges over top of pipe.

Design Notes:

1. All bed and haunch zone material passing the 0.075 mm sieve to have low plasticity (AS 1726).
2. Ordinary fill material to have no stones > 150 mm dia., and no more than 20% to be 75-150 mm.
3. For additional information refer to the project specification.
4. The trench width shown above is not to be exceeded.
5. A nominal pipe wall thickness of 25 mm has been assumed.

Concrete Pipe Association of Australasia

CPAA
PipeClass
Detailed Load Report

DESIGN OF 225 DIA. CLASS 2 RRJ PRESSURE PIPE

Client And Project Details

Date: 29-Jul-2021

Job number:	20971	Design:	ex pipe with retaining wall
Client:	SINSW	Designer:	DD
Project:	Budawang	Company:	H&H
Description:	Ex sewer	File:	New Project

In Service Load Cases/Combinations Considered (controlling load case/combination highlighted)

Load Description*	Fill Height (m)	Wg/2.0	Wq/1.5	Tc	Pipe Class
earth	2.800	10.2		10.2	2
uniform surcharge load	2.800	10.9		10.9	2

All loads in kN/m. *Includes earth load at fill height shown

Construction Load Cases/Combinations Considered

Load Description^	Allowable Fill Ranges (m)
CAT312B (Const)	0.150 - 2.799

All loads in kN/m. ^Includes earth load at fill ranges shown.
*Cracking is likely in this fill range as the combined load can be less than 5% of the proof load.

earth

Height of fill, H = 2.800 m
Pipeline orientation is longitudinal

Trench Condition, vertical walls
Spangler coefficient, Ct = 2.954
Working load due to earth fill, Wg = 20.4 kN/m

Positive Projection Check
Settlement ratio, rs = 1.000
Projection ratio, p = 0.700
Plane of equal settlement height, He = 0.524
Modified Spangler coefficient, C'e = 1.445
Working load due to earth fill, Wg = 23.2 kN/m

Trench controls, adopt Wg = 20.4 kN/m

uniform surcharge load

Working load due to uniform surcharge load, Wg = 1.4 kN/m

Installation Specification for Type H2 Support

This specification is prepared to ensure the pipe installation conforms with the requirements of AS/NZS 3725:2007 Design for installation of buried concrete pipes.

Type H2 supports represents an installation with controlled compaction in the bed zone and haunch zone.

Excavation and Bedding

The trench width for both trench condition and embankment condition shall be as shown on the drawings.

Any deviation in trench width in the field from that specified must be referred to the designer prior to continuation of construction.

For an embankment installation, the positive projection of the pipe shall be 0.7 times the pipe outside diameter or less. Where the projection of the pipe above natural ground surface is greater than 0.7 times the pipe outside diameter, it will be necessary to construct the embankment to a height above top of bed level at least equal to 0.3 time pipe outside diameter, prior to laying the pipe, and to a width equal to at least 1.0 times pipe nominal diameter on each side of the proposed trench width.

The embankment shall be constructed in accordance with the specification for refilling, bed zone. A trench is then to be cut through the constructed embankment.

The required trench for the installation, to the width and depth shown on the drawings shall be excavated centrally through the above compacted select fill material.

Excavation shall be to line and level shown on the drawings.

Should the excavation to the required foundation at the bottom of the bed level reveal material, which in the opinion of the superintendent is unsuitable, the trench shall be over-excavated to a depth required to remove the unsuitable material and refilled with compacted material conforming to the requirements for the bed zone.

Bedding

Bed zone material shall be select fill. Select fill as defined in AS/NZS 3725:2007 is material obtained from excavation of the pipe trench or elsewhere with a particle size not greater than 19 mm, and which conforms with the soil classes as defined in Appendix D of AS 1726.

Select fill grading requirements are defined as below.

Sieve Size (mm)	19.0	2.36	0.60	0.30	0.15	0.075
% Mass Passing	100	100-50	90-20	60-10	25-0	10-0

The material passing the 0.075m sieve must have low plasticity as described in Appendix D of AS 1726.

Alternatively select fill as defined in AS/NZS 3725:2007 which does not conform with the above grading limits may be used provided that it is cement stabilized.Where controlled low strength materials are used they should comply with Appendix A of AS/NZS 3725:2007 to achieve 28 day compressive strength in the range of 0.6 to 3.0 MPa.

The bed zone shall be placed to the final required thickness as follows:

Pipe Nominal Diameter	Minimum bed zone thickness
≤ 1500mm	100mm
> 1500mm	150mm

The bed material shall extend over the full width of the trench and shall be compacted by tamping, rolling and/or vibration to a minimum Density Index (DI) of 60.

Compaction achieved shall be monitored by field testing in accordance with AS 1289.

The bed level shall be graded to provide for a uniform fall to the discharging end of the pipeline, with line and level as shown on the drawings.

For pipes with sockets protruding beyond the barrel outside surface, chases shall be dug into the bed and foundation if necessary, in the appropriate positions, so that each pipe is supported along the full length of the barrel and the socket is not subjected to point loading.

Refilling

The refilling shall be carried out in three stages and these are to be identified as:

- Haunch zone
- Overlay zone
- Backfill or embankment fill

The **haunch zone** shall extend from the top of the bed zone to 0.1 times the pipe outside diameter and shall be fill material complying with the requirements shown above for the bed zone.

The material shall be placed over the full width of the trench either in layers not exceeding 150mm compacted thickness and compacted by conventional methods or compacted in one operation by saturation and vibration to achieve a minimum Density Index (DI) of 60.

The select fill in the haunch zone should be placed and compacted in relatively thin layers of not more than 150mm.

Compaction achieved shall be monitored by field testing in accordance with AS 1289.

The **overlay zone** shall extend from the top of the haunch zone to 150mm above the top of the pipe and around the pipe measured radially from any point. The fill material in the overlay zone shall be ordinary fill consisting of material from the excavation or elsewhere. It shall not contain any stones larger than 150mm, nor more than 20% with a size between 75mm and 150mm. No defined degree of compaction is specified yet material should be compacted as necessary to prevent excessive settlement in the ground surface level over the installed pipeline.

Fill material should be placed and compacted in relatively thin layers. For ordinary fill the layer thickness should not exceed 200mm.

Backfill or Embankment fill is to be the remainder of the refilling and should consist of any available material up to finished levels as shown on the drawings.

Refilling of sheeted trenches shall be carried out to the following requirements:

- No struts, walling or other supports shall be removed until the top of the compacted refilling has reached the level of these supports.
- No wall sheeting is to totally removed from the trench until the level of the compacted refill is within 1500 mm of the surface.
- No wall sheeting is to be removed, in dewatered trenches, until the level in water table between natural ground and refill material is less than 500mm.
- The wall sheeting is to be withdrawn or removed in such a manner that the pipe and compacted bed and haunch support are not disturbed during such withdrawal or removal.

Important Notes:

- Ensure the bed zone is even and well graded to provide uniform support for the pipe.
- Do not compact directly over the pipe.
- Ensure the pipe is appropriately embedded and covered before allowing any construction equipment or plant over the top.
- Compact as you go and ensure that the appropriate levels of compaction are reached.

Concrete Pipe Association of Australasia

CPAA
PipeClass
Construction Load Graph

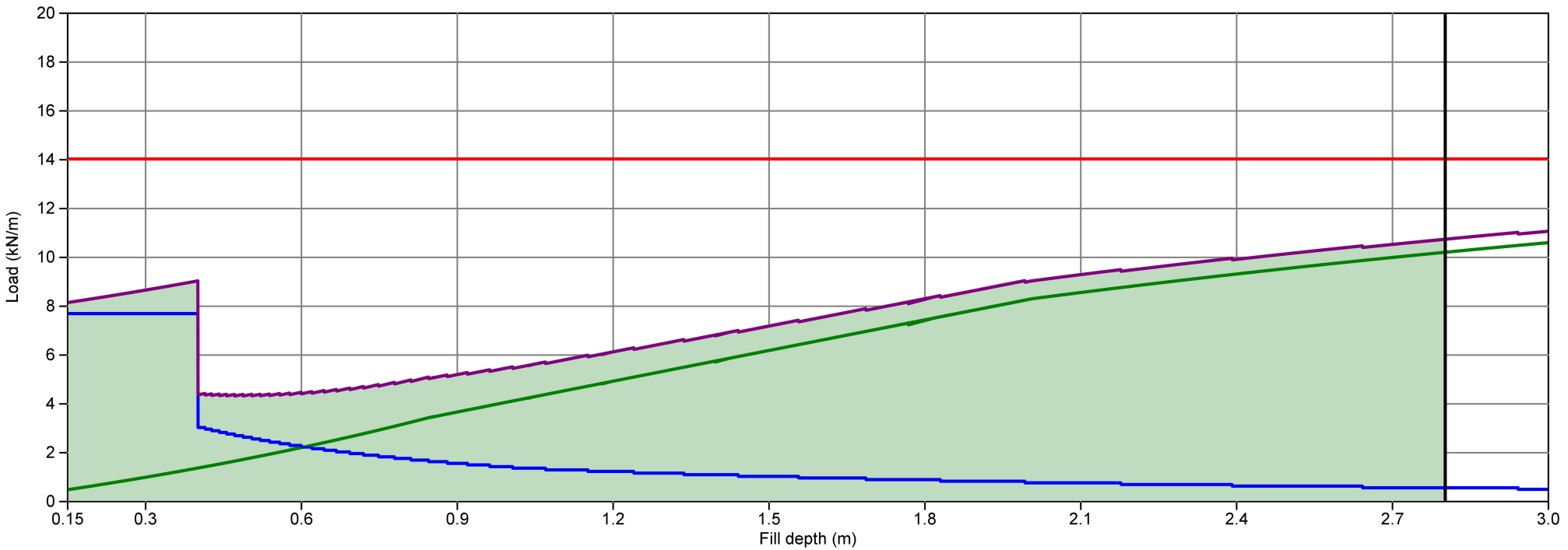
DESIGN OF 225 DIA. RRJ PRESSURE PIPE

Client And Project Details

Date: 29-Jul-2021

Job number:	20971	Design:	ex pipe with retaining wall
Client:	SINSW	Designer:	DD
Project:	Budawang	Company:	H&H
Description:	Ex sewer	File:	New Project

CAT312B on a 225mm dia. RRJ Class 2 pressure pipe with H2 support (BF = 2.0)



Earth load

Construction load

Combined load

Proof load

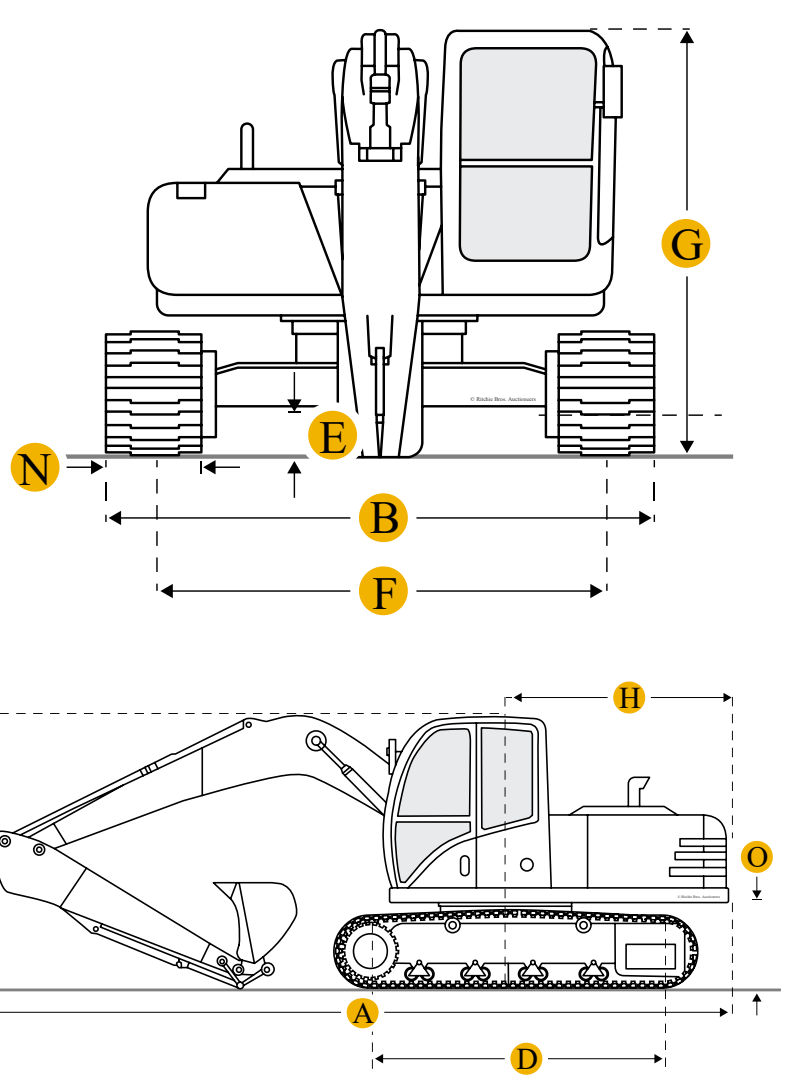
Design fill height (2.800 m)

Disallowed fill heights

Allowable fill range (m): 0.150 - 2.799

APPENDIX C – CONSTRUCTION EQUIPMENT SPECIFICATION USED FOR PIPECLASS

Caterpillar 312B L Hydraulic Excavator



Units Imperial Metric

Dimensions

Boom/Stick Option (Hex) 1

I	**Max Cutting Height**	8230 mm
J	**Max Loading Height**	5860 mm
K	**Max Reach Along Ground**	7790 mm
L	**Max Vertical Wall Digging Depth**	4430 mm
M	**Max Digging Depth**	5130 mm
	Boom/Stick Option (Hex) 1	boom w/ stick 2100mm

Boom/Stick Option (Hex) 2

A	**Shipping Length Of Unit**	7595 mm

I	**Max Cutting Height**	8475 mm
C	**Shipping Height Of Unit**	2760 mm
J	**Max Loading Height**	6095 mm
K	**Max Reach Along Ground**	8175 mm
L	**Max Vertical Wall Digging Depth**	4970 mm
M	**Max Digging Depth**	5550 mm
	Boom/Stick Option (Hex) 2	Boom 14\'1\" (4300mm) / Stick 8\'2\" (2500mm)

Boom/Stick Option (Hex) 3

A	**Shipping Length Of Unit**	7610 mm
I	**Max Cutting Height**	8695 mm
J	**Max Loading Height**	6330 mm
C	**Shipping Height Of Unit**	2760 mm
K	**Max Reach Along Ground**	8625 mm
L	**Max Vertical Wall Digging Depth**	5345 mm
M	**Max Digging Depth**	6050 mm
	Boom/Stick Option (Hex) 3	Boom 14\'1\" (4300mm) / Stick 9\'10\" (3000mm)

Dimensions

E	**Ground Clearance**	440 mm
G	**Height To Top Of Cab**	2760 mm
B	**Width To Outside Of Tracks**	2490 mm
D	**Length Of Track On Ground**	3040 mm
H	**Tail Swing Radius**	2130 mm
	Removal Counterweight Clearance	920 mm

Undercarriage

F	**Track Gauge**	1990 mm
N	**Shoe Size**	500 mm
	Drawbar Pull	102 kN
	Ground Pressure	38 kPa

Max Travel Speed	5.5 km/h

Specifications

Engine

Number Of Cylinders	4
Engine Make	2236
Engine Model	3064T
Gross Power	67.9 kw
Net Power	62.7 kw
Power Measured @	1900 rpm
Displacement	4.3 L
Aspiration	Turbocharged
Bore	102.2 mm
Stroke	130.1 mm
Engine Model	Cat 3064T Diesel Engine
Flywheel Power	62.7 kw
Eec 80/1269	62.7 kw
Sae J1349	61.9 kw
Iso 9249	62.7 kw

Operational

Operating Weight	12705.2 kg
Fuel Capacity	250 L
Cooling System Fluid Capacity	15.5 L
Hydraulic System Fluid Capacity	162 L
Engine Oil Capacity	13 L
Operating Voltage	24 V
Swing Drive Fluid Capacity	2.8 L
Alternator Supplied Amperage	50 amps
Hydraulic System Relief Valve Pressure	

	34335.9 kPa
Hydraulic Pump Flow Capacity	240 L/min

Swing Mechanism

Swing Torque	30400.2 Nm
Swing Speed	12 rpm

Weights

Operating Weight	14111.3 kg

Buckets

Reference Bucket Capacity	0.5 m3
Minimum Bucket Capacity	0.4 m3
Maximum Bucket Capacity	0.8 m3

Hydraulic System

Pilot System - Maximum Flow	4.8 gal/min
Pilot System - Maximum Pressure	570 psi
Maximum Pressure - Travel	4980 psi
Maximum Pressure - Swing	3340 psi
Maximum Pressure - Implements	4340 psi
Main Implement System - Maximum Flow (2x)	64 gal/min
Boom Cylinder - Bore	109.3 mm
Boom Cylinder - Stroke	1016 mm
Stick Cylinder - Bore	122 mm
Stick Cylinder - Stroke	1193.8 mm

Service Refill Capacities

Cooling System	15.6 L
Fuel Tank	249.9 L
Final Drive - Each	2.5 L
Hydraulic Tank	98.1 L
Hydraulic System - Including Tank	162.1 L
Engine Oil	12.9 L

Swing Drive - Each	2.9 L

Drive

Maximum Drawbar Pull	10400.9 kg
Travel Speed	5.5 km/h

Compare similar models

Manufacturer/Model	Net Power	Operating Weight	Reference Bucket Capacity
Volvo EC140LCM	98.6 hp	31812.8 lb	0.7 yd3
Caterpillar 311D LRR	80 hp	27513.7 lb	0.6 yd3
Volvo EC140BLCM	93 hp	33400.1 lb	0.6 yd3

Compare

Find Caterpillar 312B L Hydraulic Excavator for Sale

1999 CATERPILLAR 312B Hydraulic Excavator

12992

DENVER, CO

2003 Cat 345B L Track Excavator, Hydraulic Excavator

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NEW JERSEY, USA

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See Caterpillar Hydraulic Excavator for sale ironplanet.com

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